

Higher Secondary Course
COMPUTER APPLICATIONS
(Humanities)

CLASS - XII



Government of Kerala
DEPARTMENT OF EDUCATION
State Council of Educational Research and Training (SCERT),
Kerala

2015

THE NATIONAL ANTHEM

Jana-gana-mana adhinayaka, jaya he
Bharatha-bhagya-vidhata.
Punjab-Sindh-Gujarat-Maratha
Dravida-Utkala-Banga
Vindhya-Himachala-Yamuna-Ganga
Uchchala-Jaladhi-taranga
Tava subha name jage,
Tava subha asisa mage,
Gahe tava jaya gatha.
Jana-gana-mangala-dayaka jaya he
Bharatha-bhagya-vidhata.
Jaya he, jaya he, jaya he,
Jaya jaya jaya, jaya he!

PLEDGE

India is my country. All Indians are my brothers and sisters.
I love my country, and I am proud of its rich and varied heritage.
I shall always strive to be worthy of it.
I shall give my parents, teachers and all elders respect, and treat everyone with courtesy.
To my country and my people, I pledge my devotion. In their well-being and prosperity alone lies my happiness.

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Dear learners,

The syllabus of Computer Application for the Humanities stream has been revised in view of the growing importance of computer aided technology for various applications, especially in the field of publishing, information sharing, data analysis, etc. While designing the syllabus and the textbook, the other subjects of the Humanities group were also taken into consideration. Such a study will render the learning of those subjects more interesting and effective. It will also enlighten the learner about emerging trends in the field of computer applications and Information Technology.

The syllabus of Class XII Computer Application (Humanities) focus on the two major publishing media - print media and the web. The textbook, designed in accordance with the syllabus, begins with the basic idea about publishing and proceeds detailing word processing activities. Since we are in the age of Internet and most of us are users of web applications, HTML is introduced to develop and host websites. The concept of database and facilities of information retrieval are included. An exclusive section on the new trends and issues in the field of Information Communication Technology is also incorporated. Considering the increase in the use of Internet, an awareness about Cyber laws is presented to safeguard against Cyber crimes.

I hope this book will meet all the requirements for stepping to levels of higher education and pave the way to the peak of success.

Dr. S. Raveendran Nair
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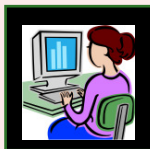
Let us do



Know your progress



Information box



Let us practice



Let us conclude



1

Introduction to Publishing

Significant Learning Outcomes



After the completion of this chapter, the learner

- explains the process of publishing.
- identifies the different types of publishing.
- identifies the stages in publishing.
- uses the elements of design while designing a page.
- applies principles of design while designing a page.
- identifies the need for creating a proof.
- explains the need of plates for printing.
- explains the different types of printing processes.
- explains electronic publishing.
- identifies the different types of electronic publishing.

Any new idea, story, poem, news, etc. has to be distributed for it to be useful for the society. Information like those discussed above can be distributed in the society only by publishing it. Previously, publishing was done only by printing and distributing it. Today, the popularity of Internet and devices like e-book readers which are built for reading electronic books increased the need of publishing a work electronically. Books, newspapers, magazines, etc. whether it is in print or through electronic media should be presented in an attractive manner so that it invites the attention of the reader. The page design principles, page setting, placement of images, etc. improves the readability of a document. This chapter discusses the ways in which content can be presented attractively. The different press related processes and post press activities in printing are also discussed. The recent developments in electronic publishing like blogs, websites, etc. have changed the world of publishing.

1.1 Publishing

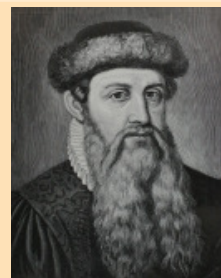
Publishing comprises of the creation, compilation and mass reproduction of graphic and text images thereby making information

available to the public. Books, newspapers, notices, etc. are published to provide information to the society.

The process of publishing dates back to 30000 BC when ancient humans drew pictures on the walls of the caves. Humans continued publishing as a way of expressing themselves on various media like stones, barks of trees, leaves, etc. Later Egyptians and Chinese contributed to the invention of paper and this led to a major change in publishing history. In 1455, Johannes Gutenberg, developed a printing machine. This printing machine was in use till the 20th century. With the advent of computers and advanced printing technologies, publishing of books, magazines, newspapers, etc. was made easy. Today publishing has transformed from print media to Internet and digital formats.



Johannes Gutenberg was a German inventor who developed a method of printing from a movable type. In those times, the types (characters or letters) for printing were carved from wood. Gutenberg developed a metal type instead of wooden types for his press. Gutenberg's innovation of developing metal types using special alloys made production easier. He printed the first book, 'The Bible', which had only forty two lines, using his printing press.



Johannes Gutenberg
1398 - 1468

Publishing can be classified as publishing through print media and publishing through electronic media (electronic publishing). Publishing through print media involves designing the document, printing and preparing it for distribution. The quality of document design, paper quality, paper size, type of press used for printing, type of binding, etc. determines the quality of publishing through print media. The publication of books, periodicals, etc. in digital format, usually on CD, DVD or as downloadable from Internet, for subscribers or public is called publishing through electronic media or electronic publishing. Today, electronic publishing has gained popularity and has reached a stage where some magazines are having electronic editions only. The acceptance of devices like electronic book readers and facilities in mobile phones to read books, prompted publishers to publish electronic versions of their print editions.

1.2 Publishing through print media

Publishing a work in print can be in the form of advertisement, poster, brochure, books, packaging, newspaper, magazine, etc. Publishing process starts when the editor edits content for publishing. Once the content is ready, it is considered to be

in production stage. The activities in production stage are classified as prepress jobs, printing and post press jobs. Prepress is the process of making the document ready for printing. Printing is the stage where the actual printing happens inside a press. Post press jobs include binding, cutting, etc. after which the document is in the finished stage. Fig. 1.1 shows the stages in publishing through print media. We will now discuss the different stages in publishing through print media.

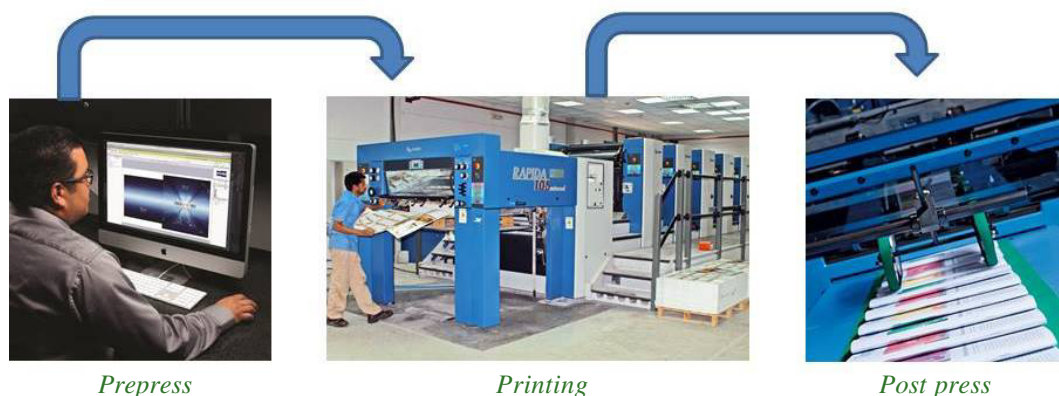


Fig. 1.1 : Stages in publishing through print media

1.2.1 Prepress

Prepress is the stage of work that happens between the designing of the page layout up to sending the book for printing in the press. Prepress is an important stage where the visual impact of the presentation is decided. While deciding the layout of a page, the size of book or magazine is an important factor to be considered. After finalising the layout of a page, the text and image content in the publication is added to the page layout.

Today, there are several Desktop Publishing (DTP) softwares available that make this process easy. Desktop Publishing is the creation of page layouts for documents using DTP software. Some of the popular DTP software are Scribus, Adobe InDesign, QuarkXPress, etc.

A. Designing

You might have noticed while browsing through books in a library or a book shop, some books catch our eye. They prompt us to read through some pages of the book. This is mostly due to the design of the book. The design of a book has an impact on the readability and success of the published material. Therefore, more attention is given by DTP operators while designing a page. Page layout design deals with the arrangement of visual elements in a page. It involves the specific communication objectives of the book. Some of the elements and principles of design that creates an impact on the reader of the publication are given below:

Elements of design

i. Line : Lines are useful for dividing space and drawing the eye to a specific location. Artists use lines to create edges, outlines of objects, etc. A line is created by the movement of the artist's pen.

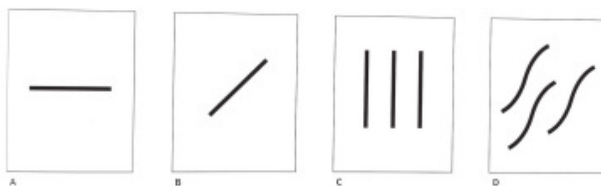


Fig. 1.2 : Design using line

The direction of a line can convey mood. Horizontal lines are calm and quiet, vertical lines suggest movement, while diagonal lines strongly suggest movement and give more of a feeling of energy to a picture. The lines in Figure 1.2 show the moods reflected by the lines.

ii. Shape : Shapes, geometric or organic, add interest. Shapes are defined by boundaries, such as lines or colour. They are often used to emphasize a portion of the page. Shapes have two dimensions, length and width. They can also be geometric or free-form. A good designer must think in terms of how the various elements of a design are creating shapes, and how those shapes are interacting. Figure 1.3 shows the different shapes and their effect.

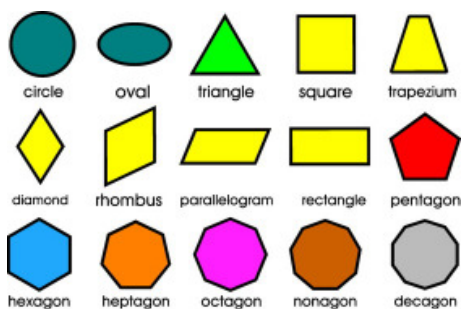


Fig. 1.3 : Different shapes

iii. Colours : Colour is one of the most noticeable elements of a design. It can stand alone, as a background, or can be applied to other elements, like lines, shapes, textures or typography. Colour creates a mood. Every colour says something different, and combinations can alter that impression further. Figure 1.4 shows the different colours.



Fig. 1.4 : Colours

iv. Space : White space is the area in a document where there is no text or graphics. When used effectively, white space can be used to guide the reader's eyes exactly where you want them to go. Space is also a three dimensional volume that can be empty or filled with objects. It has width, height and depth. Space that appears in a two dimensional painting creates an illusion of three dimension and a feeling of actual depth. Various techniques can be used to show such visual depth or space. Figure 1.5 shows a feeling of three dimension and depth.



Fig. 1.5 : Space creates depth

v. Typography : One of the most important parts of design is typography. Typography is the art and technique of arranging type (letters) to make written language readable and beautiful. The arrangement of type involves selecting typefaces, point size, line length, line-spacing, letter-spacing and adjusting the space within letters pairs. The fonts used tell the readers about the seriousness of the publication. Words are important, but the style of the words is equally essential. Generally fonts are classified into two styles: Sans Serif and Serif. Sans Serif is a style of fonts 'without feet'. Common Sans Serif typefaces include Arial, Tahoma and Verdana. Serif style of fonts have a 'little feet.' Common Serif fonts include Times Roman, Garamond and Palatino. The visual difference between the two styles is shown in Figure 1.6.

San Serif fonts

This is 14 point bold Arial

This is 14 point bold Verdana

This is 14 point bold Tahoma

Serif fonts

This is 14 point bold Times New Roman

This is 14 point bold Garamond

This is 14 point bold Palatino

Fig. 1.6 : The different font styles

Principles of design

Principles are concepts used to organise or arrange the elements of design. The way in which these principles are applied affects the expressive content, or the message of the work. The principles of design are balance, proportion, rhythm, emphasis and unity.

i. Balance : Balance is the distribution of the visual weight of objects, colours, texture and space. In visual images, balance is formal when both sides are symmetrically arranged. Balance is informal when sides are not exactly symmetrical, but the resulting image is still balanced. Informal balance is more dynamic than formal balance and normally keeps the learner's attention focused on the visual message. Figure 1.7a shows formal balance and Figure 1.7b shows informal balance.



Fig. 1.7a : Formal balance



Fig. 1.7b : Informal balance

ii. Repetition : Repetitive works with a pattern makes the artwork look active. The repetition of elements of design creates unity within the artwork. Repetition with variation is interesting, without variation repetition can become monotonous. If



you wish to create interest towards the document, the repeating element should include a degree of variation. Repetition can also give a work a sense of motion. Figure 1.8a shows a repetitive work without variation and Figure 1.8b displays a repetitive work with variation.

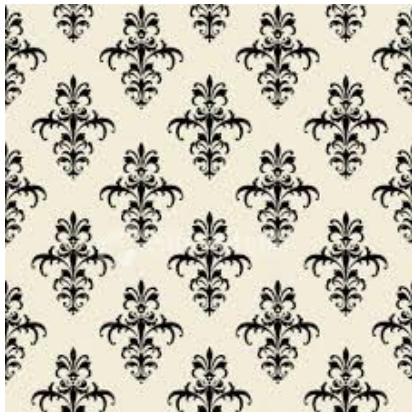


Fig. 1.8a : Repetition without variation

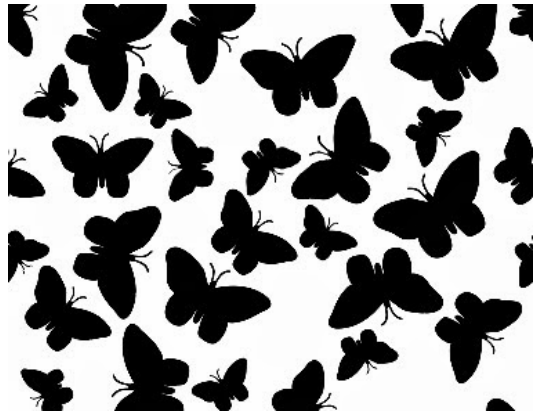


Fig. 1.8b : Repetition with variation

iii. Contrast : Contrast is the association of opposing elements like opposite colours, tone, direction, etc. It can be contrast in the colour wheel where opposites like red and green, blue and orange, etc. are used (Shown in Figure 1.9a). Contrast in tone can be light and dark (Shown in Figure 1.9b). Contrast in direction can be horizontal and vertical. The major contrast in a painting should be located at the center of interest. Too much contrast scattered throughout a painting can destroy unity and make a work difficult to look at. Contrast allows us to highlight key elements in our design. Contrast focuses on making items stand out by emphasizing differences in size, colour, direction and other characteristics.

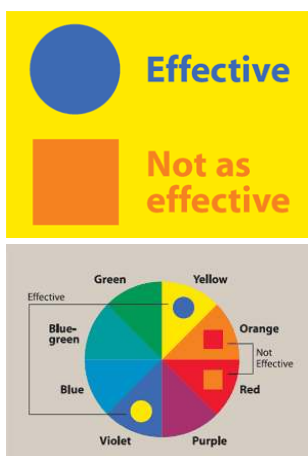


Fig. 1.9a : Colour contrast

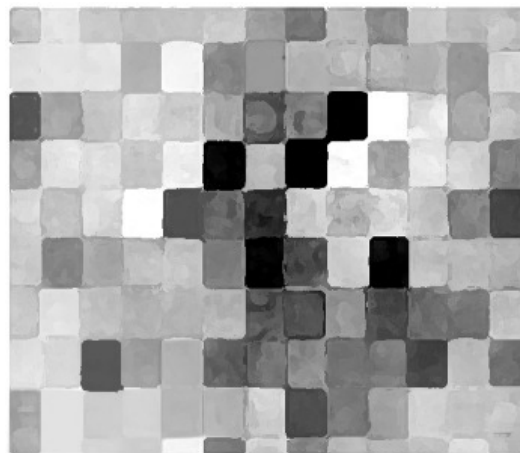


Fig. 1.9b : Tone contrast

iv. Harmony : Harmony is the visually satisfying effect of combining similar, related elements. The combination of adjacent colours on the colour wheel, similar shapes, related textures, etc. Harmony in visual design means all parts of the visual image relate to and complement each other. Harmony of colours and shapes are displayed in Figure 1.10a and 1.10b respectively.



Fig. 1.10a : Harmony of colours

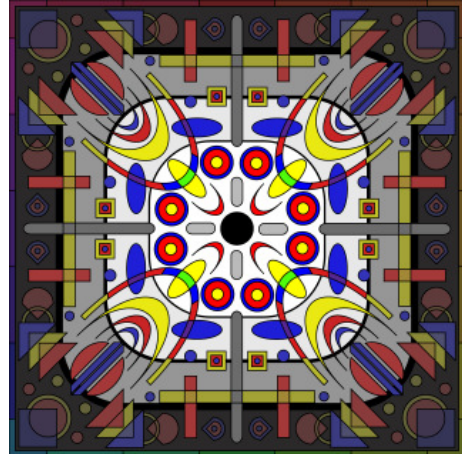


Fig. 1.10b : Harmony of shapes

v. Unity : Relating the design elements to the idea being expressed strengthens unity. A design on active aggressive subject would work better with diagonal direction, course, rough texture, angular lines, etc. as shown in Figure 1.11. A design on quiet passive subject would be better if horizontal lines, soft texture and less tonal contrast are used. Unity in a painting also refers to the visual linking of various elements of the work.



Fig. 1.11 : Unity

vi. Dominance : Dominance raises interest, reducing confusion and monotony. Dominance can be applied to one or more of the elements to give emphasis. A dominant element in the center (horizontally or vertically) creates symmetry, producing a formal, static design. A dominant element close to the edge creates an out of balance tension as shown in Figure 1.12. The position of the dominant element (colour, shape, line, etc.) should be used to the advantage of the topic.



Fig. 1.12 : Dominance

Everyone involved in the creation of visual content, whether knowingly or unknowingly, uses this collection of tools known as the elements and principles of



design. An understanding of this simple set of tools opens infinite choices to them. The designers can make use of these tools to make their designs look right.

Once the page layout and design is set, the entire material is reviewed for modifications. The correction cycle includes processes such as proof reading and image retouching. This is continued until no further modifications are required.

Design a poster in a chart paper for saving trees. Apply the design principles and use the elements of design effectively to convey the message.

Know your progress



1. What is publishing?
2. The different classifications of printing are _____ and _____.
3. What are the three activities in the production stage of publishing through print media?
4. State whether true or false.
 - a. Prepress is the process of making the document ready for printing.
 - b. Page designing is done during the post press stage.
5. Choose the odd one out.
 - a. line
 - b. typography
 - c. balance
 - d. colours
6. Expansion of DTP is _____.
7. What do you mean by unity in design?

B. Pre-flighting

Once the graphics file has been created by the designer, it undergoes the next pre-press stage called pre-flight. In this stage, the file is checked to make sure it contains all the elements necessary for a successful printing.

The file is checked to make sure the images have the proper format and resolution, all the fonts are included and CMYK colours are set up appropriately. We have discussed the use of CMYK in Chapter 7 of Class XI.

You might have noticed the mark shown in Figure 1.13a in the corners of books. This is called crop marks. Crop marks (trim marks) are lines printed in the corners of the page to show the printer where to trim the paper. The layout elements such as margins, crop marks and bleeds are also checked to make sure that it is set up correctly. Bleed refers to printing that goes beyond the edge of the sheet before

trimming. It is the bleed area that is to be trimmed off. A margin is the area between the main content of a page and the page edges. The margin helps to define where a line of text begins and ends. Crop marks, bleed and margin are displayed in Figure 1.13b.

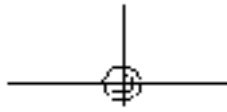


Fig. 1.13a : Crop mark

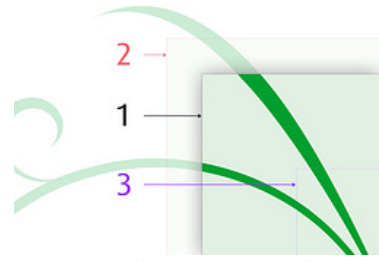


Fig. 1.13b : 1-Crop marks, 2-Bleed, 3-Margin

Depending on the software used to create the graphics file, sometimes the entire file needs to be converted to a format better suited for commercial printing. The most popular format that is supported by most printers is Adobe PDF (Portable Document Format).

C. Creating a proof

In this stage, a proof is prepared, which will be a representation of how the finished piece will appear when it is printed.

In the case of business cards or postcards, a proof is often created as a PDF. Since a PDF is an electronic file, it can be e-mailed to the client for approval. But, if the process involves finishing operations such as binding or folding, like that of a book or brochure, it is recommended that a physical proof be created. A physical proof will demonstrate how the piece will be constructed, where it will be folded, the order of the pages, etc.

In addition to avoiding any unforeseen errors, the purpose of the proof stage is to ensure that the printed material is of the quality required.

D. Printing plates

After the proof has been approved, the project is ready to be produced on a printing press. If the project is to be produced on a digital printing press, printing of plates is not required. This is because the graphics file can be electronically transferred directly to the digital press for output.

However, if the project is to be produced on an offset press, it will need printing



Fig. 1.14 : Plate prepared for offset press



plates. In this case, the final stage of the pre-press process is the creation of printing plates. Printing plates are made for each job and they provide the method for transferring the inked images to the proper place on the paper. The size of a plate depends on the press. Each plate can be used to print a number of pages, depending on the size of the page to be printed. The plates fixed on an offset press are shown in Figure 1.14.

In the case of colour printing, separate plates are to be prepared for the four colour components cyan, magenta, yellow and black, known as CMYK. For this, colour separation of the project has to be done. Colour separation is the process by which original artwork is separated into individual colour components for printing. By combining CMYK colours, a wide spectrum of colours can be produced on the printed page. When the colours are combined on paper, the human eye combines these colours to see the final image.

1.2.2 Printing

Once the prepress jobs are over, the project is ready for the next stage - printing. Here the finished file/plate is given to the press for printing. The printing process can be lithography, digital, gravure, flexography and screen printing. We will discuss the different printing processes in detail below.

A. Lithographic printing

Lithography is an offset printing technique using plates. In offset printing, ink is applied to the printing plate to form an image to be printed. It is then transferred or offset to a rubber blanket. The image on the blanket is then transferred to the paper to produce the printed product. The lithographic process for printing is based on the repulsion of oil and water. Lithographic printing is popular for commercial printing of newspapers, books, forms, etc. An offset press is shown in Figure 1.15.

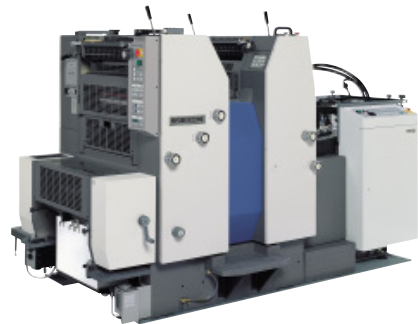


Fig. 1.15 : Offset press

B. Digital printing

Digital printing refers to methods of printing from a digital image directly to a variety of media. In this type of printing plates are not used. Digital printing can be done using large format, high volume laser or inkjet printers. Digital printing has a higher cost per page than more traditional offset printing methods. But this price is usually offset by avoiding the cost of all the technical steps required to make printing plates. It also supports the modification of the image (pages to be printed) anytime,

which is not possible in offset printing once the plates are made. It also allows on-demand printing, where a book is printed only when an order is received. A digital press is shown in Figure 1.16.

C. Gravure printing

Gravure or rotogravure printing is used in flexible packaging printing process. It can be used to print on materials including polyester, nylon, polyethylene, aluminium foils and paper. The cylinder of the gravure printer is engraved with the image to be printed. The cylinder is immersed in ink and its engraved cells store the ink which is transferred to the material to be printed. Its features are good quality image reproduction and low cost per unit on high volume production. Rotogravure printing is a suitable choice to print on laminated packaging for different ingredients. Figure 1.17a shows a rotogravure press and Figure 1.17b shows printing samples.



Fig. 1.17a : Rotogravure press



Fig. 1.17b : Gravure printing samples

D. Flexography

Flexographic presses are capable of producing good quality printing on many different materials. It is considered as the least expensive and simplest of the printing processes used for printing on packing material. Flexography has a relatively simple operation, similar to the use of a rubber seal and ink stamp pad. The image to be printed is prepared on flexographic plates made of a flexible material, such as plastic, rubber, etc. This plate is then inked and then it is transferred to printing material. Compared

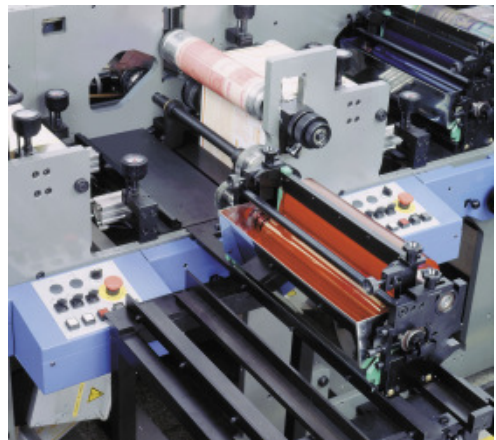


Fig. 1.18 : Flexographic press

to offset and gravure, its ink dries faster which results in faster production, thereby lowering costs. Due to this the use of flexographic printing presses is on the rise. Flexography is used for the production of shopping bags, flexible plastics for milk and other food packets, self-adhesive labels, disposable cups and containers, envelopes and wallpaper.

E. Screen printing

Screen printing is a simple process for printing. It is a printing technique that uses a woven mesh to support an ink blocking stencil to receive a desired image. A rubber blade is moved across the screen stencil which forces the ink through the mesh openings on to the print surface. Screen printing has to be done on a flat

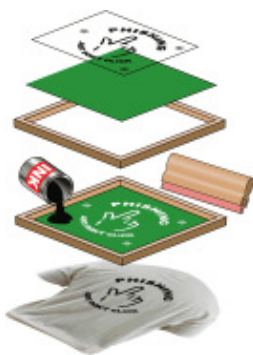


Fig. 1.19 : Screen printing

surface and the area being printed should not be under pressure. It can be used to print on a wide variety of materials, including paper, plastics, glass, metals, fabrics and others. A screen printing process is displayed in Figure 1.19.

1.2.3 Post press

Post press is the final stage in the printing process. It involves all the cosmetic or functional changes that are done on the final print. The four major operations in post press are folding, assembling, binding and cutting. There are many additional post press finishing processes such as varnishing, laminating, embossing, perforating, drilling, etc. that improves the appearance or functionality of the printed material.

A. Folding

Usually in a printing press, several pages are printed on both sides of a large paper and then they are folded according to an imposition scheme. Imposition scheme is the arrangement of pages for printing in such a way that when the sheet is folded, the pages will be in the correct order. The folding process can be according to various imposition schemes. A sample layout of the pages after printing is given in Figure 1.20. Page numbers are specified in the figure. This sheet has to be folded

Front				Back			
5	21	6	8	7	01	11	9
4	13	16	1	2	15	14	3

Fig. 1.20 : Folding scheme for 16 pages

according to a scheme so that the pages are in serial order. A folding machine can automatically fold any type of paper according to the imposition scheme for notebooks, textbooks, magazines, brochures, etc.

B. Assembling

The assembling/gathering is the process that brings all the printed pages of the final product together in the required order according to the binding style. Assembly processes can be manual, semiautomatic or fully automatic. Manual and semiautomatic assembling requires the attention of a worker. Fully automatic assemblers are kept in line with the binding machines in order to improve efficiency.

C. Binding



Fig. 1.21 : Different types of binding

Book binding is the process of physically assembling a book from a number of folded or unfolded sheets of paper or other material. The type of binding is usually selected based on the function of the document, the number of pages it contains and the printing budget. Some of the popular binding techniques are hard cover binding, punch and binding (spiral binding), thermally activated binding, stitched binding, etc. Some of the types of binding are given in Figure 1.21.

D. Cutting

Cutting is done according to the crop marks printed on the paper. Cutting can be either done manually or using a machine. A cutting machine cuts the stacked printed pages. The cutting blade is powered electrically. Though cutting is generally considered a postpress operation, most lithographic and gravure presses have integrated cutters as well as



Fig. 1.22 : Cutting machine



equipment to perform related operations like perforating. Perforation is a small hole or a row of small holes punched in a sheet of paper so that paper can be easily torn through this. Figure 1.22 displays a cutting machine.



Calico is an all-cotton plain woven fabric printed with simple designs in one or more colours. Calico originated in Calicut, India, by the 11th century. Calico cloth was used for binding books. This style of binding was popular as calico binding. This process involved stitching, gluing and then coving the area to be binded using calico cloth. In the 17th and 18th centuries calicoes were an important commodity traded between India and Europe.



Job Definition Format (JDF) is a printing industry standard designed to simplify information exchange between different programs and printing systems. It is managed by the industry association CIP4 (International Cooperation for the Integration of Processes in Prepress, Press and Postpress Organization). It manages the print, packaging and label work (job) flows. JDF starts a job ticket with an 'intent' for the job. More JDF details are added later in various steps of the production workflow. A JDF ticket contains information that enables each node to determine what files it needs as input, where they are found and what processes it should perform. After executing a task, it modifies the JDF job ticket to describe what it has done and examines the JDF ticket to determine where accompanying files and instructions should be sent next.

Know your progress



1. What is pre-flighting?
2. The expansion of pdf is _____.
3. What is the purpose of creating a proof?
4. State whether true or false.
 - a. The lines printed in the corners of the page to show the printer where to trim the paper is called margin.
 - b. Bleed refers to printing that goes beyond the edge of the sheet before trimming.
5. Name the printing technology that can be used to print on nylon.
 - a. Gravure b. Digital c. Offset d. Screen
6. List the different types of binding.
7. What is lithography?

1.3 Electronic publishing

You might have noticed people watching movies, enjoying songs, reading books, etc. in their mobile devices like mobile phones, tablets, laptops, etc. while travelling. Today more and more people are forced to spend time for travel regularly due to many reasons like work, visiting relatives, etc. They wish to utilise their time fruitfully by reading books, listening to music, etc. This has compelled the publishing companies to release electronic versions of their publications. These publications can be bought online and people can read them using their mobile devices.

Electronic publishing is the digital publication of e-books, digital magazines and the development of digital libraries and catalogues. Electronic publishing takes the format of works published online, on a compact disk, e-mailed or provided in a file format compatible with handheld electronic readers. It is also called e-publishing or digital publishing.

Electronic publishing can be either web based publishing or as digital distribution of content. In web based publishing, information is published in websites. We can browse and use the website to read the material. Websites like www.wikipedia.org publish content over their websites. In the case of digital distribution publishing, the material can be downloaded from a website and can be read using an electronic reading device like mobile phone or e-book reader. Many publishers now publish their books electronically in downloadable format.

The effective use of elements of design improves the appearance of content in electronic publishing. Principles of design can also be used to enhance the design of pages.

1.3.1 Web based publishing

Web publishing or online publishing is the process of publishing content on the Internet. It includes creating and uploading websites, updating webpages, and posting blogs online. The published content may include text, images, videos, and other types of media. Websites like Wikipedia, online newspapers, blogs, etc. are examples of web based publishing.



Fig. 1.23 : Web based publishing

Web based publishing requires an Internet connection to read the material. This material is available on any device that has an Internet connection. Web based publishing are mostly freely available on Internet.



To develop a website for publishing content, we require a web development tool like, HTML (Hypertext Markup Language), CSS (Cascading Style Sheet), JavaScript, PHP, etc. The site thus developed has to be uploaded to a web server, called web hosting. We will discuss HTML, CSS and the technologies for uploading web sites to a web server in detail in the forthcoming chapters. Publishing through blogs does not require much knowledge about the web based technologies. This can be done easily using the user friendly features provided by the popular blogging services like blogger.com, wordpress.com, etc.

Since web publishing does not require physical materials such as paper and ink, the cost of publishing content on the web is almost nothing. Therefore, anyone with basic knowledge of Internet can be a web publisher. It has a vast audience since content posted on the web can be viewed by anyone in the world with an Internet connection. These advantages of web publishing have led to a new era of publishing that was not possible before. Figure 1.23 displays websites and blogs in various devices.

1.3.2 Digital distribution

The electronically published materials like e-books, e-journals, etc. can be downloaded from various websites. This type of publishing is called digital distribution. Book publishing companies sell the e-book versions of their hard bound publications through the various e-commerce websites. Users can download any number of these e-books from these websites to their mobile devices and can read them when required.



Amazon - Kindle

Barnes & Noble - Nook

Apple- iPad

Fig. 1.24 : Popular e-book readers

An e-book reader is a mobile electronic device that is designed for reading e-books and digital periodicals. An e-book reader is similar in form, but more limited in purpose than a tablet. In e-book readers, the light in the screen is from above, whereas in the case of mobile phones, tablets and laptops the light from the screen

is backlit. The backlit screen causes fatigue, if used for reading for long hours. The front lit screens in the e-book readers provide a better reading experience. In comparison to tablets, many e-book readers are better than tablets for reading because they are more portable, have better readability in sunlight and have longer battery life. The popular e-book readers are Amazon Kindle, Barnes & Noble Nook, Apple iPad, etc. Some of the popular e-book readers are displayed in Figure 1.24.

Electronically published materials can be developed using the same DTP software used for print based publishing. The process of publishing the material in the prepress stage of print based publishing is the same here too. The material to be published is then converted to a format readable by the e-book readers. The popular e-book formats are PDF, iBook, Kindle, etc.

PDF (Portable Document Format) was developed by Adobe Systems and first released in 1993. This format was developed to provide a platform independent means of exchanging documents. PDF documents can be read using a wide variety of readers freely available like Adobe Reader, Open Office.org, Nitro PDF, etc. PDF files are supported by almost all modern e-book readers, tablets and smartphones. iBook is the native file format for Apple iPad and Kindle is the file format for Amazon's Kindle book reader.

Know your progress



1. What is electronic publishing?
2. Name any two web based publishing technologies.
3. Write an example of a popular blog for publishing.
4. What is the use of an e-book reader?
5. PDF was developed by _____.
6. List two examples for PDF readers.



Let us conclude

Any creative work has to be published for distributing to the society. The success of a published work depends on its appearance. Publishing can now be divided into print based and digital publishing. Print based publishing dates back to the years of Johannes Gutenberg, the person who developed the first printing machine. Today the different stages of print based publishing like prepress, printing and post press has been automated. Prepress work includes designing the document to be printed. Softwares are used to design the layout of a page. This is done based on the principles of design and also by giving importance to the various design elements.



The well designed material is checked for errors by creating a proof and then transferred to plates. Once the plates or the material is ready for printing, it can be printed using the press suitable for the material. Once printing is over, the pages need to be cut, folded, assembled and bound to form a book. Electronic publishing has gained importance due to the popularity of Internet. The different types of electronic publishing are web based and downloadable format. Web based publishing can be done through websites or through blogs. They are mostly cheap. Downloadable e-books requires specific softwares to read. Portable e-book readers can be used to buy and read e-book versions of popular hard bound books online.

Let us assess



1. Explain the three different stages in publishing.
2. Arun plans to design a brochure for his restaurant. Name two softwares that can be used to design the brochure.
3. Explain the elements of design.
4. In a paper advertisement, a designer has space to draw lines. Suggest a line style that can give a feel of energy to the brochure.
5. Classify the following fonts into serif and sans serif categories.
Arial, Times New Roman, Garamond, Verdana, Palatino
6. Write short notes on contrast and balance in design principles.
7. Why are plates not used in a digital press?
8. What is the use of plates in an offset press?
9. What is colour separation?
10. Harilal is planning to publish a book. Suggest a printing process that can be used for this purpose. Justify your suggestion.
11. Why is flexography used in mass production when compared to other printing processes?
12. Explain how screen printing is done.
13. What do you mean by post press? List and explain the four major operations that are done during this stage.
14. What is electronic publishing? What are the different types of electronic publishing?
15. You have written a story in English and you wish to publish it electronically. Which type of publishing would you prefer? Why?
16. Vimala has an e-book reader and a mobile phone with a large screen. Which device will be better for reading while travelling? Why?



2

Introduction to Word Processors

Significant Learning Outcomes

After the completion of this chapter, the learner

- recognises the use of word processing software and its features.
- differentiates various components of the IDE of the word processor.
- creates documents using word processor.
- copies or moves text from one place to another in a document.
- searches a particular text in the document and replaces it with another text.
- changes the appearance and style of text by applying the features like bold, italic, underline, font face, font size, etc.
- configures a paragraph of text by changing alignment, indent, line space, etc.
- creates lists using bullets or numbers.
- alters the page size, orientation and page margins.
- inserts header and footer in pages.
- takes the hard copy of a document.

We discussed various aspects of publishing in the last chapter. It is identified that pre-press activities play an important role in print-media publishing. This chapter introduces a type of software called word processor that helps to perform prepress activities when the text material is ready. Word processor is an application software tool or package that processes textual matter and creates organised and flawless documents. Document is a file that contains text or images which was earlier prepared using pen and paper, and typewriting machines. Bio data, reports, write-ups, publications, etc are examples of documents. Word processor not only removes all the limitations of conventional typewriting machines but also offers various useful and attractive features. Many software companies offer word processor packages. A large community of users like scholars, teachers, lawyers, doctors, publishers, students, etc. enjoy the features of word processors. Some of the popular examples are LibreOffice Writer, Microsoft Word, AbiWord, etc.



2.1 Features of a word processor

The word processing software is developed in such a way that it helps the creation of a document with ease. It provides menus and tools to perform various operations like creating documents, editing and formatting text, inserting tables and images, etc. Let us see some of the important characteristics of word processors.

Quickness: Word processors help easy creation of a new document and manipulation of the content. Tools are available for speedy typing, editing and formatting in the form of menus, icons and short-cut keys. Document files can be saved, retrieved and printed quickly and easily.

Word wrapping: As we type the text matter towards the end of a line, a word may not fit completely in the line. In that case, the word going past the right margin is placed in the next line automatically. This feature is called word wrapping.

Editing features: Editing is the process of correction like insertion or deletion of text, copying or moving of text, etc. We can perform these with ease using word processors.

Drawings and graphics: Word processor provides tools for drawing various shapes and figures. It also allows pictures or images to be inserted in documents.

Tables: Tables are provided in documents to present text or data in rows and columns.

Formatting features: Word processor offers various types of formatting like character formatting, paragraph formatting and page formatting. Formatting the content makes a document more legible and beautiful.

Header, Footer and Page number: Header is the text appearing at the top of all pages and footer is the text appearing at the bottom of all pages in a document. Page numbers are continuous numbers given to each page in the document. Word processors provide these features to manage multi pages document effectively.

Object Linking and Embedding (OLE): OLE is a program-integration technology used to share information between programs through objects. Objects are saved entities like images, charts, equations, files created using other software, etc. These objects can be linked and embedded with a document.

Spell check and Grammar check: Using this feature, a word processor scans documents to identify any spelling or grammatical error in the document. The comparison of the text in document is made with a standard built-in dictionary.

Mail merging: This facility helps to print many documents with same content and addressed to different people. This is mainly used for mailing invitation letters, notices, etc.

Index and Table of contents: Index is usually created at the end of a professional document like project report, survey report, government write-ups, etc. Index includes important terms or words appearing in the document. Table of Contents appears at the beginning of a professional document or textbook, after the title page. This contains the main headings and sub headings appearing in the document with the respective page numbers. Both the above pages can be easily created using the options available in word processors.

Templates: Templates are predefined document formats available with the software. They have predesigned layouts and formats. It is easy to create a new document from a template. We need only to enter the text at required positions.

This chapter introduces the basic formatting features of word processing software. The advanced features will be explained in the next chapter. Though there are several products for word processing, we use the LibreOffice Writer for further discussions. It is one of the components of LibreOffice integrated package, which is an open source software. It provides all features of a typical word processor. LibreOffice has separate versions for both Linux OS and Windows OS.

2.2 LibreOffice Writer IDE

In the Linux Operating System, we open LibreOffice Writer using the command sequence **Applications → Office → LibreOffice Writer**. The LibreOffice Writer window will be opened as shown in Figure 2.1. This window is known as LibreOffice Writer Integrated Development Environment (IDE) window. The main components of the IDE window are Title bar, Menu bar, Toolbars, Ruler, Scroll bars and Text area.

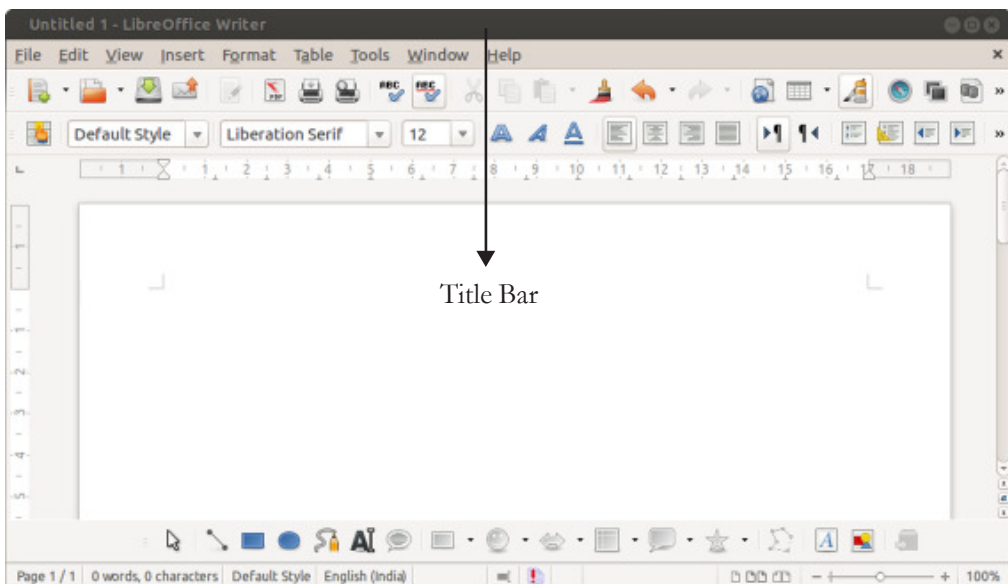


Fig.2.1: LibreOffice Writer IDE window

**Let us do**

In Figure 2.1, the Title bar is marked. Similarly, identify the other components that are detailed below and mark them in the figure. You may refer the opening window of LibreOffice Calc that you learned in Class XI or run the software in the computer.

These components are similar to those seen in the opening window of LibreOffice Calc. Let us have a look at these components.

Title bar: It is the topmost part of the IDE window. It shows the name of the document and the name of the software at the left, and the control buttons (Minimize, Maximize and Close) at the right. In Figure 2.1, we can see the text item **Untitled1**, the default name of the document which can be changed when we save the document with a user-supplied name. It is followed by the name of the software LibreOfficeWriter. We know that on clicking the Minimize button the document window (IDE) is minimised to a small icon and kept in the task bar, Maximise button is used for maximising the current document window to fit the whole screen area, and the Close button closes the software itself.

Menu bar: It contains all the important menus available with the software. They include **File, Edit, View, Insert, Format**, etc. When we click on a menu item, a pull-down menu appears with more commands associated with the menu item as options. There may be sub-menus under certain options in the pull-down menus.

Toolbar: It contains shortcut commands in the form of various buttons. Each button is characterised by the presence of an icon (small pictures or symbols). If we place the mouse pointer on a button, a short text will appear as its description called 'Tool Tip'. There are many toolbars like Standard toolbar, Formatting toolbar, Drawing toolbar, etc. Toolbars can be managed using the **View** menu. Additions and removal of toolbars are possible by selecting the required toolbar from the list. In Figure 2.1, we can see Standard toolbar and Formatting toolbar at the top and Drawing toolbar at the bottom.

Scroll bars: Scrolling is the process of moving up and down or left and right through the document window. There are two scrollbars namely Vertical and Horizontal scroll bars for scrolling the document vertically or horizontally. The Vertical scroll bar appears at the right most part of the IDE screen. The Horizontal scroll bar appears just above the Status bar which is at the bottom part of the IDE window. This scroll bar will be visible only when it is required, i.e.; when the document window resizes to small window. We can see vertical scroll bar in Figure 2.1.

Ruler: This allows changing the left and right margins of the document. There are two rulerbars. One is at the top and the other is at the left side. Figure 2.1 shows



these rulers. Margin is the distance between the text and an edge of the paper. The ruler in the IDE window displays the positions of margins.


Margins are mainly of four types:

1. Left Margin : The distance between the text and the left edge of the paper.
2. Right Margin : The distance between the text and the right edge of the paper.
3. Top Margin : The distance between the text and the top edge of the paper.
4. Bottom Margin: The distance between the text and the bottom edge of the paper.

Status bar: It is visible at the bottom of the IDE window. It displays information like page numbers, column and line number where the cursor (small vertical blinking character) is located, the selected language etc. as shown in Figure 2.1. The page number area usually shows the page number where the cursor waits and the total number of pages in the document. For example, Page 1/4 indicates that the current position of the cursor is at page number 1 and the total number of pages in the document is 4. Another important item on the Status bar is the zoom area which is placed at the right most end of the Status bar. The middle point button present in the area can be drawn to the right (+) or to the left (-). If we drag the button to the right (zoom out), the document window enlarges and when the button is moved left (zoom in), the document window shrinks. This is very useful for getting a closer view or distant view of the document. The Status bar also shows the Insert/OverWrite status which will be discussed later.

Text area: It is the place where we type the text matter of the document to be created. It is also called the document area. The cursor will be present in the text area.

2.3 Creating a new document

We have seen that when we run the LibreOffice Writer in a computer we get a window as shown in Figure 2.1. Actually a new document is opened and we can input or type in the desired text in this document. If an existing document is visible in the IDE, a new document can be opened using the command sequence **File → New → Text Document** or by pressing the key combination **Ctrl+N** (the keys **Ctrl** and **N**). A new document can also be open by clicking New button  in the Standard toolbar. In such a case, the new document will be opened in a new IDE window. Let us prepare an article for the school magazine about voluntary blood donation. Assume that we are ready with enough material for the article. Let us type in the text matter in the new document. Assume that the first page looks like the one as shown in Figure 2.2.

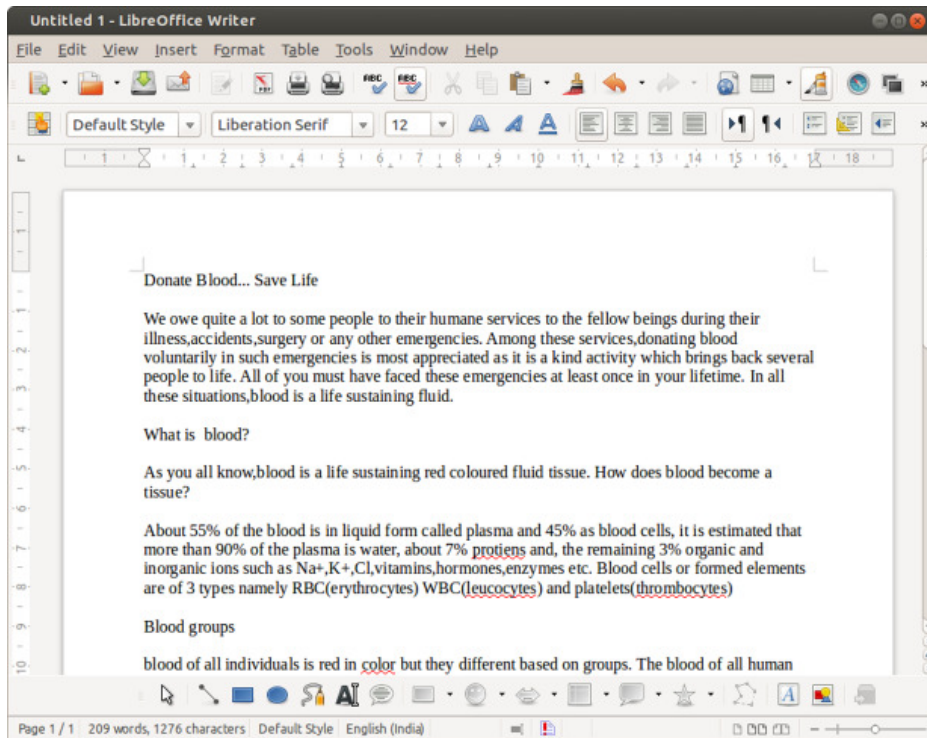



Fig.2.2: A document in Writer IDE window

While typing, the space bar key, tab key and Enter key, etc. may have to be used. We can see that the text matter is aligned to the left margin. The font characteristics of the text take the default values like Liberation Serif face, 12 point size, black colour, etc. These are visible in the Formatting toolbar (just above the horizontal ruler) in the window. We can see that some words are underlined in red colour. This indicates that the word is misspelt. We can correct them by adding some letters or deleting some other letters. There may be grammatical error also. Such corrections are part of editing process. We may also have to change the font characteristics of some text and set the margins and spacing to make the article more presentable and attractive. These are part of the formatting processes. We will discuss these details in the coming sections. Before doing these processes, it is better to save the document with a suitable file name.

2.4 Saving a document

As mentioned in the previous section, when we open a new document for storing a text matter, it is better to be saved frequently to avoid loss of material due to unexpected termination of the program. The document can be saved permanently in the computer by selecting the command sequence **File** → **Save** or by pressing the key combination **Ctrl+S** or by clicking the Save button  on the Standard toolbar.

When we save the document for the first time using any of these methods, the Save window appears as shown in Figure 2.3. We can give a suitable name to the file in the text box against the label **Name:**. As seen in Figure 2.3, the default name **Untitled1** will be highlighted initially, which will be replaced by the user-supplied name. The file will be saved with extension **.odt** in the current folder. We have the freedom to place the file in the desired folder. Let us save the file with the name **donation.odt**. The window shown in Figure 2.3 will not appear on further execution of Save command. But, if we select the command sequence **File → Save As...** or press **Ctrl+Shift+S** frequently, this window will appear each time and the same document has to be saved in another name in the current folder or with the same name in another folder. When we complete a session in the preparation of the document, it is to be closed.

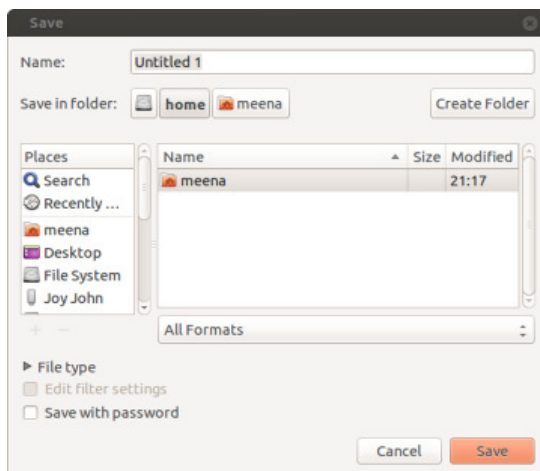




Fig. 2.3: Save window of Writer



Let us do

Create a document to prepare an assignment paper on "Influence of the Visual Media on Students". Initially you collect sufficient material and start typing into the document, and save it in a file. Don't bother about the format, layout, mistakes and such things for the time being.

2.5 Closing a document

At the end of a session we need to close the file in which we are preparing the document. A file can be closed by using the command sequence **File → Close** or by clicking the Close button  in the Menu bar. Note that if we click the Close button  in the Title bar, the software LibreOffice Writer will be closed along with the file(s) in use. Before closing a document, it is always better to save the latest changes in the file. In case if we have not saved the document with the latest version, the Writer will prompt us with a dialog box with three options namely, **Close without saving**, **Cancel** and **Save** as shown in Figure 2.4. One of those buttons can be selected. If we select the **Save** button, the Save dialog box will appear if it is the first time saving, otherwise the file will be saved with the latest

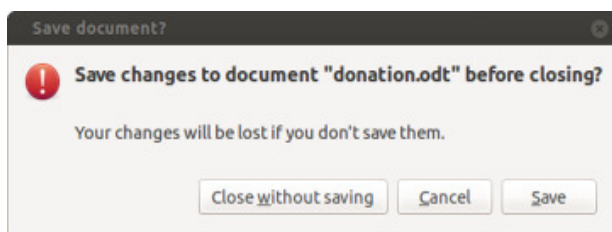



Fig. 2.4: Save document? window



changes in the current file name. If we click the **Close without saving** button, the file will be closed without saving the changes after the last save. On clicking the **Cancel** button the dialog box will disappear and the document will remain in the edit mode itself.

The final step of every Writer session is to come out of the software. It can be done with the command sequence **File → Exit LibreOffice** or using the keyboard shortcut **Ctrl+Q**. It is also possible with a click on the the Close button in the Title bar as mentioned earlier.

2.6 Opening a document

Suppose we want to see the content of a file or make some modifications in the form of adding more data, deleting some existing content or replacing some current portion with new material. Whatever be the intention, the file is to be opened first. This can be done with the command sequence **File → Open** or with the shortcut keys **Ctrl+O**. It is also possible with a click on the Open button  in the Standard toolbar. Now a dialog box appears as shown in Figure 2.5. Choose the required file from those visible in the window. If the file is not found in the opened folder, find the folder first from the Places list box in the window. Once the file is selected, click the **Open** button in the window. Double click on the file will also do the same. The file will be displayed on the screen.

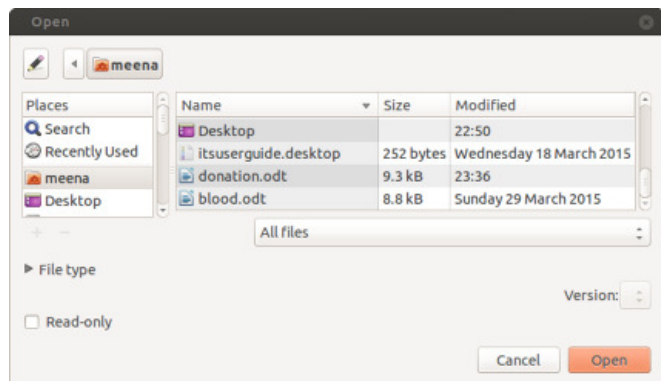


Fig. 2.5: Open dialog box

2.7 Editing a document

Editing is a process of bringing about changes in a document. It may include copying, moving, finding, replacing, deleting, and inserting text or graphics. This process may require navigation through the document. Let us see the common activities during document editing.

2.7.1 Prerequisites for editing

Before editing a document we may need to perform some operations like navigation, Insert/OverWrite mode setting, selection of text, etc. Let us familiarise ourselves with these operations.



A. Navigation

Moving from a point to another in a document is normally called navigation. While editing a document, to make changes at a particular location, the cursor is to be placed at that place. The following keys facilitate navigation:

Arrow keys: To move the cursor to the very next character (to the left or right, or at the previous or next line).

Home: To move the cursor to the beginning of the current line.

End: To move the cursor to the end of the current line.

Page Up: To place the cursor after moving one screen full of content upwards from the current position.

Page Down: To place the cursor after moving one screen full of content downwards from the current position.

Ctrl+→: To move the cursor to the beginning of the previous word.

Ctrl+←: To move the cursor to the beginning of the next word.

Ctrl+Home: To move the cursor to the beginning of the document.

Ctrl+End: To move the cursor to the end of the document.


Navigation can also be performed by scrolling the mouse. The document can be scrolled upwards or downwards by keeping the mouse pointer anywhere in the document and rolling the scroll wheel on the mouse. The same effect can also be achieved by dragging the scroll button on the scroll bars in the window or clicking on the up and down scroll arrows. In Figure 2.1, you might have identified a vertical scroll bar. Though it is not present in this figure, there is a horizontal toolbar at the bottom of window.

B. Insert/OverWrite mode setting

The Status bar at the bottom of the IDE window shows this setting. If we can see a blank box to the right of Language status display, we will say that the document is in Insert mode. This mode allows insertion of a new character in the document without losing the existing information. If we press the **Insert** key in the keyboard, the status will change to OverWrite mode which we can see in the Status bar. In this mode, a new character will replace the existing one. **Insert** key is a toggle type key. By default the mode is Insert mode. When we insert a new text in the Insert mode, the existing matter will be shifted to the right to accommodate the new text. Addition of new text in a document and replacing existing content by new information are all part of editing.



C. Undo and Redo actions

Writer provides two special buttons Undo and Redo . We can use Undo for undoing or cancelling the most recent actions. However, if we want to retrieve an action cancelled by Undo we can use Redo button. The Undo and Redo actions can also be performed by the keyboard shortcuts **Ctrl+Z** and **Ctrl+Y**, respectively.

D. Text selection

While working with a document, we may have to perform some operations on a block of text. A word, phrase, sentence, paragraph or even the entire document can be a block of text. The block of text is to be marked or selected prior to perform any edit operation. This is called text selection, which is mostly done in two ways as follows:

Using mouse: Place the cursor at the starting position of the text to be selected. Hold down the left mouse button and drag slowly till the end of the text is selected.

Using keyboard: Place the cursor at the starting position of the text to be selected. Hold down the **Shift** key and press the proper navigation keys until the required text matter is selected.

The selected text will appear in a shaded area with a slight colouration. If we want to select the whole document, it can easily be done with the keyboard shortcut **Ctrl+A**, or using the command sequence **Edit → Select All**. After selecting the text, if we click anywhere in the document area, the selection will be lost. Figure 2.6 shows a selection in the document we are creating.

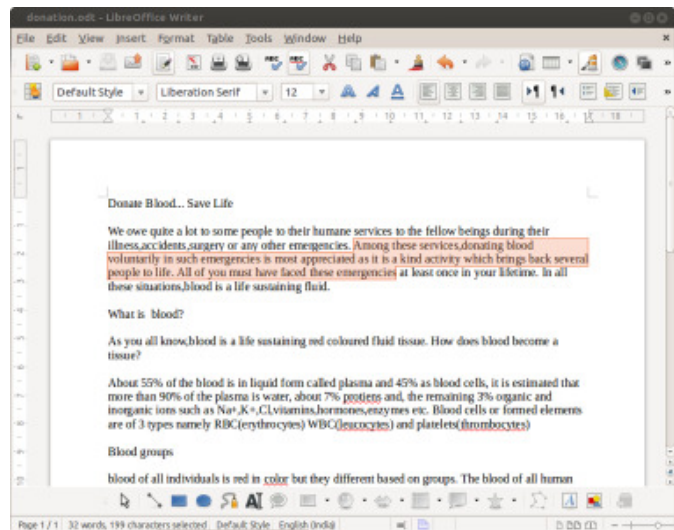


Fig. 2.6: Text selection

2.7.2 Cut, Copy, and Paste functions

These are the functions used frequently in editing. Commands, keyboard shortcuts and button are available to perform these functions. Figure 2.7 shows these buttons seen in the Standard toolbar.



Fig. 2.7: Cut, Copy, Paste buttons



While preparing the document or at a later stage we may find that some text is at an improper location in the document. We may think of deleting the content from its current place in the document and retyping it at the new location. But Writer helps us by providing the facility of Cut and Paste function, by which we can move a block of text or any other object from one position to another. It requires the following steps:

- i. Select the text or object to be moved.
- ii. Use any one of following actions for cutting:
 - Select the command **Cut** from **Edit** menu.
 - Right click the mouse at the selected text and select **Cut** from the context menu.
 - Press **Ctrl+X**.
 - Click Cut button (refer Figure 2.7) in the Standard toolbar.
- iii. Place the cursor at the position where the text/object is to be moved.
- iv. Use any one of the following actions for pasting:
 - Select the command **Paste** from **Edit** menu.
 - Right click the mouse at the selected text and select **Paste** from the context menu.
 - Press **Ctrl+V**.
 - Click Paste button (refer Figure 2.7) in the Standard toolbar.

Sometimes, a text may need to appear in different places in the document. In some cases, a portion of the content in one document may need to be present in another document. If the text is too large to type again and again, Writer gives the facility of copy and paste. The procedure is as follows:

- i. Select the text or object to be copied.
- ii. Use any one of following actions for cutting:
 - Select the command **Copy** from **Edit** menu.
 - Right click the mouse at the selected text and select **Copy** from the context menu.
 - Press **Ctrl+C**.
 - Click Copy button (refer Figure 2.7) in the Standard toolbar.
- iii. Place the cursor at the position where the text/object is to be copied.
- iv. Use any one of the following actions for pasting:
 - Select the command **Paste** from **Edit** menu.



- Right click the mouse at the selected text and select **Paste** from the context menu.
- Press **Ctrl+V**.
- Click Paste button (refer Figure 2.7) in the Standard toolbar.



Let us do

Let us distinguish between Cut - Paste and Copy - Paste functions. Table 2.1 contains some points. The cells left blank are intended for you. Fill in with suitable value points.

Cut - Paste	Copy - Paste
• Does not duplicate text	•
•	• Selected text will be present at both the source and destination location
• Moves the text from one place to another	•

Table. 2.1: Cut-Paste Vs Copy-Paste

2.7.3 Deleting text

Deleting is the act of removing a selected word or text matter permanently from the document. It can be performed by any method mentioned in the previous section for cutting the text. Alternatively, we can press the **Del** or **Delete** key in the keyboard after the selection.

As soon as we copy or cut a selected text, it will be placed in a temporary memory area called Clipboard. At any point of time, this matter can be pasted somewhere before exiting from the package.

2.7.5 Find and Replace facility

While editing a document, we may need to search for a particular word or text in the document. Sometimes, the searched text is to be replaced by some other word. Word processor provides Find and Replace facility for this purpose. Let us see how we can do this in Writer.

A. Finding a text

There may be one or more occurrences of the searched item. If we want to search for a text in the document select **Find** option from **Edit** menu or use the keyboard shortcut **Ctrl+F**. A floating toolbar as shown in Figure 2.8 will be opened. Here we have to type in the search text (see the word blood in the textbox) and then click on

the Next or Previous button. The very next occurrence of the search text after or before the cursor position will be highlighted as shown in Figure 2.8. All the occurrences of the search text will be highlighted if we click Find All button in the toolbar. Usually the case of the text will not be considered while searching. Case sensitivity can be enforced by clicking the check box visible at the left of Match Case in the Find toolbar.

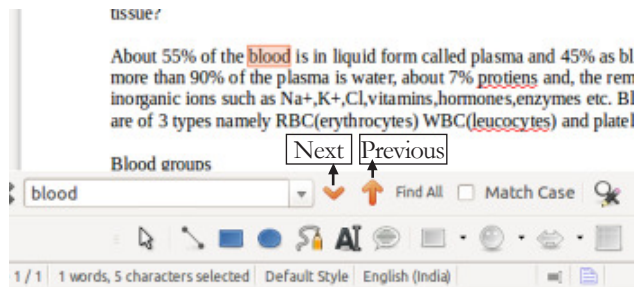


Fig. 2.8: Find floating tool bar

B. Finding and Replacing a text

When we want to replace an existing text by a new one, we have to select **Find & Replace** option from **Edit** menu or press **Ctrl+H**. The Find & Replace dialog box will appear as shown in Figure 2.9. The dialog box provides all facilities to find the search text in the document and replace with the new text wherever it is needed. In the **Search for** box, enter the text to be searched. There are mainly two checkboxes. One is the **Match case** as mentioned earlier. The other is **Whole words only**, which on click will search for the text that appear as whole words only.

In the **Replace with** box, enter the replacement text. Then click the **Replace** or **Replace All** button as per our requirement. To cancel a search in progress, we need to press **Esc** key in the keyboard.

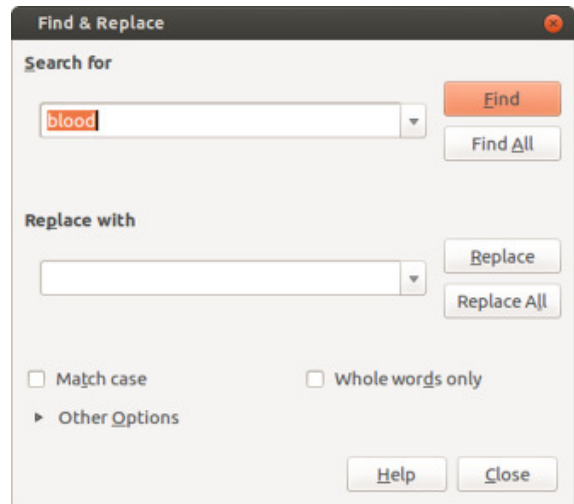


Fig. 2.9: Find & Replace dialog box



Let us do

Write down the procedure to search for the word "blood" and replace it by "Blood", whenever it appears at the beginning of a sentence.

2.8 Formatting the document

A document can be made attractive by applying certain formatting features. The general arrangement of text is known as formatting. Formatting makes our



document presentable. We can make some text bigger in size, stylish in font and beautiful in colour. Different types of emphasis can be given by underlining, italicising, etc. All these activities are included in the process of formatting the document. The whole content in the document will not be of the same importance or at the same level. There may be headings at different levels, listing of items, notable content, etc. While formatting a document, we need to keep in mind all these factors. Formatting provides documents a neater and more legible outlook. There are various aspects of text formatting like character formatting, paragraph formatting and page formatting.

2.8.1 Character formatting

Character formatting plays an important role in enhancing the appearance of a document. It decides how individual characters in the document should appear. Character formatting is concerned about making decisions regarding the font characteristics such as type of font, size and colour. The character formatting is also associated with the setting of text attributes like bold, italics, underline, etc. and text positioning like superscript, subscript, etc. Some of the important text attributes in character formatting and their effect are shown in Table 2.2. Word processor offers a variety of character formatting facilities at the same place. Let us see the steps for character formatting in Writer. Before applying the character formats, the text is to be selected. Using the command sequence **Format → Character...**, the Character dialog box as shown in Figure 2.10 can be opened where the formatting facilities are provided in different tabs.

Text attribute	Effect after applying the attribute
Bold	Computer Applications
Italic	<i>Computer Applications</i>
Strikethrough	Computer Applications
Overlining	<u>Computer Applications</u>
Underlining	<u>Computer Applications</u>
Font color	Computer Applications
Superscript	A ² (2 is superscripted)
Subscript	A ₂ (2 is subscripted)

Table 2.2: Text attributes

- Font** tab provides **Family** (different font faces), **Style** (Regular, Bold, Italic, Bold Italic), and **Size**. (*In Ubuntu Linux based LibreOffice Writer, fonts for English and Malayalam languages will be visible as in Figure 2.10*).
- Font Effects** tab gives options for **Font color**, **Effects** (Capitals, Lowercase, etc.) and **Relief** (Embossed and Engraved). It also provides **Overlining**, **Strikethrough** and **Underlining** with different types and colours of lines. Some checkboxes are given for **Outline**, **Shadow**, etc.

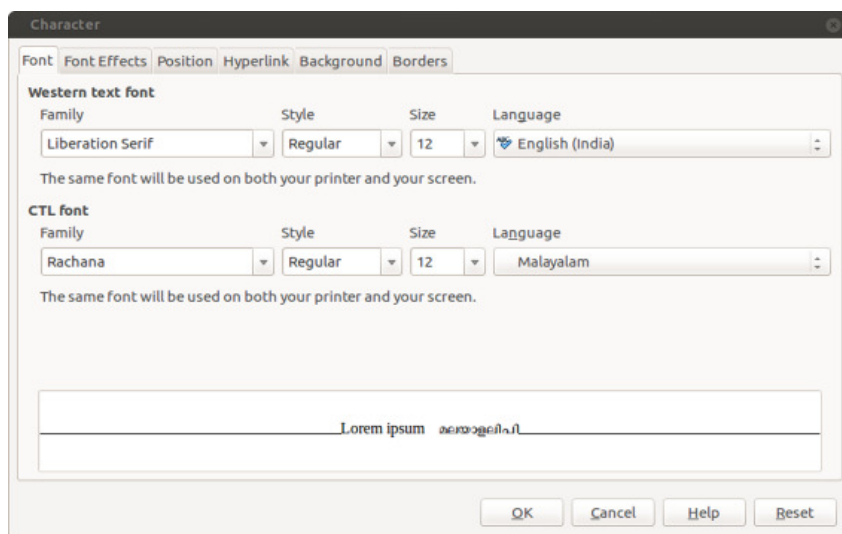


Fig. 2.10: Character formatting dialog box

- iii. **Position** tab facilitates superscripting, subscripting, etc. It also gives options to rotate the selected text at an angle. Another facility available is that, the spacing between the characters in the text can be increased (expanded) or decreased (condensed).
- iv. **Hyperlink, Background** and **Borders** are the other tabs in the dialog box.


The font style Bold, Italic and Underline can also be applied to a selected text by the keyboard shortcuts **Ctrl+B**, **Ctrl+I**, and **Ctrl+U**, respectively. The key combination **Ctrl+B+I+U** can make the three styles effective on the selected text.



Let us do

Figure 2.11 shows a portion of the document "donation.odt" in which we can see formatted text. Write down the procedure required for this and check whether you get the same format with your procedure. Note the position of the character + after Na and K in the last line of the window. Also identify the buttons in the Formatting toolbar seen in the figure, to apply Font Style (Bold, Italic, Underline) to the selected text.

2.8.2 Copying a format

The word processor provides an easy way to copy the character formats applied to a selected text and use the same for a particular text at another place in the document. Suppose we have formatted a heading text with some font characteristics and font style. The same can be easily copied and apply to another text in the same document using the Format Paintbrush button  in the Standard toolbar. The procedure is as follows:

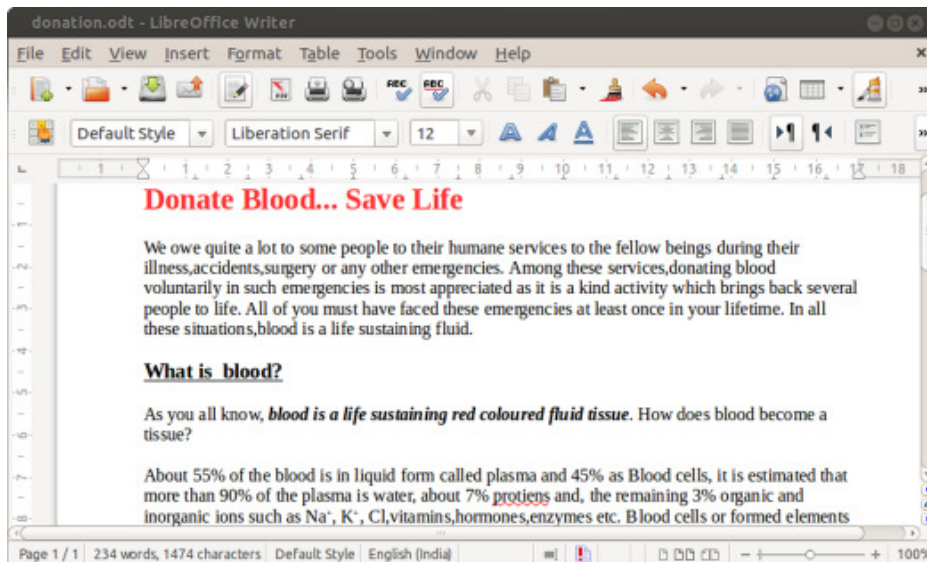


Fig. 2.11: The document after some character formatting

- Select the text from where the format is to be copied.
- Click the Format Paintbrush button.
- Click the text or paragraph where the format is to be applied.

Know your progress



1. State whether the following statements are True or False:
 - a. Writer automatically wraps the text extending beyond the right margin to the next line.
 - b. Ctrl+S is the short cut key combination to select a text in Writer.
 - c. Copy/Cut/Paste buttons are present in the Standard toolbar.
 - d. Writer does not offer a facility to cancel the most recent actions.
 - e. A text entered in Writer can be rotated to 900.
2. Fill in the blanks
 - a. The Bold button is present in _____ toolbar.
 - b. Formats applied to one text can be copied using the _____ button.
 - c. The text or graphics copied or cut from the document will be temporarily placed in the memory area called _____.
 - d. To move a text or object from one place to another in a document, _____ and _____ operation is required. (Cut, Copy, Paste)
 - e. The keyboard shortcut for opening an existing file in Writer is _____.



Modify your assignment paper with necessary editing and apply suitable character formatting features.

Let us do

2.8.3 Paragraph formatting

Paragraph formatting involves controlling the appearance of the entire text in a paragraph. The main contents of documents like articles, assignment papers, textbooks, reports, etc. appear in paragraphs. So it is very important to format paragraphs properly. Some of the formatting features are text alignment, tab stops, paragraph indentation, line spacing, etc. The text delimited by the Enter key is treated as a paragraph. In that sense, paragraph formatting is applicable to headings, list of items, etc.

The facilities provided by Writer to format paragraph is made available using the command sequence **Format** → **Paragraph...** A dialog box as shown in Figure 2.12 will be opened. Different tabs are available in this dialog box for paragraph formatting.

A. Paragraph alignment

Paragraph alignment refers to the text layout within a paragraph with respect to the document margins. The boundaries of text get affected by left and right margins and the indentation for the paragraph. There are two categories of text alignment - horizontal alignment and vertical alignment.

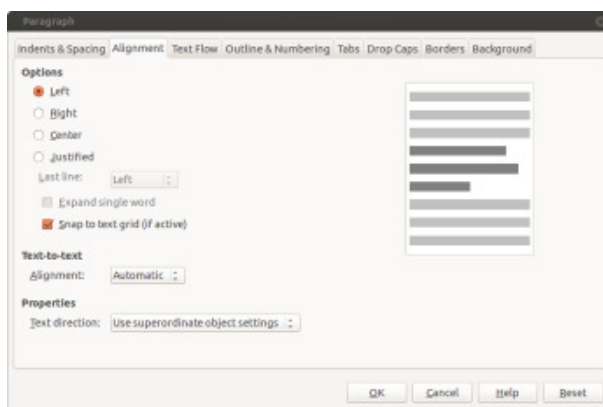


Fig. 2.12: Paragraph formatting dialog box

Horizontal alignment refers to the text alignment with respect to the left and right margins. There are four types of horizontal text alignment as specified below:

- i. **Align Left:** This alignment aligns the selected text/paragraph aligned to the left margin. This is the default alignment.
- ii. **Align Right:** This alignment aligns the selected text/paragraph aligned to the right margin.
- iii. **Centered:** This alignment aligns the selected text/paragraph in the middle between the left and right margins.
- iv. **Justified:** In this alignment, the text is flushed to both the left and right margins, thus the text/paragraph aligns evenly between left and right margins. The spacing between the text or words will be automatically adjusted.

Vertical alignment refers to the alignment of the selected text or object relative to the current line or top and bottom margins of cells in a table. There are four types of vertical text alignments. These alignments have no effect on normal text appearing in a document. It is applicable when the text is placed in a table cell. We will discuss this in the next chapter. The various types of vertical alignments are given below:

- i. **Top:** The text in the cell is aligned at the top.
- ii. **Bottom:** The text in the cell is aligned at the bottom.
- iii. **Middle:** The text in the cell is aligned at the centre with respect to upper and lower margins of the cell in a table.

B. Paragraph indentation and line spacing

The indent refers to the distance between text boundaries and page margin. When we start a new paragraph, we usually start typing by leaving some space from the left margin. This space is indentation. There are mainly four types of indents as shown in Figure 2.13.

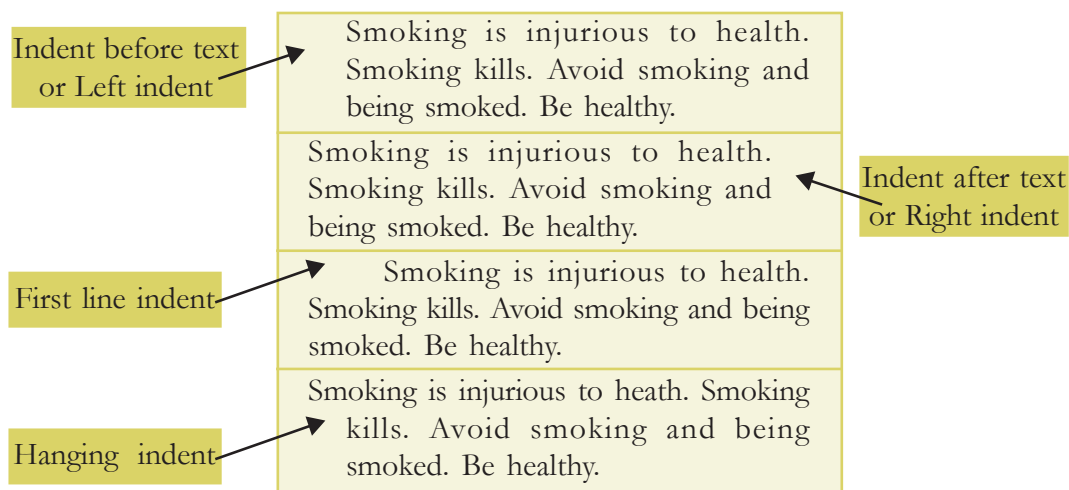


Fig. 2.13: Four types of indents

Figure 2.14 shows the **Indents & Spacing** tab of Paragraph dialog box where we can specify values for the indents shown in Figure 2.13.

On the basis of the values given, indentation can also be classified as follows:

- i. **Positive Indent:** Here the text is placed a little inward from the margins.
- ii. **Negative Indent:** This type of indent allows the text to extend outward from the margins.
- iii. **First line Indent:** Here the very first line of the selected paragraph is placed a little inward with respect to the rest of the text.

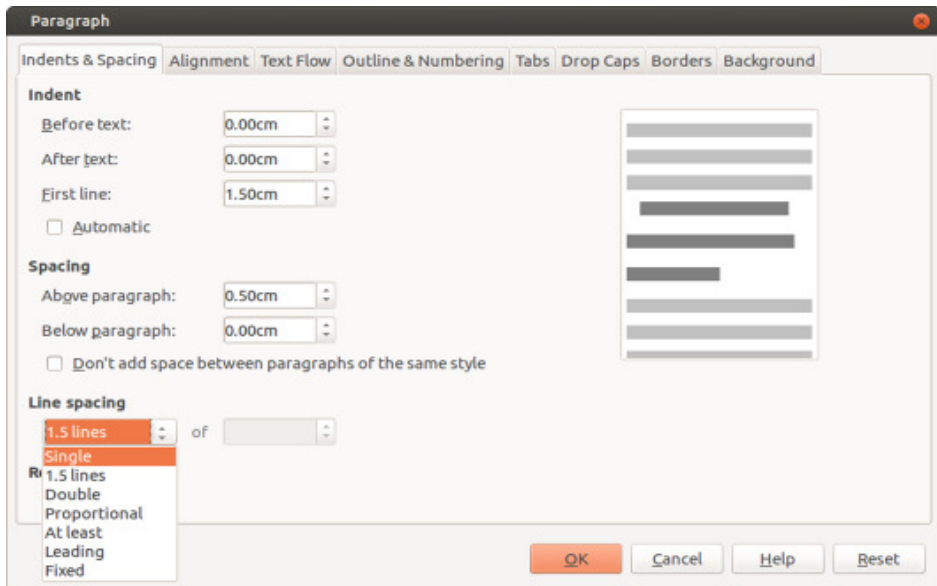


Fig. 2.14: Indents & Spacing tab of Paragraph dialog box

- iv. **Hanging Indent:** It makes the text other than the first line to move little inward from the left margin.

When the indent applied is applicable to the left side of the page, it is called Before text indent and the indent for the right side of the page is called After text indent.

Sufficient spacing can be given before and after a paragraph. Similarly, line spacing within a paragraph can also be specified in the **Indent & Spacing** tab of Paragraph dialog box. Line spacing refers to the space between two lines of text in a paragraph. Another way of interpretation is the total height of a line of text. The standard line spacing are Single, 1.5 lines and Double. Refer to Figure 2.14 to see more options for line spacing. The desired spacing in all these cases are specified in centimetres.

C. Drop Caps feature

In some documents, the first letter in a paragraph, usually the first paragraph, may take the height of two or more line. This is called Drop Caps feature. We can see this feature in all chapters of this textbook. Have a look at the first page of any chapter. To incorporate drop caps in a paragraph, proceed as follows:

- Place the cursor anywhere in the paragraph in which we utilise this facility.
- Open the Paragraph dialog box and select **Drop Caps** tab.
- Specify the number of characters to be dropped from the first and number of lines it should span.
- Click **OK** button.

Several formatting facilities are available for paragraph formatting. Considering the scope of the syllabus we confine our discussion only on these features.



Let us do

Look at Figure 2.15. Our document is now formatted according to the settings as shown in Figure 2.14. Write down the procedure adopted to make the document as shown in Figure 2.15.

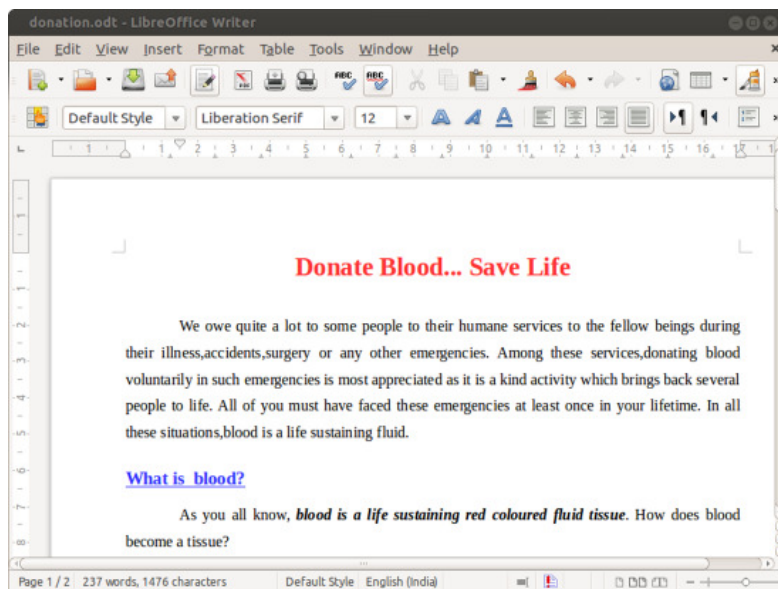


Fig. 2.15: Document after applying character and paragraph formatting

2.8.4 Bullets and Numbering

Documents may contain list of items. Two types of lists are common - bulleted lists and numbered lists. Bulleted lists are used when the list does not require any order for the presentation of its items. Bullet is a small graphic symbol, as shown in Figure 2.16, that appears in front of each item in the list. For example, one's hobbies can be presented as a bulleted list. But some items may need to be presented in an order. In such a case we use numbered list. For example, the districts in Kerala may be presented with numbers 1 through 14 for Thiruvananthapuram to Kasaragode.

The procedure for making a list is as follows:

- Click the **Edit** menu and choose **Bullets and Numbering...** option.

A window as shown in Figure 2.16 will be opened. We can select the **Bullets** or **Numbering** type tab and choose the style of bulleting or numbering. Figure 2.16 and 2.17 shows different types of bulleting and numbering.

- Select the desired bullet/number and click **OK** button.
- Go on with typing of each item.

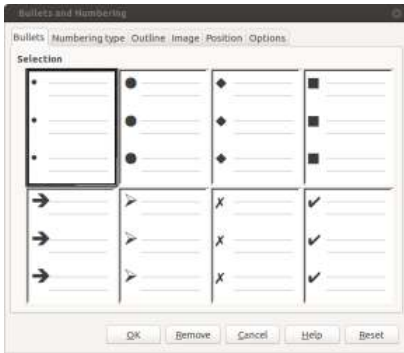


Fig. 2.16: Bullets tab of Bullets and Numbering window

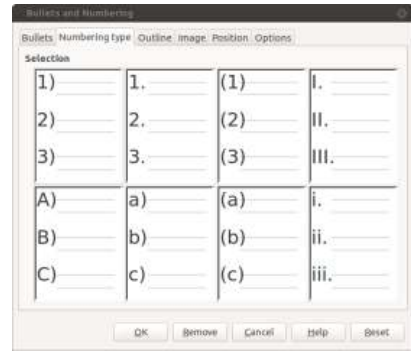


Fig. 2.17: Numbering type tab of Bullets and Numbering window

Whenever **Enter** key is pressed after presenting an item, a new bullet for the next item will appear automatically. The window provides more tags for colourful bullets, alignments, nesting (a list in which some or all items may have another sub list), etc. Figure 2.18 and 2.19 shows a bulleted list and a numbered list respectively. These lists belong to our article, which is now under formatting process.

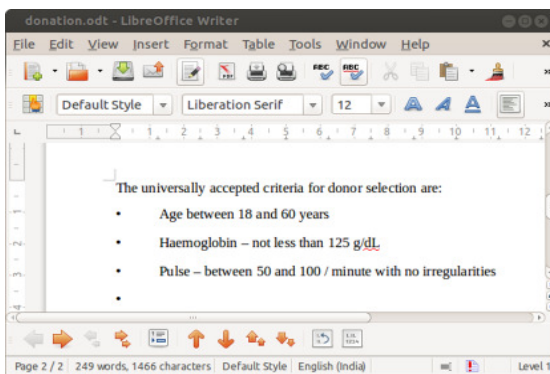


Fig. 2.18: Bulleted list in the document

Note that a tool bar appears at the bottom of the IDE window (just above the Status bar) which facilitates moving of items upwards or downwards within the list, renumbering, navigation through sublevels, etc.

2.8.5 Page formatting

Page formatting involves the setting of page layout and design. That is we have to specify the page size, orientation, margins etc. In Writer, page formatting is controlled through Page Style dialog box which is obtained by selecting the **Page** option from the **Format** menu. Figure 2.20 shows Page Style dialog box.

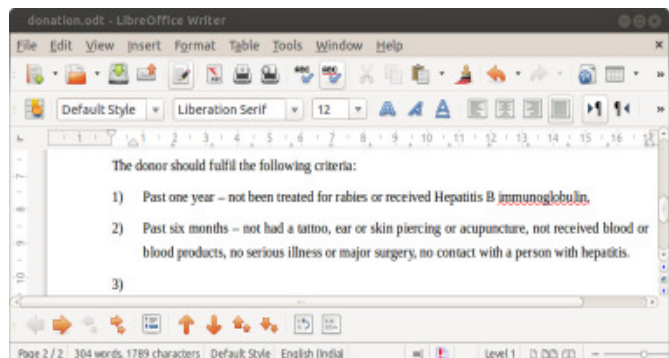


Fig. 2.19: Numbered list in the document

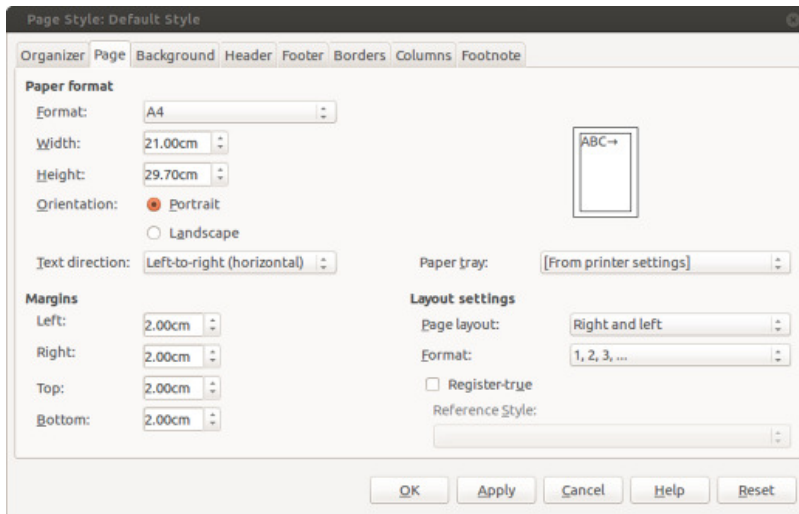


Fig. 2.20: Page tab of Page Style dialog box

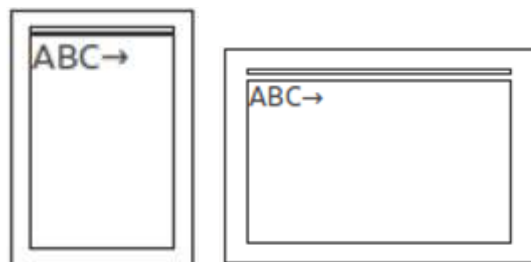
A. Page Size (Paper Size) and Orientation

Writer offers standard page sizes for the documents like A3, A4, Letter, Legal etc. To set the page size, click the **Page** tab of **Page Style** dialog box which shows the page formatting facilities as in Figure 2.20. Here we specify any of the predefined paper sizes available in the **Format:** box of **Paper format** section. We can also select the desired page-orientation by clicking on one of the desired Orientation buttons - **Portrait** or **Landscape**.

Orientation refers to whether the text is to be printed length-wise or width-wise. When the text is printed or typed length-wise, it is called **Portrait Page Orientation** and when the text is printed or typed width-wise, it is called **Landscape Page Orientation**. Figures 2.21(a) and 2.21(b) show the two types of orientation.

In the **Page** tab, we can specify the margins (left, right, top and bottom) and layout settings. Margins can be set in two ways - using **Ruler bars** and using **Page Style** dialog box

Using Ruler bars: Move the mouse over the area where the white ruler changes to gray. When the cursor becomes a double-ended arrow, click with the mouse and drag the margin indicator to the desired location. Release the mouse when the margin is set.



a. Portrait

b. Landscape

Fig. 2.21: Page orientations

Using Page Style dialog box: In the **Page** tab on the **Page Style** dialog box, either directly specify the desired measurement for the margins in the corresponding boxes

or increment/decrement the default measurements using increment/decrement buttons till we get the desired result (refer to Figure 2.20).

B. Header and Footer


Look at the top of the pages of our text book. We can see in print the words “Computer Applications (Humanities) - XII” on every left pages. Similarly page numbers can be seen at the bottom with a design. These text items are called header and footer, respectively. These are commonly used in publications, books, project reports etc. The common text appearing on the top of every page is the header and at the bottom is the footer. Thus header or footer may be the page number, system date, or a company logo. A header is printed in the top margin, and footer in bottom margin. We can insert either header or footer or both in a document. Once it is inserted in any page, it will be available in all pages of the document.


To add a header to a page, choose **Header** option from **Insert** menu and type the text in the Header box. Similarly, to add footer to a page, choose **Footer** option from the **Insert** menu. Usually we put page numbers in the footer. When the cursor is in the footer section, the command sequence **Insert** → **Field** → **Page Number** can be used to get page number in the footer. Some other information like Total pages, Author, Date, etc. can also made available in the footer.

Alternatively, we can select **Header** or **Footer** tab in the Page Style dialog box (refer to Figure 2.20). Here we have to select the Header on or Footer on textbox. Clicking the **Apply** button followed by **OK** button brings the cursor at the header or footer area.

2.9 Printing the document

When we complete the preparation of a document after editing and formatting, its hard copy (print out) may be required. Usually the documents are to be submitted to the concerned in the form of hard copy. Now we can see how to take a print out.

We can use the command sequence **File** → **Print**, or the keyboard shortcut **Ctrl+P**, or the Print button  in the Standard toolbar. The Print dialog box will be opened as shown in Figure 2.22. We can see the print preview of a page in the left pane of the window. Any page of the document can be previewed by clicking the next or previous button seen below the preview. Page numbers, number of copies, layout setting, etc. can be given in this window. On clicking the **OK** button, the document will be printed, if the printer is ready.

Print preview of more than one page can be obtained using the the command sequence **File** → **Print Preview**, or the keyboard shortcut **Ctrl+Shift+O**, or the Print Preview button  in the Standard toolbar. The Print Preview window is shown in Figure 2.23.

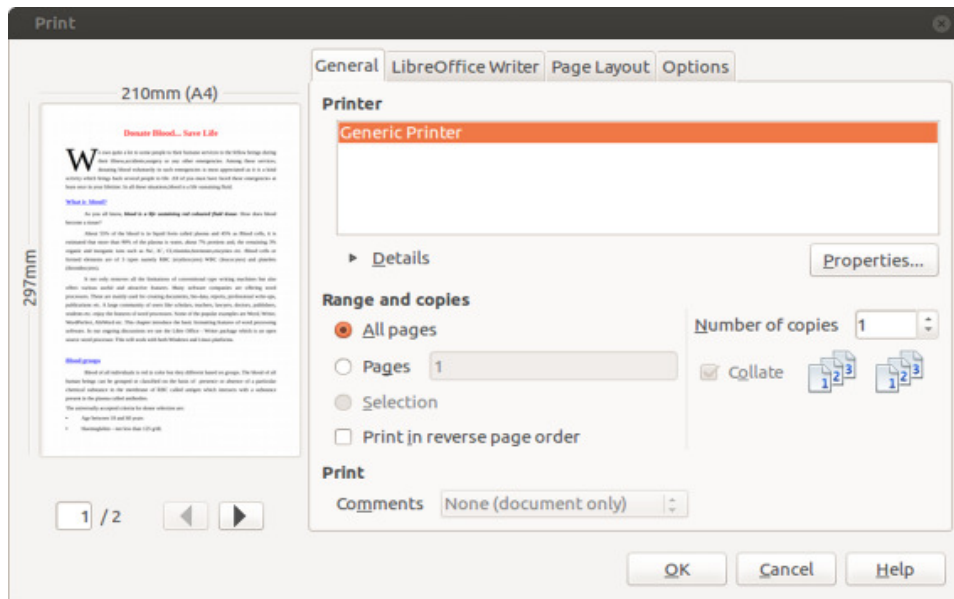


Fig. 2.22: Print dialog box

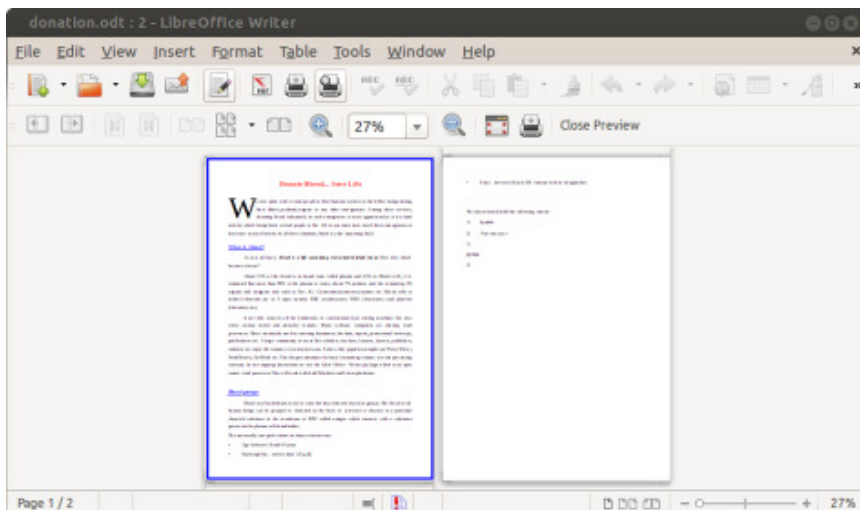


Fig. 2.23: Print Preview window

Know your progress



1. Name the four types of text/paragraph alignments.
2. Which type of indent shows the text present in the paragraph little inward from the first line of text?
3. Common text appearing on top of all pages is _____.
4. Print Preview option is available in _____ menu.
5. Line spacing option is available in _____ menu.



Let us conclude

A word processor is a package that helps to create attractive documents. It provides editing and various kinds of formatting facilities. It also provides features like word wrapping, copy/cut and paste features, finding and replacing, etc. Character formatting features include font setting, bold facing, italicizing, underlining, etc. Different types of alignments, indentations, line spacing, etc. are covered in paragraph formatting. Towards the end, page formatting features and print setting are discussed.



Let us practice

1. Open a new Writer document and prepare the following letter to a parent regarding PTA general body meeting.

From

Principal,
Your school name,
School address.

To

Parent's Name,
Home address.

Dear parent,

Sub: PTA General body meeting

It is decided to conduct the PTA general body meeting of this year in our school auditorium next Monday. You are requested to attend the meeting without fail.

Thanking you

Yours faithfully

Principal

Place

Date

- a. Save the document as pta.odt
- b. Make the From and To addresses bold and italic
- c. Change the font face to Arial and size 12.
- d. Under the text 'Sub: PTA General body meeting'.



- e. Copy your name from the 'From' address to the bottom of the document.
 - f. Align the text 'Thanking You' at the centre.
 - g. Right align 'Yours faithfully' and 'Principal' at the bottom.
 - h. Double space the matter of the letter.
 - i. Save the letter again.
2. Prepare your own bio data. Apply the formatting features of the word processor to beautify it.
 3. Prepare an application to the principal requesting for TC and Conduct certificate.

Let us assess



1. What is meant by 'word wrapping'?
2. How is a Writer document saved?
3. What is meant by indenting?
4. Differentiate between 'Undo' and 'Redo' features.
5. Write down the effect of using the key combinations Ctrl+N and Ctrl+Q.
6. Differentiate between 'Save' and 'Save As' options.
7. Distinguish between Copy-Paste and Cut-Paste functions.
8. Differentiate between Print and Print Preview options.
9. Differentiate between Portrait and Landscape page orientation.
10. Write a few features of a Word processing software.
11. Explain the various types of text alignments in Writer.
12. Suppose you want to replace a particular text in the document with another text. Write the steps to do that.
13. Differentiate between Left indent, First line indent and Hanging indent.
14. How do you change the margins of a document?
15. Write the steps to take a print out of the document.
16. Briefly explain the IDE of the word processor, LibreOffice Writer.
17. Explain the various formatting features of Writer.



3

Creating Professional Documents

Significant Learning Outcomes



After the completion of this chapter, the learner

- inserts graphics, drawings, drop caps, symbols and watermarks in the documents.
- uses tables for presenting matter in a tabular form and manipulate it.
- converts the text data directly to into a table.
- removes spelling and grammar mistakes in the document.
- types complex equations using equation editor.
- applies multi column style to the document matter.
- generates table of contents for the documents.
- defines index entries in the text document under preparation.
- uses mail merge features to send letters.

We have familiarised ourselves with the basic features of the word processor (LibreOffice Writer) like document creation, editing, formatting and printing. In this chapter we will explore the powerful features of Writer to prepare professional documents like project reports, resumes, survey reports, business plans, company profiles, reports created for governments, international organisations, etc. These reports may contain tables, graphics, symbols, equations and watermarks. These professional documents also require spelling and grammar correction. Today's word processors provide solutions to all these requirements. Apart from this, facilities for formatting the text in multiple columns are also provided. In the case of reports and books where the content is divided into different topics, a Contents page and an Index are usually included. These features are incorporated in almost all word processors. We also discuss mail merge features used to send letters with common content to multiple recipients.

3.1 Inserting tables


Tables are effective to organise and present large amount of information like financial or statistical reports, product catalog showing



descriptions, prices and photographs of products, list of names with address, age and other information, etc. Tables can often be used as an alternative to spreadsheets to organise data. Table is an arrangement of data in the form of rows and columns. Rows appear in horizontal manner and columns appear in vertical manner. A well-designed table can help readers understand the data better than writing contents in a paragraph. Usually, tables are used to align text and numbers, but they can also be used to align images. Tables can also be used as a page-layout tool to position the text with proper alignments and indentations. For this, the cells in the table are filled with the text and then the borders are removed.

3.1.1 Creating a table

Let us consider a survey statistics regarding cleanliness in 100 children within the age group 13 to 17. For this, first we must decide all the number of columns and rows. Suppose we consider three aspects such as (i) Wash hands before food, (ii) Wash hands after the use of toilet, and (ii) Brushing teeth twice a day. Responses of the children for each of these aspects are collected by giving four options – Always, Frequently, Sometimes and Never. So, it is clear that we need a table with 5 columns and 4 rows to present the consolidation.

A table can be inserted in a document either by clicking the Standard toolbar icon  or using the menu option **Table → Insert → Table....** It is also possible with the keyboard shortcut **Ctrl+F12**. It opens the Insert Table dialog box as shown in Figure 3.1. We can see **Table1** as the table name in the textbox which can be replaced if we need. There is provision to specify the number of columns and rows required. In the figure, we can see the number 2 for each of these, which are the default values. After giving the required number(5 and 4), click the **Insert** button to get the table on the page. A table consisting of 5 columns and 4 rows will be inserted in the document as shown in Figure 3.2.

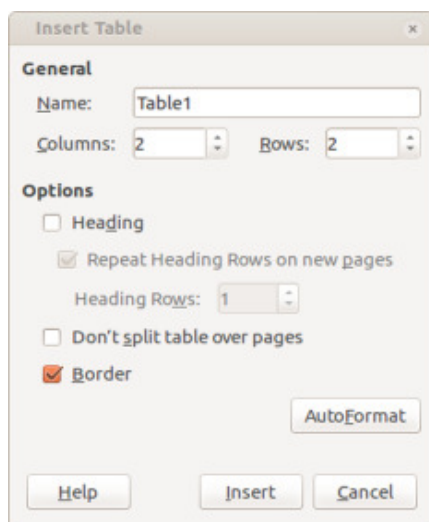


Fig. 3.1: Insert Table dialog box

The **Heading** check box in the Insert Table dialog box can be used to provide a heading to the table. If

Fig. 3.2: Table with 5 columns and 4 rows

the table spans over more than one page, the heading can be repeated on all pages. The number of rows to be used as heading can also be provided here. The default is one row. The checkbox for **Don't split table over pages** prevents the table from spanning to more than one page. This can be useful in situations where a table is about to start near the end of a page. If we tick mark the checkbox, the table will be placed on the following page. If the table is too long to fit in a page, we need either to deselect this option or manually split the table. **Border** checkbox is available in the dialog box to specify border lines required for the table.

If we click **AutoFormat** button in the Insert Table dialog box, we will get AutoFormat dialogbox as shown in Figure 3.3. It gives a set of predefined table styles from which we can select the the desired one.

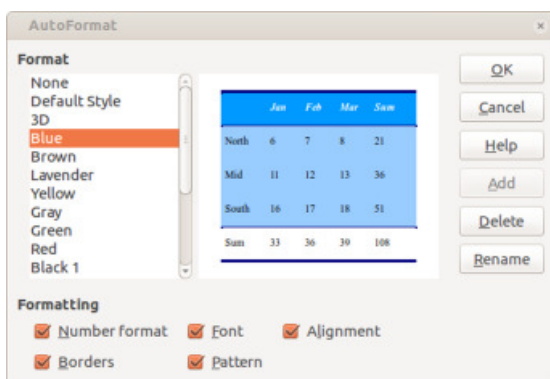


Fig. 3.3: AutoFormat dialog box

3.1.2 Applying borders to tables

Borders are the boundary lines appearing around each cell in the table. By default the thickness and style will be normal. Table border can be changed using the menu option **Table → Table Properties**. The Table Format dialog box will be opened as shown in Figure 3.4, which gives facilities to set the border. In this dialog box, we can set the line style, line width, and colour of the border. It also facilitates spacing between cell border and its contents. All these formatting can also be done using the tools in the Table Properties toolbar shown in Figure 3.5.

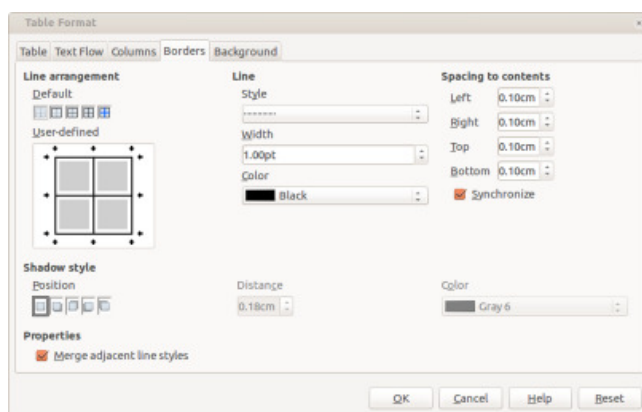


Fig. 3.4: Table Format dialog box



Fig. 3.5: Table Properties toolbar

The Table Format dialog box or the Table Properties toolbar can be used to give background colour, border style, border colour and various other formatting to make the table attractive as shown in Figure 3.6.



	Always	Frequently	Sometimes	Never
Wash hands before food	80	14	6	0
Wash hands after toilet use	81	9	6	4
Brushing teeth twice a day	5	11	57	27

Fig. 3.6: Cleanliness in children between ages 13 to 17

3.1.3 Managing tables

After inserting the table, the data are entered in the table cells. A cell is the intersection of a row and a column. Sometimes we may have to change the width or height of the rows or columns. After creating a table, we may need to insert a new row or a column into it. Sometimes we may have to remove a row or a column from the table. Such activities can be managed using **Table** menu or Table Properties toolbar.

a. Changing column width or row height

If we want to change the column width or row height, place the mouse pointer on the column/row boundary. The mouse pointer changes to a double headed arrow. Click and drag to resize the column/row. The column width or row height of the selected rows can be set or can be made equal using the menu options **Table** → **Autofit**.

b. Inserting new rows/columns

While working with tables, it may be necessary to insert a new row or a column into the table. Inserting a row or column can be done by the following steps:

- Place the cursor in the row/column of the table.
- From the Table menu select the **Table** → **Insert** → **Rows** or **Table** → **Insert** → **Columns**. A dialog box appears as in Figure 3.7.
- Enter the number of rows/columns to insert. The position to insert the row/column has to be selected. It can be either before the current row/column or after the current row/column.
- Click **OK** button to insert the new row/column.

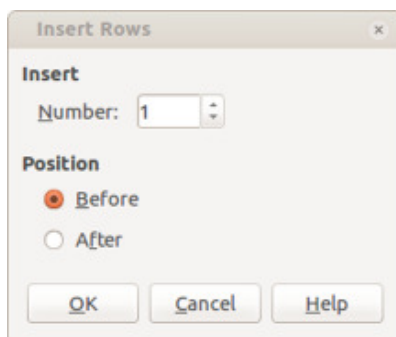


Fig. 3.7: Insert Rows dialog box

c. Deleting rows/columns

Deleting means removing rows or columns from the table permanently. This can be done as follows:

- Place the cursor in the row/column or select the required rows/columns in the table.

- ii. From the Table menu select **Table → Delete → Rows** or **Table → Delete → Columns**. The row/column will be deleted.

d. Merging rows/columns

Merging means combining the selected cells into a single cell. The procedure is as follows:

- i. Select the cells to be merged.
- ii. Right-click and choose **Cell → Merge** in the context menu, or choose **Table → Merge Cells** from the menu bar. The contents of the cells appear in the merged cell.

e. Splitting rows/columns

It is the process of dividing the selected cell into multiple cells. We can proceed as follows:

- i. Place the cursor inside the cell.
- ii. Right-click and choose **Cell → Split** in the context menu, or choose **Table → Split Cell** from the menu bar.
- iii. Select how to split the cell from the Split Cells dialog box that appears as given in Figure 3.8. A cell can be split either horizontally (create more rows) or vertically (create more columns) and we can specify the total number of cells to create.

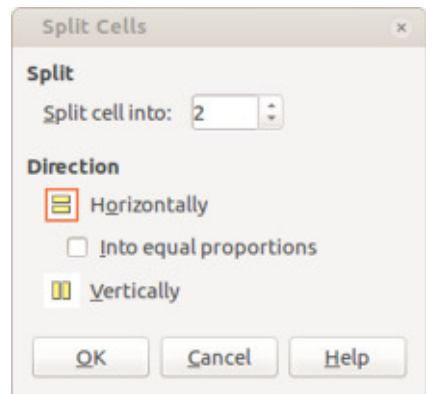


Fig. 3.8: Split Cells dialog box



Let us do


Insert a table as in Figure 3.6. Insert one more row with row heading 'Wash hands using soap'. Add sample values in the columns. Make sure that all the table cells are filled with sample data. Then apply a formatting for the table using Table Format dialog box. Finally, remove the second row from the table.

3.2 Inserting graphics

Supporting images along with text description convey the content effectively. This improves readability and helps to understand the content easily. There are three basic types of graphic content that can be inserted in a document.

- a. Image files such as photos, drawings or scanned images.
- b. Diagrams created using tools available in the Drawing toolbar.
- c. Charts created using the chart facility.

3.2.1 Adding an image

This facility allows the user to insert an external image file into the document. Images can be scanned pictures, photographs, etc. with file extensions .jpg, .gif, .png, .bmp, etc. Inserting a picture can be done either by using the From File icon  in the Picture toolbar or by using menu option, **Insert** → **Image** → **From File**.

Before inserting an image, we have to place the cursor in the document where we need to insert the picture. Let us now insert an image of Mahatma Gandhi cleaning the premises in the document. Using any of the methods mentioned above we can obtain the Open dialog box as shown in Figure 3.9. Choose the image file from the folder listed in the Open dialog box and click **Open** button. The image will be inserted in the article in the position where the cursor is placed. The resultant document is displayed in Figure 3.10.

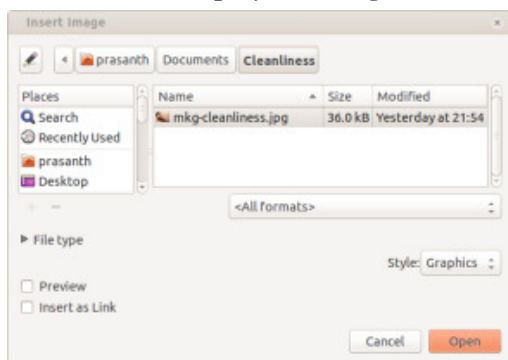


Fig. 3.9: Insert Image dialog box



Fig. 3.10: Image inserted in the document

3.2.2 Using drawing tools

Drawing tools can be used to create graphics, such as simple diagrams using rectangles, circles, lines, text and other predefined shapes. This includes inserting autoshapes, curves, lines, freeform line, callouts, fontwork gallery, etc. If the Drawing toolbar as shown in Figure 3.11 is not present in the current window, it can be added by clicking **View** → **Toolbars** → **Drawing**. The Drawing toolbar contains buttons for drawing shapes or art works.

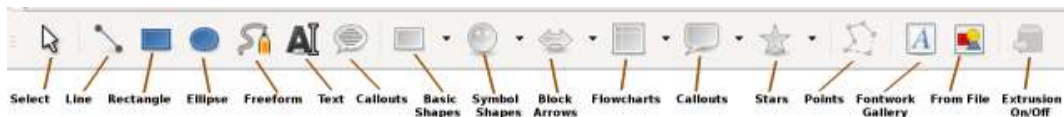


Fig. 3.11: Drawing toolbar

On selecting any of the tools in the toolbar the mouse pointer changes to a drawing pointer. To cancel the selected drawing function, press the **Esc** key or click on the Select icon on the Drawing toolbar. Let us discuss some of the important tools in the Drawing tool bar.

Line Tool: It is used for drawing straight lines. The length of the line can be increased or decreased by clicking on it and resizing.

Rectangle and Ellipse Tool: These are used for drawing rectangles and ellipses in the document.

Freeform Tool: Freeform tool is used to draw a freehand figure or shape.

Text Tool: This tool helps to insert a text box in the document. Any text matter can be typed inside it.

Basic Shapes, Symbol Shapes, Block Arrows, Flowcharts, Callouts, Stars: The shapes in these categories can be inserted into a document. Almost all these shapes allow the text to be inserted inside it. Figure 3.12 shows the different shapes available in these categories of tools.

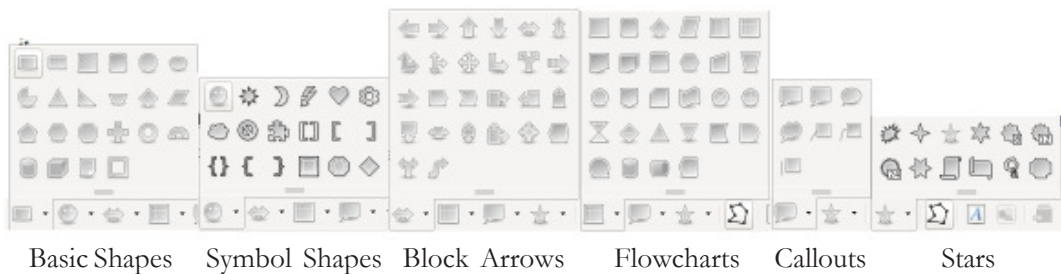


Fig. 3.12: Drawing shapes

Fontwork Gallery Tool: Fontwork tool can be used to create graphical text art objects. These are custom shapes or art works readily available as shown in Figure 3.13. Any of these can be selected and applied to the text. The text will appear in the form of selected art work.

From File: This tool is used to insert images from a folder as we have discussed in the previous section.

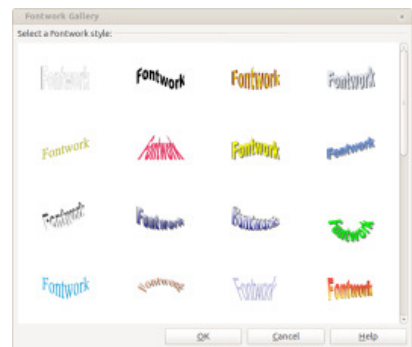


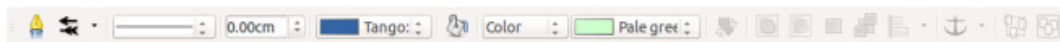
Fig. 3.13: Fontwork Gallery

Extrusion on/off: This tool switches the 3D effects on and off for the selected objects.

Set or change properties for drawing objects

Before drawing, we can set the properties for a drawing object by proceeding as follows:

- i. Click the Select tool on the Drawing toolbar (refer to Figure 3.11). It opens the Drawing Object Properties toolbar as shown in Figure 3.14.

*Fig. 3.14: Drawing Object Properties toolbar*

- ii. Provide suitable values to the relevant properties for the drawing object

The properties of drawing objects may differ. When an object is selected, only the properties associated with that object will be enabled in the toolbar.

3.2.3 Inserting charts

In Class XI, Chapter 4, Data Analysis using Spreadsheet, we discussed the creation of charts using spreadsheet software. Here Writer, the word processing software also provides limited features for creating charts. Charts or graphs are created for easy analysis and representation of data. This feature is mainly useful for interpreting mathematical data like marks, percentage, result analysis etc.

Consider a survey statistics regarding cleanliness in 100 children within the age group of 13 to 17 given in Figure 3.6.

A chart can be inserted into a document using the following steps.

- i. Select the table for which chart is to be created.
- ii. Select the menu option **Insert** → **Object** → **Chart....** It opens the Chart Wizard as shown in Figure 3.15
- iii. In the Chart Wizard dialog box, select the Chart Type, Data Range, Data Series and Chart Elements.
- iv. Click **Finish** button to create the chart. This chart can be placed at the desired position in the document.

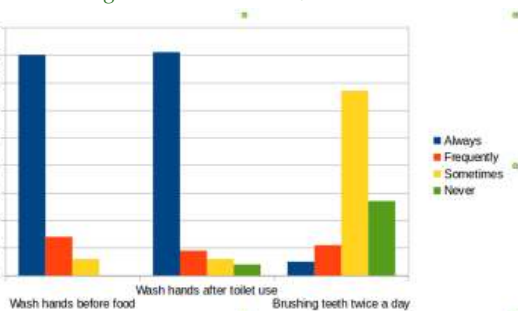
*Fig. 3.15: Chart Wizard window**Fig. 3.16: Chart displaying cleanliness in children*

Figure 3.16 shows the chart created using the content in Figure 3.6.

3.3 Inserting special characters

A special character is one not found on a standard English keyboard. For example, ©, ¾, ?, ?, ø, ¢, etc. are all special characters. We can insert a special character with the following steps:

- i. Place the cursor in the document where the character is to appear.

ii. Click **Insert** → **Special Character...** to open the Special Characters dialog box as shown in Figure 3.17.

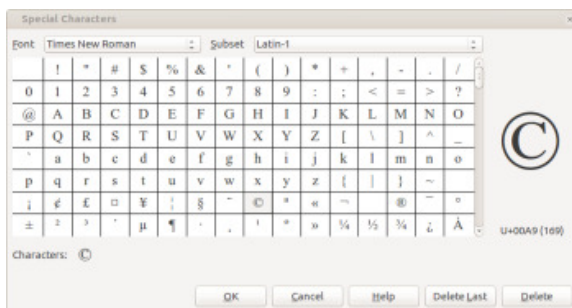


Fig. 3.17: Special Characters dialog box

iii. Select the required character provided by the default font family. We can also choose other fonts to get a variety of special characters.

iv. If more than one character is needed, select them in the required order and then click **OK** button.

As we select each character, it will be shown on the right side of the dialog box along with the numerical code for that character. All the selected characters will be shown in the lower left side.

3.4 Inserting page breaks

Page break happens when we reach the end of a page and start working with the new page. There will be a predefined number of lines of text for a page. Normally in word processors, the new page comes automatically when the current page is completed. This is called automatic page break. This also depends on page size. But there may be situations where we need to break the current page forcefully and start a new page. This is called manual page break. Let us see the procedure.

i. Click on the document where we want the new page to begin.

ii. Select the menu option **Insert** → **Manual Break....** Insert dialog box appears as in Figure 3.18.

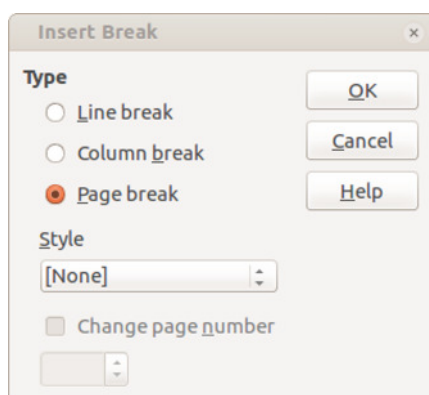


Fig. 3.18: Insert Break dialog box

iii. Now select **Page break** option under **Type** section in the dialog box.

iv. Click the **OK** button. A page break line appears and a new page starts.

The same can be done using the keyboard shortcut **Ctrl+Enter**. Similarly we can insert a Line break or Column break in the document using the same dialog box.



3.5 Inserting page borders

It is possible to insert a closed line around a page in a document. This is generally called page border. The page border inserted for a page will be applicable to all pages in the document. Any change made to borders applies to all pages that use the same page style. This can be done as follows:

- Choose menu option **Format → Page...**. It opens the Page Style dialog box, as shown in Figure 3.19.
- In the **Borders** tab of this dialog box, select one of the border styles given under **Line arrangement** area.
- Select a line style, width and colour for the selected border style in the **Line** area. These settings apply to all border lines that are included in the selected border style.
- Select the distance between the border lines and the content in the page in the **Spacing to contents** area of the dialog box.
- Click **OK** button to apply the changes.

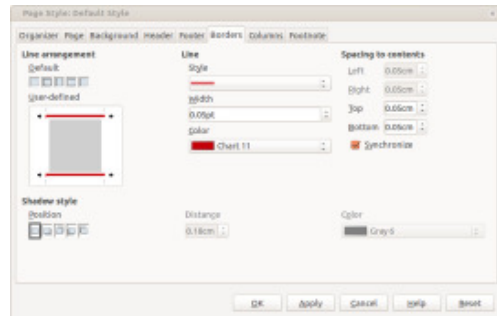


Fig. 3.19: Page Style dialog box

If we apply the procedure on the article on cleanliness it will now appear as in Figure 3.20.



Fig. 3.20: After giving borders

Source: <http://www.mkgandhi.org>,
<http://shubhsrathi.blogspot.in>

3.6 Inserting watermarks

We might have seen some lightly coloured text or graphics appearing as background in official documents like reports, balance sheets, certificates, etc. The text may be like 'Confidential', 'Official', 'Draft Copy', etc. Similarly, while viewing television programmes, you might have seen the name of the channel in the background of

the screen. If somebody copies such documents or records the TV shows, the background will also be copied or recorded. This is called watermark. Watermark is a facility to define text, graphics or colours in the background of the document pages. The watermark appears merged with the page background. It is possible to type any content on the page as usual. The watermark will not be a barrier. In Writer, watermark can be inserted only while exporting the document to the Portable Document Format (PDF). This is usually done after finishing the entire work of the document because the PDF document is non-editable. The article on cleanliness can be given a watermark and exported to PDF format through the following steps:

- i. Open the file to be exported.
- ii. Choose the menu option **File** → **Export as PDF** option. PDF Options dialog box appears as shown in Figure 3.21.
- iii. Type the required watermark.
- iv. Click the **Export** button to convert the document to PDF format with watermark text.

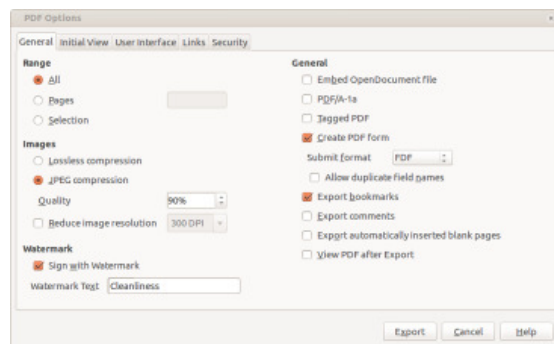


Fig. 3.21: PDF Options dialog box

- v. The Export dialog box appears as shown in Figure 3.22. Give a suitable file name and save it.

The article on cleanliness is now in PDF format and will appear as in Figure 3.23.

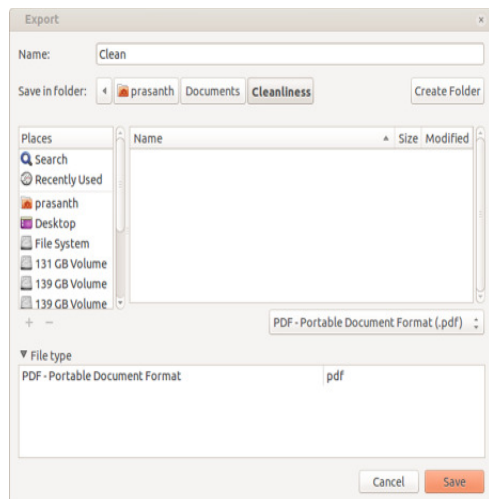


Fig. 3.22: Export dialog box

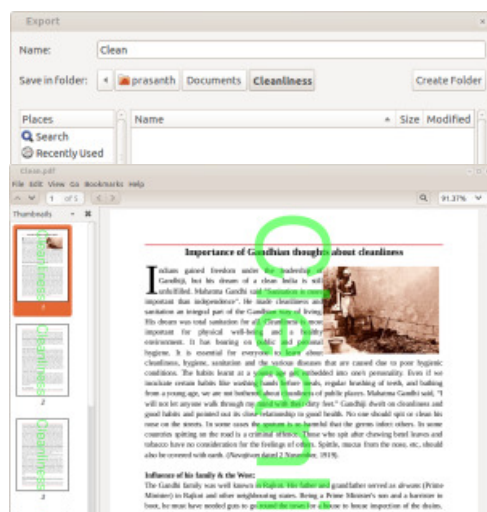


Fig. 3.23: PDF file with watermark



Know your progress



1. Name the three types of graphics that can be inserted in Writer.
2. Identify the name of the tool which is used to apply custom shapes to text entries.
3. Which drawing tool is used for drawing shapes or figures of our own interest?
4. What are the two ways of inserting a table in a document?
5. Watermarks can be inserted while _____ the text document.

3.7 Converting text to table

Writer provides a facility to convert text matter directly into a table. Using this feature we can present data in tabular form with less effort. The text to be converted must contain characters to indicate column separators. It can be tab, semicolon, space or any other character. Paragraph marks indicate an end of a table row.

Let assume that we have data on plastic waste, organic waste, etc. collected by NSS volunteers in urban and rural areas. The figures are in kilograms. To convert this text to a table, the steps to be followed are:

- i. Select the text matter.
- ii. Select the menu option **Table → Convert Text to Table**.
- iii. Convert Text to Table dialog box as in Figure 3.24 appears.
- iv. Choose the column separator from the options given under **Separate text at** area in the dialog box.
- v. Then click **OK** button.

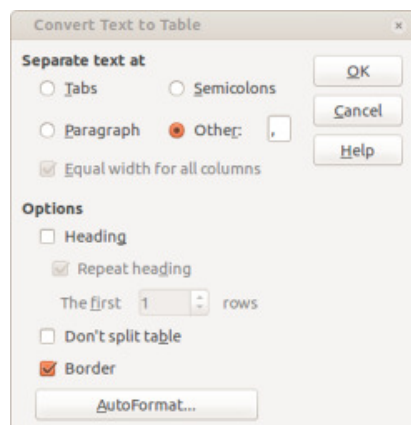


Fig. 3.24: Convert Text to Table dialog box

This creates a table in the position of text matter in the document. A text matter and its corresponding table is given in Figure 3.25.

Type, Rural, Urban		
Plastic waste, 30, 55		
Organic waste, 50, 39		
Other waste, 25, 35		

Type	Rural	Urban
Plastic waste	30	55
Organic waste	50	39
Other waste	25	35

Fig. 3.25: Text to table conversion

In the above example the text separator is the comma (,) character. The corresponding option button is to be selected based on the delimiter given in the text matter which is to be converted to table. The Border checkbox is selected for displaying border for the table's cells.

3.8 Splitting text into columns

You might have noticed that the text matter appearing in the news paper is in multiple columns. This is because it enhances the readability of the content. Writer provides the facility to split the single column matter to multi column.

Suppose we want to separate the text matter in the article into two columns. The following steps are to be performed for this.

- Select the matter in the document area.
- Choose the menu option **Format** → **Columns...**
- The Columns dialog box as in Figure 3.26 appears. Then select the number of columns, width of columns, spacing (space between column border and text matter), separator lines (column boundary line), etc. in the dialog box.
- Click **OK** button to complete the task.

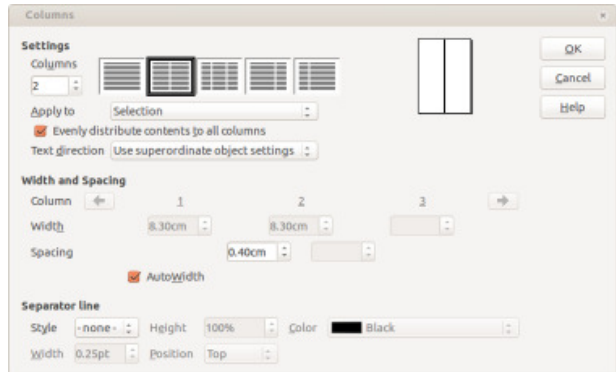


Fig. 3.26: Columns dialog box

Figure 3.27 shows the two column formatted article.




Fig. 3.27: Article formatted into two columns

3.9 Spelling and Grammar

It is very essential that a professional document must be free from errors in spelling and grammar. Writer provides us with a feature to check spelling and grammar mistakes and correct them. Spellings are compared with the built in dictionary in the word processor. This feature helps us to produce error-free documents.



Writer provides two ways to check spelling and grammar.

Activate AutoSpellcheck feature by clicking on the AutoSpellcheck button  which is present in the Standard toolbar, before typing the content. Writer will automatically check the document for spelling and grammar mistakes and shows wavy underline. To correct an error, click the right button, a short-cut menu appears as in Figure 3.28 and choose the suggested replacement. The replacement can also be from the AutoCorrect submenu available in the context menu.

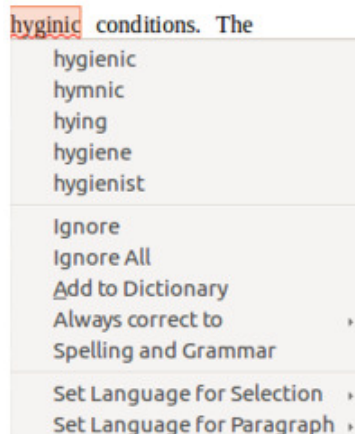



Fig. 3.28: Autocorrect menu

The second method is by selecting the menu item **Tools → Spelling and Grammar** or by clicking the Spelling and Grammar button  present in the Standard toolbar.

Writer will check each and every word in the document which are wrongly spelt or missing in the built-in dictionary. A Spelling dialog box will appear as shown in Figure 3.29 and allow the user to select the suggestions or ignore it.



Fig. 3.29: Spellings dialog box

The software will indicate names of persons or places as wrong words because these words will not be present in the dictionary available with the word processor. Suppose we want to add such words to the custom dictionary, it is possible using the **Add to Dictionary** button in the Spelling dialog box. After that the particular word will be available in the dictionary and spelling mistakes can be corrected accordingly. User is allowed to select the required language as the text language. The spelling corrections will be based on that selected language. For example, here we selected English(UK) as the text language which is the default language.

Another helpful feature present in the software is AutoCorrect. The user can enter the commonly misspelt words and their replacements in AutoCorrect dialog box.

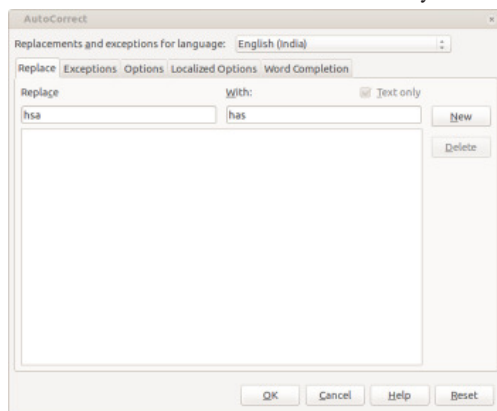


Fig. 3.30: Autocorrect dialog box

After that, if we type the wrong word, it will be replaced by the correct word immediately. Figure 3.30 shows the AutoCorrect dialog box to add a wrong word and its replacement.

3.10 Working with formulas

While preparing a document, we may need to type complex mathematical equations. Normally it is a tedious work. Writer gives an easy way to do the task.

Suppose we need to enter the formula $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$. The following steps describes the whole process:

- i. Choose the menu option **Insert** → **Object** → **Formula**. Now, the document window turns to a form as given in Figure 3.31. A new pane appears below the normal work area and we can type the required formula there. Several functions, formula patterns, mathematical symbols etc. can be seen on the left pane of the window.
- ii. Select the appropriate type of formula element for typing the equation.

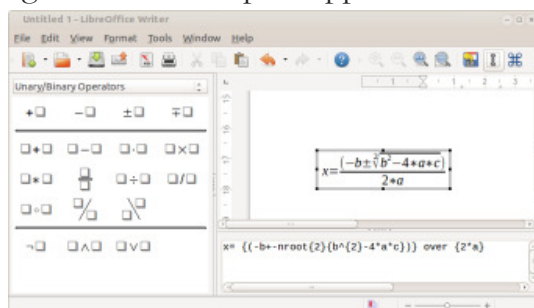


Fig. 3.31: Entering equations

On clicking the document window, the word processor IDE is back to normal.

3.11 Defining Table of Contents

Before the content begins in a professional document or text book or any publication, a Table of Contents (TOC) page is necessary. It clearly indicates the main contents of the document or book. The main headings, the sub headings and the page numbers usually appear in the Table of Contents. The reader can easily go to the required page. LibreOffice Writer provides Table of Contents feature to build an automated table of contents from the headings in our document. These entries are automatically generated as hyperlinks in the table. Whenever changes are made to the text of a heading in the body of the document, or the page on which the heading appears, those changes automatically appear in the table of contents when it is updated.

Creating TOC involves two steps. Initially, the TOC entries are to be made. It is followed by the creation of Table of Contents.

Creating TOC entries

To create the TOC entries the following steps are to be taken:

- i. Select the headings or sub-headings in the document which are indented for TOC.



- ii. Choose the menu option **Insert → Indexes and Tables → Entry**. Insert Index Entry dialog box appears as shown in Figure 3.32.
- iii. Set **Index** as **Table of Contents**.
- iv. Select the **Level** as, 1 for main headings, 2, 3, 4, etc. for sub-headings.
- v. Click the **Insert** button.

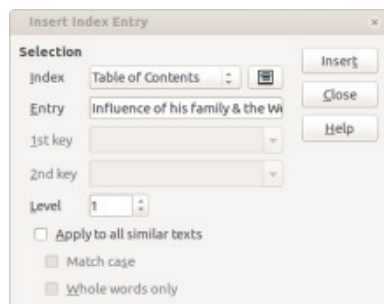


Fig. 3.32: Insert Index Entry dialog box

Creating Table of Contents page

To create the TOC page the following steps are to be taken:

- i. Click on a fresh page of the document where you want to create the Table of Contents.
- ii. Choose the menu option **Insert → Indexes and Tables → Indexes and Tables**. The Insert Index Entry dialog box appears as in Figure 3.33.
- iii. Click the **Index/Table** tab
- iv. Select **Table of Contents** in the **Type** box.
- v. Click **OK** button to complete the task.

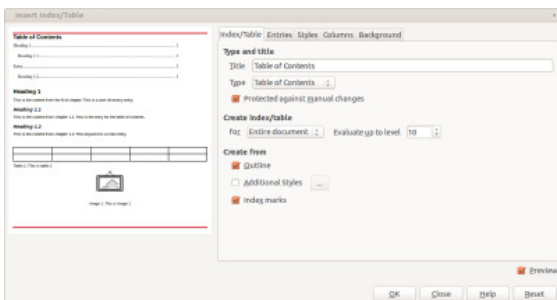


Fig. 3.33: Insert Index/Table dialog box

Table of Contents page will be inserted in the document as shown in Figure 3.34.

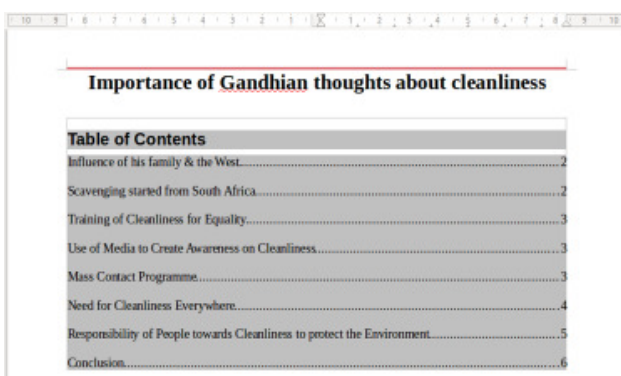


Fig. 3.34: Table of Contents

3.12 Defining index entries

In text books, professional documents, standard publications, etc. there will be an index page towards the end. An alphabetical index (referred to as an index) is a list of keywords or phrases used throughout a document. Across each index entry the corresponding page number will also appear, which helps the readers to find the information quickly. It is mainly used for reference.

Let us now create an index for the article on cleanliness. The whole process involves three steps:

1. Decide the words needed for the index page.
2. Create index entries.
3. Create the index page.

Creating index entries

The steps for the selection of words are:

- i. Click on a word, or select the words in your document that you want to use as an index entry.
- ii. Choose the menu option **Insert** → **Indexes and Tables** → **Entry**. The Insert Index Entry dialog box appears as shown in Figure 3.35. The selected word will appear in the Entry box.
- iii. To add an index mark to similar words in the document, select **Apply to all similar texts**.
- v. Then click the **Insert** button.

For example the word 'sanitation' is selected as an index entry as shown in the Figure 3.35. Similarly all entries are to be made.

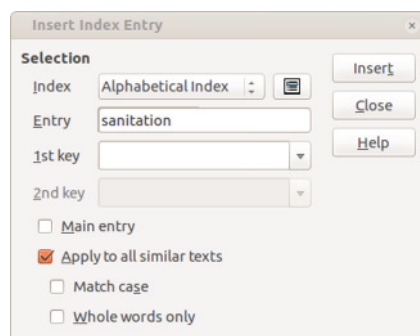


Fig. 3.35: Insert Index Entry

After defining the index entries, the index page is to be prepared. For that, the following steps are required:

- i. Click on the document where we want to create the alphabetical index.
- ii. Choose the menu option **Insert** → **Indexes and Tables** → **Indexes and Tables**. Insert Index/Tables dialog box appears as shown in Figure 3.36 and then click the Index/Table tab.
- iii. Select **Alphabetical Index** in the **Type** box.
- iv. Select any additional options in the tabs **Columns**, **Style**, **Background**, etc. if required.
- v. Click **OK** button to complete the process. The index will be created as in Figure 3.37.

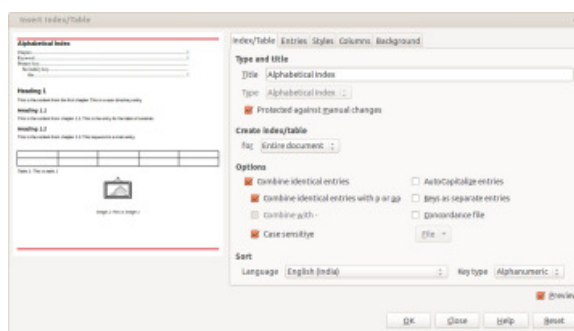


Fig. 3.36: Insert Index/Table dialog box

Alphabetical Index	
hunger	3p.
hygiene	2, 4
khadi	4
sanitation	2p.
Sanitation	2
scavenging	2p, 5p.
Scavenging	1p, 6
South Africa	1pp.
Swami	4
untouchability	3
untouchables	3p.

Fig. 3.37: Alphabetical index created

3.13 Concept of templates

Documents can also be created with predefined styles, formats, company logos, header/footer etc. For doing that Writer provides us the facility of using templates.

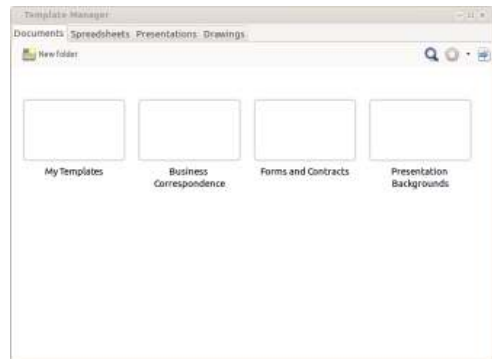
A template is a document model using which we can create other documents. Templates can contain anything that regular documents contain, such as text, graphics, a set of styles, etc. If we do not specify a template when we start a new Writer document, the document is based on the default template for text documents.

3.13.1 Using templates

The following steps can be used to create a template for a document:

- i. Choose the menu option **File → New → Templates**.
- ii. Template Manager dialog box appears as shown in Figure 3.38.

- iii. Double-click the folder that contains the template that we want to use, typically this will be **My Templates**. All the templates (predefined document formats) contained in that folder are then listed. More templates can also be added from outside sources like Internet.



- iv. Double-click on the required template.

A new document based on the selected template opens in Writer. We can then edit and save the new document just as we do in any other document.

Fig. 3.38: Template Manager dialog box

3.13.2 Creating a template

Writer also provides the facility to create our own templates. Suppose we have created a document like a bio data which is professionally designed. This can be saved as a template file so that when we open it a new copy of it opens and anybody can customize it, then save with a new name. We need to enter only the data. The formatting remains the same as that of the template file. The following steps illustrate the way of creating a template from a document:

- i. Open a new or existing document that we want to make it as a template.
- ii. Add or modify the content and styles or formats as we want.
- iii. Choose **File → Template → Save as Template** option.
- iv. A Template Manager dialog box appears with default folders.
- v. Select the **My Templates** folder.

- vi. Click the **Save** button.
- vii. Enter a name for the template in the text input box that opens, and click **OK** button. Figure 3.39 displays a newly saved template with the name article.

Any settings that are added to or modified in a document can be saved in a template. The file extension will be .ott (Document Text Template) by default. Thus the file will be saved as 'article.ott'.

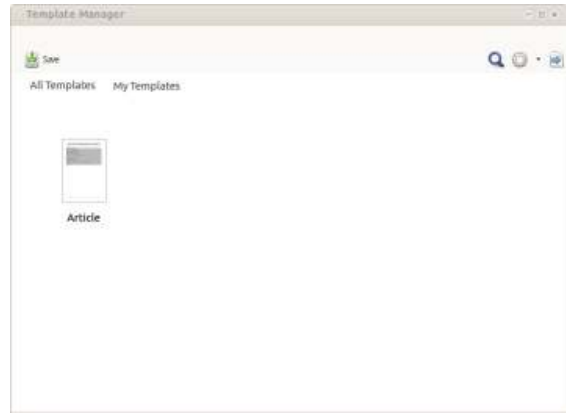


Fig. 3.39: Template saved with name Article

Know your progress



1. Column option is available in the _____ menu.
2. In a Writer document, the presence of a red wavy underline below some words indicates _____.
3. Identify the facility provided by Writer which corrects the wrongly spelt words immediately after typing.
4. What is a template?
5. What is TOC in a document?
6. Name the option available in Insert menu to create formulas.

3.14 Mail merge

In government/private offices there may be situations where a letter containing the same text matter may have to be sent to different people. These documents also have a typically common layout but only the recipient address, salutation, etc. are different. Such letters will be prepared by typing the unique contents like address, salutation, etc. in documents and then saving each letter separately. But this is laborious and time consuming.

Mail merge is a tool in word processors which allows to create formal letters, mailing labels and envelopes by linking a main document to a set of data or data source. The main document, which contains the common text, is linked to the data source by common fields of data, called merge fields. We can also create our own merge fields, specific to the data source.

Let us assume that the NSS Programme Co-ordinator of Directorate of Higher Secondary Education has to send a letter to all Principals of higher secondary schools in Kerala to conduct a cleanliness campaign as part of Independence day.

The whole process of mail merging can be done easily through Mail Merge Wizard. A wizard is nothing but a series of steps in which dialog boxes appear and the user needs to input sufficient data and instructions and finally the task will be completed.

At first, let us create the letter from the Programme Co-ordinator which will be called as the main document as shown in Figure 3.40.

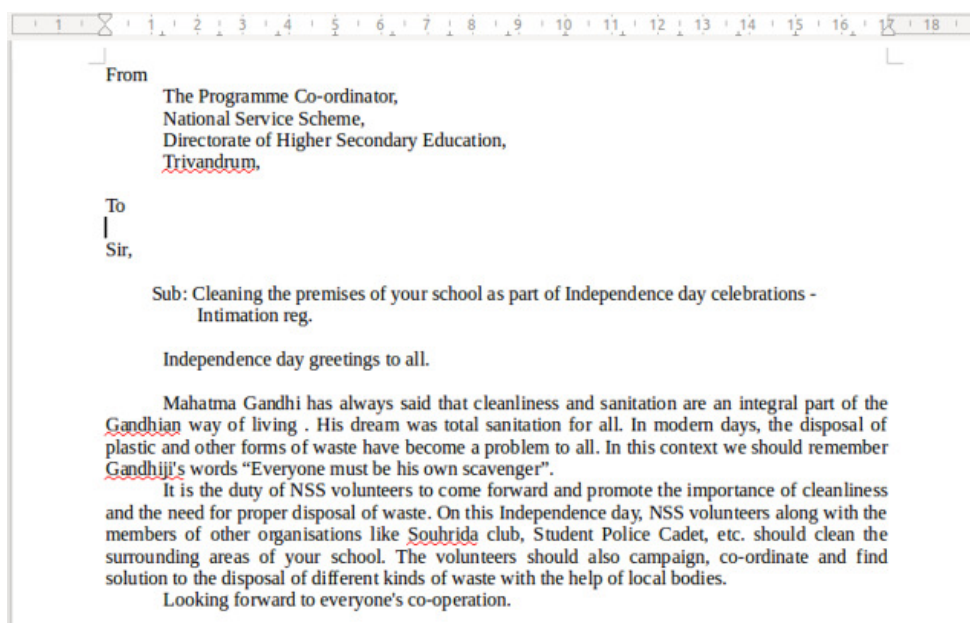


Fig. 3.40: Main document

In this document the address of the principals of the different schools in Kerala has to be inserted below the "To" address. Now click on a position below the "To" address and use the menu option **Tools → Mail Merge Wizard** to start the Mail Merge Wizard as shown in Figure 3.41.

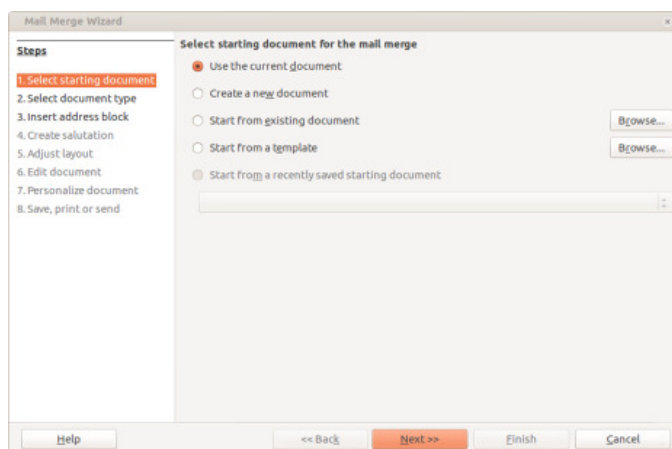


Fig. 3.41: Template saved with name Article

Step 1: Select starting document

This step allows to select the main document. Since we have taken the Mail Merge Wizard from the main document, we can select the option **Use the current document**. This step provides options, as shown in Figure 3.41, to create a new main document or to select a document that already exists, recently saved document or a template. After selecting the main document click **Next** button.

Step 2: Select document type

This step allows to select the type of document to be created as shown in Figure 3.42. The type of document can be a written letter or an e-mail message. After selecting **Letter** option click **Next** button.

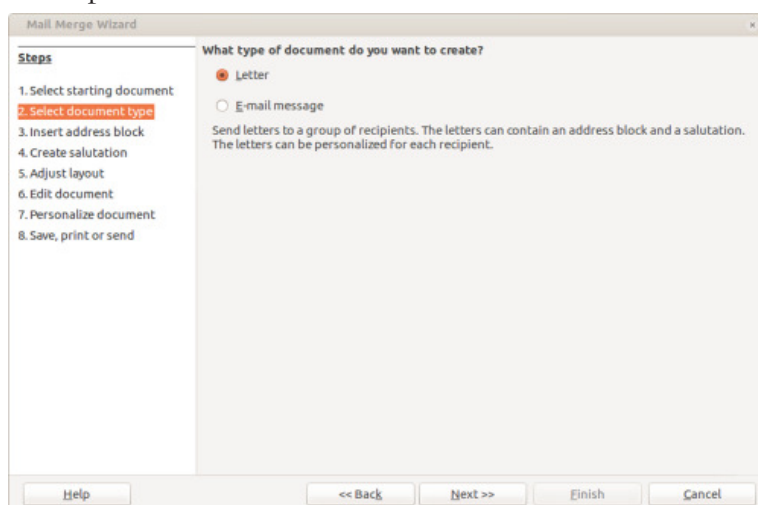


Fig. 3.42: Select type of document

Step 3: Insert address book

As shown in Figure 3.43, this step is used to insert/create the address list for merging. Address list consists of address (Name, Office Name, Address, City, State, PIN code, etc.) of various persons to whom the letters are to be sent. In the wizard, click the **Select Address List...** button to open the Select Address List dialog box as shown in the figure. This dialog box allows to add an

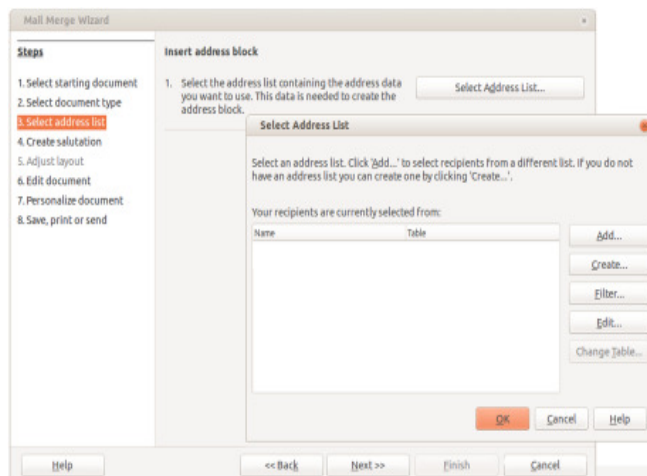


Fig. 3.43: Insert address book



existing address list, create a new address list or to filter or edit an existing list. In this case let us create a new address list using the **Create...** button.

This opens a New Address List dialog box as shown in Figure 3.44. In this dialog box add the required fields/elements like First Name, Company Name, Address Line1, etc. To enter another address, click **New** button. After entering all the addresses, click **OK** button to save the address list.

A new dialog box to save the address list appears as shown in Figure 3.45. Give a suitable name to the list and click **Save** button to save the list. Let us give the name "Address" to this file.

Fig. 3.44: New address list dialog box

Fig. 3.45: Save address list dialog box

This will be displayed in the Select Address List dialog box as shown in Figure 3.46. Now click **OK** button to select the recipient address list named "Address". This opens a section to set an address block using the address elements as shown in Figure 3.47. This block can be inserted into the main document. Here we can see that the address does not contain the school name.

Fig. 3.46: Select Address List dialog box after creating address list

Fig. 3.47: Dialog box displaying options to set the address book

We can add it by editing this block. For this use the **More...** button in the dialog box.

It opens a Select Address Block dialog box as shown in Figure 3.48. Click on **Edit...** button to open Edit Address Block dialog box as shown in Figure 3.49. Using the arrows provided we can add or remove the Address elements to create the address block. We have entered the school name in the field "Company Name".

Insert this field in the block. The position of the elements can be changed using the arrows on the right side of the dialog box. A preview of the address is also displayed in the dialog box. The modified block is displayed in the Figure 3.49. Click **OK** button to set the address block. In the Select Address Block dialog box, click **OK** to select the address block created. Then click the **Next** button on the wizard to proceed to the next step.

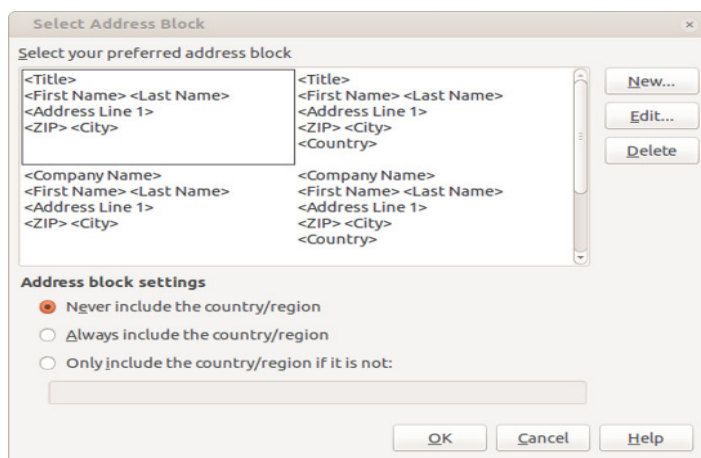


Fig. 3.48: Select Address Block dialog box

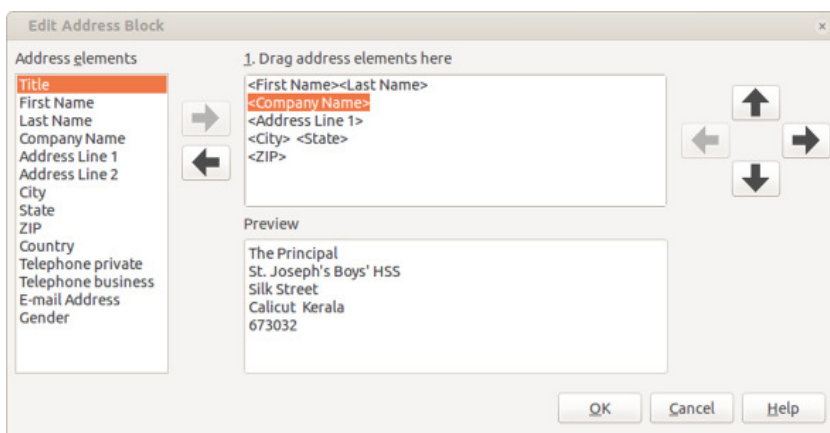


Fig. 3.49: Edit Address Block dialog box

Step 4: Create salutation

In this step a dialog box as shown in Figure 3.50 is provided to create a personalised salutation in the main document. i.e., "Mr." for males and "Mrs." for females. To check whether a person is a male or female, an address field/element can be used in the address list. According to the value in the field "Mr." or "Mrs." will be displayed.



In the case of our letter, the recipients are principals of schools. Therefore we have the salutation "Sir", which is placed in the main document itself. Because of this, we remove the check mark against This document should contain a salutation. Click **Next** button to move to the next step.

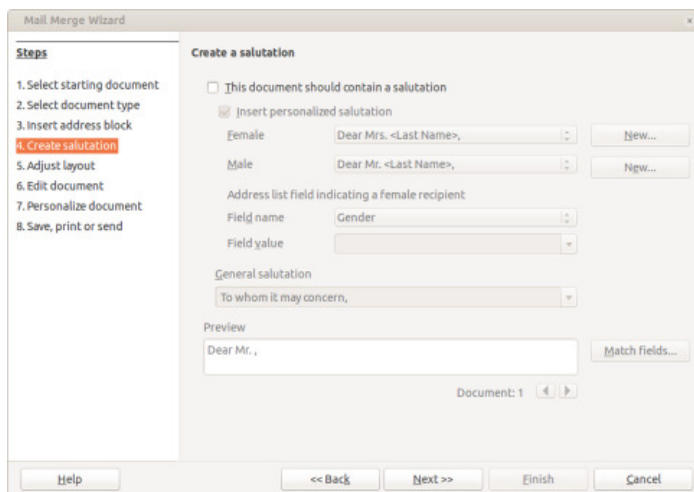


Fig. 3.50: Step to create salutation

Step 5: Adjust layout

In this step, Writer gives a dialog box as shown in Figure 3.51 to align the address block to the correct position in the main document. The position can be adjusted according to its distance from the left and top of the main document. The distance in centimeters can be modified to position the block. It can also be aligned to text body by putting tick mark against the check box Align to text body. A preview of the block is provided in the dialog box. Use Next button to move to the next step.

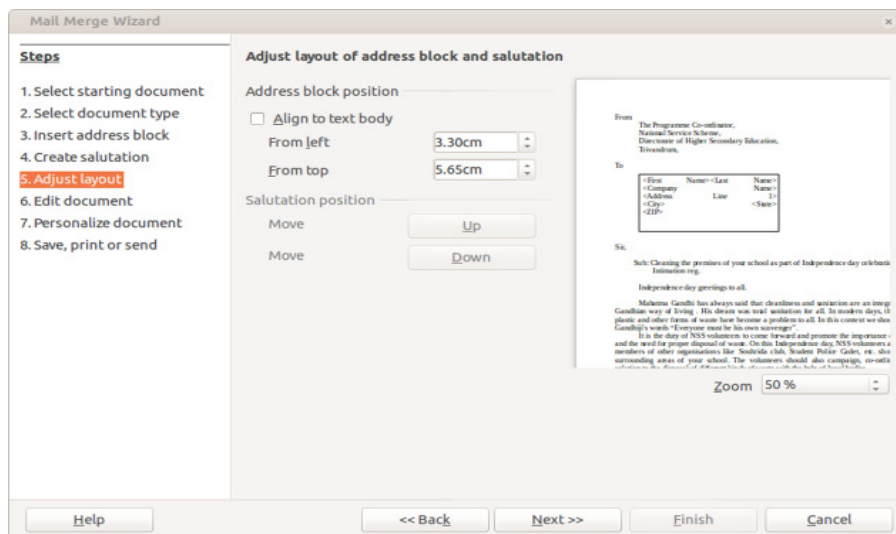


Fig. 3.51: Dialog box to adjust the position of the address block

Step 6: Edit documents

This step helps to preview and edit the merged documents as shown in Figure 3.52. To preview a particular merged document, use the arrows. To edit the

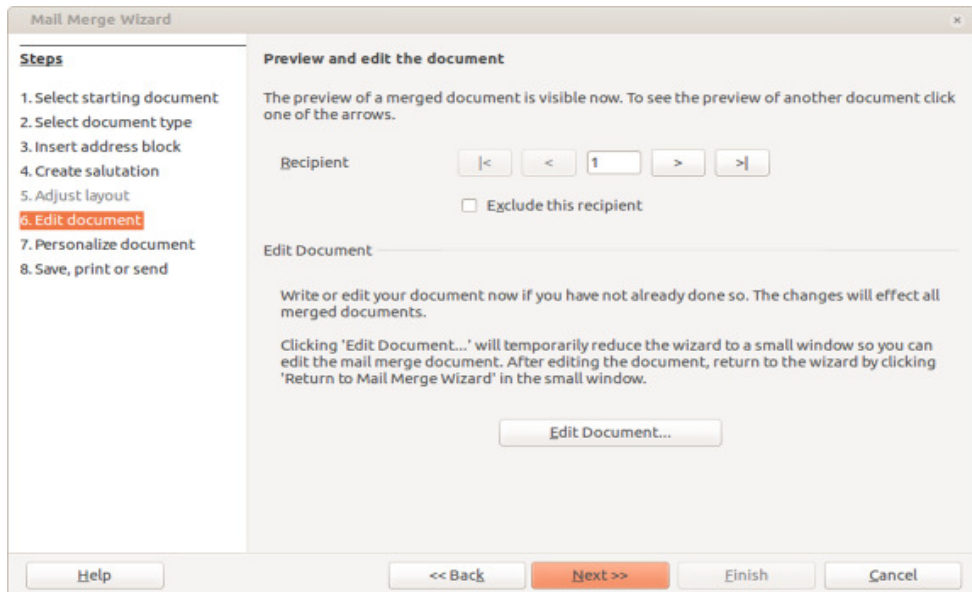


Fig. 3.52: Editing the main document

document, click **Edit Document...** button. We can also create/modify the contents of the main document using this option. The Mail Merge Wizard will be reduced to a small button while editing the main document as shown in Figure 3.53. We can click on the button to return back to the wizard. Clicking the **Next** button takes us to the next step.

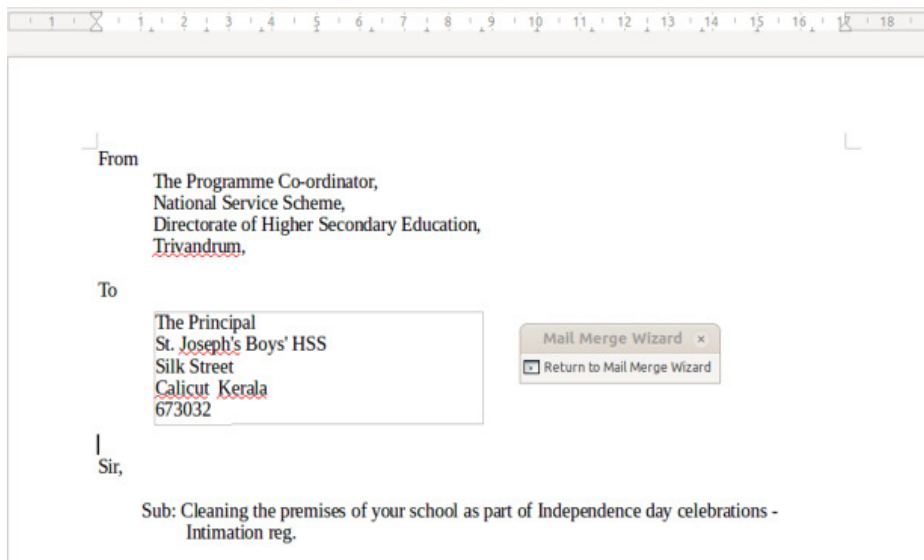


Fig. 3.53: Editing process in progress

Step 7: Personalise documents

The Mail Merge Wizard creates a single merged document with page breaks between each recipient. When we reach a page through the wizard, the names and the addresses of that particular recipient will be contained in the document. This merged document can be personalised by editing it.

This is as shown in Figure 3.54. The wizard provides a feature to edit individual documents and also find a particular word in the merged document.

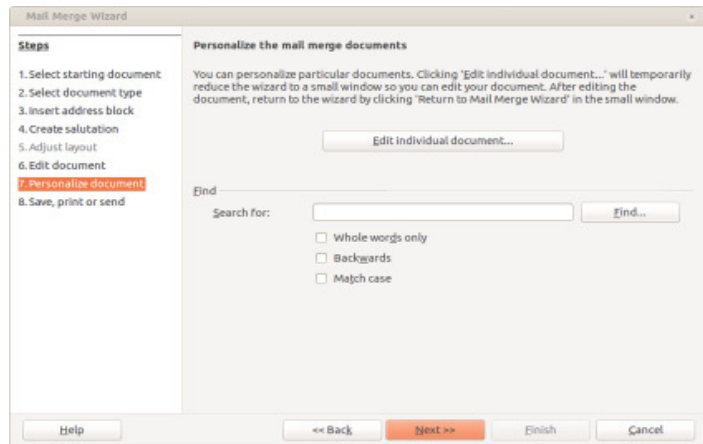


Fig. 3.54: Personalised merged document

Step 8: Save, print or send

This step provides the output options for merged documents as shown in Figure 3.55. The main document now contains the address block inserted into it. This document can be saved using the first option **Save starting document**. The merged document containing letters to the principals can be saved as a single document or separate documents for a group of letters. This can be done using the **Save merged document** option. **Print merged document** option prints all or selected letters on a printer. **Send merged documents as E-Mail** option sends the output as e-mail

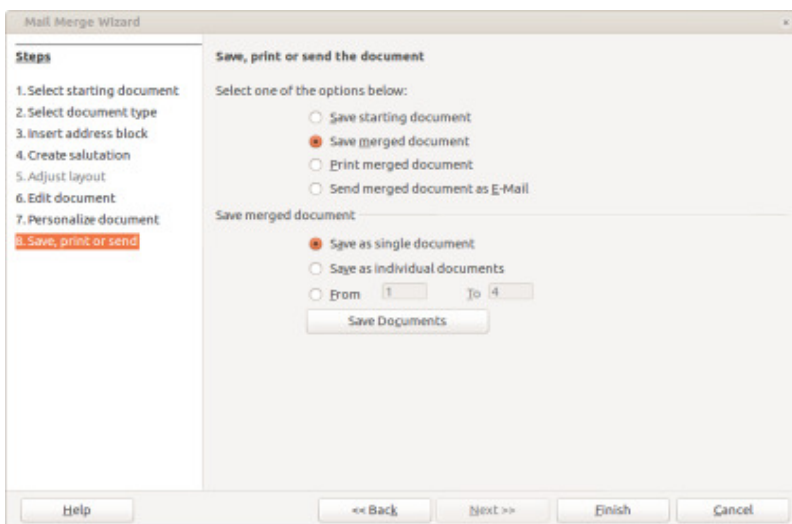


Fig. 3.55: Saving merged document

messages to all the recipients. This option provides features to specify To, CC, BCC addresses, e-mail subject, attachments, etc. Click on **Finish** button to receive the merged file. A part of our merged document/letter is given in Figure 3.56.

The figure displays three identical merged letter documents side-by-side. Each document is addressed to a different recipient, with the 'To' field containing the name and address of the recipient. The body text of each letter is identical, discussing the importance of NSS volunteers and the disposal of waste. The documents are signed by the Programme Coordinator.

Document 1 (Left):

From: The Programme Coordinator,
National Service Scheme,
Directorate of Higher Secondary Education,
Bhubaneswar.

To: The Principal,
St. Joseph's Boys' NSS,
Salt Secret,
Cuttack, Bhubaneswar,
751 002.

Sr. Sub: Cleaning the premises of your school as part of Independence day celebrations -
Information ref.

Independent day greetings to all.

Mahatma Gandhi has always said that cleanliness and sanitation are an integral part of the Gandhian way of living. His dream was total sanitation for all. In modern days, the disposal of plastic and other forms of waste have become a problem to all. In this context we should remember Gandhi's words, "Everyone must be his own scavenger".

It is the duty of NSS volunteers to come forward and promote the importance of cleanliness and the need for proper disposal of waste. On this Independence day, NSS volunteers along with the members of other organizations like Sahakari club, Student Police Cadets, etc. should clean the surrounding areas of your school. The volunteers should also campaign, coordinate and find solution to the disposal of different kinds of waste with the help of local bodies.

Looking forward to everyone's cooperation.

Programme Coordinator

Document 2 (Middle):

From: The Programme Coordinator,
National Service Scheme,
Directorate of Higher Secondary Education,
Bhubaneswar.

To: The Principal,
St. Joseph's NSS,
Bhubaneswar, Bhubaneswar,
751 001.

Sr. Sub: Cleaning the premises of your school as part of Independence day celebrations -
Information ref.

Independent day greetings to all.

Mahatma Gandhi has always said that cleanliness and sanitation are an integral part of the Gandhian way of living. His dream was total sanitation for all. In modern days, the disposal of plastic and other forms of waste have become a problem to all. In this context we should remember Gandhi's words, "Everyone must be his own scavenger".

It is the duty of NSS volunteers to come forward and promote the importance of cleanliness and the need for proper disposal of waste. On this Independence day, NSS volunteers along with the members of other organizations like Sahakari club, Student Police Cadets, etc. should clean the surrounding areas of your school. The volunteers should also campaign, coordinate and find solution to the disposal of different kinds of waste with the help of local bodies.

Looking forward to everyone's cooperation.

Programme Coordinator

Document 3 (Right):

From: The Programme Coordinator,
National Service Scheme,
Directorate of Higher Secondary Education,
Bhubaneswar.

To: The Principal,
Govt. Model NSS,
Cuttack, Bhubaneswar,
751 001.

Sr. Sub: Cleaning the premises of your school as part of Independence day celebrations -
Information ref.

Independent day greetings to all.

Mahatma Gandhi has always said that cleanliness and sanitation are an integral part of the Gandhian way of living. His dream was total sanitation for all. In modern days, the disposal of plastic and other forms of waste have become a problem to all. In this context we should remember Gandhi's words, "Everyone must be his own scavenger".

It is the duty of NSS volunteers to come forward and promote the importance of cleanliness and the need for proper disposal of waste. On this Independence day, NSS volunteers along with the members of other organizations like Sahakari club, Student Police Cadets, etc. should clean the surrounding areas of your school. The volunteers should also campaign, coordinate and find solution to the disposal of different kinds of waste with the help of local bodies.

Looking forward to everyone's cooperation.

Programme Coordinator

Fig. 3.56: Merged document



Let us conclude

We have discussed the advanced features of a word processing software like inserting objects like picture or image, inserting tables, watermarks, special symbols, etc. Then we have gone through converting text into table, multi column formatting, editing complex equations, correcting spelling and grammar, etc. Towards the end, powerful features like index entries, table of contents, templates, mail merging, etc. are also detailed. The features of Writer do not end here. Learners can explore other advanced features at their own interest.



Let us practice

1. Using the word processor, create a leave letter addressed to your class teacher, requesting for one day leave. Perform the following activities also in the same document
 - a. Save the file as 'Leave.odt'
 - b. Bold face the 'From' and 'To' addresses appearing in the document.
 - c. Change the font size of above addresses to 12.
 - d. Make the body of the letter justify within left and right margins.
 - e. Change the line spacing of the body of the letter to double and font size 11.
 - f. Right align the name and signature at the end of the document.
 - g. Save the document with another name 'Leave1.odt'
2. Prepare your class time table using the inserting Table feature of word processor. Save the document with name 'MyClass.odt'
3. Some data is given below. Convert the data directly into tabular form

ClassNo,Name,Sub1,Sub2,Sub3>Total

1. Aneesh.50.45.55.150
2. Parvathi.50.40.50.140
3. Sreedev.40.30.50.120
4. Sreedhar.40.40.30.110
5. Rahul.50.50.40.140

Hint. The text separator is full stop (.)

4. Type the following expressions using the word processor



b. $(A+B)^2 = A^2 + B^2 + 2AB$

5. Insert the following special symbols in the word processor

α (alpha), (beta), (gamma), (sigma), (lamda), (ohm), (theta),
(pi)

6. Suppose your school day is to be conducted on next Monday. Invitation letters are to be sent to nearby schools, addressed to respective Principals. The content of the letter is the same, but the receipient addresses are different. Use the mail merge facility to do the task.

A sample letter is given below:

From

The Principal,
Name of Your School
Place

To

Mr /Ms/Mrs

Sub: Invitation

This is to inform you that our school anniversary is planned to be conducted on next Friday. You are invited to attend the function.

Thanking you

Yours faithfully

Principal

Place:

Date:

**Let us assess**

1. Name the button in the toolbar which when pressed shows wrongly spelt words while we type the document with a wavy red line.
2. A picture can be added into a document using _____ menu.
3. Name the tool in drawing toolbar which helps to draw a figure or picture in free hand style.
4. Which tool in the Drawing toolbar is used for creating graphical text art objects?
5. Suppose you have prepared a question paper. Your school name is to be lightly printed on all pages. The presence of the text does not block the normal text in the pages. Identify the name of this feature in Writer. How do you do that?
6. The facility for applying predefined table formats is called _____.
7. A table is made up of _____ and _____.
8. Name the button in the Table toolbar using which predefined format can be applied to a table.
9. Write the steps to convert a text matter directly to table.
10. Suppose you want to insert some special symbols like £, ©, etc. in your document. Write the steps to do that.
11. Write the need for templates in Writer. How do you prepare a document from a template.
12. You are supplied with a common letter file (main document) and another address file (contains many addresses). Write the steps to combine these two documents using mail merging.
13. Write the steps to prepare an index page for the document.



4

Web Technology

Significant Learning Outcomes

After the completion of this chapter, the learner

- explains how secure communication is brought about on the web.
- describes the use of a web server and the concept of web hosting.
- differentiates static and dynamic pages.
- identifies the differences between programming languages and scripts.
- compares the different types of scripting languages.
- explains the need for cascading style sheet.
- identifies the basic HTML elements to create web pages.
- lists fundamental HTML tags and their important attributes.
- classifies the HTML tags.
- uses formatting tags appropriately in an HTML document to make the web page attractive.
- identifies the similarities and differences among the formatting tags.
- observes the use of the tags `<PRE>` and `<DIV>`.
- chooses the tag for moving objects/ contents in a document.
- uses the `` tag to format the text content effectively.
- utilises the facility of comments in an HTML document.
- inserts images into HTML document using `` tag.

We are all living in an era of the Internet and might have accessed it for seeking information. You might have searched for your Class XI results and viewed it from a website. People rely on different websites for various purposes like submitting online applications, viewing web contents, watching movies, for banking transactions, purchase of goods through online transaction, and so on. We know that a website is a collection of web pages. A web page may contain texts, graphics, sounds, animations, and movies. A website consisting of several web pages are designed to give information about an organisation, product, service, etc. How is this website made available on the Internet? These web pages are to be stored in web servers connected to the Internet, to be made available to others. This chapter presents an overview of communication over the Internet and the role of web servers in it. The different tools and technologies that are available for developing websites are introduced here. The concept of dynamic web pages and an overview of the scripting languages used to make web pages dynamic are also discussed. Web pages are developed with the help of a language called Hyper Text Markup Language

(HTML). HTML is also known as the language of the Internet. HTML tells the browser how to display the contents on a browser window. In this chapter, we will also familiarise ourselves with the fundamentals of creating web pages using HTML.

4.1 Communication on the web

We have learned the actions that occur when a web browser (client) tries to access a website from the Internet in Chapter 9, Internet of Class XI. First, the URL (Uniform Resource Locator) is sent to a Domain Name System (DNS) server to obtain its corresponding IP (Internet Protocol) address and then the browser connects to this server using the IP address. The web server software installed in the server computer processes this request and the web page to be displayed is then sent to the client. The client browser formats and displays this web page.

In order to communicate on the web, computers/devices need to understand each other. This is made possible by making all devices follow the same protocol, namely the Transmission Control Protocol/Internet Protocol (TCP/IP). We have discussed TCP/IP protocol and its working in detail in Chapter 8, Computer Networks of Class XI. The data to be sent is broken down into small data packets along with the address of the recipient computer by the TCP protocol. The devices called routers, route and transport these data packets to their destination computers using Internet Protocol. Figure 4.1 shows the route of a data packet from a sender to a recipient.

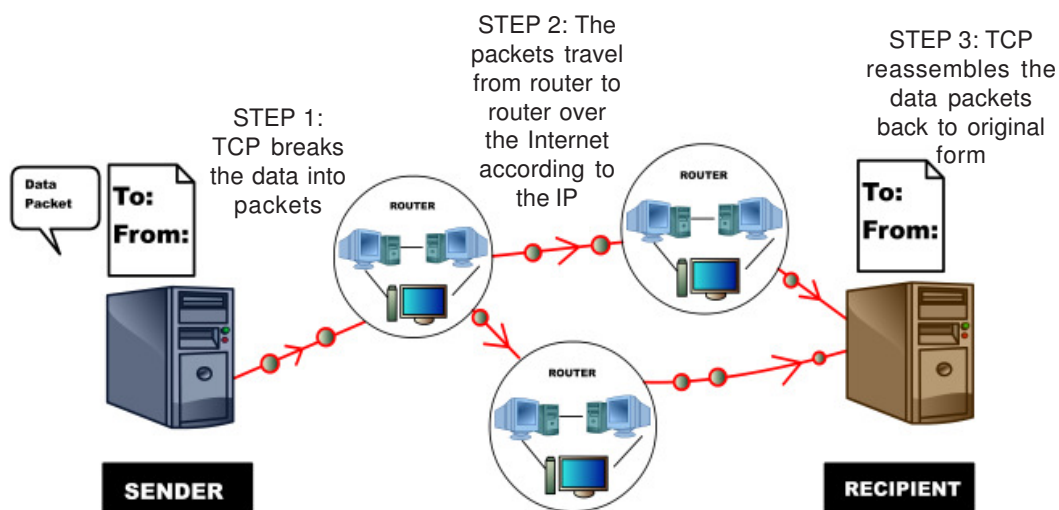


Fig. 4.1: Routing of a data packet from a sender to a recipient

In the Internet, there are several types of communication like, accessing websites, sending e-mails, etc. We have already learned in Chapter 9, Internet of Class XI that websites are accessed using HTTP (Hyper Text Transfer Protocol) and e-mail

communication happens using SMTP (Simple Mail Transfer Protocol). Both these protocols work on top of lower level protocol called Internet Protocol. Internet Protocol provides the basics of communication over Internet. The use of a single protocol - Internet Protocol - for all communication over the Internet has several advantages. The routers need not be programmed separately to handle different types of data. They do not need to know about the data they are transporting and are concerned only about the address to which the packet is to be delivered. This openness of the data part of the packet gives the freedom to design new protocols for the Internet. It is this openness and flexibility of TCP/IP that led to the development of protocols for social media websites to handle messages, content websites to handle video and audio, banking websites to handle money transfer securely, etc. This turned out to be a deciding factor for the economic success of the Internet.

Communication on the web can be categorised as (i) client (browser) to web server and (ii) web server to web server communication. Authentication and security are essential for communication over the Internet. Authentication on the web is the process of determining whether a computer/server is the computer that it claims to be. Security should be provided to communication over Internet so that the messages are not intercepted and modified by hackers.

4.1.1 Client to web server communication

Client to web server communication does not usually require authentication. But in the case of web based banking applications/e-mail services, user names and passwords are required to be sent to the server. This information cannot be sent to the server in plain text due to security reasons. The hackers may steal usernames and passwords, if it is communicated and shared as plain text. In such cases we use HTTPS (Hyper Text Transfer Protocol Secure) technology to encrypt the username and password, and then send it to the server. HTTPS works using Secure Sockets Layer (SSL) which provides a standard security technology for establishing an encrypted connection between computers on Internet. SSL provides security capabilities to HTTP. The SSL protocol not only ensures privacy, but also ensures that no other website can impersonate the user's login account nor alter the information sent.

When the browser requests for a secure web page, the server first returns its SSL certificate. The browser then verifies whether this certificate is valid by checking it with the corresponding certification authority. A certification authority certifies whether an SSL certificate given to it is a valid one. This is an assurance that the particular website is of the organisation it claims to be. Verisign Inc. is a certification



authority. If an SSL certificate is valid, the browser starts an encrypted session. During this session, the browser and the server encrypts all the transmitted data. This process is displayed in Figure 4.2(a). In India, Information Technology Act makes it mandatory for websites that provide banking transactions to use HTTPS to accept confidential information from clients. You can click on the lock symbol in the address bar and view the certificate as shown in Figure 4.2(b).

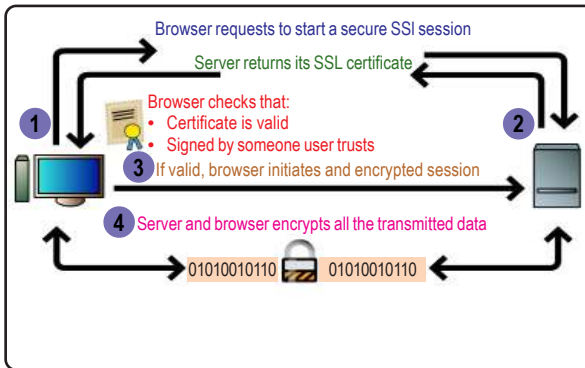


Fig. 4.2(a) : Client - server authentication process

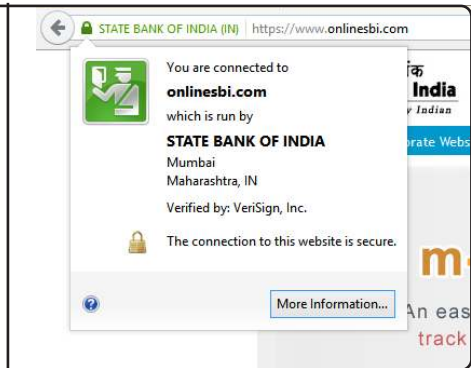


Fig. 4.2(b): https authentication of SBI website

4.1.2 Web server to web server communication

Web server to web server communication also may be required in certain web applications. For example, the web server of an online shopping website (seller/merchant on Internet) needs to send confidential information to a bank web server and vice versa. In such cases the web servers of the merchant and the bank are to be authenticated. Digital certificates help to verify whether the data received is from

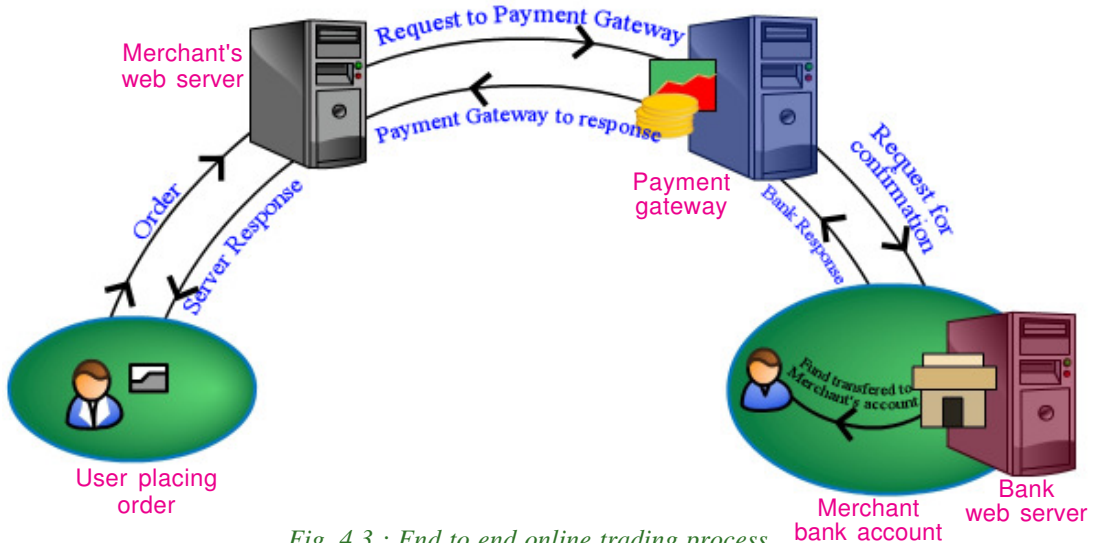


Fig. 4.3 : End to end online trading process

the actual server itself. Once the servers are authenticated, the servers communicate using encrypted data. Payment gateway is a server that acts as a bridge between merchant server and bank server and transfers money in an encrypted format whenever an online payment/money transfer is made. This process is shown in Figure 4.3.

4.2 Web server technologies

Let us see what happens internally when we visit the website www.dhsekerala.gov.in, the official website of the Directorate of Higher Secondary Education (DHSE). At first, the home page (the first page displayed when a website will be accessed) of the website will be transferred to our computer (client) from the web server of DHSE. The client is usually a computer or a mobile device which has a browser software that requests for web pages. The web server uses the web server software to store the pages of the websites and delivers it on request from the client. In the following sections, we will discuss the features of a web server and the requirements for setting up a web server.

4.2.1 Web server

The term web server is often used for referring to the server computer that hosts websites. It is also used to refer to a web server software that is installed in a server computer in order to make it a web server. In this section we will discuss the features of a web server computer and a web server software.

A web server enables us to deliver web pages or services like e-mail, blog, etc. to users on the Internet. A web server consists of a server computer that runs a server operating system and a web server software installed on it for providing services like www, e-mail, etc. over the Internet.

A web server is a powerful computer which is always switched on and connected to a high bandwidth Internet connection. This will facilitate Internet users around the world to access the websites and services hosted by it at any point of time. Depending on the requirements, a web server can have single or multiple processors, fast access RAM, high performance hard disks, Ethernet cards that supports fast communication, etc. To ensure faster Internet connectivity and redundant power supply, a web server is usually installed in a data center.



Fig. 4.4 : A data center



A data center is a dedicated physical location where organisations house their servers and networking systems. Data centers are used for storing, processing and serving large amounts of mission-critical data to their clients. A data center requires extensive backup power supply systems, cooling systems, high speed networking connections and security systems. A typical data center facility is shown in Figure 4.4. In a data center several servers may be mounted into special racks that offer good ventilation and easy maintenance as shown in Figure 4.5.



Fig. 4.5 : Rack mounted servers

Popular server operating systems include various Linux distributions (Redhat, openSUSE, Debian, Ubuntu, etc.), Microsoft Windows Server, FreeBSD, Oracle Solaris, etc.

After setting up a server, a web server software has to be installed in it and configured according to the given operating system. The web server software is a program that uses the client-server model and the Hypertext Transfer Protocol (HTTP) to ensure timely distribution of files stored in it to the users. These files are sent as webpages to the user on request using the web server software and can be accessed using a web browser. Some of the preferred web server packages are Apache Server, Microsoft Internet Information Server (IIS), Google Web Server (GWS) and nginx (pronounced as engine-x).

After the installation and configuration of a web server software, software packages like FTP (File Transfer Protocol), e-mail, DNS, database, etc. can be added as well. The main features provided by the web server software are the provisions to create multiple websites, configure website security, etc.

4.2.2 Software ports

We have discussed hardware ports in Chapter 2, Components of the Computer System of Class XI. Hardware ports are used to connect external devices to the computer. These devices communicate with the computer using these ports, i.e., VGA ports are used to connect monitors, PS/2 ports for keyboard/mouse, etc. Similarly, a software port is used to connect a client computer to a server to access its services like HTTP, FTP, SMTP, etc. To distinguish the ports, the software ports are given unique numbers. The purpose of software ports is to identify different services like e-mail, file transfer, etc. running on a single server computer. Each service available on the server can be set and accessed using a different port number.

Port number is a 16-bit number which when added to a computer's IP address/URL, can be used for communicating with a particular service available on that server. A service in a website can be accessed in the format given below:

`http://google.co.in:80`

Here http is the protocol, google.co.in is the domain name and 80 is the port number. Some well-known ports and the associated services are listed in Table 4.1.

Default Port No.	Service
20 & 21	File Transfer Protocol (FTP)
22	Secure Shell (SSH)
25	Simple Mail Transfer Protocol (SMTP)
53	Domain Name System (DNS) service
80	Hypertext Transfer Protocol (HTTP)
110	Post Office Protocol (POP3)
443	HTTP Secure (HTTPS)

Table 4.1: Ports and their services

4.2.3 DNS servers

In Chapter 8, Computer Networks of Class XI, we learned about Domain Name System (DNS). A DNS server runs a special purpose networking software that contains a database of domain names and their IP addresses. The Domain Name System (DNS) runs on a DNS server and returns the IP address of a domain name requested by the client computer.

A Domain Name System contains several DNS server computers. The DNS servers are arranged in a hierarchy. At the top level there are 13 root servers that contain name server information for all the generic top-level domains such as .com and .org as well as country-specific domain addresses such as .in or .uk. Several copies of these root servers are placed in different locations around the globe as shown in Figure 4.6. All other DNS servers are installed in the lower level of hierarchy.



Fig. 4.6 : Root servers around the globe

Let us see how the DNS searches and locates the IP address of a domain name. Suppose we are visiting the website of the Police department of the Government of Kerala. Let us type the domain name for the police department, namely www.keralapolice.org in our browser. The following steps illustrate how the DNS resolves the IP address. See Figure 4.7.

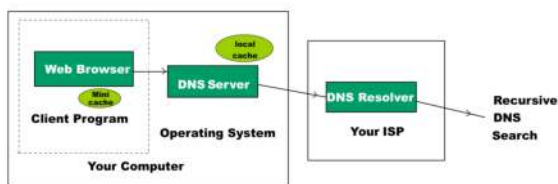


Fig. 4.7 : DNS search

1. All browsers store the IP addresses of the recently visited websites in its cache. Therefore, the browser first searches its local memory (mini cache) to see whether it has the IP address of this domain. If found, the browser uses it.
2. If it is not found in the browser cache, it checks the operating system's local cache for the IP address.
3. If it is not found there, it searches the DNS server of the local ISP.
4. In the absence of the domain name in the ISP's DNS server, the ISP's DNS server initiates a recursive search starting from the root server till it receives the IP address.
5. The ISP's DNS server returns this IP address to the browser.
6. The browser connects to the web server using the IP address of www.keralapolice.org and the webpage is displayed in the browser window. If the IP address is not found, it returns the message 'Server not found' in the browser window.



The 13 root servers around the globe manage the entire database of domain names and their corresponding IP addresses. Each of these root servers are a network of servers installed in many countries around the world. They are named as A, B, C, D, E, F, G, H, I, J, K, L and M. These servers are maintained by various agencies like ICANN, NASA (National Aeronautics and Space Administration), University of Maryland, VeriSign Inc., etc. ICANN's (Internet Corporation for Assigned Names and Numbers) Root Server System Advisory Council is comprised of the organisations that manage the root servers. They are responsible for advising ICANN on matters relating to the operation, administration, security and integrity of the Internet's Root Server System. In India, NIXI (National Internet Exchange of India) has sponsored three root servers at Mumbai (I Root), Delhi (K Root) and Chennai (F Root).

In large organisations like educational institutions, government departments, software firms, etc. where there are hundreds of computers or devices connected to the Internet, a local DNS server is hosted inside the intranet of the organisation.

This local DNS server contains a list of domain names and their IP addresses which the users in the organisation regularly access. This list can be updated periodically to include new domain names. Whenever a computer in the intranet tries to access a website in the Internet, it first searches for the domain name in the local DNS server and finds the IP address. This speeds up the Internet access in the organisation. Only if the domain name is not found in the local DNS server, it searches the DNS of ISP.



Instead of directing the computer to search for IP address in the ISP's DNS server, we can direct it to search the public DNS operated by Google. Google Public DNS is a free Domain Name System (DNS) resolution service that can be used as an alternative to our current DNS provider. The IP addresses for Google's public DNS are 8.8.8.8 and 8.8.4.4. We can configure our network settings to direct to Google's public DNS using either of the IP addresses.

Know your progress



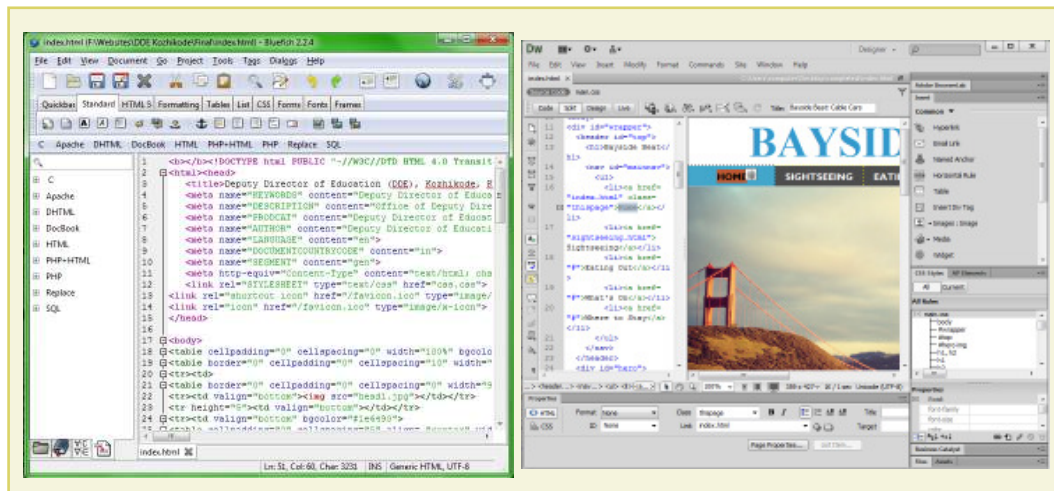
1. Name a protocol that works on top of the Internet Protocol (IP).
2. Expand HTTPS.
3. What are the advantages of installing web servers in data centers?
4. State whether true or false.
 - a. The web server software works based on a client-server model.
 - b. The web server consists of server operating system and web server software.
5. The number of bits in a software port number is _____.
 - a. 8
 - b. 16
 - c. 32
 - d. 64
6. A Domain Name System returns the _____ of a domain name.

4.3 Web designing

The first step in setting up a website is planning the web pages for the website. Suppose we are going to develop a website for our school. After deciding the pages and the links, we need to design these web pages. Any text editor can be used to create a home page, a page for displaying the courses in the school, facilities available, contact address, etc. and link them using a menu to form an attractive website.



There are many web designing softwares available. You can also employ the features available in any of the web designing tools that helps you to create a web page with the ease of preparing a document in a word processor. These software also provide features to design web pages and link them together to form a website. Facilities to transfer files to the server using FTP protocol is also built into such software. Popular web designing softwares are Bluefish, Bootstrap, Adobe Dreamweaver, Microsoft Expression Web, etc. Figure 4.8 shows the Integrated Development Environment (IDE) of popular web designing softwares.



Bluefish

Dreamweaver

Fig. 4.8 : IDE of web designing software

You have already learned the basics of creating web pages in high school classes. HTML consists of tags and its attributes used to format web pages. In this chapter we will also get familiar with the different HTML tags and attributes.

4.4 Static and dynamic web pages

You might have noticed that the web pages in the website of some small business/ organisations, school website, etc. remain the same whenever you visit it. These websites are called static websites. There are some other websites like the website that displays your mark in SSLC or Higher Secondary Examination (HSE), that changes when different register numbers are given to them. They are called dynamic web pages.

Static web pages are web pages that remain the same all the time until their code is changed manually. Initially, web pages were created with HTML only and such web pages are static web pages. Later, the emergence of scripting languages like JavaScript, VBScript, etc. brought animations into the web page. The colour and style of a portion of the web page changes when the mouse is kept over it, images are loaded

and displayed one after another in a sequence - all these are designed using scripting languages. The web pages that contain all these features are also classified as static web pages.

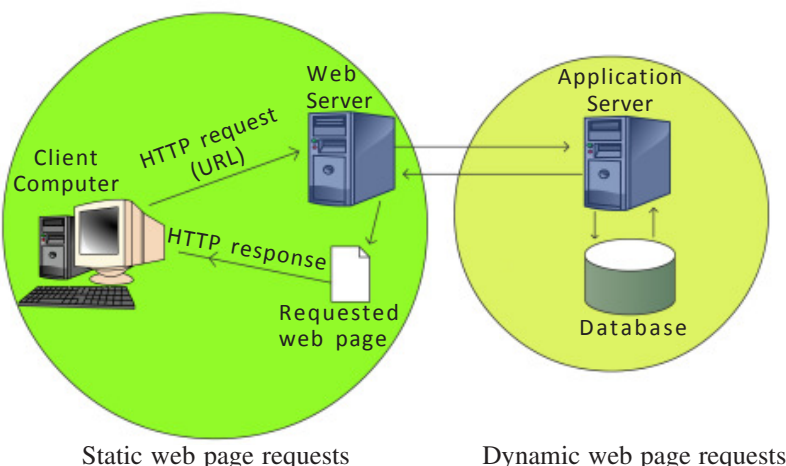


Fig. 4.9 : Static and dynamic web page requests

The web pages that contain server side code which creates a web page each time it is accessed are called dynamic web pages. Program code that runs on the server is called server side code. Dynamic web pages are executed using a server side application program that is installed on a web server. The script in the web page is executed on the web server and the resulting HTML page is sent to the client browser. In most cases data is accessed from databases to create web pages. The web pages that display SSLC, HSE results, bus, train and flight booking, banking/financial transactions, etc. display dynamic content, and are considered as dynamic web pages. Technologies like PHP, ASP, JSP, etc. are used to develop dynamic web pages. The working of static and dynamic web pages is represented using Figure 4.9. A comparison of static and dynamic web pages is given in Table 4.2.

Static web page	Dynamic web page
The content and layout of a web page is fixed.	The content and layout may change during run time.
Static web pages never use databases.	Database is used to generate dynamic content through queries.
Static web pages directly run on the browser and do not require any server side application program.	Dynamic web page runs on the server side application program and displays the results.
Static web pages are easy to develop.	Dynamic web page development requires programming skills.

Table 4.2: Comparison of static and dynamic web pages



4.5 Scripts

Scripts are program codes written inside HTML pages. They are written using a text editor like notepad. Scripting languages like JavaScript, VB script, PHP, Perl, etc. are used to create dynamic web pages.

Traditional programming languages are set of instructions carried out by the computer hardware with the help of an operating system, whereas scripting languages are interpreted by a web browser or by a web server software. Today most of the standalone programs are being replaced by web based programs. Earlier, the software used in banks were installed in the branches of the bank itself. Almost all banks have their banking software available on the bank's web server and the bank employees access them using the Internet. Web based software like banking software, higher secondary admission software, etc. use scripting languages for their development.

In an HTML page, a script is written inside **<SCRIPT>** and **</SCRIPT>** tags. **<SCRIPT>** is used to embed or refer to an executable script within an HTML document. It has the attributes **Type** and **Src**. Type attribute is used to identify the scripting language code embedded within the script tag. We will see more about HTML tags and attributes later in this chapter.

`<SCRIPT Type="text/javascript">` is used to insert JavaScript code in the HTML code.

Scripts can be written as an external file and can be linked to an HTML file. **src** attribute is used to specify the URL of an external file containing scripting code to be linked to a web page.

`<SCRIPT Type="text/javascript" Src="scriptcode.js">` is used to insert JavaScript code inside the file `scriptcode.js` into an HTML file.

4.5.1 Types of scripting languages

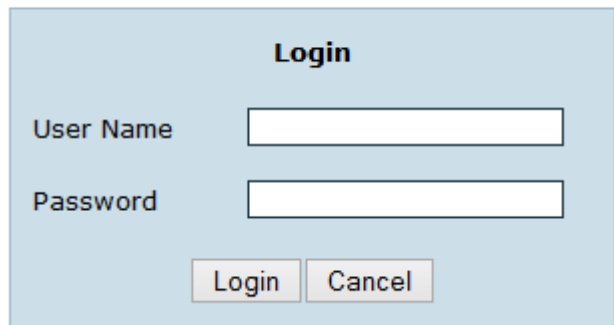
Let us consider a login page of a website in the Internet. Usually the page will prompt the user to enter the user name and password. User will click the 'Login' button after entering the user name and password. What will happen if the user clicks the 'Login' button without entering the user name? Naturally, the computer will tell the user that he/she has not entered the user name. Remember that the web page we are viewing is controlled by two computers - the client computer where the web page is viewed and the server computer where the web page comes from.

Where will we check whether the user has entered a user name or not - in the client computer or in the server computer? The server computer is thousand times busier

than the client computer, because a large number of people may be visiting the same web site and the server is the only one computer to handle all those requests. Therefore, all the tasks that can be done at the client side must be done at the client side itself. This will reduce the workload of the server.

It should also be noted that, if this type of checking is done at the server, when the user clicks the 'Login' button, the entered data has to be sent to the server from the client through the Internet. The data has to travel a long distance through the Internet to reach the server. When the data reaches the server, it will be placed in a queue because a large number of clients may be sending the same request to the server. The sent data will wait in the queue till it gets the chance to be processed by the server. The server will check whether any user name or password is entered by the client or not. If not, it will send a message back to the client specifying that the user name is not given as displayed in Figure 4.10. Again, the message has to travel a long distance back from the server to the client through the Internet. In short, if the user clicks the submit button, without entering the user name, he/she has to wait a few seconds till he/she gets the message that he/she has not given the user name. Besides this, the data has to travel from client to server and back from server to client, which unnecessarily makes network traffic busy.

Login Failed. Please Check User Name.



The image shows a web form with a light blue background. At the top center is the title 'Login' in bold black text. Below the title are two input fields. The first field is labeled 'User Name' in bold black text to its left. The second field is labeled 'Password' in bold black text to its left. Below the input fields are two buttons: 'Login' and 'Cancel', both in a light gray box with black text.

Fig. 4.10 : Response from the server

If this checking is done at the client side itself, when the user clicks the submit button, the script code in the client side can check, whether the user has given some entry as the user name and password. If not, a message can be displayed. During this process, the data does not travel across the Internet to the server, nor does it disturb the server for this simple task. When the user clicks the submit button, the user gets the message that he has not given the user name, within a second as shown in Figure 4.11. It also does not engage network resources unnecessarily.

Now let us consider another situation. Suppose a user enters a wrong user name and password. The client computer may be able to check whether there is any entry with such a user name and password. However it cannot check whether the user name and password are correct or not. This is because only the server computer has the details of all user names and corresponding passwords. Therefore, whether



the user name and password match each other, can be checked at the server side only. This is a situation where you have to use the server side scripting for the validation. When you need to perform some kind of validation of data that makes use of information from the server, it must be done at the server side itself.

Isn't it now clear that scripting languages are classified into client side scripts and server side scripts? Client side scripting is used to perform any task at the client side and is executed in the browser. Scripts that are executed in the server are called server side scripts. The output produced after execution of the server side scripts is in the form of an HTML page which is sent to the client.

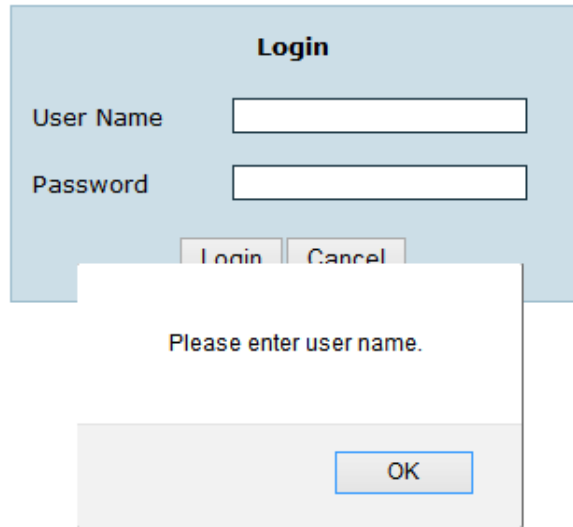


Fig. 4.11 : Response from client browser

A. Client side scripting

In client side scripting, the script code for validation is downloaded along with the HTML code to our browser. When we click the submit/save button this client side script is executed in our browser. If there is an error, it displays the message. It will send the data to the web server only if the validations are correct.

Since the script code is executed on the client browser, it provides a quicker response to users. This type of scripting will allow the client browser to share some of the burden on the web server while running a web application. The disadvantage of client side scripting is that there are browsers that do not support scripts. In some cases users may turn off the execution of scripts in the browser. In such cases client side scripting may not work.

Popular client side scripting technologies are JavaScript and VB script. Client side scripting is mostly used for validations and also for performing simple calculations at the client side before sending the data to the web server.

B. Server side scripting

We discussed dynamic web pages in the previous section. Server side scripts are used to create dynamic web pages. Let us discuss another example for server side scripting. Consider the website that displays the results of SSLC examination. When we enter the SSLC register number of a student, the website displays the scores of

that particular student. This is the same for each student who has appeared for the SSLC examination. We know that it is not practical to design a web page for each of the several lakhs of students who have written the SSLC examination. If so, how is this done? The results of these several lakhs of students are stored in a database in the web server. Server side

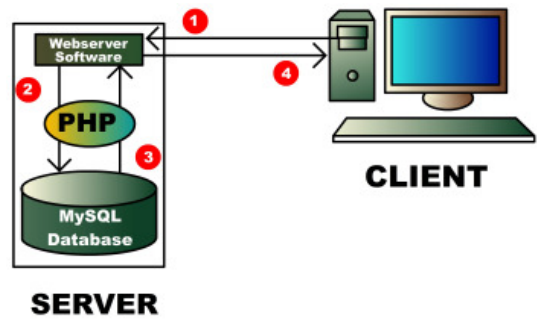


Fig. 4.12 : Working of server side scripts

scripts are used to access the result of a particular student from the database whose register number is entered by the user. The server side script then uses this result to create a simple HTML web page. This web page is then sent to the client browser and the browser displays it. This way the server side script creates a web page for each student who has appeared for SSLC examination as shown in Figure 4.12. The rapid growth of web based applications has increased the use of server side scripting.

Server side scripting is a technology in which the web page containing server side scripts requested by the user is executed in the server and the result, which is an HTML code, is sent to the client browser. Server side scripting creates web pages dynamically. Since the scripts are executed at the server, the type and version of the browser or operating system on the client's computer does not affect its execution. Since the scripts are executed on the server, it consumes server resources. Popular server side scripting languages are Perl, PHP, ASP, JSP, etc.

A comparison of the classifications of scripting languages is given in Table 4.3.

Client side scripting	Server side scripting
Script is copied to the client browser	Script remains in the web server
Script is executed in the client browser	Script is executed in the web server and the web page produced is returned to the client browser
Client side scripts are mainly used for validation of data at the client.	Server side scripts usually used to connect to databases and return data from the web server
Users can block client side scripting	Server side scripting cannot be blocked by a user
The type and version of the web browser affects the working of a client side script	The features of the web browser does not affect the working of server side script

Table 4.3 : Comparison of client side and server side scripting



We have seen that the client side scripts are mainly used for validations at the user's browser and that it reduces the load on the server and network traffic. Therefore, the entire validation checking scripts are moved to the client side. Now the data sent to the web server is free from all errors and can be directly saved to the database. But if the client's browser does not support scripts or the user has turned off the scripting in the browser for security reasons, the data will be sent to the server without validation. This causes invalid data to be stored in the database. In order to protect the validity of the data saved in the database, it is better to have a validation check at the server side also.

4.5.2 Scripting languages

We have learned the different classifications of scripting languages. Let us now discuss the features of some of the popular scripting languages.

A. JavaScript

JavaScript is a client side scripting language used to make web pages interactive. JavaScript was developed by Brendan Eich (Figure 4.13) while he was working for Netscape Communications Corporation. On the client side, JavaScript is implemented as an interpreted language. Any text editor such as Geany IDE, Notepad, etc. can be used to write JavaScript code. It is popular as a client side scripting tool and works in almost every web browser. JavaScript can be inserted inside HTML code or can be written as an external file and then included inside HTML file. If a JavaScript code is written as an external file, it is common to use the extension .js. This identifies the file as a JavaScript file. JavaScript is popular as a tool for validation of forms in the client side. It can also be used for performing simple calculations and also for bringing animations to a web page.



Fig. 4.13: Brendan Eich (1961 -)

The popularity of JavaScript has led to more developments in client side scripting. While applying online for Higher Secondary Plus One admissions, immediately after entering your SSLC register number, you might have noticed that your name, date of birth and other details appear in the text boxes below. This is done without reloading the entire web page. The data is taken from the server and filled in the text boxes without refreshing the web page. Ajax is the technology used here. Ajax improves the interactivity of the browsers. Ajax is Asynchronous JavaScript and Extensible Markup Language (XML). XML is a markup language which helps users to create new tags. After implementing Ajax on a website, it does not require the entire page to be reloaded for displaying dynamic content on web pages. Ajax

allows web pages to be updated by exchanging small amounts of data between the client and the server behind the scenes. This means that it is possible to update parts of a web page, without reloading the entire web page. However, since Ajax relies more on JavaScript, if the browser is not capable of handling JavaScript or the user has turned off JavaScript functionality in the browser, the Ajax application will not work.

B. VB Script

VBScript is a scripting language developed by Microsoft Corporation based on the popular programming language Visual Basic. VBScript was developed to use either as a client side scripting language for the Microsoft Internet Explorer or as a server side scripting language with the Microsoft Internet Information Server (IIS). Unfortunately, browsers other than Internet Explorer may not be able to correctly interpret and display the VBScript code. Therefore, it is less popular as a client side scripting tool. Since Windows operating system is popular as a server based operating system, VBScript is popular for server side scripting. With the introduction of .NET framework - a library of usable program code, Microsoft has taken the decision to incorporate VBScript as a part of ASP.NET in .NET framework.

C. PHP

PHP stands for 'PHP: Hypertext Preprocessor'. PHP is an open source general-purpose scripting language that is suited for web development and can be embedded into HTML code. It is a server side scripting tool and its code is similar to Java, C and Perl. The main objective of PHP is to develop dynamic web pages at ease. PHP was originally created by Rasmus Lerdorf (Figure 4.14) in 1994 but it is now developed by The PHP Group. The web page files that contain PHP code have the extension .php.



Fig. 4.14: Rasmus Lerdorf (1968 -)

PHP code is inserted inside HTML code and when the user requests for a PHP web page, it is interpreted and executed on the web server. To process the PHP code on the web server, a PHP interpreter has to be installed on the web server. After execution of the PHP code in the web server, an HTML page is created, which is sent to the client browser. One of the strongest and most significant features in PHP is its support for database programming. The most common database used with PHP is MySQL. PHP interpreter is available for all operating systems. Linux platforms commonly use LAMP (Linux, Apache, MySQL and PHP) server software which is freely downloadable. LAMP uses Linux as the server operating system, Apache as the web server, MySQL as the database and PHP for server side scripting. Windows operating systems use WAMP server software which is also available for free download.



D. Active Server Pages

Microsoft Active Server Pages (ASP) is a server-side scripting environment that can be used to create and run interactive web applications. ASP contains HTML and a scripting language code. The scripting language can be VBScript or JavaScript. ASP files have the extension .asp. These files are compiled using a feature built in Microsoft's web server software, Internet Information Server (IIS). ASP files are executed only on Windows operating systems. After execution at the server, the resultant HTML web page is sent to the client browser. It is a very powerful scripting language that provides support to a variety of databases. The introduction of ASP.NET stopped Microsoft from releasing further versions of ASP. ASP.NET provides features like reduced coding, availability of a variety of buttons, text boxes etc. which help in creating web based applications.

E. Java Server Pages

Java Server Pages (JSP) technology provides a simple and fast way to create dynamic web content. It is a server side scripting language that was developed by Sun Microsystems in 1999. JSP is similar to PHP, but uses Java as programming language. JSP files have the extension .jsp. To run JSP, Apache Tomcat web server is required. The JSP code consisting of HTML and Java is executed on the web server and the resulting HTML code is sent to the browser. JSP is an integral part of Java 2 Platform Enterprise Edition (J2EE) which is used for developing and running large scale web based softwares.

4.6 Cascading Style Sheet

Cascading Style Sheets (CSS) is a style sheet language used for describing the formatting of a document written in HTML. Using CSS, we can control the colour of the text, the style of fonts, the spacing between paragraphs, how columns are sized and laid out, borders and its colours, what background images or colours are used, as well as a variety of other effects in a web page. A CSS file allows us to separate HTML content from its style. CSS can be implemented in three different ways - inline, embedded and linked.

- In inline style, the CSS style is applied to each tag separately using the style attribute in the body part of the web page.
- Embedded CSS codes are placed within the **<HEAD>** part of the web page.
- Linked CSS implementation is done using an external file with the file extension .css that contains only CSS code and is linked with the web page.

The advantage of CSS is that we can reuse the same code for all the pages. If the CSS styles for a website is implemented as a linked external file, then the modification

of a style, modifies the way the tags are presented in all the web pages of the website. Since CSS styles are written in a common place, it separates CSS and HTML, which makes it easy for maintenance. Moreover, the tags in web pages are well organised with the style specifications and therefore it is easy to understand. This also reduces the size of the web page thereby providing faster downloads for web pages.

CSS allows adapting the presentation of a web page to devices with different screen sizes such as desktop monitors, tablets or mobiles. It is considered that CSS along with JavaScript will be used in the next version of HTML called HTML5, to bring animations and interaction to web pages. More about CSS will be discussed in Chapter 6.

Know your progress



1. The web pages that remain the same until their code is changed manually are called _____.
2. Name two technologies that can be used to develop dynamic web pages.
3. The tag used to embed scripts is _____.
4. Write any one of the uses of client side scripting.
5. A JavaScript file has the extension _____.
6. What is the advantage of using Ajax?
7. Classify the following scripting languages into client side and server side.
Javascript, PHP, ASP, VBScript
8. .asp files are compiled using the web server software _____.
9. List the different ways of implementing CSS.

4.7 Basic concepts of HTML documents

HTML is the most widely used language to write web pages. Every web page is actually an HTML file. Each HTML file is a plain text that defines a set of commands for creating hypertext documents. These commands are known as **HTML tags**. While using these tags, some keywords may be attached to them, which make the instruction more specific. These words are known as attributes. Therefore, an **HTML document** is made up of tags and attributes which work together to decide how the contents of the web page have to be displayed on the browser. Actually, the study of HTML means the study of tags and their attributes. Before going into the details of tags and attributes, let us have a look at the basic structure of an HTML document.



4.7.1 Basic structure of an HTML document

The basic structure of an HTML document is shown in Example 4.1.

Example 4.1: A sample HTML document to illustrate the structure of a web page

```
<HTML>
  <HEAD>
    <TITLE> This is the title of web page </TITLE>
  </HEAD>
  <BODY>
    Hello, Welcome to the world of web pages!
  </BODY>
</HTML>
```

You can see some of the words in the upper case within a pair of angle brackets **<** and **>**. These are HTML tags. It is not necessary that tags be written in the upper case. HTML is not case sensitive. We can use either the upper or lower case or even a mix of the two. In this book, we follow the style of using the upper case for HTML tags and sentence case (i.e., the first letter is capital) for attributes to distinguish them from other words or text.

As shown in Example 4.1, all HTML pages begin with the tag **<HTML>** and end with tag **</HTML>**. There are mainly two sections in an HTML document namely head section and body section. The **<HEAD>** tag is used to define the head section. The head section contains the information about the document, including the title of the web page. The **<TITLE>** tag is used to define the title of the page, which will be displayed on the title bar of the browser window. The **<BODY>** tag is used to define the body section. The body section contains the contents to be displayed in the web page. If we open this document in a web browser, it will appear as shown in Figure 4.15.

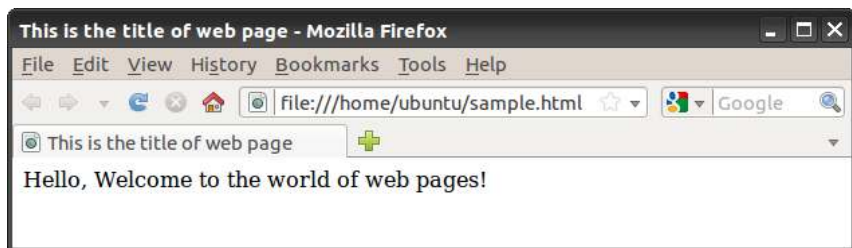


Fig. 4.15 : A sample web page opened in a web browser



Versions in HTML: HTML was created by Tim Berners Lee in late 1991 but "HTML 2.0" was the first standard HTML specification which was published in 1995. HTML 4.01 was a major version of HTML and it was published in late 1999. The latest version, HTML 5 was released in 2012, more features are being added for multimedia integration.

4.7.2 Tags in HTML document

As mentioned earlier, tags are the commands used in the HTML document that tell web browsers how to format and organise our web pages to show the contents. Every tag consists of a tag name enclosed between the angle brackets '<' and '>'. HTML tags are not case sensitive. Therefore the tags <HTML>, <html>, <Html>, <HtMl>, etc. have the same meaning.

4.7.3 Container tags and empty tags

Most tags are used in pairs - an opening tag and a closing tag. For example <HTML> is the opening tag and </HTML> is the closing tag. Note that the closing tag has the same text as the opening tag, but has an additional forward slash (/) character after the first angle bracket. Tags that require opening tag as well as closing tag are known as container tags. Container tags are applicable for a section. The opening tag is given at the beginning of a section and closing tag is placed at the end of the section. For example, <HTML> and </HTML> forms the opening and closing tag pairs for an HTML document.

Some tags are given an exemption to this rule, and these tags do not require closing tag. Such tags are known as empty tags. This kind of tag does not span over a section. The tags
, <HR>, , etc. are examples of empty tags. We will see these tags in the forthcoming section of this chapter.

4.7.4 Attributes of tags

Certain parameters are frequently included within the opening tag to provide additional information such as colour, measurement, location, alignment or other appearances to the web browser. These parameters are called attributes. Most of the attributes require a value. In HTML, the value can be given in single quotes or double quotes (i.e., attribute='value' or attribute="value"). Each tag has a standard set of attributes and we can use them as per the requirement. If an attribute is used, normally it appears after the tag name separated by a space. If more than one attribute is used, their order of appearance is not important.

For example, to change the background colour of the web page to yellow, we can write the code as <BODY Bgcolor = "Yellow">. Here, Bgcolor is the attribute and Yellow is the value of this attribute. The other attributes of <BODY> tag and other tags will be discussed in the forthcoming section.

4.7.5 HTML Elements

A pair of tags and the content enclosed between these tags are known as an element. Figure 4.16 shows that the Body element contains the opening tag <BODY> with



attributes if any, the closing tag `</BODY>`, and the contents in between these two tags.

The basic structure of an HTML document contains four sets of HTML tags.

They are:

```
<HTML>      </HTML>
<HEAD>      </HEAD>
<TITLE>     </TITLE>
<BODY>     </BODY>
```

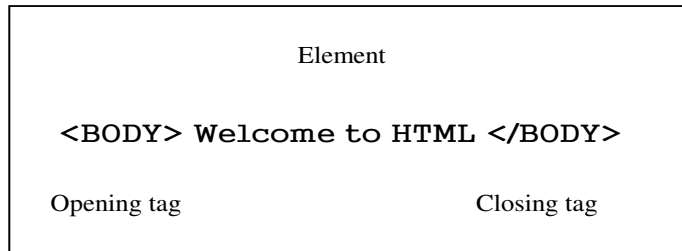


Fig. 4.16 : An HTML element

4.8 Creating an HTML document

Now, let us create a simple web page using the HTML code given in Example 4.1. Text editors like Geany, Gedit, TextPad, Notepad, Notepad++, etc. can be used to create HTML documents. The file is to be saved with a name with an extension **.html** or **.htm** (for example, sample.html). Figure 4.17 shows an HTML code in Geany editor, saved as **sample.html**.

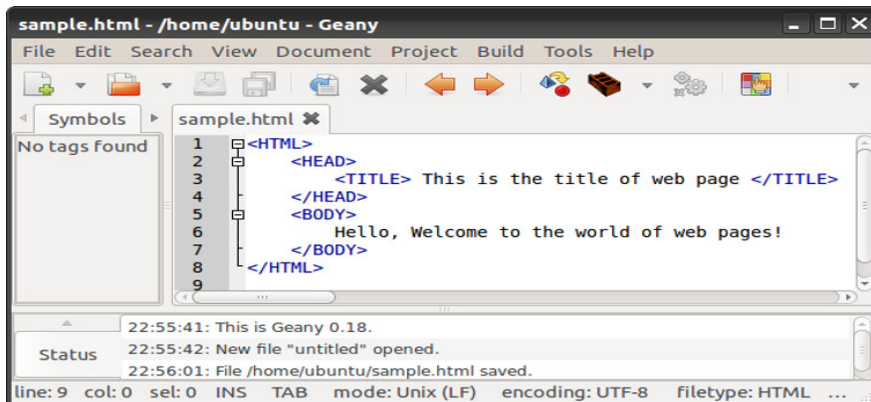


Fig. 4.17: HTML code in Geany Editor

Viewing an HTML document in a Browser

Once the HTML document is prepared, it can be viewed in a browser by opening the document with the browser. There are many browsers like Mozilla Firefox, Google Chrome, Internet Explorer, Netscape navigator, etc. Screen shots given in this book, are obtained by opening the web page using Mozilla Firefox. The output of the HTML code created using Geany can also be obtained by clicking the Execute button in the tool bar of Geany.

4.9 Essential HTML tags

Let us have a detailed discussion on the essential tags required to create web pages. The tags, their use, associated attributes and their values, and their appearance in the browser window will be illustrated in this section.

4.9.1 <HTML> - Starting an HTML page

The entire HTML document is bounded by a pair of `<HTML>` and `</HTML>` tags. The `<HTML>` tag identifies the document as an HTML document. In general `<HTML>` is always the first tag in an HTML page and the `</HTML>` is the last tag. Everything else in the web page is in between these two tags. That is, the Head section and the Body section lie inside the `<HTML>` and `</HTML>` tags. It is a container tag pair. The main attributes of the `<HTML>` tag are **Dir** and **Lang**.

Dir

The **Dir** attribute of `<HTML>` tag specifies the direction of the text to be displayed on the web page. This attribute can have values either **ltr** (left-to-right) or **rtl** (right-to-left). By default, the value of this attribute is **ltr**. The value **rtl** is used when languages like Arabic, Hebrew, Chinese etc. are used for content presentation. For example, `<HTML Dir = "rtl">` specifies that the document is to be read from right-to-left.

Lang

The **Lang** attribute of `<HTML>` tag specifies the language we have generally used within the document. The value "en" is used for English language and "it" is used to specify Italian language.

Sl. No.	Code	Language
1	En	English
2	Fr	French
3	De	German
4	It	Italian
5	El	Greek
6	Es	Spanish
7	Ar	Arabic
8	Ja	Japanese
9	Hi	Hindi
10	Ru	Russian

Table 4.3 : Some common language codes

For example, the code `<HTML Lang = "ar">` specifies that the language used in the HTML document is Arabic language. Some common language codes used with **Lang** attribute are given in Table 4.3.

4.9.2 <HEAD> - Creating head

It contains the head of an HTML document, which holds information about the document such as its title, scripts used, style definitions, etc. The tag pair `<HEAD>` and `</HEAD>` declares the head section. It is also a container tag pair.



4.9.3 <TITLE> - Creating a title

It is a container tag pair that contains the title of the HTML document, which will appear in the web browser's title bar. The search engine uses the Title to identify the page. The tag pair <TITLE> and </TITLE> is used inside the tag pair <HEAD> and </HEAD> to mention the document title.

4.9.4 <BODY> - Creating a body

The body tag pair <BODY> and </BODY> specifies the document body section. This section contains the content to be displayed in the browser window. Hence, all other tags, which define the document content are given in the body section. Before discussing these tags, let us discuss various attributes of <BODY> tag.

Background

This attribute sets an image as background for the documents body. This attribute of <BODY> tag makes the page more attractive. The general format is:

```
<BODY Background = "URL of the picture">
```

The HTML code given in Example 4.2 shows the sky as the background image of a web page.

Example 4.2: To set an image as background for a web page

```
<HTML>
<HEAD>
  <TITLE> Background Image </TITLE>
</HEAD>
<BODY Background = "Sky.jpg">
  Hello, Welcome to the world of Web Pages!.....
</BODY>
</HTML>
```

Here, the HTML code in Example 4.1 is modified by providing an attribute Background with the value "Sky.jpg" in the <BODY> tag as <BODY Background = "Sky.jpg">. Before opening the page, we have to place the image file in the current working directory. The web page is displayed as shown in Figure 4.18.

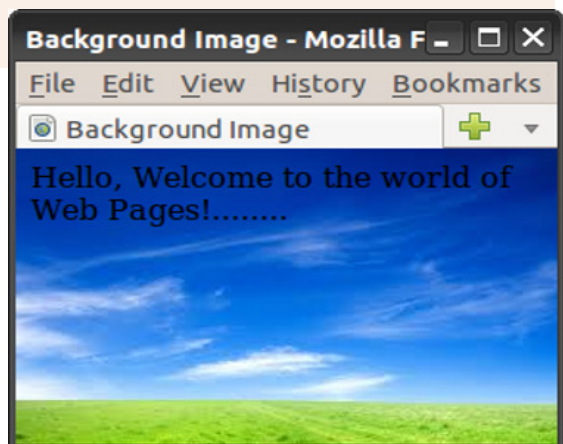


Fig. 4.18 : An image as background

Bgcolor

This attribute specifies a colour for the background of the document body. For example, `<BODY Bgcolor = "grey">` will display the background in grey colour.

The value of Bgcolor attribute can be given in two ways.

- **Color_name** - specifies the background colour with a colour name (like "red", "grey" etc.)
- **Hex_number** - specifies the background colour with a hexadecimal code (like "#ff6080", "#303030" etc.). Each hexadecimal code will be preceded with a hash sign #.

The six digit number and letter combinations represent colours by giving their RGB (Red, Green, Blue) value. Of the six digits, the first two digits represent the amount of red, the second two digits represent the amount of green, and the last two digits represent the amount of blue as a hexadecimal value in the range 00 - FF. For example, #000000 is black, #FF0000 is bright red, #00FF00 is bright green, and #FFFFFF is white (fully saturated with all the three colours). We can try various colour combinations according to our choice of hex number. Table 4.4 shows a few colours with their Names and Hex values.

Colour	Colour Name	Colour HEX
	Black	#000000
	Red	#FF0000
	Green	#00FF00
	Blue	#0000FF
	Yellow	#FFFF00
	Aqua	#00FFFF
	Grey	#C0C0C0
	White	#FFFFFF

Table 4.4: List of colours with their Name and Hexadecimal value

Text

This attribute specifies the colour of the text content in the page. By default the browser displays the text in black colour on a white/grey background. We have already discussed how to change the background colour using Bgcolor attribute. Similarly the colour of the text can be changed using the attribute Text. For example, `<BODY Text = "yellow">` shows the text in yellow colour. Like Bgcolor, the value of Text attribute can be given as colour name or hexadecimal code. For example, `Text = "Blue"` or `Text = "#00FFDD"` etc.



Link, Alink and Vlink

A hyperlink is an element, a text or an image that we can click on, and jump into another document or another section of the same document. A hyperlink points to a whole document or to a specific element within a document. We will discuss hyperlink in detail later in this chapter.

Link: This attribute specifies the colour of the hyperlinks that are not visited by the viewer. The default colour for Link attribute is blue.

Alink: It specifies the colour of the active hyperlink. The link remains active only for the moment the mouse is clicked on it. Hence at the time of selection the colour of the link will be changed to Alink value. The default Alink colour is green.

Vlink: It specifies the colour of the hyperlink which is already visited by the viewer. The default colour for Vlink is purple.

Leftmargin and Topmargin

The margin refers to the blank area left from the edge of the page. Leftmargin attribute is used to leave some blank area on the left side of the document and Topmargin refers to the blank area at the top edge of the document window. The value is specified in pixels.

For example, `<BODY Leftmargin = "60" Topmargin = "70">` will make the body text indent 60 pixels away from left edge of the page and 70 pixels away from the top edge of the page.

The code in Example 4.3 is an illustration to the attributes Bgcolor, Text, Topmargin, and Leftmargin of <BODY> tag. Figure 4.19 shows the corresponding web page.

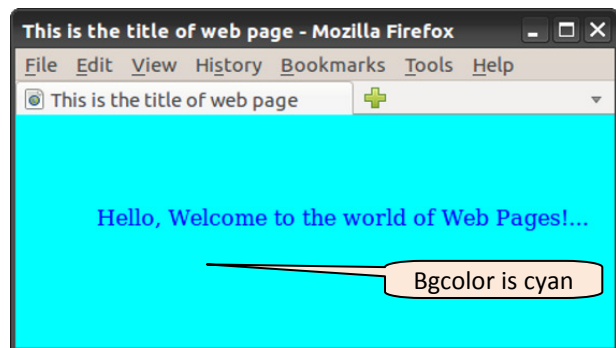


Fig. 4.19: Use of attributes with BODY tag

Example 4.3: To set a colour in the background of a web page

```
<HTML>
<HEAD>
    <TITLE> This is the title of web page </TITLE>
</HEAD>
<BODY Bgcolor= "cyan" Text= " Blue">
```

```

Topmargin= "70" Leftmargin= "60">
Hello, Welcome to the world of Web Pages!.....
</BODY>
</HTML>

```

Know your progress



1. HTML stands for _____.
2. What is a container tag?
3. The type of tag that requires only a starting tag but not an ending tag is called _____.
4. State true or false
 - a. Tags are case sensitive.
 - b. Bgcolor is an attribute of <BODY> tag.
 - c. <TITLE> tag is an empty tag.
 - d. Dir is an attribute of <HEAD> tag.
5. Name the attributes of <HTML> tag.
6. What is the use of attributes in a tag?
7. List the different attributes of <BODY> tag.



Let us do

Create an HTML document to display the name of your school with an image of the school as background of the web page. Then modify the page by changing the colour of the text and background.

4.10 Some common tags

We have discussed the basic tags and their attributes needed for an HTML document. There are several other tags, with which web page contents can be made more attractive. Some of these tags are used for formatting the text contents in the body section of the HTML document and therefore they are called formatting tags. Now let us see some of them, which are essential for the layout of the body content.

4.10.1 <H1>, <H2>, <H3>, <H4>, <H5> and <H6> - Heading tags

A heading is a word, phrase, or sentence given at the beginning of a written passage that explains what it is about. Headings are typically displayed in larger and/or bolder fonts than normal body texts. HTML has six levels of headings from <H1>



to **<H6>**. Here **<H1>** creates the biggest text and **<H6>** the smallest. While displaying any heading, browser adds one line before and one line after that heading. The main attribute of this tag is **Align** and the possible values are,

Left : Text is aligned to the left margin.

Right : Text is aligned to the right margin.

Center : Text is aligned to the centre of the page.

Example 4.4 shows different heading types and alignments and Figure 4.20 shows the corresponding web page.

Example 4.4: To illustrate different heading styles

```
<HTML>
<HEAD>
  <TITLE> Heading Tags </TITLE>
</HEAD>
<BODY Bgcolor= "#FFEEFD">
  <H1 Align= "left"> This is a Heading type 1 </H1>
  <H2 Align= "center"> This is a Heading type 2 </H2>
  <H3 Align= "right"> This is a Heading type 3 </H3>
  <H4> This is a Heading type 4 </H4>
  <H5> This is a Heading type 5 </H5>
  <H6> This is a Heading type 6 </H6>
</BODY>
</HTML>
```

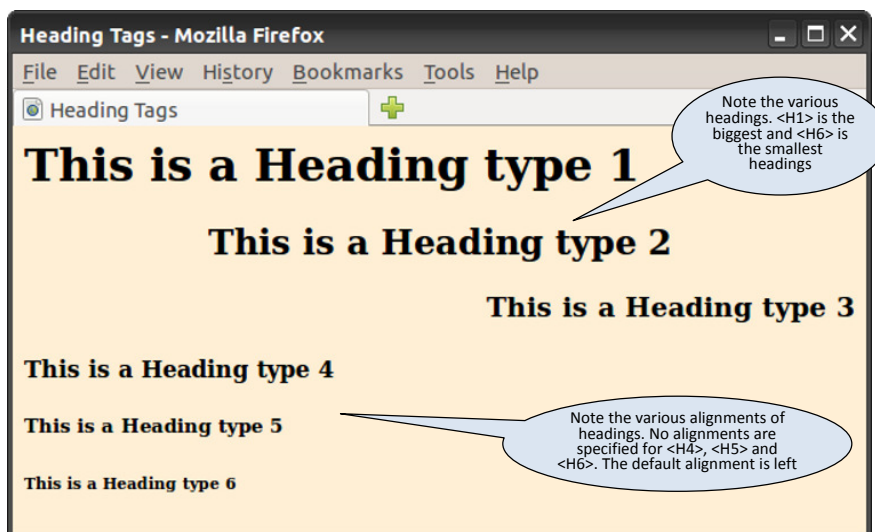


Fig. 4.20 : Setting different heading tags with different alignments

4.10.2 <P> tag - Creating paragraphs

The <P> tag enables us to organise the text within the <BODY> tag into paragraphs. It indicates a new paragraph and instructs the browser to add a blank line before the paragraph. Paragraphs in HTML acts much like the paragraphs in any word processor. The paragraph element begins with the <P> tag and ends with </P> tag. The **Align** attribute sets the alignment of the text in the paragraph with the values left, right, center or justify.

The code given in Example 4.5 shows how paragraphs are designed with different alignments. Figure 4.21 shows the resultant web page.

Example 4.5: To design paragraphs with different alignments

```
<HTML>
<HEAD>
    <TITLE> Paragraph Tags </TITLE>
</HEAD>
<BODY>
    <P>
        This paragraph          contains
        a lot of lines in the source    code,
            but the browser ignores it.
    </P>
    <P Align= "right">
        This paragraph          contains a lot of spaces
        in the source code, but the browser ignores it.
    </P>
    <P Align= "justify">
        The number of lines in a paragraph depends on
        the size of the browser window.
        If you resize the browser window, the number of lines
            in this paragraph will change.
        When we align a paragraph as justify, the space between
        the words in a line will be adjusted
        so that the lines will be both left and right aligned
        at the same time.
    </P>
</BODY>
</HTML>
```

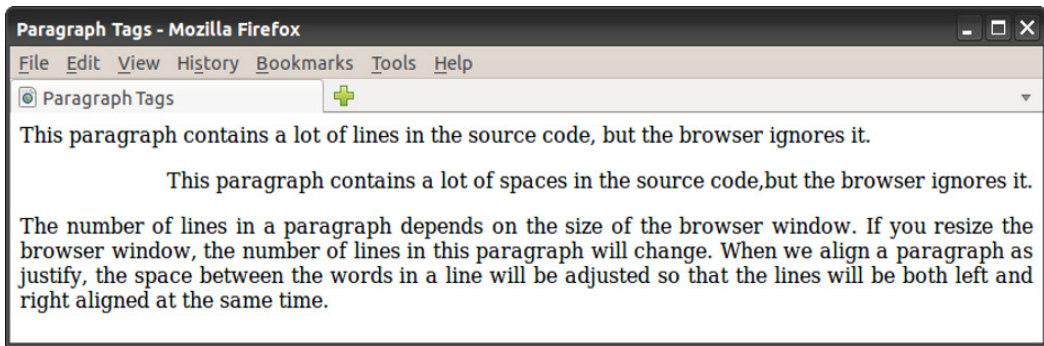



Fig. 4.21: Use of <P> tag with Align attribute

In Example 4.5, we can see that the source code contains three lines in the first paragraph and two lines in the second paragraph with extra spaces. But the web page of this code shown in Figure 4.21 gives a single line for the first two paragraphs. That is, the browser will remove extra spaces and extra lines when the page is displayed. Note that the second paragraph is right aligned and the third paragraph is aligned as justify. Any number of spaces and any number of lines count as only one space. Therefore with HTML, we cannot change the output by adding extra spaces or extra lines in the HTML code. But this is possible in HTML. Now let us discuss how an extra line can be added to the text content using **
** tag. Note that the web pages obtained in large or small screens and resized windows may not match with the one given in Figure 4.21.

4.10.3
 tag - Inserting line break

The purpose of BR element is that it creates a line break within a block of text in a web page. The **
** tag is used to break the current line of text and continue from the beginning of the next line. The **
** tag is an empty tag, which means that it has no ending (closing) tag.

The HTML code in Example 4.6 displays our National Pledge and Figure 4.22 shows the resultant page in which we can see the effect of **
** tag and the difference between **<P>** tag and **
** tag.

Example 4.6: To show the National Pledge with line breaks

```
<HTML>
<HEAD>
  <TITLE> Line Breaks </TITLE>
</HEAD>
<BODY Bgcolor = "#FFEF5">
  <H1 Align = "center"> Our National Pledge </H1>
  <P>India is my country and all Indians
```

```

are my brothers and sisters.<BR>
I love my country and I am proud of its
rich and varied heritage.<BR>
I shall always strive to be worthy of it.<BR>
I shall give respect to my parents, teachers and all
elders and treat everyone with courtesy.<BR>
To my country and my people, I pledge my
devotion. <BR>In theirwell-being and prosperity alone
lies my happiness.
</P>
</BODY>
</HTML>

```

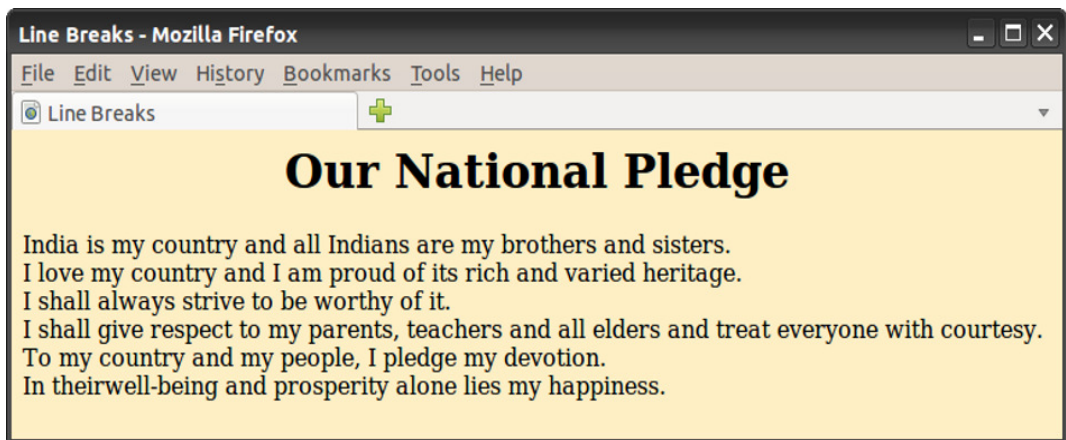


Fig. 4.22 : Output showing the use of
tag



Let us do

Referring to Example 4.6 and Figure 4.24, fill in Table 4.5 with appropriate points to distinguish between <P> tag and
 tag.

<P> tag	 tag
	Breaks the current line and continues to the next line.
Container tag	

Table 4.5: <P> tag Vs
 tag

4.10.4 <HR> tag - creating horizontal line

The <HR> tag produces a horizontal line (rule) spread across the width of the browser window. We can change the size (thickness) and width (length) of the line using its attributes **Size** and **Width**. The value of Size is given in pixels; and the value of



Width attribute is given in pixels or in percentage of total width of the document window (72 pixels = 1 Inch). The other important attributes of <HR> tag are Noshade and Color. The Noshade attribute has no value. The Color attribute sets the colour of the line (rule). Remember that <HR> is an empty tag. Obviously Align is another attribute which uses to set the alignment to left, center or right.

The code given in Example 4.7 creates a web page as shown in Figure 4.23 to show the effect of <HR> tag and its attributes.

Example 4.7: To draw various types of lines

```
<HTML>
<HEAD>
  <TITLE> Horizontal Rules </TITLE>
</HEAD>
<BODY Bgcolor= "#BDB76B">
  <H1 Align= "center"> Horizontal Rules </H1>
  Line 1<HR Width= "50%" Align= "center"> <BR>
  Line 2<HR Width= "40%" Align= "center" Noshade> <BR>
  Line 3<HR Size= "10" Width= "30%" Align= "center"> <BR>
  Line 4<HR Size= "10" Width= "30%" Align= "center" Noshade><BR>
  Line 5<HR Size= "10" Width= "20%" Align= "center" Noshade
      Color= "gold"> <BR>
  Line 6<HR Size="10" Width="20%" Align="center" Color="Aqua">
</BODY>
</HTML>
```

Examining this HTML document and its output, can you identify the similarities and the differences in the shapes of lines? Here, the first two lines are drawn without the Size attribute and the first line hasn't any Noshade attribute. Line 3 and Line 4 are of size 10 but the third one does not have any Noshade attribute. The last two lines have an additional attribute Color. Note the different shapes of these lines in each case. You may modify this code with all possible values for different attributes and see the changes in the web page, during your lab activity.



Fig. 4.23 : Different types of horizontal rules

4.10.5 <CENTER> tag - Centering the content

The <CENTER> tag brings the content to the centre of a web page horizontally. The content may be text, image, table, etc. This is a container tag and the content enclosed between <CENTER> and </CENTER> tag pair will be centred in the browser window. There is no attribute for this tag.

4.10.6 Text formatting tags

The text in the web page can be formatted, as we often do in word processors. The importance of a text is usually specified with features such as bold, italics, underline, etc. Let us discuss the HTML tags available for this purpose.

 - Making text bold

This tag sets the text style to bold. The element displays the content enclosed in bold typeface.

<I> - Italicising the text

It sets the text style to italics. The content enclosed between <I> and </I> tags become italicised.

<U> - Underlining the text

The <U> tag is used to underline a text in HTML. The contents enclosed between <U> and </U> tags become underlined. The formatting tags <U>, and <I> can be combined, so that the content will become bold, italicized and underlined.

<S> and <STRIKE> - Striking through the text

The <S> and <STRIKE> tags are used for the same effect. They display the text in strike through style. For example, ~~Thank you all~~ is a strike through text.

<BIG> - Making the text big sized

The <BIG> tag is used to make the content bigger in size than the normal text size. It is often used to emphasise the word or lines in the document. Normally the font size of <BIG> tag is one size bigger than the current font size.

<SMALL> - Making the text small sized

The <SMALL> tag is used to make the size of the text smaller than the current size. Normally the font size of <SMALL> tag is one size smaller than the current font size.

 - Making bold text

The tag is a phrase tag. It defines an important text. The text is usually rendered in bold face. It is just the same as tag. The strong element is used to emphasize a phrase of text content.



The code given in Example 4.8 illustrates the application of these tags. For instance, let us quote the words of Mahatma Gandhi. Figure 4.24 shows the resultant web page of this code.

Example 4.8: To illustrate the text formatting tags

```
<HTML>
<HEAD>
  <TITLE> Formatting Tags </TITLE>
</HEAD>
<BODY>
  <P>
    <CENTER><B>Mahatma Gandhi </B>is the <I> <U> Father of
      our Nation.</U> </I> </CENTER>
    Every student must learn the inspiring words (quotes)
    of Gandhiji. It will inspire everyone. Let us have a
    look at it.
  </P><BR>
  <SMALL> The weak can never forgive </SMALL>.
  <BIG> Forgiveness is an attribute of the strong</BIG>
  <BR> Live as if you were to die tomorrow.
  <STRONG> Learn as if you were to live forever.</STRONG>
</BODY>
</HTML>
```

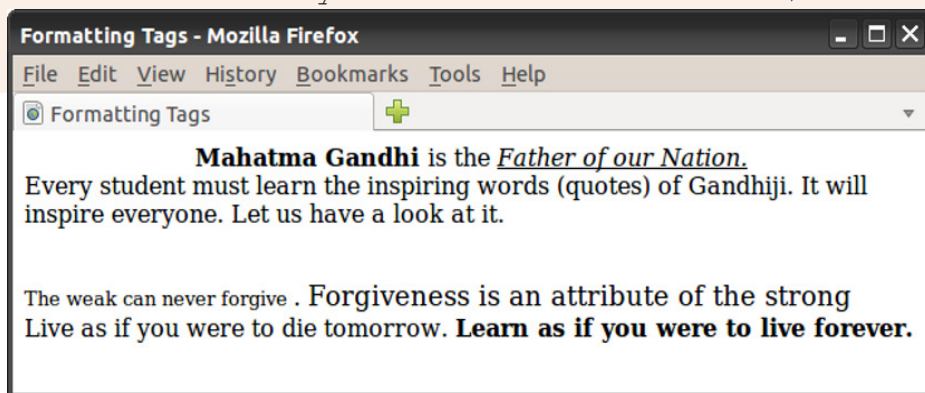


Fig. 4.24: Illustration of text formatting tags

Let us see some more tags which give the text some special appearance.

 - Emphasising the text

The tag is used to emphasise the text. In practice, the element is usually rendered in italics. The effect of using tag is the same as that of <I> tag.

<SUB> and <SUP> tags- Creating subscripts and superscripts

We have studied the molecular formula of water, sulfuric acid, etc. in high school classes. Obviously they are H_2O and H_2SO_4 respectively. How can we represent

such notations in HTML? We can see that the figures are written in subscript form. The `<SUB>` tag is used to create subscripts in a web page. We can display the text H_2O with the code `H₂O`.

Similarly, the superscripts as in algebraic expressions like $(a+b)^2 = a^2 + 2ab + b^2$ can be represented by the tag `<SUP>`. The above expression can be written as

`(a+b)² = a² + 2ab + b²`

`<BLOCKQUOTE>` and `<Q>` tags - Indenting a quotation

The `<BLOCKQUOTE>` tag is used to indent the content enclosed in these tags. The HTML `<Q>` tag (Quote tag) is used to indicate the text enclosed in double quotation marks with an indent. This tag is intended for short quotations that do not require paragraph breaks, whereas `<BLOCKQUOTE>` is used for long quotations.

The illustration of the tags mentioned above is done in Example 4.9. Let us remember that World Environment Day is celebrated on June 5. Let us create thoughts for this day and create a web page using these tags. The corresponding web page is shown in Figure 4.25.

Example 4.9: To illustrate `<SUP>`, `<BLOCKQUOTE>` and `<Q>` tags

```
<HTML>
<HEAD>
  <TITLE> BlockQuote and Q tags  </TITLE>
</HEAD>
<BODY Bgcolor= "#98FB98" Text= "#008000">
  Every year we celebrate World Environment Day on 5<SUP>
th</SUP> June. Let us have a message to all on this
  occassion.
  <BLOCKQUOTE> <B>June 5<SUP>th</SUP> is World Environment
    Day. </B>
    Mother nature too needs care and protection. Show her
    your care by caring for her trees. Love trees and love
    nature. And work for a greener environment because
    generations have to come... The future depends on us...
  </BLOCKQUOTE>
  <Q>Keep your world clean and green. Save trees, Save the
    environment!!
  </Q>
</BODY>
</HTML>
```



From Figure 4.25, it can be seen that the first paragraph is a normal paragraph, which starts from the left edge of the browser window. The superscripting is also applied in it. The second paragraph starts with an indent due to the use of `<BLOCKQUOTE>` tag. Finally, the third paragraph is within double quotes. It is the content enclosed by the `<Q>`

tag pair. Observe the alignment of these paragraphs also. Note that, the `<BLOCKQUOTE>` tag may include more than one paragraph.

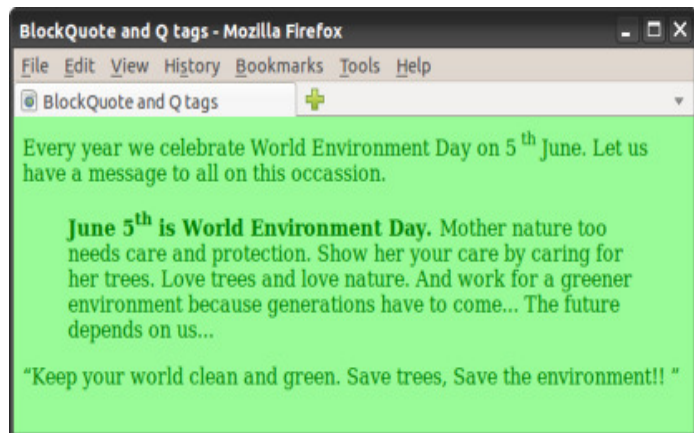


Fig. 4.25: Output of Example 4.9

Know your progress



1. Name some of the text formatting tags.
2. List the different attributes of `<HR>` tag.
3. How many levels of heading tags are available in HTML?
4. Write an HTML code segment to display x^3+y^3 .
5. State True or False.
 - a. `
` tag is an empty tag.
 - b. `` and `<I>` tags have same usage in HTML document.
 - c. `<U>` and `<I>` tags are not allowed to be used together.
6. What is the use of `` tag?
7. Which tag performs the same function as that of `` tag?
8. Pick the odd one out from the following:
 - a. HTML b. ALIGN c. HEAD d. CENTER

4.10.7 `<PRE>` - Displaying preformatted text

Suppose we want to display the content as we entered in the text editor. The `<PRE>` tag can facilitate this purpose. Normally the browser delimited the white spaces, new line characters, the tab spaces, etc. Therefore, we can turn off the automatic formatting applied by the browser with the help of `<PRE>` tag. This tag tells the browser that the enclosed text is preformatted and should not be reformatted again; i.e., it tells the browser to display the text exactly in its original form.

Example 4.10 and Figure 4.26 give us an idea of this tag. Let us create a web page that contains some slogans on World Environment Day.

Example 4.10: To illustrate <PRE> tag

```
<HTML>
<HEAD>
  <TITLE> Pre Formatting tags </TITLE>
</HEAD>
<BODY Bgcolor = "#eee8aa" Text = "#b22222">
  <PRE>
    Don't Pollute Water,
        Don't Pollute Air,
    Don't Pollute Environment,
        And Don't Pollute Yourself,
    Celebrate World Environment Day ...
  </PRE>
</BODY>
</HTML>
```

The web page in Figure 4.26 shows that anything written within <PRE> and </PRE> tags will be displayed as it is in the HTML document.

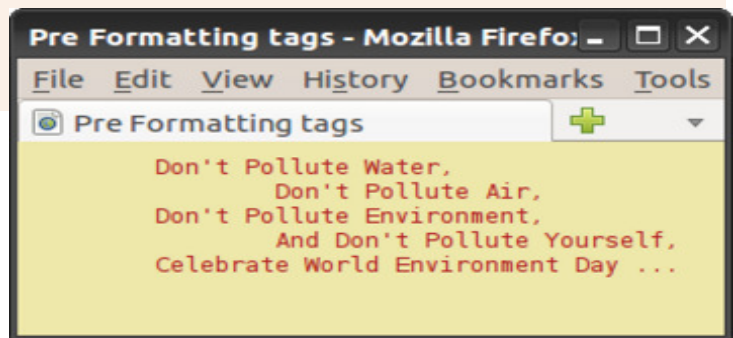


Fig. 4.26: Illustration of <PRE> tag

4.10.8 <ADDRESS> - Displaying the address

The <ADDRESS> tag defines the contact information for the author/owner of a document or an article. The content of this tag can include name, phone numbers, PIN numbers, e-mail addresses, etc. Most of the browsers display the texts in italics.

The code given in Example 4.11 illustrates the <ADDRESS> tag. The appearance of this page is shown in Figure 4.27.

Example 4.11: To illustrate <ADDRESS> tag

```
<HTML>
<HEAD>
  <TITLE> Address tag </TITLE>
</HEAD>
<BODY Bgcolor= "#DDA0DD">
```



The contact details of the "SCERT" is the following:

<ADDRESS>

State Council of Educational Research and Training
(SCERT),

Poojappura,

Thiruvananthapuram,

PIN: 695012, KERALA.

Tel : 0471 - 2341883

</ADDRESS>

</BODY>

</HTML>

The <ADDRESS> tag is usually used to describe a postal address, when it is considered as a part of the contact information.

Although the address element displays the

text with the same default styling as that of <I> or elements, it is suitable for use while dealing with contact information. Typically an <ADDRESS> element can be placed inside the footer which contains information about the author, copyright, etc. of the current section, if any.

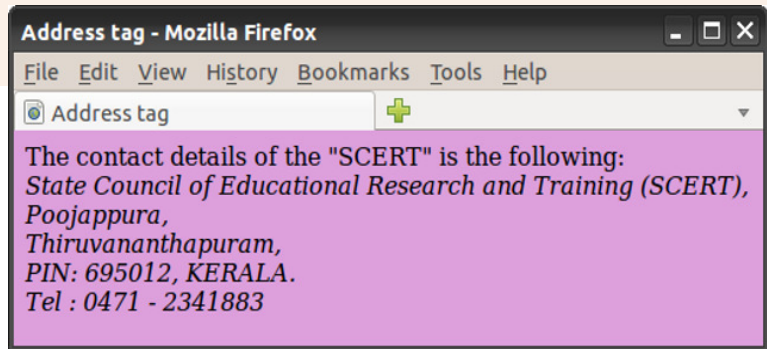


Fig. 4.27 : Web page containing <ADDRESS> Tag

4.10.9 <MARQUEE> - Displaying text in a scrolling Marquee

So far we discussed the tags in HTML that just display the contents in the browser. But there is a tag called <MARQUEE>, which displays a piece of text or image scrolling horizontally or vertically in the web page.

Given below is the list of important attributes that are used with <MARQUEE> tag.

- **Height:** Sets the height of the marquee in pixels or in percentage of browser window height.
- **Width:** This specifies the width of the marquee in pixels or in percentage of browser window's width value.
- **Direction:** This specifies the direction in which marquee should scroll. This can have a value like up, down, left or right.
- **Behaviour:** This specifies the type of scrolling of the marquee. This can have a value like scroll, slide and alternate.

- **Scrolldelay:** This specifies time delay between each jump. This will have value in seconds like 10, 15, etc.
- **Scrollamount:** This specifies the speed of the marquee text.
- **Loop:** This specifies how many times the marquee element should scroll on the screen. The default value is *Infinite*, which means that the marquee scrolls endlessly.
- **Bgcolor:** This specifies background colour in terms of colour name or colour hex value.
- **Hspace:** This specifies horizontal space around the marquee. This can be a value in pixels or percentage value.
- **Vspace:** This specifies vertical space around the marquee. This can be a value in pixels or percentage value.

The code given in Example 4.12 illustrates the use of <MARQUEE> tag and Figure 4.28 shows the corresponding web page.

Example 4.12: To illustrate <MARQUEE> tag

```
<HTML>
<HEAD>
  <TITLE> HTML marquee Tag </TITLE>
</HEAD>
<BODY>
  <MARQUEE Width= "50%"> This will take only 50% width of
    Browser Window</MARQUEE>
  <MARQUEE Height= "100" Hspace= "100" Bgcolor= "#44BB22"
    Direction= "up"> Scrolling up </MARQUEE>
  <MARQUEE Height= "20" Vspace= "30" Bgcolor= "#FFBB00"
    Direction= "right"> This will scroll from left to right
  </MARQUEE>
</BODY>
</HTML>
```

The first marquee starts from the middle and scrolls towards the left of the window since the width is 50%. The second marquee is in the green coloured portion and 100 pixels height is provided for scrolling. The

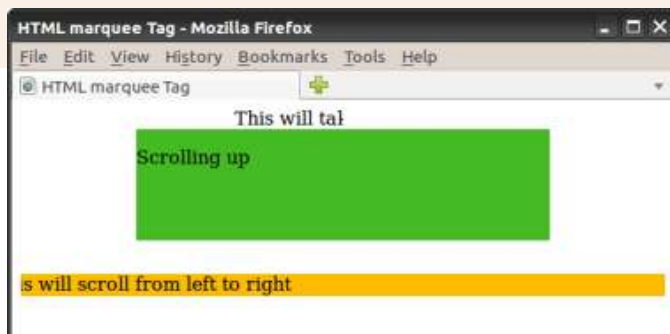


Fig. 4.28 : Marquee tag with different attributes



scroll area is set 100 pixels horizontally away from the left margin. The third marquee is filled with the background colour "#FFBB00" and placed 30 pixels vertically below the previous marquee. The scroll window has a height of 40 pixels and it scrolls from left to right. Instead of words or phrases, we can also use images as the marquee content.

4.10.10 <DIV> - Formatting a block of text

The <DIV> tag is used for defining a section or a block in the document. With the <DIV> tag, we can group large sections of HTML documents together and format them. This section may contain paragraphs, tables, etc. Most browsers place a line break before and after <DIV> elements. The attributes of <DIV> tag are:

Align : sets the horizontal alignment with values left, right, center, and justify.

Id : assigns a unique identifier for the tag.

Style : indicates how to render the content in terms of colour, font, etc.

In Example 4.13, we use <DIV> tag to apply Align and Style. Figure 4.29 shows the resultant web page.

Example 4.13: To illustrate <DIV> tag

```
<HTML>
<HEAD>
  <TITLE> DIV Tag </TITLE>
</HEAD>
<BODY Bgcolor= "#ddffff">
  <H2 Align= "center"> Success Story </H2>
  <DIV Align= "Center" Style= "Color:#0000FF"> One day a
  partially deaf four - year old child came home with a
  note in his pocket from his teacher, "Your Tommy is too
  stupid to learn, get him out of the school."
  <P>His mother read the note and answered, "My Tommy is
  not too stupid to learn, I will teach him myself." And
  that Tommy grew up to be the great Thomas Alwa Edison.
  </P> He had only three months of formal schooling.
  </DIV>
  All success stories are stories of great failures.
  You learn from your failure and move forward.
</BODY>
</HTML>
```

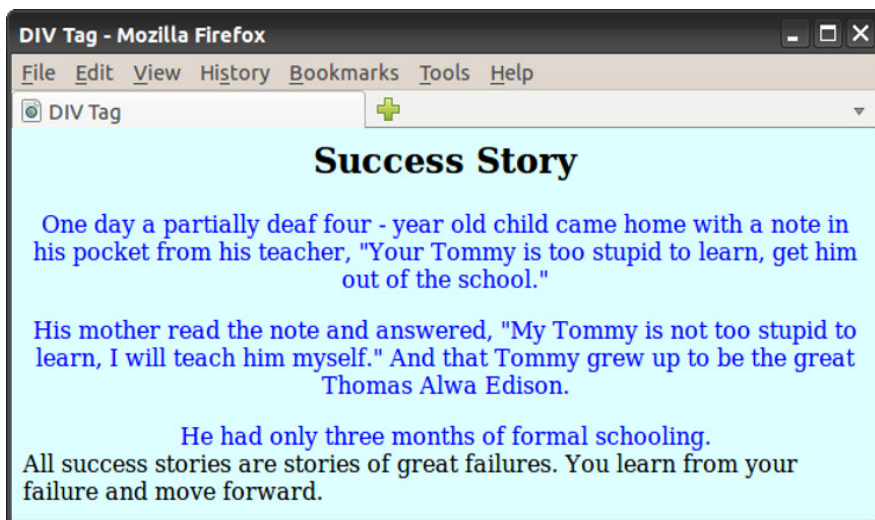


Fig. 4.29 : Application of <DIV> tag

In the code given in Example 4.13, we apply the <DIV> tag to a section, including paragraphs. For this section, we apply both the Align and Style attributes.

4.10.11 - Specifying font characteristics

The tag allows us to change the size, style and colour of the text enclosed within and tags. It is generally used for changing the appearance of a short segment of the document. The attributes of tag are:

- Color** : This attribute sets the text colour using either a ColorName or a colour in the Hexadecimal format.
- Face** : This attribute specifies the font face. If no face attribute is mentioned, the document text in the default style is used in the first font face that the browser supports.
- Size** : This attribute specifies the font size whose value ranges from 1 to 7, with default value 3.

The code given in Example 4.14 illustrates the usage of tag and Figure 4.30 shows the corresponding web page.

Example 4.14: To illustrate tag

```
<HTML>
<HEAD> <TITLE> Font tags </TITLE> </HEAD>
<BODY Bgcolor= "#eee8aa">
    Every success story is also a story of great failure.
    The only difference is that every time they failed,
    they bounced back. <BR><BR>
```

```
<FONT Size="6" Face="Courier New" Color="#B22222">
Successful people don&apos;t do great things,
they only do small things in a great way.
</FONT>
</BODY>
</HTML>
```

In the above code, we marked a portion `'` in green colour. What do you mean by this? From the output, we can understand that this is for getting the single quote in the word **don't**. There are several other characters like this. They are discussed in the following section.

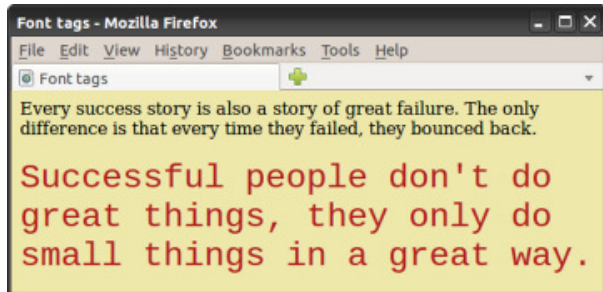


Fig. 4.30: Illustration of `` tag

4.11 HTML entities for reserved characters

In HTML, the symbols like `<`, `>`, `&`, etc. have special meaning and cannot be used in the HTML documents as part of the text content. The browser treats these symbols as the punctuation marks of HTML words like tags and entities. For example, the angle brackets `<` and `>` are used to express tags. So, when we want to display these symbols as part of the text in the web page, we must use HTML entities. Table 4.6 shows a list of a few special characters and their equivalent entities.

In order to display the text `A < B` & `A > C` in a web document, we have to specify it in the HTML document as: `A <`; `B >`; `A &`; `C.`

Character	Entity	Description
	<code>&nbsp;</code>	Non Breaking Space
"	<code>&quot;</code>	Double quotation mark
'	<code>&apos;</code>	Single quotation mark
&	<code>&amp;</code>	Ampersand
<	<code>&lt;</code>	Less than
>	<code>&gt;</code>	Greater than
©	<code>&copy;</code>	Copyright Symbol
™	<code>&trade;</code>	Trademark Symbol
®	<code>&reg;</code>	Registered Symbol

Table 4.6 : List of entities and their description

4.12 Adding comments in HTML document

It is a good practice to add comments in HTML documents, especially in complex documents. Comments help us to understand the code and it increases the code readability. HTML provides comment tag to insert comments in the source code.

Comments are not displayed in the browser window. HTML comments are placed within `<!-- -->` tag. So any content placed within `<!-- -->` tag will be treated as a comment and will be completely ignored by the browser. In Geany editor the comments are displayed in red colour. The code in Example 4.15 illustrates the use of comments and Figure 4.31 shows the resultant message.

Example 4.15: To illustrate the use of comment tag

```
<HTML>
<HEAD> <!-- Document Header Starts -->
    <TITLE> Comment Tags </TITLE>
</HEAD>
<BODY Bgcolor= "#D8D8D8">
    <!-- This is a comment -->
    <p>The paragraph starts here. Comment statements are
    not displayed in the browser window</p>
    <!-- Comments are not displayed in the browser -->
</BODY>
</HTML>
```

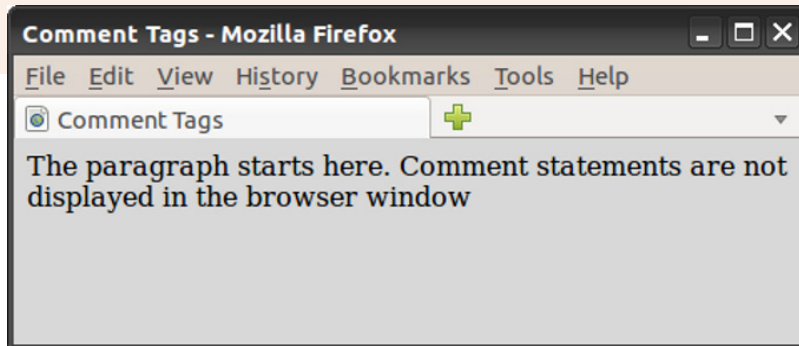


Fig. 4.31: Comments in HTML

Know your progress



1. How are special characters represented in HTML?
2. Face attribute is used with _____ tag.
3. List the attributes of `` tag.
4. What is the use of `<PRE>` tag?
5. For scrolling a text, we use _____ tag.
6. What are the main attributes of `<MARQUEE>` tag?
7. What is the use of `<ADDRESS>` tag?
8. What is the normal font size in `` tag?
9. Name the main attributes of `<DIV>` tag.



4.13 Inserting images

Images always make content presentation more attractive and communicative. Now a days, most of the websites are rich in visuals. New versions of HTML come with many web development features, but the code required for adding images is simple. HTML provides a tag **** to insert images in HTML pages. The following is the simple way of using this tag:

```
<IMG Src = "picture1.jpg">
```

The **** tag is an empty tag and it has many attributes. Src is the main attribute and it specifies the file name of the image to be inserted. We can use JPEG, PNG or GIF image files based on our needs, but make sure that the correct filename with the extension is specified using Src attribute. If the image file is not in the current working directory, we have to specify the path of the file or the URL where the file is available.

Setting space for the image

We can set the space in the web page for the image by specifying the values for the **Width** and **Height** attributes. The values are given in terms of either pixels or percentage of its actual size. If these attributes are not specified, the browser will display the image in its actual size.

Now let us discuss how to set space between images. We know that there are two types of space between the images when they are placed in a window - vertical space and horizontal space. HTML offers two attributes **Vspace** and **Hspace**, for providing vertical spacing and horizontal spacing between the images in the web page.

The HTML code in Example 4.16 demonstrates the two types of spacing discussed above and Figure 4.32 shows the web page obtained from the code.

Example 4.16: To provide different types of spacing for images

```
<HTML>
<HEAD>
  <TITLE> Inserting Images </TITLE>
</HEAD>
<BODY Bgcolor="#E0FFFF">
  <H2 Align="center">Inserting vertical and horizontal
    spacing between images</H2>
  Here the images are placed with <B><I><U> Vspace and
  Hspace </U></I></B> attributes <BR>
```



```

<IMG Src= "book3.jpg" Height= "50" Width= "70"
      Vspace= "10" Hspace= "10">
<IMG Src= "book3.jpg" Height= "50" Width= "70"
      Vspace= "10" Hspace= "10"> <BR>
<IMG Src= "book3.jpg" Height= "50" Width= "70"
      Vspace= "10" Hspace= "10">
<IMG Src= "book3.jpg" Height= "50" Width= "70"
      Vspace= "10" Hspace= "10"> <BR>
</BODY>
</HTML>

```

Figure 4.32 shows that the images are placed within the given width and height, and the distance between the images is according to the specified horizontal and vertical spacing.

Now let us discuss another important attribute, **Align** for `` tag, which aligns the image with respect to the base line of the text. The possible values for this attribute are the following:



Fig. 4.32: Images within the specified size and with horizontal and vertical spaces between them.

Bottom : Aligns the bottom of the image with the baseline of the text and this is the default setting.

Middle : Aligns the middle of the image (vertically) with the baseline of the text.

Top : Aligns the image with the top of the text.

Let us see the effect of these values for the attribute **Align**. Example 4.17 and Figure 4.33 demonstrate this.

Example 4.17: To provide different alignments for an image

```

<HTML>
<HEAD>
  <TITLE> Alignment of Images </TITLE>
</HEAD>
<BODY Bgcolor= "#E0FFFF">
  <H2 Align= "center">Alignment of Images</H2>
  This Image is <I><U>aligned at the bottom </U></I>

```



```

<IMG Src= "book3.jpg" Height= "40" Width= "50"
    Align= "Bottom"> <BR> <BR>
    This Image is <I><U>aligned at the Middle </U></I>
<IMG Src= "book3.jpg" Height= "40" Width= "50"
    Align= "Middle"> <BR> <BR>
    This Image is <I><U>aligned at the Top </U></I>
<IMG Src= "book3.jpg" Height= "40" Width= "50" Align="Top">
</BODY>
</HTML>

```

There are some more values for the Align attribute of tag. They are left and right, which align the image the left and right sides of the browser window respectively.



Fig. 4.33: Different alignment of images with the text



Fig. 4.34: Images aligned left and right of browser window

Observe Figure 4.34, in which the left and right alignments of images in the browser window are shown. Write the HTML document for this web page.



Let us do

Setting border around an image

Suppose we want to give a border to an image inserted in a web page. It is possible with the Border attribute of tag. The thickness of the border can be set by giving appropriate value to this attribute. The HTML code in Example 4.18 and the corresponding web page shown in Figure 4.35 give the effect of border attribute.

Example 4.18: To give a border to an image

```

<HTML>
<HEAD>
    <TITLE> Inserting Images </TITLE>
</HEAD>
<BODY Bgcolor= "#E0FFFF">
    <H2 Align= "center">Inserting Border to Images</H2>
    Here is an image <B><I><U> with Border </U></I></B>
    attribute

```

```

<IMG Src= "book3.jpg" Height= "50" Width= "70" Border="5">
<BR>Here is an image<B><I><U> without Border</U></I></B>
attribute
<IMG Src= "book3.jpg" Height= "50" Width= "70">
</BODY>
</HTML>

```

We have learnt various attributes of `` tag and their effects on the image. If the image file specified with the `Src` attribute is not found in the



Fig. 4.35: Images with border and without border

given path, how will the web page look? The specified place in the web page for the image will be left blank. Due to some other reason also, the web browser may not be able to display the image. In such a situation, we can provide an alternative text in the browser in the absence of image. HTML provides the attribute **Alt** to specify an alternate text for an image, if the browser cannot display the image. The code in Example 4.19 illustrates the effect of `Alt` attribute and Figure 4.36 shows the resultant web page.

Example 4.19: To illustrate the effect of `Alt` attribute of `` tag

```

<HTML>
<HEAD> <TITLE> Inserting Images </TITLE> </HEAD>
<BODY Bgcolor= "#E0FFFF">
    <H2 Align= "center">Inserting Images</H2>
    If the browser cannot display the image, then the text
    entered in the <B>Alt</B> attribute will be displayed.<BR>
    <IMG Src= "book5.jpg" Height= "20%" Width= "20%"
        Alt= "Image of an opened book"> <BR>
</BODY>
</HTML>

```



Fig. 4.36 : Effect of `Alt` attribute in `` tag



Know your progress



1. To insert images in an HTML document _____ tag is used.
2. _____ is the main attribute of tag.
3. What is the use of Alt attribute of tag?
4. Name the attributes that are used to display an image in a particular size.
5. Which are the attributes that provides horizontal and vertical spaces between two images?



Let us conclude

The security of communication over the Internet is a determining factor in the success of the Internet. The security of transactions over the Internet is implemented using HTTPS and digital certificates. Internet infrastructure consists of technologies like web server, software ports and DNS servers used to store and communicate data. Web servers consist of a single/several websites. Websites consist of web pages. We can design web pages either by writing HTML code or using web designing softwares. Webpages can be classified as static and dynamic. Dynamic web pages can be developed using scripts. We can perform client side validations using client side scripting languages like, JavaScript, VBScript, etc. Server side scripts like PHP, ASP, etc. are used to create pages dynamically in the web server. Cascading Style Sheet (CSS) can be used to provide a uniform style to the entire website. The basic concepts of HTML language and web page designing are discussed here. We are now familiar with different tags and their important attributes. We know that some of the tags are container tags, but some others are empty tags. We can make a web page with neatly formatted text using a variety of formatting tags. Different kinds of listing are discussed to make the text more presentable. The beauty of the web pages can be enhanced by including marquees, images, audio and video. We have also discussed the importance of hyper linking and have been familiarised with various kinds of hyperlinks. We should have a sound knowledge of the concepts discussed in this chapter and an excellent practical experience in creating HTML documents, so that we can easily internalise the concepts in the following chapters. Also, we will be able to design beautiful web sites and develop web applications ourselves.



Let us practice

1. Write an HTML code for a web page of Kerala with the following details and features:
 - ◆ A heading followed by a paragraph of 5 sentences about Kerala using text formatting tags and attributes.
 - ◆ Background of the page needs an image of a scenery.
2. Write an HTML code for a web page for your school with the following details and features:
 - ◆ A heading followed by a paragraph of 3 sentences about the district using text formatting tags and attributes.
 - ◆ Provide a colour to the background of the page.
 - ◆ Include an image of the school.
3. Write an HTML code for a web page for your school with the following details and features:
 - ◆ A heading followed by a paragraph of 3 sentences about the district using text formatting tags and attributes.
 - ◆ Give the postal address of the school.
 - ◆ Include a marquee that "Admission for the new academic year commences on 10th May"
4. Write an HTML code for a web page to show the lyrics of our National Anthem with the following details and features:
 - ◆ A heading with a different font characteristics.
 - ◆ An image of our national flag

Let us assess

1. What is the role of routers in transporting data over the Internet?
2. The social media websites developed their own protocol for communicating over the Internet. How is this possible when Internet uses TCP/IP protocol?
3. The user name and password of an e-mail account has to be sent securely over the Internet.
 - a. Name the technology used to send the data to the server.
 - b. How does this technology support secure data communication?
4. What is the role of payment gateway in online purchases?
5. ABC Engineering College has about 1000 computers connected to the Internet, in its campus. What is the advantage of having a local DNS server in the college's intranet?



6. Write an example of a web server operating system and a web server package.
7. What is the use of software ports in a web server?
8. The port used for HTTP is _____.
9. Suppose you are browsing the website www.prdkerala.org. Explain how the DNS resolves the IP address.
10. What are scripts? Explain the different scripting languages.
11. Consider the home page of your school website and the web page that displays the results of class XI examinations.
 - a. Compare the difference between the two web pages based on their creation.
 - b. Write the technologies that can be used for developing these web pages.
12. a. The file name extension for a JavaScript file is _____.
b. Write two popular uses of JavaScript in a web page.
13. What is Ajax? What is its use?
14. Your friend Ravi wishes to create a website that displays the marks of the students in your class in each examination.
 - a. Suggest a technology to implement this.
 - b. Justify your suggestion.
15. Consider that Manoj is developing a website using PHP that uses a database in MySQL. What are the requirements to implement this if he is using Linux web hosting?
16. "Almost all websites today use CSS for its development." What are the advantages of using CSS in web sites?
17. Who developed HTML?
18. In HTML, there are mainly two sections. Can you name them?
19. If you analyse web pages you can see different colours for links, visited links, background etc. Explain how this can be done in HTML, with examples.
20. Compare container and empty tags in HTML with examples.
21. The default colour of the attribute A link is _____.
22. The default color of the attribute V link is _____.
23. Classify the following HTML related words:
BR, IMG, ALIGN, FONT, FACE
24. Name the tag which has Noshade attribute.
25. Write the main attribute of tag to insert an image file in the webpage.
26. Mention the purpose of Alt attribute in tag.
27. The default alignment of an image obtained by using tag is _____.
28. List the main attributes of tag.



5

Web Designing using HTML

Significant Learning Outcomes



After the completion of this chapter, the learner

- uses different list tags to present the content effectively in web pages.
- identifies the relevance of hyper linking and uses `<A>` tag for different types of linking.
- provides audio and video in web pages with the help of `<EMBED>` tag.
- produces inline sounds and videos in web pages.
- lists and explains the tag and attributes for creating a table.
- uses the tags associated with `<TABLE>` tag to design tables with different characteristics.
- constructs different tables using the tags and attributes.
- identifies the importance of frames in the web page.
- creates frames using appropriate tags to display different web pages in the same browser window.
- identifies the concept of Forms in the web page.
- explains various components in a Form and creates them using proper tags and attributes.
- designs web pages with tables, frames and forms.

In the previous chapter, we studied the basic tags of HTML. We have also learnt to create some simple web pages using those tags and their attributes. But we are familiar with websites that provide much more facilities and utilities. There are websites that contain different types of lists. Linking between web pages is the backbone of World Wide Web. The different types of linking are discussed in this chapter. You might have come across certain information in tabular form. Sometimes you see more web pages in the same browser window. We are also familiar with websites through which we submit the register number to obtain the mark list of examinations, apply for admission and scholarships, pay the bills of electricity and water consumption etc. How can we create tables in web pages to present information? Can we place more than one web page in a single browser window? If yes, how? How are web pages created to accept data from the user to provide information? HTML provides all these facilities for web developers. In this chapter, we discuss the HTML tags required to answer all these questions.



5.1 Lists in HTML

While presenting information, the facility of listing can make it more communicative. Lists are of different types. We are familiar with numbered lists and bulleted lists. HTML offers several mechanisms for specifying lists of information. All lists must contain one or more list elements. There are three kinds of lists in HTML - unordered lists, ordered lists and definition lists.

5.1.1 Unordered lists

Unordered lists or bulleted lists display a bullet or other graphic in front of each item in the list. We can create an unordered list with the tag pair `` and ``. Each item in the list is presented by using the tag pair `` and ``. Unordered lists are used when a set of items can be placed in any order.

The code in Example 5.1 presents some hardware components of a computer in bulleted list. The corresponding web page is shown in Figure 5.1.

Example 5.1: To create an unordered list

```
<HTML>
<HEAD>
  <TITLE> Unordered Lists </TITLE>
</HEAD>
<BODY Bgcolor= "#DEB887">
  <CENTER> <H2> Unordered List </H2> </CENTER>
  While buying a computer, we have to consider many items.
  Here are some important items to consider.
  <UL>
    <LI> RAM </LI>
    <LI> Hard Disk </LI>
    <LI> Mother Board </LI>
    <LI> Processor </LI>
  </UL>
</BODY>
</HTML>
```

We can customise unordered lists by setting the **Type** attribute to three different values: Disc (default value), Square and Circle, which set the type of bullet that appears before each list item. The following code creates a list as shown in Figure 5.2.

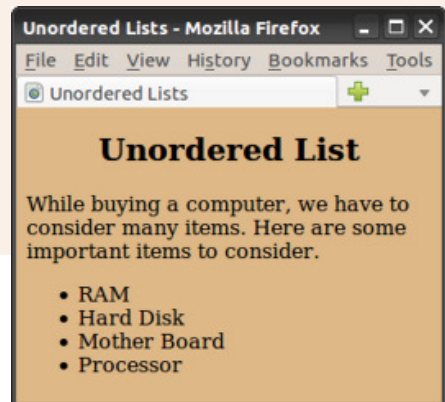


Fig.5.1: Web page containing unordered list

```
<UL Type= "Square">
  <LI> RAM </LI>
  <LI> Hard Disk </LI>
  <LI> Mother Board </LI>
  <LI> Processor </LI>
</UL>
```

5.1.2 Ordered lists

Ordered lists present the items in some numerical or alphabetical order. HTML provides the tag pair **** and **** to create an ordered list. The items in the ordered list are presented by **** tag in **** element. The ordered list is also called numbered list. Ordered lists or numbered lists are used to display a list of items that need to be placed in a specific order.

Example 5.2 is a code that presents an ordered list of items. The corresponding web page is shown in Figure 5.3.

Example 5.2: To create an ordered list

```
<HTML>
<HEAD>
  <TITLE> Ordered Lists </TITLE>
</HEAD>
<BODY Bgcolor= "#DDA0DD">
  <H2 Align= "center"> Ordered List </H2>
  Consider the memory devices of a computer.
  Then according to the speed of data processing,
  we can arrange the memory devices as follows.
  <OL>
    <LI> Registers </LI>
    <LI> Cache </LI>
    <LI> RAM </LI>
    <LI> Hard Disk </LI>
  </OL>
</BODY>
</HTML>
```

We can see that the list in Figure 5.3 is numbered from one through four. There are other numbering styles for presenting the list



Fig.5.2: Unordered list with square bullet

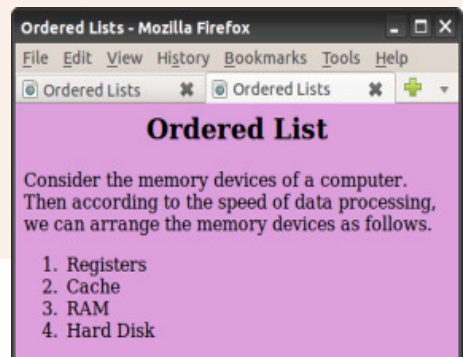


Fig.5.3: Web page containing ordered list



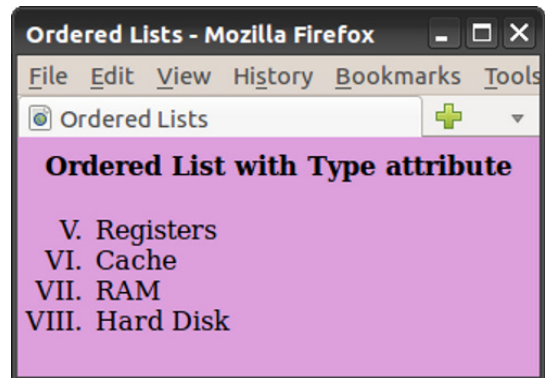
items. We can customise the numbering system used in ordered list by using the **Type** attribute, which can set with the values as detailed below:

- 1 Default numbering scheme (1, 2, 3, ...)
- A Upper case letters (A, B, C, ...)
- a Lower case letters (a, b, c, ...)
- I Large roman numerals (I, II, III, ...)
- i Small roman numerals (i, ii, iii, ...)

An ordered list, by default, starts with the first number in the series used in the list. That is, the starting number will be any one from 1, A, a, I and i. If we want to start with any other number in the series, then the **Start** attribute of `` tag enables us to change the beginning value. To start numbering a list at 5, for example, we may write: `<OL Start= "5">`. Thus, the numbering starts from 5 and then proceeds with 6, 7, 8, ... and so on.

The **Start** attribute sets the starting value of the item (it must be an integer) and the **Type** attribute sets the numbering style. For example, the following ordered list starts numbering from V and continues with VI, VII, ... and so on. The output of this code is shown in Figure 5.4.

```
<BODY Bgcolor = "#DDA0DD">
<H4 Align="center">Ordered List with Type attribute</H4>
<OL Type= "I" Start= "5">
  <LI> Registers </LI>
  <LI> Cache </LI>
  <LI> RAM </LI>
  <LI> Hard Disk </LI>
</OL>
</BODY>
```



5.1.3 Definition lists

A definition list is a list of terms and the corresponding definitions. The definition text is typically indented with respect to the term. No bullet symbol or number is provided for the list items. The tag pair `<DL>` and `</DL>` enclose the definition lists. Each term in the list is created using the `<DT>` tag and the `<DD>` tag supplies the definition of the term.

The code in Example 5.3 creates a web page to present the definitions of some terms related to security aspects of Internet. Figure 5.5 shows the resultant web page.

Fig.5.4: Ordered list with different numbering style and starting value

Example 5.3: To create a definition list

```

<HTML>
<HEAD> <TITLE> Definition List </TITLE> </HEAD>
<BODY Bgcolor= "#FFE4C4" Leftmargin= "100" Rightmargin= "150">
  <H2 Align= "center"> Definition List </H2>
  Today cyber security has an immense role in the
  field of Internet. The following are some of
  the threats that affect a computer network.
  <DL>
    <DT>Spam :</DT>
    <DD> Spam is the unsolicited e-mail sent in the
      hope of increasing the sales of some product, or
      just for annoying people.</DD>
    <DT>Phishing :</DT>
    <DD> Phishing is an attempt to acquire information
      such as usernames, passwords and credit card details
      by posting as the original website, mostly that
      of banks and other financial institutions. </DD>
  </DL>
</BODY>
</HTML>

```

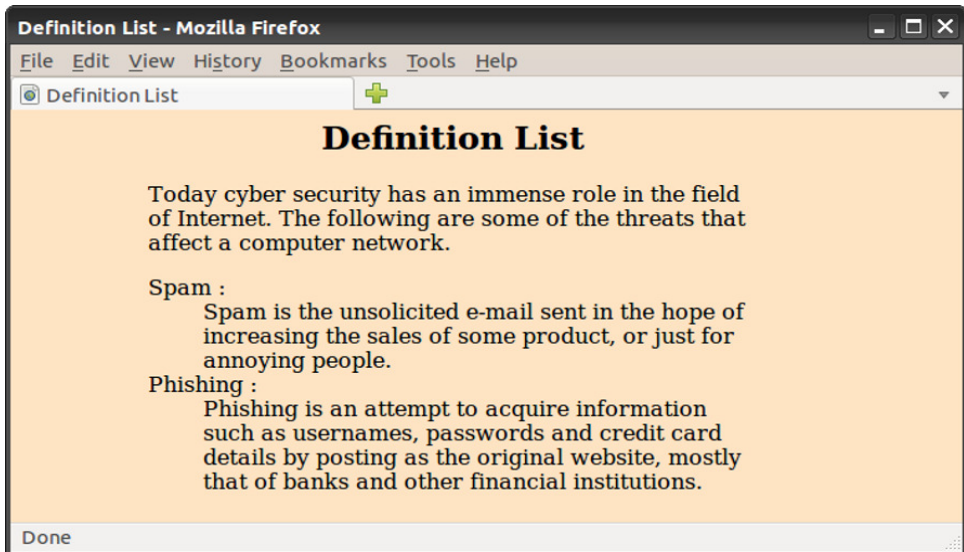


Fig. 5.5: Web page containing a definition list

In Figure 5.5, we can see that each annotation is indented under the corresponding term. Also note the left and right margins in the window.



5.1.4 Nested lists

A list of items can be given under each item of another list. It is known as nesting of lists. This is possible in many ways. For example, we can insert an unordered list into another unordered list, an unordered list into an ordered list, an ordered list inside an unordered list, etc. The code given in Example 5.4 demonstrates the concept of nested list and Figure 5.6 shows the resultant web page.

Example 5.4: To create a nested list

```
<HTML>
<HEAD>
  <TITLE> Nested Lists </TITLE>
</HEAD>
<BODY Bgcolor= "#E0FFFF">
  <H2 Align= "center"> Nested List </H2>
  Consider the devices of a computer.
  We can list some of them as follows.
  <OL>
    <LI> Input Devices </LI>
    <UL>
      <LI>Keyboard</LI>
      <LI>Mouse</LI>
      <LI>Scanner</LI>
      <LI>MICR</LI>
    </UL>
    <LI> Output Devices </LI>
    <UL Type= "Square">
      <LI>Printers</LI>
      <LI>Monitors</LI>
      <LI>Speakers</LI>
    </UL>
    <LI> Memory Devices </LI>
    <UL Type= "Circle">
      <LI>Hard Disc</LI>
      <LI>CD Rom</LI>
      <LI>Flash Drive</LI>
    </UL>
  </OL>
</BODY>
</HTML>
```

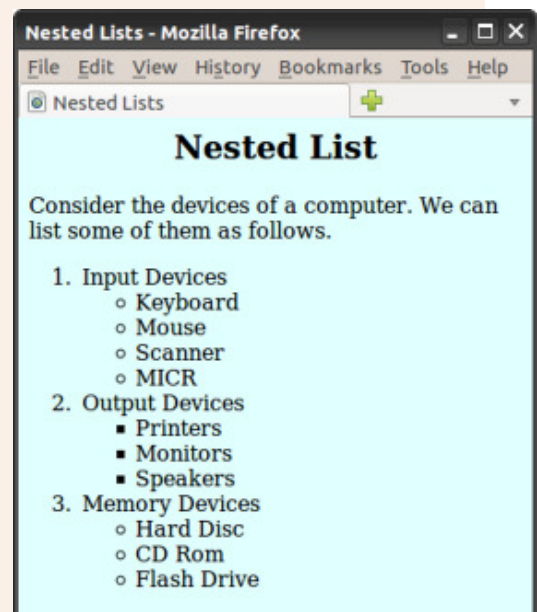


Fig.5.6: Classification of devices using nested list

In Example 5.4, three sets of unordered lists are nested into an ordered list.

Know your progress



1. What are the different types of lists in HTML?
2. Suppose your teacher asks you to display the list of students in your class using HTML document. Which type of list will you prefer? Why?
3. What are the common attributes of `` and `` tags?
4. What is the difference between `` tag and `` tag?
5. Name the tags used in the definition list.

5.2 Creating links

A hyperlink is an element, a text, or an image in a web page that we can click on, and move to another document or another section of the same document. Hyperlinks allow visitors to navigate between websites by clicking on words, phrases and images. HTML provides the ability to hyperlink text, image etc. to another document or section of a document. Hyperlink is often referred to as links. In HTML, the `<A>` tag provides the facility to give hyperlinks. This tag is called anchor tag and anything given between the tag pair `<A>` and `` becomes part of the link and a user can click that part to reach the linked document. **Href** is the main attribute of `<A>` tag and it means hyper reference. The value of this attribute is the URL of the document (address of the web page/site) to which hyperlink is provided.

For example, consider the following code segment:

```
<A Href= "http://www.dhsekerala.gov.in">Higher Secondary</A>
```

This creates the target of the hyperlink to the website [http:// www.dhsekerala.gov.in](http://www.dhsekerala.gov.in). At the time the user clicks the link, the browser opens the home page of this URL. The text inside the tag pair `<A>` and `` will appear underlined and in different colour.

The HTML code in Example 5.5 and Figure 5.7 show how hyperlinks are created in web pages.

Example 5.5: To create a hyperlink in a web page

```
<HTML>
<HEAD>
    <TITLE> Anchor Tag </TITLE>
</HEAD>
<BODY Bgcolor= "#FFFFFF">
    <H2 Align= "center"> Hyperlinks </H2>
```



```
<P>Now this will create a hyperlink to the website of
  Higher Secondary Department.<BR>
  Kindly click on the words
  <A Href= "http://www.dhsekerala.gov.in">Higher Secondary
    Education</A>.
</BODY>
</HTML>
```

As shown in Figure 5.7, the hyperlinked text is in underlined format ([Higher Secondary Education](http://www.dhsekerala.gov.in)) and in a different colour.

Hyperlinks are considered either "internal" or "external" depending on their target.

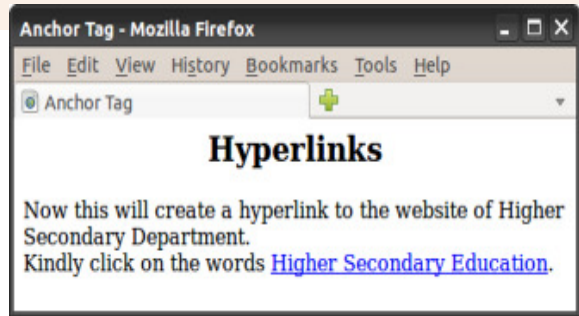


Fig.5.7: Web page containing hyperlink

5.2.1 Internal linking

A link to a particular section of the same document is known as internal linking. The attribute **Name** of <A> tag is required for this. We have to give a name to identify the section to be opened by the browser. This name is used with the Name attribute to establish the link.

For example, suppose we have three paragraphs on the subject "Environment Pollution". Let it be the Introduction section, Air pollution section, and Water pollution section. We refer to these sections by giving different values to the Name attribute of <A> tag.

```
<A Name= "Introduction"> INTRODUCTION </A>
<A Name= "Air"> Air Pollution </A>
```

Now, we can refer to these sections by giving the values of Href attribute as #Introduction, #Air (the # symbol is essential) from another section of the document as follows:

```
<A Href = "#Introduction"> Go to Introduction </A>
<A Href = "#Air"> Air pollution </A>
```

Let us create a web page incorporating the concepts of internal linking. Example 5.6 is an HTML code that has two internal links. Figure 5.8 shows the resultant page of this code.

Example 5.6: To create a web page containing internal links

```

<HTML>
<HEAD> <TITLE> Internal Linking </TITLE> </HEAD>
<BODY Bgcolor= "f8f8f8">
    <H2 Align= "center">ENVIRONMENTAL POLLUTION</H2>
    <A Name= "Introduction"><B>INTRODUCTION</B></A>
    <P><FONT Size= "15">E</FONT>nvironment pollution is a
    wide-reaching problem and it is likely to affect the
    health of human population.Here we discuss the environment
    pollution in the perspective of <A HREF= "#Air">air
    pollution </A>,
    <A Href= "#Water"> water pollution </A>and land/soil
    waste pollution. Studies find that these kinds of
    pollutions are not only seriously affecting humans
    but also animals and plants.
    </P>
    <A Name= "Air"><B> Air Pollution</B></A>
    <P>The air we breathe is an essential ingredient for our
    health and wellbeing. Unfortunately polluted air is common
    throughout the world, especially in developed countries.
    </P>
    <A Name= "Water"><B> Water pollution</B></A>
    <P>The water we drink is an essential ingredient for our
    health and wellbeing. Unfortunately polluted water and
    air are common throughout the world.Water pollution is
    caused by the discharge of industrial effluents, sewage
    water and agricultural or household waste.
    </P>
    <A Href= "#Introduction">Go to Introduction </A>
</BODY>
</HTML>

```

On clicking the hyperlink [air pollution](#) and [water pollution](#) on the web page shown in Figure 5.8, we get that particular section of the document as shown in Figure 5.9.

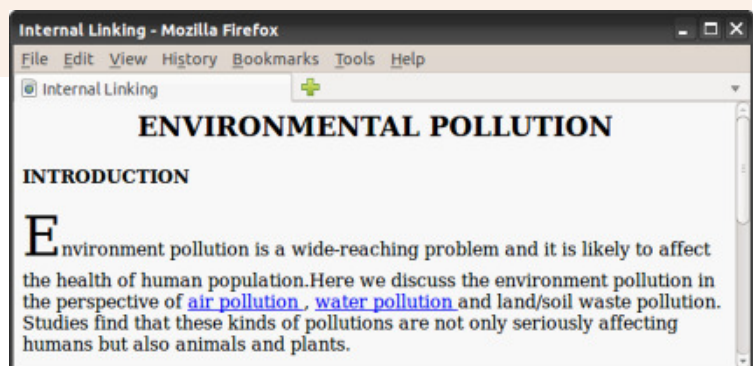


Fig. 5.8: Web page containing internal hyperlinks



Similarly, when we click on the link [Go to Introduction](#) at the bottom of the page shown in Figure 5.9, the introduction section will be displayed on the window.

5.2.2 External linking

The link from one web page to another web page is known as external linking. It is made possible by providing the URL of the external file in the Href attribute of **<A>** tag of the current page. The procedure for external linking is illustrated in the beginning of Section 5.2.

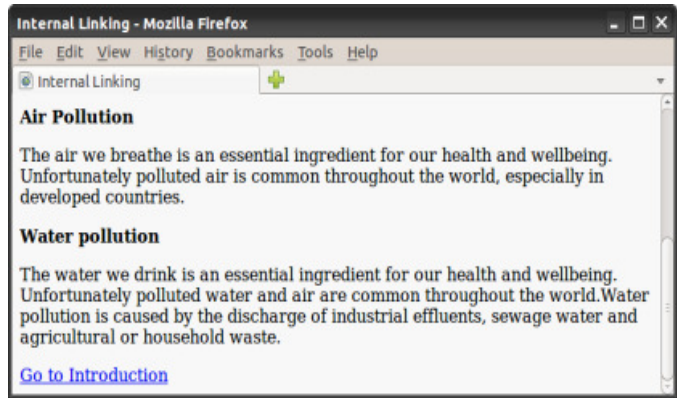


Fig. 5.9: Hyperlinked section of a page in the browser

5.2.3 Concept of URL

URL stands for Uniform Resource Locator, and it means the web address. In fact, there are two types of URLs - relative URL and absolute URL.

The referencing `` is an absolute URL, because it is referring to a specific URL. On the other hand, `` is relative reference. Here we give the file name, 'image.html' as the URL, and it is a relative URL, relative to the current document. If the URL of the current web page document is `D:\HTML\hyperlink.html`, the web browser knows that the hyperlink `` points to the file `image.html` in the directory `D:\HTML` itself.

5.2.4 Creating graphical hyperlinks

In the previous sections, we gave hyperlinks to texts. We can make hyperlinks to images also using **** tag inside the **<A>** tag. The HTML code given in Example 5.7 and Figure 5.10 show a web page containing graphical hyperlink.

Example 5.7: To create a web page containing graphical hyperlink

```
<HTML>
<HEAD> <TITLE> Graphical Hyperlink </TITLE> </HEAD>
<BODY Bgcolor = "#E0FFFF">
    <H2 Align= "center">Graphical Hyperlink</H2>
    Here is the image with <I>Graphical hyperlink </I>
    <A Href= "https://www.wikipedia.org">
```

```
<IMG Src= "wiki.jpg" Alt= "Image of Wiki"
      Height= "30" Width= "40" Border= "1"> </A>.
```

We can click over this image and the home page of linked site, wikipedia.org will open.

```
</BODY>
```

```
</HTML>
```

Suppose you move the mouse pointer upon the image of the wikipedia logo in the web page, the mouse pointer will change to the hand symbol. This indicates that, this image is a hyperlink. When we click on this image, then the corresponding web page www.wikipedia.org will be opened.

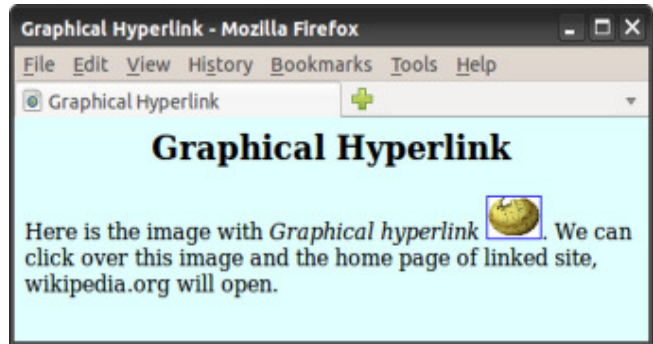


Fig. 5.10: Web page containing graphical hyperlink

5.2.5 Creating e-mail linking

We can create an e-mail hyperlink to a web page using the hyperlink protocol **mailto:**. Let us see the code in Example 5.8 and the web page shown in Figure 5.11 to understand the concept of e-mail hyper linking.

Example 5.8: To create a web page containing e-mail hyperlink

```
<HTML>
<HEAD> <TITLE> e-mail Linking </TITLE> </HEAD >
<BODY Bgcolor= "#E0FFFF">
    <H2 Align= "center">e-mail linking</H2>
    Now we can create an <B><I>e-mail hyperlink </I></B> to
    SCERT in the following way. Kindly click on the word
    <A Href= mailto: "scertkerala@gmail.com"> SCERT</A> Kerala.
</BODY>
</HTML>
```

As shown in Figure 5.11, the web contains a link **SCERT**. If we click on it, e-mail program will be opened with an empty message box addressed to the mail address scertkerala@gmail.com.



Fig. 5.11: Web page containing e-mail hyperlink



5.3 Inserting music and videos

Nowadays, web pages are enriched not only with text and images, but also with plenty of music, video and other multimedia resources. Let us have a basic idea about the inclusion of such resources in web pages. There are two ways of handling multimedia in a web browser. One is as inline and the other is as external data. The inline refers to files and data that are handled as part of the page. These files play the music or video when the page is visible in the browser window. We can also link a web page to external multimedia files with extensions .jpg, .gif, .avi, .png, .tiff, .mp3, .mp4, etc.

The easiest way to add music or video to the web page is with a special HTML tag, called **<EMBED>**. This tag includes the controls of the multimedia automatically in the browser window. In case, the browser does not support the **<EMBED>** tag, then we can use **<NOEMBED>** tag. The content within this tag pair will be displayed, if the **<EMBED>** tag is not supported by the browser.

The main attribute of the **<EMBED>** tag is **Src**, which specifies the URL of the music or video files to be included. The other attributes are **Height**, **Width**, **Align**, **Alt**, etc. The values of these attributes are familiar to us. One more important attribute of **<EMBED>** tag is **Hidden** which indicates whether the embedded component should be made visible or not. It is done by setting the value to **True** (by default) or **False**.

The code in Example 5.9 creates a web page that includes an audio link. Figure 5.12 shows the corresponding web page.

Example 5.9: To create a web page containing audio link

```
<HTML>
<HEAD>
  <TITLE> Embed Tag </TITLE>
</HEAD>
<BODY Bgcolor = "#DDFFFF">
  <H2 Align= "center"> Adding Music and Videos </H2>
  Here is a tag <B><I>EMBED </I></B> with the Multimedia
  features.<BR>
  <EMBED Src= "song1.mp3" Width= "300" Height= "60">
  </EMBED>
</BODY>
</HTML>
```

When the HTML document in Example 5.9 is opened, the webpage will play the music that we embedded along with the document. The audio controls like play/pause, volume, etc. will also be displayed on the web page. Similarly we can add movies in a webpage by using the tag `<EMBED>` and its attribute **Src**.

The code in Example 5.10 and the resultant web page shown in Figure 5.13 illustrate this linking.

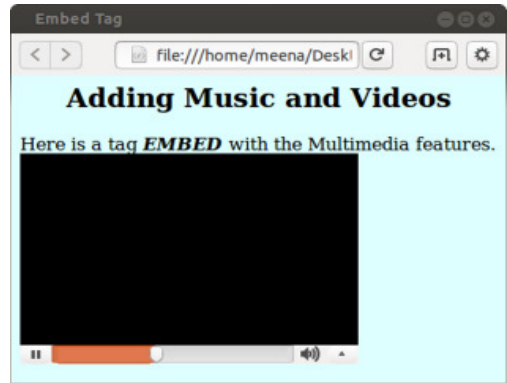


Fig. 5.12: Web page containing audio link

Example 5.10: To create a web page containing video link

```
<HTML>
<HEAD>
  <TITLE> Embed Tag </TITLE>
</HEAD>
<BODY Bgcolor = "#DDFFFF">
  <H2 Align="center">Adding Music and Videos</H2>
  Here is a tag <B><I>EMBED </I></B>with the Multimedia
  features.
  <EMBED Src= "alan.mp4" Width= "300" Height= "150">
  </EMBED>
  <NOEMBED><IMG Src= "book2.jpg"
    Alt= "Alternative Media">
  </NOEMBED>
</BODY>
</HTML>
```

When we open this page, the video starts to play. Here again, we can control the different properties of the audio and video, such as volume, pause, full screen mode, etc. We can also include audios and videos from other web pages or sites by linking them to our pages.

As mentioned earlier, music can be played in the background while the page is viewed. This kind of audio inline is achieved by the tag `<BG SOUND>`. The code in Example 5.11 illustrate the use of this tag.

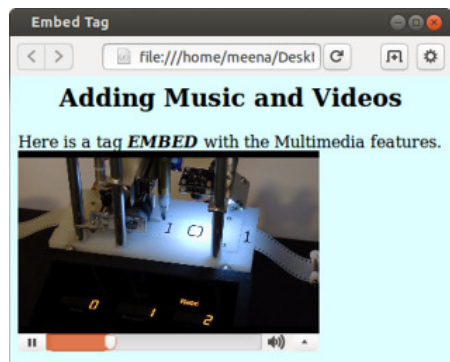


Fig. 5.13: Web page with video

**Example 5.11: To illustrate the use of <BGSOUND> tag**

```
<HTML>
<HEAD> <TITLE> Background Music </TITLE> </HEAD>
  <BODY Bgcolor = "#DDFFFF">
    <H2 Align= "center">Adding Background Music </H2>
    Here is a tag <B><I> BGSOUND </I></B> which helps
    us to play background music in our web page.
    <BGSOUND Src= "Song2.mp3" Loop= "Infinite">
  </BODY>
</HTML>
```

We can adjust the volume control by using the `Volume` attribute of `<BGSOUND>` to make the music softer or harder. Note that while creating HTML documents that include external files in `Src` and `Href` attributes, the correct path should be provided. If you try out the codes given in the examples, you have to make necessary modifications in these attributes. The attribute `Loop` determines the duration of play. The value `Infinite` causes the music play as long as the page is in view.

5.4 Creating tables in a web page

Sometimes, presenting a lot of information in a structured way is essential, especially in websites. Suppose we need to compare the data collected from a hospital for the period from 2012 to 2014, which states the number of newly diagnosed cancer patients among regular smokers, pan users and alcohol consumers. It can be presented in a tabular form as shown in Table 5.1.

NEWLY DIAGNOSED CANCER PATIENTS IN THE HOSPITAL FOR THE LAST 3 YEARS			
Year	2012	2013	2014
Smokers	129	140	143
Pan users	54	56	49
Alcohol users	74	68	77
Other cases	95	93	92

Table 5.1: Cancer patients diagnosed in a hospital

As we know, a table is a structured element that consists of rows and columns of cells. We can place any kind of content like text, image, and even other tables within these cells. In HTML, `<TABLE>` tag is used to create tables. This tag needs the support of some other tags like `<TH>`, `<TR>` and `<TD>` for constructing tables. Let us discuss these tags in the following sections.

5.4.1 <TABLE> tag

<TABLE> tag is a container tag. The whole content of the table should be enclosed within the tag pair **<TABLE>** and **</TABLE>**. This tag has many attributes to improve the general layout of the table. Some of the main attributes are listed below:

1. **Border:** This attribute specifies the thickness of the border line around the table. To draw the border of the table we have to specify a non-zero value to Border attribute in pixels. A border value of zero produces a table without border.
2. **Bordercolor:** It is used to assign colour to the table border.
3. **Align:** The position of the table inside the browser window is determined by Align attribute. The possible values are left (by default), right or center.
4. **Bgcolor:** We can change the background colour of the table using this attribute.
5. **Background:** It is used to assign a background image for a table. To set the background, specify the pathname of the image as value of this attribute. For example, `<TABLE Background = "images/flower.gif">` sets the background of a table with the image in the file *flower.jpg* stored in the folder *images* in the current drive. When both Bgcolor and Background are specified, the Background will override Bgcolor.
6. **Cellspacing:** Table cells have space in between them. We can either increase or decrease the space between cells. The Cellspacing attribute determines the space to be left between cells. The value is given in number of pixels.
7. **Cellpadding:** There is a space between the content and cell border. We can increase or decrease the space between cell border and content. The Cellpadding attribute specifies the space in between the cell border and cell content. The value is given in number of pixels.
8. **Width and Height:** We can set a table width and height using Width and Height attributes. We can specify table width or height in terms of pixels or in terms of percentage of browser window.
9. **Frame:** This attribute with one of the values given in Table 5.2 indicates how table borders are displayed.

Value	Description
Void	Display no borders
Above	Display a border on the top of the table only
Below	Display a border on the bottom of the table only



Value	Description
Hsides	Display borders on the horizontal sides (top and bottom) only
lhs or rhs	Display the border only the left side or the right side
Vsides	Display borders on the vertical sides (right and left) only
box or border	Display borders on all sides of the table (It is the default value)

Table 5.2: Values of Frame attribute

10. **Rules:** We can use the Rules attribute to control what rules (borders between cells) are displayed in a table. Table 5.3 shows the values of Rules attribute.

Value	Description
none	Display no rules
cols	Display rules between columns only
rows	Display rules between rows only
groups	Display rules between row groups and column groups only
all	Rules will appear between all rows and columns

Table 5.3: Values of Rules attribute

Now let us discuss some other tags associated with <TABLE> tag.

5.4.2 <TR> tag

The rows in a table are created using <TR> tag. It is a container tag. The whole row is enclosed within the tag pair <TR> and </TR>. A <TR> tag always comes inside the <TABLE> tag. A row itself is a collection of cells. A cell is the smallest component of a table. There are two types of cells - heading cells and data cells. As seen in Table 5.1, the values given in red colour are of heading type. The values given in blue are just data cells.

5.4.3 <TH> tag

<TH> tag is used to define heading cells. It is also a container tag. The heading data should be enclosed between <TH> and </TH> tags. The heading cells are displayed in bold face and in centred form. <TH> tag always comes inside the <TR> tag.

5.4.4 <TD> tag

<TD> tag is similar to <TH> tag and is used to display data cells. It is also a container tag. The data is given in between <TD> and </TD> tags. Similar to <TH> tag, <TD> tag is also placed within the <TR> tag.

The code given in Example 5.12 creates a simple table and Figure 5.14 shows the resultant web page.

Example 5.12: To create a web page containing a simple table

```

<HTML>
<HEAD> <TITLE> Html Tables </TITLE>
</HEAD>
<BODY>
    <TABLE Border="1">
        <TR>
            <TH>Roll No</TH>
            <TH>Name</TH>
        </TR>
        <TR>
            <TD>1</TD>
            <TD>Aliya</TD>
        </TR>
        <TR>
            <TD>2</TD>
            <TD>Arun</TD>
        </TR>
    </TABLE>
</BODY>
</HTML>

```

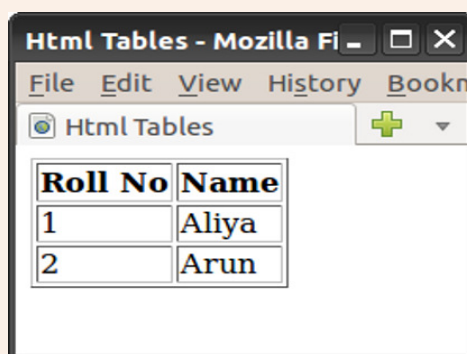


Fig. 5.14: Web page containing a simple table with two columns

Now, let us create the following table with some of the attributes discussed above.

The code given in Example 5.13 can create a web page as shown in Figure 5.15.

Year	2012 - 14
Smokers	412
Pan users	159
Alcohol users	219
Other cases	280

Example 5.13: To create a web page containing a table with border and colour

```

<HTML>
<HEAD> <TITLE> Hospital Table </TITLE> </HEAD>
<BODY>
    <TABLE Border= "3" Bordercolor= "RED" Bgcolor= "#4EB0AF"
        Align= "left" Cellspacing= "16" Cellpadding= "5"
        Width= "50%">
        <TR>
            <TH> Year </TH>
            <TH> 2012-14 </TH>
        </TR>

```



```

<TR>
  <TH> Smokers </TH>
  <TD> 412 </TD>
</TR>
<TR>
  <TH> Pan users </TH>
  <TD> 159 </TD>
</TR>
<TR>
  <TH> Alcohol users </TH>
  <TD> 219 </TD>
</TR>
<TR>
  <TH> Other cases </TH>
  <TD> 280 </TD>
</TR>
<TABLE>
<BODY>
<HTML>

```

In Example 5.13, we used `<TH>` tags within all `<TR>` tag pairs, which make the first column of the table similar to header column as shown in Figure 5.15.

Year	2012-14
Smokers	412
Pan users	159
Alcohol users	219
Other cases	280

Fig. 5.15: Table using Cellspacing and Cellpadding

Attributes of `<TR>` tag

The characteristics of a row can be changed using the attributes of `<TR>` tag.

1. **Align:** This attribute specifies the horizontal alignment of the text in a cell in that particular row. This can take the values `left`, `right` or `center`. The default is `left` for data and `center` for headings (see Figure 5.15).
2. **Valign:** We can specify the vertical alignment of the content in a cell of any row using `Valign`. The possible values are `top`, `middle`, `bottom` or `baseline`. Baseline vertical alignment aligns the baseline of the text across the cells in the row.
3. **Bgcolor:** This attribute gives background colour to a particular row. Usually this helps in highlighting a row.

The following code segment is the modified part of the code given in Example 5.13. It modifies the third row of the table shown in Figure 5.15 with a background colour, and horizontal and vertical alignments.

```

<TR Bgcolor= "yellow" Align= "right" Valign= "middle">
    <TH> Pan users </TH>
    <TD> 159 </TD>
</TR>

```

The modified web page is shown in Figure 5.16.

Attributes of <TH> and <TD> tags

Most of the attributes of <TH> and <TD> tags are common, as both these tags are used for creating table cells. Let us discuss some of the main attributes.

1. **Align:** It specifies the horizontal alignment of the content within a cell. It can take the values left, right or center. The default value is center for <TH> and left for <TD>.
2. **Valign:** It specifies the vertical alignment of the content within a cell. It can take a value top, bottom, middle or baseline.
3. **Bgcolor:** We can set background colour for any cell using this attribute. The tags <TABLE>, <TR>, <TD>/<TH> all have Bgcolor attribute. If Bgcolor attribute is set for all these tags, the cell will take the colour assigned to this attribute in <TH>/<TD> tag.
4. **Colspan:** Usually a cell spans over a single column, but sometimes we may need columns occupying more than one cell. Colspan value defines the number of columns occupied by that particular cell. For example, <TH Colspan="3"> makes the cell span over three columns.
5. **Rowspan:** Similar to Colspan, Rowspan attribute specifies the number of rows to be spanned by the cell. The default cell span is single row, but we can make it span multiple rows by setting Rowspan attribute a numeric value greater than one. For example, <TD Rowspan="4"> makes the cell span over four rows.

Year	2012-14
Smokers	412
Pan users	159
Alcohol users	219
Other cases	280

Fig. 5.16: Table with modified row using Bgcolor, Align and Valign

Let us create a web page with a simple table to illustrate the effect of the attributes discussed above. The code given in Example 5.14 shows the use of these attributes and Figure 5.17 shows the corresponding web page.

Example 5.14: To create a table to demonstrate Colspan and Rowspan

```

<HTML>
<HEAD> <TITLE> Students Registration </TITLE>
</HEAD>

```




```

<BODY>
  <TABLE Border= "1" Cellspacing= "3" Cellpadding= "5">
    <TR>
      <TH Colspan= "3"> No. of Registered Students </TH>
    </TR>
    <TR>
      <TH Rowspan= "2"> Year </TH>
      <TD> 2014 </TD> <TD> 75 </TD>
    </TR>
    <TR>
      <TD> 2015 </TD> <TD> 88 </TD>
    </TR>
  </TABLE>
</BODY>
</HTML>

```

No. of Registered Students		
Year	2014	75
	2015	88

Now, let us create a web page to display the details of cancer patients as shown in Table 5.1. The code given in Example 5.15 can design a table as shown in Figure 5.18.

Fig. 5.17: Table with row span and column span

Example 5.15: To create a table to show the data of cancer patients

```

<HTML>
<HEAD> <TITLE> CompleteTable </TITLE> </HEAD>
<BODY Bgcolor= "silver">
  <TABLE Border= "3" Bordercolor= "red" Bgcolor= "#4EB0AF"
    Align= "left" Cellspacing= "2" Cellpadding= "2"
    Width= "50%">
    <TR>
      <TH Colspan= "5"> Number of cancer patients reported
        at the hospital </TH>
    </TR>
    <TR Align= "center">
      <TH Colspan= "2"> Year </TH>
      <TH> 2012 </TH>
      <TH> 2013 </TH>
      <TH> 2014 </TH>
    </TR>
    <TR Align= "center">
      <TH Rowspan= "4"> Cancer Origin </TH>
      <TH> Smokers </TH>
      <TD> 129 </TD>

```

```

        <TD> 140 </TD>
        <TD> 143 </TD>
    </TR>
    <TR Align= "center">
        <TH> Pan users </TH>
        <TD> 54 </TD>
        <TD> 56 </TD>
        <TD> 59 </TD>
    </TR>
    <TR Align= "center">
        <TH> Alcohol users </TH>
        <TD> 74 </TD>
        <TD> 68 </TD>
        <TD> 77 </TD>
    </TR>
    <TR Align= "center">
        <TH> Other cases </TH>
        <TD> 95 </TD>
        <TD> 93 </TD>
        <TD> 92 </TD>
    </TR>
    <TR Align= "center">
        <TH Colspan= "2"> TOTAL Patients </TH>
        <TD> 352 </TD>
        <TD> 357 </TD>
        <TD> 371 </TD>
    </TR>
</TABLE>
</BODY>
</HTML>

```

Number of cancer patients reported at the hospital				
Year		2012	2013	2014
Cancer Origin	Smokers	129	140	143
	Pan users	54	56	59
	Alcohol users	74	68	77
	Other cases	95	93	92
TOTAL Patients		352	357	371

Fig. 5.18: Web page containing a table of cancer patients Bgcolor, Rowspan, Colspan, Align and Valign



Let us do

Try to create a table containing the number of students studying different second languages available in your school. The table should provide details of each class of your higher secondary section.

5.4.5 Table caption with <CAPTION> tag

We can provide a heading to a table using the <CAPTION> tag. It provides an easy method to add descriptive text to a table as its caption. Suppose we want to modify the table shown in Figure 5.19 with a caption. We can modify the code section before the first <TR> tag in Example 5.15 with following code segment:

```
<TABLE Border= "3" Bordercolor= "red" Bgcolor= "skyblue"
      Align= "left" Cellspacing= "2" Cellpadding= "2"
      Width= "50%">
<CAPTION> Number of new cancer patients reported at the
           hospital during 2012-14
</CAPTION>
```

The modified HTML code will produce a table as shown in Figure 5.19.

Number of cancer patients reported at the hospital				
Year		2012	2013	2014
Cancer Origin	Smokers	129	140	143
	Pan users	54	56	59
	Alcohol users	74	68	77
	Other cases	95	93	92
TOTAL Patients		352	357	371

Fig. 5.19: Modified table with a caption

Know your progress

1. Name any two associated tags of <TABLE> tag.
2. Choose the odd one out:
 - a. TABLE
 - b. TR
 - c. TH
 - d. COLSPAN
3. Differentiate between <TD> and <TH>.
4. <TABLE> tag is an empty tag. State whether this statement is true or false.
5. Give any two attributes of <TR> tag.



5.5 Dividing the browser window

Sometimes we need to include more than one webpage inside a single browser window. The browser window can be divided into two or more panes to accommodate different pages simultaneously. HTML provides a facility called frameset to partition the browser window into different sections. Each section accommodates different HTML pages. Each individual section created by a frameset is called a frame. Figure 5.20 shows a simple frameset consisting of three frames. To create a frameset, we need **<FRAMESET>** and **<FRAME>** tags.

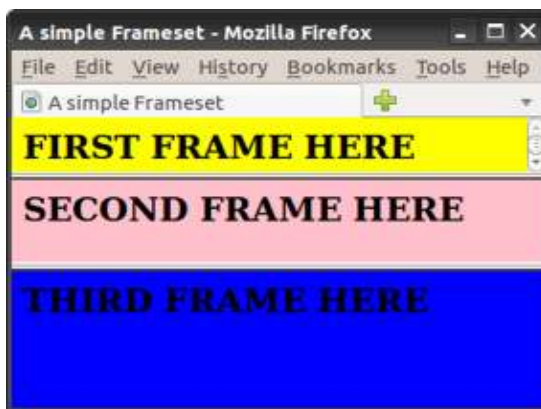


Fig. 5.20: A simple frameset with three frames

5.5.1 <FRAMESET> tag

<FRAMESET> is a container tag for partitioning the browser window into different frame sections. The frames are defined within the tag pair **<FRAMESET>** and **</FRAMESET>**. The main attributes are:

1. **Cols:** This attribute determines the number of vertical frames in the frameset page and its dimensions. The column width can be given either in percentage of total width or in number of pixels. For example, **<FRAMESET Cols = "30%, 500, *">** will create three vertical frames. The first frame will occupy 30% of the total window width, the next will take 500 pixels space, and the asterisk(*) symbol given at the end denotes the remaining space which is given to the third frame.
2. **Rows:** Similar to Cols, Rows attribute defines the number and dimension of horizontal frames.
3. **Border:** We can specify the thickness of border for the frames by using Border attribute. Here the value is given in pixels.
4. **Bordercolor:** We can specify border colour by assigning a colour to this attribute.

5.5.2 <FRAME> tag

<FRAME> tag is an empty tag and it defines the frames inside the **<FRAMESET>**. For each division inside the **<FRAMESET>** tag, we should have a corresponding **<FRAME>** tag. **<FRAME>** tag always comes with **Src** attribute which specifies the HTML page to be loaded in the frame. The main attributes related to **<FRAME>** tag are:



1. **Src:** As we have already discussed, Src specifies the URL of the document to be loaded in the frame. For example, `<FRAME Src = "school.html">` loads the page *school.html* in a particular frame.
2. **Scrolling:** When the content inside a frame exceeds the frame size, a scrollbar appears depending upon the value of the Scrolling attribute. It can take values Yes, No or Auto. Auto is the default value and it displays scroll bars if the frame content exceeds the normal display area.
3. **Noresize:** It is used to prevent users from resizing the border of a specific frame by dragging on it. Just giving Noresize prohibits resizing the frame window. For example, `<FRAME Src= "school.html" Noresize>`.
4. **Marginwidth and Marginheight:** We can set horizontal and vertical margins to the frame by using Marginwidth and Marginheight, respectively. The values are given in pixels.
5. **Name:** It gives a name to a frame. This particular frame can be referenced using this name later in the code.

The following code can create the frameset shown in Figure 5.20. It is assumed that the three HTML pages *sampleframe1.html*, *sampleframe2.html* and *sampleframe3.html* are already created as in Figure 5.20.

```
<HTML>
<HEAD> <TITLE> A simple Frameset </TITLE> </HEAD>
  <FRAMESET Rows= "20%, 30%, 50%">
    <FRAME Src= "sampleframe1.html">
    <FRAME Src= "sampleframe2.html">
    <FRAME Src= "sampleframe3.html">
  </FRAMESET>
</HTML>
```

5.5.3 Targeting frames

In a frameset page, we can provide hyperlink in any frame and the linked page can be targeted to any other frame. When we click on the link in a frame, the corresponding page is opened within another frame in the frameset. For this, first we have to allot a name for the destination frame using its Name attribute. Then we can refer the named frame using Target attribute of the link to be displayed.



Let us do

Create three HTML files *bio.html*, *poem.html* and *fiction.html* to show a list of books belonging to biography, poetry and fiction, respectively.

Now let us create a web page with two frames - one for showing the links for these files and the other for opening the respective web pages. When a user clicks on any one of the three links available in one frame, the associated file will open in the other frame.

Once you have created the three files mentioned above, the two HTML codes given in Example 5.16 can satisfy our need.

Example 5.16: To illustrate the concept of targeting frames

Save the following code in a file *main.html*

```
<HTML>
<HEAD> <TITLE> Left Frame </TITLE> </HEAD>
<BODY Bgcolor= "#00AFFF" Text= "#282D2F">
  <H2> Select the option </H2>
  <FONT Size= "5">
    <A Href= "bio.html" Target="right_frame">Biography</A><BR>
    <A Href= "poem.html" Target="right_frame">Poetry</A><BR>
    <A Href= "fiction.html" Target="right_frame">Fiction</A>
  </FONT>
</BODY>
</HTML>
```

Now create a file to store the following code:

```
<HTML>
<HEAD> <TITLE> Targeting Frames </TITLE> </HEAD>
<FRAMESET Cols= "200, *">
  <FRAME Src= "main.html" Name= "left_frame">
  <FRAME Name= "right_frame">
</FRAMESET>
</HTML>
```

When the above document is executed, a web page with two frames will be opened. The first column of the browser window will show the *main.html* and the second column will be blank. Note that **Src** attribute is not specified for that frame, but a name *right_frame* is assigned. If the first link (biography) is selected, the file *bio.html* will be opened in the second frame as shown in Figure 5.21. It is

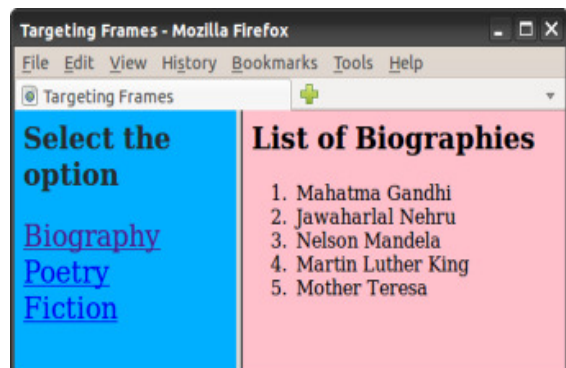


Fig. 5.21 : Web page with target frame



assumed that the file *bio.html* contains the details as shown in the figure. Note the difference in colour in the selected link.

Note that, the HTML document *main.htm* contains three pairs of `<A>` tag to link the three HTML files. A tag named **Target** is used in `<A>` tags to specify the frame in which the linked file is to be opened. Here comes the relevance of names given to the frames.



`<FRAMESET>` tag is not supported in HTML 5 version.

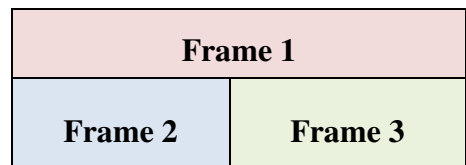
There are many arguments against the use of frameset. Some of them are given below.

- The browser's back button will not work naturally inside a frameset.
- It is difficult to refer a specific document within a frameset.
- Any attempt to reload a specific frame may reload the entire frameset. As a result it will reset the frame contents to their default sources.
- Search engines can struggle when navigating through framed documents.
- It is difficult to print contents of a frameset.
- Bookmarking contents of a frameset is difficult.

5.5.4 Nesting of framesets

In Figures 5.20 and 5.21, we can see frames in the browser window. The first figure shows horizontal division of the browser window into three frames. But the second figure shows vertical division into two frames.

Suppose we want to divide the browser window as shown in Figure 5.22. It is possible with nested frameset. It is the process of inserting a frameset within another frameset.



The following steps illustrate the nesting of frameset for the division shown in Figure 5.22.

Fig. 5.22: Nesting of frameset

1. Create the initial frameset, defining two rows as shown below:

```
<FRAMESET Rows= "85, *">  
    <FRAME Src= "sampleframe1.html">  
</FRAMESET>
```

This code horizontally divides the window into two frames and the first row is reserved for the file *sampleframe1.html*.

2. The second row is left free. Now we will divide it into two frames vertically. So, instead of a second `<FRAME>` tag, insert another opening `<FRAMESET>` tag as shown below:

```
<FRAMESET Rows= "85, *">
  <FRAME Src= "sampleframe1.html">
  <FRAMESET Cols= "220, *">
    </FRAMESET>
  </FRAMESET>
```

This code will divide the second row into two columns. Now, we can add two `<FRAME>` tags within the inner frameset and complete the HTML code as given in Example 5.17. The resultant web page is shown in Figure 5.23. It is assumed that the three HTML pages are already created as in Figure 5.23.

Example 5.17: To implement the concept of nested frameset

```
<HTML>
  <HEAD>
    <TITLE> nesting frames </TITLE>
  </HEAD>
  <FRAMESET Rows= "85, *">
    <FRAME Src= "sampleframe1.html">
    <FRAMESET Cols= "200, *">
      <FRAME Src= "sampleframe2.html">
      <FRAME Src= "sampleframe3.html">
    </FRAMESET>
  </FRAMESET>
</HTML>
```

5.5.5 <NOFRAMES> tag

Earlier browsers did not support frames. In such a situation, the browser is expected to respond to the user in some way or the other. The tag pair `<NOFRAMES>` and `</NOFRAMES>` is used to display some text content in the window if the browser is unable to support frames. The following code illustrates the use of `<NOFRAMES>` tag.

```
<HTML>
  <HEAD> <TITLE> A simple Frameset </TITLE>
  </HEAD>
```



Fig. 5.23: Nested framesets



```
<FRAMESET Rows= "20%, 30%, 50%">
  <FRAME Src= "sampleframe1.html">
  <FRAME Src= "sampleframe2.html">
  <FRAME Src= "sampleframe3.html">
</FRAMESET>
<NOFRAMES>
  <P> Your browser doesnt support frames.<BR>
    Click <A Href="index.htm">here... </A></P>
</NOFRAMES>
</HTML>
```

Here, if the browser does not support <FRAMESET> then a message "Click here..." will be displayed with an alternate link to the file *index.html*.

Know your progress



1. <FRAMESET Rows="100, *"> divides the frame into ____ sections.
2. List any three attributes of <FRAME> tag.
3. What is nested frameset?
4. What is the use of <NOFRAME> tag?
5. No <BODY> section is needed for frameset page. Say TRUE or FALSE.

5.6 Forms in web pages

HTML Forms are required when we have to collect some data from the webpage viewer for processing. For example, we use www.hscap.kerala.gov.in for the admission to Class XI in Kerala. We enter information such as name, SSLC Register Number, grades, choice of course and school, etc. in this web page. It is an implementation of HTML Form.

A Form will take input from the web page viewer and then it will post the data to a back-end application such as Common Gateway Interface (CGI), Active Server Pages (ASP), PHP, etc. for processing. We will study about these technologies in the next chapter. A form consists of two elements: a **<FORM>** container and any number of Form controls within that container. There are various Form controls like text fields, textarea fields, drop-down menus, radio buttons, checkboxes, etc.

5.6.1 <FORM> tag

A **<FORM>** tag provides a container for creating a Form. An HTML Form starts with **<FORM>** and ends with **</FORM>** tag. A web browser can only gather information through Forms. We must provide some back-end application to handle (save, modify, etc.) the data collected. We use Form handlers like CGI, JavaScript or PHP script for that purpose. All of the input elements associated with a single Form are processed by the same Form handler. A Form handler is a program on the web server that manages the data sent through the Form. The form handler is specified as the value for the Action attribute of **<FORM>** tag. The concept of server and other associated technologies will be discussed in the next chapter.

Most frequently used attributes of **<FORM>** are:

1. **Action:** It specifies the URL of the Form handler, which is ready to process the received data.
2. **Method:** It mentions the method used to upload data. The most frequently used Methods are `Get` and `Post`.
3. **Target:** It specifies the target window or frame where the result of the script will be displayed. It takes values like `_blank`, `_self`, `_parent`, etc. The main values of `Target` attribute are given in Table 5.4.

Value	Description
<code>_blank</code>	Opens the linked document in a new browser window
<code>_self</code>	Opens the linked document in the same frame as the link
<code>_parent</code>	Opens the linked document in the parent frameset
<code>_top</code>	Opens the linked document in the main browser window, replacing any frame present
<code>name</code>	Opens the linked document in the window with the specified name

Table 5.4: Values for Target attribute



A common use for JavaScript (or any client side scripting language) is to verify that users have filled in all the required fields in a Form and/or to check whether the input data is valid or not, before the browser actually submits the Form to the form handler on the web server.

Form controls

There are different types of Form controls that we can use to collect data using HTML Form. These controls include Text box, Password, Check Box, Radio Button,



Text Area, Select Box, Submit and Reset Button. We can create most of these controls in any HTML Form using **<INPUT>** tag.

5.6.2 <INPUT> tag

The visible part of a Form is a set of controls to accept the input from the viewers. Different types of input can be selected based on the nature of input. The **<INPUT>** tag is an empty tag that can be used to make different types of controls such as Text Box, Radio Button, Submit Button etc. The **Type** attribute determines the type of control created by this tag.

Attributes of <INPUT> tag

1. **Type:** This attribute determines the control type created by the **<INPUT>** tag. The main values of **Type** are given in Table 5.5.

Value	Description
text	creates a text box
password	same as text box. But here characters are represented by coded symbols such as asterisk.
checkbox	creates a checkbox where user can enter Yes or No values (check or uncheck).
radio	similar to checkbox but is used to select a single value from a group of values. When multiple radio buttons are assigned with the same value for Name attribute, users can select only one button at a time. When the user changes the selection, the one that is already selected becomes deselected.
reset	a special button used to clear all the entries made in the form and to bring it to the initial state.
submit	another special button used to submit all the entries made in the form to the server.
button	creates a standard graphical button on the form. We can call functions on clicking this button.

Table 5.5: Values of Type attribute

2. **Name:** It is used to give a name to the input control. When the Form is submitted, the data values are passed to the server along with the corresponding name of the control.
3. **Value:** It can be used to provide an initial (default) value inside the control.
4. **Size:** This attribute sets the width of the input text in terms of characters. It is applicable only to the input types text and password.

- 

A password field helps in hiding the content visually. It doesn't encrypt or scramble the information in any way.

The HTML code given in Example 5.18 creates an HTML Form to input a name and password. Figure 5.24 shows the resultant web page.

Example 5.18: To create an HTML Form

[illegible]

In Example 5.18, a file *login.php* is assigned to the `Action` attribute of the `<FORM>` tag. It means that the data entered through this Form will be captured and processed by the application stored in the file *login.php*. Also observe the use of HTML entity ` ` to provide non break spaces by referring to the code and Figure 5.24.



The screenshot shows a Mozilla Firefox browser window. The title bar reads "Login - Mozilla Firefox". The menu bar includes "File", "Edit", "View", "History", "Bookmarks", "Tools", and "Help". The address bar displays "Login" with a green plus icon on the right. The main content area has a pink background and contains the following elements:

- A label "Name:" followed by a white text input field.
- A label "Password:" followed by a white text input field.
- At the bottom, two buttons: "Clear" and "Send".

Fig. 5.24: HTML Form with text and password

The code given in Example 5.19 creates a Form to specify the gender and hobbies of a person with the help of radio buttons and check boxes. Figure 5.25 shows the corresponding web page.

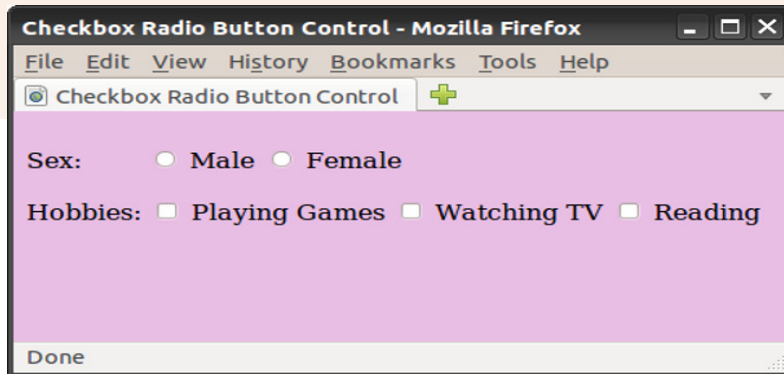
[illegible]

Fig 5.25: Form with checkbox and radio button

5.6.3 <TEXTAREA> tag

We have seen single line text entry facility in a Form with the statement `<INPUT Type = "text">` (refer Example 5.18 and Figure 5.24). But in practice, there are occasions where we need to enter multiple lines of text in a Form. Postal address is an example. The container tag `<TEXTAREA>` can be used for this purpose. The area

between the tag pair gives space for multi line text depending on the values given to the attributes. The main attributes of `<TEXTAREA>` tag are:

1. **Name:** It is used to give a name to the control.
2. **Rows:** It specifies the number of rows in a text area control.
3. **Cols:** It indicates the number of columns in a text area, i.e., number of characters in a line.

Consider the following code segment and observe the usage of `<TEXTAREA>` tag:

```
<FORM Action= "guestbook.php" Method= "post">
    <TEXTAREA Rows= "10" Cols= "30" Name= "address">
        Enter your address.
    </TEXTAREA>
</FORM>
```

On completing the code and opening it, we can see a page as shown in Figure 5.26. Any text we include between tag pair `<TEXTAREA>` and `</TEXTAREA>` appears in a text box. When the user enters any data in the text box, it overrides default text.

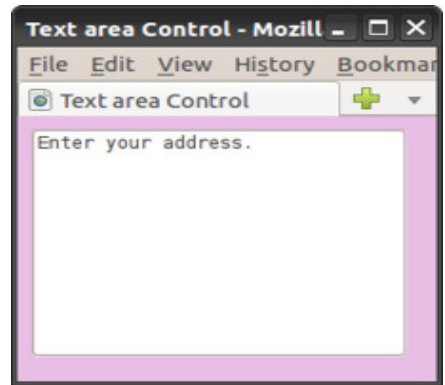


Fig. 5.26: HTML Form with text area

5.6.4 `<SELECT>` tag

A select box, also called dropdown box, provides a list of various options in the form of a dropdown list, from where a user can select one or more options. Select box is helpful when a number of options are to be displayed in a limited space. The options in the list are specified using `<OPTION>` tag, which will be contained in the `<SELECT>` tag pair.

The container tag pair `<SELECT>` and `</SELECT>` encloses a select box. The main attributes of `<SELECT>` tag are:

1. **Name:** It gives a name to the control, which is sent to the server to be recognized and to get the value.
2. **Size:** This can be used to present a scrolling list box. Its value will decide whether the select box should be a drop down list or a list box. If the value is 1, we get a dropdown list (or combo box).
3. **Multiple:** It allows users to select multiple items from the menu.

Now let us discuss the role of `<OPTION>` tag in select boxes. It is an empty tag placed inside the container tag `<SELECT>` and `</SELECT>`. It lists out the options provided in the select box. The main attributes of `<OPTION>` tag are:



1. **Selected:** This attribute is used to indicate default selection.
2. **Value:** It is used here to allow the submission of a value that differs from the content of the <OPTION> tag. If it is not present, the content is used as the value.

The HTML code given in Example 5.20 creates a web page that contains a drop down list. Note that the value of the `Size` attribute of <SELECT> tag is 1 and there are four options inside the select box.

Example 5.20: To create an HTML Form with a drop down list

```
<HTML>
<HEAD> <TITLE> Drop down list </TITLE> </HEAD>
<BODY Bgcolor= "#E9BEE5">
    <FORM Action= "guestbook.php" Method= "post">
        <P> Nationality:
        <SELECT Name= "Nationality" Size= "1">
            <OPTION Value= "Indian" selected> Indian
            <OPTION Value= "British"> British
            <OPTION Value= "German"> German
            <OPTION Value= "Srilankan"> Srilankan
        </SELECT>
    </FORM>
</BODY>
</HTML>
```

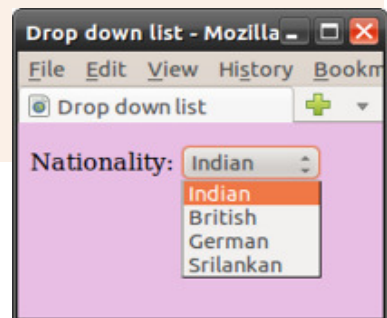


Figure 5.27 shows the dropdown list obtained on clicking the combo button.

Fig. 5.27: Select box in a Form



Modify the code given in Example 5.20 with different values for the `Size` attribute and predict the changes in the select box.

Let us do

5.6.5 Grouping Form data with <FIELDSET> tag

Sometimes grouping related controls in a Form become a necessity. The <FIELDSET> element helps in grouping related data in a Form. By using <FIELDSET> we can divide a Form into different subsections, each subsection containing related elements. To identify each <FIELDSET>, we can use the <LEGEND> tag. The <LEGEND> tag defines a caption for the <FIELDSET> element. It is a container tag.


```
<HTML>  
<HEAD> <TITLE> FormResume </TITLE> </HEAD>  
<BODY Bgcolor= "#E9BEE5">  
    <CENTER ><H3>Enter your details</H3></CENTER>  
    <FORM Action= "guestbook.php" Method= "get">  
        Name:&nbsp;  ;  
        <INPUT Type= "text" Name= "first_name" Size= "20"  
            Maxlength= "20" Value= "First Name Here"><BR><BR>  
        Age:  
        <INPUT Type="text" Name="age" Size="3" Maxlength="3"><BR>  
        Sex: &nbsp;  ;&nbsp;  ;&nbsp;  ;  
        <INPUT Type="radio" Name="sex" Value="male"> Male  
        <INPUT Type="radio" Name="sex" Value="female"> Female  
        <FIELDSET>  
            <LEGEND>Nationality</LEGEND>  
            <SELECT Name= "Nationality" Size= "4">  
                <OPTION Value= "Indian" Selected> Indian  
                <OPTION Value= "British"> British  
                <OPTION Value= "German"> German  
                <OPTION Value= "Srilankan"> Srilankan  
            </SELECT><BR><BR>  
            Nativity:  
            <INPUT Type= "text" Name="State" Size="15"><BR><BR>  
            District:&nbsp;  ;  
            <INPUT Type= "text" Name= "District" Size= "15">  
        </FIELDSET><BR>  
        Hobbies:  
        <INPUT Type= "checkbox" Name= "Hobby" Value= "games">  
            Playing Games  
        <INPUT Type= "checkbox" Name= "Hobby"  
            Value= "WatchingTV"> Watching TV  
        <INPUT Type= "checkbox" Name= "Hobby" Value= "Reading">  
            Reading<BR><BR>
```



```

<TEXTAREA Rows= "5" Cols= "25" Name= "address">Address
</TEXTAREA><BR><BR>
<INPUT Type= "submit" Value= "submit">
<INPUT Type= "Reset" Value= "reset">
</FORM>
</BODY>
</HTML>

```

The screenshot shows a web browser window titled 'FormResume - Mozilla Firefox'. The browser's address bar shows 'FormResume'. The page has a light purple background and is titled 'Enter your details'. The form contains the following elements:

- Name:** A text input field with the placeholder text 'First Name Here'.
- Age:** A text input field.
- Sex:** Two radio buttons labeled 'Male' and 'Female'.
- Nationality:** A dropdown menu with the following options: Indian, British, German, and Srilankan.
- Nativity:** A text input field.
- District:** A text input field.
- Hobbies:** Three checkboxes labeled 'Playing Games', 'Watching TV', and 'Reading'.
- Address:** A large text area with the placeholder text 'Address'.
- Buttons:** Two buttons at the bottom labeled 'submit' and 'reset'.

Fig 5.28: An HTML Form to submit the details of a student

5.6.6 Form submission

When we click the submit button on the Form, it will send the collected input data to the server, a computer capable of processing the received data. In a web server, there are special server side programs for processing Form data coming from the browser of a client (a computer, a tab or a mobile phone through which we submit the data).

As mentioned earlier, the `Action` attribute defines the action to be performed when the Form is submitted. Normally it assigns the URL of the server side program to process the Form data. The common way to submit a Form to a server is by using a **submit** button. In Example 5.21, a server-side script *guestbook.php* is specified to handle the submitted form in the `<FORM>` tag.

The Method attribute of the <FORM> tag specifies the HTTP method (get or post) to be used when submitting the forms.

Know your progress



1. HTML provides _____ to input data through web pages.
2. Name the two tags used within <FORM> to enter text data.
3. How do radio button control and check box control differ?
4. Which tag is used to group data within the Form?
5. Name the tag used within <FORM> to input data.

5.7 Overview of HTML 5

HTML 5 is the major revision of the HTML standard after HTML 4.01. HTML5 was developed jointly by World Wide Web Consortium (W3C) and the Web Hypertext Application Technology Working Group (WHATWG). The new standard incorporates features like video playback, drag-and-drop etc.

The latest versions of all leading browsers including Google Chrome, Mozilla Firefox, Apple Safari, Opera and Internet Explorer support HTML5. Mobile web browsers that are pre-installed in iPhones, iPads, Android phones, etc. also support HTML5. HTML5 is designed, as much as possible, to be backward compatible with existing web browsers. The logo of HTML5 is given in Figure 5.29.



Fig. 5.29: HTML5 logo

Some new tags introduced in HTML5 are given below:



1. **<VIDEO> and <AUDIO>:** These tags offer the facility to easily embed media into HTML documents.
2. **<CANVAS>:** This tag gives us an easy and powerful way to draw graphics, build charts and graphs and customise graphics.
3. **<HEADER> and <FOOTER>:** The <HEADER> element specifies a header for a document or section. The <FOOTER> element specifies footer for a document or section. A footer typically contains the author of the document, copyright information, contact information, etc. We can have several <HEADER>, <FOOTER> elements in one document.
4. **<ARTICLE> and <SECTION>:** These tags are used to create articles and sections within a webpage. An article is an independent, stand-alone piece of discrete content like a blog post, or a news item. Article represents a full block of content. Section is used as a way of sectioning a page into different subject areas, or sectioning an article. <ARTICLE> and <SECTION> tags, if properly used will increase search engine visibility of the webpage.



5. **<OUTPUT>**: This tag represents the result of a calculation usually performed by a script.
6. **<DETAILS>**: Sometimes website needs to have an expanding/collapsing block of text. With **<DETAILS>** tag it is easier to make a simple block that expands and collapses the content when the header is clicked.
7. **<FIGURE>** and **<FIGCAPTION>**: **<FIGURE>** is a container for content like images, and **<FIGCAPTION>** element represents a caption or legend for a figure. It comes inside the **<FIGURE>** tag.
8. **<PROGRESS>** and **<METER>**: **<PROGRESS>** and **<METER>** are similar. The **<PROGRESS>** tag represents the progress of a task. It is useful for things like displaying the progress of a file upload. **<METER>** tag is used to display a scalar measurement within a known range, like showing hard drive usage.



Let us conclude

In this chapter, we have gone through some of the advanced features of HTML. Different kinds of lists are discussed to make the text more presentable. The beauty of the web pages can be enhanced by including marquees, images, audio and video. We have also discussed the importance of hyper linking and familiarised with various kinds of hyperlinks. Creating a table with the tags **<TABLE>**, **<TR>**, **<TH>**, and **<TD>**, and their attributes were discussed. The importance of **Rowspan** and **Colspan** attributes are identified. We can divide the browser window into different frames using framesets so that different pages can be opened and viewed at the same time. We have also seen that division of browser window can be done in different ways with the concept of nested framesets. We have discussed how **Target** attribute is used to create link between different frames of the browser window. We have also identified the utility of **Form** in the web page to submit data to the server using online facility. We have seen various elements such as text box, password, radio button, text area, select box, etc. that facilitate the input of data in different ways. We have just mentioned the concept of client side programs and server side programs. So, this chapter is a stepping stone to the next chapters in which we will discuss how the input data in the **Form** is verified and how the data is stored or processed in the server.



Let us practice

1. Write an HTML code for a web page of a district in Kerala with the following details and features:
 - A heading followed by a paragraph of 3 sentences about the district using text formatting tags and attributes.
 - A list of the tourist places in the district.
2. Write an HTML code for a web page for your school with the following details and features:
 - A heading followed by a paragraph of 3 sentences about the district using text formatting tags and attributes.
 - Include a list of five co-curricular activities like NCC, NSS, Clubs, etc.
3. Write an HTML code for a web page to show the following details:

Components of a Computer

- **Hardware**
 1. I/O Devices
 2. RAM
 3. Hard Disk & DVD Drive
- **Software**
 1. Operating System
 2. Application Programs

4. Write an HTML code to present some details about Onam - the festival of Kerala, in a web page with the following features:
 - A heading with attractive font characteristics.
 - An image of "Vallam Kali" (boat race) in the background of the page.
 - Internal links to any two of the traditional events like "Pookkalam", "Thumpi Thullal", "Thiruvathira", "Onavillu", "Vallam kali", "Kummatti", "Pulikali", etc.
5. Write HTML codes to create two web pages to show some information about the higher secondary and high school sections of your school. Create another web page to divide the browser window horizontally into two. In the first frame, a brief introduction of the school and two links are to be provided - one for HSS and the other for HS. On clicking these links the respective web page is to be opened in the second frame.



6. Write an HTML code to show the following table in a web page and also provide an external link to the website of Kerala Police given below the table:

Road Accidents in Kerala during 2012 - 2014

Year	Total Number of		
	Cases	Persons Killed	Persons Injured
2012	36174	4286	41915
2013	35215	4258	40346
2014	36282	4049	41096

Data Source: www.keralapolice.org

7. Write an HTML code to display an application form as shown below:

APPLICATION FOR THE BEST STUDENT AWARD

Name: Sex: Male ☐ Female ☐

Class & Division: ▼

Total Grade Point in Class XI:

Average Grade Point in Termly Exams in Class XII:

Cocurricular Activities:

NCC ☐ NSS ☐ Sports ☐ Arts ☐ Literary ☐

Other Achievements:

Let us assess

1. Find the errors in the following and correct it.

- a. `<UL Type = "i" Start = 3>`
- b. ``
- c. `<HTML>`
`<HEAD><TITLE><HEAD></TITLE>`
`<BODY> this is the body of the HTML`
`document</BODY>`
`</HTML>`

2. Rohit created a table in HTML but a border was not visible. What could be the reason?
3. _____ attribute is used with <A> tag to display the linked page in a specified frame.
4. Your computer teacher asked you to prepare a list of your best friends in a webpage. Which tag will you prefer? Write HTML code segment for this list.
5. Name the possible values of type attribute of tag.
6. Write the attributes of tag.
7. How do you create a list using upper case letters for numbering?
8. Suppose you want to create a list using lower case letters for numbering. How can this be made possible?
9. How can we create a list starting from 6 onwards?
10. Write the HTML code for creating the following webpage:

ABC Pvt. Ltd.	
Kerala	
1.	Health Care
2.	Baby Products <ul style="list-style-type: none"> • Toys • Dress
3.	Ladies Wear <ul style="list-style-type: none"> • Kurthas • Jeans

11. Varun is creating a web page. He wants to create a link on the word 'sample' to a file named *sample.html* that is stored in a subdirectory *Exam* in *D drive*. Write the HTML command for this purpose.
12. Name the tag which has Noshade attribute.
13. Sunil developed a personal website, in which he has to create an e-mail link. Can you suggest the protocol used to achieve this link.
14. Shahir wants to connect his webpage to www.gmail.com. Write the tag and attribute required for this.
15. Mention the characteristics of two types of hyperlinks available in HTML.
16. Differentiate between Cellspacing and Cellpadding.
17. Differentiate between Text control and Textarea control used in Form.
18. Action and _____ are the main attributes of the <FORM> tag.



19. Say true or false:
- The default value of Align attribute of <TABLE> tag is center.
 - <FRAME> is a container tag.
 - Scrolling prevents users from resizing the border of a specific frame.
20. Which tag does allow partitioning of the browser window into different sections?
21. List down the main attributes of <FRAME> tag.
22. Create a frameset dividing the page into two sections vertically. Give names of your favorite football players in left frame. The profile of selected players should appear in the right Frame.
23. Predict the output of the following code:

```
<HTML>
<HEAD><TITLE>A simple table</TITLE></HEAD>
<BODY>
<TABLE border="1" Cellspacing= "1" Cellpadding= "10">
  <TR><TD> 1 </TD><TD> 2 </TD><TD> 3 </TD></TR>
  <TR><TD> 4 </TD><TD> 5 </TD><TD> 6 </TD></TR>
  <TR><TD> 7 </TD><TD> 8 </TD><TD> 9 </TD></TR>
</TABLE>
</BODY>
</HTML>
```

1	2	3
4	5	6
7		

24. Write an HTML code to create the given table:
25. Write an HTML code to accept your e-mail, address, phone number and password.
26. Write an HTML code to create a list of 3 bikes of your choice in a frame. Link each one to display the description with a picture in another frame.
27. Raju created a web page as follows. But he is unable to view any tabular format in the web page, when it is displayed in the browser. Find out the reason for it and correct it.

```
<HTML>
<HEAD><TITLE> My Page </TITLE></HEAD>
<BODY>
<TABLE><TR><TH>Roll No. </TH><TH> Name </TH></TR>
<TR><TD>1 </TD><TD> Huda </TD></TR>
<TR><TD>2 </TD><TD>Bincy</TD></TR>
</TABLE>
</BODY>
</HTML>
```



6

Cascading Style Sheet

Significant Learning Outcomes



After the completion of this chapter, the learner

- explains the need to use CSS in a web page.
- identifies the various parts of a style rule.
- explains the method to embed style rule in a web page.
- distinguishes different types of selectors.
- uses properties applicable to format text in a web page.
- explains various properties used for displaying text.
- groups selectors in CSS in a web page.
- differentiates the various methods to embed style rules in a web page.
- creates web pages that make use of style rules.

In the previous chapters, we studied how to create web pages using HTML. Building a website with HTML is only half the story. We learned how to use the `` tag, `<P>` tag, `` tag, etc. to include text and images in the web page. A web page can use images to make the page more attractive. But the use of excess images for a web page is not desirable, because it will slow down the loading of web pages through the Internet. So, a good website should use minimum images, but at the same time, it must be attractive also. Cascading Style Sheet (CSS) is an extension of HTML by which we can enhance the look and feel of a website very easily. We can control the appearance of entire web pages in a website, by simply modifying a single file in the website. In this chapter, we will learn the basic concepts of using CSS in an HTML page.

6.1 Need to use CSS in a web page

We all know how to use a word processor to create a document. Using word processor, we can insert an image at any location in the document very easily. We can give different left or right margins for different paragraphs in the document. We can set foreground colour and background colour for paragraphs in a



document very easily. Now, think of doing these things in a web page. While creating a web page, is it possible to place an image at any location in the web page as you desired? Can you set different margins for different paragraphs or give a background colour for a paragraph? The tags in HTML provide only limited attributes to set the visual appearance of the contents in the web page. HTML is the language used for describing the appearance of documents when opened in a browser. Using CSS, we can control the colour of text, the style of fonts, the spacing between paragraphs, the location of images, etc. very easily. CSS was first proposed by Hakon Wium Lie in 1994. It has now become the most powerful tool in the hands of a web designer to make the page visually impressive.



Hakon Wium Lie

Advantages of using CSS

CSS provides an easy way to set the layout of the entire website. The following are some of the advantages of CSS.

Easy to change layout: We can very easily change the style of a web page using CSS. Instead of using CSS for each web page separately, a single CSS file can be created and it can be used by all the web pages in the site. The browser will download the CSS file only once, and it will be used for the entire pages in the web site. This makes it easy to change the style of the entire website.

Reduce the size of a web page: We can separate CSS styles into a separate file and link it with an HTML page. This will reduce the size of the web page.

Reduction in bandwidth: Using a single CSS file for the entire website reduces the size of the files to be downloaded. This will reduce the network traffic load.

Consistency in web pages: Since the appearance of the entire web pages in the site is defined by a single CSS file, the appearance of all the web pages remains the same.

Viewing options: Screen size of media such as computers, mobile phones, etc. differs considerably. The web page designed for a computer may not be viewed properly in a mobile phone. If we use CSS, we can create separate CSS file for mobile phones and computers. Then the same HTML page can make use of these different CSS files to make it suitable to be viewed in that particular device.

Saves time: The size of the HTML file becomes considerably smaller, when we use CSS. This will reduce the coding time for the web designer. This also improves the speed of page loading.

6.2 Style rules

A style rule tells the browser how to render a particular element such as a text, paragraph, image, button, etc. on a web page. Each web browser has its own style rule for rendering each element in a web page. We can define our own style rules to make the element visually attractive.

A style rule can be defined as follows:

A style rule has two portions: a **selector** and a **declaration block**.



Selector: It is the HTML element or elements to which the CSS rule is applied. It tells the browser how elements should be rendered. In the above rule, 'P' is the selector. Hence, the rule will be applied to all the `<P>` tags in the web page.

Declaration block: It can contain several declarations enclosed within curly braces, { and }. A declaration has a property name, a colon, and one or more values separated by commas. A style rule can contain more than one declaration. In such cases all the declarations must be separated by semicolon. In the above example, 'margin' is a property and '40px' is its value.

6.3 Embedding style rules in an HTML page

A style rule can be embedded in an HTML page using `<STYLE>` tag. This tag has an attribute namely **Type**. This attribute is given the value `'text/css'` to specify that the content that follows is a CSS rule. So the style rules must be embedded between the `<STYLE>` and `</STYLE>` tags as follows:

```
<STYLE Type = "text/css">
    style rules
</STYLE>
```

Example 6.1: To create a simple web page

```
<HTML>
<HEAD> <TITLE>Simple Web Page</TITLE>
</HEAD>
<BODY>
    <P>
        We can set the style rules for a paragraph
        to improve its visual appearance.
    </P>
</BODY>
</HTML>
```



We can use the Geany editor or any other text editor that you have used for creating web pages in the previous chapters. Save the above file as Code 6.1.html. Then open the file in any web browser. We will get the output as shown in Figure 6.1.

All the tags used in the above web page are quite familiar to us. Now let us add a simple CSS rule in the above html document.

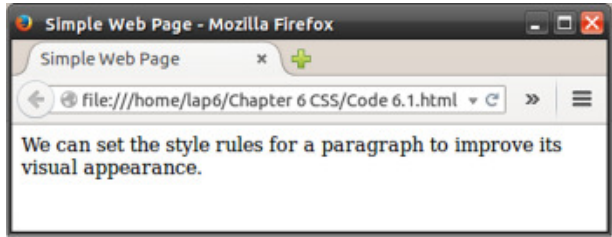


Fig. 6.1: A web page without using CSS styles

Example 6.2: To illustrate a simple CSS rule

```
<HTML>
<HEAD><TITLE>CSS Margin</TITLE>
<STYLE Type= "text/css">
P {
    margin: 40px;
}
</STYLE>
</HEAD>
<BODY>
<P>
We can set the style rules for a paragraph to improve its
visual appearance.
</P>
</BODY>
</HTML>
```

The style rule is included in the above web page using <STYLE> tag in the head section. The output is given in Figure 6.2. The style rule tells the browser that the content within the <P> tag must have a margin 40px from all sides of the browser window. We can compare the output in Figure 6.2 with Figure 6.1 and observe the effect of the CSS rule in the web page.

Now, let us make a little modification in the style rule as follows:



Fig. 6.2: A web page using CSS rule

Example 6.3: To add more styles to a paragraph

```

<HTML>
<HEAD><TITLE>CSS Paragraph</TITLE>
<STYLE Type= "text/css">
P {
    margin: 40px;
    background-color: #eee4c1;
    font-family: "Courier New";
}
</STYLE>
</HEAD>
<BODY>
<P>
We can set the style rules for a paragraph to improve
its visual appearance.
</P>
</BODY>
</HTML>

```

The style rule in the above code contains two more declarations. We can see the semicolon at the end of each declaration. Here each declaration is placed in a separate line. It is not necessary to put them in separate lines. We can type all the declarations in a single line also. But typing style rules in multiple lines certainly increases the readability of the code. The output of the above code is given in Figure 6.3. We will study about various properties and their values later in this chapter.



Fig. 6.3: A web page containing style rules for a paragraph

In the above web page, the paragraph is given a margin, a background colour and a particular font name also. We can note that we have not made any change in the body section of the web page. The rendering of the paragraph (<P> tag) is fully controlled by the style rules which is given at the head section of the web page.

Now, let us make a little modification in the <BODY> section as in Example 6.4. The body section contains some content within <P> tag and also some content outside the <P> tag.

**Example 6.4: To illustrate the working of paragraphs with and without style rules**

```

<HTML>
<HEAD><TITLE>CSS Paragraph</TITLE>
<STYLE Type= "text/css">
P {
    margin: 40px;
    background-color: #eee4c1;
    font-family: "Courier New";
}
</STYLE>
</HEAD>
<BODY>
<P>
We can set the style rules for a paragraph to improve
its visual appearance.
</P>
This line is outside the paragraph.
</BODY>
</HTML>

```

We can see the output in Figure 6.4. See how the content outside the paragraph is displayed on the web page. Since the text which is outside the paragraph is within the <BODY> tag, it is rendered by the style rule for the <BODY> tag. But we have not specified any style rule for the <BODY> tag.

Each browser has a default style rule for rendering contents within each element (tag). So the text is rendered by the default style rule for the <BODY> tag by the browser.

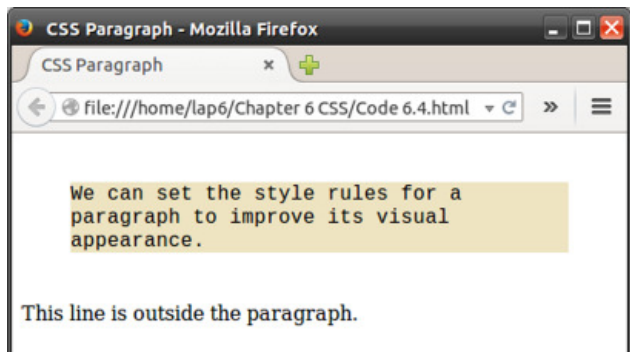


Fig. 6.4: A web page consisting of paragraphs that use and do not use style rules

Let us see how we can give a style rule for the <BODY> tag.

Example 6.5: To illustrate CSS rules for <BODY> tag

```

<HTML>
<HEAD><TITLE>CSS Body</TITLE>
<STYLE Type= "text/css">
P {
    margin: 40px;

```

```

        background-color: #eee4c1;
        font-family: "Courier New";
    }
    BODY {
        margin: 20px;
        background-color: #aae4c1;
        font-family: "Tahoma";
        font-size: 20px;
    }
</STYLE>
</HEAD>
<BODY>
<P>
We can set the style rules for a paragraph to improve
its visual appearance.
</P>
This line is outside the paragraph.
</BODY>
</HTML>

```

The above web page defines style rules for two elements, `<P>` tag and `<BODY>` tag. The body section of this code is exactly similar to Example 6.4. Look at the output of the above code in Figure 6.5.

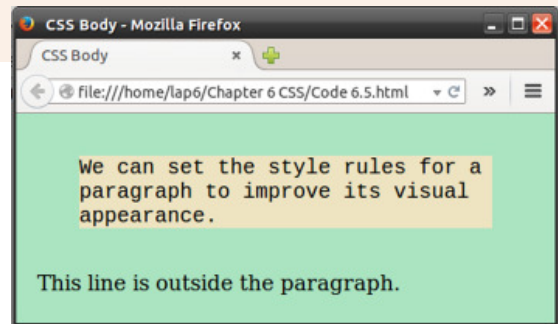


Fig. 6.5: A web page using CSS rules for `<BODY>` tag

The content within the body section is rendered by the style rule specified for the `<BODY>` tag. Thus we can control the visual effects of the contents within the web page without making any modification in the body section.

Example 6.6: Example displaying use of style rule for `<P>` tag

```

<HTML>
<HEAD> <TITLE>CSS Paragraphs</TITLE>
<STYLE Type= "text/css">
P {
    margin: 40px;
    background-color: #eee4c1;
    font-family: "Courier New";
}
BODY {
    margin: 20px;
    background-color: #aae4c1;
}

```



```

        font-family: "Tahoma";
        font-size: 20px;
    }
</STYLE>
</HEAD>
<BODY>
<P>
We can set the style rules for a paragraph to improve
its visual appearance.
</P>
This line is outside the paragraph.
<P>
This is another paragraph. The style rule which is de-
fined for <P> tag will be affected to all the
<P> tags in the web page.
</P>
</BODY>
</HTML>

```

We have added one more paragraph to the body section. The output of the above code is given in Figure 6.6. We can see that the style rule defined for the `<P>` tag was applicable for all the paragraphs in the web page.

Can we think of making the above web page without using CSS? Ofcourse, we may use a number of `` tags, `` tags, etc. at different places in the web page to get the same result. But, how will you bring about the same modification in the appearance of all the paragraphs in a web page? We will have to change the attribute values of the `` tag in all the places in the web page. Still, we may not get the correct result as shown in the figure. But if we use CSS, we can easily modify the style rule, written only at one location and the style will be automatically applied to all the `<P>` tag elements in the web page.

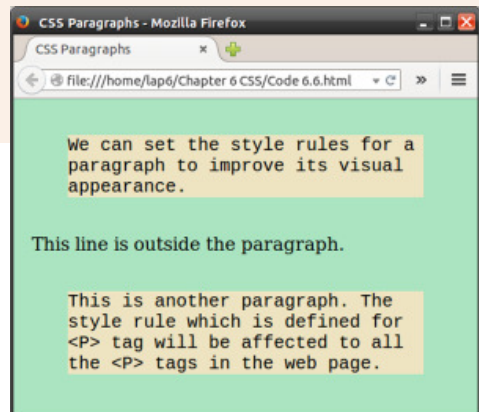


Fig. 6.6: A web page with style rules for `<P>` tag

Know your progress



1. What is a selector?
2. Mention the use of style rules.
3. State whether the statements are true or false
 - a. A style rule has a selector and a declaration block.
 - b. A style rule can contain only one declaration.
4. The CSS property used to set the margin of a page is _____.
5. CSS was proposed by _____.

6.4 Selectors

A selector is an HTML element or set of elements to which a CSS rule is applied. HTML supports different type of selectors. The following are the commonly used selectors in CSS.

6.4.1 Universal selector

It uses the * symbol in place of tag element. The style rule given for the universal selector will be applicable to all the elements in the web page. This selector is rarely used for a web page.

```
<STYLE Type= "text/css">
    * {
        font-family: "Courier New";
        color: red;
    }
</STYLE>
```

To understand the working of the universal selector, let us consider the following web page.

Example 6.7: To illustrate the working of universal selector

```
<HTML>
<HEAD><TITLE>CSS Universal Selector</TITLE>
<STYLE Type= "text/css">
* {
    font-family: "Courier New";
    color: red;
}
</STYLE>
</HEAD>
<BODY>
<P>
Universal selector sets the style rule for all the elements
in the web page.
</P>
This line is outside the
paragraph.
</BODY>
</HTML>
```

The output of the above code is given in Figure 6.7. We can see that the content within the <BODY> tag

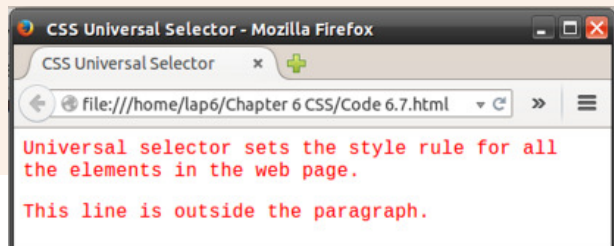


Fig. 6.7: A web page using universal selector



and `<P>` tag are rendered exactly in the same fashion specified in the style rule given for the universal selector.

6.4.2 Type selector

It uses the element name or tag name. The style rule given for a particular element of tag will be applicable for all the occurrences of that tag in the web page.

```
<STYLE Type= "text/css">
  P {
    font-family: "Courier New";
    color: red;
    margin: 10px;
  }
</STYLE>
```

When we specify an HTML element in a style rule, do not enclose the element in angle brackets. The style rule specified in the above example is applicable for all `<P>` tags in the web page. Note that we have used only the letter P without the angle brackets in the style rule.

Example 6.8 : To illustrate the use of type selector

```
<HTML>
<HEAD> <TITLE>CSS Type Selector</TITLE>
<STYLE Type= "text/css">
P {
    font-family: "Courier New";
    color: red;
    margin: 10px;
}
</STYLE>
</HEAD>
<BODY>
<P>
Type selector sets the style rule for all occurrences of
a particular element in the web page.
</P>
This line is outside the paragraph.
</BODY>
</HTML>
```

The output of the above code is given in Figure 6.8. We can see that the style were applied to only the `<P>` tag in the web page.

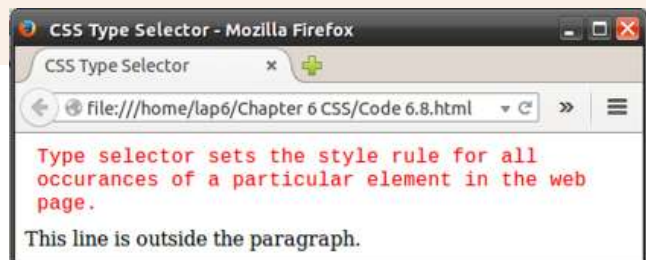


Fig. 6.8: A web page using type selector

6.4.3 Class selectors

We have learned how to use type selector to set style rules for different elements in a web page. What will we do, if only two or three paragraphs in the web page have a style different from the other paragraphs? If we specify a style rule for a <P> tag, the rule will be applicable for all the paragraphs in the web page which is not desired in this case. Using class selector, we can apply a style rule to the desired element in the web page. When we use a class selector, we write the class name preceded by a dot as shown below.

```
<STYLE Type= "text/css">
.myStyle {
    font-family: "Courier New";
    color: red;
    margin: 10px;
}
</STYLE>
```

In the above example, 'myStyle' is the class name. We can give any name for a class. Along with alphabets, we can use numbers also. A class name cannot contain space. A class name is case sensitive for some browsers. Hence we must be careful while using upper or lower case letters in the class name. We can also see that the class name in the above style rule is preceded by a dot symbol. This dot symbol denotes that the selector is a class selector. Any selector that precedes a dot is a class selector. Now let us see how a class selector is used in a web page.

Example 6.9: To illustrate class selectors

```
<HTML>
<HEAD><TITLE>CSS Class Selector</TITLE>
<STYLE Type= "text/css">
.myStyle {
    font-family: "Courier New";
    color: red;
    margin: 10px;
}
</STYLE>
</HEAD>
<BODY>
<P>
This is a paragraph that does not make use of any style
rule.
</P>
```



```
<P Class= "myStyle">
This is another paragraph that makes use of a style rule
using class selector.
</P>
</BODY>
</HTML>
```

Carefully observe the line `<P Class= "myStyle">` in the second paragraph of the body section of the above web page. It denotes that the paragraph should be rendered by the style rule specified by the class name 'myStyle'. That means, the class selector style rule will be applicable only to those elements where **Class** attribute is given the value 'myStyle'. While giving value for the class attribute, we do not use the dot symbol. It is used only when we define the style rule within the `<STYLE>` tag. The output of the above code is given in Figure 6.9.

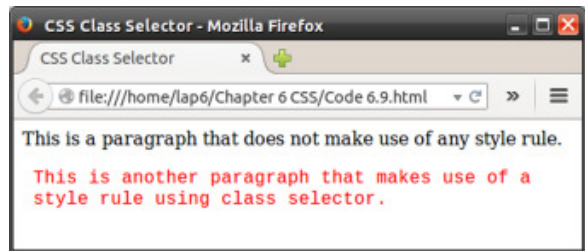


Fig. 6.9: A web page using class selector

Let us consider another example to understand the use of class selector in detail. Consider the following web page. The body section contains four paragraphs. No modification is made in the style rule.

Example 6.10 : To create a web page that illustrates class selector in detail

```
<HTML>
<HEAD><TITLE>CSS Class Selector</TITLE>
<STYLE Type= "text/css">
.myStyle {
    font-family: "Courier New";
    color: red;
    margin: 10px;
}
</STYLE>
</HEAD>
<BODY>
<P>
This is a paragraph that does not make use of any style
rule.
</P>
<P Class= "myStyle">
This paragraph makes use of a style rule using class
selector.
</P>
```

```

<P>
This paragraph also does not make use of any style rule.
</P>
<P Class= "myStyle">
This is another paragraph that makes use of the same
style rule using class
selector.
</P>
</BODY>
</HTML>

```

The output of the above code is given in Figure 6.10. We can see that the style rule was applied only to two paragraphs in the web page.

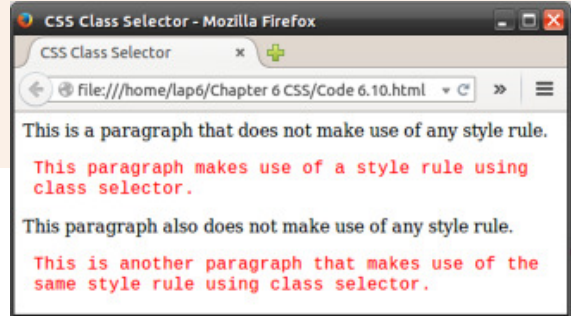


Fig. 6.10: A web page that uses a class selector more than once

6.4.4 ID selectors

These selectors are used to apply a style rule only to a single element in the web page. Just like a class name, an ID name also can be given to a selector. But the ID name should be preceded by a # symbol. The # symbol denotes that the selector is an ID selector.

```

<STYLE Type= "text/css">
    #myStyle {
        font-family: "Courier New";
        color: red;
        margin: 10px;
    }
</STYLE>

```

The following web page makes use of an ID selector.

Example 6.11: To illustrate the working of ID selector

```

<HTML>
<HEAD><TITLE>CSS ID Selector</TITLE>
<STYLE Type= "text/css">
#myStyle {
    font-family: "Courier New";
    color: red;
    margin: 10px;
}
</STYLE>
</HEAD>
<BODY>

```



```

<P>
This is a paragraph that does not make use of any style
rule.
</P>
<P Id= "myStyle">
This is another paragraph that makes use of a style
rule, using ID selector.
</P>
</BODY>
</HTML>

```

We can note the line `<P Id = "myStyle">` in the second paragraph in the body section of the web page. While giving value to the Id attribute, we do not use the `#` symbol. This `#` symbol is used only when we define the style rule within the `<STYLE>` tag. The output of the above code is given in Figure 6.11.

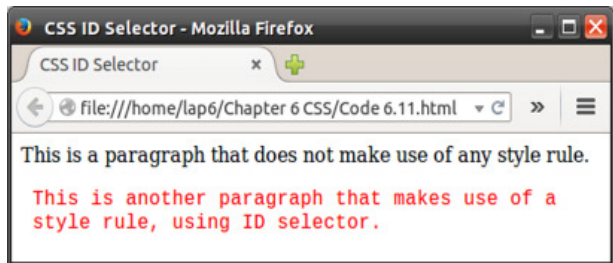


Fig. 6.11: A web page using ID selector

The rule defined by an ID selector can be applied only to a single element in the web page. The reason is that no two elements in the web page can have the same ID name. The rule defined by an ID selector can be applied only to those elements in a web page that have the same ID name. Consider the following example:

Example 6.12: To illustrate the use of ID selector

```

<HTML>
<HEAD><TITLE>CSS ID Selector</TITLE>
<STYLE Type= "text/css">
#myStyle {
    font-family: "Courier New";
    color: red;
    margin: 10px;
}
</STYLE>
</HEAD>
<BODY>
<P>
This is a paragraph that does not make use of any style
rule.
</P>

```



```

<P Id= "myStyle">
This is another paragraph that makes use of a style
rule, using ID selector.
</P>
<P Id= "myStyle">
This is another paragraph that wrongly makes use of a
style rule, using ID selector.
</P>
</BODY>
</HTML>

```

The above code has two paragraphs with the same ID. In HTML no two elements in a web page can have the same ID. But today, some web browsers allow the same ID for more than one element. The output from such a web browser is given in Figure 6.12. If we need to apply a particular style to more than one place in a web page, we must use class selectors rather than ID selector.

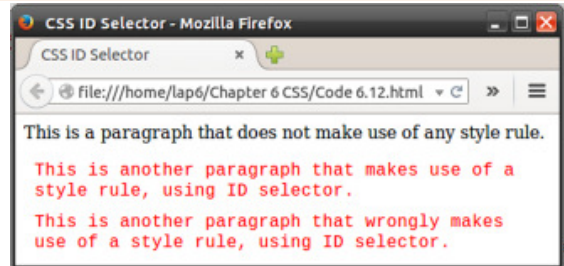


Fig. 6.12: A web page that wrongly uses the same Id for more than one element

6.5 Properties

Properties are the keywords used in style rules. We can give different values for properties. CSS provides a large number of properties. We can classify properties into the following different categories:

6.5.1 Font properties

The following are the important properties applicable to fonts:

Property	Possible values
font-family	name of font or font family
font-style	normal, italic
font-weight	normal, bold
font-size	values in pixels (12px, 13px, 14px, etc.)

font-family: This property is used to specify the font face. We can give the name of the font as the value for this property.



Example:

```
<STYLE Type= "text/css">
  H1 {

      font-family: "Arial";

  }
</STYLE>
```

When we use the above style rule, contents within the <H1> tag will use the 'Arial' font. If necessary, we can give the font name within single or double quotes as follows. If a font name contains spaces in it, it must be enclosed within single or double quotes.

```
<STYLE Type= "text/css">
  H1 {

      font-family: "Times New Roman";

  }
</STYLE>
```

The web pages may be viewed by a large number of people all over the world. They may be using different browsers for viewing the web page. The operating systems they use may also be different. Therefore we cannot be sure whether the font that we specify in this font-family property is present in the client computer. To overcome this issue, we can specify a number of fonts separated by comma as shown below:

```
<STYLE Type= "text/css">
  H1 {

      font-family: "Arial, Courier New, Sans-serif";

  }
</STYLE>
```

In the above case, the browser will search for the Arial font first. If it is not installed in the computer, it will search for the Courier New font and then Sans-serif.

font-style: This property is used to specify a text as italic. The possible values for this property are normal or *italic*.

If we use the above style rule, all the content within the <H1> tag will be displayed in Arial font and will be displayed in *italic* style also. The following example demonstrates the working of these font properties.

Example 6.13: To create a web page using font properties

```

<HTML>
<HEAD><TITLE>CSS Font Styles</TITLE>
<STYLE Type= "text/css">
H1 {
    font-family: "Arial";
    font-style: italic;
}
</STYLE>
</HEAD>
<BODY>
<H1>
This heading is in H1 style
</H1>
</BODY>
</HTML>

```

The output of the above code is given in Figure 6.13. We can see that the content within the <H1> tag is displayed using Arial font and is in *italics*.



Fig. 6.13: A web page displaying font properties

font-weight: This property is used to specify a text as bold. The possible values for this property are normal or bold.

Example:

```

<STYLE Type= "text/css">
    .boldStyle {
        font-weight: bold;
    }
</STYLE>

```

The above code uses a class selector. To explain the working of font-weight property, let us discuss another example.

Example 6.14: To illustrate the use of font-weight property

```

<HTML>
<HEAD> <TITLE>CSS Font Styles</TITLE>
<STYLE Type= "text/css">
    .boldStyle {
        font-weight: bold;
    }

```



```

.normalStyle {
    font-weight: normal;
}

</STYLE>
</HEAD>
<BODY>
<P Class= "normalStyle">
This is in normal weight.
</P>
<P Class= "boldStyle">
This is in bold weight.
</P>
</BODY>
</HTML>

```



Figure 6.14 gives the output of the above code. We can see that the two paragraphs in the web page are displayed in normal and bold weights, respectively.

Fig. 6.14: A web page displaying font-weight property

font-size: It is used to set the size of a font. We can give values such as 12px, 13px, 14px, etc. for this property. The px in 12px denotes pixels.

```

<STYLE Type= "text/css">
    .size12 {
        font-size: 12px;
    }
</STYLE>

```

The following web page explains the working of this property.

Example 6.15: To create a web page to display the working of font-size property

```

<HTML>
<HEAD><TITLE>CSS Font Styles</TITLE>
<STYLE Type= "text/css">
.size12 {
    font-size: 12px;
    font-family: "Tahoma";
}
.size16 {
    font-size: 16px;
    font-family: "Arial";
}

```

```

.size20 {
    font-size: 20px;
    font-family: "Times New Roman";
}
</STYLE>
</HEAD>
<BODY>
<P Class= "size12">
This is in size 12px.
</P>
<P Class= "size16">
This is in size 16px.
</P>
<P Class= "size20">
This is in size 20px.
</P>
</BODY>
</HTML>

```

The output of the above example is given in Figure 6.15.

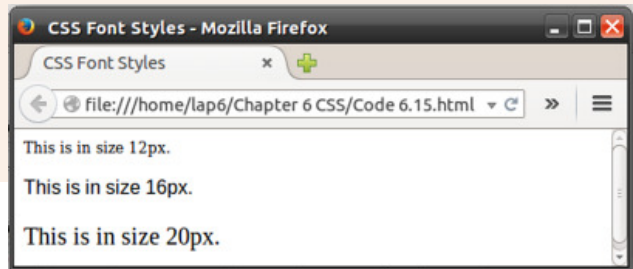


Fig. 6.15: A web page displaying font-size property

6.5.2 Text properties

Given below are the important properties used for manipulating the display of the text.

Property	Possible values
text-align	left, right, center, justify
text-decoration	none, underline, overline, line-through
text-indent	values in pixels. (20px, 25px,..., etc.)
line-height	numbers such as 1, 1.5, 2, 2.5,

text-align: It is used to align the text. The possible values are left, right, center and justify.

```

<STYLE Type= "text/css">
    .alignRight {
        text-align: right;
    }
</STYLE>

```

We can see the text-align property in action from the following web page.

**Example 6.16: To create a web page to display the working of text-align property**

```
<HTML>
<HEAD>
<TITLE>CSS Text Styles</TITLE>
<STYLE Type= "text/css">
.alignRight {
    text-align: right;
}
.alignLeft {
    text-align: left;
}
.alignCenter {
    text-align: center;
}
.alignJustify {
    text-align: justify;
    font-family: "Arial";
    font-size: 16px;
    color: blue;
}

</STYLE>
</HEAD>
<BODY>
<P Class= "alignRight">
This paragraph is right aligned.
</P>
<P Class= "alignCenter">
This paragraph is center aligned.
</P>
<P Class= "alignLeft">
This paragraph is left aligned.
</P>
<P Class= "alignJustify">
This paragraph is aligned with justify. When we align a
paragraph with this option, both the left and right side
will be aligned with the borders of the browser.
</P>
</BODY>
</HTML>
```


The output of the above code is given in Figure 6.16. We can see that different paragraphs are aligned in different ways specified by the style rules.

text-decoration: It is used to underline, overline and draw a line through the text. The possible values are underline, overline, line-through and none.

```
<STYLE Type= "text/css">
    .underline {
        text-decoration: underline;
    }
</STYLE>
```

We can make use of this property in the following code for the web page shown in Figure 6.17.

Example 6.17: To create a web page to display the use of text-decoration property

```
<HTML>
<HEAD><TITLE>CSS Text Styles</TITLE>
<STYLE Type= "text/css">
    .underline {
        text-decoration: underline;
        font-family: "Arial";
        font-size: 18px;
    }
    .overLine {
        text-decoration: overline;
        font-family: "Arial";
        font-size: 18px;
    }
    .lineThrough {
        text-decoration: line-through;
        font-family: "Arial";
        font-size: 18px;
    }
</STYLE>
</HEAD>
<BODY>
<P Class= "underline">
This paragraph is underlined.
</P>
```

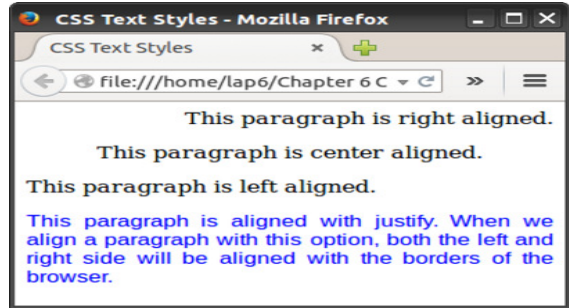


Fig. 6.16: A web page displaying text-align property



```
<P Class= "overLine">
This paragraph is overlined.
</P>
<P Class= "lineThrough">
This paragraph is linethrough.
</P>
</BODY>
</HTML>
```

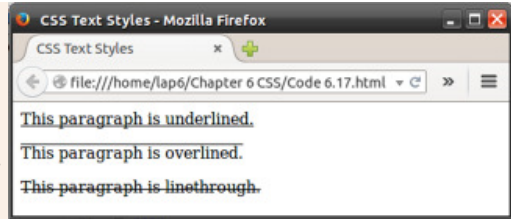


Fig. 6.17: A web page displaying font-decoration property

text-indent: It is used to set the starting position of the first line in a paragraph. The value for this attribute can be given in pixels as 30px, 40px, etc. We can also give negative value for this attribute as -30px. If a negative value is given to text-indent, the starting position of the first line is moved to the left margin.

```
<STYLE Type= "text/css">
.indent {
    text-indent: 30px;
    font-family: "Arial";
    font-size: 18px;
    text-align: justify;
    margin: 50px;
}
</STYLE>
```

We can make use of this in the following example.

Example 6.18: To create a web page that displays the use of text-indent property

```
<HTML>
<HEAD><TITLE>CSS Text Styles</TITLE>
<STYLE Type= "text/css">
.indent30 {
    text-indent: 30px;
    font-family: "Arial";
    font-size: 18px;
    text-align: justify;
    margin: 50px;
}
.negativeIndent {
    text-indent: -30px;
    font-family: "Arial";
    font-size: 18px;
    text-align: justify;
    margin: 50px;
}
</STYLE>
</HEAD>
```

```

<BODY>
<P Class= "indent30">
This paragraph has the indent 30. The indent sets the
starting position of the first line in the paragraph. The
indent value can be given in pixel.
</P>
<P Class= "negativeIndent">
This paragraph has the indent -30. This shows that we can
give negative value as the indent. When a negative value
is given for the indent, the starting position of the
first line in the paragraph is moved before the margin.
</P>
</BODY>
</HTML>

```

The output of the above example is given in Figure 6.18.

In the output, we can see that the starting position of the first line in the first paragraph is moved 30 pixels towards the right of the margin and in the second paragraph, the first line is moved 30 pixels towards the left of the margin.

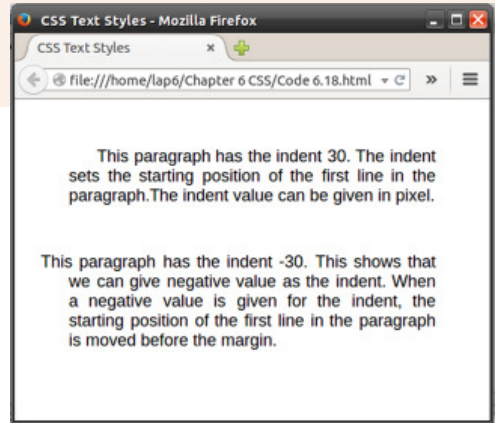


Fig. 6.18: A web page displaying text-indent property

line-height: It is used to specify the height of a line. The value can be a number or a fraction. If we give the value as 2, then the height of the line will be double the height of the actual line. If the value is 1.5, the height will be one and half times the height of the actual line.

```

<STYLE Type= "text/css">
    .height2 {
        line-height: 2;
    }
</STYLE>

```

The following example demonstrates the working of the property line-height.

Example 6.19: To create a web page to display the working of line-height property

```

<HTML>
<HEAD><TITLE>CSS Text Styles</TITLE>
<STYLE Type= "text/css">
    .height1 {
        line-height: 1;
        font-family: "Arial";
        font-size: 18px;
    }
</STYLE>

```



```

        text-align: justify;
        margin: 40px;
    }
    .height1_5 {
        line-height: 1.5;
        font-family: "Arial";
        font-size: 18px;
        text-align: justify;
        margin: 40px;
    }
    .height2 {
        line-height: 2;
        font-family: "Arial";
        font-size: 18px;
        text-align: justify;
        margin: 40px;
    }
</STYLE>
</HEAD>
<BODY>
<P Class= "height1">
Lines in this paragraph has normal height. The line-
height property is given the value 1 for this paragraph.
</P>
<P Class= "height1_5">
Lines in this paragraph is one and half times the actual
height of the line. The line-height property is given
the value 1.5 for this paragraph.
</P>
<P Class= "height2">
Lines in this paragraph is double
the height of the actual line.
The line-height property is given
the value 2 for this paragraph.
</P>
</BODY>
</HTML>

```

The output of the above code is given in Figure 6.19. We can see the difference in the height of the lines in the different paragraphs. By increasing the height of a line, we are actually increasing the gap between the lines.

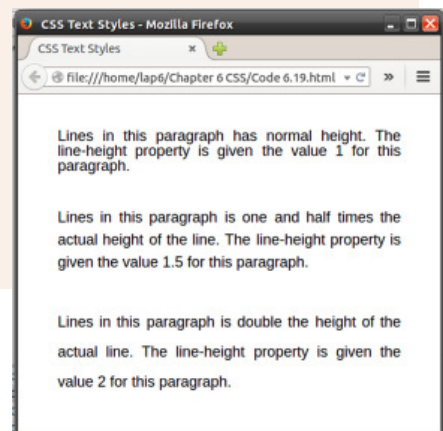


Fig. 6.19: A web page displaying line-height property

Know your progress



1. What is the difference between class selector and ID selector?
2. The selector used to apply a style rule to only a single element in the web page is _____.
3. The selector used to set style rules for the entire elements in a web page is _____.
4. The property used to set the line height is _____.
5. The property used to set the starting position of the first line in a paragraph is _____.
6. The property used to underline a text is _____.
7. A paragraph can be aligned in different ways using _____ property.
8. What is the advantage of universal selector?
9. What are the values that can be given to the text-align property of CSS?

6.6 Ways to add CSS to a web page

In the previous examples, we used CSS rules in our web page using the <STYLE> tag. There are three different methods to include CSS in a web page. We will discuss these methods in the following section.

6.6.1 Internal style sheet

Here style rules are included between <STYLE> and </STYLE> tags directly in an HTML document. These tags are placed inside the <HEAD> section of an HTML page. We used this method to include CSS in the previous examples. Consider the following example.

Example 6.20: To illustrate the use of internal style sheet

```
<HTML>
<HEAD><TITLE>CSS Internal</TITLE>
<STYLE Type= "text/css">
p {
    margin: 40px;
    background-color: #eee4c1;
    font-family: "Courier New";
}
</STYLE>
</HEAD>
```



```
<BODY>
<P>
Inline style sheet
is used when a web
page has a unique
style.
</P>
</BODY>
</HTML>
```

The output of the above example is given in Figure 6.20.

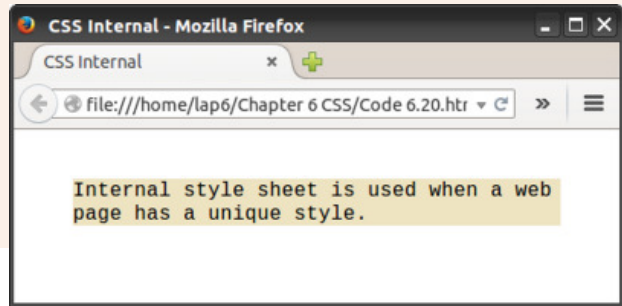


Fig. 6.20: A web page illustrating internal style sheet

6.6.2 External style sheet

In this method, the style rules are entered and saved in a separate CSS file. This CSS file can be linked to any web page where the style rules are to be applied. This is the most powerful and useful method to include style rules in a web page. When we save the CSS file, the file name must be given an extension .css. This CSS file is included in a web page using <LINK> tag.

Example 6.21: To create a web page to illustrate the use of external style sheet

Let us create a text file using the following content and save it as 'myStyle.css'.

```
BODY {
    background-color: lightgreen;
}

P {
    font-family: "Arial";
    font-style : italic;
    color: blue;
}
```

Now, create an HTML file as follows.

```
<HTML>
<HEAD><TITLE>CSS Internal</TITLE>
<LINK Rel= "stylesheet" Type= "text/css" Href=
"myStyle.css">
</HEAD>
<BODY>
<P>
External style sheet is ideal when a style is applied to
many pages.
</P>
</BODY>
</HTML>
```


We can see the following line in the above code:

```
<LINK Rel= "stylesheet" Type= "text/css" Href= "myStyle.css">
```

Here the <LINK> tag makes use of three attributes namely Rel, Type and Href in it. Rel attribute is used to specify the relation between the current document and the linked document. Here the value of Rel attribute, 'stylesheet' specifies that the linked file is the stylesheet for the web page. It is used only if the Href attribute is present. Type property specifies that the linked file is a CSS file and Href is used to mention the path and file name of the external CSS file. The output of the above code is given in Figure 6.21.

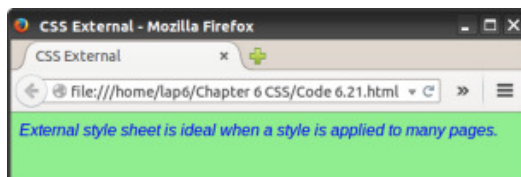


Fig. 6.21: A web page illustrating external stylesheet

The biggest advantage of using this method is that when we define style rules for various elements in a separate file, the same file can be included in all the web pages of a web site. Hence all web pages in a website will have a similarity in their appearance. If we require any modification in the style, we need to modify only a single CSS file. The changes will automatically be reflected in all the web pages in the site.

6.6.3 Inline style

It uses the Style attribute of the HTML tags. Properties and their corresponding values can be directly assigned to this attribute. This method does not make use of the power of CSS. Therefore, using this style is undesirable for web developers. Let us consider the following example.

Example 6.22: To illustrate the use of inline style

```
<HTML>
<BODY><TITLE>CSS Inline</TITLE>
<H2 Style= "font-family:'Courier New'; color:blue;">
This head uses inline style.
</H2>
<H2>
This head does not use any style.
</H2>
</BODY>
</HTML>
```

We can see that the style rule is included in the <H2> tag using **Style** attribute. The properties are given within double quotes and their corresponding values are specified within single quotes. Each property-value pair must be separated by a semicolon. The output of the above code is given in Figure 6.22.



We can also note that the style rule given for the first <H2> tag does not have any effect on the second <H2> tag. Therefore, this method cannot be used to apply a style rule for all the occurrences of a particular element.

6.7 Grouping of selectors

In all previous examples, we defined a style rule only for a single element in a web page. If we need to define the same style rules for more than one element, we can group those elements as:

```
P, H1 {
    background-color: #eee4c1;
    font-color: blue;
}
```

In the above code, the style rule is applicable to the two elements <P> and <H1>. The elements are separated by a comma for defining style rules. Similarly, we can group any number of elements. Consider the following example.

Example 6.23 : To illustrate the grouping of selectors

```
<HTML>
<HEAD><TITLE>CSS Grouping</TITLE>
<STYLE Type= "text/css">
P, H1 {
    background-color: #eee4c1;
    color: blue;
}
```

```
</STYLE>
```

```
</HEAD>
```

```
<BODY>
```

```
<H1>THIS IS H1 HEAD</H1>
```

```
<P>
```

The style rule defined for the <H1> tag is applicable for this paragraph also.

```
</P>
```

```
<H2>THIS IS H2 HEAD</H2>
```

```
</BODY>
```

```
</HTML>
```



Fig. 6.22: A web page illustrating inline style

The style rules defined will be applicable in all the places where these elements are specified in the web page. The output of the above code is given in Figure 6.23. Note that the style rule defined was applied only to the tags <H1> and <P>.



Let us conclude

This chapter introduces CSS for designing web pages. CSS can be used to provide a uniform layout and design for web pages. The four different types of selectors namely, universal, type, class and ID can be used for

defining styles. The font and text properties in CSS are also discussed here. CSS consists of several properties which we can explore ourselves. These properties allow you to create attractive web pages. CSS styles can be added to HTML documents as internal style sheet, external style sheet and as inline style. Grouping of selectors is also introduced in this chapter. This chapter provides us with the basic concepts of CSS, that allow further experiment with different styles and create attractive websites.



Fig. 6.23: A web page displaying grouping of selectors



Let us practice

1. Design a web page that promotes cleanliness in public places. The web page should contain a description for cleanliness, images and a set of instructions for keeping public places clean. The CSS style rules should be specified as internal style sheet using class selectors. Following are the style rules to be followed.
 - Heading - font-Tahoma, size-18, colour-green, underline
 - Paragraphs - font - Garamond, size - 12, colour - blue
 - Lists - font - Arial, size - 12, colour - brown, italics, line height should be 1.5 lines

The paragraphs should have a margin of 30 pixels and background colour yellow.
2. Design a web page on Akshaya centers in Kerala. Use an external style sheet to format the web page. Give suitable font, colour and line spacing for heading and paragraphs using type selector.
3. Design a web page for tourism promotion - Incredible India - and format it using external style sheet. Class selectors should be used to provide the style rules. Give suitable background colour, font, margins and font colour for the whole page. The popular tourist destinations should be given in brown colour, using Tahoma font and in bold.



Let us assess

1. State whether the statements are true or false.
 - a. Use of style sheet reduces the size of a web page.
 - b. Style rules enhance the visual appearance of a web page.
 - c. There is only one method to include style rule in an HTML page.
 - d. Class selector is used when a style rule is to be applied only for some selected elements in the web page.
2. The separator used for grouping selectors in a style rule is _____.
3. The tag used to include an external CSS file in a web page is _____.
4. The attribute of an HTML element used to include style rules inline is _____.
5. The most powerful method to include style rule in a web page is _____.
7. What are the advantages of using CSS in a web page?
8. Explain the different methods to include CSS in a web page.
9. Explain the syntax of a style rule with an example.
10. Explain the different types of selectors.
11. Suggest a situation where you can make use of class selector.
12. What are the various properties used for formatting a text.
13. Consider the style rule given below.

```
.lineThrough18 {  
    text-decoration: linethrough;  
    font-family: "Arial";  
    font-size: 18;  
}
```

 - a. Correct the errors in the above style rule.
 - b. Modify this style rule to make the text bold, italics and to reduce the font size to 14 pixels.
14. Explain the various properties used for displaying text.
15. Explain the different methods to include style rules in a web page.
16. How can we group selectors? Explain with an example.



7

Web Hosting

Significant Learning Outcomes

After the completion of this chapter, the learner:

- describes the use of a web server and the concept of web hosting.
- classifies different types of hosting.
- explains the way to buy hosting space.
- registers a domain and hosts a website using FTP client software.
- explains the features of free hosting.
- identifies the use of Content Management Systems.
- describes the need for responsive web design.

We familiarised ourselves with creating web pages in the earlier chapters. A website consisting of several web pages are designed to give information about an organisation, product, service, etc. Suppose we have developed a website for our school using HTML. How can we make this website available on the Internet? These web pages are to be stored in the web servers connected to the Internet, to be made available to others. This chapter presents an overview of web hosting, its different types and general features. For accessing a website we need a domain name. How domain names are chosen and registered are also presented here. The various FTP client softwares available to transfer the files of the website (web pages, images, etc.) from our computer to the server are also discussed. After learning this chapter, one will be able to register a domain name and host a website.

7.1 Web hosting

To develop a website for our school we need to design web pages. In the previous chapters, we discussed how to design web pages. Any text editor or a web designing tool can be used to develop a home page, a page for the courses



in the school, facilities available, contact address, etc. and link them using a menu to form an attractive website.

After developing the school website in our computer, it has to be made available in the Internet. The designed website has to be uploaded to a web server to make it available to Internet users all over the world. For this, either storage space is rented on a web server to store the web pages that we have created or our own web server is set up. Setting up a web server is very expensive compared to hosting a website in a rented storage space.

Web hosting is the service of providing storage space in a web server to serve files for a website to be made available on the Internet. The companies that provide web hosting services are called web hosts. Web hosts own and manage web servers. These web servers offer uninterrupted Internet connectivity, software packages for offering additional services such as databases and support for programming languages such as PHP, Java, ASP.NET, etc.

7.1.1 Types of web hosting

Suppose the entire content of our school website including html files, images, etc., require 4 MB of hard disk space on the web server. Web hosts provide only standard packages of 10 MB, 20 MB, etc. of space on the web server. We may need to choose the web host considering the packages offered by them that suit our purpose. The number of visitors expected to visit our website is also a factor. If our website requires a database, contains scripts, etc. then the support of such features are also to be considered while choosing a web host.

The type of web hosting has to be decided based on requirements like the amount of space needed for hosting, the number of visitors expected to visit the website, the use of resources like databases, programming support, etc. Web hosts provide different types of hosting packages. They can be shared hosting, virtual hosting and dedicated hosting.

a. Shared hosting: Shared web hosting is the most common type of web hosting. It is referred to as shared because many different websites are stored on one single web server and they share resources like RAM and CPU. The features available on shared web servers are generally basic and are not flexible to suit a website that require specific features like high bandwidth, large storage space, etc. Shared hosting is most suitable for small websites that have less traffic. Shared servers are cheaper and easy to use, since they are configured with the most popular options. The updates and the security issues of the software installed in the web server are taken care of by the hosting company itself. A drawback is that since the bandwidth is shared by several websites, if any of these has a large volume of traffic, it will slow down all other websites hosted in the shared server.

b. Dedicated hosting: Dedicated web hosting is the hosting where the client leases the entire web server and all its resources. The web server is not shared with any other website. Websites of large organisations, government departments, etc. where there are large numbers of visitors, opt for dedicated web hosting. Here, the client has the freedom to choose the hardware and software for the server and has full control over the web server. Dedicated servers provide guaranteed performance, but they are very expensive. The advantage of dedicated servers is that such servers are usually hosted in data centers where the service provider facilitates Internet connectivity, round-the-clock power supply, etc. and the technical expertise for managing web servers. The cost of setting up and managing these facilities is thus reduced for the client. Since the bandwidth is not shared with other websites, it speeds up the access of the website. If the client is allowed to place their own purchased web server in the service providers facility, then it is called co-location.

c. Virtual Private Server: A Virtual Private Server (VPS) is a physical server that is virtually partitioned into several servers using the virtualization technology. Each VPS works similar to a dedicated server and has its own separate server operating system, web server software and packages like e-mail, databases, etc. installed in it. Unlike shared hosting, VPS provides dedicated amount of RAM for each virtual web server. Each of these VPS works as a fully independent web server, as if each were running on a separate physical server. The users of VPS are provided with the rights to install and configure any software on their VPS. They are also given the right to restart their VPS without affecting other virtual servers running on the same physical server.

VPS hosting provides dedicated bandwidth to each website on the server. This provides the advantages of a dedicated hosting, even though the actual server is shared. This type of hosting is suitable for websites that require more features than that provided by shared hosting, but does not require all the features of dedicated hosting. VPS provides almost the same services at a lesser cost than that of dedicated hosting. Some popular server virtualization softwares are VMware, Virtualbox, FreeVPS, User-mode Linux, Microsoft Hyper-V, etc.

Figure 7.1 gives a symbolic representation of the different types of web hosting packages.

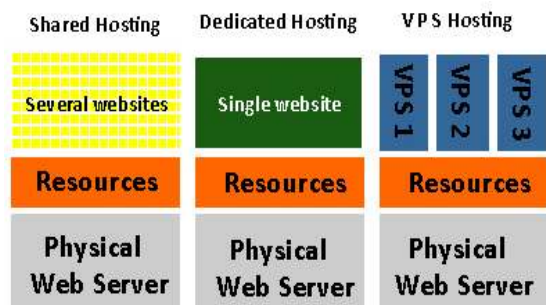


Fig. 7.1 : Types of web hosting

7.1.2 Buying hosting space

We have designed and stored the web pages of our school website in a folder in the computer. These files are to be copied to a web server to make it available on the Internet as shown in Figure 7.2. For this, the appropriate type of web hosting has to be chosen. It is preferred that the website is hosted using the services of a shared hosting service provider as it is cheaper and appropriate. Once the type of hosting server is decided, hosting space has to be purchased from a web hosting service provider.

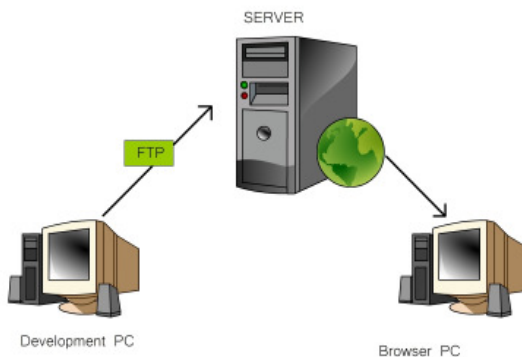


Fig. 7.2 : Making a website available on the Internet

While purchasing hosting space, several factors have to be taken into consideration. First, we have to decide on the amount of space required. We need to select a hosting space that is sufficient for storing the files of our website. If the web pages contain programming content, we need a supporting technology in the web server. The program used in the web page may require Windows hosting or Linux hosting. Here we need to choose between a Windows server or a Linux server as shown in Figure 7.3. If our website contains only HTML code, we can choose any server. Other features like database support, e-mail facility, etc. can also be considered while choosing the web host.

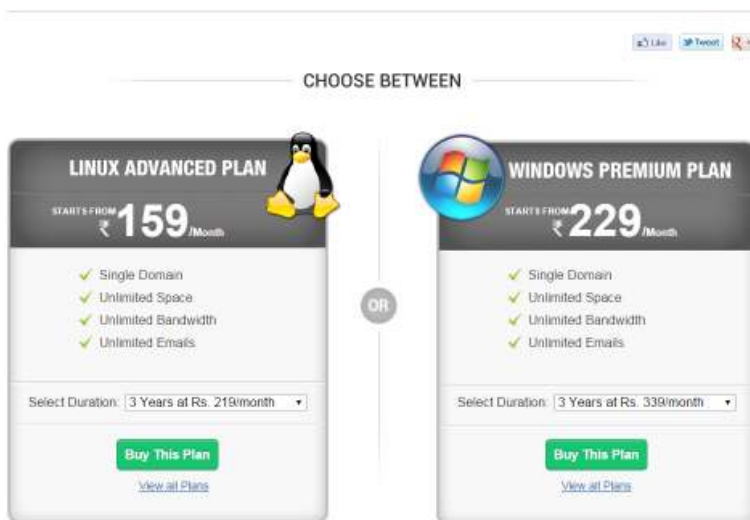


Fig. 7.3 : Hosting options

7.1.3 Domain name registration

We have now bought hosting space for our web pages and now we need an identification (URL) on the Internet. For this a suitable domain name has to be registered for our school. Domain names are used to identify a website in the Internet.

Most of the web hosting companies offer domain name registration services. After finalising a suitable domain name for our website, we have to check whether this domain name is available for registration or it is already in use by somebody else. The websites of the web hosting companies or web sites like www.whois.net provide an availability checker facility where we can check this. These websites check the database of ICANN that contains the list of all the registered domain names and gives a response as shown

in Figure 7.4. If the domain name entered is available, we can proceed with the registration. The registration requires filling information for WHOIS database of domain names for ICANN. WHOIS information requires the name, address, telephone number and e-mail address of the registrant, as shown in Figure 7.5. This information can be made public or can be kept private according to the registrant's wish. After paying the annual registration fees online, the domain is purchased and is registered in our name. The shopping cart of the purchase is shown in Figure 7.6.

Fig. 7.4 : Domain name registration search result

Fig. 7.5 : Providing WHOIS information

Thus, we have purchased a web server space for our school website and have registered a domain name for it. Now, when the user types our domain name, www.stjosephsbhss.org,

Fig. 7.6 : Buying a domain name

in the browser window, it should display the webpage stored in the web server we have purchased. This will happen only if the DNS for server returns the IP address of our web server when the browser requests for it with www.stjosephsbhss.org.



Therefore, our domain name has to be connected to the IP address of the web server where the web pages are stored. This is done using 'A record' (Address record) of the domain. An 'A record' is used to store the IP address of a web server connected to a domain name. The 'A record' can be modified by logging into the control panel of the domain. Here, you can set the 'A record' of the domain name to point to the IP address of web server as shown in Figure 7.7. After this, the DNS servers will be able to resolve our domain name to connect to our web server.

	NAME	TYPE	CONTENT	PRIORITY	Save Changes
	stjosephsbhss.org	A	<input type="text" value="118.67.244.3"/>		<input type="button" value="Save Changes"/>
	www.stjosephsbhss.org	A	<input type="text" value="118.67.244.3"/>		<input type="button" value="Save Changes"/>

Fig. 7.7 : Changing 'A record' of the domain



A WHOIS search will provide information regarding a domain. It may include information like domain ownership, where and when registered, expiration date, etc. It is also used to determine whether a given domain name is available or not. A WHOIS lookup on www.kerala.gov.in returns the following.

```
Domain ID:D8944-AFIN
Domain Name:KERALA.GOV.IN
Created On:31-Dec-2003 05:00:00 UTC
Last Updated On:16-Jul-2014 11:37:59 UTC
Expiration Date:31-Dec-2016 05:00:00 UTC
Sponsoring Registrar:National Informatics Centre (R12-AFIN)
Status:OK
Registrant ID:R-R03120114034
Registrant Name:Government of Kerala
Registrant Organization:
Registrant Street1:Chief Minister's Office
Registrant Street2:
Registrant Street3:
Registrant City:Government Secretariate, Trivandrum, 69500
Registrant State/Province:Kerala
Registrant Postal Code:695001
Registrant Country:IN
```



Let us do

Prepare a comparative table of popular web hosts and their prices per year for their respective minimum hosting space. Provide pricing for both Windows and Linux web hosting.

Prepare a comparative table for the pricing for a year for .org and .com domain registrations in the popular service providers.

Search the WHOIS details of www.dhsekerala.gov.in and www.scert.kerala.gov.in in www.whois.net and prepare a chart of the details.

Know your progress



1. The companies that provide web hosting services are called _____.
2. List the factors that decide the type of web hosting.
3. VPS is
 - a. Virtual Premium Service
 - b. Virtual Private Service
 - c. Virtual Premium Server
 - e. Virtual Private Server
4. What is co-location?
5. What does WHOIS information contain?
6. Why is 'A record' important for a domain name?

7.1.4 FTP client software

After buying a space on the hosting server and a domain name, we need to transfer the files of the website from our computer to the web server. This requires an FTP client software.

We have already discussed FTP in Chapter 8, Computer Networks of Class XI. FTP is used to transfer files from one computer to another on the Internet. FTP client software establishes a connection with a remote server and is used to transfer files from our computer to the server computer. To connect to an FTP server, FTP client software requires a username and password and also the domain name. This is to be provided in the Site Manager dialog box as shown in Figure 7.8. FTP sends username and password to the server as plain text which is unsecure. Therefore nowadays, SSH FTP (SFTP) protocol which encrypts and sends usernames, passwords and data to the web server is used in the FTP software. SFTP uses Secure Shell (SSH) protocol which provides facilities for secure file transfer.

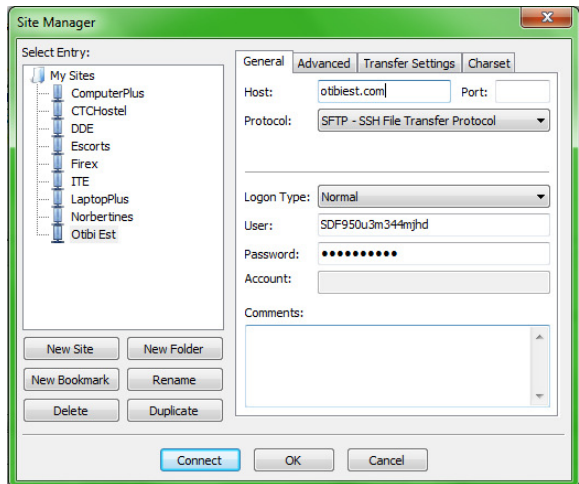


Fig. 7.8 : FTP Login

Once the FTP client is authenticated the IDE of FTP software appears as given in Figure 7.9. In this figure, the portion on the left side displays the folders and files in our computer and the right side displays the files in the web server computer. We



can use either the menu or 'drag and drop' files from the left side window to the right side window to upload the files to the web server. The files will then be transferred (copied) from our computer to the web server. The popular F^TP client software are FileZilla, CuteF^TP, SmartF^TP, etc.

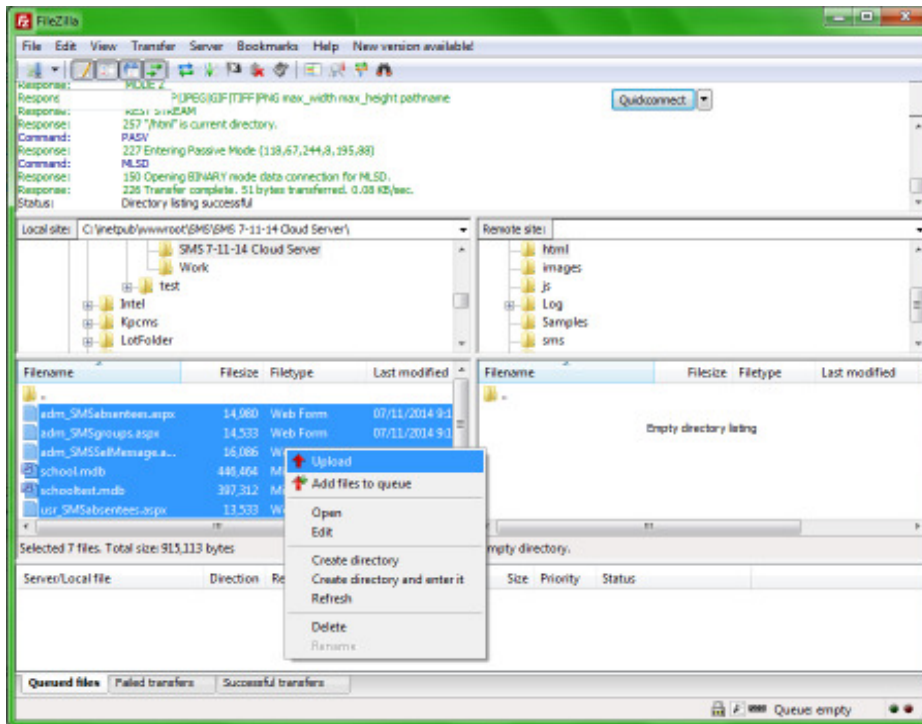


Fig. 7.9 : FTP client software IDE

Some web hosting companies provide their own control panel webpage through which users can upload the files. Such hosting companies do not allow third party FTP client software to upload files to their web servers. Figure 7.10 displays a control panel provided by a web hosting company to transfer files.

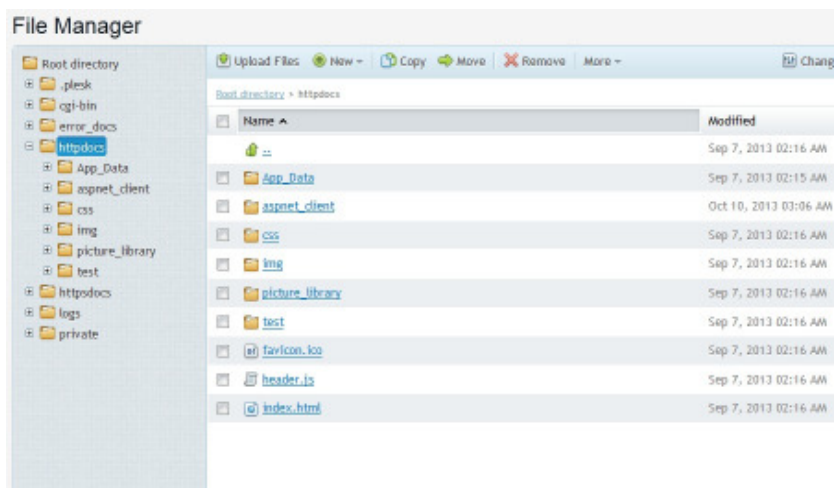


Fig. 7.10 : FTP control panel provided by a hosting company

7.2 Free hosting

Free hosting provides web hosting services free of charge. The service provider displays advertisements in the websites hosted to meet the expenses. Some free web hosting sites provide the facility to upload the files of our website in their server, but may place certain restrictions on the files. The size of the files that can be uploaded may be limited (supports upto 5 MB only), audio/video files (mp3, mp4, etc.) may not be permitted and so on. These websites usually provide control panels to upload files from our computer to the web server as shown in Figure 7.10. Some other websites only permit us to use the templates (pre-formatted designs) they provide for designing websites. They do not allow external files to be uploaded to their web server.

Free web hosting services usually provide either their own subdomain (oursite.example.com) or as a directory service (www.example.com/oursite) for accessing our websites. Some free web hosting companies provide domain name registration services also. Free web hosting is useful for sharing content on the web, among groups having similar interests like family unions, nonprofit organisations, etc. who are not able to spend money on web hosting. The availability of cheap web hosting services has reduced the need for free web hosting. Sites.google.com, yola.com, etc. are free web hosting services. A website of higher secondary school teachers that uses free hosting is given in Figure 7.11.

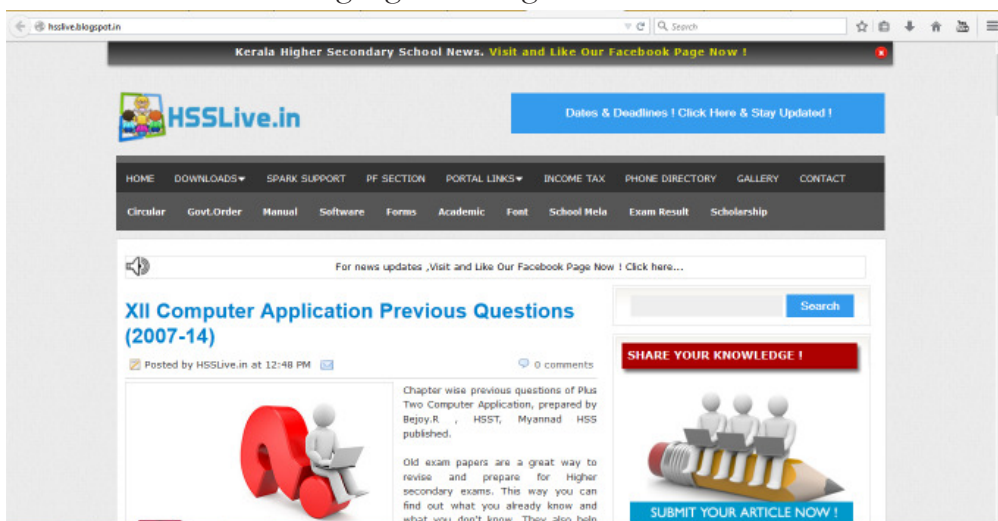


Fig. 7.11 : A free web site

7.3 Content Management System

Content Management System (CMS) refers to a web based software system which is capable of creating, administering and publishing websites. CMS provides an easy way to design and manage attractive websites.



Most CMS is available for free download at their websites. Copy the files of the CMS to the hosting space on our web server and configure the website as shown in Figure 7.12. Templates that provide a list of preset designs for websites are also

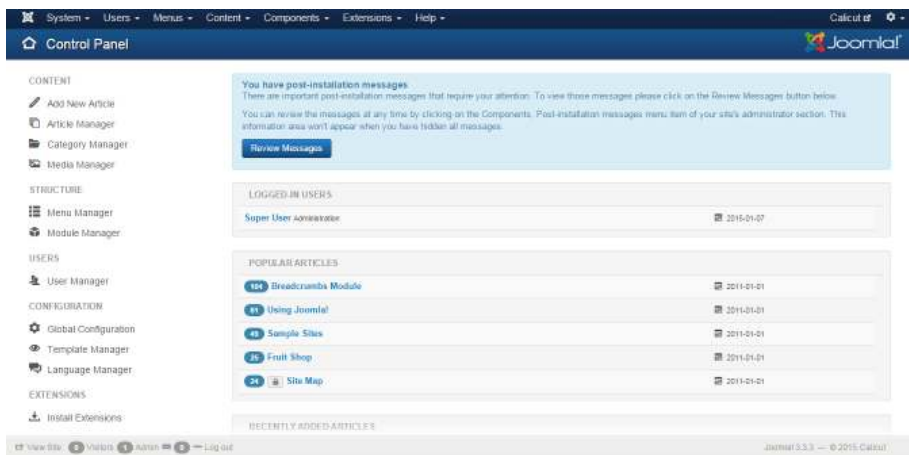


Fig. 7.12 : Configuring a website using Joomla!

available for download in some websites. Some sample templates available are displayed in Figure 7.13. The users need to choose a template from the given list, upload them to our website and add titles, images and other descriptions for the chosen design. This is as simple as designing a document in a word processor.

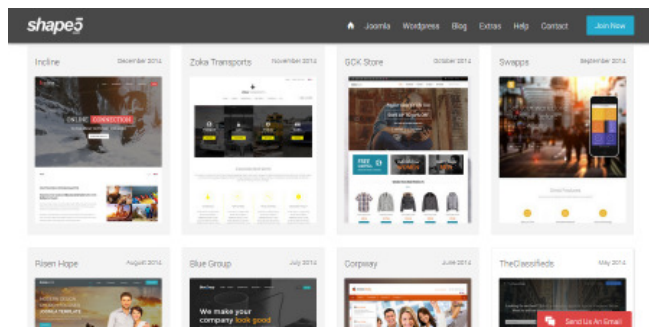


Fig. 7.13 : Templates available in Joomla!



Fig. 7.14 : A web site developed using Joomla! CMS

CMS provides standard security features in its design, that help even people with less technical knowledge to design and develop secure websites. The CMS templates also reduce the need for repetitive coding and design for headings and menus that appear in all pages in a website, by internally providing features to add them in all pages. Templates are available for download for free or for a small price at

popular CMS websites. There are also third party vendors who customise the CMS for a fee. If you are hosting on a shared web server, verify whether the web server supports the CMS you have downloaded.

CMS is economical and now many organisations, bloggers, etc. use it for their websites. Some of the popular CMS software are WordPress, Drupal and Joomla! Figure 7.14 shows the website of Motor Vehicles department of Government of Kerala, developed using Joomla!

7.4 Responsive web design

Today we browse web pages using various devices like desktops, laptops, tablets and mobile phones. All these devices have different screen sizes. Traditional web pages are designed to be displayed on the screens of devices like desktops and laptops. These web pages are difficult to view when it is accessed using tablets and mobile phones. The user may have to use the scroll bar to move from one part of the web page to another. In earlier days, a separate website was created for the purpose of viewing in mobile devices. These websites contained web pages whose size matched the screen size of these devices. But maintaining two websites for a single organisation created issues. It would be better if the web page was able to adjust itself to the screen size of the device. This type of web page designing is called responsive web design. Figure 7.15 shows the appearance of a responsive website in different devices.

Responsive web design is the custom of building a website suitable to work on every device and every screen size, no matter how large or small, mobile phone or desktop or television. The term 'responsive web designing' was coined by Ethan Marcotte, an independent designer

and author, to describe a new way of designing for the ever-changing Web. Responsive web design can be implemented using flexible grid layout, flexible images and media queries. Flexible grid layouts set the size of the entire web page to fit the display size of the device. Flexible images and videos set the image/video dimensions to the percentage of display size of the device. Media queries provide the ability to specify different styles for individual devices. A horizontal menu in a web page for larger displays might have to be converted to a drop down menu for a mobile phone. These settings can be done using media queries inside the CSS file.

Screen sizes always vary - from a wearable device, mobile phones, tablets to laptops, desktops and televisions. Therefore, it is important that websites are designed to adapt to the screen size of the device.



Fig. 7.15 : Responsive web design

**Let us do**

Design a website containing the name, age, total runs scored, no. of wickets taken, etc. of the members of the Indian cricket team and host the web site using any free hosting services.

Prepare a list of popular CMS providers and write their features.

In the web hosting space provided, upload the files of the school website you have prepared using any FTP software.

**Let us conclude**

After designing a website, it has to be hosted over the Internet using a suitable type of hosting. Websites of small organisations can be hosted using shared hosting, websites that have more traffic and need more security can opt for VPS hosting, whereas websites of large organisations or those with very high traffic require dedicated hosting. After buying a suitable web hosting space, FTP software can be used to connect to the web server and can securely transfer the files of the website to it. Domain name can be registered through a service provider and the 'A record' can be set to point the domain to the web server. There are free hosting websites that provide hosting free of cost. Content Management Systems (CMS) offer tools and standard security features in its design that helps even people with less technical knowledge to design and develop secure websites. Today, since we browse websites using devices like mobile phones, tablets, laptops, etc. that have different screen sizes, it is important to design websites that display themselves according to the size of the screen they are viewed from.

Let us assess

1. What do you mean by web hosting? Explain the different types of web hosting.
2. A supermarket in a city wishes to take its business online. It plans to accept orders for its products through a website and receive payments online.
 - a. Which type of hosting is suitable for this website?
 - b. Explain the reason for your choice.
3. Emil wishes to purchase the web hosting space required to host a website for his medical shop. List the features to be taken into consideration while buying hosting space on a web server.
4. How can we connect a website hosted in a webserver to a domain name?
5. What is the advantage of using SFTP protocol in FTP software?
6. Raju wishes to host a website for his family. What are the advantages that free web hosting companies provide?
7. What is CMS? What are the features of CMS? Give Examples.
8. Explain the need for applying responsive web design while developing websites today.
9. How is responsive web design implemented?



8

Database Management System

Significant Learning Outcomes

After the completion of this chapter, the learner

- recognises the need for files.
- identifies the major limitations of the conventional file management system.
- lists and explains the different advantages of the Database Management System.
- lists the various components of DBMS and explains their purpose.
- recognises the types of users and their roles in the DBMS environment.
- explains the levels of data abstraction and data independence in DBMS.
- explains relational data model by citing examples.
- uses different terminologies in RDBMS, appropriately.
- applies and evaluates various operations in Relational algebra.

This is an era of information. The survival of organisations in this competitive world largely depends on the need for information obtained with high accuracy and speed. We know that information is obtained through the processing of data. For this, a huge amount of data is to be collected, stored and processed to generate information. Every organisation that we can think of like schools, banks, business organisations, etc. are in need of information. Can you imagine how this huge quantity of data was handled traditionally? In earlier days, this was handled manually with data recorded in books termed as 'book keeping'. It is obvious that large storage space is a hazard and processing of data is laborious. With the advent of computers the data could be stored effectively, but the possibility of duplication, inconsistency, invalidity, etc. remained. This chapter provides an effective mechanism to overcome these limitations. The concept of Database Management System (DBMS) is introduced in this chapter as an effective record keeping system (earlier called book keeping). Various operations are also discussed to retrieve the required and relevant information from the database.



8.1 Concept of database

Consider the Single Window System (SWS) of the Department of Higher Secondary Education, maintaining a large collection (say 5,00,000 applications or 19 GB) of data concerning students, courses, schools and grades each year for Class XI admission process. This data is accessed simultaneously by several schools and students. Questions about the allotment of students and schools must be answered quickly, changes made to the data by different schools must be applied consistently, and access to certain parts of the data (e.g., Grades or WGPA) must be restricted.

We can manage the data by storing it in the conventional file management system. But, this approach has many drawbacks:

- We must keep more copies of the same data for different applications. This storage leads to duplication of data.
- There is no mechanism to protect the data from inconsistent changes made by different users accessing the database simultaneously.
- If the data are not properly organised, retrieval of information will be difficult, and time consuming, and there may be chances of inaccuracy in the information..
- There is no way to ensure that data is restored to a consistent state if the system crashes while changes are being made.
- Operating systems provide only a password mechanism for security. This is not sufficiently flexible to enforce security policies in data.
- There is no standardisation on data.

8.1.1 Need of database

The drawbacks mentioned above can be overcome by using database. In situations, where huge amount of data is to be maintained and manipulated, conventional file system will not be sufficient. In such a situation we use database. **Database** is an organized collection of inter-related data stored together with minimum redundancy, in a manner that makes them accessible for multiple applications. Now we can try to manage the data in SWS by storing it in a database. The software Database Management System (DBMS) is essentially a set of programs which facilitates storage, retrieval and management of database. The primary goal of DBMS is to provide an environment that is both convenient and efficient to use in retrieving and storing database.

8.1.2 Advantages of DBMS

Database systems are designed to manage large amounts of data. DBMS involves both the database structures definition for the storage of data and the provision of

mechanisms for the manipulation of data. In addition, the database system must ensure the safety of the data stored, against unauthorized access or system failure. If data is to be shared among several users, the system must avoid possible anomalous results. The database management system has a number of advantages over the traditional file management system. They are listed below.

- **Controlling data redundancy:** In file management systems, data may be placed in many files. The storing of the same data in multiple locations (may be in the same file or different files) or duplication of data is known as data redundancy. Redundancy leads to higher cost in storage and data access. Database systems do not maintain redundant data, instead all the data is kept at one place in a centralized manner. All the applications or users that require data refer to the centrally maintained database. Sometimes there can be technical or business reasons for maintaining several copies of the same data. However, redundancy should be carefully controlled in any case.
- **Data consistency:** Data redundancy may lead to data inconsistency; that is, the various copies of the same data show different values in different files. Assume that your class teacher and Principal maintain separate copies of the address list of all students admitted in your class. During periodic address change a few students report to the Principal and a few students report to the changes to the class teacher. After a certain period of time both the address lists become irrelevant and inconsistent since total corrections are not updated in both. By controlling data redundancy, data consistency is obtained. If a data item appears only once, any update to its value has to be performed only once and the updated value is immediately available to all users.
- **Efficient data access:** A DBMS utilises a variety of techniques to store and retrieve data efficiently.
- **Data integrity:** Data integrity refers to the overall completeness, accuracy and consistency of data in the database. This can be indicated by an absence of any alteration in data between two updates of a data record. Data integrity is imposed within a database at its design stage through the use of standard rules and procedures. Data integrity can be maintained through the use of error checking and validation routines.
- **Data security:** The information inside a database is valuable to any company or organization. Therefore it must be kept secure and private. Data security refers to the protection of data against accidental or intentional disclosure or unauthorized destruction or modification by unauthorized persons. The various programs and users may share data in common. But access to specific information can be limited to selected users by setting the access rights. Through



the use of passwords, the information in a database is made available only to authorised persons.

- **Sharing of data:** The data stored in the database can be shared among several users or programs even simultaneously and each may use it for different purposes.
- **Enforcement of standards:** With central control of the database, a Database Administrator (DBA) defines and enforces the necessary standards. Standards can be defined for data formats to facilitate exchange of data between systems. Applicable standards might include naming conventions, display formats, report structures, terminology, documentation standards, update procedures, access rules and so on. This facilitates communication and cooperation among various departments, projects and users within the organization.
- **Crash recovery:** When a system crashes, all or a portion of the data can become unusable. DBMS provides some mechanism to recover data from the crashes. Thus the DBMS protects data from the effects of system failures.

Know your progress



1. Storing of the same data in different places is called _____.
2. Address of a particular student is stored in two ways in a school record; this situation is known as _____.
3. Unauthorised accessing of data can be prevented from using _____.
4. Sharing of data can reduce data redundancy. State whether true or false?
5. Data redundancy will reduce data consistency. State whether true or false?

8.2 Components of the DBMS environment

DBMS have several components, each performing very significant tasks in its environment. The components are

- Hardware
- Software
- Data
- Users
- Procedures

Hardware: The hardware is the actual computer system used for storage and retrieval of the database. This includes computers (PCs, workstations, servers and supercomputers), storage devices (hard disks, magnetic tapes), network devices (hubs, switches, routers) and other supporting devices for keeping and retrieval of data.

Software: The software part consists of the actual DBMS, application programs and utilities. DBMS acts as a bridge between the user and the database. In other words, DBMS is the software that interacts with the users, application programs, and databases. All requests from users for access to the

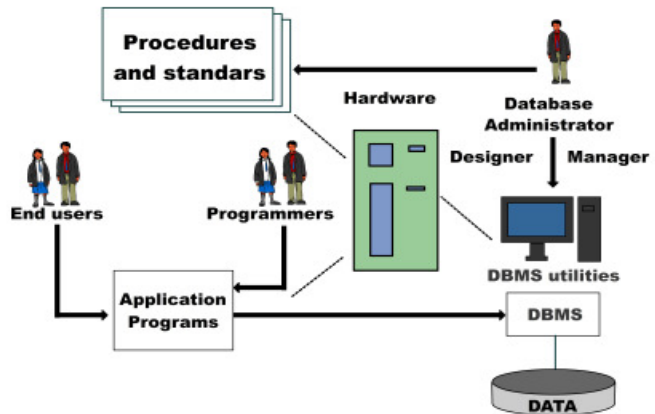


Fig. 8.1: Database system environment

database are handled by the DBMS. Database management system software consists of several software components that handle various tasks such as data definition, data manipulation, data security, data integrity, data recovery and performance optimization. One general function provided by the DBMS is thus the shielding of database from complex hardware-level detail. The DBMS controls the access and helps to maintain the consistency of the data.

Application programs are most commonly used to access data found within the database to generate reports, tabulations, and other information to facilitate decision making. Utilities are the software tools used to help manage the database system. For example, all major DBMS provide graphical user interfaces (GUIs) to help create database structures, control database access, and monitor database operations.

Data: It is the most important component of DBMS environment from the end users point of view. The database contains operational data and the meta-data (data about data). The database should contain all the data needed by the organization. The major feature of databases is that the actual data and the programs that uses the data are separated from each other. For effective storage and retrieval of information, data is organized as fields, records and files.

Assume a box containing a collection of cards which stores the Admission Number, Name, Batch, Result, Marks of students in a class. Each card will have the same format but the data written on them is different as in Figure 8.2.

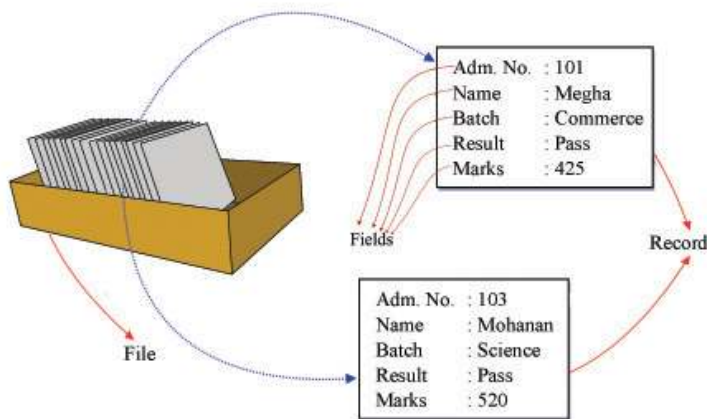


Fig. 8.2: Concept of data organisation

Fields: A field is the smallest unit of stored data. Each field consists of data of a specific type. In Figure 8.2 Adm. No., Name, Batch, Result, and Marks are the fields.

Record: A record is a collection of related fields. In the Figure 8.2, each card in the box contains the related fields of a record. For example, the fields 103, Mohanan, Science, Pass, and 520 constitute a record.

File: A file is a collection of all occurrences of same type of records. The box shown in Figure 8.2 may be considered as a file.

Users: There are a number of users who can access data on demand using application programs. The users of a database system can be classified depending on the mode of their interactions with DBMS. The different categories of users are Database Administrator (DBA), Application Programmers, Sophisticated users and Naive Users.

Procedures: Procedures refer to the instructions and rules that govern the design and use of the database. The users of the system and the person that manages the database require documented procedures on how to use or run the system. These may consist of instruction on how to:

- i. log onto the DBMS.
- ii. use a particular DBMS facility or application program.
- iii. start and stop the DBMS.
- iv. make backup copies of the database or handle hardware or software failures
- v. reorganise the database across multiple disks, improve performance, or archive data to secondary storage.

Know your progress



1. Data about data is called _____.
2. List the name of major components of a database system?
3. Categorize the following components of DBMS environment.
Hard disk, Switch, DBA, Payroll system, End user, railway reservation system.

8.3 Data abstraction and data independence

For the system to be usable, it must retrieve data efficiently. The need for efficiency has led designers to use complex data structures to represent data in the database. Since many database system users are not computer trained, developers hide the complexity from users through several levels of abstraction. The data in a DBMS is described at three levels of abstraction, as illustrated in Figure 8.3. The database description consists of a structure at each of these three levels of abstraction: the physical level, conceptual level and view level.

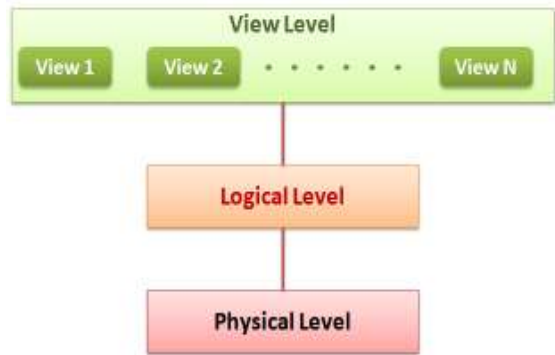


Fig. 8.3: Levels of abstraction

a. Physical level

The lowest level of abstraction describes how data is actually stored on secondary storage devices such as disks and tapes. The physical level describes complex low-level data structures in detail. We must decide what file organisations are to be used to store the relations and create auxiliary data structures, called indexes, to speed up data retrieval operations.

A sample physical schema for the SWS database follows:

- Store all relations as unsorted files of records. (A file in a DBMS is either a collection of records or a collection of data)
- Create indexes on the first column of the files Student, School, and Course.

b. Logical level

The next-higher level of abstraction describes what data is stored in the database, and what relationships exist among those data. The logical level thus describes the entire database in terms of a small number of relatively simple structures. Although



implementation of the simple structures at the logical level may involve complex physical-level structures, the user of the logical level does not need to be aware of this complexity. Database administrators, who must decide what information to keep in the database, use the logical level of abstraction. Logical level is also referred as conceptual level.

c. View level

View level is the highest level of database abstraction and is the closest to the users. It is concerned with the way in which individual users view the data. It describes only a part of the entire database. Most of the users of the database are not concerned with all the information that is contained in the database. Instead they need only a part of the database that is relevant to them. This simplifies their interaction with the system. The system may provide many views for the same database. Figure 8.4 shows the three levels of data abstraction for a STUDENT file with fields AdmNo, Name, Batch, Result, Marks.

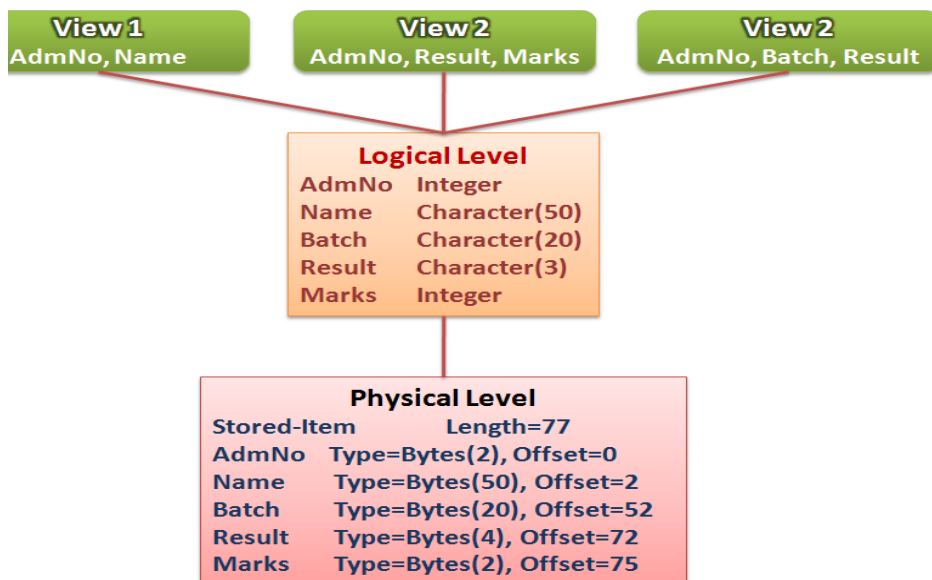


Fig. 8.4: Example for levels of abstraction

8.3.1 Data independence

Since a database may be viewed through three levels of abstraction, any change in the database structure at a particular level may affect the schema of other levels. The frequent changes made on database should not lead to the redesigning and re-implementation of the database. The ability to modify the schema definition (data structure definition) in one level without affecting the schema definition at the next

higher level is called data independence. There are two levels of data independence, physical data independence and logical data independence.

a. Physical data independence

Physical data independence refers to the ability to modify the schema followed at the physical level without affecting the schema followed at the conceptual level. That is, the application programs remain the same even though the schema at physical level gets modified.

b. Logical data independence

Logical data independence refers to the ability to modify a conceptual schema without causing any changes in the schema followed at view (external) level. The logical data independence ensures that the application programs remain the same.

It is more difficult to achieve logical data independence than physical data independence because the application programs are heavily dependent on the logical structure of the database.

8.4 Users of database

Depending on the degrees of expertise or the mode of the interactions with DBMS the users of a database system can be classified into the following groups:

- Database Administrator (DBA)
- Application Programmers
- Sophisticated Users
- Naive Users

8.4.1 Database Administrator

The person who is responsible for the control of the centralized and shared database is the Database Administrator (DBA). The DBA is responsible for many critical tasks such as,

Design of the conceptual and physical schemas: The DBA is responsible for interacting with the users of the system to understand what data is to be stored in the DBMS and how it is likely to be used. Based on this knowledge, the DBA must design the conceptual schema and the physical schema.

Security and authorization: The DBA is responsible for ensuring authorized access of data. For example, in a school, teachers allow students to find out course details, results of the student and the details as to who teaches a particular subject. At the same time students shall not be permitted to see teachers' salaries or grades of



other students. The DBA can enforce this policy by giving permission to students to read only the course view.

Data availability and recovery from failures: The DBA must take steps to restore the data to a consistent state when the system fails to complete a transaction or in case of a system crash. The DBMS provides software support for these functions, but the DBA is responsible for implementing procedures to back up the data periodically and maintain logs (special files for storing all activities in a database such as insertion, deletion, updation etc.) of system activity (to facilitate recovery from a crash).

8.4.2 Application programmers

Application programmers are computer professionals who interact with the DBMS through application programs. Application programs are programs written in any host language (for example Visual Basic, C, C ++, Java, etc.) and interact with the DBMS through Data Manipulation Language (DML). Application programs should ideally access data through the external schema.

8.4.3 Sophisticated users

Sophisticated users include engineers, scientists, business analysts, and others who are thoroughly familiar with the facilities of the DBMS. They interact with the systems through their own queries (a request to a database) to meet their complex requirements.

8.4.4 Naive users

Naive users interact with the system by invoking one of the application programs that were written previously. They are not concerned with or even aware of the details of the DBMS. Naive users deal only with the higher level of abstraction. People accessing data over the web, clerical staff in an office, billing clerk in a supermarket or hotels, bank clerk, etc. are examples of some naive users.

Know your progress



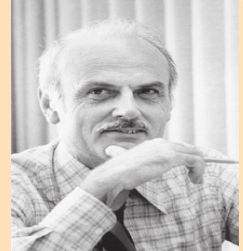
1. The person who interacts with the database through query language is called _____
2. The billing clerk in a Supermarket is a _____ user.
3. Who provides data security in a database?
4. Who changes the structure of a database?
5. _____ interacts with the database through the prewritten application program.

8.5 Relational data model

The relational data model represents database as a collection of tables called relations, each of which is assigned a unique name. In relational model, both data and the relationships among them are represented in tabular form. This representation enables even beginners to understand the concepts of a database easily.



Edgar Frank Codd (19 August 1923 - 18 April 2003) was an English computer scientist who invented the relational model for database management. He was born on the Isle of Portland in England. He served as a pilot in the Royal Air Force during the Second World War. In 1948, he joined IBM. He received the Turing Award in 1981. He died of heart failure at his home in Williams Island, Florida, at the age of 79 on 18 April 2003.



Today, a vast majority of database products are based on the relational model and they are known as Relational DataBase Management System (RDBMS). The major advantages of the relational model over the other data models are its simple data representation and the ease with which even complex queries can be expressed. The popular RDBMS are Oracle, Microsoft SQL Server, MySQL, DB2, Informix and Ingress. Most commercial relational database systems offer a query language that includes Structured Query Language (SQL), Query-by-Example (QBE) or Datalog. We shall study the widely used query language SQL in the Chapter 9.

8.6 Terminologies in RDBMS

Before discussing the operations on relational databases, let us be familiar with some terminologies associated with RDBMS.

a. Entity

An entity is a person or a thing in the real world that is distinguishable from others. For example, each student is an entity, and each school can be considered as another entity.

b. Relation

Relation is a collection of data elements organized in terms of rows and columns. A relation is also called Table. A sample relation named STUDENT is shown in Table 8.1.

**STUDENT relation**

AdmNo	Roll	Name	Batch	Marks	Result
101	24	Sachin	Science	480	EHS
102	14	Rahul	Commerce	410	EHS
103	4	Fathima	Humanities	200	NHS
104	12	Mahesh	Commerce	180	NHS
105	24	Nelson	Humanities	385	EHS
106	8	Joseph	Commerce	350	EHS
107	24	Shaji	Humanities	205	NHS
108	2	Bincy	Science	300	EHS

Table. 8.1: A sample relation

c. Tuple

The rows (records) of a relation are generally referred to as tuples. A row consists of a complete set of values used to represent a particular entity. In Table 8.1, each row in the STUDENT relation represents the result of a particular student.

d. Attribute

The columns of a relation are called attributes. AdmNo, Roll, Name, Batch, Marks and Result are attributes of the STUDENT relation. The values of each attribute are taken from the range of possible values called domain.

e. Degree

The number of attributes in a relation determines the degree of a relation. The relation STUDENT has six columns or attributes and therefore the degree of the STUDENT relation is 6.

f. Cardinality

The number of rows or tuples in a relation is called cardinality of the relation. The relation STUDENT has eight tuples and hence the cardinality of the STUDENT relation is 8.

g. Domain

A domain is a pool of values from which actual values appearing in a given column are drawn. For example, the domain of the column Batch in the relation STUDENT shown in Table 8.1 is the set of values {Science, Humanities, Commerce}. That is,

any one of the values from this set only can appear in the column Batch. Similarly, the set {EHS, NHS} is the domain of the column Results.

h. Schema

The description or structure of a database is called the database schema, which is specified during database design. In the relational model, the schema for a relation specifies its name, the name of each column, and the type of each column. As an example, student information in a School database may be stored in a relation with the following structure:

STUDENT	(Admno : integer,
	Roll : integer,
	Name : character(50),
	Batch : character(20),
	Marks : decimal,
	Result : character(4))

i. Instance

An instance of a relation is a set of tuples in which each tuple has the same number of fields as the relational schema. The preceding schema says that each row in the STUDENT relation has six columns, with column names and types as indicated. An example for instance of the STUDENT relation is shown in Table 8.1.

Know your progress



1. Organization of data in terms of rows and columns is called _____.
2. _____ in a table gives the complete data of a particular entity.
3. Number of rows in a relation is called _____.
4. Number of _____ in a relation is called degree of the relation.
5. In the relational model, data is organised as _____.

8.6.1 Keys

A relation is defined as a set of tuples. All the tuples in a relation must be distinct. That is, no two tuples can have the same combination of values for all their attributes. Therefore there should be a way to identify a tuple in a relation. The concept of a key allows us to make such distinctions. A key is an attribute or a collection of attributes in a relation that uniquely distinguishes each tuples from other tuples in a



given relation. If a key consists of more than one attribute then it is called a composite key. In the extreme, the entire tuple is the key since each tuple in the relation is guaranteed to be unique. However, we are interested in smaller keys, if they exist, for a number of practical reasons.

a. Candidate key

A candidate key is the minimal set of attributes that uniquely identifies a row in a relation. In the STUDENT relation of Table 8.1, AdmNo can uniquely identify a row. Therefore it can be considered as a candidate key. There may be more than one candidate key in a relation. Also, a candidate key need not be just one single attribute. It can be a composite key. For example, a combination of Roll, Batch and Marks can also be used to identify a particular student. Therefore, Roll + Batch + Year can be considered as another candidate key of STUDENT relation.

b. Primary key

A primary key is one of the candidate keys chosen to be the unique identifier for that table by the database designer. A primary key is a set of one or more attributes that can uniquely identify tuples within the relation. As it uniquely identifies each entity, it cannot contain null value and duplicate value.

Candidate keys are considered as candidates for primary key position. From the candidate keys the one with the least number of attributes may be selected as primary key. In our example (STUDENT relation), the attribute AdmNo can be used as the primary key. That is, no two students in the STUDENT relation can have the same AdmNo. In Table 8.1, we can see unique values in the column Name, but in real case scenario, more than one student can have the same name.

c. Alternate key

A candidate key that is not the primary key is called an alternate key. In the case of two or more candidate keys, only one of them can serve as the primary key. The rest of them are alternate keys. In our example the combination of Roll + Batch + Year is the alternate key since AdmNo is taken as the primary key.

d. Foreign key

A key in a table can be called foreign key if it is a primary key in another table. Since a foreign key can be used to link two or more tables it is also called a reference key. Suppose we have used Batch code instead of Batch name as shown in Table 8.2 and we have a relation BATCH as shown in Table 8.3. It is clear that BatchCode is the primary key in relation Batch, but it is used in STUDENT table as a non-key attribute. So, BatchCode is referred to as a foreign key with respect to STUDENT relation.

STUDENT relation

AdmNo	Roll	Name	BatchCode	Marks	Result
101	24	Sachin	S2	480	EHS
102	14	Rahul	C2	410	EHS
103	4	Fathima	H2	200	NHS
104	12	Mahesh	C2	180	NHS
105	24	Nelson	H2	385	EHS
106	8	Joseph	C2	350	EHS
107	24	Shaji	H2	205	NHS
108	2	Bincy	S2	300	EHS

*Table 8.2: Modified STUDENT relation***BATCH relation**

BatchCode	BatchName	Strength
S1	Science	150
S2	Science	150
C1	Commerce	100
C2	Commerce	100
H1	Humanities	100
H2	Humanities	100

*Table 8.3: Instance of Batch relation***Know your progress**

1. The minimal set of attributes that uniquely identifies a row in a relation is _____
2. In a table Employee Emp_code, Pan_no are the candidate keys. If Emp_code is taken as the primary key then Pan_no is _____ key.
3. How many primary keys are possible in a relation?
4. If a key consists of more than one attributes then it is called _____

8.7 Relational algebra

We have discussed the features of relational model, which provides facilities for creating a database. Once the database is designed and data is stored, the required information is to be retrieved. A variety of operations are provided by RDBMS. The collection of operations that is used to manipulate the entire relations of a database is known as relational algebra. These operations are performed with the



help of a special language associated with the relational model, called query language. We will learn this language in the next chapter to perform these operations. The operations involved in relational algebra take one or two relations as input and produces a new relation as the result. The fundamental operations in relational algebra are SELECT, PROJECT, UNION, INTERSECTION, SET DIFFERENCE, CARTESIAN PRODUCT, etc. The SELECT and PROJECT operations are unary operations because they operate on one relation. The remaining operations are binary operations as they operate on pairs of relations.

8.7.1 SELECT operation

SELECT operation is used to select rows from a relation that satisfies a given predicate. The predicate is a user defined condition to select rows of user's choice. This operation is denoted using lower case letter sigma (σ). The general format of select is as follows:

$$\sigma_{\text{condition}}(\text{Relation})$$

The result of SELECT operation is another relation containing all the rows satisfying the given predicate (or conditions). The relational algebra uses various comparison operators $<$ (less than), \leq (less than or equal to), $>$ (greater than), \geq (greater than or equal to), $=$ (equal to) and $< >$ (not equal to) to set up simple conditions, and logical operators \vee (OR), \wedge (AND) and $!$ (NOT) to construct composite conditions.

To illustrate the SELECT operation, consider the relation STUDENT given in Table 8.1. The following examples show how SELECT operations are expressed in relational algebra and what output they produce.

Example 8.1: To select all the students who are eligible for higher studies.

$$\sigma_{\text{Result}="EHS"}(\text{STUDENT})$$

The output of this operation is a relation as shown in Table 8.4.

Example 8.2: To select all the students in the Commerce batch who are failed.

AdmNo	Roll	Name	Batch	Marks	Result
101	24	Sachin	Science	480	EHS
102	14	Rahul	Commerce	410	EHS
105	24	Nelson	Humanities	385	EHS
106	8	Joseph	Commerce	350	EHS
108	2	Bincy	Science	300	EHS

Table 8.4: Output of Example 8.1

$$\sigma_{\text{Result}=\text{"NHS"} \wedge \text{Batch}=\text{"Commerce"}}(\text{STUDENT})$$

The result of this operation is a relation as shown in Table 8.5

AdmNo	Roll	Name	Batch	Marks	Result
104	12	Mahesh	Commerce	180	NHS

Table 8.5: Output of Example 8.2

Example 8.3: To select all the students in the batch Science or Commerce.

$$\sigma_{\text{Batch}=\text{"Science"} \vee \text{Batch}=\text{"Commerce"}}(\text{STUDENT})$$

Table 8.6 shows the output this operation.

AdmNo	Roll	Name	Batch	Marks	Result
101	24	Sachin	Science	480	EHS
102	14	Rahul	Commerce	410	EHS
104	12	Mahesh	Commerce	180	NHS
106	8	Joseph	Commerce	350	EHS
108	2	Bincy	Science	300	EHS

Table 8.6: Output of Example 8.3

8.7.2 PROJECT operation

The PROJECT operation selects certain attributes from the table and forms a new relation. If the user is interested in selecting the values of a few attributes, rather than all the attributes of the relation, then use PROJECT operation. It is denoted by lower case letter π . The general format of project operation is as follows:

$$\pi_{A_1, A_2, \dots, A_n}(\text{Relation})$$

Here A_1, A_2, \dots, A_n refer to the various attributes that would make up the relation specified.

Example 8.4: Select Name, Result and Marks attributes in STUDENT relation.

$$\pi_{\text{Name, Marks, Result}}(\text{STUDENT})$$

The output of this operation is given in Table 8.7.

It is possible to combine the SELECT and PROJECT operations into a single statement. The illustration of this is shown in Examples 8.5 and 8.6.

Name	Marks	Result
Sachin	480	EHS
Rahul	410	EHS
Fathima	200	NHS
Mahesh	180	NHS
Nelson	385	EHS
Joseph	350	EHS
Shaji	205	NHS
Bincy	300	EHS

Table 8.7: Output relation of Example 8.4



Example 8.5: To select admission number and name of students who are Eligible for Higher Studies.

$$\pi_{\text{AdmNo, Name}} (\sigma_{\text{result}="EHS"} (\text{STUDENT}))$$

The resultant relation of this operation is given in Table 8.8. Compare it with Table 8.4 for the verification of correctness of the result.

Example 8.6: To select name and marks of those students in the Humanities batch who are Not eligible for Higher Studies.

$$\pi_{\text{Name, Marks}} (\sigma_{\text{result}="NHS" \wedge \text{Batch}="Humanities"} (\text{STUDENT}))$$

The result of this nested operation is shown in Table 8.9.

AdmNo	Name
101	Sachin
102	Rahul
105	Nelson
106	Joseph
108	Bincy

Table 8.8: Output relation of Example 8.5

Name	Marks
Fathima	200
Shaji	205

Table 8.9: Output relation of Example 8.6

8.7.3 UNION operation

UNION operation is a binary operation and it returns a relation containing all tuples appearing in either or both of the two specified relations. It is denoted by \cup . The two relations must be union-compatible, and the schema of the result is defined to be identical to the schema of the first relation. If two relations are union-compatible, then they have the same number of attributes, and corresponding attributes, taken in order from left to right, have the same domain. Note that attribute names are not used in defining union-compatibility.

Consider two relations ARTS and SPORTS given in Tables 8.10 and 8.11 containing the details of students who participate in the arts festival and the sports meet of a school, respectively. Both the relations ARTS and SPORTS consist of AdmNo, Name and BatchCode as fields. It is clear that that these two relations are union

ARTS relation

AdmNo	Name	BatchCode
101	Sachin	S2
103	Fathima	H2
106	Joseph	C2
110	Nikitha	S1
132	Vivek	C1
154	Nevin	C1

Table 8.10: Instance of ARTS relation

SPORTS relation

AdmNo	Name	BatchCode
102	Rahul	C2
103	Fathima	H2
105	Nelson	H2
106	Joseph	C2
108	Bincy	S2
132	Vivek	C1
164	Rachana	S1

Table 8.11: Instance of SPORTS relation

compatible. That is, the two relations have the same number of attributes and the type of the corresponding attributes are also the same.

Relation $ARTS \cup SPORTS$ returns the details of the students participated in arts or sports or both. That is, the expression $ARTS \cup SPORTS$ returns a table as shown in Table 8.12. This table consists of the records belonging to the tables $ARTS$ or $SPORTS$ or both, eliminating the duplication. In Table 8.12, we can see that records of students with admission numbers 103, 106, and 132 appear only once in the relation.

AdmNo	Name	BatchCode
101	Sachin	S2
103	Fathima	H2
106	Joseph	C2
110	Nikitha	S1
132	Vivek	C1
154	Nevin	C1
102	Rahul	C2
105	Nelson	H2
108	Bincy	S2
164	Rachana	S1

Table. 8.12: Relation of $ARTS \cup SPORTS$

8.7.4 INTERSECTION operation

INTERSECTION operation is also a binary operation and it returns a relation containing the tuples appearing in both of the two specified relations. It is denoted by \cap . The two relations must be union-compatible, and the schema of the result is defined to be identical to the schema of the first relation.

If we apply INTERSECT operation on the relations in Tables 8.10 and 8.11, the expression $ARTS \cap SPORTS$ returns the details of the students participated in both arts and sports. That is $ARTS \cap SPORTS$ returns a table consisting of rows common to $ARTS$ and $SPORTS$ as shown in Table 8.13.

AdmNo	Name	BatchCode
103	Fathima	H2
106	Joseph	C2
132	Vivek	C1

Table. 8.13: Relation of $ARTS \cap SPORTS$

8.7.5 SET DIFFERENCE operation

SET DIFFERENCE operation is also a binary operation and it returns a relation containing the tuples appearing in the first relation but not in the second relation. It is denoted by $-$ (minus). The two relations must be union-compatible, and the schema of the result is defined to be identical to the schema of the first relation.

The result of SET DIFFERENCE operation $ARTS - SPORTS$ on Tables 8.10 and 8.11 returns the details of the students participated in arts but not in sports. That is, the resultant table will contain the rows appearing in relation $ARTS$ but not in relation $SPORTS$ as given in Table 8.14.



Relation $\text{SPORTS} - \text{ARTS}$ returns the details of the students participated in sports but not in arts as shown in Table 8.15.

Union and Intersection operations are commutative, that is the order of relation is not important. For example, the result of $\text{ARTS} \cup \text{SPORTS}$ and $\text{SPORTS} \cup \text{ARTS}$ are same. Also the result of $\text{ARTS} \cap \text{SPORTS}$ and $\text{SPORTS} \cap \text{ARTS}$ are the same. But Set Difference operation is not commutative, that is the order of relation is important. For example, the result of $\text{ARTS} - \text{SPORTS}$ and $\text{SPORTS} - \text{ARTS}$ are not same (refer to Tables 8.14 and 8.15).

AdmNo	Name	BatchCode
101	Sachin	S2
110	Nikitha	S1
154	Nevin	C1

Table. 8.14: Relation of $\text{ARTS} - \text{SPORTS}$

AdmNo	Name	BatchCode
101	Rahul	C2
105	Nelson	H2
108	Bincy	S2
164	Rachana	S1

Table. 8.15: Relation of $\text{SPORTS} - \text{ARTS}$

8.7.6 CARTESIAN PRODUCT operation

CARTESIAN PRODUCT returns a relation consisting of all possible combinations of tuples from two relations. It is a binary operation on relations, which has a degree (number of attributes) equal to the sum of the degrees of the two relations operated upon. The cardinality (number of tuples) of the new relation is the product of the number of tuples of the two relations operated upon. CARTESIAN PRODUCT is denoted by \times (cross). It is also called CROSS PRODUCT. All the tuples of the first relation are concatenated with tuples of the second relation to form tuples of the new relation.

Let us consider a relation TEACHER as shown in Table 8.16, which contains the details of teachers in the school. We can use this relation to perform cartesian production operation with STUDENT relation in Table 8.2. The output of the operation $\text{STUDENT} \times \text{TEACHER}$ is shown in Table 8.17. This table shows that each record of STUDENT relation is concatenated with the rows in TEACHER relation.

TEACHER relation

TeacherId	Name	Dept
1001	Viswesaran	English
1002	Meenakshi	Computer

Table 8.16: Instance of TEACHER relation

Adm No	Roll	Name	Batch Code	Marks	Result	TeacherId	Name	Dept
101	24	Sachin	S2	480	EHS	1001	Viswesaran	English
101	24	Sachin	S2	480	EHS	1002	Meenakshi	Computer
102	14	Rahul	C2	410	EHS	1001	Viswesaran	English
102	14	Rahul	C2	410	EHS	1002	Meenakshi	Computer
103	4	Fathima	H2	200	NHS	1001	Viswesaran	English
103	4	Fathima	H2	200	NHS	1002	Meenakshi	Computer
104	12	Mahesh	C2	180	NHS	1001	Viswesaran	English
104	12	Mahesh	C2	180	NHS	1002	Meenakshi	Computer
105	24	Nelson	H2	385	EHS	1001	Viswesaran	English
105	24	Nelson	H2	385	EHS	1002	Meenakshi	Computer
106	8	Joseph	C2	350	EHS	1001	Viswesaran	English
106	8	Joseph	C2	350	EHS	1002	Meenakshi	Computer
107	24	Shaji	H2	205	NHS	1001	Viswesaran	English
107	24	Shaji	H2	205	NHS	1002	Meenakshi	Computer
108	2	Bincy	S2	300	EHS	1001	Viswesaran	English
108	2	Bincy	S2	300	EHS	1002	Meenakshi	Computer

Table 8.17: Result of STUDENT X TEACHER operation



A Database model defines the logical design of data. The model describes the relationships between different parts of the data. The different models used in database design are Hierarchical Model, Network Model, Relational Model and Object-Oriented Model. Hierarchical structures were widely used in the early mainframe database management systems, such as the Information Management System (IMS) by IBM. Popular DBMS product in Network model were Cincom Systems' Total and Cullinet's IDMS.



Let us conclude

We have discussed the basic concepts of DBMS and its components. The advantages of database over traditional file system have been detailed. A brief idea about various terminologies associated with database is presented in the context of relational data model. Once the data is organised systematically in database, the operations provided by relational algebra to generate required information are



experienced with the help of sample relations. A good understanding about the concepts introduced by this chapter is essential to learn the next chapter effectively. In that chapter we will discuss how database is created and information is retrieved using a query language.

Let us assess

1. Who is responsible for managing and controlling the activities associated with the database?
 - a. Database administrator
 - b. Programmer
 - c. Naive user
 - d. End user
2. In the relational model, cardinality is the
 - a. number of tuples
 - b. number of attributes
 - c. number of tables
 - d. number of constraints
3. Cartesian product in relational algebra is
 - a. a Unary operator
 - b. a Binary operator
 - c. a Ternary operator
 - d. not defined
4. Abstraction of the database can be viewed as
 - a. two levels
 - b. four levels
 - c. three levels
 - d. one level
5. In a relational model, relations are termed as
 - a. tuples
 - b. attributes
 - c. tables
 - d. rows
6. In the abstraction of a database system the external level is the
 - a. physical level
 - b. logical level
 - c. conceptual level
 - d. view level
7. Related fields in a database are grouped to form a
 - a. data file
 - b. data record
 - c. menu
 - d. bank
8. A relational database developer refers to a record as
 - a. criteria
 - b. relation
 - c. tuple
 - d. attribute
9. An advantage of the database management approach is
 - a. data is dependent on programs
 - b. data redundancy increases
 - c. data is integrated and can be accessed by multiple programs
 - d. none of the above

10. Data independence means
 - a. data is defined separately and not included in programs
 - b. programs are not dependent on the physical attributes of data
 - c. programs are not dependent on the logical attributes of data
 - d. both (b) and (c)
11. Key to represent relationship between tables is called
 - a. primary key
 - b. candidate Key
 - c. foreign Key
 - d. alternate Key
12. Which of the following operations is used if we are interested only in certain columns of a table?
 - a. PROJECTION
 - b. SELECTION
 - c. UNION
 - d. SELECT
13. Which of the following operations need the participating relations to be union compatible?
 - a. UNION
 - b. INTERSECTION
 - c. SET DIFFERENCE
 - d. All of the above
14. Which database level is closest to the users?
 - a. External
 - b. Internal
 - c. Physical
 - d. Conceptual
15. The result of the UNION operation between R1 and R2 is a relation that includes
 - a. all the tuples of R1
 - b. all the tuples of R2
 - c. all the tuples of R1 and R2
 - d. all the tuples of R1 and R2 which have common columns
16. A file manipulation command that extracts some of the records from a file is called
 - a. SELECT
 - b. PROJECT
 - c. JOIN
 - d. PRODUCT
17. An instance of relational schema R (A, B, C) has distinct values of A including NULL values. Which one of the following is true?
 - a. A is a candidate key
 - b. A is not a candidate key
 - c. A is a primary Key
 - d. Both (a) and (c)



18. How many distinct tuples are there in a relation instance with cardinality 22?
 - a. 22
 - b. 11
 - c. 1
 - d. None
19. A set of possible data values is called
 - a. Attribute
 - b. Degree
 - c. Tuple
 - d. Domain
20. Why should you choose a database system instead of simply storing data in conventional files?
21. Explain the different levels of data abstraction in DBMS?
22. How are schema layers related to the concepts of logical and physical data independence?
23. Consider the instance of the EMPLOYEE relation shown in the following table. Identify the attributes, degree, cardinality and domain of Name and Emp_code.

Emp_Code	Name	Department	Designation	Salary
1000	Sudheesh	Purchase	Manager	25000
1001	Dhanya	Sales	Manager	25000
1002	Fathima	Marketing	Clerk	12000
1003	Shajan	Sales	Clerk	13000

24. Identify primary key, candidate keys and alternate keys in the instance of EMPLOYEE relation in Question 23.
25. Consider the instance of the STUDENT relation shown in the following table. Assume Reg_no as the primary key.
 - a. Identify the candidate keys and alternate keys in the STUDENT relation.
 - b. How are the primary key and the candidate key related?

Reg_no	Name	Batch	Result	Marks
101	Sachin	Science	Pass	480
103	Fathima	Humanities	Fail	200
106	Joseph	Commerce	Pass	350
108	Bincy	Science	Pass	300

26. What is a database? Describe the advantages and disadvantages of using DBMS.
27. What is data independence? Explain the difference between physical and logical data independence.
28. Enforcement of standard is an essential feature of DBMS. How are these standards applicable in a database?
29. Cardinality of a table T1 is 10 and of table T2 is 8 and the two relations are union compatible. If the cardinality of result $T1 \cup T2$ is 13, then what is the cardinality of $T1 \cap T2$? Justify your answer.
30. Cardinality of a table T1 is 10 and of table T2 is 8 and the two relations are union compatible
 - a. What will be the maximum possible cardinality of $T1 \cup T2$?
 - b. What will be the minimum possible cardinality of $T1 \cap T2$?
31. Consider the relations, City (city_name, state) and Hotel (name, address, city_name). Answer the following queries in relational algebra
 - a. Find the names and address of hotels in Kochi.
 - b. List the details of cities in Kerala state.
 - c. List the names of the hotels in Thrissur.
 - d. Find the names of different hotels.
 - e. Find the names of hotels in Kozhikode or Munnar .
32. Using the instance of the EMPLOYEE relation shown in question 23, write the result of the following relational algebra expressions.
 - a. $\sigma_{\text{Department}=\text{"Sales"}}(\text{EMPLOYEE})$.
 - b. $\sigma_{\text{salary}>20000 \wedge \text{Department}=\text{"Sales"}}(\text{EMPLOYEE})$.
 - c. $\sigma_{\text{salary}>20000 \vee \text{Department}=\text{"Sales"}}(\text{EMPLOYEE})$.
 - d. $\pi_{\text{name, salary}}(\text{EMPLOYEE})$.
 - e. $\pi_{\text{name, salary}}(\sigma_{\text{Designation}=\text{"Manager"}}(\text{EMPLOYEE}))$.
 - f. $\pi_{\text{name, Department}}(\sigma_{\text{Designation}=\text{"Clerk"} \wedge \text{salary} > 20000}(\text{EMPLOYEE}))$.
33. Consider the instance of the BORROWER and DEPOSITOR relations shown in following figure which stores the details of customers in a Bank. Answer the following queries in relational algebra.
 - a. Display the details of the customers who are either a depositor or a borrower.
 - b. Display the name of customers who are both a depositor and a borrower.



- c. Display the details of the customers who are depositors but not borrowers.
- d. Display the name and amount of customer who is a borrower but not depositor.

BORROWER		
Acc_No	Name	Amount
AC123	Albin	50000
AC103	Rasheeda	25000
AC106	Vishnu	25000
AC108	Aiswarya	30000

DEPOSITOR		
Acc_No	Name	Amount
AC123	Albin	500
AC105	Shabana	25000
AC116	Vishnu	125000
AC108	Aiswarya	3000

34. Consider the instance of the CUSTOMER and BRANCH relations shown in the following table. Write the Cartesian Product of the two relations.

CUSTOMER			
Acc_No	Name	Branch_ID	Amount
AC123	Albin	B1001	50000
AC103	Rasheeda	B1001	25000
AC106	Vishnu	B1001	25000
AC108	Aiswarya	B1077	30000

BRANCH	
Branch_ID	Name
B1001	Kochi
B1002	Guruvayur
B1077	Idukki



9

Structured Query Language

Significant Learning Outcomes



After the completion of this chapter, the learner

- recognises the importance and features of Structured Query Language.
- explains the components of SQL.
- distinguishes the features of DDL, DML and DCL commands.
- identifies the characteristics of MySQL.
- lists different data types and their features.
- explains the effect of different constraints in SQL.
- performs operations using DDL commands like CREATE, ALTER, DROP.
- uses DML commands like SELECT, INSERT, UPDATE, DELETE for data manipulation.
- identifies various clauses associated with SQL commands and their purpose.
- uses operators for setting different conditions.
- lists different aggregate functions and explains their usage.
- constructs nested queries for information retrieval.

In the last chapter, we discussed the Relational Database Management System (RDBMS). We know that relational database is a set of related data stored in tables called relations. We also have a basic idea about relational algebra, which deals with various operations performed on relations. Now, we need more clarity on these operations which include creating a table, inserting data into a table, manipulating the data stored in a table and deleting data from a table, modifying the structure of a table, removing a table, etc. on a relational database. This chapter introduces a language called Structured Query Language (SQL) for these operations. Most of the relational database management systems like MySQL, Oracle, Sybase, Informix, Postgres, SQL Server and MS Access use SQL as standard database language. We use one of the most popular open source RDBMS, like MySQL, to implement Structured Query Language.

9.1 Structured Query Language

Structured Query Language (SQL) is a language designed for managing data in relational database management system (RDBMS). SQL provides an easy and efficient



way to interact with relational databases. There are numerous versions of SQL. The original version was developed in the 1970's by Donald D. Chamberlin and Raymond F. Boyce at IBM's San Jose Research Laboratory (now the Almaden Research Centre). This language was originally called Structured English Query Language (Sequel) and later its name was changed to SQL. In 1986, American National Standard Institute (ANSI) published an SQL standard.

As we know a relational database system is a structured collection of tables (relations) and the data is stored in these tables. Tables are uniquely identified by their names and are comprised of columns and rows. A column (field) in a table represents a particular type of information. In a table, each row represents a collection of related data. We know that rows in a table are known as tuples (or records) and columns are known as attributes.



Let us do

Examine the following table, named "Student" (refer to Table 9.1) and answer the questions given below for recollecting the basic terminologies related to database.

Adm_no	Name	Gender	Date_Birth	Income	Course
1001	Alok	M	2/10/1998	24000	Science
1002	Nike	M	26/11/1998	35000	Science
1003	Bharath	M	1/1/1999	45000	Commerce
1004	Virat	M	5/12/1998	22000	Science
1005	Meera	F	15/8/1998		Science
1006	Divakar	M	21/2/1998		Humanities

Table 9.1: Student table

- The cardinality of the table is _____.
- The degree of the table is _____.
- List out the different tuples in the table.
- List out the different attributes in the table.
- What are the values in the domain of the attribute 'Course'?

SQL is a powerful tool for implementing RDBMS. It provides facilities to create a table, insert data into a table, retrieve information from a table, modify data in the table, delete the existing data from a table, modify the structure of a table, remove a table from a database, etc.

9.1.1 Features of SQL

Structured Query Language is an ANSI/ISO standard language for writing database queries. A query is a request to a database. It can perform all the relational operations mentioned earlier. SQL is effective in framing queries because of the following features:

- SQL is a relational database language, not a programming language like C, C++.
- It is simple, flexible and powerful.
- It provides commands to create and modify tables, insert data into tables, manipulate data in the tables etc.
- It gives guidelines to major popular RDBMS like Oracle, SQL Server, MySQL, MS Access, Sybase, Informix and Postgres to perform database operations.
- SQL is a non-procedural language since it describes what data to retrieve, delete, or insert, rather than how to perform the operation.
- As part of ensuring data security, SQL provides facility to add or remove different types of access permissions to users on databases or tables.
- It provides the concept of views (This concept will be discussed later in this chapter).

9.1.2 Components of SQL

SQL has three components, namely Data Definition Language (DDL), Data Manipulation language (DML) and Data Control Language (DCL). Let us discuss these components and their roles in developing RDBMS.

Data Definition Language

Consider Table 9.1 (Student table). How can we create such a table? Is it possible to add a new column to this table? How can we remove a table from the database? The Data Definition Language (DDL) will give solutions to all these questions.

DDL is a component of SQL that provides commands to deal with the schema (structure) definition of the RDBMS. The **DDL commands** are used to create, modify and remove the database objects such as tables, views and keys. The common DDL commands are CREATE, ALTER, and DROP.

Data Manipulation Language

In Table 9.1, we can see several tuples (or rows or records). How are these tuples inserted into the table? Suppose the monthly family income of a particular student is to be modified. Is it possible? How can we delete the record of a student from



the table? The Data Manipulation Language (DML) provides commands for these types of manipulations.

DML is a component of SQL that enhances efficient user interaction with the database system by providing a set of commands. **DML** permits users to insert data into tables, retrieve existing data, delete data from tables and modify the stored data. The common DML commands are `SELECT`, `INSERT`, `UPDATE` and `DELETE`.

Data Control Language

Data Control Language (DCL) is used to control access to the database, which is very essential to a database system with respect to security concerns. **DCL** includes commands that control a database, including administering privileges and committing data. The commands `GRANT` and `REVOKE` are used as a part of DCL.

GRANT : Allows access privileges to the users to the database.

REVOKE : Withdraws user's access privileges given by using `GRANT` command.

Know your progress



1. SQL stands for _____.
2. Which are the three components of SQL?
3. SQL can be used to:
 - a. create database structures only.
 - b. query database data only.
 - c. modify database data only.
 - d. All of these can be done by SQL.
4. SQL is:
 - a. a programming language.
 - b. an operating system.
 - c. a data sublanguage.
 - d. a DBMS.
5. Which of the following is not an RDBMS package?
 - a. ORACLE
 - b. SQL SERVER
 - c. MySQL
 - d. HTML

9.2 Working on MySQL

The American National Standards Institute (ANSI) in 1986, and the International Organization for Standardization (ISO) in 1987, standardised SQL. Since 1986, the SQL standard has been evolving to include a larger set of features. The standard has been revised several times and several versions exist. SQL:2011 is the seventh revision of the ISO and ANSI standard for the SQL database query language. It was formally adopted in December 2011. Despite the existence of such standards, the different database software packages provide their own versions of the standard

ANSI SQL. Therefore, most SQL codes are not completely portable among different database software without adjustments. In this chapter, SQL will be discussed using open source database software MySQL.

MySQL is a free, fast, easy-to-use RDBMS, used for many applications. It is developed, marketed, and supported by MySQL AB, which is a Swedish company. MySQL is becoming very popular for many reasons:

- MySQL is released under an open-source license. So it is customizable.
- It provides high security to the database.
- It is portable as it works on many operating systems and with many languages including PHP, PERL, C, C++, JAVA, etc.
- MySQL works rapidly and effectively even with large volume of data.
- It is highly compatible with PHP, one of the popular languages for web development.



MySQL was developed by Michael "Monty" Widenius and David Axmark in 1995. It was originally owned by a Swedish company called MySQL AB, and was bought over by Sun Microsystems in 2008. Sun Microsystems was acquired by Oracle in 2010.

MySQL is often deployed in a Linux-Apache-MySQL-PHP (LAMP), Windows-Apache-MySQL-PHP (WAMP), or Mac-Apache-MySQL-PHP (MAMP) environment. All components in LAMP are free and open-source, inclusive of the Operating System. The official site for MySQL is www.mysql.com. The reference for MySQL is the "MySQL Reference Manual", available at <http://dev.mysql.com/doc>

9.2.1 Opening MySQL

We can work on MySQL by giving commands at the `mysql>` prompt. In Ubuntu Linux, we have to open the Terminal window using the following command sequence to get this prompt:

Applications → Accessories → Terminal

In the Terminal window we give the following command to start MySQL:

```
mysql -u root -p
```



MySQL in Windows OS can be opened by proceeding as follows:

Start → Programs → MySQL → MySQL Server (version number) → MySQL command line client



```
meena@meena-laptop: ~
File Edit View Search Terminal Help
meena@meena-laptop:~$ mysql -u root -p
Enter password:
Welcome to the MySQL monitor.  Commands end with ; or \g.
Your MySQL connection id is 42
Server version: 5.5.41-0ubuntu0.14.04.1 (Ubuntu)

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Type 'help;' or '\h' for help. Type '\c' to clear the current input statement.

mysql> 
```

Fig 9.1: MySQL prompt at Ubuntu Linux Terminal window

When we open MySQL, it may ask for the password for verification. (Here we should use the same password that we entered during the installation process). After the password verification, we will get the prompt of MySQL as shown in Figure 9.1.



SQL is not case sensitive. That is, commands can be given in the upper or the lower case or even in a mix. But hereafter, we will use some styles to distinguish SQL commands and keywords from other texts. Commands and keywords will be specified in the upper case letters, whereas user-defined words such as table name, column name etc. will be in the lower case. Commands and outputs (or responses) can be stored in a text file after using the command `tee`. For example, `tee E:\outputs.txt` will create a file `outputs.txt` in E: drive to store whatever appears in the screen after the execution of this command. In this chapter the outputs stored in this file will be presented as figures.

The prompt gives us the message that MySQL is ready to accept any query from the user. Now we can input our queries at this prompt.

To exit from MySQL, give the command **QUIT** or **EXIT** at the prompt as:

```
mysql> EXIT;
```

9.2.2 Creating a database

We need to create a database before we work on the data. The database is the container in which we store the tables. To create a database in MySQL, we use the **CREATE DATABASE** command. The syntax is as follows:

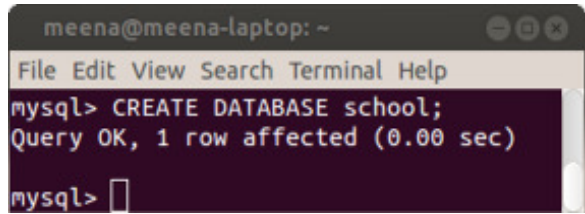
```
CREATE DATABASE <database_name>;
```

While creating a database, the following points are to be remembered:

- The `<database_name>` in the syntax indicates the name of the database that we want to create. It is recommended that the database name should be as meaningful and descriptive as possible.

- The `<database_name>` should be unique. We cannot have two databases with the same name in a MySQL database server.

Let us start our database operations with the creation of a new database called "*school*". Figure 9.2 shows the screen shot after the execution of the command. We can see the MySQL command prompt and the command in the first line. The second line is the message returned by MySQL as a response to the command being executed. From the message, it is clear that a new database with the name *school* has been created successfully. (Note that here onwards we will avoid such screen shots as figures, instead the command required for the specified operation will be presented in a separate font.)



```
meena@meena-laptop: ~
File Edit View Search Terminal Help
mysql> CREATE DATABASE school;
Query OK, 1 row affected (0.00 sec)
mysql>
```

Fig. 9.2: MySQL window after the execution of a command

9.2.3 Opening database

To perform operations on a database, we have to open it explicitly. When we open a database, it becomes the active database in the MySQL server. MySQL gives a command **USE** to open a database. The syntax is:

```
USE <database_name>;
```

Let us open the data base *school* using the command as follows:

```
USE school;
```

The response of this command after the execution is given below:

Database changed

Now the database named *school* is the active database in our system. That means, the different DDL, DML and DCL commands we execute hereafter will be related to the database *school*. We can check the existence of a database. The **SHOW DATABASES** command is used to check whether a database exists or not. It will list the entire databases in our system. The syntax is:

```
SHOW DATABASES;
```

The output of this command is shown in Figure 9.3.

9.2.4 Data types in SQL

Data type defines the type of value that may be entered in the column of a table. Data types ensure

```
mysql> SHOW DATABASES;
+-----+
| Database |
+-----+
| information_schema |
| mysql |
| school |
| test |
+-----+
4 rows in set (0.00 sec)
```

Fig. 9.3: Output of SHOW DATABASES command



the correctness of the data, if we use them in a meaningful way. Care should be taken to assign correct data types for columns during the designing of the database. For example, if the numeric value 2 is designated as a text data type, such as a string, then it cannot be used in a mathematical operation; whereas the same number stored in an integer column can be used mathematically. So, let us understand the concept of SQL data types like, the type of data they represent, range of values supported by each of them, etc. Data types differ in different versions of SQL. Here, we look at the different data types available in MySQL.

MySQL data types are classified into three. They are numeric data type, string (text) data type, and date and time data type. All numerical values like 7, 100.234, -456, 0, etc. can be represented by any of the numeric data types. The data "Aleena" (name of a student), "Kerala" (name of a state), 'F' (specification of a gender), etc. are string type by nature. Data like '01-01-2020', '23:34:3' can be represented by Date and Time data types.

a. Numeric Data types

Numeric data type values can be used like any normal number. They can be added, subtracted, multiplied and divided. The most commonly used numeric data types in MySQL are **INT** or **INTEGER** and **DEC** or **DECIMAL**.

(i) **INT** or **INTEGER**

As we know, integers are whole numbers without a fractional part. They can be positive, zero or negative. An integer value can be represented in MySQL by **INT** or **INTEGER** data type. The data items like 69, 0, -112 belong to **INT** data type.

(ii) **DEC** or **DECIMAL**

Numbers with fractional parts can be represented by **DEC** or **DECIMAL** data type. The standard form of this type is **DECIMAL(size, D)** or **DEC(size, D)**. The parameter **size** indicates the total number of digits the value contains including decimal part. The parameter **D** represents the number of digits after the decimal point. For example, the type specification **DEC(5, 2)** or **DECIMAL(5, 2)** denotes that 5 is the precision and 2 is the scale. The column with this specification is able to store any value having a maximum of five digits, out of which two are after the decimal point. That is, the range of values will be from -999.99 to 999.99.

Table 9.2 shows an overview of numeric data types in MySQL. Remember that the values are version dependent.

Data types	Usage	Signed	Unsigned	Storage in Bytes
TINY INT	Very small integer values	-128 to 127	0 to 255	1
SMALL INT	A small integer	-32768 to 32767	0 to 65535	2
MEDIUM INT	A medium-sized integer value	-8388608 to 8388607	0 to 16777215	3
INT	Normal sized integer value	2147483648 to 2147483647	0 to 4294967295	4
BIG INT	Large integer value	Value up to 19 digits	Value up to 264	8
FLOAT (M, D)	Floating point numbers	Decimal precision can go to 24 places		4
DOUBLE (M, D)	A double precision floating-point number	Decimal precision can go to 53 places		8
DECIMAL (M, D)	Store exact precision values	A Decimal type can store a Maximum of 65 Digits, with 30 digits after decimal point.		8

Table 9.2: Numeric data types of MySQL and their characteristics

b. String (Text) data types

String is a group of characters. The most commonly used string data types in MySQL are **CHARACTER** or **CHAR** and **VARCHAR**.

(i) CHAR or CHARACTER

Character includes letters, digits, special symbols etc. The CHAR is a fixed length character data type. The syntax of this data type is CHAR (x) , where x is the maximum number of characters that constitutes the data. The value of x can be between 0 and 255. CHAR is mainly used when the data in a column are of the same fixed length and small in size. For example, if we want to store data like 'M' for male and 'F' for female, in the column *Gender* of a table, it is better to declare that column as of type CHAR. It always uses the specified amount of space even though the data



need not require that much. If the number of characters in the data is less than the declared size of the column, the remaining character positions in the string will be filled with white spaces (spacebar character). But when we retrieve this value from the table, all trailing spaces are removed. Note that if the size of a column of type CHAR is 1, it is not necessary to mention the size, because the default size of CHAR type is 1.

(ii) **VARCHAR(size)**

VARCHAR represents variable length strings. It is similar to CHAR, but the space allocated for the data depends only on the actual size of the string, not on the declared size of the column. For example, if we want to store data in the column *Name* of a table, it is better to declare that column as of type VARCHAR, because the data in the column may contain different number of characters. The length of the string can vary from 0 to 65535 characters (MySQL version dependent). The VARCHAR type saves memory space since VARCHAR type did not append spaces with the values when they are stored. The data like name of people, addresses etc. are examples of this data type.

C. Date and Time data types

MySQL has data types for storing dates and times. The data type used to store date type value is **DATE** and to store time value is **TIME**.

(i) **DATE**

The DATE data type is used to store dates. MySQL represents date values in YYYY-MM-DD format. The supported range is from 1000-01-01 to 9999-12-31. Dates are displayed in MySQL in one format, but we can use various date formats in our SQL statements. The YYYY-MM-DD is the standard format. But we can use any punctuation character between the date parts. For example, '2011-01-24', '2011/01/25', '20110126' are valid date combinations in MySQL. We can insert date type values into a column of DATE data type in any of the above formats. Although MySQL tries to interpret values in several formats, date parts must always be given in year-month-day order (for example, '98-09-04').

(ii) **TIME**

The TIME data type is used to specify a column to store time values in MySQL. It shows values in the standard HH:MM:SS format. The TIME data type can be used to store a specific point in time (like 10 hours 05 minutes 25 seconds) as well as an interval of time between two points in time (like the time between now and the weekend) that may sometimes be larger than 23 hours. When manually entering a time into MySQL it is highly recommended that you use the exact format HH:MM:SS.



Let us do

Now look at Table 9.3 and fill the **Data type** column with suitable MySQL data type for the given data.

Value	Data type
325.678	
'A'	
'Computer'	
'2016-01-01'	
450	
22:32:45	
456787	

Table 9.3: Data type of values

Know your progress



1. SQL stands for _____.
2. _____ command is used to make a database active.
3. How can we see the names of databases in the system?
4. What is the difference between CHAR and VARCHAR data types?
5. Which is the format for storing date type data in MySQL?
6. Can we store the number 234 in a column declared with CHAR (5) data type?

9.3 SQL commands

SQL provides commands to perform different operations on database. As we mentioned earlier, the commands are classified as DDL commands, DML commands and DCL commands. Here, we will discuss the most commonly used DDL commands and DML commands. DDL commands are used to perform operations associated with the structure of database. The operations include creation of tables, modification in the structure of tables and removal of tables. DML commands are associated with the operations on the content of tables. These operations include insertion of records, retrieval of records, modification or updation of records and deletion of records.

These commands will be introduced in such a way that we can create a table for organizing data of a particular entity, retrieve required information and remove those we do not want to keep further.

9.4 Creating tables

Tables are the central and the most important objects in any relational database. The primary purpose of any database is to hold data that are stored in tables. Now



let us again consider the table *student* given in Table 9.1. How can we create a table with a set of columns? The DDL command **CREATE TABLE** is used to define a table by specifying the name of the table and giving the column definitions consisting of name of the column, data type and size, and constraints if any, etc. Remember that each table must have at least one column. The syntax of **CREATE TABLE** command is:

```
CREATE TABLE <table_name>
(<column_name> <data_type> [<constraint>]
[, <column_name> <data_type> [<constraint>],]
.....
..... ) ;
```

Here, the `<table_name>` represents the name of the table that we want to create; `<column_name>` represents the name of a column in the table; `<data_type>` represents the type of data in a column of the table; and `<constraint>` specifies the rules that we can set on the values of a column. All the columns are defined within a pair of parentheses, and are separated by commas. We can define all the columns even in a single line.

9.4.1 Rules for naming tables and columns

While naming the tables and columns, certain points are to be remembered and they are listed below.

- The name may contain letters (A - Z, a - z), digits (0 - 9), under score (_) and dollar (\$) symbol.
- The name must contain at least one character. (Names with only digits are invalid).
- The name must not contain white spaces, special symbols.
- The name must not be an SQL keyword.
- The name should not duplicate with the names of other tables in the same data base and with other columns in the same table.



In some MySQL versions, the table name can be a quoted identifier. The identifier quote character is the backtick (" "). If we use table name as quoted, then we can include any special symbols in the name of the table.

Now, let us create a table *student* to store the details of a group of higher secondary students in a school. The fields of the table and their descriptions are given in Table 9.4.

Sl. No.	Attributes	Description
1	Admission number	Integer value
2	Name	String of 20 characters long
3	Gender	A single character
4	Date of birth	Date type
5	Course	String of 15 characters long
6	Family income	Integer value

Table 9.4: Attributes of student table

The SQL statement or query to create a table in MySQL to incorporate the details shown in Table 9.4 is given in Query 9.1.

Query 9.1

```
CREATE TABLE student
(adm_no INT,
name VARCHAR(20),
gender CHAR,
dob DATE,
course VARCHAR(15),
f_income INT);
```

Here, the CREATE TABLE statement creates a table named student with five columns adm_no, name, gender, dob, course and f_income. The columns adm_no can contain integer values, name can contain strings up to a maximum of 20 characters, gender can store a single character indicating whether a student is a boy or a girl, dob can store date of birth, course can contain the group in which he/she is studying and f_income can hold the monthly income of the family. The columns name and course will spare only the actual space required by the respective string data.

After creating a table, when we insert records in that table, some kind of restriction may need to be enforced in certain columns. Restrictions may be in the form of denying empty values in some columns and refusing duplicate values in some other columns. But it should be addressed during the table creation itself. MySQL provides some keywords called constraints, for this purpose.

9.4.2 Constraints

Constraints are the rules enforced on data that are entered into the column of a table. When we create a table, we can apply constraints on the values that can be entered into its fields. If this is specified in the column definition, SQL will not



accept any values that violate the criteria concerned. This ensures the accuracy and reliability of the data in the database. The constraints ensure database integrity and hence they are often called data base integrity constraints. Constraints could be column level or table level.

a. Column Constraints

Column constraints are applied only to individual columns. They are written immediately after the data type of the column. The following are column constraints:

i. NOT NULL

This constraint specifies that a column can never have NULL values. NULL is a keyword in SQL that represents an empty value. It is important to remember that NULL does not equate to a blank or a zero; it is something else entirely. Though a blank is equal to another blank and a zero is equal to another zero, a NULL is never equal to anything, not even another NULL. Two NULL values cannot be added, subtracted or compared.

ii. AUTO_INCREMENT

MySQL uses the AUTO_INCREMENT keyword to perform an auto-increment feature. If no value is specified for the column with AUTO_INCREMENT constraint, then MySQL will assign serial numbers automatically and insert the newly assigned value in the corresponding column of the new record. By default, the starting value for AUTO_INCREMENT is 1, and it will be incremented by 1 for each new record. This special behavior also occurs if we explicitly assign the value NULL to the column. The AUTO_INCREMENT feature makes it easy to assign a unique ID to each new row, because MySQL generates the values for us. The auto increment column must be defined as the primary key of the table. Only one AUTO_INCREMENT column per table is allowed.

iii. UNIQUE

It ensures that no two rows have the same value in the column specified with this constraint.

iv. PRIMARY KEY

This constraint declares a column as the primary key of the table. This constraint is similar to UNIQUE constraint except that it can be applied only to one column or a combination of columns. The primary keys cannot contain NULL values. In other words, it can be considered as a combination of UNIQUE and NOT NULL constraints. A PRIMARY KEY constraint is used to enforce a rule that a column should contain only unique, non-NULL data.

V. DEFAULT

Using this constraint, a default value can be set for a column, in case the user does not provide a value for that column of a record.

Let us apply some of these constraints in the student table and modify Query 9.1 as given in Query 9.2.

Query 9.2

```
CREATE TABLE student
(adm_no INT PRIMARY KEY AUTO_INCREMENT,
name VARCHAR(20) NOT NULL,
gender CHAR DEFAULT 'M',
dob DATE,
course VARCHAR(15)
f_income INT);
```

In Query 9.2, the constraints `PRIMARY KEY` and `AUTO_INCREMENT` are applied to the column `adm_no`. So, this column will not allow duplicate values during data entry. If we donot specify a value for this column, MySQL will generate a data automatically. The constraint `NOT NULL` applied to the column `name` does not allow to leave the column with a `null` value. That is, data is a must in this column. Similarly, if we do not give a value to the column `gender`, 'M' will be stored as the default value.

b. Table constraints

Table constraints are similar to column constraints; the main difference is that table constraints can be used not only on individual columns, but also on a group of columns. When a constraint is to be applied on a group of columns of a table, it is called table constraint. The table constraint appears at the end of the table definition. For example, Query 9.3 creates a table named *stock*. The constraint `UNIQUE` is applied to the combination of `icode` and `iname`.

Query 9.3

```
CREATE TABLE stock
(icode CHAR(2) PRIMARY KEY AUTO_INCREMENT,
iname VARCHAR(30) NOT NULL,
dt_purchase DATE,
rate DECIMAL(10,2),
qty INT,
UNIQUE (icode, iname));
```

In Query 9.3, the constraint `UNIQUE` is applied to the combination of values of columns `icode` and `iname`. It enforces a situation that no two rows can have the same values for the columns `icode` and `iname` when taken together.



9.4.3 Viewing the structure of a table

We have created two tables, *student* and *stock*. How do we know the structure of the table after its creation? The **DESCRIBE** command is used to display the structure definitions of a table. The syntax is:

```
DESCRIBE <table_name>;
```

OR

```
DESC <table_name>;
```

The structure of the table *student* can be viewed using the command:

```
DESC student;
```

Figure 9.4 shows the output of this command.

Field	Type	Null	Key	Default	Extra
adm_no	int(11)	NO	PRI	NULL	auto_increment
name	varchar(20)	NO		NULL	
gender	char(1)	YES		M	
dob	date	YES		NULL	
course	varchar(15)	YES		NULL	
f_income	int(11)	YES		NULL	

6 rows in set (0.02 sec)

Fig. 9.4: Structure of student table

Note that in Query 9.2, we did not mention the size for the columns *adm_no* and *f_income* while creating the table. But MySQL takes the default size 11 as the size of these two columns. The column *adm_no* is declared with PRIMARY KEY and AUTO_INCREMENT. So this column will not allow duplicate values and null values. If we do

not specify a value for this column, a new value will be generated by adding 1 to the value of the respective column of the previous record. In the absence of a value for this column for the first record, MySQL gives 1 as the value. We can also see that a default value 'M' is set for the column *gender*. Figure 9.4 illustrates these aspects. There is a command **SHOW TABLES**, which shows the tables created in the current database as given in Figure 9.5.

```
+-----+
| Tables_in_school |
+-----+
| student          |
+-----+
1 row in set (0.00 sec)
```

Fig. 9.5: Output of SHOW TABLES



Let us do

Write the structure of the table *stock*, referring to Figure 9.4 and Query 9.3. Verify your answer in the lab with the command, **DESC stock;**

Know your progress



- Which of the following commands is used to display the structure of a table?
a. LIST b. SHOW c. DESCRIBE d. STRUCT
- Write the syntax of `CREATE TABLE` command.
- Name the different column constraints.
- What is the difference between primary key constraint and unique constraint?
- What are the features of `AUTO_INCREMENT` constraint?
- Write down the rules for naming a table.
- How many columns in a table can be specified as primary key of the table?

9.5 Inserting data into tables

We have created a database and its tables. Now we need to put some records into these tables. We have the details of six students in Table 9.1. Let us discuss how these records can be inserted into the table.

The DML command **INSERT INTO** is used to insert tuples into tables. The syntax is:

```
INSERT INTO <table_name> [<column1>,<column2>,...,<columnN>]
VALUES(<value1>,<value2>,...,<valueN>);
```

Here `<table_name>` is the name of the table into which the tuples are to be inserted; `<column1>,<column2>,...,<columnN>` indicate the name of columns in the table into which values are to be inserted; `<value1>,<value2>,...,<valueN>` are the values that are inserted into the columns specified in the `<column_list>`.

For example, let us insert a new record into the table *student* with data 1001, 'Alok', 'M', 1998/10/2, 'Science', 24000 into the columns `adm_no`, `name`, `gender`, `dob`, `course` and `f_income`, respectively. Query 9.4 makes it possible.

Query 9.4

```
INSERT INTO student
VALUES (1001,'Alok','M','1998/10/2','Science',
      24000);
```

The response of the system will be:

Query OK, 1 row affected (0.05 sec).



The INSERT statement adds a new row to the table *student* giving a value for every column in the table. While inserting a row, if we provide values for all the columns of the table, we need not specify the name of column(s) in the query. But we need to make sure that the order of the values is in accordance with the order of the columns in the table. Now let us insert another row with some modifications as shown in Query 9.5.

Query 9.5

```
INSERT INTO student (name, dob, course, f_income)
VALUES ('Nike', '1998/11/26', 'Science', 35000);
```

The response for this statement will be:

Query OK, 1 row affected (0.01 sec)

In Query 9.5, admission number and gender are not provided. Being a record after the one with admission number 1001, the admission number of this student will be 1002. The gender will be set with the default value 'M'.

While inserting data into tables, the following points are to be taken care of:

- While adding a new row, we should ensure the data type of the value and the column matches.
- We follow the integrity constraints, if any, defined for the table.
- CHAR or VARCHAR type data should be enclosed in single quotes or double quotes.
- Column values for DATE type columns are to be provided within single quotes. The string will internally be converted into DATE data type.
- Null values are specified as NULL (or null) without quotes.
- If no data is available for all columns, then the column list must be included, following the table name.

MySQL allows inserting several rows into a table with a single INSERT command by specifying multiple value lists. The general format is as follows:

```
INSERT INTO <table-name> VALUES(...), (...), ... ;
```

Let us insert two more records given in Table 9.1 using Query 9.6.

Query 9.6

```
INSERT INTO student (name, dob, course, f_income)
VALUES ('Bharath', '1999/01/01', 'Commerce', 45000),
      ('Virat', '1998/12/05', 'Science', 22000);
```

The response of the system will be:

Query OK, 2 rows affected (0.02 sec)

Records: 2 Duplicates: 0 Warnings: 0

We can observe that the two records are given within separate pairs of parentheses. The response indicates that the two records are inserted successfully.

Suppose we do not have the monthly income data of a student. How can we insert the record? Query 9.7 illustrates the solution.

Query 9.7

```
INSERT INTO student(name, dob, gender, course)
VALUES ('Meera', '1998/08/15', 'F', 'Science');
```

As a response to this query, the value for `adm_no` will be generated by the system, but the value for `f_income` column will be kept as `NULL`. The order of columns is also changed in this query. The absence of values in a row can be managed in another way also as shown in Query 9.8.

Query 9.8

```
INSERT INTO student(name, dob, gender, course,
                    f_income)
VALUES ('Divakar', '1998/02/21', 'Science', NULL);
```

Note that, in the `VALUES` clause, `NULL` is given for `f_income`.



Let us insert some more records in table *student*. Write queries to store the details of students shown in Table 9.5.

Let us do

adm_no	name	gender	dob	course	f_income
1025	Kaushi	M	1998/10/2	Commerce	17000
1026	Niveditha	F	1999/03/04	Humanities	52000
1027	Sreekumar	M	1998/06/06	Science	15000
1057	Chaithanya	F	1999/06/03	Science	

Table 9.5: More records for Student table

Know your progress



- Which of the following is used to add a row into a table?
a. ADD b. CREATE c. INSERT d. MAKE
- Which statement is used to insert new data into a table?
a. ADD RECORD b. INSERT RECORD
c. INSERT INTO d. INSERT ROW
- Write the essential keywords used along with `INSERT` command.

**Let us do**

Write SQL statements to insert some records in the table *stock* created using Query 9.3. While giving values to the columns, utilise the facility of `AUTO_INCREMENT` and `UNIQUE` constraints.

9.6 Retrieving information from tables

We have created a database *school* and a table *student*, and then inserted ten records into it. Now let us learn how information is retrieved from the data stored in tables. It is a kind of data manipulation operation and SQL provides the command **SELECT** for this purpose. It is used to retrieve information from specified columns in a table. The **SELECT** command has several forms of its own. The simplest form of **SELECT** command is:

```
SELECT <column_name>[, <column_name>, <column_name>, ...]
FROM <table_name>;
```

Here `<column_name>` indicates the column from which data is retrieved and `<table_name>` denotes the name of the table from which the information is retrieved. The name of the table is given with the keyword **FROM**, which is an essential clause with **SELECT** command. The **SELECT** command will display the data in columns, in the order in which they appear along with the **SELECT** command.

Now let us illustrate the execution of **SELECT** command through various queries. On executing Query 9.9 we get the name and course of students in the table *student* as shown in Figure 9.6.

Query 9.9

```
SELECT name, course
FROM student;
```

If we want to display the entire column values of a table, we need not give a complete list of columns of the relation. Instead, an asterisk (*) symbol can be used to substitute the complete list of columns as shown in Query 9.10. The output is shown in Figure 9.7.

Query 9.10

```
SELECT * FROM student;
```

name	course
Alok	Science
Nike	Science
Bharath	Commerce
Virat	Science
Meera	Science
Divakar	Science
Kaushi	Commerce
Niveditha	Humanities
Sreekumar	Science
Chaithanya	Science

10 rows in set (0.00 sec)

Fig. 9.6: Output of Query 9.9

adm_no	name	gender	dob	course	f_income
1001	Alok	M	1998-10-02	Science	24000
1002	Nike	M	1998-11-26	Science	35000
1003	Bharath	M	1999-01-01	Commerce	45000
1004	Virat	M	1998-12-05	Science	22000
1005	Meera	F	1998-08-15	Science	NULL
1006	Divakar	M	1998-02-21	Science	NULL
1025	Kaushi	M	1998-10-02	Commerce	17000
1026	Niveditha	F	1999-03-04	Humanities	52000
1027	Sreekumar	M	1998-06-06	Science	15000
1057	Chaithanya	F	1999-06-03	Science	NULL

10 rows in set (0.00 sec)

Fig. 9.7: Entire content of student table

We can see NULL values in column `f_income` of some rows in Figure 9.7. It is due to the missing of values in the insertion of those rows (refer Queries 9.7, 9.8 and Table 9.1, and 9.5).

9.6.1 Eliminating duplicate values in columns using DISTINCT

Suppose we want to know the names of different courses in the table *student*. If we construct a query **SELECT course FROM student;** it will display the column `course` with all the ten values as shown in Figure 9.7. Data will be selected from all rows of the relation to display, even if the data appearing in the result get duplicated. This duplication can be eliminated using the keyword **DISTINCT** as given in Query 9.11. Observe the output given in Figure 9.8.

Query 9.11 **SELECT DISTINCT course**
 FROM student;

In the output, there are no duplicate values. If the column used with **DISTINCT** keyword contains more than one NULL value, only one will be shown in the result.

If we give the keyword **ALL** in the place of **DISTINCT**, then the result will contain all the duplicate values in the column. That is, the output will be the same as that in the case when we neither specify **DISTINCT** nor **ALL**.

course
Science
Commerce
Humanities

3 rows in set (0.25 sec)

Fig. 9.8: Use of DISTINCT

9.6.2 Selecting specific rows using WHERE clause

In certain situations, we need to display only a subset of a table. For example, we may require the details of female students only, or the details of students whose family monthly income is below Rs. 25000/-. In these cases, there is a selection in



the retrieval of records. Obviously the selection is based on some condition(s). SQL enables us to impose some selection criteria for the retrieval of records with **WHERE** clause of **SELECT** command. The syntax of **SELECT** command with **WHERE** clause is:

```
SELECT <column_name>[, <column_name>, <column_name>, ...]
FROM <table_name>
WHERE <condition>;
```

When a **WHERE** clause is present, the **SELECT** command goes through the entire table one row at a time and examines whether the row satisfies the condition(s) or not. If a row satisfies the condition, that row is displayed in the output. The conditions are expressed with the help of relational operators and logical operators. MySQL provides a variety of such operators and they are listed in Table 9.6.

	Operator	Meaning/Result
Relational Operators	=	Equal to
	<> or !=	Not equal to
	>	Greater than
	<	Less than
	>=	Greater than or equal to
	<=	Less than or equal to
Logical operators	NOT	True when condition is false
	AND	True if both the conditions are true
	OR	True if either of the conditions is true

Table 9.6: Operators used for setting conditions

Let us write an SQL statement to display the details of female students in the table. Query 9.12 is the required statement which contains a **WHERE** clause and **=** operator for setting the condition and Figure 9.9 shows the output.

Query 9.12

```
SELECT * FROM student
WHERE gender='F';
```

adm_no	name	gender	dob	course	f_income
1005	Meera	F	1998-08-15	Science	NULL
1026	Niveditha	F	1999-03-04	Humanities	52000
1057	Chaithanya	F	1999-06-03	Science	NULL

3 rows in set (0.06 sec)

Fig. 9.9: List of female students - the output of Query 9.12

Suppose we want to see the name, course and monthly family income of only the Science group students whose income is below Rs. 25000. Here we have to constitute two conditions - one for checking the income and the other for checking the course. When these two conditions are matched while going through the records in the table, the values of their name, course and f_income columns will be retrieved for display. Query 9.13 is the required query and Figure 9.10 shows the output. Note that **AND** operator is used to combine the two conditions.

Query 9.13

```
SELECT name, course, f_income FROM student
WHERE course='Science' AND f_income<25000;
```

Write a query to display the name, course and monthly income of students studying in courses other than *Science* group (i.e., the students of *Commerce* and *Humanities* groups).

name	course	f_income
Alok	Science	24000
Virat	Science	22000
Sreekumar	Science	15000

3 rows in set (0.00 sec)

Fig. 9.10: Use of **AND** operator

While writing the above query, you might have used **OR** operator for setting the condition. The same information can be obtained by the use of **NOT** operator. Query 9.14 illustrates this and Figure 9.11 shows the corresponding output.

Query 9.14

```
SELECT name, course, f_income FROM student
WHERE NOT course='Science';
```

Identify some requirements with respect to the table *stock* which can be attained by setting different conditions, and construct queries using appropriate operators.

name	course	f_income
Bharath	Commerce	45000
Kaushi	Commerce	17000
Niveditha	Humanities	52000

3 rows in set (0.00 sec)

Fig. 9.11: Use of **NOT** operator

SQL has a set of special operators for setting conditions. These include

BETWEEN . . . AND, **IN**, **LIKE** and **IS**. Let us discuss how these operators help us to constitute conditions.

a. Condition based on a range of values

A range of values can be given as condition. The SQL operator **BETWEEN . . . AND** is used to specify the range. Suppose we need a list of students whose monthly income falls in the range of Rs. 25000/- to Rs. 45000/-. We know that this can be obtained by the statement given in Query 9.15. Figure 9.12 shows the output.

Query 9.15

```
SELECT name, f_income FROM student
WHERE f_income>=25000 AND f_income<=45000;
```



The same output can be obtained by using the statement given in Query 9.16. In this statement the operator `BETWEEN...AND` is used to construct the condition. The output includes both the lower and upper values given in the range.

Query 9.16

```
SELECT name, f_income FROM student
WHERE f_income BETWEEN 25000 AND 45000;
```

From Query 9.16 and Figure 9.12, we can conclude that the `BETWEEN...AND` operator allows specifying a range of values which belong to either numeric or date and time type data.

b. Conditions based on a list of values

While setting conditions for the retrieval of records, a list of values can be provided. The values may be of any data type, but it should match with those of the column used in the condition. In such a case, the operator **IN** is used with the list. Suppose we want to retrieve the details of students in *Commerce* and *Humanities* groups. The statement in Query 9.17 can generate the details as shown in Figure 9.13.

Query 9.17

```
SELECT * FROM student
WHERE course='Commerce' OR course='Humanities';
```

adm_no	name	gender	dob	course	f_income
1003	Bharath	M	1999-01-01	Commerce	45000
1025	Kaushi	M	1998-10-02	Commerce	17000
1026	Niveditha	F	1999-03-04	Humanities	52000

3 rows in set (0.00 sec)

Fig. 9.13: Output of Query 9.17

The same output can be obtained by using `IN` operator in the condition as shown in Query 9.18.

Query 9.18

```
SELECT * FROM student
WHERE course IN('Commerce', 'Humanities');
```

As we see in Query 9.18, the `IN` operator checks whether the value in the specified column (here it is `course`) of a record matches any of the values in the given list. When matches are found while going through the records, they will be displayed. Since there are only three courses in the table, the result shown in Figure 9.13 can also be obtained using Query 9.19.

Query 9.19

```
SELECT * FROM student
WHERE course NOT IN('Science');
```


c. Conditions based on pattern matching

There may be the need of retrieving data based on some pattern matching. That is, string data having some similarities in characters may be the criterion for the retrieval of records. SQL provides a pattern matching operator **LIKE** for this purpose. Patterns are specified using two special wildcard characters % and _ (underscore), where % (percentage) matches a substring of characters and _ (underscore) matches a single character. Patterns are case sensitive; i.e.; uppercase characters do not match lower case characters. Consider the following examples:

- "Ab%" matches any string beginning with "Ab".
- "%cat%" matches any string containing "cat" as substring. For example, "education", "indication", "catering" etc.
- "____" matches any string of exactly four characters without any space in between them.
- "___%" matches any string of at least 3 characters.

Query 9.20 illustrates the use of **LIKE** operator. It gives a list of names in the table that end with the substring 'ar'. Figure 9.14 shows the output of this query.

Query 9.20

```
SELECT name FROM student
WHERE name LIKE '%ar';
```

The following query will display only 'Divakar' since there are two _ (underscore) characters for pattern matching.

```
SELECT name FROM student
WHERE name LIKE 'Div__ar';
```

```
+-----+
| name      |
+-----+
| Divakar   |
| Sreekumar |
+-----+
2 rows in set (0.00 sec)
```

Fig. 9.14: Use of pattern matching

d. Conditions based on NULL value search

We have seen that there may be NULL values in some fields of a record. We can retrieve such records with the help of **IS** operator. The condition will be true when the specified column contains a NULL value in the records. In the *student* table, the *f_income* column contains NULL value in three records (refer to Figure 9.7). Query 9.21 retrieves these records and Figure 9.15 shows the output.

Query 9.21

```
SELECT name, course FROM student
WHERE f_income IS NULL;
```

```
+-----+-----+
| name      | course |
+-----+-----+
| Meera     | Science |
| Divakar   | Science |
| Chaithanya | Science |
+-----+-----+
3 rows in set (0.00 sec)
```

Fig. 9.15: NULL value checking



On the other hand, if we want to retrieve the records containing non-null values in the `f_income` column, the following statement can fulfill the task:

```
SELECT name, course FROM student
WHERE f_income IS NOT NULL;
```



Let us do

Identify some requirements with respect to the table *stock* which need the use of the special SQL operators we discussed, and construct queries to solve the problems.

Know your progress



1. Name the keyword used with `SELECT` command to avoid duplication in the values of a column.
2. Which is the essential clause for `SELECT` query?
3. Which of the following operators is used to check for `NULL` value in a column?
a. `IN` b. `LIKE` c. `IS` d. `NOT`
4. The operator used for checking pattern matching is _____.
5. What is wrong with the following statement?

```
SELECT * FROM emp WHERE grade = NULL;
```
6. The command that extracts records from a table is _____.

9.6.3 Sorting results using **ORDER BY** clause

As we can see in the results of the `SELECT` queries discussed so far, the records are always obtained in the order in which they appear in the table. Is it possible to display them in a specific order - ascending or descending, of some column values? Yes. The result of a query can be sorted in the ascending or descending order by making use of **ORDER BY** clause. The order is to be specified by using the keyword **ASC** (for ascending) or **DESC** (for descending) along with the column name that is used with `ORDER BY` clause. By default, the display will be in the ascending order. Remember that only the results that appear on the screen are sorted. The order of records in the table will be kept unaltered.

Query 9.22 will display the details of students in the alphabetical order of their names. Figure 9.16 shows the output.

Query 9.22

```
SELECT * FROM student ORDER BY name;
```

adm_no	name	gender	dob	course	f_income
1001	Alok	M	1998-10-02	Science	24000
1003	Bharath	M	1999-01-01	Commerce	45000
1057	Chaithanya	F	1999-06-03	Science	NULL
1006	Divakar	M	1998-02-21	Science	NULL
1025	Kaushi	M	1998-10-02	Commerce	17000
1005	Meera	F	1998-08-15	Science	NULL
1002	Nike	M	1998-11-26	Science	35000
1026	Niveditha	F	1999-03-04	Humanities	52000
1027	Sreekumar	M	1998-06-06	Science	15000
1004	Virat	M	1998-12-05	Science	22000

10 rows in set (0.00 sec)

Fig. 9.16: Details of students according to the alphabetical order of their names

Suppose we want to see the details according to their monthly family income. If we have to obtain the result from the highest income to the lowest, Query 9.23 can serve the purpose. Figure 9.17 shows the output.

Query 9.23

```
SELECT * FROM student
ORDER BY f_income DESC;
```

adm_no	name	gender	dob	course	f_income
1026	Niveditha	F	1999-03-04	Humanities	52000
1003	Bharath	M	1999-01-01	Commerce	45000
1002	Nike	M	1998-11-26	Science	35000
1001	Alok	M	1998-10-02	Science	24000
1004	Virat	M	1998-12-05	Science	22000
1025	Kaushi	M	1998-10-02	Commerce	17000
1027	Sreekumar	M	1998-06-06	Science	15000
1006	Divakar	M	1998-02-21	Science	NULL
1005	Meera	F	1998-08-15	Science	NULL
1057	Chaithanya	F	1999-06-03	Science	NULL

10 rows in set (0.00 sec)

Fig. 9.17: Age-based listing of students (younger to older)

As shown in Figure 9.17, if the column used with ORDER BY clause contains NULL values, they will be listed last.

Multiple sorting can be performed after selection with the help of ORDER BY clause. For example, if we need a course-based listing of students in the alphabetical order of their names, a statement as given in Query 9.24 can be used. Figure 9.18 shows its output.

Query 9.24

```
SELECT name, course FROM student
ORDER BY course, name;
```



Look at the output shown in Figure 9.18. First the values in the column `course` is arranged alphabetically and then the names are arranged under each course.

Earlier we have used the `WHERE` clause for condition based retrieval of records. The retrieved records can be displayed in a particular order using `ORDER BY` clause. Suppose we want to display the name and family income of *Science* group students according to the descending order of income. The two clauses can be combined to generate this output as shown in Query 9.25. The output is shown in Figure 9.19.

name	course
Bharath	Commerce
Kaushi	Commerce
Niveditha	Humanities
Alok	Science
Chaithanya	Science
Divakar	Science
Meera	Science
Nike	Science
Sreekumar	Science
Virat	Science

10 rows in set (0.00 sec)

Fig. 9.18: Multiple sorting

Query 9.25

```
SELECT name, course, f_income FROM student
WHERE course='Science'
ORDER BY f_income DESC;
```

As shown in Figure 9.19, the records with `NULL` values in the sorted column will appear at last as they appear in the table. Another important aspect is that, if an `ORDER BY` clause is used in a `SELECT` statement, it should appear only after the `WHERE` clause, if any. Because, the records should be selected first, then only they are given for reordering.

name	course	f_income
Nike	Science	35000
Alok	Science	24000
Virat	Science	22000
Sreekumar	Science	15000
Meera	Science	NULL
Divakar	Science	NULL
Chaithanya	Science	NULL

7 rows in set (0.00 sec)

Fig. 9.19: Condition based selection and sorting

Know your progress

- What is the meaning of `ORDER BY` clause?
- Which keyword is used for sorting the data in descending order in MySQL?
 - DESC
 - ASC
 - SORT
 - MODIFY
- In which order are the records displayed in the absence of `ORDER BY` clause.
- In SQL, what is the default sort order of the `ORDER BY` clause?





Let us do

Identify some requirements with respect to the table *stock* which need the sorting of records based on different conditions, and construct queries to solve the problems.

9.6.4 Aggregate functions

MySQL provides a number of built-in functions that can be applied to all rows in a table or to a subset of the table specified by *WHERE* clause. These functions are called aggregate functions because they operate on aggregate of tuples (records). The result of an aggregate function is a single value.

Commonly used aggregate functions are given in Table 9.7.

Function	Return value
SUM ()	Total of the values in the column specified as argument.
AVG ()	Average of the values in the column specified as argument.
MIN ()	Smallest value in the column specified as argument.
MAX ()	Largest of the values in the column specified as argument.
COUNT ()	Number of non NULL values in the column specified as argument.

Table 9.7: Some built-in functions of MySQL

Let us discuss these functions to generate useful information from the table. Query 9.26 gives the highest, lowest and average family monthly incomes of the students. Figure 9.20 shows the result.

Query 9.26

```
SELECT MAX(f_income), MIN(f_income), AVG(f_income)
FROM student;
```

While calculating these values, the NULL values in the argument column are not considered.

```
+-----+-----+-----+
| MAX(f_income) | MIN(f_income) | AVG(f_income) |
+-----+-----+-----+
|          52000 |          15000 | 30000.0000 |
+-----+-----+-----+
1 row in set (0.03 sec)
```

Fig. 9.20: Use of aggregate functions

These functions can be applied to a subset of the table formed by some selection criterion as shown in Query 9.27. It gives the number of students in the *Science* group. Figure 9.21 shows the output.

Query 9.27

```
SELECT COUNT(*), COUNT(f_income)
FROM student
WHERE course='Science';
```

If we refer to Figure 9.19, we can see that the correct answer is 7. Then, why is there a mismatch between the two column values in Figure 9.21? The first column is **COUNT (*)** and it gives the number of records having *Science* as the value in column

COUNT (*)	COUNT(f_income)
7	4

1 row in set (0.03 sec)

Fig. 9.21: Use of COUNT() function

course. Note that the * (asterisk) symbol stands for the collection of all the columns in the table. So, if there is at least one field in a record, that record will be taken into consideration for **COUNT (*)**. But **COUNT(f_income)** in Query 9.27 counts only the non-NULL values in column *f_income* of the records which contains *Science* in column *course*. This is why the second column in Figure 9.21 contains only 4. Refer to Figure 9.17 and identify the rows that contains NULL in column *f_income*.

9.6.5 Grouping of records using GROUP BY clause

Sometimes, we need to divide the tuples in a table into different groups based on the values in a column. The rows of a table can be grouped together based on a common value using the **GROUP BY** clause. The attribute (column) specified in the **GROUP BY** clause is used to form groups. Tuples with the same value in the attribute specified in the **GROUP BY** clause are placed together in one group. Thus different groups are formed based on distinct values in the column. So this process can be considered as categorisation of records.

Using Query 9.27, number of students in *Science* group is obtained. Suppose we want to know the number of students in each group along with average family monthly income. Query 9.28 can be used. The output is shown in Figure 9.22.

Query 9.28

```
SELECT course, COUNT(*), AVG(f_income)
FROM student
GROUP BY course;
```

Here different groups are formed under different values ('Commerce', 'Humanities' and 'Science') in column *course* and the functions **COUNT(*)** and **AVG(f_income)** are applied to each group.

course	COUNT (*)	AVG(f_income)
Commerce	2	31000.0000
Humanities	1	52000.0000
Science	7	24000.0000

3 rows in set (0.00 sec)

Fig. 9.22: Grouping of rows using GROUP BY clause

9.6.6 Applying conditions to form groups using HAVING clause

We have already learnt about the **WHERE** clause, which places conditions on individual rows. We can apply conditions to form groups with the help of **HAVING** clause.

This clause is used along with `GROUP BY` clause. The condition in `HAVING` clause is applied to form groups of records, not individual rows.

Query 9.29 applies a condition for forming groups. Here the groups will be formed only if the condition provided with `HAVING` clause is satisfied.

Query 9.29

```
SELECT course, COUNT(*) FROM student
GROUP BY course
HAVING COUNT(*) > 3;
```

If we refer to Figures 9.22 and 9.23, we can find that only *Science* group has more than 3 students. Groups are not formed based on values '*Commerce*' and '*Humanities*', since the number of records with each of these values are 2 and 1, respectively. That is why details of these groups are not shown by Query 9.29.

```
+-----+-----+
| course | COUNT(*) |
+-----+-----+
| Science |          7 |
+-----+-----+
1 row in set (0.00 sec)
```

Fig. 9.23: Condition based grouping

Know your progress



1. List the aggregate functions of SQL.
2. How do `COUNT(*)` and `COUNT(column_name)` differ?
3. What is the difference between `WHERE` clause and `HAVING` clause?
4. The usage `SUM(*)` or `MAX(*)` is invalid. Why?
5. What will be the result of the following query?

```
SELECT COUNT(DISTINCT course) FROM student;
```



Let us do

Identify some queries with respect to the table *stock* which requires the utilisation of aggregate functions and `ORDER BY` clause. Write SQL statements to answer these queries.

9.7 Modifying data in tables

In certain situations, we need to change the values in the columns of a table. For example, following a revision in salary or wages, the family monthly income of a student may be changed. Similarly, the missing values (`NULL`) in monthly income of some students may need to be replaced by valid data at a later stage. This kind of changes can be done using the DML command **UPDATE**. It changes the values in one or more columns of specified rows. These changes may be affected in all or only in selected rows of the table. The new data for the column within these rows is given using the keyword **SET**, which is the essential clause of `UPDATE` command. The new data can be a constant, an expression or data from other tables.



The syntax of UPDATE command is:

```
UPDATE <table_name>
SET <column_name> = <value> [, <column_name> = <value>, ...]
[WHERE <condition>];
```

Suppose the family monthly income of the student *Kaushi* is to be changed to Rs. 27000/-. Query 9.30 can perform this modification.

Query 9.30

```
UPDATE student
SET f_income=27000
WHERE name='Kaushi';
```

After the execution of this query, the response of MySQL will be as follows:

```
Query OK, 1 row affected (0.08 sec)
Rows matched: 1  Changed: 1  Warnings: 0
```

Let us see the change in the record using the query,

```
SELECT * FROM student WHERE name='Kaushi';
```

The output of this query is shown in Figure 9.24. Compare this figure with Figure 9.17 and see the change.

adm_no	name	gender	dob	course	f_income
1025	Kaushi	M	1998-10-02	Commerce	27000

1 row in set (0.00 sec)

Fig. 9.24: Details of Kaushi with modified data in f_income column

We can use expressions to set the column values in records. Query 9.31 illustrates this concept.

Query 9.31

```
UPDATE student
SET f_income=f_income+1000
WHERE f_income<25000;
```

The output of this query will be as follows:

```
Query OK, 3 rows affected (0.06 sec)
Rows matched: 3  Changed: 3  Warnings: 0
```

The output reveals that three records satisfy the given condition and hence the values in f_income column of these records are incremented by 1000 (refer to Figures 9.17, 9.25).

The columns with NULL values can also be modified with UPDATE command. Suppose we want to store Rs. 20000/- as the monthly income in the respective field of the

records in which the column contains NULL value at present. Query 9.32 makes it possible.

Query 9.32

```
UPDATE student
SET f_income=20000
WHERE f_income IS NULL;
```

The changes made by Queries 9.31 and 9.32 can be observed in Figure 9.25, which is obtained by the query: `SELECT * FROM student;`

adm_no	name	gender	dob	course	f_income
1001	Alok	M	1998-10-02	Science	25000
1002	Nike	M	1998-11-26	Science	35000
1003	Bharath	M	1999-01-01	Commerce	45000
1004	Virat	M	1998-12-05	Science	23000
1005	Meera	F	1998-08-15	Science	20000
1006	Divakar	M	1998-02-21	Science	20000
1025	Kaushi	M	1998-10-02	Commerce	27000
1026	Niveditha	F	1999-03-04	Humanities	52000
1027	Sreekumar	M	1998-06-06	Science	16000
1057	Chaithanya	F	1999-06-03	Science	20000

10 rows in set (0.00 sec)

Fig. 9.25: Modifications in column `f_income`



Let us do

With respect to the table **stock**, write SQL statements to make some modifications in some column values.

9.8 Changing the structure of a table

In some situations, we may need to modify the structure of tables. It is an operation related to the schema and hence SQL provides a DDL command **ALTER TABLE** to modify the structure of a table. The alteration will be in the form of adding or dropping column(s), changing the data type and size of existing column(s), renaming a table, etc. Let us see how these changes are incorporated.

9.8.1 Adding a new column

One or more columns can be added at any position in an existing table. The syntax for adding a new column to a table is:

```
ALTER TABLE <table_name>
ADD <column_name> <data_type>[<size>] [<constraint>]
[FIRST | AFTER <column_name>];
```



Here the `<table_name>` indicates the name of the table which is to be altered; **ADD** is the keyword to add the new column; `<column_name>` `<data_type>` [`<size>`] indicates the description of the new column. **FIRST** | **AFTER** indicates the position of the newly added column.

If we want to add a column at the first position, use the clause **FIRST**. If we want to add a column at a specified position, use the clause **AFTER** `<column_name>`. Note that if we do not specify the position of the new column, then by default, it will be added as the last column of the table. Remember that the newly added column contains only **NULL** values.

Let us add two columns **gr_mks** and **reg_no** in the table *student* to hold the grace marks awarded to the students and their register number for the Higher Secondary examinations, respectively. Query 9.33 can make these changes in the structure of the table.

Query 9.33

```
ALTER TABLE student
ADD gr_mks INTEGER AFTER dob,
ADD reg_no INTEGER;
```

The response of MySQL for this query will be as follows:

```
Query OK, 10 rows affected (0.25 sec)
Records: 10  Duplicates: 0  Warnings: 0
```

9.8.2 Changing the definition of a column

We can modify the characteristics of a column like data type, size and/or constraints by using the clause **MODIFY** with **ALTER TABLE** command. The syntax to modify the definition of a column is:

```
ALTER TABLE <table_name>
MODIFY <column_name> <data_type>[<size>] [<constraint>;
```

Let us modify the newly added column **reg_no** by providing a constraint **UNIQUE** to ensure that no two students have the same register number. Query 9.34 makes this change.

Query 9.34

```
ALTER TABLE student
MODIFY reg_no INTEGER UNIQUE;
```

The response of MySQL will be the same as that we obtained for Query 9.30. We can observe the changes made by the Queries 9.33 and 9.34 using the command: `DESC student;`. The output is shown in Figure 9.26.

Field	Type	Null	Key	Default	Extra
adm_no	int(11)	NO	PRI	NULL	auto_increment
name	varchar(20)	NO		NULL	
gender	char(1)	YES		M	
dob	date	YES		NULL	
gr_mks	int(11)	YES		NULL	
course	varchar(15)	YES		NULL	
f_income	int(11)	YES		NULL	
reg_no	int(11)	YES	UNI	NULL	

8 rows in set (0.00 sec)

Fig. 9.26: Structure of table student after alteration

We can see from Figure 9.26 that column `gr_mks` is added after `dob` and `reg_no` as the last column. Also note that column `Key` for `reg_no` contains **UNIQUE** constraint. Now, if we see the contents in the new columns using the command `SELECT * FROM student;`, we can see NULL values as shown in Figure 9.27.

adm_no	name	gender	dob	gr_mks	course	f_income	reg_no
1001	Alok	M	1998-10-02	NULL	Science	25000	NULL
1002	Nike	M	1998-11-26	NULL	Science	35000	NULL
1003	Bharath	M	1999-01-01	NULL	Commerce	45000	NULL
1004	Virat	M	1998-12-05	NULL	Science	23000	NULL
1005	Meera	F	1998-08-15	NULL	Science	20000	NULL
1006	Divakar	M	1998-02-21	NULL	Science	20000	NULL
1025	Kaushi	M	1998-10-02	NULL	Commerce	27000	NULL
1026	Niveditha	F	1999-03-04	NULL	Humanities	52000	NULL
1027	Sreekumar	M	1998-06-06	NULL	Science	16000	NULL
1057	Chaithanya	F	1999-06-03	NULL	Science	20000	NULL

10 rows in set (0.00 sec)

Fig. 9.27: Contents in the new columns after modifying the structure of table student



Let us do

Write SQL statements to fill in data in the new columns with proper values and display the changes in the records.

Make some structural modifications in the table *stock* and store values according to the changes.

9.8.3 Removing column from a table

If we want to remove an existing column from a table, we can use **DROP** clause along with `ALTER TABLE` command. The syntax for removing a column from a table is:

```
ALTER TABLE <table_name>
DROP <column_name>;
```

For example, if we want to remove the column `gr_mks` from the table *student*, Query 9.35 is sufficient.

**Query 9.35**

```
ALTER TABLE student
DROP gr_mks;
```

The response of MySQL will be the same as we received for the earlier ALTER TABLE statements. The change can be observed using the command: DESC student;

9.8.4 Renaming a table

We can rename a table in the database by using the clause **RENAME TO** along with ALTER TABLE command. We can rename a table even though it contains tuples. The syntax for renaming a table is:

```
ALTER TABLE <table_name>
RENAME TO <new_table_name>;
```

For example, if we want to rename the table *student* as *student2015*, Query 9.36 can help us.

Query 9.36

```
ALTER TABLE student
RENAME TO student2015;
```

The response of this query will be as follows:

Query OK, 0 rows affected (0.06 sec)

The change can be viewed using the query: SHOW TABLES; and the output will be as shown in Figure 9.28.

```
+-----+
| Tables_in_school |
+-----+
| student2015      |
+-----+
1 row in set (0.00 sec)
```

Fig. 9.28: Renaming of table

9.9 Deleting rows from a table

Sometimes we need to remove one or more records from the table. The DML command **DELETE** is used to remove individual or a set of rows from a table. The rows which are to be deleted are selected by using the WHERE clause. If the WHERE clause is not used, all the rows in the table will be deleted. The DELETE command removes only records and not the individual field values. The syntax of the DELETE command is:

```
DELETE FROM <table_name> [WHERE <condition>;]
```

For example, if the record of *Sreekumar* with admission number 1027 is to be deleted from the table, Query 9.37 can be used.

Query 9.37

```
DELETE FROM student2015 WHERE adm_no=1027;
```

The output of this query will be: **Query OK, 1 row affected (0.08 sec)**

Note that the name of the table is specified as *student2015*, because we have renamed the table *student* as *student2015*. The change in the table can be observed in Figure 9.29, which is obtained by the query: SELECT * FROM student2015;

adm_no	name	gender	dob	course	f_income	reg_no
1001	Alok	M	1998-10-02	Science	25000	NULL
1002	Nike	M	1998-11-26	Science	35000	NULL
1003	Bharath	M	1999-01-01	Commerce	45000	NULL
1004	Virat	M	1998-12-05	Science	23000	NULL
1005	Meera	F	1998-08-15	Science	20000	NULL
1006	Divakar	M	1998-02-21	Science	20000	NULL
1025	Kaushi	M	1998-10-02	Commerce	27000	NULL
1026	Niveditha	F	1999-03-04	Humanities	52000	NULL
1057	Chaithanya	F	1999-06-03	Science	20000	NULL

9 rows in set (0.02 sec)

Fig. 9.29: Contents in the renamed table after deleting a record

Figure 9.29 shows only seven columns. This is because of the removal of column `gr_mks` as a result of Query 9.35.



The deletion of values in a column is not possible. The effect may be brought out by filling the column with `NULL` values using `UPDATE` command as follows:

```
UPDATE <table-name>
SET <column-name> = NULL
[WHERE <condition>];
```

9.10 Removing table from a database

If we do not need a table, it can be removed from the database using **DROP TABLE** command. This DDL command removes a table from the database permanently even though the table contains tuples. We have to be very careful while deleting any existing table because once data is lost, it cannot be recovered later. The syntax to remove a table is:

```
DROP TABLE <table_name>;
```

For example, if we want to remove the table *student2015* from the database *school*, Query 9.38 can be used.

Query 9.38

```
DROP TABLE student2015;
```

Know your progress



1. The command used to edit the structure of a table is _____.
2. Restructuring of a column affects the values in it. State whether true or false.
3. How will you remove a column from a table?
4. Name the command used to remove a row from a table.
5. What happens when we use `DELETE FROM` command without a `WHERE` clause?



9.11 Nested queries

We are all familiar with the concept of nesting as we discussed it in nested if, nested loop, etc. Now, we will discuss nested queries. We know that nested means one inside another. Here the result of one query is dynamically substituted in the condition of another. A MySQL inner query is also called sub query, while the query that contains the sub query is called an outer query. SQL first evaluates the inner query (sub query) within the WHERE clause and the result of inner query is then substituted in the condition of the outer query. While using relational operators, ensure that the sub query (inner query) returns a single row output.

Suppose we want to display the name and course of the students who have the highest family monthly income. Query 9.39 can perform this task and Figure 9.30 shows the output.

Query 9.39

```
SELECT name, course FROM student2015
WHERE f_income=(SELECT MAX(f_income)
                  FROM student2015);
```

In this example, the sub query (here query inside the pair of parentheses) is evaluated first and the highest value in f_income column (here 52000) is returned. This value is then compared with the value in f_income attribute of the records in the table and when a match is found, it is retrieved by the outer query.

```
+-----+-----+
| name   | course |
+-----+-----+
| Niveditha | Humanities |
+-----+-----+
1 row in set (0.03 sec)
```

Fig. 9.30: Result of nested query

9.12 Concept of views

MySQL supports the concept of views, which is a feature of RDBMS. A **view** is a virtual table that does not really exist in the database, but is derived from one or more tables. The table(s) from which the tuples are collected to constitute a view is called base table(s). These tuples are not physically stored anywhere, rather the definition of the view is stored in the database. Views are just like windows through which we can view the desired information that is actually stored in a base table. The contents of a view are taken from other tables depending upon a query condition. A view can be created with the DDL command CREATE VIEW. The syntax is:

```
CREATE VIEW <view_name>
AS SELECT <column_name1> [, <column_name2> , ...]
FROM <table_name>
[WHERE <condition>];
```

Let us create a view that contains the details of only those students who were born before January 1, 1999. Query 9.40 creates this view named *student1998*.

Query 9.40 `CREATE VIEW student1998`
 `AS SELECT * FROM student2015`
 `WHERE dob < '1999-1-1';`

The output of this query will be: **Query OK, 0 rows affected (0.31 sec)**

Figure 9.31 shows the structure of the view and Figure 9.32 shows the contents of the view. These can be obtained by the commands `DESC student1998;` and `SELECT * FROM student1998;` respectively.

Field	Type	Null	Key	Default	Extra
adm_no	int(11)	NO		0	
name	varchar(20)	NO		NULL	
gender	char(1)	YES		M	
dob	date	YES		NULL	
course	varchar(15)	YES		NULL	
f_income	int(11)	YES		NULL	
reg_no	int(11)	YES		NULL	

7 rows in set (0.01 sec)

Fig. 9.31: Structure of the view student1998

adm_no	name	gender	dob	course	f_income	reg_no
1001	Alok	M	1998-10-02	Science	25000	NULL
1002	Nike	M	1998-11-26	Science	35000	NULL
1004	Virat	M	1998-12-05	Science	23000	NULL
1005	Meera	F	1998-08-15	Science	20000	NULL
1006	Divakar	M	1998-02-21	Science	20000	NULL
1025	Kaushi	M	1998-10-02	Commerce	27000	NULL

6 rows in set (0.00 sec)

Fig. 9.32: Contents in the view student1998

Note that in Figure 9.31, the column `Key` does not contain the constraints of `adm_no` and `reg_no`, and Figure 9.32 shows the details of students born in the year 1998 only.

We can use all the DML commands with the view in quite a similar fashion as in the case of tables. Figure 9.32 is a result of such a query. Remember that we are accessing the base table through the associated views. So, take care when operations like `update` and `delete` are performed on views as they actually reflect in the base tables. Query 9.41 illustrates this concept.

Query 9.41 `UPDATE student1998`
 `SET reg_no=2201020`
 `WHERE adm_no=1001;`



Let us check the data in the table '*student2015*' after executing this query. Figure 9.33 shows the output of the query: `SELECT * FROM student2015;`

adm_no	name	gender	dob	course	f_income	reg_no
1001	Alok	M	1998-10-02	Science	25000	2201020
1002	Nike	M	1998-11-26	Science	35000	NULL
1003	Bharath	M	1999-01-01	Commerce	45000	NULL
1004	Virat	M	1998-12-05	Science	23000	NULL
1005	Meera	F	1998-08-15	Science	20000	NULL
1006	Divakar	M	1998-02-21	Science	20000	NULL
1025	Kaushi	M	1998-10-02	Commerce	27000	NULL
1026	Niveditha	F	1999-03-04	Humanities	52000	NULL
1057	Chaithanya	F	1999-06-03	Science	20000	NULL

9 rows in set (0.00 sec)

Fig. 9.33: Effect of updation in the base table through the view

The advantages of views lie in the fact that without sparing extra storage space, we can use the same table as different tables (but virtual). Another advantage is that the views implement sharing along with privacy. It also helps to reduce the complexity of conditions with `WHERE` clause while retrieving, updating or deleting records from tables.

If a view is no longer needed, it can be removed from the database with **DROP VIEW** command. But it will not affect the base table(s). The syntax is:

```
DROP VIEW <view_name>;
```

For example, if we want to delete the view *student1998* from the database, Query 9.42 can be used.

Query 9.42 `DROP VIEW student1998;`

Know your progress

1. What is mean by nested query?
2. What is view in SQL?
3. Creation of a view needs a `SELECT` command. State whether true or false.
4. Removal of a view deletes a table from the database. State whether true or false.
5. Can we update a table using its view?



Let us do

We have discussed all the DDL and DML commands of SQL, which are implemented through MySQL, with examples and their outputs. Let us summarise them in Table 9.8. The first two rows are filled in and the remaining rows are left to you.

SQL	Command	Essential Keyword	Purpose of the command
DDL	CREATE TABLE	ADD/MODIFY	To create tables
	ALTER TABLE		To change the structure of tables
	DROP TABLE		
	CREATE VIEW		
	DROP VIEW		
DML	INSERT		
	SELECT		
	UPDATE		
	DELETE		

Table 9.8: Summary of SQL command



Let us conclude

Structured Query Language is used to operate on relational database. MySQL is a popular RDBMS package by which we can implement SQL commands. We have used various DDL commands to perform operations related with the structure of database. Constraints have been presented to ensure data validity and integrity in database. We have also discussed different DML commands to perform operations associated with the data contained in tables of a database. These operations include insertion, retrieval, modification and deletion of data in tables. We have also familiarized ourselves with nested queries and the concept of views. A good understanding of this chapter is essential for your higher studies in the field of computers.



Let us practice

- The structure of a table is given to store the details of marks scored by students in an examination.

Data	Type	Description
Register number	Numeric	A unique and essential data to identify a student
Name	String	A maximum of 30 characters
Course	String	It can be Science, Commerce or Humanities
Marks of six subjects	Numeric each	Six separate columns are required



Write SQL statements for the creation of the table and the following requirements:

- a. Insert data into the fields (at least 10 records).
 - b. Display the details of all students.
 - c. List the details of Science group students.
 - d. Count the number of students in each course.
 - e. Add a new column named Total to store the total marks.
 - f. Fill the column Total with the sum of the six marks of each student.
 - g. Display the highest total in each group.
 - h. Find the highest, lowest and average score in Subject 6 in Commerce group.
 - i. Display the names in the alphabetical order in each course.
 - j. Display the name of the student with the highest total.
2. The structure of a table is given to store the details of items in a computer shop.

Data	Type	Description
Item number	Numeric	A unique and essential data to identify an item
Item name	String	A maximum of 30 characters
Date of purchase	Date	Duplication is allowed
Unit price	Fractional Number	Price of a single item
Quantity	Numeric	Number of items
Manufacturer	String	Name of supplier (can duplicate)

Write SQL statements for the creation of the table and the following requirements:

- a. Insert data into the fields (at least 10 records).
- b. Display the details of all items in the table.
- c. Display the names of items and total price of each.
- d. List the items manufactured by a company (*specify the name*) available in the table.
- e. Find the number of items from each manufacturer.
- f. Display the details of items with the highest price.

- g. List the names of items whose price is more than the average price of all the items.
 - h. Display the names of items purchased after 1-1-2015.
 - i. Get the details of items manufactured by two or three companies (*specify the names*) available in the table .
 - j. Display the details of items from a company (*specify the name*) with a stock of more than 20 pieces.
3. The structure of a table is given to store the details of higher secondary school teachers.

Data	Type	Description
Teacher ID	Numeric	A unique and essential data to identify a teacher
Name	String	A maximum of 30 characters
Gender	Character	Male or Female
Date of joining	Date	Duplication is allowed
Department	String	Science, Commerce, Humanities or Language
Basic pay	Numeric	Basic salary of a teacher

Write SQL statements for the creation of the table and the following requirements:

- a. Insert data into the fields (at least 10 records).
 - b. Display the details of all female teachers in the table.
 - c. List the details of male teachers in the Science department.
 - d. Display the names and basic pay of teachers in the Language department whose basic pay is Rs. 21000/- or more.
 - e. Display the names and 71% of basic pay of the teachers.
 - f. Find the number of teachers in each department.
 - g. Display the details of teachers whose basic pay is less than the average basic pay.
 - h. List the male teachers who joined before 1-1-2010.
 - i. Increment the basic pay of all teachers by Rs. 1000/-.
 - j. Delete the details of teachers from the Language department.
4. The structure of a table is given to store the details of customers in a bank.



Data	Type	Description
Account number	Numeric	A unique and essential data to identify a customer
Name	String	A maximum of 30 characters
Gender	Character	Male or Female
Date of joining	Date	Duplication is allowed
Type of account	String	SB or Current
Balance amount	Numeric	Can be a fractional number

Write SQL statements for the creation of the table and the following requirements:

- Insert data into the fields (at least 10 records).
- Display the details of customers having SB account.
- Display the names of customers with a balance amount greater than Rs. 5000/-.
- Display the details of female customers with a balance amount greater than Rs. 10000/-.
- Count the number of male and female customers.
- Display the names of customers with the highest balance amount.
- Display the names of customers whose names end with 'kumar'.
- Update the balance amount of a particular customer with a deposit amount of Rs. 2000/-.
- Display the details of customers with a tax deduction of 2% of the balance amount for those who have Rs.2,00,000/- in their account.
- Delete the details of customers with current account.

Let us assess



- The command to remove rows from a table 'CUSTOMER' is:
 - REMOVE FROM CUSTOMER
 - DROP TABLE CUSTOMER
 - DELETE FROM CUSTOMER
 - UPDATE CUSTOMER
- If values for some columns are unknown, how is a row inserted?
- Distinguish between CHAR and VARCHAR data types of SQL.
- What is the difference between PRIMARY KEY and UNIQUE constraints?
- What do you mean by NULL value in SQL?

6. Which of the following is the correct order of clauses for the SELECT statements?
 - a. SELECT, FROM, WHERE, ORDER BY
 - b. SELECT, FROM, ORDER BY, WHERE
 - c. SELECT, WHERE, FROM, ORDER BY
 - d. SELECT, WHERE, ORDER BY, FROM
7. The SQL operator _____ is used with pattern matching.
8. Read the following strings:
 (i) 'Sree Kumar' (ii) 'Kumaran' (iii) 'Kumar Shanu' (iv) 'Sreekumar'
 Choose the correct option that matches with the pattern '%Kumar', when used with LIKE operator in a SELECT statement.
 - a. Strings (i) and (ii) only
 - b. Strings (i), (iii) and (iv) only
 - c. Strings (i) and (iii) only
 - d. All the strings
9. List any five built-in functions of SQL and the value returned by each.
10. Distinguish between WHERE clause and HAVING clause.
11. Write any four DML commands in SQL.
12. Write the essential clause required for each of the following SQL command.
 - a. INSERT INTO
 - b. SELECT
 - c. UPDATE
13. Consider the given table Customer and write the output of the following SQL queries:

AccNo	Name	Branch	Amount
1001	Kumar	Calicut	10000
1002	Salim	Trivandrum	20000
1003	Fida	Kottayam	18000
1004	John	Kannur	30000
1005	Raju	Thrissur	5000

- a. `SELECT * FROM customer WHERE Amount>25000;`
- b. `SELECT Name FROM customer
WHERE Branch IN ('Calicut, 'Kannur');`
- c. `SELECT COUNT(*) FROM customer WHERE Amount < 20000;`
- d. `SELECT Name FROM customer WHERE Name LIKE "%m%";`
- e. `SELECT * FROM customer ORDER BY Amount DESC;`



14. Distinguish between `COUNT (*)` and `COUNT (column-name)`.
15. Consider the given table ITEMS.

Item Code	Name	Category	Unit Price	Sales Price
0001	Pencil	Stationery	5.00	8.00
0002	Pen	Stationery	8.00	10.00
0003	NoteBook	Stationery	10.00	20.00
0004	Chappal	Footwear	50.00	70.00
0005	Apple	Fruits	60.00	90.00
0006	Orange	Fruits	40.00	60.00
0007	Pen	Stationery	10.00	12.00

- a. Suggest a suitable primary key for the above table. Give justification.
- b. Write SQL statements for the following:
- To list all stationery items.
 - To list itemcode, name and profit of all items.
 - To count the number of items in each category.
 - To list all stationery items in the descending order of their unit price.
 - To find the item with the highest selling price.
 - To create a view that contains the details of all stationery items.
16. What are the different modifications that can be made on the structure of a table? Which is the SQL command required for this? Specify the clauses needed for each type of modification.
17. A table is created in SQL with 10 records. Which SQL command is used to change the values in a column of specified rows? Write the format.
18. Name the keyword used with `SELECT` command to avoid duplication of values in a column.
19. Distinguish between `DISTINCT` and `UNIQUE` in SQL.
20. Pick the odd one out and give reason:
- a. `CREATE` b. `SELECT` c. `UPDATE` d. `INSERT`



10

Trends and Issues in ICT

Significant Learning Outcomes

After the completion of this chapter, the learner

- identifies the various mobile computing terminologies.
- recognises the features of mobile operating systems.
- discovers the features of Android operating system.
- lists and explains various Intellectual Property Rights.
- explains cyberspace.
- distinguishes different types of cyber-crimes.
- details cyber law and ethics.
- identifies the importance of IT Act.
- recognise infomania.

The use of Internet has increased rapidly in the last few decades. The modern society cannot think of a day without the Internet and the services provided by it. The developments in computer technology have led to the development of powerful but cheaper mobile devices. People have started accessing these services on Internet using their mobile devices like mobile phones, tablets, etc. Information and Communication Technology (ICT) is the term often used as an extended synonym for Information Technology (IT). ICT is more specific in integrating telecommunication and computers. In this chapter we discuss the different technologies and services in mobile communication. The various mobile operating systems available are discussed here with special focus on Android operating system.

Similar to rights on property like land, house, etc., intellectual properties like music, films, software, designs, etc. have also ownership rights. These rights are called Intellectual Property Rights and the issues related to them are discussed in this chapter. Every technology has a dark side. Internet also has its share of issues and threats. Some people use this medium for performing illegal activities. We will discuss such actions and how we can safeguard ourselves in the Internet.

10.1 Mobile computing

The advances in computer technology have led to the development of more computing power in small devices. Light weight computing devices with low power consumption are now cheap and common. Devices like laptops, tablets, smart phones, etc. have drastically changed the lifestyle and work culture of people. Today people are able to connect to others, send and receive files or other information anywhere, anytime. This has increased computing demands on a daily basis.

Mobile computing is a technology that has computing capability and can transmit/receive data while in motion. Mobile computing requires portable computing devices like laptops, tablets, smart phones, etc., wireless communication networks and connectivity to the Internet. The demand for mobile computing initiated the growth and development of mobile communication technology.

10.2 Mobile communication

The term ‘mobile’ has completely revolutionised communication by opening up innovative ways for exchanging information. Today, mobile communication has become the backbone of society. Mobile system technologies have improved standards of living. Mobile communication networks do not depend on any physical connection to communicate between two devices.

10.2.1 Generations in mobile communication

The mobile phone was introduced in the year 1946. In the initial stage, growth in mobile communication was very slow. With the increase in the number of users, accommodating them within the limited available frequency spectrum became a major problem. To solve this problem, the concept of cellular communication was evolved. The cellular concept was developed in the 1960's at Bell Laboratories. However, in the late 1990's, when the Government of India offered spectrum licenses for mobile communication, cellular technology became a common standard in our country. The different generations in mobile communication are given below:



a. First Generation networks

First Generation (1G) network refers to the first-generation of wireless telephone technology (mobile telecommunications) developed around 1980. 1G mobile phones were based on the analog system and provided basic voice facility only.

b. Second Generation networks

Second Generation (2G) networks follow the digital system for communication. This improved the audio quality in transmission. In 2G networks, phone conversations are digitally encrypted. These networks provided far greater mobile phone coverage. 2G networks also introduced data services for mobile. Picture messages and Multimedia Messaging Service (MMS) were introduced. The two popular standards introduced by 2G systems are Global System for Mobiles (GSM) and Code Division Multiple Access (CDMA). A detailed discussion on the GSM and CDMA standards are given below.

i. Global System for Mobile

Global System for Mobile (GSM) is a globally accepted standard for digital cellular communication. It is a digital, circuit-switched network for voice telephony. The frequency band for GSM is 900 MHz to 1800 MHz. GSM follows a uniform international standard that made it possible to use a mobile device around the world. The network is identified using the Subscriber Identity Module (SIM). Users can select a handset of their choice. GSM is the most successful family of cellular standards. Let us now discuss the different technologies that are used to enhance data communication features to GSM.

GPRS and EDGE

2G network was expanded later to include improved data communication features using GPRS (General Packet Radio Services) and EDGE (Enhanced Data rates for GSM Evolution).

GPRS is a packet oriented mobile data service on GSM. When compared to conventional GSM, users of GPRS benefited from shorter access time and higher data rates. GPRS allows billing based on the volume of data transferred. Although GPRS is a data only technology, it helps to improve GSM's voice quality.

EDGE is a digital mobile phone technology that allows improved data transmission rates for GSM. EDGE is a superset to GPRS and can function on any network with GPRS deployed on it. It provides nearly three times faster speeds than the GPRS system. Both the phone and the network must support EDGE, otherwise the phone will revert automatically to GPRS.

ii. Code Division Multiple Access

In Code Division Multiple Access (CDMA) system, several transmitters can send information simultaneously over a single communication channel. CDMA provides wider coverage than GSM and provides better reception even in low signal strength conditions. The voice quality in CDMA is better than GSM. It has a signal with



wider bandwidth and increased resistance to interference. CDMA technology provides better security to the mobile network when compared to GSM.

c. Third Generation networks

Third Generation (3G) wireless network technology provides high data transfer rates for handheld devices. The high data transfer rates allow 3G networks to offer multimedia services combining voice and data. 3G is also referred to as wireless broadband as it has the facility to send and receive large amounts of data using a mobile phone. The access part in 3G networks uses Wideband Code Division Multiple Access (WCDMA). It requires upgrading the base stations (mobile towers) and mobile phones. Besides, the base stations need to be close to each other.

d. Fourth Generation networks

Fourth Generation (4G) system, also called Long Term Evolution (L.T.E.), provides mobile ultra-broadband Internet access to mobile devices. 4G networks offer very high speeds and provides excellent performance for bandwidth intensive applications such as high quality streaming video. One of the key requirements for 4G is a wireless IP-based access system. The access part in 4G networks uses Orthogonal Frequency Division Multiple Access (OFDMA). 4G provides good quality images and videos than TV.

e. Fifth Generation networks

Fifth Generation (5G) is the next step in the evolution of mobile communication. It will offer faster, more number of connections, more energy-efficient and cost-effective data communication than its predecessors. 5G will be a key component that will help to realise the vision of unlimited access to information and sharing of data anywhere and anytime. 5G will also provide wireless connectivity for a wide range of new applications in wearable devices, smart homes, traffic safety/control, industry applications, etc. By 2020, it is thought that 5,000 crore to 1,00,000 crore devices will be connected to the Internet. 5G will be a wireless access solution which is aimed at addressing the demands and requirements of mobile communication beyond 2020.

10.2.2 Mobile communication services

Mobile communication industry uses a number of acronyms for the various technologies that are being developed. Here, we will discuss a few popular mobile communication technologies like SMS, MMS, GPS and smart cards.

a. Short Message Service

Short Message Service (SMS) is a text messaging service in mobile communication systems that allows exchanging short text messages. SMS is the most widely used data application by mobile phone users. The GSM standard allows to send a message containing upto 160 characters. When a message is sent, it reaches a Short Message Service Center (SMSC), which provides a 'store and forward' mechanism. SMSC attempts to send messages to the recipients. If a recipient is not reachable, the SMSC waits and then retries later. Some SMSC's also provide a 'forward and forget' option where transmission is tried only once and if it fails, the message is not sent again. SMS messages are exchanged using the protocol called Signalling System No. 7 (SS7).



The First SMS

The first SMS message was sent on 3rd December 1992 from a personal computer to a cellular phone on the Vodafone GSM network in the UK. The content of the message was 'Merry Christmas'.

b. Multimedia Messaging Service

Multimedia Messaging Service (MMS) is a standard way to send and receive messages that consists of multimedia content using mobile phones. It is an extension of the capability of SMS to send text messages. Unlike SMS, MMS does not specify a maximum size for a multimedia message. MMS supports contents such as text, graphics, music, video clips and more. An MMS server is responsible for storing and handling incoming and outgoing messages. Associated with the MMS server is the MMS proxy relay, which is responsible for transferring messages between different messaging systems.

c. Global Positioning System

The Global Positioning System (GPS) is a satellite based navigation system that is used to locate a geographical position anywhere on earth, using its longitude and latitude. GPS is designed and operated by the U.S. Department of Defence and it consists of satellites, control and monitoring stations, and receivers.

The basis of the GPS is a group of satellites that are continuously orbiting the earth. These satellites transmit radio signals that contain their exact location, time, and other information. The radio signals from the satellites, which are monitored and corrected by control stations, are picked up by the GPS receiver. GPS receivers take the information transmitted from the satellites to calculate a user's exact location on earth. A GPS receiver needs only three satellites to plot a 2D position, which

will not be very accurate. Ideally, four or more satellites are needed to plot a 3D position which is much more accurate.

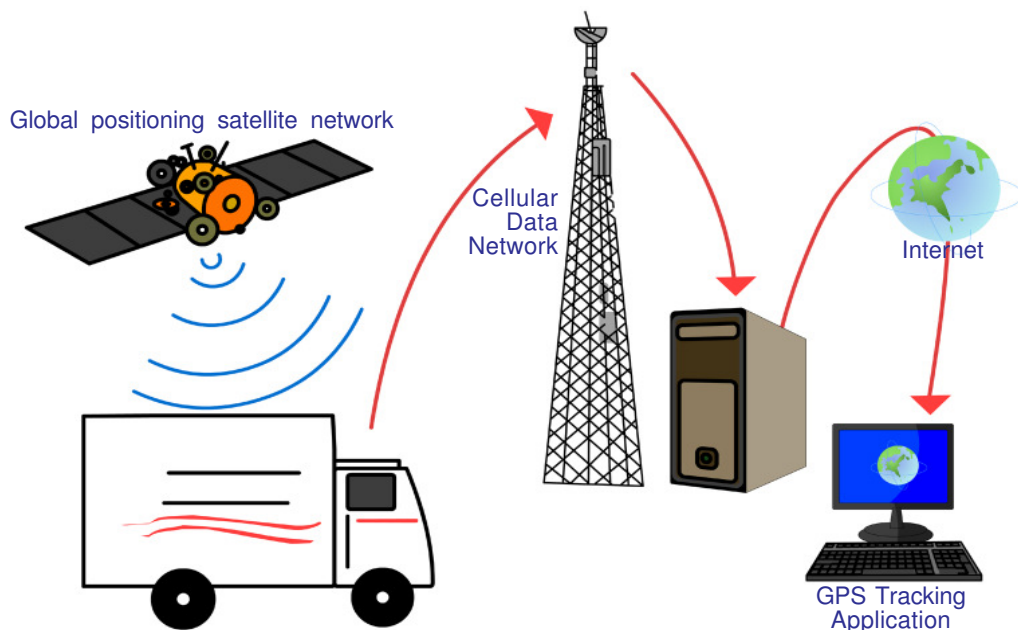


Fig. 10.1: GPS fleet tracking

GPS is used for vehicle fleet tracking by transporting companies to track the movement of their trucks. Figure 10.1 depicts the working of a truck tracking application using GPS. Vehicle navigation systems will direct the driver to his or her destination through the best route. In commercial aviation GPS is used for aircraft navigation. GPS is also used in oil exploration, farming, atmospheric studies, etc. GPS receivers are now integrated in many mobile phones for implementing various tracking applications.

d. Smart cards

Let us recollect about smart cards and smart card readers that we discussed in Chapter 2 of Class XI. A smart card is a plastic card embedded with a computer chip / memory that stores and transacts data. The advantages of using smart cards is that it is secure (data is protected), intelligent (it can store and process data) and that it is convenient (it is easy to carry). That is why business firms and other organisations use smart cards for authentication and storing data. A model of smart card issued by the Government of India for RSBY scheme is shown in Figure 10.2.



Fig. 10.2: A model smart card

In mobile communication, the smart card technology is used in Subscriber Identity Modules (SIM) for GSM phone systems (refer to Figure 10.3). The smart card is inserted or integrated into the mobile handset. The card stores personal subscriber information and preferences. SIM cards help to identify a subscriber, roam across networks and provide security to value added services like Internet browsing, mobile commerce, mobile banking, etc. Smart cards also work as credit cards, ATM cards, fuel cards, authorisation cards for television receiver, high-security identification cards, etc.



Fig. 10.3 : GSM SIM card

10.3 Mobile operating system

A mobile operating system is the operating system used in a mobile device (smart phone, tablet, etc.), similar to an operating system used in a desktop or laptop computer.

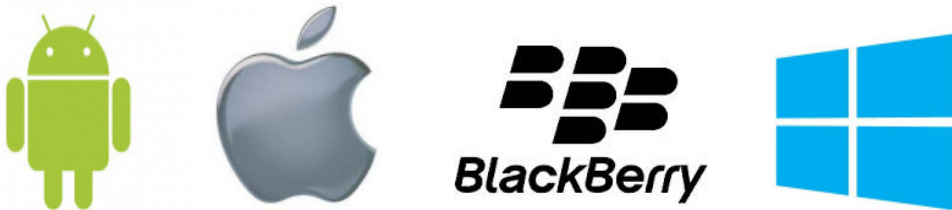


Fig. 10.4: Icons of popular mobile operating systems

A mobile OS manages the hardware, multimedia functions, Internet connectivity, etc. in a mobile device. It is the software platform on which other programs, called application programs, run. Popular mobile operating systems are Android from Google, iOS from Apple, BlackBerry OS from BlackBerry and Windows Phone from Microsoft.

Android operating system

Android is a Linux-based operating system designed mainly for touch screen mobile devices such as smart phones and tablet computers. It was originally developed by Android Inc. that was founded in Palo Alto, California in 2003 by Andy Rubin and his friends. In 2005, Google acquired Android Inc. making it a wholly owned subsidiary of Google. At Google, the team led by Rubin developed a mobile device platform powered by the Linux kernel. In 2007, the Open Handset Alliance, a consortium of several companies which include Google, HTC, Intel, Motorola, etc. was established with a goal to develop open standards for mobile devices. Android was released along with the formation of the Open Handset Alliance (OHA).



The user interface of Android is based on touch inputs like swiping, tapping, pinching and reverse pinching to manipulate on-screen objects. Android allows users to customise their home screens with shortcuts to applications and widgets. Since its launch in 2007, the Android operating system's market share has been growing at a fast pace to make it the most widely used mobile operating system today. Major Android versions have been developed under a codename and released according to alphabetical order. Table 10.1 shows the Android version names.

The Android OS consists of a kernel based on Linux kernel. Android uses Linux kernel as it has a powerful memory and process management system, permissions-based security structure and open source nature. An Application Framework for developers to build applications using the Android Software Development Kit is available in Android. Android Software Development Kit can be used to develop applications like Google Maps, Facebook, etc. that run on Android.

Version	Code name
4.4	KitKat
4.1	Jelly Bean
4.0.3	Ice Cream Sandwich
3.1	Honeycomb
2.3	Gingerbread
2.2	Froyo
2.0	Eclair
1.6	Donut
1.5	Cupcake

Table 10.1: Android version names

The Android code is released under the Apache License. Apache licensing allows the software to be freely modified and distributed by device manufacturers and developers. Android has a large community of developers writing applications called 'apps' that enhance the functionality of devices. Apps are written using a customised version of the Java programming language.

The acceptance of Android is due to factors like its open source nature. This makes it easy for developers to make programs/applications for Android OS called Android apps. Most of these apps are available for free download from the Android Play Store. It enhances the popularity of this OS.

With remarkable advances in mobile hardware and software, these trimmed-down operating systems may be heading in a direction that could replace a desktop OS. It is also likely that mobile OS could be further developed to be included in electronic devices like televisions, washing machines, watches, etc.



Let us do

Prepare a chart displaying the different mobile operating systems available in the market and their features.

Know your progress



1. SIM is
 - a. Subscriber Identity Module
 - b. Subscriber Identity Mobile
 - c. Subscription Identification Module
 - d. Subscription Identification Mobile
2. What is a GPS?
3. The protocol used to send SMS messages is _____.
4. Name the technology used to send multimedia content using mobile phones.
5. What are the functions of a mobile operating system?

10.4 Information security

Today, almost all activities that we perform in real life, like communication, buying goods, banking, etc. can be achieved through the Internet. While executing all these activities, information is exchanged between computers. The security of information passed over Internet is a primary concern. In this section, we will discuss in detail about the cyber world and the various issues like copyright and trademark violations, cyber crimes, etc. that we come across while surfing the Internet.

10.4.1 Intellectual Property Right

Many people are engaged in creative work like music, literary work, artistic work, discoveries, inventions, designs and software development. These works are the creation of the mind. They demand a lot of hard work and time. The outcome of such work is called intellectual property. It is unjust to use the idea of a person without his permission. The person involved in developing such properties must get the benefits of it. So it should be protected from unauthorised access.

The importance of intellectual property was first recognised in the Paris Convention for the Protection of Industrial Property in 1883 and the Berne Convention for the Protection of Literary and Artistic Work in 1886. Both treaties are now administered by the World Intellectual Property Organization (WIPO). WIPO was established in 1960 as an agency of United Nations (UN). It is dedicated to ensure that the rights

of creators or owners of intellectual property are protected worldwide and the inventors and authors are recognised and rewarded by their creation. The logo of WIPO and its Indian counterparts is given in Figure 10.5.

Intellectual Property Rights (IPR) are similar to any other property right like right over land, house, etc. IPR refers to the exclusive right given to a person over the creation of his/her mind for a period of time. IPR enables people to earn recognition and financial benefit from what they invent or create. IPR owners can disclose their creations in exchange for money. The company which receives the rights, markets and sells this innovation to the society. In this way, the IPR owner, the company and the society benefit from the creation. IPR is encouraged by UN and almost all countries worldwide with the intention of encouraging innovations.

Each country has its own IPR registration system which is applicable to that country. WIPO serves as an international registration system for trademark, industrial design, etc. which is applicable to its member countries. Intellectual property is divided into two categories - industrial property and copyright.



Fig. 10.5: Logo of WIPO

A. Industrial property



Fig. 10.6: Logo of IP India

Industrial property right applies to industry, commerce and agricultural products. It protects patents to inventions, trademarks, industrial designs and geographical indications. In India, industrial property rights can be registered with Controller General of Patents Designs and Trademarks under Ministry of Commerce and Industry. Logo of Intellectual Property India is given in Figure 10.6.

Patents: A patent is the exclusive rights granted for an invention. An invention means a new product or process (procedure) involving an inventive step, and capable of industrial application. It is the legal right obtained by an inventor for exclusive control over the production and sale of his/her mechanical or scientific invention for a limited period of time. To be patentable, an invention must:

- relate to a process or product
- be new
- involve an inventive step
- be capable of industrial use
- not be developed with the intention to harm others

Patent protection means that the invention cannot be commercially made, used, distributed or sold without the patent owner's consent. A patent provides the right to the patent owner to decide how the invention can be used by others. The owner can sell the right to the invention to someone else, who will then become the new owner of the patent. The term of every patent in India is 20 years from the date of filing of patent application. Once a patent expires, the protection ends and an invention can be used by the public freely. The details of the first patent filed for a zipper is given in Figure 10.7.

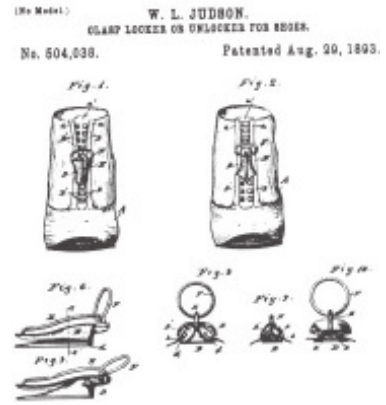


Fig. 10.7: The first patent for zipper

Trademark: A trademark is a distinctive sign that identifies certain goods or services produced or provided by an individual or a company. A trademark can be a name, logo, symbol, etc. that can be used to recognise a product or service. It provides protection to the owner of the trademark by ensuring the exclusive right to use it to identify goods or services. It helps consumers to identify and purchase a product or service. A trademark must be registered. The initial term of registration is for 10 years. Thereafter it can be renewed. In order to determine whether any person or company is using a particular trademark, a trademark search can be conducted through the trademark registry maintained by Controller General of Patents Designs and Trademarks (<http://ipindiaonline.gov.in>). The effect of a trademark registration is limited to that country. Some popular trademarks in India are given in Figure 10.8.



Fig. 10.8: Popular Indian trademarks

Industrial designs: An industrial design refers to the ornamental or aesthetic aspects of an article. A design may consist of three-dimensional features such as the shape, surface of an article or two-dimensional features, such as patterns, lines or colour. An industrial design right protects the visual design of objects that are not purely functional. Industrial designs are applied to a wide variety of industrial products and handicrafts like medical instruments, watches, jewellery, vehicles, textile designs, etc. The registered designs of Coca-Cola bottle and iPhone are given in Figure 10.9.



Fig. 10.9: Popular industrial designs

Geographical indications: Geographical indications are signs used on goods that have a specific geographical origin and possess qualities or a reputation that are due to that place of origin. Agricultural products typically have qualities that derive from their place of production and are influenced by factors like climate and soil. Place of origin may be a village or town, a region or a country. Some of the popular products with geographical indications related to Kerala are Aranmula Kannadi and Palakkadan Matta Rice (Figure 10.10).



Fig. 10.10: Geographical indications related to Kerala

B. Copyright

A copyright is a legal right given to the creators for an original work, usually for a limited period of time.

Copyright applies to a wide range of creative, intellectual or artistic forms of works which include books, music, painting, sculpture, films, advertisement and computer software. This covers rights for reproduction, communication to the public, adaptation and translation of the work.

In India, the Copyright Act, 1957 came into effect from January 1958. This Act has been amended five times. Some of the important amendments to the Copyright Act in 2012 are extension of copyright protection in the digital environment, liabilities of Internet Service Providers, ensuring right to receive royalties for music composers and exception of copyrights for physically disabled to access any work.

Under Indian Copyright Act, a work is automatically protected by copyright when it is created. The general rule is that the copyright lasts for 60 years after the death of the last surviving author. Registration of copyright gives a legal status to a creative work. This makes it an intellectual property, giving exclusive legal right over the creation. It should be noted that it is not necessary to register to get the copyright. Copyright registrations in India are handled by the Copyright Office under the Ministry of Human Resource Development. The logo of Indian Copyright Office is given in Figure 10.11.



Fig. 10.11: Logo of Copyright Office, India

Table 10.2 shows the different symbols used to specify the registration status of intellectual property.

The copyright holders of a work can authorise or prohibit

- its reproduction in all forms, including print form and sound recording;
- its public performance and communication to the public;
- its broadcasting;
- its translation into other languages;
- its adaptation, such as from a novel to a screenplay for a film.

INTELLECTUAL PROPERTY

Registered trademark	®
Unregistered trademark	™
Copyright	©
Sound-recording copyright	!

Table 10.2: Symbols used for intellectual property

Creators often sell the rights of their works to individuals or companies for financial benefit. Computer software (source code, databases, web sites, etc.) can be copyrighted as a literary work. Even though computer software is protected under copyright, nowadays they are increasingly getting patented. This is because software development is considered as an industry and patents provide better protection when compared to copyright. It should be noted that the criteria required for obtaining patent protection is more stringent.

Table 10.3 displays the rights and the related intellectual property. The differences in the registration of intellectual property rights are shown in Table 10.4.

Intellect	Property	Right
Idea	Invention/innovation	Patent
Idea	Quality + identity	Trademark
Idea	Appearance	Design
Goods	Geographical origin	Geographical Indication
Idea	Expression	Copyright

Table 10.3: Rights related to intellectual property

	Patent	Trademark	Copyright
Refers to	Product, Process	Name, Logo, Symbols	Creative, intellectual or artistic forms of work
Registration	Required	Required	Automatic, can be registered
Duration	20 years	10 years	Until 60 years after the death of the last surviving author
Renewable	No	Yes	

Table 10.4: Differences in the registration of rights for intellectual property

10.4.2 Infringement

Unauthorised use of intellectual property rights such as patents, copyrights and trademarks are called intellectual property infringement. It may be a violation of civil law or criminal law, depending on the type of intellectual property, jurisdiction (countries) and the nature of the action.

Patent infringement is caused by using or selling a patented invention without permission from the patent holder. Many countries allow using patented inventions for research purpose. The legal dispute between Apple and Samsung over their mobile phone technologies is an example of patent infringement.

Trademark infringement occurs when one party uses a trademark that is identical to a trademark owned by another party, where both the parties use it for similar products or services. It is better to register the trademarks to get the legal advantages. An example of trademark infringement is the legal suit where a small company manufactured toffees under the trademark 'HORLIKS'. This violated the trademark rights enjoyed by 'HORLICKS'.

Copyright infringement is reproducing, distributing, displaying or adapting a work without permission from the copyright holder. It is often called piracy. Software piracy is the illegal copying, distribution, or use of software. Music piracy is the copying and distributing of a piece of music without the consent of the composer, artist or the copyright holding music company. Enforcement of copyright is generally the responsibility of the copyright holder.

Know your progress



1. Creation of the mind is known as _____.
2. Expand WIPO.
3. Intellectual property rights are categorised into ____ and ____.
4. Patents are exclusive rights given to _____.
5. _____ is a sign used to recognise a product or service.
6. What is industrial design?
7. What is the importance of geographical indicators?

10.4.3 Cyber space

Cyber space is a virtual environment created by computer systems connected to the Internet. It is the term used to refer to a simulated world, where we can do many things at one place. Let us now discuss various instances where cyberspace has influenced our lives.

Formerly, communication was mainly dependent on postal service. Nowadays e-mail has gained wide acceptance and legal validity for communication. In the Department of Higher Secondary Education (DHSE), all communications to higher secondary schools related to admissions, examinations, National Service Scheme, administration, etc. are done through *website/e-mail*. Today, Internet has become a popular medium for communication among common people.

In December 2012, a girl student was subjected to inhuman physical torture in a moving bus in a metro city in India. After a few days the girl succumbed to her injuries. This incident invoked protests among people from various walks of life. Social media like facebook, twitter, etc. became a platform for the protest. These people organised a movement in support of the girl through messages over the social media. Thousands of people gathered in the streets of Delhi with lighted candles as a protest. Taking this incident into account, the Loksabha passed 'The Criminal Law (Amendment) Act, 2013', which strictly deals with sexual assault cases. Such movements organised over *social media*, show its influence on society.

People purchase mobile phones, shoes, apparels, etc. by visiting showrooms. Today, many people prefer to purchase these goods online from e-commerce websites. The *e-commerce* sites provide catalogs which display different search options like price range, brands, etc. about the product. This made shopping easier from the comfort of home and saves time too. e-Commerce requires payments through credit cards, debit cards, Internet banking, etc. Nowadays more and more people are attracted to online buying and selling. Figure 10.12 shows e-Commerce websites.

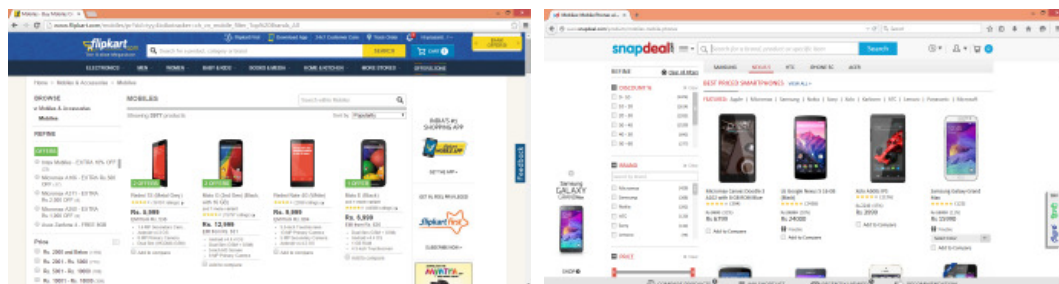


Fig. 10.12: Sample e-Commerce websites

Almost all banks offer *Internet banking* facilities to its customers. Through this facility we can transfer funds, pay telephone bills, electricity bills, payments for online purchases, train tickets, cinema tickets, etc. This saves a lot of time and effort when compared to performing these activities by actually visiting the respective offices. Hence banking is also a popular service over Internet. An Internet banking website is displayed in Figure 10.13.

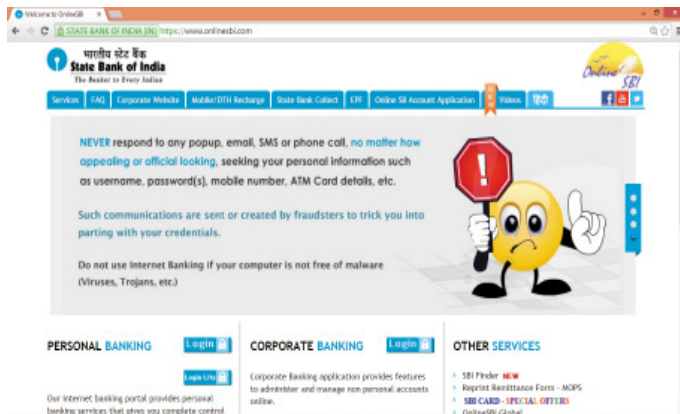


Fig. 10.13 : An Internet banking website

Cyberspace is an unreal world in which communication over computer networks occurs. It is an information superhighway where individuals gather information, interact, exchange ideas, provide social support, conduct business, play games, engage in discussions and so on.

Cyberspace is a space where social interactions dominate. Some people consider cyberspace as an uncontrolled and unregulated electronic space where anyone is free to do anything as they wish and express themselves freely. Such acts of people badly affect or negatively influence many others. Hence, when an individual works on the Internet, they have to follow some rules and ethics which are beneficial to all users.

This unregulated space also provides room for criminals. Since activities like communication, financial transactions, etc. in the cyberspace increases day by day, it has opened a new medium for criminal activities. Today cyberspace security has become a serious concern.



Fig. 10.14 : Symbolic representation of cyberspace



'Cyberspace' is a term coined by William Gibson, a Canadian science fiction writer, in his short story 'Burning Chrome' (1982). He used it to represent a world where events or transactions that are not in real world occur. He believed that cyberspace is a consensual hallucination. According to Gibson, consensual hallucination is the nature of existence within cyberspace.



10.4.4 Cyber Crimes

We know that the Internet has opened new opportunities in entertainment, business, communication education, sports, etc. At the same time, it is a reality that some people use the Internet for committing illegal activities.

The increasing use of the Internet through smart phones and tablets for online banking and other financial transactions has increased the risk. Rising Internet penetration and online banking provides opportunities for cyber criminals to target online financial transactions, using malicious software (malware) or through illegal hacking. The statistics of cyber crime committed in the recent years according to National Crime Records Bureau is given in the graph shown in Figure 10.15. This graph shows the significant rise of cyber crimes in India through the years.

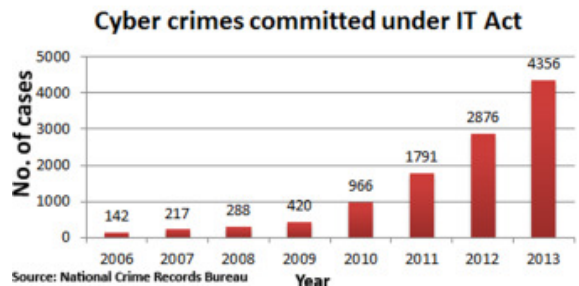


Fig. 10.15 : Cyber crime statistics in India

Cyber Crime is defined as a criminal activity in which computers or computer networks are used as a tool, target or a place of criminal activity. The victims of cyber crime lose money, reputation and face mental trauma.

An important aspect of cybercrime is its nonlocal character. A crime can occur in jurisdictions separated by vast distances. That is an attacker may operate from a country and attack a destination in some other country. So the investigating team and the judiciary of different countries must keep hand in hand. Due to the anonymous nature of the Internet, it is possible for people to engage in a variety of criminal activities. People commit cyber crimes knowingly or unknowingly.

Cyber crimes include phishing, hacking, denial of service attacks, etc. which we have learned in Chapter 9 of Class XI. Computer crime mainly consists of unauthorised access to computer systems, credit card frauds, illegal downloading, child pornography, cyber terrorism, creation and/or distribution of viruses, spam and so on. Cyber crimes can be basically divided into 3 major categories: They are cyber crimes against individuals, against property and against government.

A. Cyber crimes against individuals

The popularity of broadband Internet increased the dependence of Internet for daily activities. This increased the risk of online crimes. An act of a person in cyberspace that causes physical or mental trouble to an individual is referred as cyber crime. Harassment, assuming some one's identity, impersonation and violation of privacy are some examples of cyber crimes.

i. Identity theft: Identity theft occurs when someone uses another person's identifying information, like their name, credit card number, etc. without their permission to commit fraud or other crimes. It is a form of stealing a person's identity, by which someone pretends to be someone else, to gain access to resources like bank account, social media accounts, etc. This is done with the intention of transferring money from the victim's bank account, payments for purchases, defaming the person through social media, etc. This is done with the intention of obtaining credit from financial institutions or gaining benefits in that person's name.



Before transferring money from bank accounts, the thief may change the mailing address of the account so that the victim will not be able to realize that money is withdrawn. The stolen personal information may be used to open new accounts, open new credit card accounts, to apply for a mobile phone connection and more.

ii. Harassment: Posting humiliating comments focusing on gender, race, religion, nationality at specific individuals in chat rooms, social media, e-mail, etc. is harassment. The use of vulgar or indecent language, threatening any illegal or immoral act through a computer or a computer network is considered as harassment.

The use of the Internet, to harass someone is called cyber stalking. You might have read about statements from celebrities that the facebook accounts in their names are fake. This is because such accounts may contain pictures or posts with defaming content. These profiles might be created using the photographs and personal information of the celebrity by people with criminal intentions. There are people who defame others by sending humiliating e-mails, facebook posts, etc. All these amount to harassment against person. Common characteristics of cyber stalking include threats, false accusations, monitoring, identity theft and data destruction or manipulation. Cyber stalking also includes sexual or other exploitation of minors. It can destroy friendships, careers, self-image and confidence.

iii. Impersonation and cheating: Impersonation is an act of pretending to be another person for the purpose of harming the victim. There are people who utilise the anonymity of the Internet to commit impersonation online.

Sometimes we may receive e-mails seeking help for transferring large amounts of money from a distant country to India. Usually, the sender states that this money is in the form of an asset (land, gold, etc.) that is to be sold. To dispose the asset and complete the legal formalities, the sender requires some amount of money. The mail requests us to share a portion of the expenses and offers us up to 50% of the value



of the asset. After receiving the cheque or money order, the sender tells that due to some complications more money is required. In this way the victim may lose large amounts. We often receive similar mails with a different story. Mailing scams like this are examples of Internet fraud/cheating.

Similar crimes occur in online auction also. In some cases, individuals announce products for sale on Internet auction sites. They demand money before the delivery of the item and never carry out their order.

iv. Violation of privacy: Violation of privacy is the intrusion into the personal life of another, without a valid reason. This gives the person whose privacy has been invaded, the right to file a lawsuit for damages against the person/organisation that intruded. It consists of distributing private information like personal data, photography, workplace monitoring videos, etc.

You might have heard of issues regarding the use of hidden cameras, mobile cameras, etc. to capture images of women in public places. Photography of any person (men or women) without his/her permission amounts to violation of privacy. Posting images of others in social media, transferring them to others through e-mail/copying, etc. without their permission are considered as violation of privacy.

v. Dissemination of obscene material: The Internet has provided a medium for the facilitation of crimes like pornography. The distribution and posting of obscene material is one of the important cyber crimes today. Pornography on Internet may take various forms. It may include hosting website containing prohibited materials, use of computers for producing obscene material, downloading obscene materials through the Internet, etc. These obscene content may misguide adolescents.

Most of the cyber crimes occur without the knowledge of the victim, whereas in some others, the victim also takes part in crime to become rich easily. It should be noted that various types of preventive mechanisms have been installed to avoid such crimes. E-mail service providers use spam filter that filters unwanted mails. Different types of authentication mechanisms that exist for online financial transactions prevent fraud to a certain extent. Above all, an individual has to be careful while using the Internet.

B. Cyber crimes against property

Cyber crimes against all forms of property like credit cards, intellectual property, etc. are termed as cyber crime against property. These crimes include hacking, piracy, computer vandalism (destruction of others property), unauthorised intrusion through cyberspace, unauthorised possession of information stored in computers, etc. Let us discuss the classification of cyber crimes against property.



i. Credit card fraud: Credit card fraud involves an unauthorised usage of another person's credit card information for the purpose of payments for purchases or transferring funds from it. There are instances where the web servers of large organisations are hacked and credit card information of a large number of people is stolen by Internet thieves. They use this information to make payments or they sell this information to other fraudsters over Internet for a small price.

ii. Intellectual property theft: The infringement of IPRs come under this category. Violation of copyright, patent, trademark, etc. are intrusions against property.

Recently, an Indian IT company developed a software for correcting errors in program code. One of the employees of this company copied this software in a CD and tried to sell it to a competitor for a big price. This led to huge financial and property loss to the company. This is considered as theft of intellectual property. Software piracy is also a crime under cyber law.



Nowadays intellectual property theft has become common. Information about any topic is now freely available on the Internet. Copying of another person's language, thoughts, ideas or expressions and presenting them as one's own original work is called plagiarism. There are stringent copyright laws available in India which protect the intellectual property rights. Plagiarism can be easily detected through various tools available online.

iii. Internet time theft: Today almost all modems/routers have wireless Internet facility. They provide sharing of Internet at homes, schools, business establishments, etc. If this is not properly secured using passwords, other people may use our Internet. The usage of the Internet time by unauthorised persons, without the permission of the person who pays for it is called Internet time theft. This leads to loss of Internet time and money. Above this, others may use our Internet account for committing crimes, for which we may also be held responsible.

The different types of attacks like viruses, worms, man in the middle attack, etc., discussed in Chapter 9 of Class XI also fall under cyber crimes against property.

C. Cyber crimes against government

Increasing popularity of e-governance has made governments vulnerable to cyber attacks. The various governmental computer networks and websites are vulnerable

to risks and threats of cyber crimes. The different categories of cyber attacks against government are cyber terrorism, website defacement and e-governance denial attack.

i. Cyber terrorism: Cyber terrorism is a cyber attack against sensitive computer networks like nuclear power plants, air traffic controls, gas line controls, telecom, etc.

These types of attacks against governments are increasing globally. Cyber terrorism focuses on the use of the Internet by anti nationals to affect a nation's economic and technological infrastructure.



In 2010 a computer virus called tuxnet was used to carry out an invisible attack on Iran's secret nuclear programme. This virus was aimed at disabling Iran's Uranium enrichment programme. This virus infected large number of nuclear controls and gave false instructions leading to nuclear malfunctions and break down. Cyber terrorism may prove to be very costly to a country. Therefore governments provide very powerful security mechanisms for their servers.

ii. Website defacement: This is a common cyber attack against a government. Defacement of websites includes hacking of government websites and posting derogatory comments about a government in those websites.

iii. Attacks against e-governance websites: These types of attacks deny a particular online government service. This is done using a Distributed Denial of Service (DDoS) attack which we discussed in Chapter 9 of Class XI. In another case the website may be hacked and controlled by the hackers. They gain access to website administration through content management system and destroy the data. This causes huge loss to the government.

Cyber terrorism has increased in the modern world because of the anonymous nature of cyberspace. The availability of a variety of targets that affect a large number of people, and the fact that attacks can be conducted from a distance, have increased terrorism through cyberspace.

10.4.5 Cyber ethics

The available statistics shows that the volume of cyber crimes is increasing rapidly all over the world. Internet crime has many faces and is committed in diverse ways. Awareness is the first step in protecting ourselves, our family and our business. We should ensure that our actions in the cyberspace do not harm others. We should also remember that our actions over the Internet are being monitored by several others.



Suggestions given below can be considered as ethical practices over the Internet.

- Use anti-virus, firewall, and spam blocking software for your PC.
- Ensure security of websites (https and padlock) while conducting online cash transactions.
- Do not respond or act on e-mails sent from unknown sources.
- Use unique and complex passwords for accounts and change your passwords on a regular basis. (Should have a minimum of 8 characters, contain alphabets, numbers and special characters)
- Do not select the check boxes or click OK button before reading the contents of any agreement/message.
- Avoid the use of unauthorised software.
- Do not hide your identity and fool others.
- Do not use bad or rude language in social media and e-mails.
- Remove the check mark against 'Remember me' before logging into your account using computers other than your personal ones.



Conduct an awareness program about various cyber crimes.

Prepare a chart listing how we can protect ourselves in cyber space.

Let us do

Know your progress



1. What do you mean by cyberspace?
2. Criminal activity using computer, mobile phone and Internet is termed as _____.
3. What is cyber crime against a person?
4. Cyber terrorism is a type of cyber crime against _____.
5. Stealing one's information such as username and password is ____.

10.4.6 Cyber laws

The term cyber law in general refers to the legal and regulatory aspects of the Internet. Cyber law can be defined as a law governing the use of computers and Internet.

We have already discussed that there are different kinds of cyber crimes. Criminal activities such as theft, fraud, forgery and defamation are traditional in nature and are subject to the Indian Penal Code. The abuse of computers (cyber crime) has become wide spread in India which is addressed by the Information Technology Act, 2000 and IT Act Amendment Bill 2008.

Cyber law is important because it touches almost all aspects of transactions and activities using Internet. Whether we realise it or not, every action and every reaction in cyberspace has some legal perspectives.

10.4.7 Information Technology Act 2000 (Amended in 2008)

The Information Technology Act, 2000 is India's legislation regulating the use of computer, servers, computer networks, data and information in electronic format. The legislation has touched various aspects related to authentication, digital signature, cyber crime and liability of network service provider. The acts aim to provide legal recognition for transactions carried out by means of electronic data interchange and other means of electronic communication. IT Act allows using alternatives to paper based communication and facilitates electronic filing of documents with government agencies. It gives legal acceptance for electronic communication. It also addresses offenses and disputes in the cyberspace and provides justice to victims of cyber crimes.

IT Act aims to provide legal infrastructure for e-commerce in India. This Act was developed to promote IT industry, regulate e-commerce, facilitate e-governance and prevent cyber crimes. It promotes security practices within India that would serve the country in a global context. Under the Act certain violations are treated as serious crimes and offenders are liable to penal actions. Therefore it is important to understand the various perspectives of the IT Act, 2000 and what it offers.

In May 2000, the Indian Parliament passed the Information Technology Bill and it is known as the Information Technology Act, 2000. The Act was amended by the Information Technology Amendment Bill 2008, which was passed in December 2008. This amendment accommodates further development of IT and related security concerns, since IT Act 2000 was passed. Compensation has to be given to affected persons if damage is done to the computer system or computer network by the introduction of virus, denial of service, etc. Sections 65-74 of the Act specifically deals with cyber crimes.



SOME COMMON OFFENCES AND THEIR PUNISHMENTS NOTED IN IT ACT 2000 AND IT AMENDMENT 2008

Section	Offences	Punishments
65	Tampering with computer source code	Imprisonment up to three years, or with fine which may extend up to two lakh rupees, or with both.
66	Computer related offences	Imprisonment for a term which may extend to two three years or with fine which may extend to five lakh rupees or with both.



Section	Offences	Punishments
66B	Punishment for dishonestly receiving stolen computer resource or communication device.	Imprisonment for a term which may extend to three years or with fine which may extend to rupees one lakh or with both.
66C	Punishment for identity theft.	Imprisonment for a term which may extend to three years and shall also be liable to fine which may extend to rupees one lakh.
66D	Punishment for cheating by personation by using computer resource.	Imprisonment for a term which may extend to three years and shall also be liable to fine which may extend to one lakh rupees.
66E	Punishment for violation of privacy.	Imprisonment which may extend to three years or with fine not exceeding two lakh rupees, or with both.
66F	Punishment for cyber terrorism.	Imprisonment which may extend to imprisonment for life.
67	Punishment for publishing or transmitting obscene material in electronic form.	Imprisonment for a term which may extend to two to three years and with fine which may extend to five lakh rupees. In the event of a second or subsequent conviction with imprisonment for a term which may extend to five years and also with fine which may extend to ten lakh rupees.
67A	Punishment for publishing or transmitting of material containing sexually explicit act, etc. in electronic form.	Imprisonment for a term which may extend to five years and with fine which may extend to ten lakh rupees.
67B	Punishment for publishing or transmitting of material depicting children in sexually explicit act, etc. in electronic form.	Imprisonment for a term which may extend to five years and with a fine which may extend to ten lakh rupees. In the event of second or subsequent conviction with imprisonment for a term which may extend to seven years and also with fine which may extend to ten lakh rupees.

Punishment for sending offensive messages through online communication service like e-mail, social media, SMS, etc. will be according to the sections in Indian Penal Code (IPC).



10.4.8 Cyber Forensics

The increase in computer crimes affects our daily lives and national security. Internet and digital technologies bring us a lot of convenience. But at the same time they also provide criminals more chance to commit crimes. Traditional law enforcement tools and methodologies do not successfully address the detection, investigation and prosecution of cyber crime.

Forensics is the process of using scientific knowledge for identifying, collecting, preserving, analyzing and presenting evidence to the courts. Cyber forensics can be defined as the discipline that combines elements of law and computer science to collect and analyze data from computer systems, networks, communication systems and storage devices in a way that is admissible as evidence in a court of law. The goal of computer forensics is to analyse data in a way that preserves the integrity of the evidence collected so that it can be used effectively in a legal case.

10.4.9 Infomania

Information is considered as the key to success. It has to be collected, managed and processed well. But what happens if a person gets overloaded with information? Infomania is the state of getting exhausted with excess information. It occurs due to accumulation of information from many sources like Internet, e-mail and cell phones, but cannot be processed. While collecting information, its quality and relevance is also to be considered. Infomania is the excessive enthusiasm for acquiring knowledge. This may result in neglecting the more important things like duties, family, etc. We may see people browsing for information during dinner. It is now treated as a psychological problem. Constantly checking e-mails, social networking sites, online news, etc. are the symptoms of infomania. Many people do this to keep themselves up to date with the fear of being out of the group.

Studies prove that people addicted to infomania lose concentration and sleep. Excessive use of technology reduces intelligence. Some people give high priority to respond to incoming messages through mail and social media. These people may skip or interrupt their important family or professional engagements to answer an e-mail or a social media post. To get away from such situations, users must learn to log off social media, online news and discussion groups while they are at work or spending time with family.



Let us conclude

The convergence of a mobile phone and a computer has shifted the focus from desktops to mobile computing devices. These devices are always connected to the Internet and therefore mobile communication technology has gained importance.



The mobile communication technology has evolved through generations from 1G to 5G, the prime focus being speed. This also has led to the development of features like SMS, MMS, GPS, etc. Android is one of the popular mobile operating systems, developed by Google based on Linux kernel. A person can do a variety of jobs through cyberspace. Due to its anonymous nature, cyber space has become a venue for criminals. Crimes can be against a person, property or government. The best way to be safe is to be aware of the traps in the Internet. The rights of the creator or owner of music, software, artistic works, inventions, etc. are protected by Intellectual Property Rights. There are cyber laws which provide the framework for a secure environment in cyberspace. India has a robust IT Act. It addresses the different crimes committed using computers, Internet and mobile phones. Cyber forensics has emerged as a part of legal proceedings of almost all civil and criminal cases. While using the Internet, ensure that our actions do not harm others. The term Infomania is used for addressing the problems created by information overloading.

Let us assess



1. What is mobile computing?
2. Explain generations in mobile communication?
3. Compare GSM and CDMA standards.
4. Write short notes on SMS.
5. Differentiate GPRS and EDGE?
6. Expand GPS?
7. What is a smart card? How is it useful?
8. Explain the features of Android OS.
9. What is cyberspace?
10. Why is cyberspace called a virtual world?
11. Phishing is an example of _____.
12. Explain different categories of cyber crimes in detail.
13. "Awareness is the best way to protect ourselves in cyberspace". Comment.
14. How do trademark and industrial design differ?
15. What is copyright? How does it differ from patent?
16. Explain the exclusive right given to the owner by IPR?
17. What is piracy?
18. What do you mean by infringement?
19. Why is a cyber law important?
20. "Non-local nature of cyber crime creates problems to the investigators". Explain.
21. "Infomania has become a psychological problem". Write your opinion.



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