

Computer Science

Grade 9



Government of Nepal
Ministry of Education, Science and Technology
Curriculum Development Centre

Sanothimi, Bhaktapur

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2076

Publisher:

Government of Nepal

Ministry of Education, Science and Technology

Curriculum Development Centre

Sanothimi, Bhaktapur

© Publisher

Edition:

2076 BS (2020 AD)

Printing:

Janak Shikshya Samagri Kendra Limited

Sanothimi, Bhaktapur

Preface

The curriculum and curricular materials are developed and revised on a regular basis with the aim of making education objective-oriented, practical, relevant and job oriented. It is necessary to instill the feelings of nationalism, national integrity and democratic spirit in students and equip them with morality, discipline and self-reliance, creativity and thoughtfulness. It is essential to develop in them the linguistic and mathematical skills, knowledge of science, information and communication technology, environment, health and population and life skills. It is also necessary to bring in them the feeling of preserving and promoting arts and aesthetics, humanistic norms, values and ideals. It has become the need of the present time to make them aware of respect for ethnicity, gender, disabilities, languages, religions, cultures, regional diversity, human rights and social values so as to make them capable of playing the role of responsible citizens. This textbook for grade nine students as an optional Computer Science has been developed in line with the Secondary Level Optional Computer Science Curriculum, 2074 so as to strengthen knowledge, Skills and competencies on computer literacy. It is finalized by incorporating the recommendations and feedback obtained through workshops, seminars and interaction programmes.

The textbook is written by Mr. Sunil Kumar Gharti, Mr. Sushil Upreti and Mr. Bimal Thapa. In Bringing out the textbook in this form, the contribution of the Director General of CDC Dr. Lekha Nath Poudel is highly acknowledged. Similarly, the contribution of Prof. Dr. Shashidhar Ram Joshi, Dr. Dipendra Gurung, Ms. Pramila Bakhati, Mr. Nabaraj Paudel, Mr. Jagadish Bhatta, Mr. Dibakar Durdarshi is also remarkable. The content was edited by Mr. Yubraj Adhikari and Mr. Khil Narayan Shrestha. The language of this book was edited by Mr. Shankar Adhikari and Mr. Nabin Kumar Khadka. The layout of this book was designed by Mr. Khados Sunuwar. CDC extends sincere thanks to all those who have contributed in developing this textbook.

Efforts have been made to make this textbook activity-oriented, interesting and learner centered Curriculum Development Centre welcomes constructive feedback.

2076

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Sanothimi, Bhaktapur

Contents

S.N.		Page No
Unit 1.1	Computer Fundamentals	1
Unit 1.2	Types of Computer	12
Unit 1.3	Basic Architecture of Computer	22
Unit 1.4	Computer Hardware	29
Unit 1.5	Computer Software	57
Unit 2.1	Computer Graphics	77
Unit 3.1	Internet Technology	99
Unit 3.2	HTML (Hypertext Markup Language)	113
Unit 3.3	Cascading Style Sheets (CSS)	157
Unit 4.1	Computer Programming	174
Unit 4.2	Programming in QBASIC	186

Introduction to Computer

The modern world is called the age of science and technology. We cannot imagine life without science and technology. The modern world of advanced technology could not have been established without the development of computer technology. There is rapid development in computer. Computer is used in many different fields for varieties of tasks. It is used all over the world, no matter whether a country it is developed, developing or underdeveloped. Computer is also used in Nepal various fields like: business, bank, education, entertainment, scientific research, law, airlines, traffic control, etc. So, the computer is now affecting every sphere of human activities and leading to many changes. It has brought enormous changes in the world.

Introduction

The word "Computer" is derived from the Latin word "Computare" which means 'to calculate'. Nowadays, computer has become an indispensable part of our life. Computer is used in various places like: home, school, college, offices etc. Computer can perform complex mathematical calculations accurately in a short period of time. The modern computer has lots of capabilities like creating documents, videos, games, music presentation, etc. It can use AI (Artificial Intelligence) for understanding natural language, taking self-decision capabilities, analysing graphs and patterns, etc.

Data is raw facts, concepts, or instructions in a formalized manner, which should be suitable for communication, interpretation, or processing by computer. Data is represented with the help of characters such as alphabets (A-Z, a-z), digits (0-9) or special characters (+,-,*,<,>,=)

Information is organized or classified data, which has some meaningful results for the receiver. Information is the processed data or meaningful results on which decisions and actions are based.

A computer is an electronic device that accepts raw data and instructions from users; processes it according to the given set of instructions, stores and gives meaningful information.



Computer

Working Principle of a Computer

Computer is an electronic device that converts raw data into meaningful information carrying out various processes as instructed by the programme. Every computer has the ability to:

- a. **Input:** Enter raw data into the computer.
- b. **Process:** Process according to the given set of instructions to produce the required result.
- c. **Output:** Get meaningful information from the computer.
- d. **Storage:** Store data and information for future use.

Characteristics of a Computer

A computer is powerful and useful in all areas. The use of computer is increasing with time. The main features or characteristics of computer are described below:

i. Automatic

A computer is an automatic device. It can do tasks automatically as instructed by software. It can automatically control various devices attached with computer system.

ii. Speed

A computer performs tasks accurately. The operations on data in computer are performed through electronic circuit according to given instructions. Computer can perform millions and billions of operations on data within a second. The speed of computer is measured in MegaHertz (MHz) or GigaHertz (GHz). The time taken to perform a task is measured in fraction of second. The smaller units of second are given below:

Unit of Time	Meaning	Part of Second	Power of 10
Millisecond (ms)	One thousandth of second	1/1000	10^{-3} sec.
Microsecond(us)	One millionth of second	1/1,000,000	10^{-6} sec.
Nanosecond(ns)	One billionth of second	1/1,000,000,000	10^{-9} sec.
Picosecond (ps)	One trillionth of second	1/1,000,000,000,000	10^{-12} sec.
Femtosecond (fs)	One quadrillionth of second	1/1,000,000,000,000,000	10^{-15} sec.

iii. Accuracy

A computer performs tasks accurately. If data and instructions given to the computer are correct then it gives an accurate output. It means output totally depends on the given instructions and input data. If input data is incorrect then the output will be incorrect which is called **GIGO** (Garbage in Garbage out).

iv. Storage

Computer system consists of data storage unit. A computer has main storage and secondary storage. A large amount of data can be stored in secondary storage like hard disk, pen drive, CD/DVD, etc. for future use. The main memory (RAM) stores currently used data. Computer stores data in term of 0 and 1. The different units of storage in computer are given below:

S.No.	Memory Unit	Description
1	Bit	1 Bit = 0 or 1
2	Nibble	1 Nibble = 4 Bits
3	Byte	1 Byte = 8 Bits

4	Kilobyte (KB)	1 Kilobyte (KB) = 1024 Bytes
5	Megabyte (MB)	1 Megabyte (MB) = 1024 KB
6	Gigabyte (GB)	1 Gigabyte (GB) = 1024 MB
7	Terabyte (TB)	1 Terabyte (TB)= 1024 GB
8	Petabyte (PB)	1 Petabyte (PB) = 1024 TB
9	Exabyte (EB)	1 Exabyte (EB) = 1024 PB

v. Diligence

A computer can continuously work for a long time without losing its speed and accuracy. So it is called diligent device. It doesn't get tired or bored or lazy while working.

vi. Versatile

A computer is a versatile device which means it is flexible. It has capability of performing different types of tasks like drawing paints, playing games, music, calculations, sending an e-mail, desktop publishing work, etc. in different field efficiently. So it is used in different fields to perform varieties of tasks.

Application of Computer

A computer is given great importance in every field of work. Nowadays, it is impossible to find where computer are not used. Computer and its technology are used in education, agriculture, industries, banking, engineering, scientific research and many more. The main applications of computer are described below:

i. Education

Nowadays, computer and Internet technology have changed the present education system. Computer technology can be used for visual illustration like smart classroom and distance learning education system. Today, school and colleges use computer in computer lab and multimedia to teach students. A teacher can teach by using computer-based presentations. Students can study various subject and complete assignment by using Internet.



Computer in Education

ii. Communication

A computer plays a key role in the field of communication. The Internet and computer are used to send and receive information. A computer uses various communication services like e-mail, video conferencing, net phone, chatting, Facebook, Twitter, Instagram, etc.



Computer in Communication

iii. Banking Sector

A computer has brought revolution in the banking sector. The different services like accounting, customer records to update, bank statement etc. are performed by using computer in banking sector. **ATM** (Automated Teller Machine) allows 24 hours banking services to their customers so that they can withdraw money at any time.



Computer in Banking Sector

iv. Medicine

A computer is used in scanning and diagnosing of various diseases through **CT scan** (Computed Tomography scan), ultrasounds, **ECG** (Electro Cardio Graph) etc. It is also used in hospitals to keep records of patients and medicines. Nowadays, computer is used in surgery too. Doctors use computer and Internet services to provide telemedicine services to remote areas of our country, Nepal.



Computer in Medicine

v. Entertainment

A computer is used to entertain people. It is used to play games, listen to music, watch videos, movies and cartoon etc. It is used to watch online movies and play online games

by using Internet.



Computer in Entertainment

vi. Scientific Research

A computer is used in all types of scientific research. Scientists collect the latest information by using internet all over the world. It is used in weather forecasting, space research, complex research in various scientific fields etc.



Computer in Scientific Research

vii. Agriculture

Computer has not only made changes in modern occupation but also made changes in the traditional occupation sector like agriculture. Through the social networking site, farmers can get connect with other experts and exchange their views and other details when they have internet connected computers. Farmers can get information on different agricultural issues through internet surfing. Farmers can get connect with foreign customer which can help to improve their product and increase their production capacity. Farmers can use the computer to keep financial record, production record, online banking, online sales, online purchased the required resources through the internet. The amount of water sprinkled in a balanced quantity can also computerized.



Computer in Agriculture

Summary

- ◆ The word "Computer" is derived from the Latin word "Computare" which means to calculate.
- ◆ A computer is an electronic device that accepts the raw data and instructions from the user; processes raw data according to the given set of instructions, stores and gives meaningful information.
- ◆ The speed of computer is measured in MegaHertz (MHz) or GigaHertz (GHz).
- ◆ A large amount of data is stored in secondary storage like hard disk, pen drive, CD/DVD, etc. for future use.
- ◆ Computer and its technology are used in education, medicine, banking sector, entertainment, scientific research and agriculture.

Technical Terms

Computer	: An electronic device that processes raw data to give information.
Input	: Enter raw data and instruction into the computer.
Output	: Display meaningful information from the computer.
Process	: Computation according to given set of instructions to produce required result.

Storage	: Keeping data and information for future use.
GIGO	: If inputted data is incorrect then output will be incorrect.
Byte	: The combination of eight bits.

Exercises

1. Answer the following questions.

- a) Define Computer and list its capabilities.
- b) Write the limitations of computer.
- c) What is GIGO?
- d) Explain working principles of computer with block diagram.
- e) List any four features of computer.
- f) Why is computer called diligence machine?
- g) Describe the use of computer in education field.
- h) Mention any four uses of computer.
- i) State different units of storage in computer.

2. State 'True' or 'False'.

- a) Computer is an electrical machine which can perform a task.
- b) Computer processes raw data according to the given set of instructions.
- c) The speed of computer is measured in MegaHertz (MHz).
- d) A large amount of data is stored in secondary storage.
- e) Computer is a versatile device which has the capability of performing different types of tasks.
- f) The combination of 1025 Megabyte is equal to one Gigabyte.

3. Match the following.

Group 'A'	Group 'B'
i) Microsecond	a) Raw facts or figures
ii) Data	b) Application of computer
iii) GIGO	c) One millionth of second
iv) Education	d) Error due to wrong input
	f) RAM

4. Choose the best answer from the list.

- a. The measurement of second equal to one-millionth of a second is called...
i) millisecond ii) microsecond iii) nanosecond iv) picosecond
- b. When the input is wrong, then the output will also be wrong, it is termed as
i) FIFO ii) LIFO iii) GIGO iv) None of above
- c. How many kilobytes make one megabyte?
i) 1030 ii) 1000 iii) 1048 iv) 1024
- d. Repeatedly working capability of computer is known as
i) storage ii) speed iii) diligence iv) versatility

5. Fill in the blanks with appropriate words:

- a) The word "Computer" is derived from the Latin word.....
- b) The speed of computer is measured in.....
- c) Nowadays, computer and..... technology has changed the present education system.
- d)allows 24 hours banking services to their customers to withdraw money at any time.

6. Write the full form of.

- | | | | | |
|---------|----------|---------------|---------|--------|
| i) GIGO | ii) GB | iii) TB | iv) PB | v) EB |
| vi) KB | vii) AI | viii) MHz | ix) GHz | x) ATM |
| xi) ECG | xii) RAM | xiii) CT scan | | |

7. Write a short note on the following.

- a) Application of computer
- b) Use of computer in Scientific Research
- c) Computer in banking Sector
- d) Storage
- e) Speed

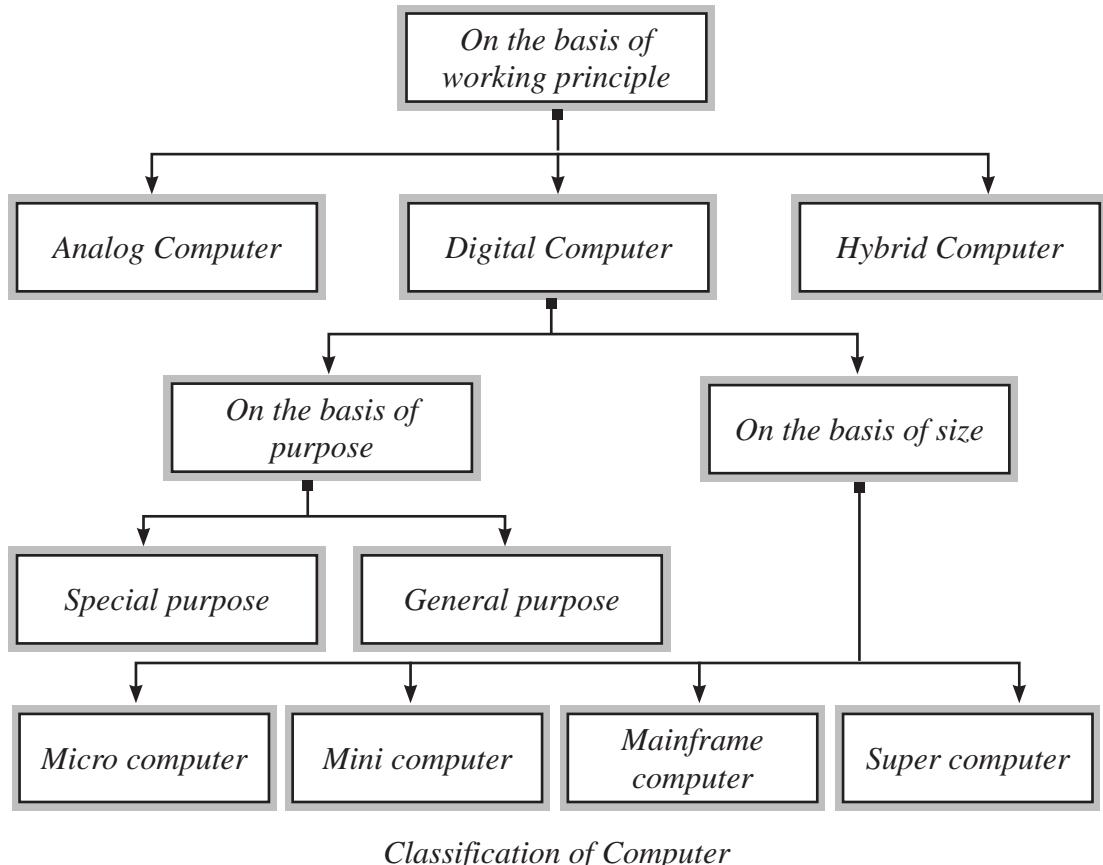
Project Work

1. Draw a computer and its parts on a chart paper and display it in your classroom.
2. Divide a class into various groups and conduct a presentation on the following topics:
 - a) Features of computer
 - b) Main application area of computer
3. During the course of a normal day, keep a list of your encounters with computer of various kinds. Your list should include the and the time of the encounter, the type of interaction you had with the technology and the result of the interaction. Share your list with the class.
4. Conduct a speech competition on the topic 'Role of computer in education and entertainment'.

Types of Computer

Nowadays, various types of computer are available. These computers are different from each other on the basis of their purpose, capacity, size, working principle, brand etc. Computer can be categorized into three types according to the working principle (data type they operate). They are:

- i. Analog computer
- ii. Digital computer
- iii. Hybrid computer



Analog Computer

Analog computers are special-purpose computers which can measure continuously changing data such as pressure, temperature, voltage, etc. It can perform a single task. For example, speedometer which displays speed of vehicles, voltmeter, analog watch, seismograph, etc. The features of analog computer are given below:

- cheaper than other device.
- on continuous data.
- storage capacity is low.
- works in real-time.
- gives output in the form of graph and signals.



Analog computer

Digital Computer

Digital computers are general-purpose computers which solve problems by computing discrete data. It works on digital values, binary digits (0 or 1). It can perform many tasks according to user requirements. Computer in school, home and office are examples of digital computer.

Feature of digital computer

- works on discontinuous.
- highly accurate and reliable.
- used for general purpose.

- based on discrete data (digit 0 and 1).



Digital Computer

On the basis of purpose, digital computers are classified into two types.

i. Special Purpose Digital Computer

These types of digital computer are designed to perform a single specific task. The program is loaded during manufacturing time in this type of digital computer which cannot be changed by user. Digital thermometer, digital watch, self-driven vehicle, washing machine, digital television, etc. are the example of special-purpose digital computers.

ii. General Purpose Digital Computer

These types of digital computer are designed to perform more than one task. The user can load programs into the computer as per requirement to perform a different task. Desktop computer, laptop, notebook, etc. are the example of general-purpose digital computers.

On the basis of size, digital computers are classified into four types. They are

- i. Microcomputer
- ii. Minicomputer
- iii. Mainframe computer and
- iv. Supercomputer

i. Microcomputer

Microcomputer is also called PC (Personal Computer) because it is used by a single person at a time. Microprocessor is used as main processing unit (CPU). IBM-PC was

the first microcomputer designed by IBM (International Business Machine) company. Microcomputers are used in the home, school, college, hospital, offices, etc. for data processing purpose. These microcomputers are further divided into the following categories:

- Desktop computer
- Laptop computer
- Palmtop computer
- Notebook computer
- Tablet computer



Notebook Computer

ii. Minicomputer



Minicomputer

Minicomputer is more powerful and expensive than microcomputer but less powerful and costly than mainframe computer. So, the capabilities of a minicomputer are in between microcomputer and mainframe computer. Minicomputer is used in scientific research, banking system, telephone switch, etc. These computers work on multiprocessor system and about two hundred of PCs can be connected to the network. PDI-1 was the first minicomputer designed by DEC (Digital Equipment Crop) company in 1960.

Time-sharing, batch processing, online processing, etc. are the services provided by minicomputer. IBM-System/3, Honeywell 200, etc. are some examples of minicomputer.

iii. Mainframe Computer



Mainframe Computer

Mainframe computers are more powerful, have large storage capacity and more expensive than minicomputer but less powerful and costly than supercomputer. These computers allows multi-user and have multi-processor and support more than 200 PCs. These computers are used as a server on WWW (World Wide Web) and also used in large organizations such as a bank, telecommunication, airlines and universities for large data processing. IBM is the major manufacturer of mainframe computer. IBM 1401 mainframe computer was brought to Nepal for the first time to process census data in year. IBM-2 series, system 210 servers, CDC (Control Data Cyber) 6600 etc. are the popular examples of mainframe computer.

iv. Supercomputer



Sunway Taihulight

Supercomputers are the most powerful, most expensive and have the highest processing speed most than other computers. It has parallel processing for performing any task. These computers are mainly used in weather forecasting, nuclear energy research, national security, space-related research, etc.

Nowadays, most powerful supercomputer is Sunway Taihulight from National Super Computing Centre, Wuxi, China. Supercomputer can perform more than one trillion calculations per second. Piz Daint, Tianhe-2, Titan, Sequoia, Cori, ETA-10, etc. are the popular examples of supercomputer.

Hybrid Computer



Hybrid Computer

The computer-designed with combined features of analog computer and the digital computer is called a hybrid computer. These computers are designed for a special purpose. They are used in hospital for Ultra Sound, ECG (Electro Cardio Graph), CT scan (Computed Tomography scan), etc., in aeroplanes for air pressure, temperature, speed, weight, in scientific lab, in ships, large industries etc.

Feature of hybrid computer

- expensive
- designed for special purpose
- works on both has continuous and discrete value
- more complex and limited storage

Summary

- Computers are different from each other on the basis of their purpose, capacity, size, working principle, brand etc.
- Analog computers are special purpose computer which can measure continuously changing data such as pressure, temperature, voltage, etc.
- Digital computers are general-purpose computers which solve problems by discrete data.
- IBM-PC was the first microcomputer designed by IBM (International Business Machine) company.
- Desktop computer, laptop, notebook, etc. are the examples of general-purpose digital computers.
- On the basis of size, digital computers are classified into four types: Microcomputer, Minicomputer, Mainframe computer and Supercomputer
- Supercomputer is the most powerful and expensive and has the highest processing speed than other computers.
- The computer-designed with combined feature of analog computer and digital computer is called a hybrid computer.

Technical Terms

Analog computer : Measures continuously changing data such as pressure, temperature.

Digital computer : Solves problems by discrete data.

Minicomputer : More powerful and more expensive than a microcomputer.

Mainframe computer : More powerful and has large storage and more expensive than minicomputer.

Super computer : The most powerful, the most has expensive and with the highest processing speed than others.

Hybrid computer : A computer with the combination of features of both analog computer and digital computer.

Exercises

1. Answer the following questions.

- a) How are computers classified into different types?
- b) What is analog computer? Where is it used?
- c) Define digital computer. What are the types of digital computers?
- d) Differentiate between general-purpose computers and special purpose computers.
- e) Classify a computer on the basis of size.
- f) What is mainframe computer and what are its typical applications?
- g) What are supercomputers? Write their application.
- h) What is microcomputer? Write its types.
- i) Define hybrid computer? How is it used in hospitals.

2. State 'True' or 'False'.

- a) Analog computer solves problems by discrete data.
- b) Laptop computers are portable computers.
- c) Hybrid computer has the features of analog and digital computer.
- d) Minicomputer is more powerful and more expensive than mainframe computer
- e) Desktop computer is an example of general-purpose digital computers.

3. Match the following.

Group 'A'

- a) i) Analog computer
- ii) Digital computer
- iii) Hybrid computer
- iv) Minicomputer

Group 'B'

- a) about 200 users
- b) used in hospital
- c) deals with 0 or 1
- d) measures continuously changing data
- e) about 5000 users

Group 'A'	Group 'B'
b) i) Mainframe computer	a) PC
ii) Super computer	b) PDP-1
iii) Microcomputer	c) IBM1401
iv) Minicomputer	d) Sunway Taihulight
	e) IBM 2040

4. Choose the correct answer.

- a. The most powerful, expensive and largest processing computer is...
 - i) Microcomputer
 - ii) Supercomputer
 - iii) Mainframe computer
 - iv) Minicomputer
 - b. CT- Scan is an example of computer.
 - i) Analog
 - ii) Micro
 - iii) Hybrid
 - iv) None of above
 - c. is the mainframe computer brought to Nepal for the first time to process census data in 2028 BS.
 - i) IBM 1400
 - ii) IBM1401
 - iii) IBM1402
 - iv) IBM1403
 - d. Nowadays, the most powerful supercomputer is Sunway taihulight from
 - i) India
 - ii) Germany
 - iii) China
 - iv) America
 - e. Minicomputer is more powerful and expensive than computer.
 - i) Micro
 - ii) Super
 - iii) Mainframe
 - iv) None of them

5. Fill in the blanks with appropriate.

- i) computers are special-purpose computers which can measure continuously changing data.
 - ii) was the first microcomputer designed by IBM.
 - iii) computer is more powerful and expensive than microcomputer but less powerful and costly than mainframe computer.

- iv) computers are used as server on WWW.
- v) computers are general-purpose computers which solve problems by computing discrete data.
- vi) has parallel processing for performing any task.
- vii) computer is used in hospital for UltraSound.

6. Write the full form of the following.

- i) IBM
- ii) CPU
- iii) PC
- iv) DEC
- v) WWW
- vi) CDC
- vii) ECG

7. Write short notes on the following.

- a) Mainframe computer
- b) Supercomputer
- c) Desktop computer
- d) Hybrid computer
- e) Analog computer

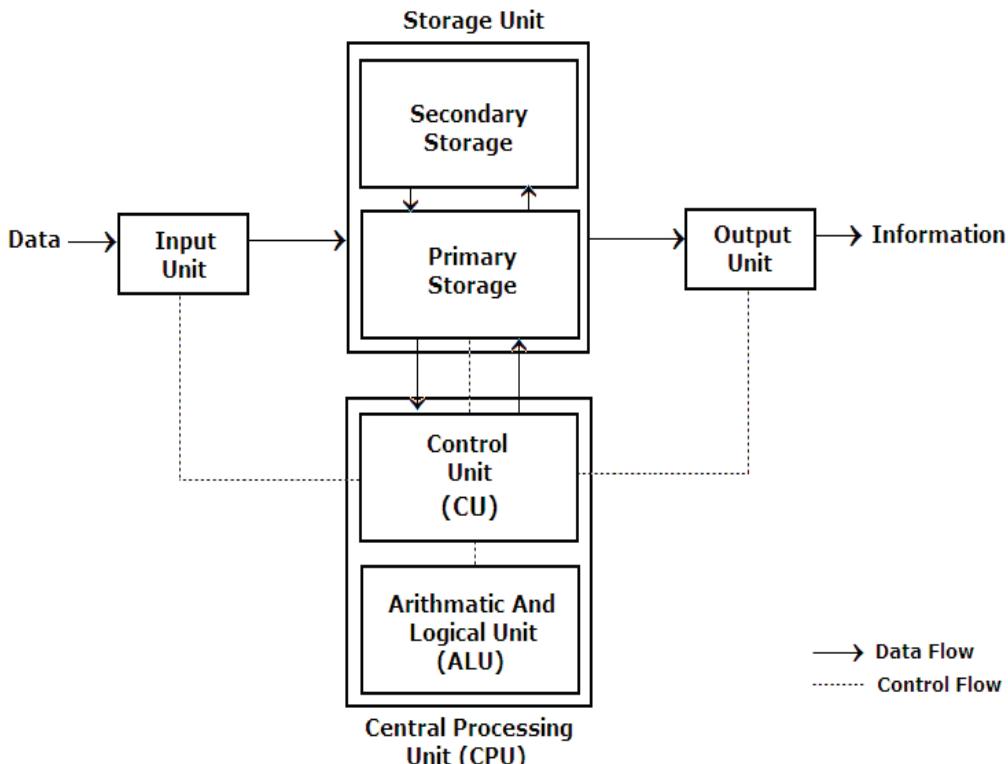
Project Work

1. Draw on a chart paper the types of computer on the basis of working principle and paste in your classroom.
2. Collect some examples of analog, digital and hybrid computers.
3. Prepare a presentation about the use and purpose of hybrid and supercomputer in different sectors and present to your class as a group work.
4. Divide a class into various groups and conduct a presentation on the following topics:
 - a. Type of computer on the basis of purpose.
 - b. Type of computer on the basis of size.
 - c. Type of computer on the basis of work.

Basic Architecture of Computer

A combination of related units that have common purpose of achieving some objectives is called a system. For example, there are different units in the hospital system like doctor, nurse, surgery room, medical, etc.

Likewise, there are different units in computer system that work together to perform varieties of tasks. So, computer system is a group of hardware and software which work together to process data according to the instructions given by user to produce information.



Basic Architecture of Computer

The main components of computer system are defined below:

- Data:** Data is the main part of computer system. It can be processed to get desired

- output as information.
- b. **Software:** A set of programs are called software which instructs the hardware to perform a task. For example MS Windows, MS Word, MS Excel, etc.
 - c. **User:** The person who operates computer system is called a user.
 - d. **Hardware:** The physical parts of a computer which can be touched, seen and felt are called computer hardware. For example Keyboard, mouse, monitor, etc.

The computer hardware is further divided into four units:

- a. Input unit
- b. Process unit
- c. Output unit and
- d. Storage unit

a. Input Unit

This unit enters data into the computer. An input unit consists of input devices like keyboard, mouse, microphone, joystick, etc. These devices are used to enter data and instructions or commands into computer system. Input unit acts as a communication channel between user and computer. The input devices translate the information into a form understandable by the computer.



Input Device

b. Processing Unit

A processing unit consists of processing devices like CPU (Central Processing Unit). CPU is the main processing unit of a computer system. It is also known as the brain of computer system. It receives data from input unit, processes it as instructed by the user and produces information as output.



CPU (Central Processing Unit)

The speed of CPU is measured in hertz. Hertz is also called CPU clock rate or CPU clock speed. Nowadays, CPU speed is measured in Gigahertz (GHz).

1 GHz = 1000 MHz (MegaHertz).

= 1,000,000 KHz (Kilo Hertz).

= 1,000,000,000 Hz (Hertz).

So, one GigaHertz is equal to one billion hertz. The CPU speed of 2.1 GHz is equal to $2.1 * 1,000,000,000$ Hertz.

The CPU consists of the three main parts.

- i. CU (Control Unit),
- ii. ALU (Arithmetic Logic Unit) and
- iii. MU (Memory Unit- Register Array)

i. Control Unit

Control Unit is a part of the CPU that controls and coordinates activities of other units of computer system. It acts as a nervous system of computer. It controls the execution of instructions given to system. It coordinates the flow of data in or out of ALU, memory and various input or output devices.

ii. Arithmetic Logic Unit

Arithmetic logic unit is a part of CPU that can perform arithmetic operation like addition, subtraction, multiplication and division. It also performs logical comparison like equal to, greater than, less than, etc. to compare between two numbers.

iii. MU (Memory Unit- Register Array)

Memory unit is also a part of CPU but not the part of main memory that store currently executing task. It is located inside the microprocessor and has very limited storage. It is used to store very active data and instructions temporarily during processing.

c. Output Unit

An output unit consists of output devices like monitor, printer, speaker, etc. These devices are used to display information after processing raw data from the processing unit.



Output devices

d. Storage Unit

A storage unit consists of primary and secondary storages. The primary storage or main storage stores raw data and instruction. RAM (Random Access Memory) and ROM (Read Only Memory) are the examples of storage unit. The functions of the storage unit are below.

- It stores intermediate results of processing.
- It stores all the data and the instructions required for processing.
- It stores the final results of processing before these results are released to an output device.

The secondary storage stores processed or unprocessed data or information for future use. Hard disk, pen drive, CD, DVD, etc. are the examples of the storage unit.



Storage devices

Summary

- A combination of related units that have common purpose of achieving some objectives is called computer system.
- A processing unit consists of Control Unit, Arithmetic logic unit and Memory unit.
- The speed of CPU is measured in hertz. Hertz is also called CPU clock rate or CPU clock speed.
- An output unit consists of output devices like monitor, printer, speaker, etc.
- A storage unit consists of primary and secondary storages.

Technical Terms

Computer system: A combination of hardware and software to produce information.

Hardware : The physical parts of computer which can be touched, seen and felt.

Software : A set of programs which instruct hardware to perform a task.

User : The person who operates a computer system.

Data : Raw facts or figures which do not have a clear meaning.

Input unit : To enter data and instructions or commands into the computer system.

Processing unit : Processes raw data as instructed by the user and produce output.

Arithmetic unit : Performs arithmetic operation like addition, subtraction, etc.

Logic unit : Performs logical operations like equal to, greater than, less than, etc.

Exercises

1. Answer the following questions.

- a) What is the computer system?
- b) Write down the main units of the computer system.

- c) Draw a block diagram of the computer system.
- d) Mention the functions performed by ALU.
- e) Define CPU with two major sections of it.
- f) Differentiate between input unit and output unit.

2. State 'True' or 'False'.

- a) The main units of computer system are input, process, output and storage.
- b) The user enters data and instruction by using input device and it is called input.
- c) The processing unit display results from computer.
- d) A scanner is the device of the memory unit.
- e) The CPU speed of 3.1 GHz is equal to 3.1 x1,000 Hertz.

3. Match the following words.

Group 'A'	Group 'B'
i) Input unit	a) Process raw data to produce output
ii) Output unit	b) store currently executing task
iii) Processing unit	c) To enter data and commands
iv) Memory unit	d) Produce information
	e) Fraction of second

4. Choose the best answer.

- a. How many units are there in a computer system?
 - i) 2
 - ii) 3
 - iii) 4
 - iv) 5
- b. Which device does not belong to input unit?
 - i) Microphone
 - ii) Keyboard
 - iii) Printer
 - iv) Mouse
- c. is also known as the brain of the computer system.
 - i) Input unit
 - ii) Processing unit
 - iii) Output unit
 - iv) Memory unit

- d. The nerve centre of computer is

i) ALU ii) main memory

iii) control unit iv) all of the above

e. Monitor, printer, plotter and speaker are the examples of device.

i) input ii) output

iii) processing iv) none of them

5. Fill in the blanks with appropriate word.

- a) computer system is a combination of..... and software.
 - b) unit consists of input devices.
 - c) is a part of CPU that controls and co-ordinates.
 - d) can perform arithmetic operation as well as logical operation.
 - e) is a part of CPU that stores currently executing task.
 - f) consists of output devices.

6. Write the full form of:

- | | | | | |
|--------|---------|-----------|---------|--------|
| i) CPU | ii) ALU | iii) Hz | iv) MHz | v) GHz |
| vi) MU | vii) CU | viii) RAM | ix) ROM | x) KHz |

7. Write short notes on:

- a. ALU
 - b. Storage Unit
 - c. Components of computer system
 - d. Output unit

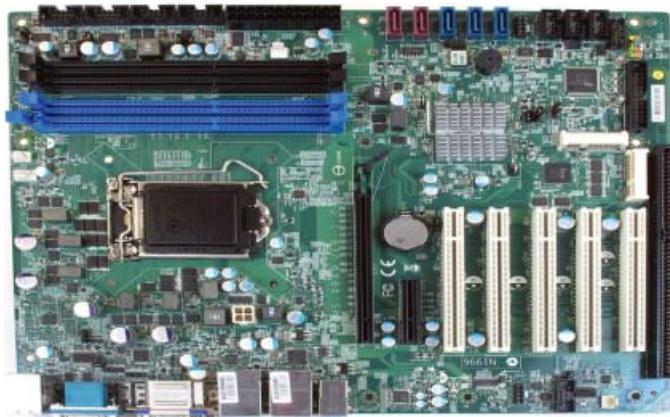
Project Work

1. Describe computer system and its main unit by using power point presentation and demonstrate in your class as a group work.
 2. Prepare a presentation about "CPU is also known as the brain of computer system" and demonstrate in your class.

The physical parts of a computer which can be seen, felt and touched are called computer hardware. Computer hardware is important component of computer system. The user can perform a task by using a set of instructions through the computer hardware. So, the combination of computer hardware and software makes up a full functioning computer system that performs specific task. Motherboard, microprocessor, RAM, ROM, hard disk, pen drive, keyboard, scanner, monitor, etc. are the examples of computer hardware.

a. Motherboard

Motherboard is called PCB (Printed Circuit Board) or system board or main circuit board. All parts of computer system like microprocessor, slots, ports etc. are mounted on motherboard. So, it is also called backbone of computer system. It also connects important chips like ROM chip, Network chip, sound card, etc.



Motherboard

Function of motherboard

- a. There are different slot which joins modem, TV card, etc. in motherboard.
- b. Motherboard helps in data communication among different hardware.
- c. BIOS (Basic Input Output System) programs are stored in ROM and ROM is

attached to motherboard to boot the system.

b. Microprocessor

Microprocessor is an important part of computer hardware. Computer cannot perform the task without a microprocessor. So, it is also called the brain of a computer.

Microprocessor gets data and instructions from various hardware and processes it with the help of software to produce information as an output to the user. It can do arithmetic calculation and logical comparison between two numbers. Nowadays, a trillion of instructions can be processed within a second.



Microprocessor

Working of Microprocessor

i. Fetch

The user can give data and instructions which is stored in RAM. Microprocessor receives data and instruction according to necessity and requirement which is known as fetch. So, fetch means get instruction from memory.

ii. Decode

The main function of microprocessor is to change fetched instruction into decoded instruction. The given instruction is separated for arithmetic or logical calculation. So decode means to decide what the instruction means.

iii. Execute

Microprocessor can perform the main task in this unit. For example, ALU is used for mathematical calculation. So, execute means to carry out the instruction into action.

iv. Write back

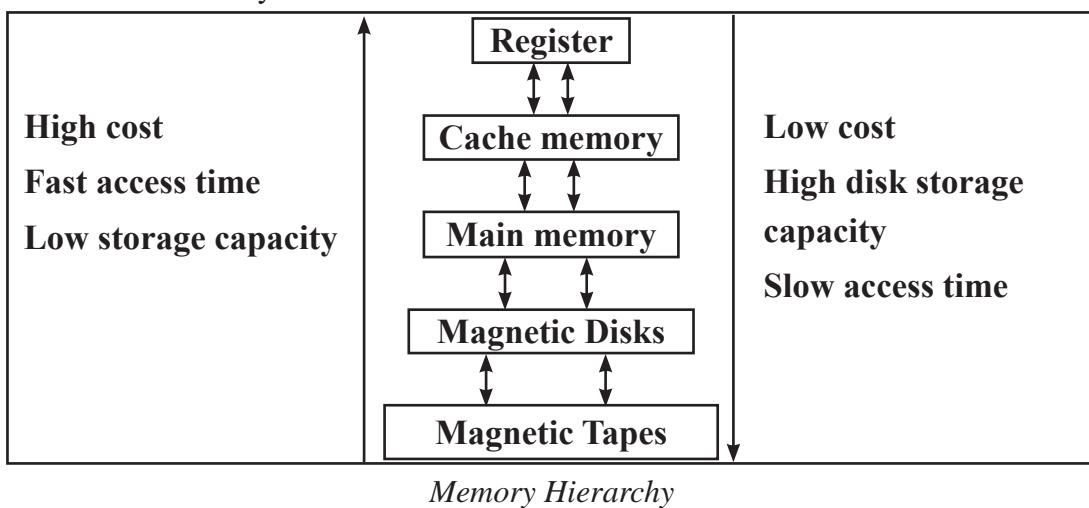
Microprocessor processes the instructions and produces result which is transferred to memory for storage. This is called to write back.

The complete cycle of four units as fetch, decode, execute and write back of microprocessor for processing the instruction is called the instruction cycle.

c. Memory

The physical part of a computer that store data, information and software temporarily or permanently is called memory or storage. Storage device or memory device is used to store data and information. The three types of memory are as follows

- i. Primary memory,
- ii. Secondary memory and
- iii. Cache memory.



i. Primary memory

The main memory is called primary memory. Primary memory stores data temporarily or permanently. It stores information during the processing of raw data. The two types of primary memory are:

RAM (Random Access Memory)

ROM (Read Only Memory)

RAM (Random Access Memory)

RAM is the main memory of computer system. It is volatile or temporary memory. Volatile memory means that RAM loses its information when the computer is switched off or faces power failure. So, it needs constant power supply to hold currently running program. It is also called semiconductor memory. It is read/write memory. There are two types of RAM. They are **SRAM** and **DRAM**.

SRAM: SRAM stands for Static Random Access Memory. It does not need periodic refreshing to preserve the information. It is faster and expensive than DRAM.

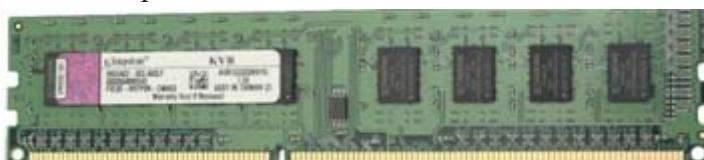
Characteristic of Static RAM

- Long life and no need to refresh
- Faster and used as cache memory
- Large size and expensive
- Expensive and high power consumption

DRAM: DRAM stands for Dynamic Random Access Memory. It needs a periodic refreshing to preserve the information. It is slower and cheaper than SRAM.

Characteristics of Dynamic RAM

- Short data lifetime and needs to be refreshed continuously
- Slower as compared to SRAM and used as RAM
- Smaller in size and less expensive
- Less power consumption



RAM

ROM (Read Only Memory)

ROM is a non-volatile or permanent memory. Non-volatile means never loses data in ROM. It stores data permanently even when the computer is switched off or power failure. It is read-only memory because the programs in ROM are stored at the time of

manufacture of the computer. It is fixed on motherboard. The three types of ROM are **PROM**, **EPROM** and **EEPROM**.

PROM

PROM stands for Programmable Read Only Memory. Once a program has been written onto the PROM, it remains there forever and can't be updated and deleted.

EPROM

EPROM stands for Erasable Programmable Read Only Memory. It can be erased by ultraviolet light and reprogramming.

EEPROM

EPROM stands for Electrical Erasable Programmable Read Only Memory. It is called flash ROM. It can be erased by exposing it to an electrical charge and reprogramming. It is also called hybrid memory with a combined feature of RAM and ROM.



ROM

Firmware

Firmware is software that's embedded in a piece of hardware. So, the firmware is software for hardware.

CPU Register

CPU Register is a small storage memory, located inside the microprocessor and has a high speed data transfer rate. It stores data and instructions used by the microprocessor.

Cache Memory

Cache memory is also like CPU Register, located inside the microprocessor but has high storage capacity than CPU Register and high-speed data access rate. It also stores the data and instruction used by the microprocessor. So, it stores very active data and instructions temporarily during processing. If required data and instruction are not found in cache memory then the searching is done in primary memory.

ii. Secondary Memory

Secondary memory is also called auxiliary memory or backup memory. These memories are used to store data and instructions permanently for future use. CD/DVD, pen drive, hard disk, etc. store data and instruction for future. The various types of secondary memory are Magnetic Tape, Hard disk, SSD (Solid State Drive), Optical Storage Disc, Pen drive, etc.

a. Magnetic Storage

Computer systems need to store data in digital format. One of the most widely used types of digital data storage is magnetic storage. This refers to any type of data storage using a magnetized medium. Several types of magnetized media are used in computer systems, including magnetic tape, floppy disks, Super disks, hard disks, etc.

Magnetic Tape

Magnetic Tape is a usable secondary storage device to store and retain a large volume of data. It is made up of a plastic strip of which one surface is coated with magnetic ink. Analog and digital data are stored in magnetic tape. Normally, minicomputer, mainframe computer, large scale business organization server, etc. uses magnetic tape for backup data and information. Magnetic tape driver are used to store and retrieve the data and information from magnetic tape. The main important function of magnetic tape is to store data safely for a long period of time.



Magnetic Tape and Tape Drive

Hard Disk

Hard disk is commonly used storage device. It stores large amount of data and information permanently. It is also called fixed disk. It is made of aluminium materials

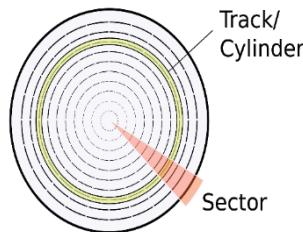
and the surface is coated with the ferromagnetic element. Circular metal discs also called platters to rotate while writing or reading the data and information into them. It stores a large amount of data on hard disk. The speed of the hard disk is measured in rpm (revolutions per minute). The hard disks with 5400 rpm or 7200 rpm are generally used in present-day computer system.

Hard disk capacity

Hard disk must be formatted before use. There are thousands of track on the surface of hard disk. So, each track is divided into various sectors. Each sector stores 512 bytes. Header is used to read and write on hard disk. The storage capacity of hard disk is determined from number of disk or platter it contains and their density.



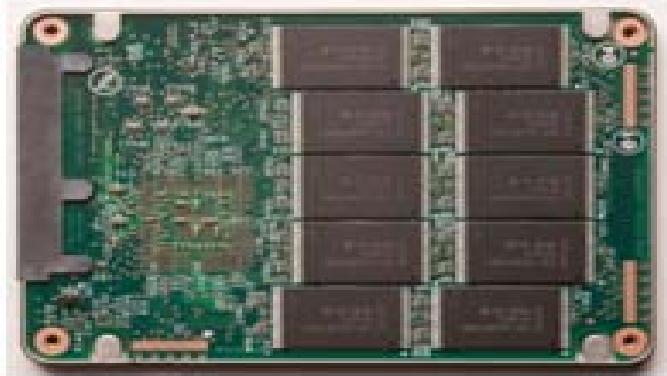
Hard Disk



Track and Sector

SSD (Solid State Drive)

Hard disk can be replaced and upgraded by SSD (Solid State Drive) as new technology. Semiconductor chips are used to store data in SSD. The speed to read and write data is greater than hard disk. So its price is more expensive than hard disk. Laptop, notebook, ultra book, etc. uses SSD as storage device. Its storage capacity is about 4 TB but various companies are trying to develop SSD with high storage capacity. It is more costly than HDD (Hard Disk Drive).



Solid State Drive

Differences between SSD and Hard disk

S.N.	Hard disk	SSD
1	It is heavier than SSD.	It is lighter than hard disk.
2	Its storage capacity is 500 GB to 100 TB.	Its storage capacity is 1 TB to 4 TB.
3	It is cheaper than SSD.	It is more expensive than hard disk.
4	It takes 6-7 watt electricity.	It takes 2-3 watt electricity.
5	The file writing speed is 50-120 MB/S (megabyte per second)	The file writing speed is 200-550 MB/S (megabyte per second)
6	It is made up of aluminium material.	It is made up of semiconductor microchip.

External Hard Drive

The working principle of hard disk is similar to that of internal hard drive but it is not placed inside CPU casing. It can be externally connected with a USB (Universal Serial Bus) port. It is portable and easy to carry. It is used to transfer data, information and software from one computer to another.



External Hard Drive

Pen drive

Pen drive is a popular flash storage device. It is also called flash memory. It is connected through the USB ports. It is a small size and portable device. It can be carried in a pocket like pen. So it got its name as a pen drive. It is used to transfer data, information and software from one computer to another. It is made up of semiconductor chip which is EEPROM technology. The writing speed of pen drive of USB 3.0 is up to 60 MB/S and data reading speed up to 120 MB/S.



Pen drive

b. Optical Storage Disc

The disc that uses laser light technology to store and retrieve data is called optical storage disc. The most commonly used optical storage discs are CD, DVD, Blu-ray disk, etc.

CD (Compact Disc)

In 1980, Philips Company of Netherland developed first CD or optical disk which was 12cm in diameter and had 72 minutes audio/video storage capacity. The laser ray technology is used to retrieve and store the data. The information on the optical disk is stored in the form of pits. The pits are tiny reflective bump.

CD has the diameter of 12 cm. Its weight is 18gm and width 1mm (millimetre). The data can be written on a CD only once. CD is made up of poly carbon and both surfaces are coated with aluminium. Nowadays, CDs are commonly used in microcomputer. It can be used to transfer data from one computer to another. The storage capacity of a CD is 700MB.

The three types of optical storage devices are:

- CD-ROM → Compact Disc – Read Only Memory
- WORM → Write Once Read Many
- CD-RW → Compact Disc – Rewritable

- a. CD-ROM stores data or programs like video, music, software, etc. for selling purpose developed by different company. The information stored on it is read-only.
- b. WORM is an optical storage media which is purchased as blank media and data can be written only once but can be read many times.
- c. CD-RW (Compact Disc - Rewritable) means read and write in it multiple time. It is similar to pen drive as information can be read from and written to the disk many times.



CD (Compact Disk)

DVD (Digital Versatile Disc)

DVD stands for Digital Versatile Disc or Digital Video Disc. Its storage capacity is higher than CD. It stores multiple layers of data. The various DVD storage capacities are

- Single Side Layer- 4.7 GB
- Single Side Double Layer-8.5 GB
- Double Layer Single Side- 9.4 GB
- Double Layer Double Side-17.08 GB

Philips, Sony, Toshiba/ Panasonic companies developed first DVD in 1995. DVD Drive is used to read/write the data on DVD.



DVD

Differences between CD and DVD

S.N.	CD	DVD
1	Its storage capacity is 700MB.	Its storage capacity is up to 20GB.
2	It is cheaper.	It is more expensive.
3	It is used to store audio and software.	It is used to store video and software.
4	Its types are CD-R, CD-RW, etc.	Its types are: DVD-RW, DVD+RW, etc.
5	It was developed by Philips and Sony.	It was developed by Philips, Sony, Toshiba, Panasonic etc.

Blue-ray Disc

It is an optical data storage device. Its storage capacity is up to 200GB. It is mainly used to store high-quality audio and movie data. It is scratch resistant discs.

Differences between Primary memory and Secondary memory:

S.N.	Primary memory	Secondary memory
1	It is also called main memory or internal memory.	It is also called auxiliary memory or backup memory.
2	It is volatile and non-volatile memory.	It is non-volatile memory.
3	The storage capacity is less.	The storage capacity is more.
4	Its types are RAM, ROM, etc.	Its types are: Hard disk, CD/DVD, etc.
5	It is made up of semiconductor.	It is made up of magnetic materials, poly carbon, etc.
6	The data is directly accessed by the processing unit.	The data cannot be directly accessed by the processing unit.

iii. Units of memory measurement

The smallest unit of memory measurement is bit (binary digit- 0 or 1). The data stored in a computer is a binary digit, byte, kilobyte, megabyte, gigabyte, terabyte, etc.

Bit

Bit stands for Binary digit. The value of the binary digit is 0 or 1.

Nibble

Nibble is the combination of 4 bits.

Byte

Byte is the combination of 8 bits.

The units of memory measurements are as follows:

S.N.	Memory Unit	Description
1	Bit	1 Bit = 0 or 1
2	Nibble	1 Nibble = 4 Bits
3	Byte	1 Byte = 8 Bits
4	Kilobyte (KB)	1 Kilobyte (KB) = 1024 Bytes
5	Megabyte (MB)	1 Megabyte (MB) = 1024 KB
6	Gigabyte (GB)	1 Gigabyte (GB) = 1024 MB
7	Terabyte (TB)	1 Terabyte (TB)= 1024 GB
8	Petabyte (PB)	1 Petabyte (PB) = 1024 TB

d. Input Device

The devices through which raw data and instructions are entered into the computer system are called input devices. The user gives raw data into the computer for processing through the input devices. Keyboard, mouse, joystick, microphone, etc. are examples of an input device.

i. Keyboard

Keyboard is a common input device. The data is entered into the computer by typing through the keyboard. The most common layout of the keyboard is "QWERTY" keyboard. The different keys present in the keyboard are:

- Alphabet keys – A-Z
- Numeric Keys – 0-9
- Function Keys – F1, F2 F12
- Special Purpose Keys – Shift, Delete, Alt, Enter, Ctrl

- Arrow keys →, ↓, ←, ↑

The keyboard which is connected to a computer without wire is called wireless keyboard. Multimedia keyboard contains additional multimedia keys. The different types of keyboard are multimedia keyboard, AT-keyboard, Enhanced Keyboard, XT-keyboard, etc.



Keyboard

ii. Mouse

The mouse is a pointing input device. It is used to point object, give command, draw paint, etc. into the computer. The common three buttons of a mouse are:

- Left Button
- Right Button
- Scroll Button



Mouse

The user uses buttons for clicking, double clicking, right-clicking, dragging, scrolling, etc. to give command into the computer.

The mouse was developed by Douglas Engelbart in 1964 that was of wood. Apple Macintosh was the first computer to use mouse. Mechanical mouse, optical mouse and wireless mouse are different types of mouse.

iii. Joystick

Joystick is an input device which is used to play video games. There are different types of joystick available for various video games. It has more buttons that help in playing and controlling objects in games.



Joystick

iv. Track Ball

Track ball is a pointing input device. It consists of a movable small ball in a socket.

The pointer moves on screen when the ball rolls with our fingertips. Track ball are mostly used on a laptop, palmtop, notebook etc. It is also called upside-down mouse as it contains ball on the top of the device. It is fixed and requires less space for operation.



Track Ball

v. Touchpad

Touchpad is a touch-sensitive pad that is used as a pointing device in a laptop computer. It is also known as Glide pad, Glide point, pressure-sensitive tablet or track pad etc. Touchpad has two buttons (left and right) like a mouse.



Touch Pad

vi. Scanner

Scanner is an input device which scans drawing or document and enters into computer in digital format. The photocopy machine gives the facility of the scanner. Scanner converts hardcopy into soft copy.



Scanner

vii. BCR (Bar Code Reader)

BCR is a hand-held or stationary input device used to capture and read the information contained in a bar code. A BCR merely captures and translates the barcode into numbers or letters. The data must be sent to a computer so that a software application can make sense of the data. Barcode scanners can be connected to a computer through serial ports, keyboard port, or an interface device called a wedge. A BCR works by directing a beam of light across the bar code and measuring the amount of light that reflects back. The scanner converts the light energy, which is then converted into data by the decoder and forwarded to a computer.



Bar Code Reader



Bar Code

viii. QR Code Scanner

It stands for Quick Response Code. The advanced form of Bar Code Reader is QR Code Scanner. A QR code is a pattern of black and white squares. The QR code of any product gives information about the website address. A QR code can be read and processed by a smartphone or a cell phone with the help of Apps or Applications.



QR Code

ix. Microphone

Microphone is a sound input device. It helps to input sound or music into the computer in a digital format. It is used in audio chatting and video conferencing through Skype, Viber, Facebook, messenger etc.



Microphone

x. Digital Camera

Digital Camera is an input device that takes photographs or video and enters them into the computer system in digital format. It stores the file in SD card. The data from the SD card then get transferred into the computer through a cable. Mobile phone camera is also an example of digital camera.



Digital Camera

xi. Graphic Digitizer

Graphic Digitizer is an input device. It is a device used to convert hand sketch image or signature into digital format to the computer. It is also called digital tablet. Stylus (electronic pen) helps to draw an image onto the flat surface and send to the



Graphic Digitizer

computer for digital store. Graphic Digitizer is mainly used by designer and engineer.

xii. Touch Screen

Touch Screen is a touch-sensitive display panel covering the screen. It is mostly used in smartphone. Nowadays, laptop, notebook, palmtop and desktop computer use touch screen as their display unit. The user touches on the screen with their finger to select an object on the screen and give command to the computer system.



Touch Screen

e. Output Device

The device which displays meaningful information from the computer is called an output device. So, an output is the result produced by processing unit. The common output devices are monitor and printer. Some other output devices are: plotter, speaker, headphone, etc.

Monitor

Monitor is the most common output device. It is also called VDU (Visual Display Unit) in computer system. The output displayed on monitor's screen in the form of text, videos and graphics is called soft copy output. On the basis of colour the monitors are of two types:

- i. Monochrome monitor and
- ii. Colour monitor

Monochrome monitor

The monitor which display output in one colour like green, white, black, blue, etc. is called monochrome monitor.

Colour monitor

The monitor which displays output in different colours more than sixteen is called colour monitor.

The information displayed on the screen is made of combination of small tiny dots. The small tiny dots are called pixel.

The clear screen consists of three terms as screen resolution, dot pitch and refreshes rate.

i. Screen Resolution

It represents the number of horizontal and vertical pixels. The clear screen is due to the high resolution of the monitor. The common resolution ranges are 640×480 , 1024×768 , 1600×1200 etc.

ii. Dot Pitch

The dot pitch is a measure of how close the pixels or dots are to create an image on the monitor. So, it is measured in millimetre. The clear screen is due to the low dot pitch of the monitor.

iii. Refresh Rate

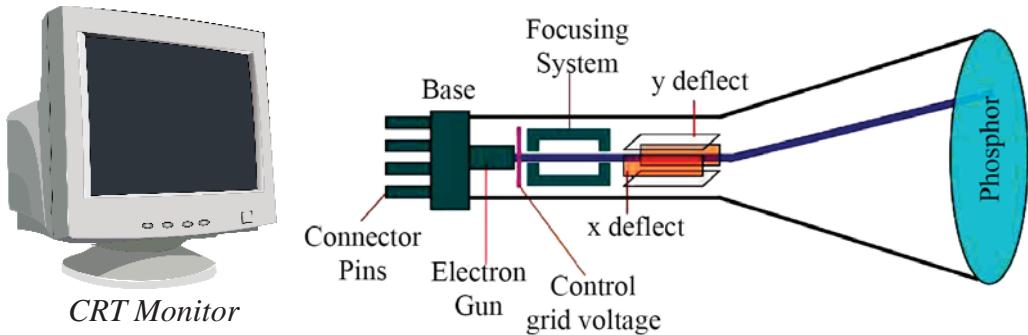
The refresh rate is the rate due to each pixel on screen re-drawn. A low refresh rate results in a poor image on the screen. It is measured in hertz. So, the clear image is due to the high refresh rate.

On the basis of technology, monitors are classified into three types as:

i. CRT Monitor

CRT stands for Cathode Ray Tube. It operates in the following ways:

- The electron gun emits a beam of electrons cathode rays.
- The electron beam passes through focusing and deflection systems that direct it towards specified positions on the phosphor-coated screen.
- When the beam hits the screen, the phosphor emits a small spot of light at each position contacted by the electron beam.
- It redraws the picture by directing the electron beam back over the same screen points quickly.



There are two ways Random scan and Raster scan by which we can display an object on to the screen.

ii. LCD Monitor

LCD stands for Liquid Crystal Display. It is very light, thin and consumes less power than CRT monitor. The two-layer in this monitor which consists of liquid crystal form an image. It is used in laptop, notebook, digital watch, desktop computer, etc. It is more expensive than CRT monitor and produces a high quality image on the screen. The fluorescent lamps are used for backlighting in LCD monitor for displaying image on the screen.



LCD Monitor

iii. LED Monitor

LED stands for Light Emitting Diode. It is very lighter and thinner than LCD and CRT monitors. It consumes less power than CRT and LCD monitors. Its working power is higher than others. So its lifetime is more and can be used for long-time-work. The quality of image on the screen is higher than that of other monitors. The diodes are used for backlighting in LED monitor for displaying the image on the screen. LCD and LED monitors are called flat panel displays.



LED Monitor

ii. Printer

Printer is a hard copy output device. It prints text & graphics on paper. There are many different types of printers available in market. Its speed is measured by CPS (Character per second), LPM (Line per minute) and PPM (Page per minute). The printers are classified in two types on the basis of printing quality. They are:

- Impact printer
- Non-impact printer

Impact Printer

An impact printer is a type of printer that operates by striking a metal or plastic head against an ink ribbon. Its structure is like a typewriter. It uses small pin-like objects or hammers that strike on the inked ribbon and characters are formed on the paper. These printers are slow and noisy. These printers use black or blue or red colour. The printing quality of impact printer is lower than non-impact printer.

The three main types of impact printer are following:

i. Dot Matrix Printer

Dot-matrix printer is a type of impact printer. The printer head contains a number of pins. The printer head strikes on the inked ribbon, the striking forms dotted characters on the paper. The speed of Dot-matrix printers ranges from 50 to 400 CPS (Character Per Second).



Dot Matrix Printer

ii. Daisy Wheel Printer

Daisy wheel printer is a type of impact printer. It uses hammer-like object to hit on the ink ribbon and a character is formed on the paper. The hammer contains letter face and is arranged in wheel like form and motor spins the wheel at a rapid rate. When desired characters spin to the correct position, a printer hammer strikes on the ribbon and output is formed on the paper. The speed of the daisy wheel printer ranges from 25 to 55 CPS (Character Per Second).



Print Head of Daisy Wheel

iii. Line Printer

Line printer is a type of impact printer. Its printing quality is better than that of Daisy wheel printer and Dot- matrix printer. It prints text line by line. So, it is called a line printer. The three types of line printer are:

Drum printer: In this type, there is a cylindrical drum which continuously rotates over the paper surface and causes characters rise and hits on the ribbon.

Chain Printer: In the chain printer, high-speed print chain is used. This chain contains different types of characters.



Drum Printer

Band Printer: In this line printer, steel print band is used to print one line printout on paper at a time.

Non-Impact Printer

The non-impact printer does not use the printing head to strike against ribbon and paper. Instead, small drops of ink are sprayed onto the paper. So non- impact printers are faster and are of high quality than impact printer. It does not produce sound while printing. Inkjet printer, laser printer, 3D printer are the popular types of non- impact printer.

i. **Ink-jet Printer**

Inkjet printer prints text and graphics on paper by spraying small drops of ink into paper. The speed of inkjet printer is generally 1 to 4 pages per minute. It uses an A4 size paper. The liquid colour-filled cartridge is used instead of ink ribbon. Colour inkjet printer uses black colour. Four colour-CMYK (Cyan, Magenta, Yellow, Black) cartridges are used for colour printout.



Inkjet Printer

ii. **Laser Printer**

A laser printer is a type of printer which makes use of a laser beam to produce an

image on the drum or you can say that it is a printer that makes use of a focused beam of light to transfer text and images onto paper. It was first developed by Gary Starkweather at Xerox PARC in 1971. Laser printer makes use of laser technology for the printing of copies onto the paper. Its printout technology is like a photocopy machine. It uses colour powdered toner to print text and graphics on paper. Its printing quality is high.



Laser Printer

iii. 3D – Three Dimensional Printer

Impact printer & non-impact printer prints text on paper but 3D printer prints an object. For example, any playing toys or any machinery parts are printed through the 3D printer. 3D printing builds parts out of plastic, metal and other materials directly from CAD (Computer-Aided Design) drawings that have been cross-sectioned into thousands of layers. This technology helps to build a 3D object by modelling. This technology is called additive manufacturing.



3D Printer

iii. Graphic Plotter

The graphic plotter is a hard copy output device which is used for good quality print or drawing like charts, map, engineering design, etc. Figures or maps are printed on

graph paper placed on square board. The graphic plotter is used to print large size figure or map. It gets instruction from computer and draws a clear image by using pen. The different types of plotters are given below.

Pen plotter: Pen plotter contains one or more pen. It prints colour drawing with shade.

Electrostatic plotter: Electrostatic plotter does not contain any type of pen. It prints like laser printer.

Dot-matrix plotter: Dot matrix plotter prints drawing like impact printer. Print head strikes on ink ribbon and prints images on paper.



Graphic Plotter

iv. Speaker

Speaker is a common audio output device. It is used to receive sound or music from computer system. It is used to covert digital data into audio analog data which user can understand. The quality of sound output depends on the speaker's quality. For example, loud speakers, sub woofers, in- wall/ceiling speaker, outdoor speaker, etc. are the different types of speakers.



Speaker

Summary

- The physical parts of computer which can be seen, felt and touched are called computer hardware.
- The complete cycle of four units as fetch, decode, execute and write back of microprocessor for processing the instruction is called instruction cycle.
- Motherboard helps in data communication between different hardwarea.
- Microprocessor gets data and instruction from various hardwarea and processes it with the help of software to produce information as an output to user
- The physical parts of a computer that store data, information and software temporarily or permanently is called memory or storage.
- Hard disk stores large amount of data and information permanently and made up of aluminium materials and surface is coated with the ferromagnetic element.
- The most commonly used optical storage discs are: CD ROM, DVD, Blu-Ray Disk, etc.
- The devices which ae used to enter raw data and instructions into the computer system are called input devices.
- The devices which display meaningful information from the computer is called an output device.

Technical Terms

Hardware	: the physical parts of a computer which can be touched, seen and felt.
Fetch	: get an instruction from memory.
Decode	: decides what the instruction means.
Write back	: microprocessor processes the instructions and produces result.
Primary memory	: stores data temporarily or permanently.
Cache memory	: the high-speed execution memory.
Secondary memory	: stores data and instruction permanently for future use.
Magnetic Tape	: store and retains a large volumes of data.

Input device	: the devices which are used to enter raw data and instructions
Output device	: the device which displays meaningful information
Screen Resolution	: represents the number of horizontal and vertical pixels.
Refresh Rate	: rate where each pixel on the screen is re-drawn.
Speaker	: a device to receive sound or music from computer system.

Exercises

1. Answer the following questions.

- a) Define computer hardware with its importance in computer system.
- b) What is a microprocessor? How does it work? Explain.
- c) What is computer memory? Write its major classification.
- d) Why is secondary memory used for future storage? Explain with its types.
- e) What is a motherboard? What does it contain?
- f) How does a computer mouse work? Who developed it?

2. Differentiate.

- a) RAM and ROM
- b) Primary and Secondary memory
- c) Input and Output devices
- d) Magnetic storage disk and Optical storage
- e) Hard disk drive and Solid state drive
- f) Impact and nonimpact printers

3. State 'True' or 'False'.

- a) Motherboard connects all parts of computer.
- b) Volatile memory saves information even when the computer is switched off.
- c) Secondary memory stores information permanently.
- d) Mouse is a pointing input device.

- e) Magnetic tapes are made up of plastic.
- f) Pen drive is more popular than an optical storage device.
- g) Google Company provides cloud storage services through Google Drive.
- h) LED is very heavier and thicker than LCD and CRT monitors.
- i) Line printer is a type of non-impact printers.
- j) Graphic plotter is a hard copy output device which is used to produce a good quality print.

4. Match the following.

Group 'A' Group 'B'

- | | |
|---------------------|---|
| a) i) Input device | a) Memory losses its information when the power is failure. |
| ii) Output device | b) a device to store data and information. |
| iii) Storage device | c) a device to enter data and commands. |
| iv) Volatile memory | d) a device to produce information. |
| | e) a device to process data. |

Group 'A' Group 'B'

- | | |
|-------------------|--------------------|
| b) i) CRT monitor | a) CAD drawings |
| ii) LCD monitor | b) Diode |
| iii) LED monitor | c) Phosphorus |
| iv) 3D printer | d) Florescent Lamp |
| | e) Carbon |

5. Choose the correct answer.

- a. is also called a brain of computer.
 - i) Motherboard
 - ii) Microprocessor
 - iii) RAM
 - iv) Monitor

- b. Which is not an output device?
i) Printer ii) Speaker iii) Plotter iv) QR Code Scanner
- c. can be erased by ultraviolet light and reprogrammed.
i) PROM ii) EPROM iii) EEPROM iv) RAM
- d. is a memory inside the microprocessor.
i) RAM ii) Cache iii) ROM iv) Secondary
- e. Hard disk can be replaced and upgraded by
- i) pen drive ii) magnetic disk iii) SSD iv) magnetic tape
- f. The speed of hard disk is measured in
- i) mgh ii) kHz iii) rpm iv) rcm
- g. represents the number of horizontal and vertical pixels.
- i) Size of monitor ii) Screen resolution
iii) Dot pitch iv) Refresh rate
- h. is an example of impact printer.
- i) 3D printer ii) Inkjet printer
iii) Laser printer iv) Line printer

6. Fill in the blanks with appropriate word.

- a) Microprocessor gets data and instructions from various and processes it.
- b) is called PCB (Printed Circuit Board).
- c) devices are used to store data and information.
- d) is volatile or temporary memory.
- e) is a non-volatile or permanent memory.
- f) stores data and instruction used by the microprocessor.
- g) Secondary memory is also called memory.
- h) Hard disk can be replaced and upgraded by
- i) The storage of data on online server by using internet is

7. Write the full form of:

- | | | | | |
|----------|-----------|------------|-----------|-----------|
| i) CPU | ii) RAM | iii) ROM | iv) PCB | v) BIOS |
| vi) SRAM | vii) DRAM | viii) PROM | ix) EPROM | x) EEPROM |
| xi) CD | xii) DVD | xiii) SSD | xiv) rpm | xv) USB |
| xvi) BCR | xvii) QR | xviii) VDU | xix) CRT | xx) LCD |
| xxi) LED | xxii) CPS | xxiii) LPM | xxiv) PPM | xxv) CMYK |
| xxvi) 3D | | | | |

8. Write short note.

- a) Motherboard
- b) 3D printer
- c) QR Code
- d) SSD
- e) LED monitor

Project Work

1. Prepare a presentation about different hardwares found in computer lab and demonstrate in your class as a group discussion.
2. Draw a chart paper about different types of computer hardware with name and paste in your classroom.
3. Consult your computer teacher to follow the steps 'how to store information in cloud storage' and demonstrate in a sheet of chart paper.
4. Visit IT solution offices such as computer maintenance centre and sales, and collect information on the latest devices.

Computer Software

The combination of hardware and software to perform a task is called computer system. The set of instructions or programs written by using a programming language to solve a problem is called computer software. So, software controls and operates computer hardware to perform a task. The set of instruction or command is called program. The set of program to perform a specific task is called software. Generally, computer software is classified into two types.

- a. **System software**
- b. **Application software**

a. System Software

The software that manages controls and supports computer system is called system software. So, system software creates link between computer and user. It is a platform for running application software. It manages files and folders. It can be sub-divided into the operating system, utility software, device driver software, language processing software, etc.

i. Operating System

An operating system is the system software that manages and controls the overall operation of computer. It coordinates, controls and manages computer hardware. The operating system is installed in C: drive of hard disk. It is the first software that is loaded into computer memory (RAM). The popular operating system are Windows XP, Windows 7, Windows 8, Windows 10, Linux based fedora, UNIX, MS-DOS etc. Android KitKat, Android Marshmallow, Android Oreo are the popular operating system of Android smartphone and IOS is the operating system of Apple iPhone.



The main functions of the operating system are explained below:

a. Memory Management:

Operating system performs the task of allocation and de-allocation of RAM-memory space needed to run programs and other resources.

b. Processor Management

Operating system must allocate resources to processes and enable processes to share and exchange information.

c. Device management

Operating system co-ordinates with all devices like keyboard, printer, monitor, mouse etc. So, the operating system helps to manage input, process and output devices.

d. File Management

Operating system manages all files in computer. It keeps records of filename, type, size, location, etc.

e. Security

Operating system provides a security mechanism while using a computer. For example, password is used in a system to prevent unauthorized access.

The operating system can be classified into two types based on the mode of the user as:

Single User Operating System

It is designed to manage the computer so that one user can effectively do one thing at a time. The Palm Operating System for palm handheld computers is a good example of a modern single-user, single-task operating system. This is the most common type of operating system used on a home computer as well as on computer in offices and other work environments. Single User Operating system is designed to manage computer so that only one user can work on it at a time. MS-DOS, Windows 8/10 etc. are the examples of single-user operating system.

Multi-User Operating System

Multi-user operating system is designed to manage computer so that many users can

work on it at a time. Many computers are connected to network through one operating system. So operating system coordinates and controls all computers connected to network. Mainframe computer uses multiuser operating system. UNIX, VMS (Vertical Memory System), Windows Server 2016, MVS (Multiple Virtual Storage), etc. are examples of multi-user operating system. The operating system can be classified into two types based on the user interface as:

CUI (Character User Interface)

In this type of operating system, user gives command or character to perform tasks. The keyboard is used to give command in this operating system. It is less user-friendly in comparison to other operating system. DOS, UNIX, Novel Netware, etc. are examples of character user interface-based operating system.



The screenshot shows a DOS command-line interface. The screen displays the following text:

```
Current date is Tue 3-01-1988
Enter new date:
Current time is 23:35:24.10
Enter new time:

The IBM Personal Computer DOS
Version 2.05 (C)Copyright IBM Corp 1981, 1982, 1983

A:\>
Volume in drive A has no label
Directories of A:\

COMMAND.COM 17664 3-08-83 12:00p
FORMAT.COM 64916 3-08-83 12:00p
COMPACT.COM 4096 3-08-83 12:00p
SYN 1400 3-08-83 12:00p
DEBUG.COM 11504 3-08-83 12:00p
SLOGF 32 1-01-88 7:44p
6 File(s) 29204 bytes free
```

DOS Screen

GUI (Graphical User Interface)

In this type of operating system, the user gives command to perform the tasks by clicking on icons, buttons and menus using a mouse. It uses keyboard as well as mouse and it is user-friendly in comparison to CUI operating system. MS Windows 7/8/10, Linux, etc. are the examples of GUI.

Nowadays, Microsoft Corporation develops GUI based operating system. Windows operating system users have increased.

Windows is a GUI based operating system that controls all activities of computer system. In this operating system, the user uses different application program and document display on window. So it is named as Windows.

Mouse is used to open file, shut down computer and perform different commands in windows operating system. The user does not need to remember long commands to perform task. Nowadays, Windows10 is the latest operating system.

ii. Language Processor

A computer is an electronic machine. So it understands machine level language (binary language: 0 or 1). A computer program is a set of instructions to perform tasks.

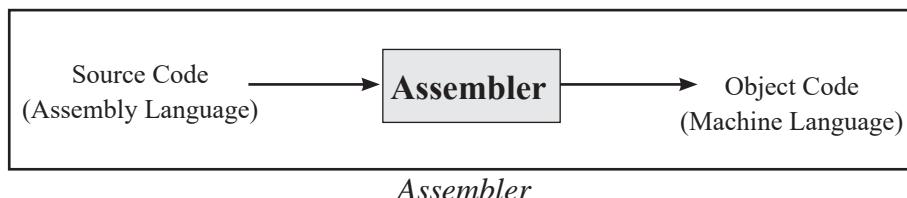
System software that converts different programming language into machine level language is called language processor. So language processor converts high-level language or assembly language into machine level language and vice versa.

The three types of language processor are explained below:

a. Assemblers

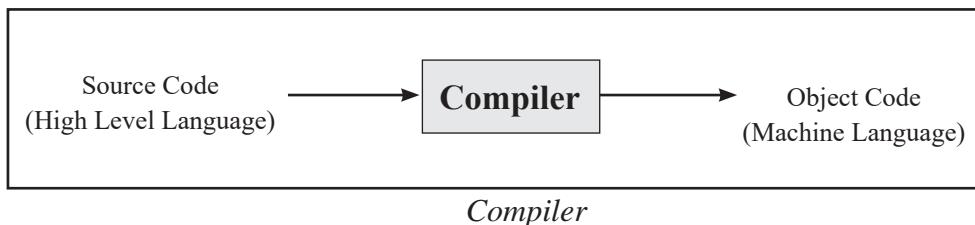
An assembler is a type of language processor which converts program code written in assembly language into machine language. Machine level language uses binary digit, 0 or 1 to write a program which is difficult. So a programmer writes programs using assembly language. Mnemonic Code is used for writing program in assembly language.

The source program is an input of assembler that contains assembly language instructions. The output generated by the assembler is the object code or machine code understandable by the computer.



b. Compilers

The high-level programming language is developed for the improvement of assembly language. A compiler is a type of language processor which converts the program written in high-level language into machine level language at once. The equivalent machine code obtained after translation is called object code. So the process of converting source code into object code is known as compilation. The compiler specifies the errors at the end of compilation with line numbers when there are any errors in the source code. The errors must be removed before the compiler can successfully recompile the source code again. C, C#, C++, Java, PHP, etc. are compiler-based programming languages.



c. Interpreter

Interpreter is a type of language processor which converts the program written in high-level language into machine level language line by line. If there is any error in the middle of the program then program is interrupted in between. So, after removing the error, the program needs to run again from the beginning. LOGO, QBASIC, BASICA, Perl, Python, etc. are interpreter based language.

iii. Utility Software

Utility software is also called service program. A set of programs that perform task related to the maintenance of computer software and hardware is called utility software. The main objective of utility software is the smooth functioning of computer system.

The examples of utility software are:

- Antivirus software (Kaspersky, Norton Antivirus)
- Backup Software (Nova BACKUP Professional, Ashampoo Backup Pro)
- Encryption Tools (Versacrypt, Bitcocker)
- File Compression Tools (Winzip, WinRAR)
- Disk Utilities (Disk Defrag, WinDirstat)

iv. Device Drivers Software

Operating system often provides programs for working with special devices such as printers. These programs are called drivers because they allow the operating system and another program to activate and use the hardware device. Most new software you buy will work with your printer, monitor and other equipment without requiring you to install any special driver because the device driver for common peripherals are already included in the operating system.

b. Application Software

Application software is designed to fulfil the requirement of user. A set of programs designed to do specific tasks is called application software. The application software is used to type e-mail, edit photos, prepare presentation, listen to music, design engineering work, edit videos, produce bills etc. The popular two types of application software are given below.

i. Packaged/General Purpose Application Software

The software developed for all general users to perform their generalized tasks is called general-purpose application software. It cannot be modified as per user requirement. It is costlier and easily available in market. The examples of general-purpose application software are:

- MS Office Package (MS-Word, MS-Excel, MS-PowerPoint)
- Adobe Photoshop
- Auto CAD
- SPSS (Statistical Package for the Social Sciences)
- Autodesk Maya.



ii. Customized/Tailored Software

The software which is designed to fulfil the specific requirement of an individual or office or organization is called customized/tailored software. It can be modified as per user's requirement. It can be used in school, college, hotel, travel agency, airlines, hospital, insurance, etc. for performing different tasks like account, administration, store, ticket booking, etc. There are different softwares in many offices and they are expensive.

Desktop

Once the computer is started, user name and password is typed and a screen opens up that is called desktop. The background area of the Windows screen is desktop. Desktop contains icons, taskbar, start button, etc. which is opened by clicking with

mouse. Desktop element differs according to versions of Windows like Windows XP and Windows10. The user can add/remove icons on desktop.



Icon

Icons are the small picture buttons that represent file, folder, programs, etc. Mouse is used to click on icon to perform a task. Icon is the main component of GUI operating system.

Windows 10 desktop elements

i. This PC

This PC is an important system folder on desktop. This PC is a gateway to user to see contents of storage device like hard disk, DVD, pen drive, network computer, etc. by double-clicking on it.



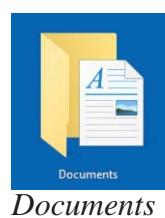
ii. Recycle Bin

Recycle Bin is a system folder which contains deleted file and folders. It is very useful for recovering the files and folders which are accidentally deleted. Select the file and press delete button to transfer to recycle bin. But pressing shift + delete button on selection will permanently delete selected file from hard disk. The file and folder can be restored from recycle bin to their original location if needed for use in future.



Documents

Document is a system folder of desktop. It is created while installing Windows operating system. The user stores the document in document folder.



Addition of Windows 10 Desktop icon

The user can add/remove the icons according to their requirement in **Windows10**. The following steps show how to add/remove the icon.

Step 1. Right-click on an empty area of desktop and click personalize.

Step 2. Select setting and click on Themes.

Step 3. Click on Desktop Icon setting which is located on left top part of setting window.

Step 4. Now Desktop Icon setting appears.

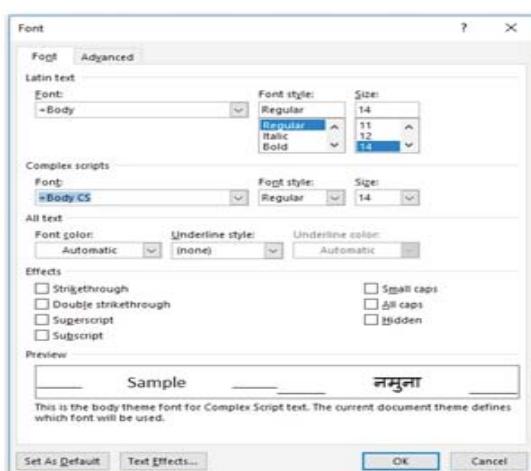
Step 5. Click on checkbox of different desktop icons as your requirement for adding/removing icons.

The user gives command by clicking mouse for different purposes. The actions of mouse and their uses are as follows:

Word	Meaning
Point	To put mouse pointer on icon or item.
Click	Once click left button of mouse and release it.
Right Click	Once click right button of mouse and release it.
Double Click	Click left mouse button of in quick succession and release it.
Drag and Drop	Point and click the item or icon by left button and drag into the new location or place and drop it.

Dialog Box

It is also called a communication box. It appears to perform a task or command like file save, document print, etc. to user in Windows operating system. The dialog box contains option like ok button or cancel button. Here, press Ok button if it is satisfied to send the command to the computer and press cancel button if unsatisfied. So the user can choose different option by means of GUI control



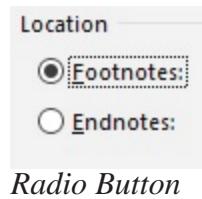
Font Dialog Box

and perform the tasks.

GUI Control of Dialog Box

a. Radio Button

A radio button is the main GUI control used in window dialog box. It allows a user to select only one option at a time. A round dark bullet is marked in the selected button.



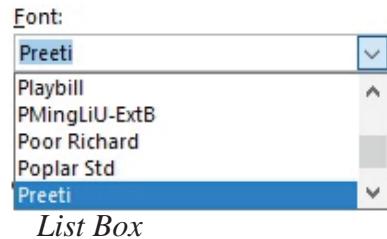
b. CheckBox

A small square box which allows a user to select the available option or multiple selections is called checkbox.



c. List Box

The series of options displayed on the box is called list box. The option of list box can be viewed by clicking on item.



d. Text Box

The rectangular box which allows a user to input or types text on it is called a text box. It contains default text or blank space.



e. Command Button

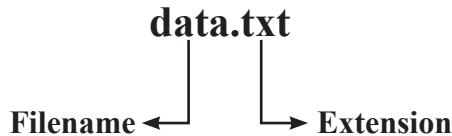
A small rectangular box that activates an action is called command button. 'Ok' and 'Cancel' are the common command buttons.

Management of Files and Folders in Windows

File

A file is a set of related data and information stored on a computer system. File names are divided into two parts as illustrated in figure below:

Extension gives information about the file types. Some popular extensions of files are:



- Media file (Video File) - .mp4, .mpeg, .avi, .flv, .wmv
- Audio file (Audio File) - .mp3, .wav, .aac
- Picture file (Image File) - .jpg, .gif, .png, .ico
- Office Document - .doc, .docx
- E-Book File - .pdf
- Spread sheet file(Excel File) - .xls, .xlsx

Folder

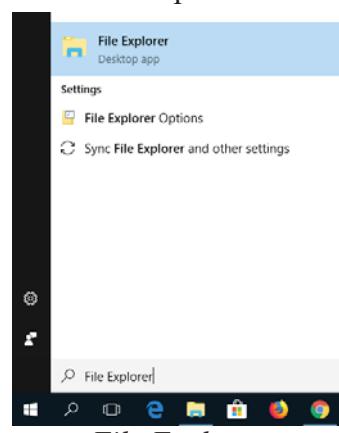
Folder is a container which stores file, program and subfolder. It is also known as directory in DOS. Subfolder is located inside the folder and store data and information.



This PC

a. This PC opening file and folder

- Double click on This PC icon on desktop.
- There appears This PC window which contains system folder like Desktop, phone, videos, documents, etc. and drive C:, D:, E:, etc.
- Double click on required file store in any drive.
- To close the open window, click on close (x) button located on top left side of window.

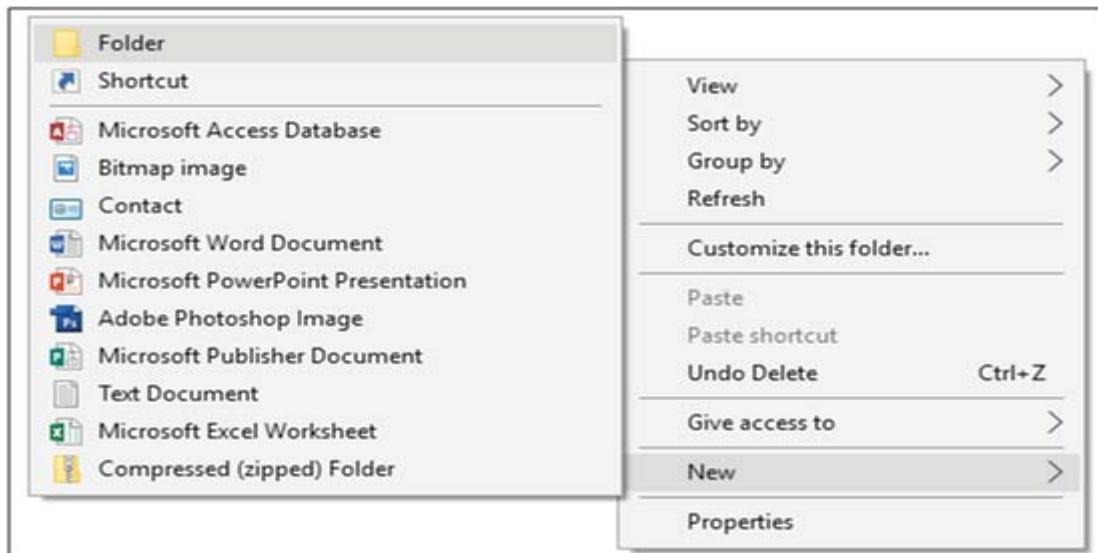


b. File Explorer

- Click on Search Windows icon  and type file explorer near to start button on desktop.
- Then click on the File Explorer menu.
- There appears File Explorer window and as a requirement of the user, click on file located on drive or folder.

Creating a new folder

- Double click on This PC.
- Double click on drive or folder where you wish to create a new folder.
- Right-click on an empty area of the of window.
- There appears temporary Floating Menu.
- Select "New" and click "Folder" and type folder name and press "Enter" key on the keyboard.



Creating new folder

Rename File or Folder

- Right-click on file or folder to be renamed.
- There appears temporary Floating Menu and click on rename option.
- Type new name and then press "Enter" key on the keyboard.

Deleting File or Folder

- Click on file or folder location to delete.
- Press delete key from keyboard. Or right-click on file or folder to delete.
- Then click on delete option.

Note: While deleting the folder, all files and folders inside that folder also get deleted.

The deleted files and folders are stored in recycle bin on the desktop which occupies hard disk of computer system. So, to delete file and folder permanently press shift + delete key from keyboard.

Copy or move file or folder

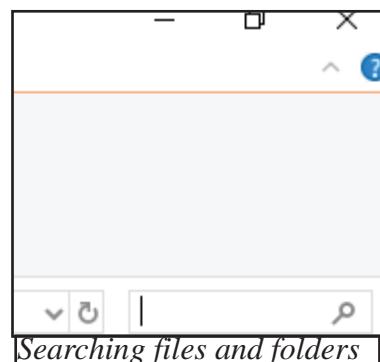
The file and folder can be copied and placed on that disk or another disk. This is called copy. The file and folder can be replaced to a new location and this is called move. The file and folder can be copied or moved in the following way.

- Right-click on the file or folder to copy or move.
- Then appears Floating menu, click on copy option to copy or click on the cut option to move it.
- Go to a new location to transfer the file or folder. Right-click on blank area then click on paste option.

Searching files and folders

We sometimes forget the name and location of files and folders saved on disk. This problem is solved by search feature or search facility provided by Windows. The following is the process of searching file and folder:

- Go to drive or folder to search. Or go to file explorer.
- There appears rectangular text box left side. Type full or half name of the file and folder with the use of wild card characters.
- Press Enter on the keyboard.



OSS (Open Source Software)

The programs written in high level language like C++, C#, Java, Python, etc. are called source code. Open-source softwares are freely available



software and source code is also free of cost. So, open-source softwares are called free software.

Ms office package, Adobe Photoshop, Windows 8/10, etc. are called proprietary softwares which do not provide source code to user after payment.

In open-source software, the user modifies source code according to user requirement. Open-source software was started by Richard Stallman in 1983. Richard Stallman announced the GNU Project in 1983. Free Software Foundations was established in 1985.

Some proprietary software and their alternative open source software are listed below:

Type	Proprietary software	Open Source Software
Operating System	Windows 8/10	Linux
Office Package	Microsoft Office	Libre Office, Apache Office
Photo Editing Software	Adobe Photoshop	GIMP
Web Browser	Microsoft Edge	Mozilla Firefox
E-mail Client	Microsoft Outlook 2016	Thunderbird
Database Management	Oracle, MS-SQL Server	MySQL

Freeware

Freeware is a software available free of charge. It is copyrighted by its developer. The developer retains the rights to control its distribution, modify it and sell it in the future. Freeware is typically distributed without its source code, thus preventing modification by its users. So, it may be freely downloaded, installed, used and shared.

Source code can be written in any programming languages. Some of the most popular programming languages are C, C++, Java, Perl, PHP, etc.

Freeware is usually distributed with a license that permits its redistribution to some extent. For example, allowing users to give copies to friends. However, there may be restrictions, such as limitations on its commercial use. Some licenses permit the software to be freely copied but not sold.

Desktop and Web Apps

A computer program that is designed for a specific purpose is called Apps or Applications. They are installed in smartphone and tablets for different purposes.

Android operating system is used in a Smartphone. Google Company developed the Android operating system as Marshmallow, Nougat, Oreo, etc. Google Play is the service provided by Google Company in Android operating system. It gives service of free or purchase of different applications or apps upon download. The main android apps are Facebook, snap chat, Instagram, Viber, Google maps, etc.

iPhone of Apple Company provides app store service of downloading various apps. Microsoft facilitates its users with Microsoft Store to download desktop apps.

Nowadays, web browser-related apps are used in all smartphones and computers. For example, Google Company developed Google Chrome as a web browser.



Summary

- The set of instructions or programs written by using a programming language to solve a problem is called computer software.
- The software that manages controls and supports computer system is called system software.
- Operating system is the system software that manages, controls overall operations of a computer.
- The background area of the Windows screen is desktop.
- Icons are the small picture buttons that represent file, folder, programs, etc.
- A dialog box appears to perform a task or command like file Save, document print, etc. to user in Windows operating system.
- A file is a set of related data and information stored on computer system.
- Folder is a container where files and subfolders are stored.
- Language processor converts high-level language or assembly language into machine level language and vice versa.
- The main objective of utility software is to maintain smooth functioning of a computer system.
- The application software is used to type an e-mail, edit photo, prepare presentation, listen to music, engineering design, video, producing bills etc.
- Open-source software is freely available software and source code is also free of cost.
- The software which is proprietary or open-source software available free of cost is called freeware.
- A computer program that is designed for a specific purpose is called Apps or Applications.

Technical Terms

Computer Software : Program which controls and operates computer hardware to perform a task.

Operating system	: Co-ordinates, controls and manages computer hardware and resources.
Desktop	: The background area of the Windows screen.
Icon	: The small picture buttons that represent files, folders, programs, etc.
This PC	: A gateway to user to see contents of storage device.
Recycle Bin	: Contains deleted files and folders.
Language processor	: Converts high-level language and assembly language into machine level language and vice versa.
Compiler	: Converts the program written in HLL into MLL whole programme at once.
Utility software	: Maintains computer software and hardware.
Application software	: Designed to fulfil the requirement of the user.
OSS	: Freely available software and source code.

Exercises

1. Answer the following questions.

- a) Define computer software with its importance in computer system.
- b) Explain operating system with examples.
- c) What is computer memory? Write its major classification.
- d) Mention major functions of operating system.
- e) How does utility software maintain computer system? Give the name of some utility software.
- f) Briefly explain about application software with its types.
- g) Distinguish between system software and application software.
- h) Give the special features of packaged software.
- i) What is the language processor? Write its types.
- j) What is open-source software? Give examples.

- k) Define proprietary software with examples.
- l) List the advantages of open-source software over proprietary software.

2. State 'True' or 'False'.

- a) A set of program is called software.
- b) Android Marshmallow is application software.
- c) Norton Antivirus is utility software.
- d) The background area of the Windows screen is desktop.
- e) DOS is an example of a character user interface.
- f) There are three types of application software.
- g) Open-source software is freely available software with source code.
- h) Google play store is a service that provides download of different applications or apps.
- i) The source code can be updated in open-source software.
- j) GIMP is a web browser.

3. Match the following.

	Group 'A'	Group 'B'
a)	i) CUI	a) Marshmallow
	ii) GUI	b) iOS
	iii) Android	c) Windows 10
	iv) iPhone	d) DOS
		e) Apple
b)	i) Radio Button	a) series of option displayed on box
	ii) Check Box	b) input or typing text
	iii) List Box	c) select the available option
	iv) Text Box	d) select only one options at a time
		e) select five options at a time

- c) i) Video file a) .mp3
ii) Audio file b) .pdf
iii) Picture file c) .mp4
iv) E-book d) .gif
 e) .mp5

4. Choose the correct answer.

- a. Which is not a function of operating system?
i) Memory management ii) Entertainment
iii) File management iv) Security
- b. Which is not a desktop icon on Windows 10?
i) This PC ii) Recycle Bin
iii) Picture iv) Document
- c. is an act of clicking left button of mouse in quick succession and releasing it.
i) Click ii) Right Click
iii) Double Click iv) Drag and Drop
- d. Which is not a picture file (Image File)?
i) .jpg ii) .gif iii) .png iv) .pdf
- e. allows a user to select the available options or multiple selections.
i) Command button ii) Text box
iii) List box iv) Checkbox
- f. To delete file permanently use+delete key from keyboard.
i) space ii) alt iii) shift iv) ctrl
- g. Which is not utility software?
i) Antivirus software ii) Encryption Tools
iii) Office Package iv) Backup Software

- h. is not proprietary software.
- i) MS office package ii) Adobe Photoshop
- iii) Windows8/10 iv) MySQL

5. Fill in the blanks with suitable word.

- a) The software that manages controls and supports computer system is
- b) controls and operates computer hardware to perform a task.
- c) is the system software that manages and controls the overall operation of computer.
- d) is designed to manage computer so that only one user can work on it at a time.
- e) is used to give command in CUI operating system.
- f) Nowadays, Microsoft Corporation develops based operating system.
- g) The background area of the Windows screen is
- h) is a system folder which contains deleted file and folders.
- i) is also called communication box.
- j) contains default text or blank space.
- k) Application software is designed to fulfil the requirement of.....
- l) The programs written in a high level language is called
- m) A computer program that is designed for a specific purpose is called

6. Write the full form of.

- i) CUI ii) GUI iii) OS iv) MSDOS v) OSS
- vi) GPL vii) GIMP viii) VMS ix) MVS x) SPSS
- xi) MS WORD

7. Write short notes on.

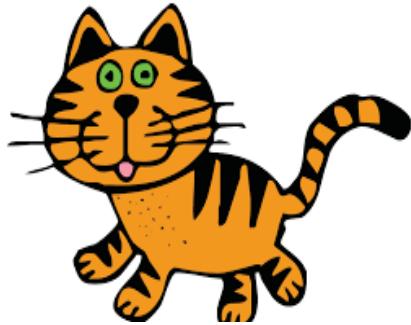
- a) Multiuser operating system
- b) Dialog Box
- c) Customized/Tailored software
- d) Desktop and Web Apps

Project Work

1. Collect names of softwares used in hospital, hotel, educational sector and other different sectors in your locality about and discuss in groups main objectives of the softwares.
2. Draw in chart paper the different types of computer hardware with name and paste in your classroom.
3. Name one useful open source software that you are familiar with. List its features. Prepare a presentation and demonstrate in your classroom.
4. Take a short interview with your teachers, friends, parents and relatives and prepare a field report about what types of computers, laptops or other devices they are using, what types of operating system the device has. Also, make a list of apps that they have used in their smartphones.
5. Make a presentation of system, application and utility software used in your computer lab.

Introduction

The term "Graphics" is derived from the Greek word 'graphikos', which means 'something written'. Graphics can be defined as visual data in the form of images or designs created to inform or communicate. Such visual images that are generated by a computer are called computer graphics.



Computer Graphics is an important area in computer applications. The term **Computer Graphics** includes everything that is presented through images. Graphics provide visual feedback to the user. Hence, it is considered as an important component of communication.

Computer Graphics includes everything that is presented through images developed or designed using different graphical software. Graphic design is a means of visual communication. As you have heard an English proverb "A picture is worth a thousand words", with a good graphical design, you can express your message more effectively and beautifully. Our brain processes visual information so much more effectively and quickly than textual information. Therefore, Graphics is a very important communication component in present days.

The term “Computer Graphics” was first used by William Fetter, Graphic Designer of Boeing Company in 1960.

Uses of Computer Graphics

- Publication of books, magazines, newspapers etc.
- Cartoon movies and computer games
- Educational materials
- Computer simulation, VR-Virtual Reality, scientific modelling, engineering design etc.

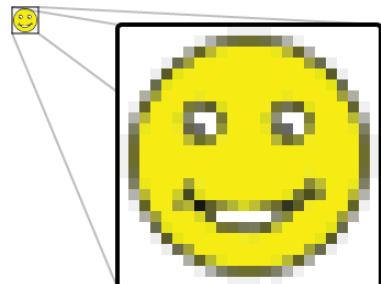
Computer-generated images vary from line drawings to the complex 2-D/3-D animated graphics. Varieties of software programs are developed to draw simple to complex graphics. Some popular image editing softwares are given below.

- Adobe Photoshop
- GIMP (GNU Image Manipulation Program)
- Google Drawing
- Adobe Illustrator
- CorelDraw
- Paint.net



2.1 Different Graphics Format

Image files are composed of digital data. Graphic formats are the standard that is used for organizing and storing digital images. Basically, there are two types of graphics format.



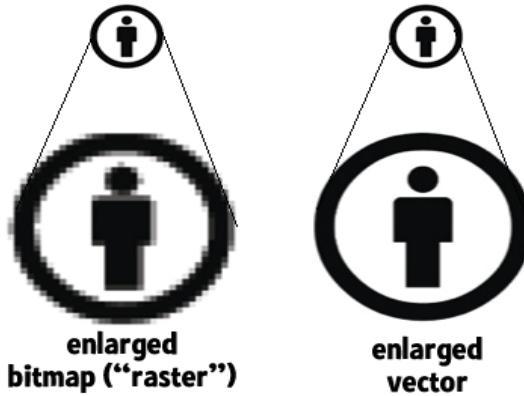
a) Raster Format

Raster format (also called Bitmap images) are composed of tiny squares called pixels (px), and each pixel is assigned a specific colour. If a JPG or GIF image is magnified greatly in a program like Adobe Photoshop, individual pixels can be viewed and changed. Pixel is the smallest element of a raster image.

A pixel (short for Picture Element) is the smallest addressable element of a picture represented on a screen. The number of pixels determines the image quality. Common file extensions of raster formats are JPG, GIF, BMP, TIF, and PNG.

b) Vector Format

Unlike raster format, vector images are not composed of pixels. Digital information is stored using some mathematical formula in a vector image. The main feature of vector graphics is that its quality remains the same when you enlarge it to any size. Common file extensions of vector formats are AI, PDF, SVG, EPS



Note:

BMP- Bitmap

TIFF- Tagged Image File Format

AI- Adobe Illustrator

SVG- Scalable Vector Graphic

EPS- Encapsulated Post Script

PDF- Portable Document Format

2.2 Graphics for Web

Graphics are the most important component of website design. It adds visual appeal to the information on the web page. Graphics are the most effective and interesting way to communicate or explain ideas visually. Web graphics include illustrated images, info graphics, charts, graphs, animated graphics, and photographs.

Things to be considered while using web graphics:

- Graphical content should be used with purpose.
- Don't use graphics with large file size. It consumes more bandwidth.
- Always use graphics relevant to the content.
- Crop the unwanted part of the graphics.
- Balance the graphics with background and text colour.

Graphical Software for web

- Adobe Photoshop, GIMP for raster graphics. They also provide limited features of handling vector graphics.
- Adobe Illustrator, CorelDraw for vector graphics.
- Google Photos, Pixlr, Befunky, Fotor, Pic Monkey, Photoshop Express, iPiccy are some popular online photo editors.

Web Graphics format

The primary web graphics formats are gif, jpg and png. These entire common web graphics format are called bitmap graphics.

JPG Graphics

- JPG is the most used image file format.
- Digital cameras usually produce images in JPG format
- Suitable for images with a lot of different colours, like photographs

GIF Graphics

- The second most common image format used on the World Wide Web after JPEG.
- Suitable for images that require a few distinct colours, such as line drawings, logos, b/w images or images with few colours.

PNG Graphics

- Newest file format.
- Better compression and transparency features than GIF.



Not Transparent Image



*Transparent Image
supported by GIF and PNG*

2.3 Image Size and Resolution

Image size refers to the length and width of a digital image. In the given figure, the dimension of the image is given as 900x445. It means:

- The image width is 900 pixels.
- The image height is 445 pixels.

Therefore, the total number of pixels that made the given image is:

$$900 \times 445 \text{ pixels} = 400,500 \text{ pixels}$$

Property	Value
Image ID	
Dimensions	900 x 445
Width	900 pixels
Height	445 pixels
Horizontal resolution	72 dpi
Vertical resolution	72 dpi
Bit depth	24
Compression	
Resolution unit	2
Color representation	
Compressed bits/pixel	

Image File Metadata

To check the image size:

Step 1: Right Click on the image file from its folder. A pop-up menu will appear.

Step 2: Click on Properties.

Resolution

Resolution refers to the number of pixels in an image. The greater the number of pixels, the higher the resolution, provides more details and better definition to the image.

The most common units to measure resolution are PPI (pixels per inch) and DPI (dots per inch).

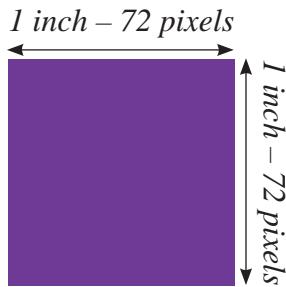
PPI – It refers to the number of pixels per inch that makes an image. It affects the print size and quality of an image.

For Example: resolution – 72 pixels/inch

What is a megapixel?

Technically a megapixel is equal to 1,048,576 pixels but the camera manufacturing company round this figure to 1,000,000 (1 million). Therefore, 1 million pixel is equivalent to 1 megapixel.

If you have 12 megapixel camera, then the photo it takes can have maximum 12x1,048,576 (12,582,912) pixels. If the aspect ratio of your camera is 3:2. Approximately, each full size of raw image taken by 12MP camera is 4344 x 2896 pixels in dimension. So, by multiplying the number of pixels along the width by those of the height ($4344 \times 2896 = 12,580,224$ – rounded to 12 million pixels) we get the actual number of pixels in the image.



Total number of pixels per square inch = 5,184 pixels (72 pixels x 72 pixels)

In the same way, if the resolution is 300 pixels/inch then the number of pixels per square inch will be 90,000 pixels.

DPI – It only refers to a printer. It indicates the number of physical dots of ink in a printed document. For example, 1200 dpi printer uses 1200 dots of ink in every inch to make up the colours.

2.4 Graphics Editing

As you know, graphics is an important component of web design. Therefore, a web designer should have good knowledge about graphics editing. There are many graphics editing application software which are available to edit web graphics. Here, some basic image editing techniques are discussed using the most popular photo-editing tool – Adobe Photoshop.

Adobe Photoshop

Adobe Photoshop is a professional image editing software that can be used to create a new image or edit an existing one. Most of the graphic designers, web designers, graphic artists, photographers and creative professionals use this popular tool.

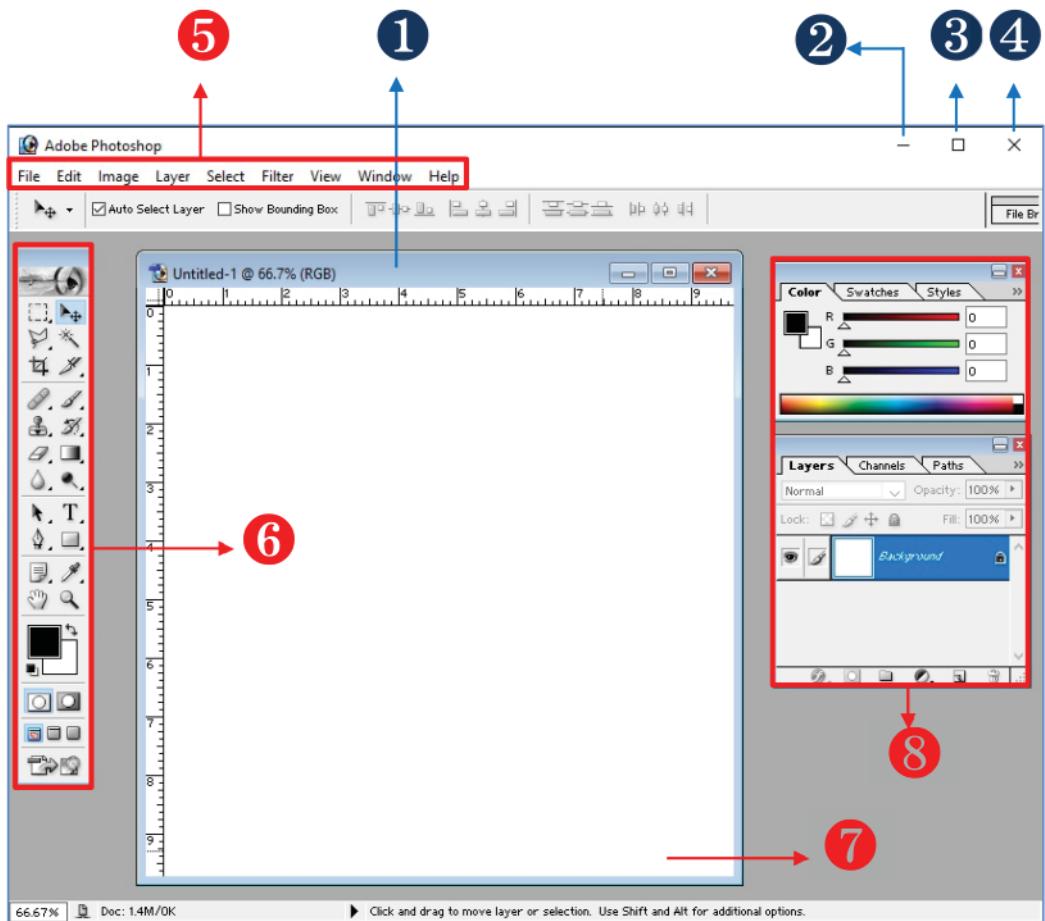
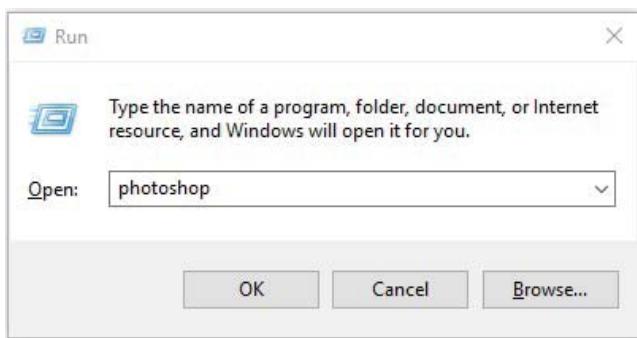
Adobe Photoshop is a very popular software because of its different image editing and retouching effects. Adobe Photoshop allows users to manipulate, crop, resize, correct colour, apply effects, add text and many other editing tasks.

How to start Photoshop

- Open the Run Window.
- Type Photoshop.

- Press Enter or click on OK.
[If Adobe Photoshop is installed in your computer, Photoshop will start.]

Photoshop Workspace



1 Photoshop Title Bar

It displays the name of the application and other title contents.

2 Minimize button

Shrinks the application window to a bar on the taskbar; you click its button on the taskbar to reopen it.

3 Maximize/Restore button

If the window is maximized (full screen), click will changes it to windowed (not full screen) and vice versa.

4 Close (Quit) button

Closes the Adobe Photoshop application.

5 Menu Bar

Contains different menus. This is the place where you can access most of the commands and features in Photoshop.

6 Tools

It contains the various tools available to create and edit images.

7 Image Window

The image will appear in its own window once you open a file. This is the main working area.

8 Palettes

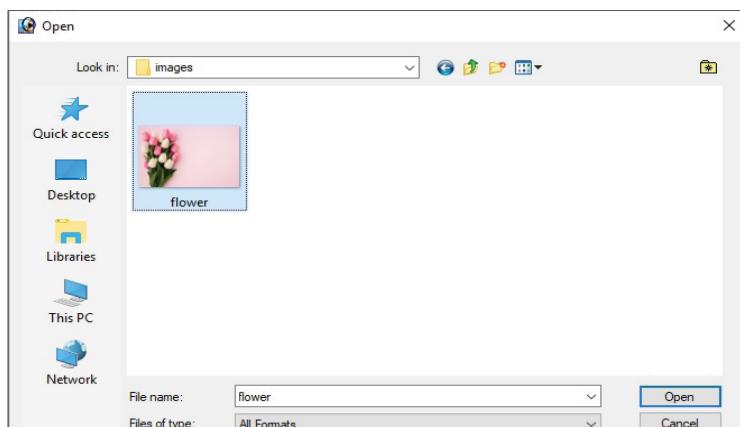
Palettes include colour, layers, character and other necessary palettes, which provide you a variety of related controls for working with images. If none of the palettes are visible, go to Windows in the menu bar and choose palettes you need to work with.

Opening an Image File

Follow the steps to open a file:

Step 1: Click on File Menu > Open ...
(Keyboard Shortcut: Ctrl + O)

An Open dialog box will appear:



Step 2: Select the folder of your image file.

Step 3: Select the required image file.

Step 4: Click the Open button.

Changing the Image Size

Image size refers to the length and width of a digital image, also called pixel dimensions. Follow the steps to change the image size:

Step 1: Open the required image file.

Step 2: Click on Image Menu > Image Size... (Keyboard Shortcut: Alt+Ctrl+I)

An Image Size dialog box will appear:

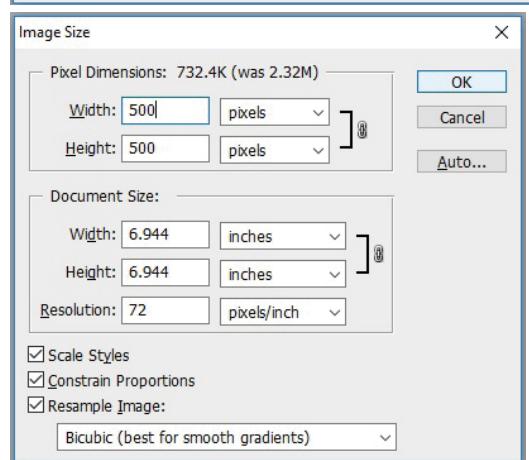
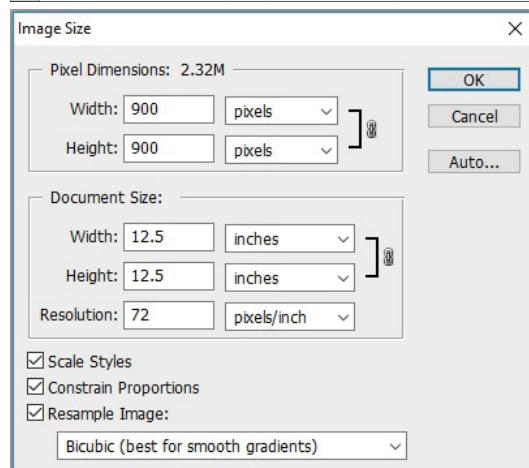
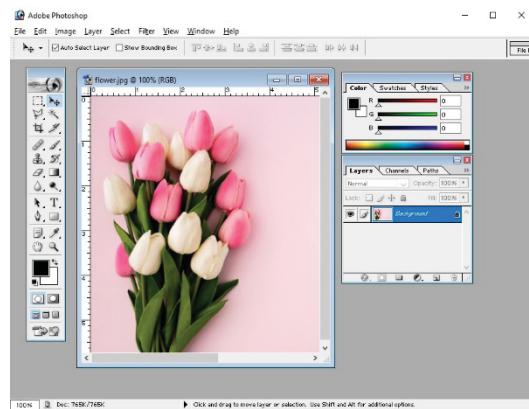
Here, the size of image is 900x900 pixels. Print size is 12.5 by 12.5 inch and the resolution is 72.

Step 3: Type the required Width and Height in the pixel dimension section.

Note: In the above dialog box, Constrain Proportions is checked. It means if you enter the value of width, the value for height will be proportionately set.

Step 4: Change the value of **width** and **height** in document size section if you want to print it.

Note: Think about the resolution of image. The output will be in low quality if you increase the size of low-resolution image.



Step 5: Click on the OK button to accept the changes.

Note: The smallest addressable element of a Pixel (Picture Element). Resolution refers to the number of pixels in an image.

Changing the Image Format

Follow the below steps to change the image format:

Step 1: Open the required image file of which you want to change the format.

Step 2: Click on File Menu > Save As...
(Shortcut Key: Shift+Ctrl+S)

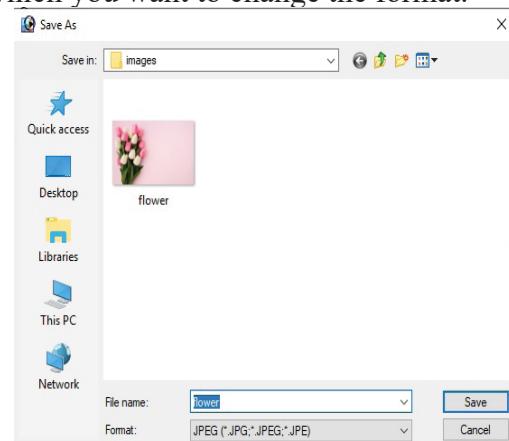
A Save As dialog box will appear:

Step 3: Type name in File Name drop-down list box, if you want to give another name.

Step 4: Select the desired folder, if you want to save in another location.

Step 5: Select the file format that you want to change.

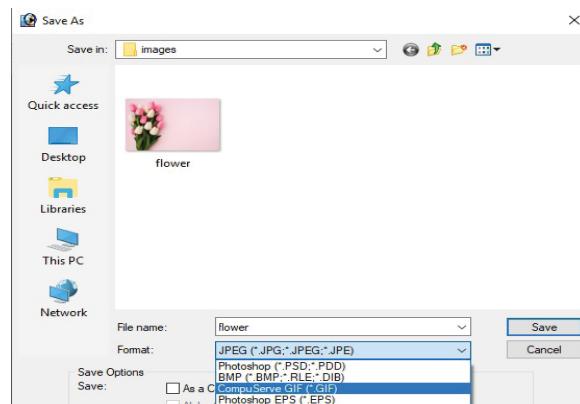
Step 6: Click on Save button.



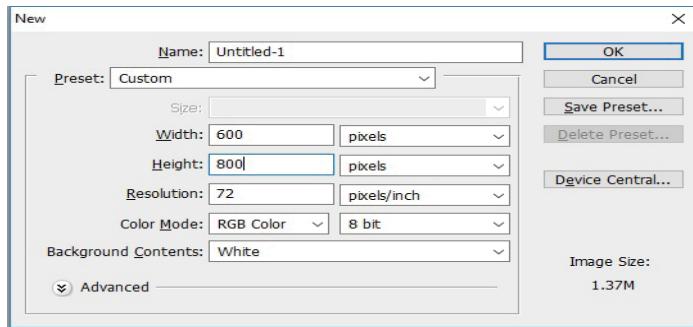
Creating a new image file

Follow the steps to create a new image file:

Step 1: Click on File Menu > New...
(Shortcut Key: Ctrl+N)



A New dialog box will appear:



Step 2: Type the required value for width, height and resolution of your page.

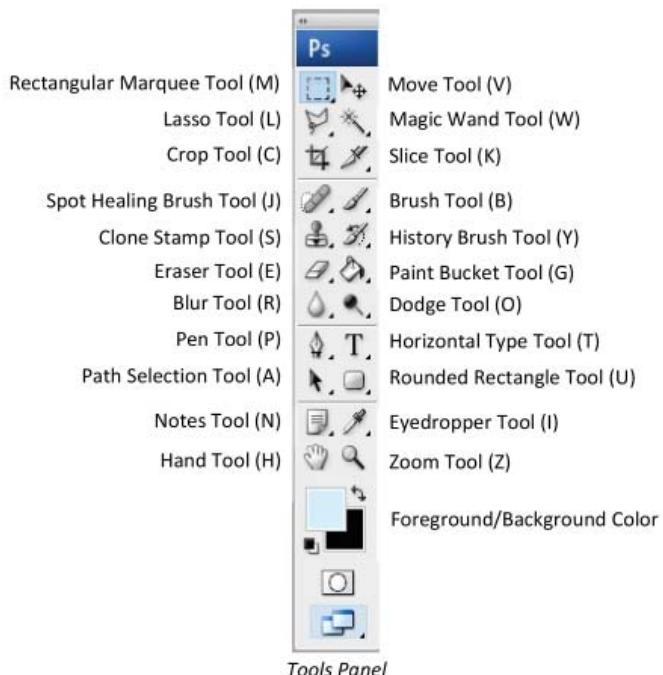
Step 3: Select Color Mode and Background Contents.

Step 4: Click on OK.

Now, a blank image file will appear on the workspace.

Tools Panel

This palette contains some groups of tools that are used to edit and manipulate images. Here, text tool and some selection tools of tools panel are discussed:



Note: The character in the bracket in Tools Panel is a shortcut key to activate the required tool. For example, press V to activate Move tool.

Type Tool

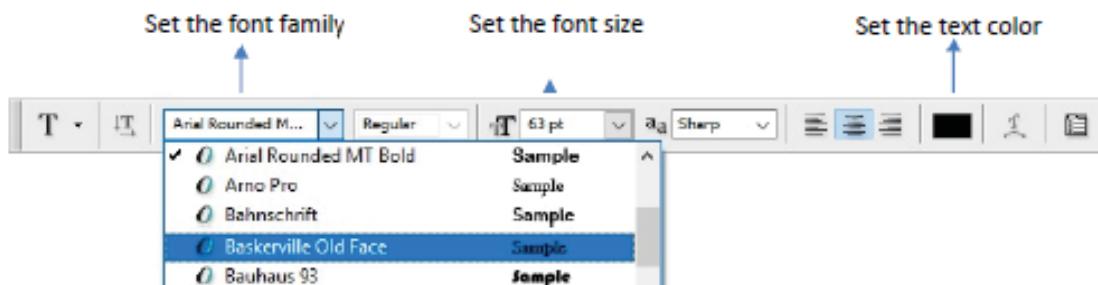
T The Type tool is used to add text to your image file. You might have to add text while creating poster, invitation or any other graphical design. You can also apply different effects to text in Photoshop.

Adding Text

Follow the steps to add text:

Step 1: Create a new file or open an existing image file.

Step 2: Click on Type tool from Tools panel or simply press "T".

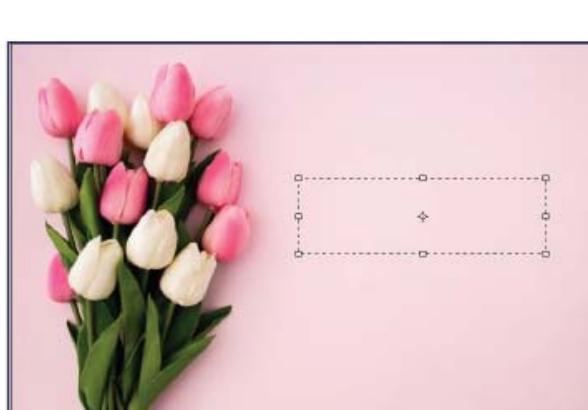


Options bar of Type Tool

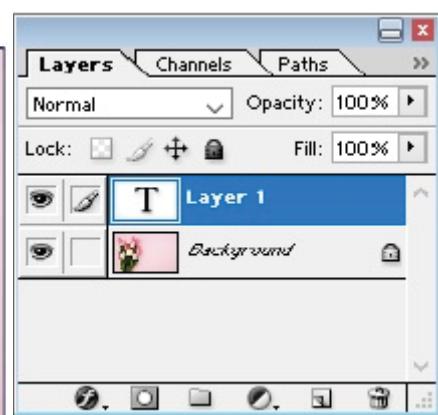
Step 4: Choose the desired font, text size and colour.

Step 5: Click and drag anywhere in the workspace (new image or existing image) window to create a text box.

Step 6: A new text layer will be added to your image.



Text Box over the image



Text Player

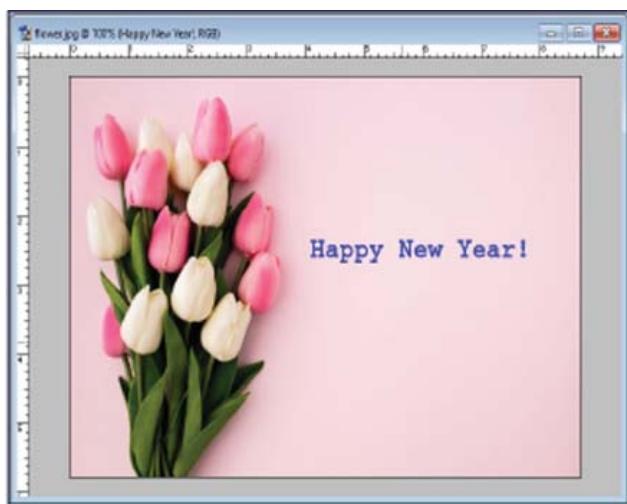
Step 7: Type the required text.

Moving Text:

- Select the text layer.
- Select the Move tool or press V.
- Click and drag the text to the required location.

Edit the Text

- Double-click on the layer icon of the required text.
or,
- Select the type tool and click on the text. The text will be highlighted.
- Now, you can modify the text, text size and colour

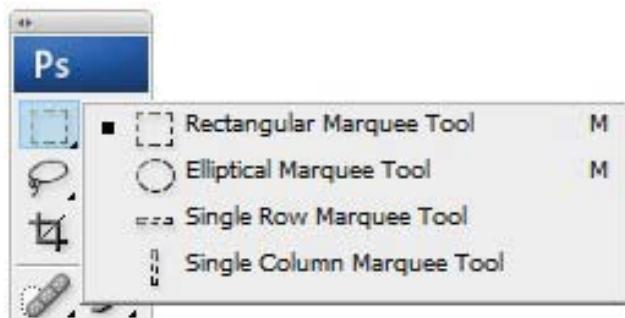


Selection Tools

Selection tool is one of the mostly used tools in Photoshop while manipulating or designing images. Selection tools are used to isolate different part of an image so that we can work only on that particular area without affecting the rest of the image.

Marquee Tool

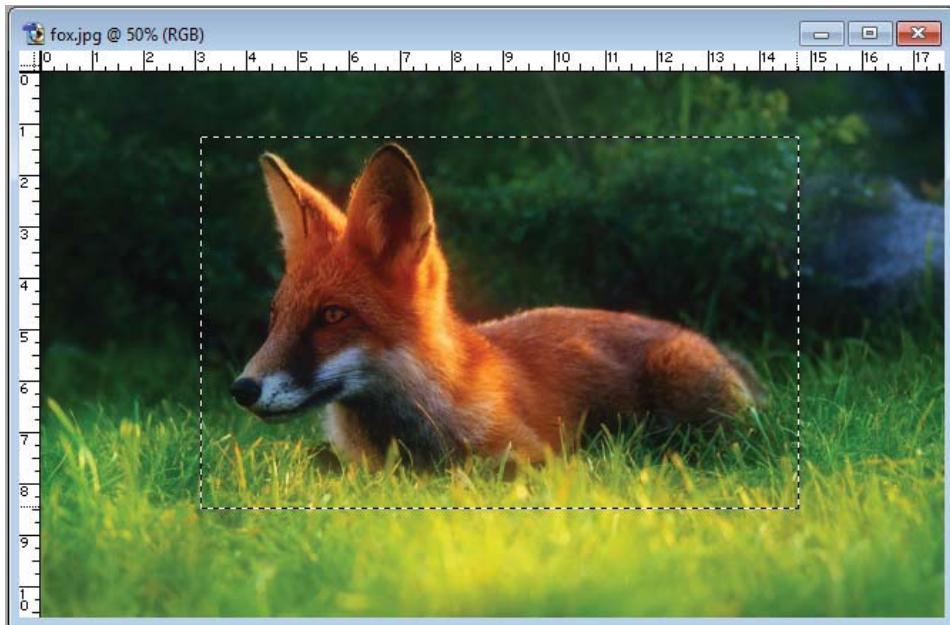
Marquee tool is a basic selection tool available in Photoshop. It allows the user to make a rectangular or elliptical selection of a certain part of an image. It also provides 1-pixel rows and columns selection.



Follow the below steps to select a part of an image using Marquee tool:

Step 1: Open a required image file.

Step 2: Select either Rectangular or Elliptical selection tool.

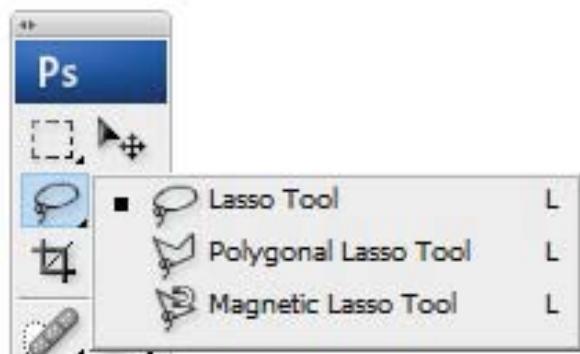


Step 3: Click and drag over the area of the image you want to select.

Note: Hold down shift button while dragging to constrain the marquee to square or circle. You can cut, copy or apply some other effects on the selected portion of the image.

Lasso Tool

Lasso Tool allows the user to draw freehand selections around objects. Besides the standard Lasso tool, Photoshop provides two other types of Lasso tool: Polygonal Lasso Tool and Magnetic Lasso Tool.



Follow the below steps to select a part of an image using Lasso tool:

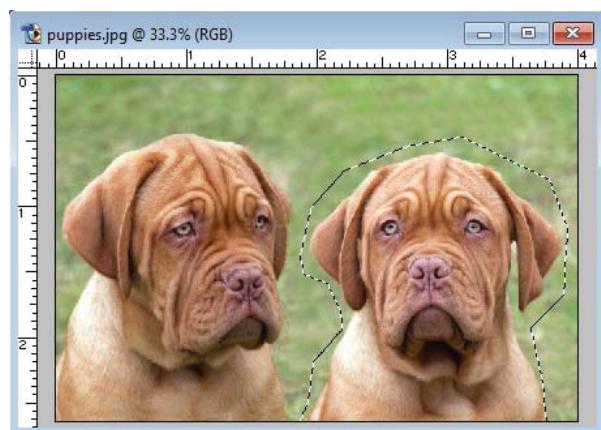
Step 1: Open a required image file.

Step 2: Select the Lasso Tool.

Step 3: Click and drag to draw a freehand selection border over a desired part of the image.

Step 4: Release the mouse button.

Note: Press **Ctrl+D** to deselect the image.



Polygonal Lasso Tool: The Polygonal Lasso tool allows the user to draw straight-edged segments of a selection border.

- Open a required image file.
- Select the Polygonal Lasso Tool.
- Click on the required point on the image to set the starting point.
- Move the cursor to the next point not far from the starting point and click the left button again. A selection path will be drawn between these two points.
- Keep putting points in the same way until the desired area is outlined.



Note:

- To draw a straight line at a multiple of 45° , hold down Shift as you move to click the next segment.
- To draw a freehand segment, hold down Alt and drag.



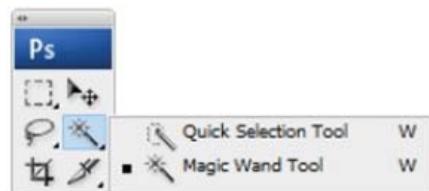
- To erase recently drawn straight segments, press the Delete key.

Magnetic Lasso Tool: The Magnetic Lasso tool is generally suitable for quickly selecting objects that have complex edges set against high-contrast backgrounds.

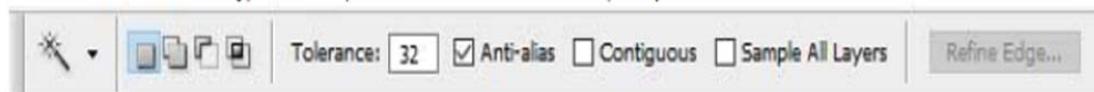
- Open a required image file.
- Select the Magnetic Lasso Tool.
- Click on the required point on the image to set the starting point.
- Release the mouse button or keep it pressed, and then move the pointer along the edge you want to trace.
- Continue to trace the edge in the same way until the desired area is outlined.

Note: To deselect the selection - Press Ctrl + D

Magic Wand Tool: Unlike other selection tools, the Magic Wand tool selects the pixels based on tone and colour.



- Open a required image file.
- Select the Magic Wand tool in the Tools panel.
- In the Options bar, uncheck Contiguous if you want to select non adjacent areas of similar color. Check Contiguous if you want to select only adjacent areas of similar colour.



- Enter the Tolerance value (up to 255). Higher tolerance value, wider range of color selection.
- Click the color in the image that you want to select.



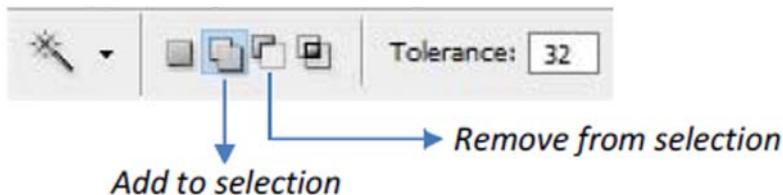
In the given image of the flag of Nepal only the blue color is selected using the Magic Wand tool.

Adding or subtracting selection

These features are used when you have already selected a part of image and want to add more part of the image to selection or remove some part of the selection.

Method #1:

Using the Options bar of selection tool



To add: Click Add to selection button and click elsewhere in the image

To subtract: Click Subtract from selection button and click inside the selection.



Method #2:

Using Keyboard Keys

To add: Press Shift key and click elsewhere in the image

To subtract: Press Alt key and click inside the selection.

Note: These adding and subtracting features are applicable in Marquee and Lasso tools also.

Cropping Images

Cropping images is one of the most basic, but important photo editing features available in Photoshop. Cropping feature allows you to remove unwanted outer parts of image.



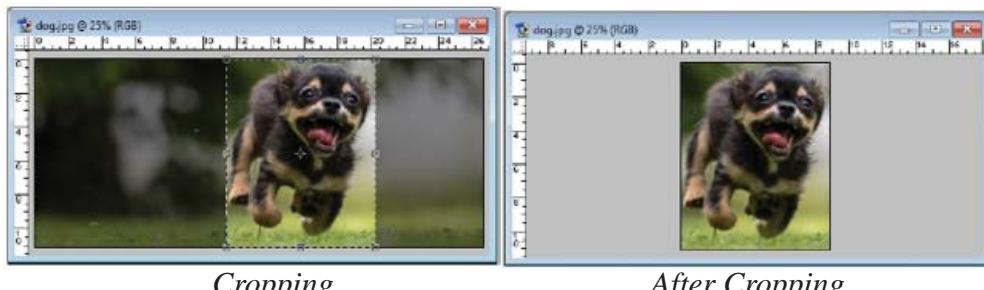
In Photoshop, you can crop your images using either crop tool or selection tool. Follow the steps to crop an image:

Step 1: Open a required image.

Step 2: Select the Crop tool from Tools panel or press C to activate crop tool.

Step 3: Select the area of the image that you want to have.

Step 4: Click on Image Menu > Crop or Press Enter.



Summary

- Computer Graphics includes everything that is presented through images developed or designed using different graphical software.
- Some popular image editing software includes Adobe Photoshop, GIMP, Adobe Illustrator, CorelDraw, Paint.net etc.
- There are two main types of Graphical Format: Raster and Vector
- Raster images are composed of tiny dots called pixels. JPG, GIF, BMP, TIF and PNG are common raster formats.
- Vector graphics are composed of paths or lines. AI, PDF, SVG and EPS are common vector formats.
- Image size refers to the length and width of a digital image, also called pixel dimensions.

- Resolution refers to the number of pixels in an image.
- Adobe Photoshop is a professional image editing software that can be used to create a new image or edit an existing one.
- Different selection tools available in Photoshop are Marquee Tool, Lasso Tool and Magic Wand Tool.
- Cropping feature allows the user to remove unwanted outer parts of image.

Technical Terms

- (a) Graphics : Visual data created to inform or communicate
- (b) Computer Graphics : Images developed using graphical software
- (c) Graphics Software : Software used to draw or design simple to complex graphics
- (d) Raster Image : Images composed of pixels
- (e) Vector Image : Images composed of paths or lines
- (f) Pixel : The smallest addressable element of a raster image
- (g) Resolution : Dimension of an image measured in dpi or ppi
- (h) Text Tool : Allows to add text on an image
- (i) Selection Tool : Allows to select a required part of an image
- (j) Cropping : Allows to remove unwanted outer part of an image

Exercises

1. Answer the following questions.

- a) Define Computer Graphics.
- b) What are the application areas of Computer Graphics?
- c) Differentiate between Raster Image and Vector Image.
- d) Mention the list of different image file formats.
- e) Write some features of JPG and GIF images.
- f) What is a pixel?

- g) What is the process of calculating image size?
 - h) Mention the steps of changing image size.
 - i) Explain the different selection tools available in Adobe Photoshop.
 - j) How do you crop an image? Explain.
- 2. Write 'True' or 'False'.**
- a) Graphics Software is used to edit images.
 - b) Microsoft Excel is an example of Graphics Software.
 - c) Vector image is composed of pixels.
 - d) Low number of pixels in an image means low quality of the image.
 - e) SVG is a vector image format.
 - f) We have to insert a small size image on the website.
 - g) 1 billion Pixel equals to 1 Megapixel.
 - h) Magic Wand Tool depends on the colour pattern of image.

3. Match the following.

- | Group “A” | Group “B” |
|---------------------------|---------------------------|
| a) i) Magnetic Lasso Tool | a) Remove unwanted part |
| ii) Magic Wand Tool | b) Type text |
| iii) Text Tool | c) Colour based selection |
| iv) Crop Tool | d) Circular selection |
| | e) Edge based selection |
-
- | Group “A” | Group “B” |
|------------------|--------------------------------|
| b) i) JPG | a) Suitable for paper printing |
| ii) GIF | b) Vector Image |
| iii) TIFF | c) Supports Animation |
| iv) PNG | d) Raster Format |
| | e) Suitable for website |

4. Choose the best answer.

- a) Which is NOT a Graphics Software?
 - i) Adobe Photoshop
 - ii) Autodesk Maya
 - iii) GIMP
 - iv) Microsoft Word
- b) Which is NOT a Graphics Format?
 - i) PNG
 - ii) PSD
 - iii) BMP
 - iv) PPT
- c) format supports only 256 colours.
 - i) GIF
 - ii) JPG
 - iii) TIFF
 - iv) PSD
- d) Which is NOT a selection tool of Adobe Photoshop?
 - i) Marquee Tool
 - ii) Lasso Tool
 - iii) Crop Tool
 - iv) Magic Wand Tool
- e) Graphic file composed of pixels.
 - i) Vector
 - ii) Autodesk
 - iii) Post Script
 - iv) Raster
- f) Tools for removing unwanted outer part of an image.
 - i) Dodge Tool
 - ii) Eyedropper Tool
 - iii) Crop Tool
 - iv) Brush Tool
- g) The shortcut key to open Save As... dialog box.
 - i) Shift+Altrl+S
 - ii) Shift+Ctrl+S
 - iii) Alt+Ctrl+S
 - iv) Shift+Ctrl+Alt+S
- h) There are types of Lasso Tool.
 - i) 2
 - ii) 3
 - iii) 4
 - iv) 5

5. Write the full form of.

- a) VR
- b) GIMP
- c) JPG
- d) GIF
- e) TIFF
- f) BMP
- g) PNG
- h) PSD
- i) SVG
- j) EPS
- k) PDF
- l)Pixel
- m) ppi
- n) dpi

6. Write short notes on.

- a) Web in Graphics
- b) Graphics Software
- c) Selection Tools of Adobe Photoshop

Activities

1. Prepare a presentation file on “Importance of Computer Graphics and its uses” and present it to your class as a group work.
2. Collect the names, logo, application areas, file extensions and other related information of different Graphics Software and draw in a sheet of chart paper.

Practical Work

1. Open any image file in Photoshop and change its width to 600 pixels and height 800 pixels.
2. Create a collage of 7 wonders of the world. Also write their names.
3. Search few jpg files in your computer. Open any one of them and save the same file in PNG format.
4. Open any graphic file and demonstrate the uses of different selection tools.
5. Open any one JPG file. Remove some unwanted portion using crop tool and save it in GIF format.
6. Run MS-Paint. Create a graphic file and save in BMP format. Open the same file in Photoshop and save it in JPG format.

Internet Technology

3.1 Introduction

Many of you might have heard of the term ‘Internet’. Nowadays, it is popularly used to search for information on any subject, to communicate with people, for shopping, for knowing the latest news, booking tickets, playing game, sending greeting cards and for a number of other purposes. Let us learn what exactly the internet technology is.

The internet technology refers to devices, software, hardware and transmission protocols used to connect computers together in order to receive or send data from one computer to another within a small network or as part of a small network within a larger network, such as the Internet.



The Internet is a **network of networks**, a global communication system that links together thousands of individual networks. As a result, virtually any computer on any network can communicate with any other computer on any other network. These connections allow users to exchange messages, to communicate in real-time (seeing messages and responses immediately), to share data and program, and to access limitless stores of information.

Internet technology

Today, the internet connects thousands of networks and hundreds of millions of users around the world. It is a huge, cooperative community with no central ownership. This lack of ownership is an important feature of the Internet because it means that no single person or group controls the network. The Internet is open to anyone who can access it. If you can use a computer and if the computer is connected to the internet, you are free not only to use the resources posted by others, but to create resources of your own.

You can publish documents on the World Wide Web, exchange e-mail message, and perform many other tasks.

The seeds of the internet were planted in 1969 when the Advanced Research Projects Agency (ARPA) of the U.S. Department of Defence began connecting computer at different universities and defence contractors. The resulting network was called ARPANET.

3.1.1 World Wide Web (WWW)

The World Wide Web was created in 1989 at the European Particle Physics Laboratory in Geneva, Switzerland. The World Wide Web is a term used to describe the interlinked collection of hypertext documents and multimedia content available on the Internet. You use a web browser to search, find, view and download information on the Internet. Over the last few years, the web has become one of the most popular Internet services.

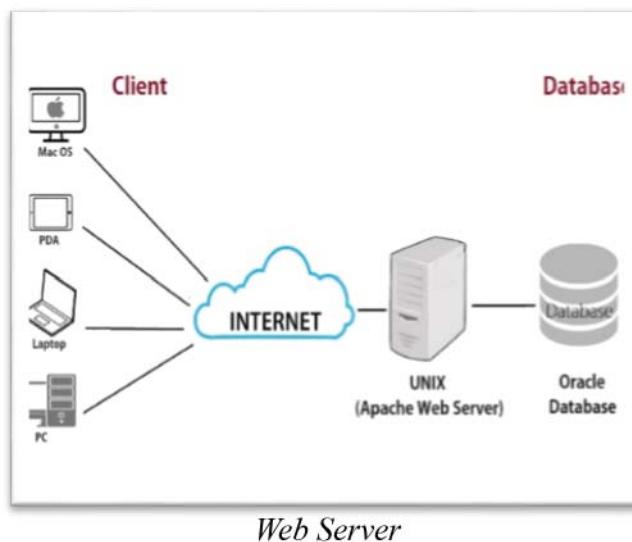


The Web is a collection of Internet host systems that make these services available on the Internet using the HTTP (Hypertext Transfer Protocol). Web-based information is usually delivered in the form of hypertext and hypermedia using HTML.

Many people believe that the Web and the Internet are the same things, but this is not correct. In fact, they are two different things. The web is a service (a system for accessing documents) that is supported by the Internet (a gigantic network).

3.1.2 Web Server

Web servers are computers on the Internet that host website, serving pages to viewers upon request. A computer that delivers (serves up) web pages. Every web server has an IP address and possibly a domain name. If you enter a URL <https://moeccdc.gov.np/> in your web browser, the browser tries to find the IP address of the domain name from the DNS server. Once IP address is resolved then request is sent to the webserver that serves web pages of moeccdc.gov.np to fetch specific page “index.html”, now server will send HTML content of that specific page to the client browser. Client browser knows how to interpret HTML for end-user. Some of the popular web server applications are Apache web servers, Microsoft IIS (Internet Information Server), NGNIX, Google Web Server (GWS) etc.

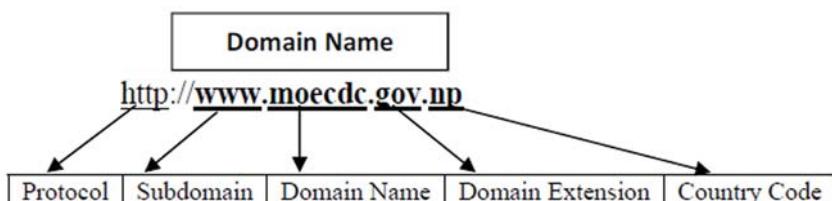


3.1.3 DNS

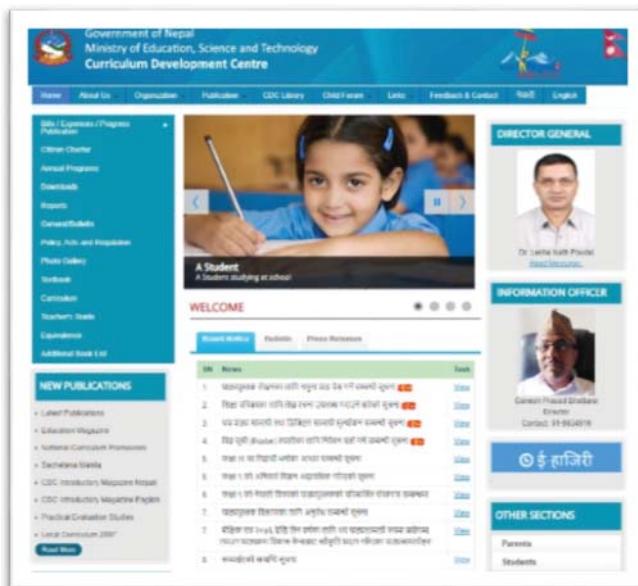
DNS stands for Domain Name System (or service or server) and is an internet service used for converting domain name into IP address on the internet or on local networks using the TCP/IP. DNS automatically converts the website name typed in web browser address bar into the IP address of web server hosting that site. For example, the domain name <https://www.moeccdc.gov.np> might translate to 202.45.144.44

3.1.4 URLs

The hypertext transfer protocol uses Internet addresses in a special format, called Uniform Resource Locator, or URL. In a URL, type specifies the type of server in which the file is located, address is the address of the server (Http, FTP), and the path is the location within the file structure of the server. The path includes the list of folders where the desired file is located. URL is the key to navigating the web. When you provide a URL for the browser, the browser finds the URL's page (index.html, index.htm, index.php) and then transfers the page to your PC.



From the above example:



http:// or https://	Hypertext Transfer Protocol / Hypertext Transfer Protocol Secure
www	Subdomain (World Wide Web)
moecd	Domain Name (eg. Google, YouTube, Baidu, gorkhapatraonline)

.gov	Domain Extension (eg. .gov=Government, .com=Commercial, .edu=Education, .mil=Military, .net=Network, .org=Organization)
.np	Country Code (eg. .np=Nepal, .us=USA, .ca=Canada, .in=India, .uk= United Kingdom)

3.1.5 Web Browser

A Web browser is a software application such as Mozilla Firefox, Google Chrome, Microsoft Edge, Brave, Safari, Opera etc. designed to find hypertext documents on the web and then open the documents on the user's computer. It is a client application that enables the client computer to gain access to a Web server or other internet servers, such as FTP and Gopher. A browser also interprets and displays documents. Mosaic was the first web browser while Mozilla Firefox and Google Chrome are the most commonly used browsers nowadays.



Brave



Mozilla firefox



Google chrome



Microsoft edge



Safari

Web browsers

3.1.6 Web Site

A website is a collection of related web pages. These pages contain text, graphics, audio, video and links to other pages which are typically identified with a common domain name, and published on at least one web server. Examples are moecdcd.gov.np,

3.1.7 Web Pages

Hypertext documents on the Internet are known as web pages. Your web browser interprets and displays web pages. Web browsers typically can display text, various graphic and multimedia format files. Web pages are created by using a special language called Hypertext Markup Language (HTML). You can see the power of the WWW in pages that contain hypertext and hypermedia. Web pages are used to distribute news, interactive educational services, product information, catalogues, highway traffic reports, and live radio, TV and other kinds of information.

3.1.8 Home Page

When we load a web browser the page which loads first is called home page. Similarly, when we type a domain name in the address bar the default page that loads on the browser are called the home page of that website. We can change the homepage of the browser by Tools Options.

3.1.9 Search Engines

Suppose you want to look at Chapter 6 of your book. What would you do? You would look at the contents page, search for the chapter and find out the page number then open that page number. Similarly, it is not always easy to find what you want on the web. That is because there are tens of millions of unique web sites, which include billions of unique pages! Search engines are - well - "engines" or "robots" that crawl the web looking for new web pages when we typed by typing one or more words. These robots read the web pages and put the text (or parts of the text) into a large database or index that you may access. The engine then displays a list of web pages that contain information related to your words called a

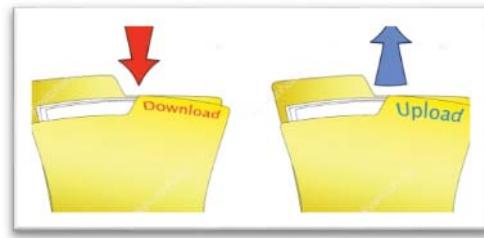


keyword. None of them covers the whole net, but some of them are quite large. Google, Bing, Yahoo Search, Ask.com, AOL.com, Baidu are some popular search engines.

For school students, an important search engine is “**KidRex**”. It provides a list of websites based on the provided keywords suitable for school students.

3.1.10 Download/Upload

Downloading means your computer is receiving data from the internet. Downloading is the transmission of a file from one computer system to another. From the Internet user's point-of-view, to download a file is to request it from another computer (or from a web page on another computer) and to receive it.



Where Uploading means data is being sent from your computer to the Internet. From an internet user's point-of-view, uploading is sending a file to a computer that is set up to receive it. Examples of uploading include sending an email, posting photos on a social media site and using your webcam.

3.1.11 Netiquette

The word netiquette is a combination of 'net' (from Internet) and 'etiquette'. It means respecting other users' views and displaying common courtesy while doing online activities.

Some Essential Netiquette Rules

- i. Never Share Personal Information
- ii. Think Before You Post
- iii. Avoid Passing on Rumours
- iv. Don't Get Involved with Cyber Bullying
- v. Don't use all caps in your mails or online messages because it is considered shouting.
- vi. Double Check Your Privacy Settings
- vii. Treat Others with Respect

viii. Keep Everyone's Privacy

ix. Help Others

3.1.12 IoT (Internet of Things)

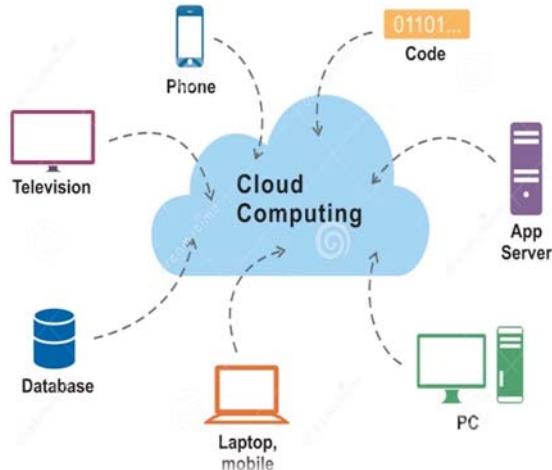
A few years earlier only computers and servers were able to communicate with each other by sharing data and information. Due to the advancement in technology, the computer-like device can be integrated with any electronic devices enabling them to share and communicate data to intended users and systems. Devices that can sense or read the values of their surrounding environment are more likely to have application for sharing/communicating information. Such devices when connected with server to communicate data from their surrounding are called the Internet of Things. In a simple way, you have things (devices) that can collect data and are capable to send these data via Internet to server or any intended users. For example, a car with a GPS sensor (thing) continuously transmits its location information to any user via internet. A temperature sensor (thing) that is reading the temperature of a particular location and transmitting that data via Internet to a Web Server so that anyone from the world can know the temperature of that location/place. It can even be used in any home appliances like TV, refrigerator, lights, AC, door, window with special-purpose sensors.



3.1.13 Cloud Computing

Cloud computing means storing and accessing data and programs over the internet “**the cloud**” instead of your computer's hard drive. When you store data or run programs from the hard drive, that's called local storage and computing. Everything you need is

physically close to you, which means accessing your data is fast and easy. For it to be considered "**cloud computing**" you need to access your data or your programs over the internet, or at the very least have that data synched with other information over the web. With an online connection, cloud computing can be done anywhere, anytime.



Companies offering these computing services are called cloud providers and typically charge for cloud computing services based on usage, similar to how we paid the bill for water, electricity, telephone at home. Some of the cloud providers are Amazon AWS, Microsoft Azure, Google Cloud, IBM Cloud, VMware Cloud, Oracle Cloud and Alibaba Cloud.

You are probably using cloud computing right now, even if you don't realise it. If you use an online service to send an email, edit documents, watch movies or TV, listen to music, play games or store pictures and other files. It is likely that cloud computing is making it all possible behind the scenes. Cloud computing can be broken up into three main services: Software-as-a-Service (SaaS), Infrastructure-as-a-Service (IaaS) and Platform-as-a-Service (PaaS).

Here are a few things you can do with the cloud :

- Create new apps and services store, back up and recover data
- Host websites and blogs
- Stream audio and video
- Deliver software on demand

Examples of Services over Cloud

- Microsoft Office 365
- Office Online (Internet versions of Word, Excel, PowerPoint, and OneNote accessed via your web browser without installing anything.)
- Google Drive: This is a pure cloud computing service, with all the storage found online so it can work with the cloud apps: Google Docs, Google Sheets, and Google Slides. Google Drive is also available on more than just desktop computers; you can use it on tablets like the iPad or on smartphones, and there are separate apps for Docs and Sheets, as well. In fact, most of Google's services could be considered cloud computing; Gmail, Google Calendar, Google Maps, and so on.
- Apple iCloud: Apple's cloud service is primarily used for online storage, backup, and synchronization of your mail, contacts, calendar, and more.



Technical Terms

- world wide web (www) : An internet service developed to incorporate footnotes, figures, and cross-references into online hypertext documents.
- Web Server : An internet host computer that may store thousands of web sites.
- Internet Protocol Address : A unique four-part numeric address (between 0 and 255) assigned to each computer on the internet, containing routing information to identify its location.
- Index page : The default page, or main web page of a website.
- Hypertext Markup Language (HTML): A page-description language used on the world wide web that defines the hypertext links between documents.

DNS	: A naming system used for computers on the internet.
Transmission Control Protocol/Internet Protocol (TCP/IP):	The set of commands and timing specifications used by the Internet to connect dissimilar systems and to control the flow of information.
Uniform Resource Locator	: An internet address used with HTTP in the format type://address/path.
Web Browser	: A program that enables the user to view web pages, navigate web sites, and move from one web site to another.
Web Site	: A collection of related Web pages.
Web Pages	: A document developed using HTML and found on the world wide web.
Search Engines	: A web site that uses powerful data-searching techniques to help the user locate web sites containing specific types of content or information.
Download	: To receive a file from a remote computer.
Upload	: To send a file to a remote computer.
Netiquette	: The correct or acceptable way of using the Internet.
Cloud Computing	: A type of Internet-based computing.
Office Online	: A completely free, web-based version of Microsoft Office.
Google Drive	: A file storage and synchronization service developed by Google.
Apple iCloud	: A cloud computing solution by Apple Computer Inc. that provides cloud storage and apps for desktop, and mobile devices.

Exercises

1. Answer the following questions.

- a. Define the term “Internet Technology”.
- b. What is the Web Browser? Name any four web browsers.

- c. What is a search engine? Give any two examples.
- d. Define web page and website.
- e. What is the purpose of the webserver? Give any two examples of web server applications.
- f. What does www explain?
- g. How does a search engine let you search for information on the web?
- h. What is netiquette? Write any four netiquette rules.
- i. What is cloud computing?
- j. Write any four advantages of cloud computing.
- k. What is a cloud service? Give any two examples.
- l. Give some examples of IoT devices.
- m. Write short notes on
 - i. URLs
 - ii. DNS
 - iii. IoT

2. Fill in the blanks.

- i)was the first web browser.
- ii) Web browsers typically can display, variousand format files.
- iii) Web pages are created by using a special language called.....
- iv) The web uses a special protocol, called the
- v)are the key to navigating the web.
- vi) A.....lets you search for information by typing one or more words.
- vii) Combination of 'net' and 'etiquette' is
- viii) Google chrome is an example of a
- ix) A device that is completely cloud-centric is the

3. Give full forms of the following abbreviations.

- a. HTML
- b. TCP/IP
- c. WWW
- d. HTTP
- e. URL
- f. IP
- g. DNS
- h. ICT
- i. ARPA

4. Write the technical terms for these.

- i. The language used to develop a web page.
- ii. The native protocol of the Internet.
- iii. The largest computer network.
- iv. The software required for browsing and surfing web sites.
- v. The first page of a website.
- vi. The website used to search for information on the internet.
- vii. An address that identifies the location of a web page on the internet.
- viii. The process of transferring data/file from the user's computer to the internet.
- ix. A special set of manners to be followed when using the Internet.

5. Match the following.

Group A	Group B
i. Web Browser	a) WWW.google.com
ii. Search Engine	b) URL
iii. World Wide Web	c) Domain Name
iv. Web Address	d) Tim Berners Lee
	e) Mozilla Firefox

Activities

1. Complete the following exercises as directed by your teacher.

- a) Prepare a list of search engines using the Internet.
- b) Practice using your browser. Launch your browser and practice navigating the Web. Try using URLs based on the names of people or companies you want to learn more about. As you visit different sites, look for hyperlinked

- text and graphics; click them, and see where they lead.
- c) Search, search, search. Pick a topic and search the Web for information about it. Pick a keyword to use in your search, then visit three search engines and use each of them to conduct a search using your chosen keyword. Use Bing, Altavista, and Google for your searches.
 - d) Prepare an article on “Internet Safety”. Using the Internet, find some information about the topic and include in your article and also mention the name of the website you visited.

2. Make a PowerPoint presentation on the topic.

- “How are the Internet and its services helping us to develop a better society?”

Project Idea

- Choose one service that Internet has been providing us or you can imagine (develop) a new idea which is possible through the Internet. Limit yourself with only one service/idea and present it in-depth with all the required specificity. Your presentation may include multimedia files, pictures, cartoons, graphs, bar charts etc. Your presentation may include information in the following order:
 - a) Introduction : (Define/introduce that idea/history of idea/summary of things you are going to present in this presentation)
 - b) Main Body : (Its use/beneficial aspects or target group/how it works, argumentation about do’s and don’ts, relate human development in socio-economic prospects, benefits and limitations with examples)
 - c) Conclusion: (Conclude your argumentation with logical interpretation and integrate it with human development.)

HTML (Hypertext Markup Language)

3.1 Introduction

In the previous lesson, you learnt that the language used to develop web pages is called Hypertext Markup Language (HTML) where Hypertext is a text which contains links to other texts. By clicking on a link in a hypertext document, a user can quickly jump to different content. For example, software that includes dictionaries and encyclopaedias has long used hypertext in their definitions so that readers can quickly find out more about specific words or topics. Though hypertext is usually associated with Web pages.

A Markup Language is a computer language that uses tags to define elements within a document. It is human-readable; markup files contain standard words, rather than typical programming syntax. While there are several markup languages the two most popular are HTML and XML (Extensible Markup Language). HTML was invented by Tim Berners-Lee at CERN, the European Particle Physics Laboratory. The World Wide Web Consortium (W3C) is the standard organization that controls the evolution of HTML. The W3C provides a list of recommendations regarding the use of HTML and other associated technologies and you should try to adhere to these recommendations when you are writing your own web pages.

3.2 HTML Tag and Attributes

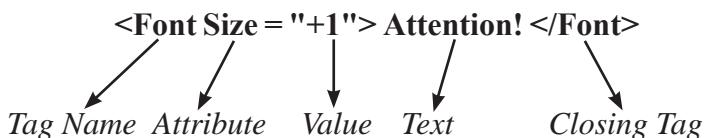
HTML Tags are instructions that are embedded directly into the text of the document. An HTML tag is a signal to a browser that it should do something other than just throw text up on the screen. By convention all HTML tags begin with an open left angle bracket (<) and end with a close right angle bracket (>). HTML tags can be two types:

- Container Tag:** Most tags come in pairs and surround the material they affect. They work like a light switch: the first tag turns the action on, and the second turns it off. For example, the tag is a container tag. It is also called paired tag. In paired tags, the first tag () is often called the opening tag and the second tag () is called the closing tag. The opening tag activates the effect and the closing tag turns the effect off.

- b. **Empty Tag:** An empty tag does not have a companion tag. Tags that are used by them are called empty tags. It is also called Singular or stand-alone tag. For instance, the
 tag creates a blank line and doesn't have an "off switch".

3.2.1 Attributes

Some elements may include an attribute, which is additional information that is included inside the start tag. For example, you can specify the FONT (size, color or face) by including the appropriate attribute with the HTML code.



One tag can have more than one attributes and values.

 Attention!

HTML is not case sensitive. is equivalent to or .

3.2.2 Structure of HTML Document

Every HTML document has a rigid structure. The HTML document is mainly divided in two sections. The entire document is enclosed within <HTML></HTML> tags. Within these tags two distinct sections are Document Head section contained in <HEAD></HEAD> and Body section contained in <BODY></BODY>.

```
<HTML>
  <HEAD>
    ..head section
  </HEAD>
  <BODY>
    ..body section
  </BODY>
</HTML>
```

<HTML> This tag recognizes the document as an HTML document.

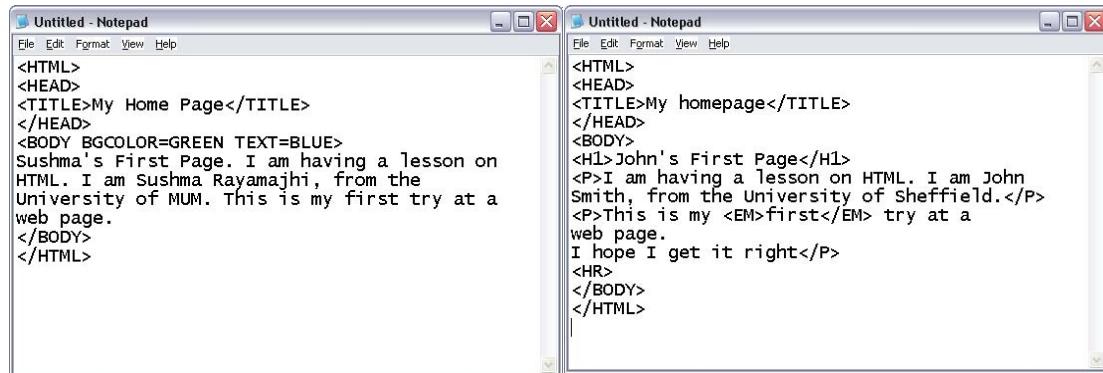
<HEAD> ...</HEAD> This tag identifies the beginning and end of the header section.

<TITLE> This tag is used to place the text in the title bar of the browser window.

<BODY> ...</BODY> This tag recognizes the beginning and end of the body section.

There are some attributes of the **<BODY>** tag which are used to specify the background colour, text color, font size, font weight and so on.

BGCOLOR	Changes the default background color to whatever color is specified with this tag.
BACKGROUND	Specifies the name of the image (.gif) file that will be used as the background of the document.
TEXT	Changes the body text color from its default value to the color specified with this attribute.



The image shows two windows of Microsoft Notepad side-by-side. Both windows have a title bar 'Untitled - Notepad' and a menu bar with File, Edit, Format, View, and Help. The left window contains the following HTML code:

```
<HTML>
<HEAD>
<TITLE>My Home Page</TITLE>
</HEAD>
<BODY BGCOLOR=GREEN TEXT=BLUE>
Sushma's First Page. I am having a lesson on
HTML. I am Sushma Rayamajhi, from the
University of MUM. This is my first try at a
web page.
</BODY>
</HTML>
```

The right window contains the following HTML code:

```
<HTML>
<HEAD>
<TITLE>My homepage</TITLE>
</HEAD>
<BODY>
<H1>John's First Page</H1>
<P>I am having a lesson on HTML. I am John
Smith, from the University of Sheffield.</P>
<P>This is my <EM>first</EM> try at a
web page.
I hope I get it right</P>
<HR>
</BODY>
</HTML>
```

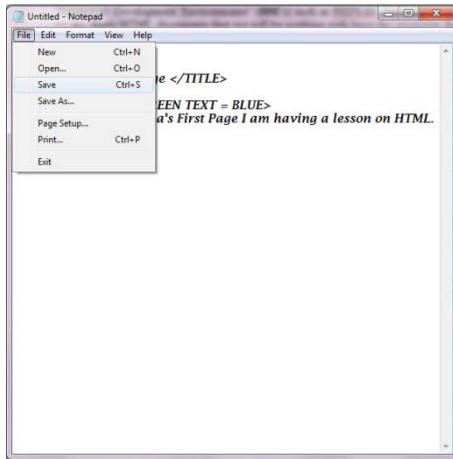
3.2.3 Creating HTML Documents in Notepad.

Now let's put this into practice. All you need is to write an HTML file in a text editor. All major operating systems have at least one text editor: Mac OS has SimpleText, UNIX/Linux has vim, emacs and Windows has Notepad; Beside this, there are numerous HTML "Integrated Development Environments" (IDE's) such as PHPEdit, Textpad, Editplus, Notepad ++ etc. Basic HTML documents that we will be working with have the extension .html or .htm.

Here are the steps to create and save the HTML document in notepad.

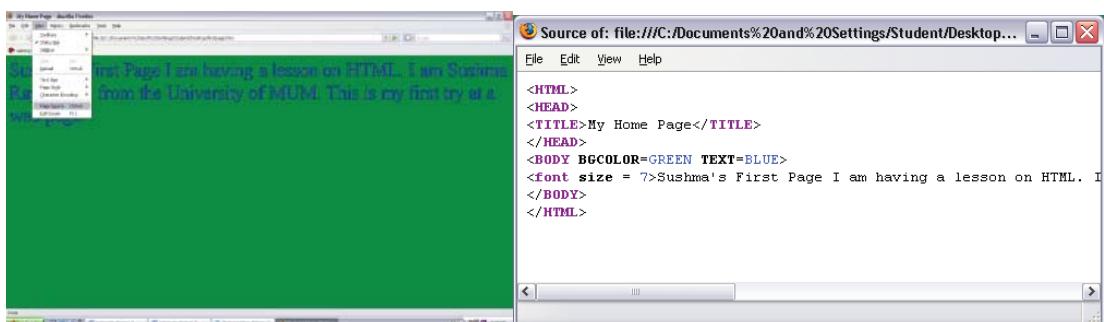
- In MS-Windows, Click the Start Button

- Type Notepad in the search text box and hit Enter. (Notepad window will appear)
- Type the HTML code in the Notepad window as shown in the figure below.
- Save the file from File Menu>Save.
- Notepad will display Save as dialog box asking for a file name as shown in the figure below.



- In the File name text box, type “Firstpage.htm” or “Firstpage.html”. Type the filename and .html or .htm extension enclosed in the double quotes else the file might be saved with TXT extension.
- Click on the save button.

To view your Web page double click on your page “Firstpage.htm” and you can see it in your default browser (like Internet Explorer or Mozilla Firefox). To view the source code of your page you can just click on View menu and click source. Now you can see the HTML source code as shown in the figure below.



3.2.4 Organizing Text in HTML document

The web browser only identifies the single space between the word or text even if there are many spaces given between the words. Use a special code to add additional spaces between the text. One inserts one space; so, use as many codes as the number of spaces you want between the text.

For line breaks and paragraph breaks
 and <P> tags are used. Apart from simple formatting tags, text-formatting tags are also used. These tags are used for changing the color, size, alignment, font etc. of the text.

Paragraph Tag <P>: A blank line always separates paragraphs in textual material. The tag that provides this functionality is <P>. At this tag, the browser moves onto a new line skipping one line between the previous line and the new line.

ALIGN=LEFT | CENTER | RIGHT attribute can be used to set the alignment of the paragraph. Left alignment is set by default.

Input:

<P> Please forward any inquiries to info@moeecd.gov.np</P>

<P ALIGN=RIGHT> DATE: </P>

**Line Break Tag
:** When text needs to start from a new line and not continue on the same line (without skipping a blank line), the
 tag should be used. This tag simply jumps to the start of the next line.

Input:

Government of Nepal,
 Ministry of Education, Science & Technology,

Curriculum Development Centre,
 Tel.: (977-1) 6630588, 6634119.

Output:

Government of Nepal,

Ministry of Education, Science & Technology,

Curriculum Development Centre,

Tel.: (977-1) 6630588, 6634119

Comment (<!-- -->) Tag

The comment tag is used to insert a comment in the HTML source code which will not be displayed on the web page itself. We can use a comment to explain tag/code, which can help us when we edit the source code later. Comments in HTML always begin with <!-- and end with -->. The browser ignores any text or tags placed inside a comment.

<!-- comment here-->

Comment tag requires exclamation (!) symbol after opening bracket, but not before the closing bracket.

Example 1

```
<HTML>
    <HEAD>
        <TITLE> An example of comment </TITLE>
    </HEAD>
<BODY>
<!—body tag includes all the tags and other text-->
The comment tag used to insert comment in the HTML source code
</BODY>
</HTML>
```

Formatting Tags

Formatting tags are used to change the appearance of the text in web page. Formatting tags can be used set the font face, font color, font size, bold, italics styles of the text.

Heading Styles <H1>...<H6>: HTML supports six different levels of headings. The highest-level header format is <H1> and the lowest level is <H6>. All the styles appear in BOLDFACE and the size of the heading depends on the level chosen, i.e. <H1> to <H6>

Input:

```
<h1>This is a heading one.</h1>
<h2>This is a heading two.</h2>
```

Output:

```
This is a heading one.
This is a heading two.
```

<h3>This is a heading three.</h3>
<h4>This is a heading four.</h4>
<h5>This is a heading five.</h5>
<h6>This is a heading six.</h6>

[**Note:** Here as the number increases next to <H> like (1,2,3.....) the font size actually decreases.]

This is a heading three.
This is a heading four.
This is a heading five.
This is a heading six.

Drawing Horizontal Lines <HR>: The tag <HR> draws line and horizontal ruler. This tag draws a horizontal line across the whole page, wherever specified. The attributes of the <HR> tag are:

Attributes	Description
	Aligns the line on the Browser screen, which is by default, aligned to the center of the screen.
ALIGN	ALIGN=LEFT will align the line to the left of the screen ALIGN=RIGHT will align the line to the right of the screen ALIGN=CENTER will align the line to the center of the screen
SIZE	Change the size of the rule.
WIDTH	Sets the width of the rule. It can be set to a fixed number of pixels, or to a percentage of the available screen width.

Input:

Welcome to Nepal VisitNepal 2020!

<HR ALIGN= “LEFT” WIDTH= “20” SIZE= “4”>

Text Styles

To format your text, you can use the following tags. ... tag to display text in BOLDFACE style, <I>...</I> tag for ITALICS, <U>...</U> tag is uses to UNDERLINE. The superscript ^{...} and subscript _{...} tags are used for placing the text above and below the specified text.

Input:

this text is bold
<i> this text is italicize </i>

<u>this text is underlined</u>

A²B²

H₂O

Output:

this text is bold

this text is italicize

this text is underlined

A²B²

H₂O

Text Effects

Centering (Text, Image etc.)

<CENTER>.....</CENTER> tags is used to center everything found between them – text, lists, images, rules, tables or any other page element.

Input:

<CENTER> Welcome to Pokhara VisitNepal 2020! <CENTER>

Controlling Font Size and Color:

All text specified within the tags and will appear in the font, size and color as specified as attributes of the tag . The attributes are:

FACE	Sets the font to the specified font name.
SIZE	Sets the size of the text. Size can take values between 1 and 7. The default sized used is 3.
COLOR	Sets the color of the text. COLOR can be set to an English language color name or to a hexadecimal triplet.

Input:

 Welcome to Nepal
VisitNepal 2020!

If you would like to specify a certain text or background color, you can do so by using color codes.

RGB color codes are represented as hexadecimal values. The RGB color codes contain three sets of numbers representing the amount of Red, Green and Blue contained in a color. These codes must be used within your HTML to specify your selected colors.

Here are a few of the basic color codes:

Black	#000000	Silver	#C0C0C0
White	#FFFFFF	Lime	#00FF00
Red	#FF0000	Gray	#808080
Green	#00CC00	Maroon	#800000
Blue	#0000FF	Purple	#800080
Yellow	#FFFF00	Aqua	#00FFFF

Input:

```
<font color="#FF0000">RED </FONT>
<font color="#00CC00">Green </FONT>
<font color="#0000FF">Blue </FONT>
```

The MARQUEE Tag

The <MARQUEE> tag is useful for creating scrolling effect.

Attribute	Description	Values
Behavior	Scrolling behavior	alternate, slide, scroll
Direction	Scrolling direction	left, right, up, down
Bgcolor	Background color	color name or value
scrolldelay	Delay in scrolling text	A number in milliseconds
Height	Height of scroll area	A number in pixels
width	Width of scroll area	A number in pixels

Input

```
<MARQUEE> COMPUTER SCIENCE !!!</MARQUEE>
<marquee behavior="scroll" direction="down" bgcolor="#CCFF00"
```

scrolldelay="1000"> Running Text! </marquee>

Lists : Types of Lists

Unordered List (Bullets)

An unordered list starts with the tag `` and ends with ``. Each list of items starts with the tag ``. The attributes that can be specified with `` are

TYPE	:	Specifies the type of bullet.
		TYPE=FILLROUND will give a solid round black bullet
		TYPE=SQUARE will give a solid square black bullet

Example 2:

Some of these products include:

```
<UL TYPE =FILLROUND>  
    <LI> Pen drive </LI>  
    <LI> Hard Disk </LI>  
    <LI> Monitors </LI>  
</UL>
```

Output:

Some of these products include:

- Pen drive
- Hard Disks
- Monitors

Ordered Lists (Numbering)

An ordered lists start with the tag `` and end with ``. Each list items start with the tag ``. The attributes that can be specified with `` are:

TYPE	Controls the numbering scheme to be used. TYPE= “1” will give counting numbers (1,2,) TYPE= “A” will give Uppercase letters (A,B,.....) TYPE= “a” will give Lowercase letters (a,b,.....) TYPE= “I” will give Uppercase Roman Numerals (I, II,) TYPE= “i” will give Lowercase Roman Numerals (i, ii, iii,
START	Alters the numbering sequence. Can be set to any numeric value.
VALUES	Changes the numbering sequence in the middle of an ordered list. It is to be specified with the tag.

Example 3:

Some of these products include:

```
<OL TYPE = “1” START=3>
    <LI> Pen drive
    <LI> Hard Disks
    <LI> Monitors
</OL>
```

Output:

Some of these products include:

3. Pen drive
4. Hard Disks
5. Monitors

Definition Lists

Definition list values appear within tags <DL> and </DL>. Definition lists consist of two parts:

Definition term	appears after the tag <DT>
Definition description	appears after the tag <DD>

Example 4:

```
<DL>
<DT> Keyboard
<DD> An input device
<DT> Printer
<DD> An output device
</DL>
```

Output:

```
Keyboard
    An input device
Printer
    An output device
```

3.2.5 Adding Image to HTML Documents

Other than text, HTML allows placing of static and/or animated images in an HTML page. Mainly two picture file formats are used in HMTL: .gif and .jpg. Images can be created to suit the requirements of a web and page and saved in these file formats using tools such as Gif Constructor or Adobe Photoshop.

Once an image is ready and stored in above-mentioned format, it can be inserted into a web page using **** tag, which takes the name of the image file (filename.gif, filename.jpg or filename.jpeg) as the value of SRC attribute.

Inserting Images Tag

The **** tag takes the following attributes:

Attribute	Value
SRC	Location and name of the image file
	Controls alignment of the text following the image ALIGN = TOP indicates the text after the image to be written at the top, next to the image.

ALIGN	ALIGN = MIDDLE indicates the text after the image to be written at the middle, next to the image.
	ALIGN = BOTTOM indicates the text after the image to be written at the bottom, next to the image.
	CONTROLS ALIGNMENT OF THE IMAGE WITH RESPECT TO THE VDU SCREEN
	ALIGN = LEFT indicates the image is aligned to the left with respect to the screen.
	ALIGN = CENTER indicates the image is aligned to the center with respect to the screen.
	ALIGN = RIGHT indicates the image is aligned to the right with respect to the screen.
	BORDER
	Specifies the size of the border to place around the image.
	WIDTH
	Specifies the width of the image in pixels.
	HEIGHT
	Specifies the height of the image in pixels.
	HSPACE
	Indicates the amount of space to the left and right of the image.
	VSPACE
ALT	Indicates the amount of space to the top and bottom of the image.
	Indicates the text to be displayed in case the Browser is unable to display the image specified in the SRC attribute

Example 5:

```
<IMG WIDTH = 447 HEIGHT = 57 BORDER =0 HSPACE = 0 SRC = "IMAGE1.GIF" ALIGN=CENTER>
```

Using the BORDER attribute

[Note: Before practising this example create a folder of your name and create another subfolder called images and copy some images in it. Save the following web page inside the folder of your name.]

Example 6:

```
<HTML>
  <HEAD>
    <TITLE> Working with Images </TITLE>
  </HEAD>
  <BODY BACKGROUND = "images/texture1.gif">
    <B> Controlling Image Borders!</B>
    <CENTER>
      <I> Image Without a BORDER </I> <BR> <BR>
      <IMG SRC = "images/corp.gif"> <BR> <BR>
      <I> Images With BORDER = 3</I> <BR> <BR>
      <IMG SRC = "images/corp.gif" BORDER = 3 > <BR>
    </CENTER>
  </BODY>
</HTML>
```

Using the WIDTH and HEIGHT attribute

Example 7:

```
<HTML>
  <HEAD>
    <TITLE> Working with Images </TITLE>
  </HEAD>
  <BODY BACKGROUND = "images/texture1.gif">
    <B> Controlling Image Sizes!</B>
    <CENTER>
      <I> Normal Image Size! </I> <BR> <BR>
```

```
<IMG SRC="images/computer.gif"> <BR>
<I> Images With Size (Height And Width) Set to 200</I> <BR> <BR>
<IMG WIDTH = 200 HEIGHT = 200 SRC=images/computer.gif"><BR><BR>
</CENTER>
</BODY>
</HTML>
```

Using the ALIGN attribute

Example 8:

```
<HTM>
<HEAD>
    <TITLE> Working with Images </TITLE>
</HEAD>
<BODY BACKGROUND = "images/texture1.gif">
    <B> <I> Image Aligned Left </I> </B>
    <IMG SRC= "images/sctonly2.gif" ALIGN = left> <BR> <BR>
```

Silicon Chip Technologies,

<I> We Specialize In Corporate Training, Software Development and Placements. Our Training Programs and Software Development include Web Based Commercial Applications and Commercial Application Development using Databases. </I>

 <I>Image Aligned Right </I>

Silicon Chip Technologies,
 <I> We Specialize In Corporate Training, Software Development and Placements. Our Training Programs and Software Development include Web Based Commercial Applications and Commercial Application Development using Databases.</I>

</BODY>

</HTML>

Using the ALT attribute

Example 9:

```
<HTML>
  <HEAD>
    <TITLE> Working with Images </TITLE>
  </HEAD>
  <BODY BACKGROUND = “images/texture1.gif”>
    <B> Use of ALT attribute </B> <BR>
    <CENTER> <I> Available Image: Javacup.gif </I> <BR> <BR>
    <IMG SRC = “images/javacup.gif”> <BR> <BR>
    <I> Unavailable Image: Javac.gif – Without the ALT Attribute </I> <BR> <BR>
    <IMG SRC =“images/javac.fig”><BR><BR>
    <I> Unavailable Image: Javac.fig – With the ALT Attribute set or “Java”</I>
    <BR> <BR>
    <IMG SRC=“images/javac.gif” ALT = “The Java cup”> <BR>
  </CENTER>
</BODY>
</HTML>
```

3.2.6 Creating Links : <A> Anchor Tag

HTML allows linking to another HTML document as well as images. Clicking on a section of text or an image in one web page will open another web page or moves to a specific location of the same page or an image. The text or an image that provides such linkage is called Hypertext, a Hyperlink, or a Hotspot.

The browser distinguishes Hyperlinks from normal text. Hyperlink has the following features.

- Appears blue in color
- The hyperlink text/images are underlined
- When the mouse cursor is placed over it, the standard arrow-shaped mouse cursor

changes to the shape of a pointing hand

Links are created in a web page by using the `<A> ` tag. Anything written between the `<A> ` tag becomes a hyperlink/hotspot. Clicking on the hyperlink navigates to a different web page or images.

The document to be navigated needs to be specified. By using the HREF attribute of the `<A>` tag the next navigable web page or images can be specified.

``

Hyperlinks can be of two types:

- Links to an external document
- Links (jumps) to a specific place within the same document

External Document References

Example 10:

` Visit my Home page `

INPUT

`<HTML>`

`<HEAD>`

`<TITLE> USING LINKS TO CONNECT TO EXTERNAL SITES </TITLE>`

`<BODY BGCOLOR= “GREEN”>`

`<H2 ALIGN= “CENTER”>VISIT THE SITES TO KNOW ABOUT NEPAL</H2><P>`

``

` WWW.welcomenepal.com `

` WWW.explorenepal.com `

` WWW.lonelyplanet.com `

` mofa.gov.np `

``

`</BODY>`

`</HTML>`

Intra-Page links or Bookmarks

Link created in a page can be opened at a different location on the same page. Such links are called intra page links or bookmarks. It is also possible to jump to a particular location on another web page using bookmarks.

Using Named Anchors

To use the intra-page links named Anchors are used.

For instance,

This is a different use of the <A> anchor tag; it is necessary to give a name at the specific point on the page where the tag occurs. The tag must be included, but no text is required between <A> and .

 TOP

The # symbol identifies the word “top” as a named anchor point within the current document, rather than a separate page. When a reader clicks on “TOP”, the web browser will display the part of the page starting with the tag.

Example 11: INPUT

```
<HTML>
<HEAD> <TITTLE> Visual Basic Information </TITTLE></HEAD>
<BODY>
<A HREF= “#LAST”> GO BOTTM </A> <!-- Linked to the location named as
“LAST”-->
<BR>
<A HREF= “#DATABASE”> DATABASE SECTION </A> <!-- Linked to the
location named as “DATABASE”-->
<BR>
<A HREF= “#TOP”> WEB SECTION </A> <!-- Linked to the location named
as “WEB”-->
<A NAME = “TOP”> </A> <!--A Name “Top” is given to this location -->
<H3> Mastering Visual Basic 6.0</H3>
```

<P>

<H3>Table of Contents</H3>

 <H4>The Fundamental

 Getting started with Visual Basic

 Visual Basic Projects

 Visual Basic Language

 Working With Forms

 Basic ActivX Controls

 <!--A NAME “DATABASE” is given to this location-- >

 Database Programming with VB

Database with VB

The Active Data objects

 <!--A NAME “WEB” is given to this location -- >

 Visual Basic and the web

 Introduction to the Web

 Scripting Objects

 VB and the Web

 Active Server Pages (ASP)


```
</OL>

<OL> Special Topics
<OL>
    <LI> The Multiple Document Interface
    <LI> Recursive Programming
    <LI> Optimizing VB Applications
</OL>
</OL>

<OL>
    <LI> Introduction to the Web
    <LI> Scripting Objects
    <LI> VB and the Web
    <LI> Active Server Pages (ASP)
</OL>
</OL>
</OL>
</OL>

<A NAME=“LAST”></A><!--A NAME “LAST” is given to the this location -- >
<A HREF=“#TOP”> GO TOP</A><!--Linked to the location named as “TOP”-- >
<BR>
<A HREF= “#DATABASE”> DATABASE SECTION </A> <!--Linked to the
location named as “DATABASE”-- >
<BR>
<A HREF= “#TOP”> WEB SECTION </A> <!--Linked to the location named
as “WEB”-- >
<BR>
</HTML>
```

Email Link

Apart from inter-page links and intra-page links, the `<A>` tag can also be used for creating e-mail links. Email link creates a new message addressed to a specified recipient using the web user's installed mail client. For this purpose, the email address must be specified after the `mailto:` statement in `<A HREF>` tag.

Example 12:

```
<HTML>
  <HEAD>
    <TITLE> USING EMAIL LINKS </TITLE>
  </HEAD>
  <BODY>
    Send your email to <A HREF = mailto: info@moecdcd.gov.np> Curriculum
    Development Center, Sanothimi Bhaktapur </A>
  </BODY>
</HTML>
```

3.2.6 Table

A table is a two-dimensional matrix, consisting of rows and columns. Tables are intended for displaying data in rows and columns on a web page. All table-related tags are included between the `<TABLE> </TABLE>` tag. Each row of a table is described between the `<TR> </TR>` tag. Each column of a table is described between the `<TD> </TD>` tag.

Table rows can be of two types:

Sunday	Monday	Tuesday	Wednesday
5	6	7	8
12	13	14	15

Header rows

A table header row is defined using `<TH> </TH>` tag. The content of a table header

row is automatically centred and appears in boldface.

Data rows (Individual data cells placed in the horizontal plane creates a data row)

There could be a single data cell (i.e. a single column table) or multiple data cells (i.e. a multi-column table)

Data cells hold data that must be displayed in the table. A data row is defined using <TR></TR> tags. Text matter displayed in a data row is left-justified by default. Any special formatting like boldface or italics is done by including appropriate formatting tags inside the <TR> </TR> tags. An image can also be displayed in a data cell.

The attributes that can be included in the <TABLE> tag are:

ALIGN	Horizontal alignment is controlled by the ALIGN attribute. It can be set to LEFT, CENTER, or RIGHT.
VALIGN	Controls the vertical alignment of cell contents. It accepts the values TOP, MIDDLE or BOTTOM.
WIDTH	Sets the WIDTH to a specific number of pixels or to a percentage of the available screen width. If width is not specified, the data cell is adjusted based on the cell data value.
BORDER	Controls the border to be placed around the table. The border thickness is specified in pixels.
CELLPADDING	controls the distance between the data in a cell and the boundaries of the cell.
CELLSPACING	Controls the spacing between adjacent cells.
COLSPAN	The COLSPAN attribute inside a <TH> or <TD> tag instructs the browser to make the cell defined by the tag to take up more than one column. The COLSPAN attribute can be set equal to the number of columns the cell is to occupy. This attribute is useful when one row of the table needs to be a certain number of columns wide.
ROWSPAN	The ROWSPAN attribute works in the same way as the COLSPAN attribute except that it allows a cell to take up more than one row. The attribute can be set by giving a numeric value. For example ROWSPAN = 3

The Caption Tag

Often tables need to be given a heading, which gives the reader a context for the information in the tables. Table Headings are called Captions. Captions can be provided to a table by using the <CAPTION> </CAPTION> tags. The paired tag appears within the <TABLE></TABLE> tags. The table caption can be made to appear above or below the table structure with the help of the attribute ALIGN, as explained in the table below.

ALIGN	It controls placing of the caption with respect to the table. ALIGN = BOTTOM will place the caption immediately below the table. ALIGN=TOP will place the caption immediately above the table.
-------	--

Bypassing a row's <TR> tag the VALIGN and ALIGN attributes, vertical or horizontal alignment can be made identical for every cell in a given row.

Bypassing the <TH> and/or <TD> tags, VALIGN or ALIGN attributes, vertical or horizontal alignments in both header and data cells can be done. Any alignment specified at the cell level overrides any default alignments and any alignments specified in a <TR> tag.

Note:

- Alignments specified in <TD> or <TH> apply only to the cell being defined.
- Alignments specified in a <TR> tag apply to all cells in a row, unless overridden by an alignment specification in a <TD> or <TH> tag.

Using the WIDTH and BORDER attribute

Example 13:

```
<HTML>
  <HEAD>
    <TITLE> Table Attributes </TITLE>
  </HEAD>
<BODY BGCOLOR=LIGHTGREY>
  <B> Specifying the BORDER and WIDTH of the Table! </B>
  <BR> <BR> <BR> <BR>
```

```

<CENTER>
<TABLE BORDER=5 WIDTH=50%>
<CAPTION ALING=bottom>
<B> Personal Information </B>
</CAPTION>
<TR>
    <TH> NAME </TH>
    <TH> AGE </TH>
</TR>
<TR ALIGN = CENTER>
    <TD> Suniska Gharti </TD>
    <TD> 16 </TD>
</TR>
<TR ALIGN=CENTER>
    <TD> Pooja Mital </TD>
    <TD>32 </TD>
</TR>
</TABLE>
</CENTER>
</BODY>
</HTML>

```

Note:

- If the WIDTH attribute is associated with the <TH> tag then the width of an individual column can be adjusted.

Using the CELLPADDING attribute

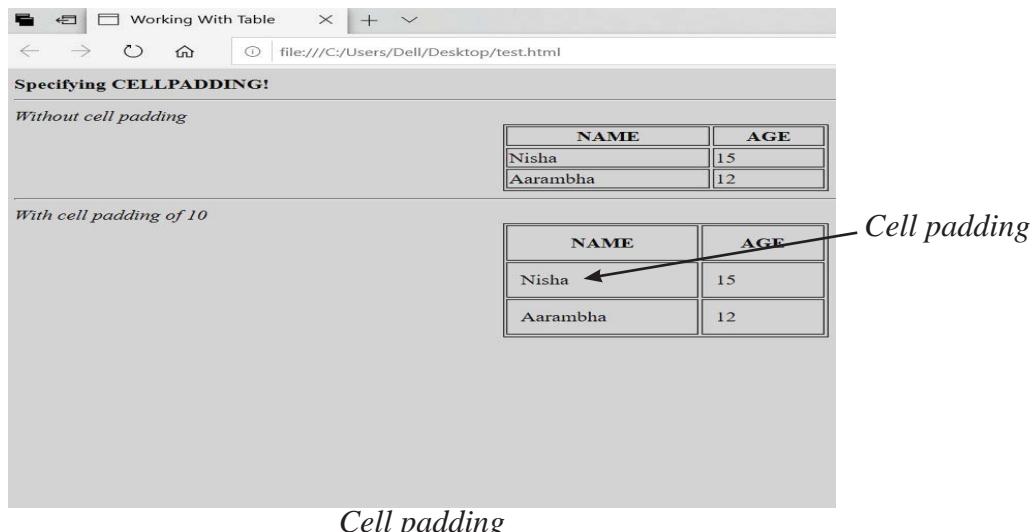
Example 14:

```
<HTML>
  <HEAD>
    <TITLE> Working With Table </TITLE>
  </HEAD>
  <BODY BGCOLOR = LIGHTGREY>
    <B> Specifying CELLPADDING! </B> <BR>
    <HR>
    <I> Without cell padding</I>
    <CENTER>
      <TABLE BORDER=1 WIDTH=25% ALIGN=CENTER>
        <TR>
          <TH> NAME </TH>
          <TH> AGE </TH>
        </TR>
        <TR>
          <TD> Nisha </TD>
          <TD> 15 </TD>
        </TR>
        <TR>
          <TD> Aarambha </TD>
          <TD> 12 </TD>
        </TR>
      </TABLE>
    </CENTER>
    <HR>
    <I>With cell padding of 10 </I>
    <CENTER>
```

```

<TABLE BORDER=1 WIDTH=25% CELLPADDING=10 ALIGN=CENTER>
<TR>
    <TH> NAME </TH>
    <TH> AGE </TH>
</TR>
<TR>
    <TD> Nisha </TD>
    <TD> 15 </TD>
</TR>
<TR>
    <TD> Aarambha </TD>
    <TD> 12 </TD>
</TR>
</TABLE>
</CENTER>
</BODY>
</HTML>

```



Using The CELLPADDING attribute

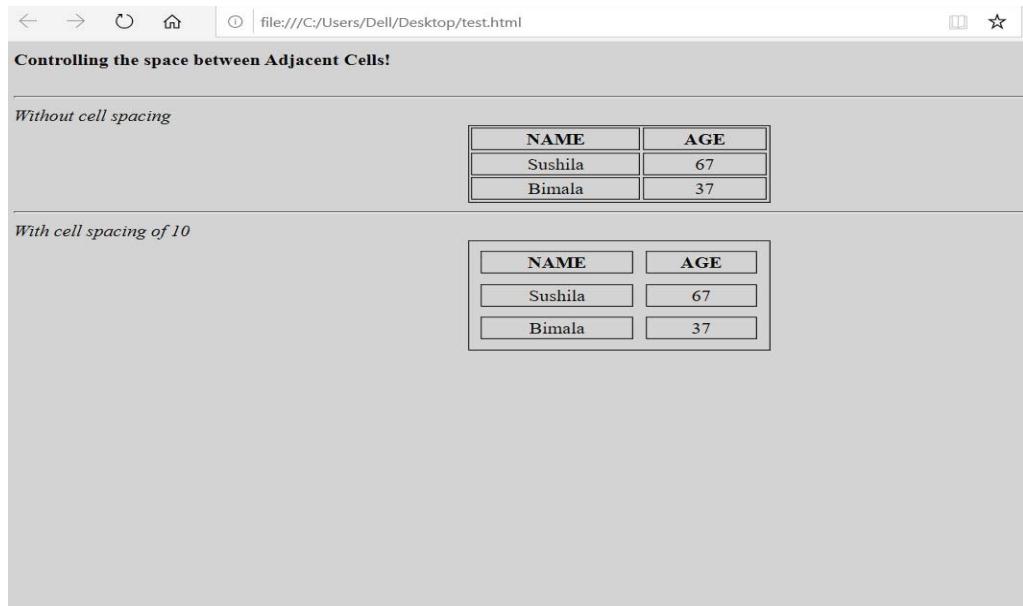
Example 15:

```
<HTML>
    <HEAD>
        <TITLE> Working With Table </TITLE>
    </HEAD>
    <BODY BGCOLOR = LIGHTGREY>
        <B> Controlling the space between Adjacent Cells! </B> <BR> <BR>
        <HR>
            <I> Without cell spacing</I>
        <CENTER>
            <TABLE BORDER=1 WIDTH=25% ALIGN=CENTER>
                <TR>
                    <TH> NAME </TH>
                    <TH> AGE </TH>
                </TR>

                <TR ALIGN = CENTER>
                    <TD> Sushila </TD>
                    <TD> 67 </TD>
                </TR>

                <TR ALIGN=CENTER>
                    <TD> Bimala </TD>
                    <TD> 37 </TD>
                </TR>
            </TABLE>
        </CENTER>
```

```
<HR>
<I>With cell spacing of 10 </I>
<CENTER>
<TABLE BORDER=1 CELLSPACING =10 WIDTH=25% ALIGN=CENTER>
<TR>
    <TH> NAME </TH>
    <TH> AGE </TH>
</TR>
<TR ALIGN = CENTER>
    <TD> Sushila </TD>
    <TD> 67 </TD>
</TR>
<TR ALIGN=CENTER>
    <TD> Bimala </TD>
    <TD> 37 </TD>
</TR>
</TABLE>
</CENTER>
</BODY>
</HTML>
```



Cell spacing

Using the BGCOLOR attribute

Example 16:

<HTML>

<HEAD>

<TITLE> Working With Table </TITLE>

</HEAD>

<BODY BGCOLOR=LIGHTGREY>

 Specifying Color red Table Cells!

<CENTER>

<TABLE BORDER = 1 WIDTH = 50% ALIGN = CENTER>

<TR>

<TH Bgcolor = Gray> NAME </TH>

<TH Bgcolor = Gray> AGE </TH>

</TR>

<TR ALIGN = CENTER>

<TD Bgcolor = black> Aarambha Gharti

```

        </TD>
        <TD Bgcolor = violet> <FONT Colo r= RED> 4 </FONT> </TD>
    </TR>

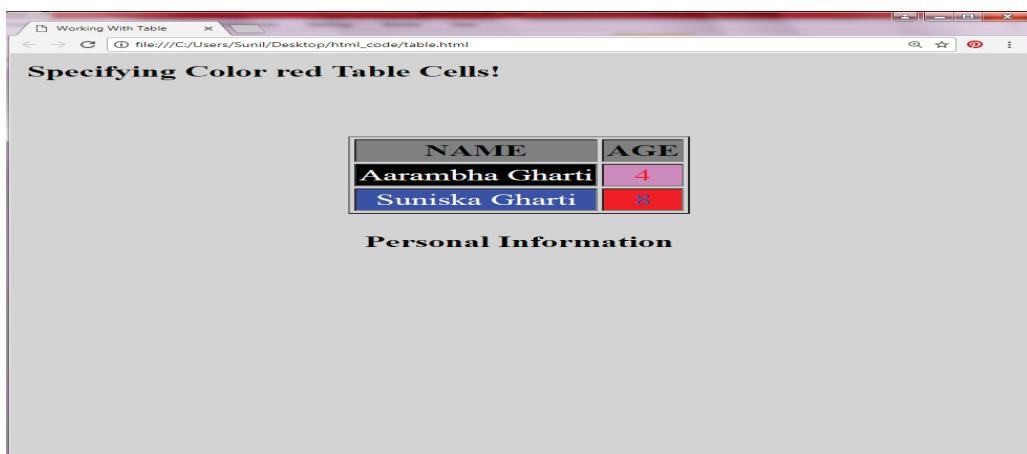
<TR ALIGN = CENTER>
    <TD Bgcolor = blue> <FONT Color = white> Suniska Gharti </FONT>
    </TD>
    <TD Bgcolor = red> <FONT Color = blue> 8 </FONT> </TD>
</TR>

<CAPTION ALIGN=bottom> <B> <BR>
Personal Information </B>
</CAPTION>
</TABLE>

</CENTER>
</BODY>

</HTML>

```



Using the COLSPAN AND ROWSPAN attributes.

Example 17:

```
<HTML>
    <HEAD>
        <TITLE> Working With Table </TITLE>
    </HEAD>

<BODY BGCOLOR=LIGHTGREY>
    <B> Specifying ROWSPAN and COLSPAN Attributes! </B>
    <BR> <BR> <BR> <BR>

    <CENTER>
        <TABLE BORDER=1 WIDTH=50% ALIGN=CENTER>
            <TR>
                <TH ROWSPAN = 2> NAME
                <TH COLSPAN = 3> MARKS
            </TR>
            <TR>
                <TH> UNIX O/S
                <TH> ASP.NET
                <TH> SQL Server
            </TR>
            <TR ALIGN=CENTER>
                <TD>Deepak
                <TD>85
                <TD>80
                <TD>72
            </TR>
            <TR ALIGN=CENTER>
                <TD> Rashmi
```

```

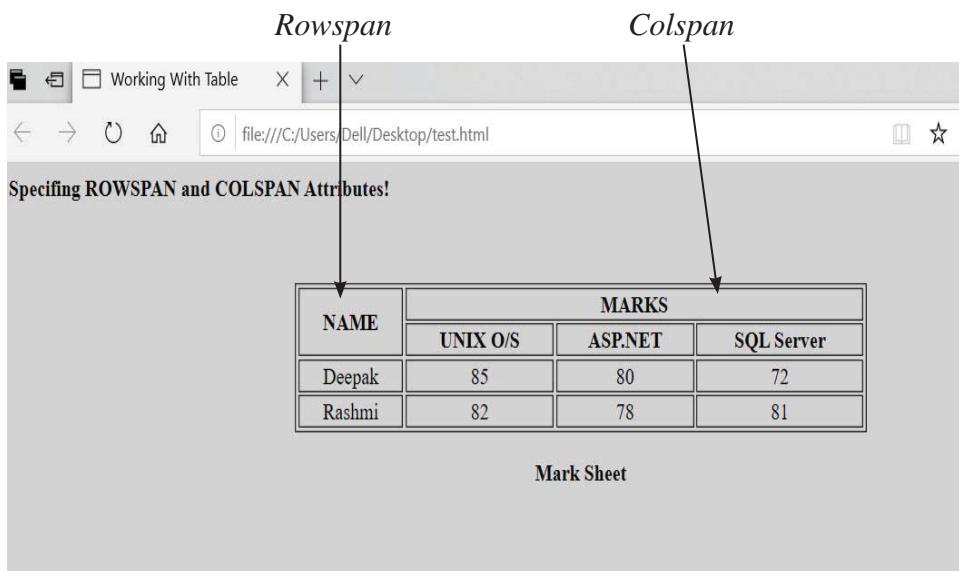
<TD> 82
<TD> 78
<TD> 81
</TR>

<CAPTION ALIGN = bottom> <B> <BR> Mark Sheet </B> </CAPTION>
</TABLE>

</CENTER>

</BODY>
</HTML>

```



Rowspan and Colspan

3.2.7 Working with Forms in HTML

HTML forms are basic for web Client-Server capabilities. Forms are the client-side GUI applications. To create a form, use the <FORM> tag. Inside the opening and closing FORM tags, individual form elements plus any other HTML content are used to create a layout for the form (paragraphs, headings, tables, and so on). As many forms on a page can be used but you can't include a <FORM> tag inside another <FORM> tag.

The opening tag of the FORM tag includes attributes namely name, method and action.

Name is used for defining the name of the form. The method attribute can be either GET or POST, which determines how the form data is being sent to the server. The action attribute is a pointer to the script that processes the form on the server-side.

Different types of form elements included in the <FORM> are text boxes, radio buttons, checkboxes, drop-down boxes, multiline, scrollable text areas and password boxes.

Each of the form element will be placed inside a <FORM>... </FORM> tag.

Elements of HTML Form

a. Text Fields

Text fields enable the client to type text into a single-line field. To create a text field, you can either use TYPE=“TEXT” in the <INPUT> tag or leave off the TYPE specification altogether. The default TYPE for the <INPUT> tag is “text”.

NAME indicates the name of this field as passes to the script processing the form.

SIZE indicates the length of the text-entry field, in characters; the field is 20 characters by default.

Example 18:

```
<form>
    User Name : <Input type= "text" Name= "userName" >
    <br><br>
    Password :&nbsp;&nbsp;&nbsp; <Input type= "password" Name= "passwd" >
</form>
```

User Name :

Text box

Password :

Note: <input type = “password”> password text fields are identical to ordinary text fields, except that all the character types are echoed back in the browser as asterisks or bullets. Here is used for one space

b. Text Area

Text areas are input fields that contain many lines of text, making them extremely useful for forms that require extensive input. For example, if you want to create a form that enables readers to compose electronic mail, you might use a text area for the body of the message.

To include a text are element in a form, use the <Textarea> ... </Textarea>.

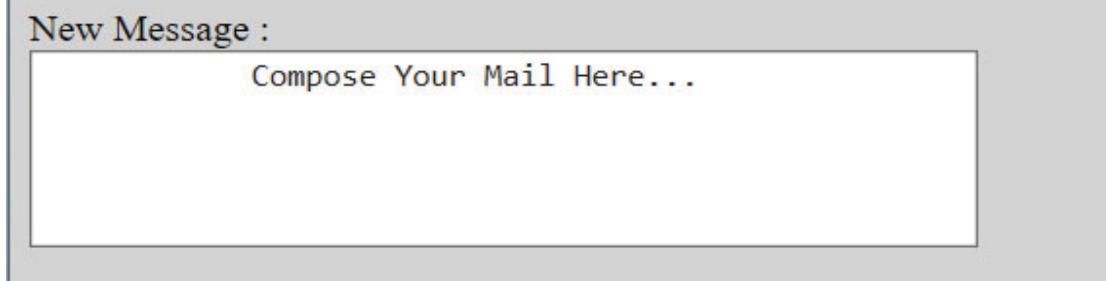
<TextArea> includes three attributes:

NAME	The name to be sent when the form is submitted
ROWS	The height of the text area element, in rows of text
COLS	The width of the text area element in columns (characters)

```
<Textarea Name=“theBody” Rows=“7” Cols =“30”> Enter your message here  
</textarea>
```

Example 19:

```
<form>  
    New Message : <br>  
    <textarea rows= "5" cols= "50" name= "details">  
        Compose Your Mail Here...  
    </textarea>  
</form>
```

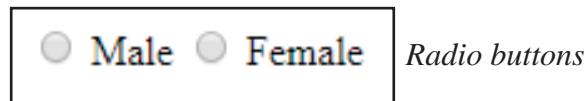


c. Radio Button

Radio buttons indicate a list of items, of which only one can be chosen. If one radio button in a list is selected, all the other radio buttons in the same list are deselected.

Example 20:

```
<INPUT TYPE= "RADIO" NAME = "r1" VALUE = "MALE">Male  
<INPUT TYPE= "RADIO" NAME = "r1" VLAUE = "FEMALE">Female
```



d. Checkbox

Checkboxes makes it possible to choose multiple items in a list. Each checkbox can be either checked or unchecked.

Example 21:

```
<Input Type= "checkbox" Name= "Red"> Red  
<Input Type= "checkbox" Name = "Green"> Green  
<Input Type = "checkbox" Name = "Blue"> Blue
```

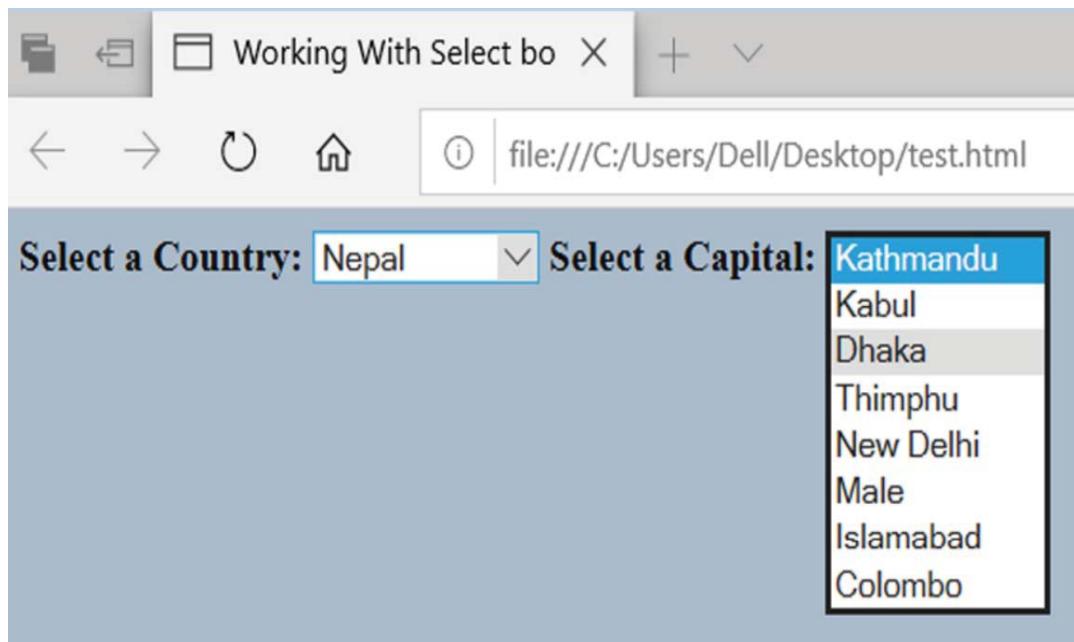
e. Select box

Select has the ability to create pull-down menus and scrolling lists. Selection enables to select one or more items for a menu on a scrolling list. They're similar in functionality to radio buttons or checkboxes, but they're displayed in a different way on-screen. The `<select>` tag and individual options within the selection indicated by the `<option>` tag are used for creating such elements.

Example 22:

```
<HTML>  
  <HEAD>  
    <TITLE> Working With Select box </TITLE>  
  </HEAD>  
  <BODY BGCOLOR="#aabbcc">  
    <form>  
      <P> <b> Select a Country:</b>
```

```
<Select Name= "Scount">  
  <option value= "Nepal" selected> Nepal </option>  
  <option value="Afghanistan"> Afghanistan </option>  
  <option value= "Bangladesh"> Bangladesh </option>  
  <option value= "Bhutan"> Bhutan </option>  
  <option value= "India"> India </option>  
  <option value= "Maldives"> Maldives </option>  
  <option value= "Pakistan"> Pakistan </option>  
  <option value= "Srilanka"> Srilanka </option>  
</select> </P>  
  
<b> Select a Capital:</b>  
  
  <Select Name= "Capital">  
    <option value= "Kathmandu" selected> Kathmandu </option>  
    <Option Value= "Kabul"> Kabul  
    <Option Value= "Dhaka"> Dhaka  
    <Option Value = "Thimphu"> Thimphu  
    <Option Value = "NewDelhi"> New Delhi  
    <Option Value = "Male"> Male  
    <option Value = "Islamabad"> Islamabad  
    <option Valu = "Colombo"> Colombo  
</Select> </P>  
</form>  
  
</HTML>
```



Select box

f. Submit Button

Submit buttons tell the browsers to send the form data to the server. You should include at least one submit button on every form.

```
<input type = "Submit" value= "Submit">
```

g. Reset Button

The Reset button is used for renewing the elements of the form. It allows the client to fill new entries by clicking on the reset button.

```
<input type = "reset" value = "reset">
```

Example 24:

```
<form>
    <input type= "submit" name= "submit" value= "Submit">
    <input type= "reset" name= "reset" value= "Reset">
</form>
```



HTML Form

Example 25:

```
<html>
<head>
    <title> Form </title>
</head>
<body bgcolor="#aabbcc">
<h1> Please fill up the below form:</h1>
<form >
    Enter your Full Name: <input type="text" size="40" maxlength="256" name="user_name"> <br> <br>
    Enter your password: &nbsp;<input type="password" size="40" maxlength="256" name="user_password"> <br> <br>
    Enter your Address: <br> <textarea name="user_comment" rows="5" cols="40">Type Your Full Address Here</textarea> <br> <br>
    Your Favourite Places: <br>
        <input type="radio" name="place1" value="kathmandu"> Kathmandu
        <input type="radio" name="place2" value="manang"> Manang
        <input type="radio" name="place3" value="pokhara"> Pokhara
        <input type="radio" name="place4" value="umustang"> Upper Mustang
        <input type="radio" name="place5" value="Rara"> Rara Lake
        <input type="radio" name="place6" value="Muktinath"> Muktinath
        <input type="radio" name="place7" checked value="PoonHill"> Poon Hill
        <input type="radio" name="place8" value="CNpark"> Chitwan National Park
        <input type="radio" name="place9" value="Jdham"> Janakpur Dham
<br> <br>
```

Your Favourite Food:


```
<select name="food" size="1">
    <option value="rice"> Daal Bhat Tarkari </option>
    <option value="Momo" selected> Momo </option>
    <option value="Dheedo"> Dheedo </option>
    <option value="AlooTama"> Aloo Tama </option>
    <option value="Chatamari"> Chatamari </option>
    <option value="Naan"> Naan </option>
    <option value="Chapatti"> Chapatti </option>
</select> <br> <br>
```

Language you speak:


```
<input type= "checkbox" name= "language" checked value= "Nepail">Nepali
<input type= "checkbox" name= "language" value = "Maithili"> Maithili
<input type= "checkbox" name= "language" value= "bhojpuri"> Bhojpuri
<input type= "checkbox" name= "language" value= "Tharu"> Tharu
<input type= "checkbox" name= "language" value= "Newari"> Nepal Bhasa
<input type= "checkbox" name= "language" value= "Magar"> Magar
```


Your Favourite Animals:


```
<select name="animals" size="6" multiple>
    <option value="buffalo">Buffalo
    <option value="cat">Cat
    <option value="dog">Dog
    <option value="goat">Goat
    <option value="horse">Horse
```

```

<option value="ox">Ox
<option value="pig">Pig
<option value="sheep">Sheep
<option value="Yak">Yak

</select> <br> <br>

<input type="submit" name="Submit">
<input type="reset" name="reset" value="Reset">
</form>
</body>
</html>

```

Please fill up the below form:

Enter your Full Name:

Enter your password:

Enter your Address:
Type Your Full Address Here

Your Favourite Places:
 Kathmandu Manang Pokhara Upper Mustang Rara Lake Muktinath Poon Hill Chitwan National Park Janakpur Dham

Your Favourite Food:

Lanugage you speak:
 Nepali Maithili Bhojpuri Tharu Nepal Bhasa Magar

Your Favourite Animals:

SAMPLE PROJECT for Online Registration Form:

```
<html>
  <head>
    <title> Sample Project </title>
  </head>
  <body bgcolor="#FFFFFF">
    <form action="" method="post" enctype="multipart/form-data"
      name="form1" id="form1">
      <table width="600" border="1" align="center" cellpadding="4"
        cellspacing="1">
        <tr>
          <td colspan="2"><h1> <font color="#00CC00">Online Registration
            Form!</font></h1></td>
        </tr>
        <tr>
          <td colspan="2" bgcolor="#999999"><b>Registration Form</b></td>
        </tr>
        <tr>
          <td>First Name</td>
          <td><input type="text" name="fname" id="fname" /></td>
        </tr>
        <tr>
          <td>Last Name</td>
          <td><input type="text" name="lname" id="lname" /></td>
        </tr>
        <tr>
          <td>Occupation</td>
```

```
<td><select name="select" id="select">
<option value="Student">Student</option>
<option value="Web Designer">Web Designer</option>
<option value="Software Developer">Software Developer</option>
<option value="Others">Others</option>
</select>    </td>
</tr>
<tr>
<td>Gender </td>
<td><input type="radio" name="gender" id="radio" value="Male" />
Male
<input type="radio" name="gender" id="radio2" value="Female" />
Female</td>
</tr>
<tr>
<td>Education</td>
<td><input name="chk1" type="checkbox" id="chk1" value="High
School" />
High School
<input name="chk2" type="checkbox" id="chk2" value="Graduate" />
Graduate
<input name="chk3" type="checkbox" id="chk3" value="Some
College"/>
Some College</td>
</tr>
<tr>
<td>Upload Your Photo</td>
```

```
<td><input type="file" name="fileField" id="fileField" /></td>
</tr>
<tr>
<td valign="top">Write about yourself <br/> (not more than 200
words)</td>
<td><textarea name="textarea" id="textarea" cols="50" rows="10"></
textarea></td>
</tr>
<tr>
<td colspan="2" valign="top" bgcolor="#999999"><strong>Login
Information </strong>
</td>
</tr>
<tr>
<td valign="top">Username</td>
<td><input name="username" type="text" id="username"
maxlength="10"/> (Max 10 characters)</td>
</tr>
<tr>
<td valign="top">Password</td>
<td><input name="textfield" type="password" id="textfield"
maxlength="12" /> (Max 12 characters)</td>
</tr>
<tr>
<td valign="top">&nbsp;</td>
<td><input type="submit" name="submit" id="submit" value="Submit"/>
<input type="reset" name="reset" id="reset" value="Reset" /></td>
</tr>
```

```

<tr>
<td colspan="2" valign="top">&copy; Copyright Vist Nepal 2020</td>
</tr>
</table>
</form>
</body>
</html>

```

Output:

Online Registration Form!

Registration Form

First Name	<input type="text"/>
Last Name	<input type="text"/>
Occupation	<input type="text" value="Student"/>
Gender	<input type="radio"/> Male <input type="radio"/> Female
Education	<input type="checkbox"/> High School <input type="checkbox"/> Graduate <input type="checkbox"/> Some College
Upload Your Photo	<input type="button" value="Browse..."/> No file selected.
Write about yourself (not more than 200 words)	<input type="text"/>

Login Information

Username	<input type="text"/> (Max 10 characters)
Password	<input type="password"/> (Max 12 characters)
	<input type="button" value="Submit"/> <input type="button" value="Reset"/>

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Cascading Style Sheets (CSS)

Dynamic Hypertext Markup Language (DHTML)

DHTML is a new and emerging technology that has evolved to meet the increasing demand for eye-catching web sites. DHTML combines HTML with Cascading Style Sheets (CSSs) and scripting Languages. HTML specifies a web page's elements like table, frame, paragraph, bulleted list, etc. Scripting Language (JavaScript and VBScript) can be used to manipulate the web page's elements so that styles assigned to them can change in response to a user's input.

3.3 Cascading Style Sheets

We already know that an HTML document can contain text, hyperlinks, images, and other multimedia content within HTML elements or tags. These contents are essentials of web pages. In order to style these HTML, we need a separate language called CSS. For example, you can define colour, font, and size of paragraph tag as follows:

```
<p style="color: #ff0000; font-weight: bold"> Some text that is red and bold </p>
```

CSS in itself has no meaning unless it is associated with HTML elements or tags. CSS is defined as a rule of styles associated with a certain element or set of elements of a HTML document.

According to W3C, “CSS is the language for describing the presentation of Web pages, including colours, layout, and fonts. It also allows adapting the presentation to different types of devices, such as large screens, small screens, or printers.”

As said in the definition, CSS can be defined in such a way that it can change layout, colors, fonts or any other styles based on the size of the screen (PC Screen, tablet screen and mobile screen) or for printers. In a desktop computer, screen size is large whereas in mobile screen size is small and accordingly HTML content should be presented to webpage viewers. CSS is used to define this type of presentation. If a viewer is trying to print a web page, the presentation of the page can be made different using CSS to make it printer-friendly.

The Style Assignment Process is accomplished with the <STYLE>...</STYLE> tags. The syntax for making the assignment is simple. Between the <STYLE> <STYLE> HTML tags, specific style attributes are listed. The <STYLE> </STYLE> tags are written within the <HEAD>...</HEAD> tags.

CSS Syntax:

```
<STYLE Type = “text/css”>  
Tag {attribute:value; attribute:value...}  
•  
•  
•  
</STYLE>
```

Attribute: Font, Color, Background, Text, Boarder, Margin and List

A CSS rule is formed from:

- A set of properties, which have values set to update how the HTML content is displayed, For example, I want my element's text color as white, and its background to be grey.
- A selector, which selects the element(s) you want to apply the updated property values to. For example, I want to apply my CSS rule to all the paragraphs in my HTML document.
- A set of CSS rules contained within a stylesheet determines how a webpage should look.

Let's make things clear by a quick example. First of all, let's take a simple HTML document, containing an <h1> and a <p>

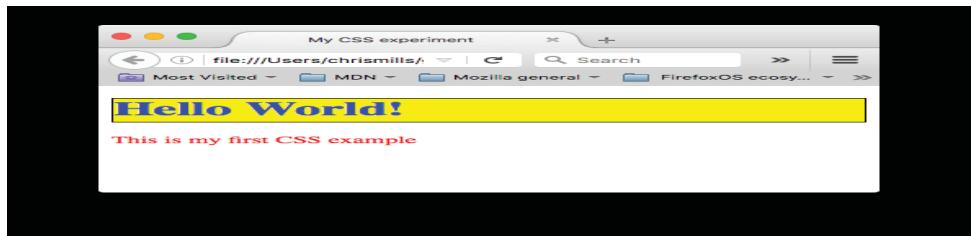
Example 1:

```
<!DOCTYPE html>  
<html>  
  <head>  
    <title>My First CSS Try</title>
```

```

<style>
    h1{
        color: blue;
        background-color: yellow;
        border: 1px solid black;
    }
    p{
        color: red;
    }
</style>
</head>
<body>
    <h1>Hello World!</h1>
    <p>This is my first CSS example </p>
</body>
</html>

```



CSS Properties

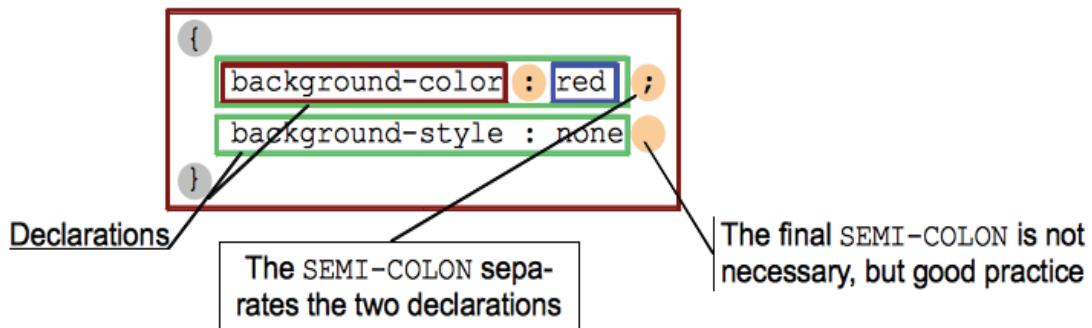
At its most basic level, CSS consists of two building blocks:

Properties: Human-readable identifiers that indicate which stylistic features (e.g. font, width, background color) you want to change.

Values: Each specified property is given a value, which indicates how you want to change those stylistic features (e.g. what you want to change the font, width or

background color to.)

A CSS declarations block:

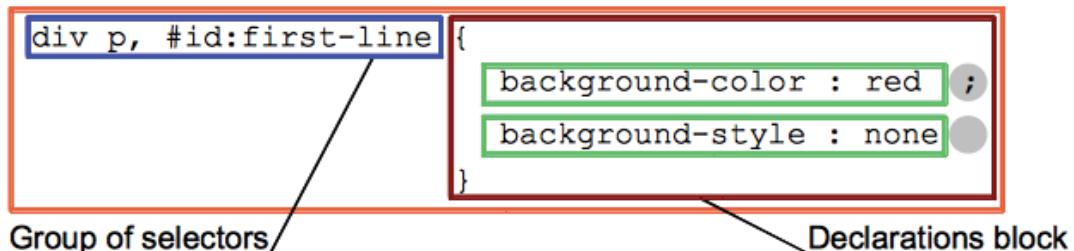


A property paired with value is called a CSS declaration. CSS declarations are put within CSS Declaration Blocks. And finally, CSS declaration blocks are paired with selectors to produce CSS Rulesets (or CSS Rules). Each property has a specific list of valid values defined for it.

Selectors

In CSS, selectors are used to target the HTML elements on our web pages that we want to style. Selectors are one part of a CSS rule and come just before CSS declaration blocks.

A CSS ruleset (or rule):



There are many different types of selectors. For our purpose, we will only introduce simple selectors that directly match one or more elements of a document, based on the type of element, class, or id.

3.3.1 CSS

There are three different ways to apply CSS to an HTML document. Here we'll briefly review each one.

- i. Inline CSS
- ii. Internal CSS
- iii. External CSS

i. **Inline styles**

Inline styles are CSS declarations that affect only one element, contained within a style attribute:

Example 2:

```
<!DOCTYPE html>

<html>
    <head>
        <title>My CSS experiment</title>
    </head>
    <body>
        <h1 style="color: blue; background-color: yellow; border: 1px solid black;">
            Good Morning Class!
        </h1>
        <p style="color:red;">This is my first CSS example of Inline styles </p>
    </body>
</html>
```

ii. **Internal stylesheet**

An internal stylesheet is where you don't have an external CSS file, but instead place your CSS inside a `<style>` element, contained inside the HTML `<head> ...</head>` tag. So the HTML would look like this:

Example 3:

```
<!DOCTYPE html>
<html>
    <head>
        <meta charset="utf-8">
        <title>My First CSS Try Page </title>
        <style>
            h1 {
                color: blue;
                background-color: yellow;
                border: 1px solid black;
            }
            p {
                color: red;
            }
        </style>
    </head>
    <body>
        <h1> Hello World! </h1>
        <p>This is my first CSS example of Internal stylesheet.</p>
    </body>
</html>
```

iii. External stylesheet

An external stylesheet is when you have your CSS written in a separate file with a .css extension, and you reference it from an HTML <LINK> tag. The HTML file looks something like this:

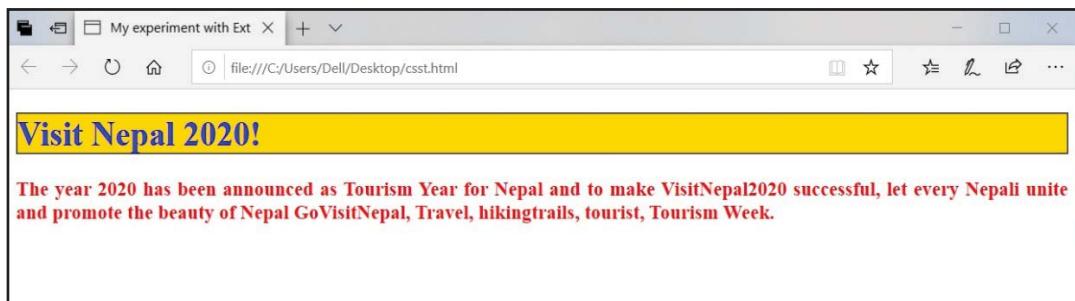
Example 4:

```
<!DOCTYPE html>
<html>
    <head>
        <meta charset="utf-8">
        <title> My experiment with External Stylesheet </title>
        <link rel="stylesheet" href="mystyle.css">
    </head>
    <body>
        <h1> Visit Nepal 2020! </h1>
        <p> The year 2020 has been announced as Tourism Year for Nepal and
            to make Visit Nepal 2020 successful, let every Nepali unite and promote
            the beauty of Nepal GoVisit Nepal, Travel, hiking trails, tourist, Tourism
            Week. </p>
    </body>
</html>
```

And (create a new file) code for mystyle.css file:

```
h1 {
    color: blue;
    background-color: gold;
    border: 1px solid black;
}

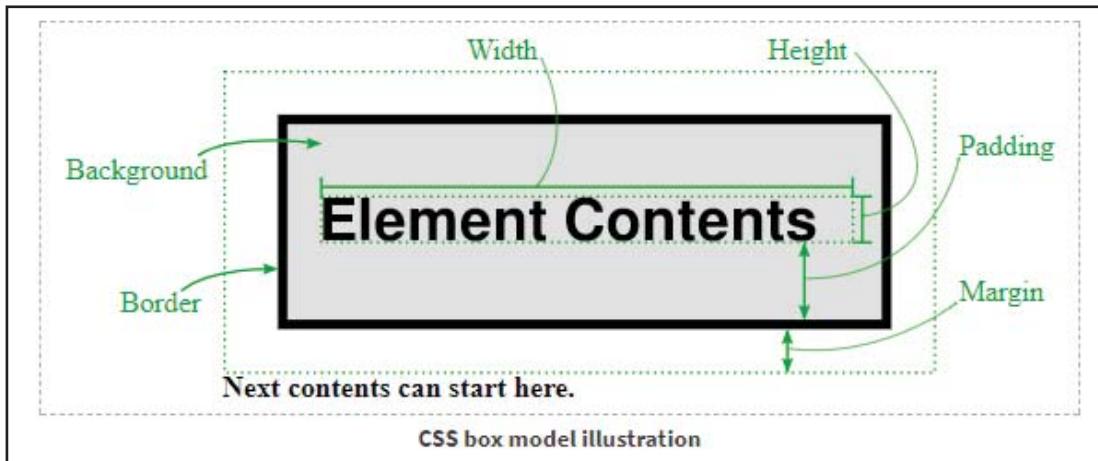
p{
    font-size:14pt;font-weight:bold;text-align:justify;color:red;
}
```



i. Common CSS properties reference

Property	Values	Used with Elements
color	#RRGGBB (Red, Green, Blue hex values)	any element that contains text
text-align	left right center justify	block elements h1..h6, p, li, etc.
text-decoration	none underline overline line-through blink inherit	mostly with a (anchor) elements
text-transformation	none capitalize uppercase lowercase	any element that contains text
line-height	% or px	block elements h1..h6, p, li, etc.
letter-spacing	normal or px value	any element that contains text
font-family	font or font-family [, font or font-family ...]	any element that contains text
font-size	px or em value	any element that contains text
font-style	normal italic oblique	any element that contains text
font-weight	normal bold	any element that contains text
background-color	#RRGGBB (Red, Green, Blue hex values)	any element with a background
background-image	url("[image url]")	mostly with body
background-repeat	repeat repeat-x repeat-y no-repeat	mostly with body
background-position	left center right top center bottom	mostly with body
list-style-type	disc square circle	ul

list-style-type	decimal lower-roman upper-roman lower-alpha upper-alpha	ol
-----------------	---	----



ii. CSS Box Model

There are several properties in CSS that are often grouped together as box properties which control the way browsers layout the page using the CSS box model.

These properties might not be immediately intuitive but aren't too difficult. Suppose we have an element on the page (like a `<h2>` Element Contents `</h2>`). Here are the parts of its “box” when drawn:

So, here is CSS code:

```
h2 {
    padding: 1em;
    border: medium dashed black;
    background-color: grey;
}
```

will make the `<h2>` have a grey background, with 1 em of space between the text and the border. The space inside the border (even if it's invisible because you don't have one) is covered with the background colour and is controlled by the padding properties.

If we want more space separating this element (and its border) from the stuff around it, we would have to increase the margin values. It's easy to mistake margin and padding, especially when there is no border or background colour. If you are trying to change the space around an element (especially when the browser's default CSS has some space there), try setting both margin and padding to zero and work from there.

```
ul{  
    margin: 0em;  
    padding: 0em;  
}
```

iii. CSS measurement units

You probably noticed the measurement **1em** above. The em is a unit of (length) measurement in CSS. Here are some common units that need a little explanation:

em - The current font size: if the current text is 12 point then this will be 12 points. Another unit, an ex is half the text size.

px - One screen pixel (dot) on the display. (Note: for some very high-resolution devices, real “pixels” are very small, so this length is adjusted to be close to the size of a pixel on a traditional display.)

mm - A millimeter. There are also units for centimeter, inch, etc. (Note: this is the browser's best guess, but might be inaccurate depending on the scaling of the display/projector/phone/etc. For example if you display your screen on a projector, the “millimeter” suddenly becomes much larger.)

```
p{  
    line-height: 1.5em;  
}  
  
blockquote{  
    margin-left: 2em;  
    border-left: 0.25em solid black;  
}  
  
#logoimg{  
    width: 120px;  
    height: 160px;  
    float: left;  
    margin-left: 1em;  
}
```

Example 5:

Here is an example page that we can style with some of the properties above:

```
<!DOCTYPE html>  
  
<html>  
    <head>  
        <meta charset="UTF-8" />  
        <title> CSS Properties </title>  
        <link rel="stylesheet" href="css-prop.css" />  
    </head>  
    <body>  
        <h1> CSS Properties </h1>
```

```
<h2> Goals </h2>

<p> This is a page that we're using to demonstrate various CSS properties
and techniques. Because of that, it's probably going to be ugly. </p>

<h2> Results </h2>

<p> Yes, it's turning out rather ugly, but it's important to demonstrate some
CSS stuff. Here are some of the new things: </p>

<ul>
    <li> more CSS properties </li>
    <li> the box model </li>
    <li> the units of length used </li>
</ul>

</body>

</html>
```

and a CSS to go with it:

```
body{
    font-family: "Helvetica", sans-serif;
}

h1{
    text-align: center;
    font-weight: bold;
    background-color: silver;
    color: teal;
    padding: 0.25em;
}

h2{
```

```
border: medium dotted teal;  
font-weight: normal;  
padding: 0.1em;  
}
```

Try experimenting with CSS on this page (or one you have created).

Exercises

1. State whether the following statements are True or False.

- a. HTML is a high-level programming language.
- b. HTML supports 6 different levels of headings.
- c. The first page of the website is known as the homepage.
- d. HTML tags are of two types:
 - Paired Tags
 - Singular Tags
- e. SIZE can take values between 1 and 7.
- f. .gif files are specified with BGCOLOR attribute.
- g. The tag used for inserting spaces in the HTML document is <MARKER>.
- h. Ordered lists are used for the bullet.
- i. START alters the numbering sequence in the middle of an ordered list.
- j. HTML allows only static text to be displayed on the page.
- k. “ALIGN=LEFT” indicates the image is aligned to the left with respect to the screen.
- l. SRC takes the name of an image file to be displayed as a parameter.
- m. HTML allows linking to other HTML documents as well as images.
- n. The vertical or the horizontal alignment for every cell in a given row is

- controlled by using the VALIGN and ALIGN attributes in the row's <TR> tag.
- o. A table header row is defined with the <TD> and </TD> tag pair.
 - p. CELLSPACING controls the distance between the data in a cell and the boundaries of the cell.
 - q. ALIGN=TOP will place the caption immediately above the table.
 - r. Anchors target links to the beginning of the document.
 - s. A filename always has to be mentioned before the # symbol in the HREF attribute of a link.

2. Answer the following questions.

- a) What is Hypertext Markup Language?
- b) Name the commonly used web browsers for viewing the HTML pages.
- c) What is an attribute?
- d) Differentiate between the paired tag and singular tag with examples.
- e) How is the FONT tag used? What are its attributes?
- f) Name the tags for breaking paragraph and line.
- g) What are the different types of lists used in HTML?
- h) What is a hyperlink?
- i) What is the use of intra page links? Illustrate with examples.
- j) Is it possible to give a background to the web page? If yes, then how?
- k) What are the main tags used in <TABLE> tag?
- l) What are the different input types?
- m) What is CSS?
- n) What are the advantages of using CSS?
- o) What are the components of a CSS Style?

3. Choose the correct answer.

- a. What does HTML stand for?
 - i. Hyperlinks and Text Markup Language
 - ii. Hypertext Markup Language
 - iii. Home Tool Markup Language
- b. The correct HTML tag for the largest heading is -----
 - i. <h1>
 - ii. <head>
 - iii. <heading>
 - iv. <h6>
- c. What is the correct HTML tag for inserting a line break?
 - i.

 - ii. <lb>
 - iii. <break>
- d. What is the correct HTML for adding a background color?
 - i. <body bgcolor="yellow">
 - ii. <background>yellow</background>
 - iii. <body color="yellow">
- e. The correct HTML tag to make a text bold is -----
 - i. <bb>
 - ii. <bold>
 - iii.
 - iv. <bld>
- f. The correct HTML tag to make a text italic is -----
 - i. <i>
 - ii. <ii>
 - iii. <italics>
- g. What is the correct HTML for making a hyperlink?
 - i. W3Schools.com
 - ii. W3Schools
 - iii. W3Schools.com
 - iv. <a>http://WWW.w3schools.com
- h. How can you make an e-mail link?
 - i. <mail> xxx@yyy </mail>
 - ii.
 - iii. <mail href="xxx@yyy">
 - iv.
- i. How can you open a link in a new browser window?
 - i.
 - ii.
 - iii.

- j. Which is NOT the attribute of <BODY> tag?
a. Background b. Text c. Color d. Link
- k. CSS stands for -----
(i) Creative Style Sheets (ii) Colorful Style Sheets
(iii) Cascading Style Sheets (iv) Computer Style Sheets
- l. Which of the following CSS tag is used for creating External style sheet?
(i) <style src="mystyle.css">
(ii) <stylesheet>mystyle.css</stylesheet>
(iii) <link rel= stylesheet href= "stylesheet file name">
- 4. Write the purposes and syntaxes of the following HTML tags.**
- a) <P> b) <SUB> c) <HR> d) <A>
e) <TABLE> f) g) <CENTER> h)
i) j) <U> k) l)

Activities

- 1. Design a web page having the following specifications.**
- The italic tag
 - The center tag
 - The Paragraph tag
 - The Break tag
 - The font tag and its attributes
- 2. Design a web page using the image files according to the following specifications.**
- Use a Border for Image
 - Resize the Width and Height of the image to 100 pixels each.

3. Create a Web page using HTML and CSS giving the following flight details.

- Airlines Name
- Departure Airport
- Destination
- Arrival and Departure time
- Fare

Use a caption saying “Time Table and Fare List”.

Airlines Name	Departure Airport	Destination	Time		Fare
			Arrival	Departure	
Singapore Airlines	Tri. Int. Airport	Singapore Changi Airport	14:45	19:15	Rs.60,000
-----	-----	-----	-----	-----	-----
-----	-----	-----	-----	-----	-----

4. Design website for your school having the following pages using HTML, CSS and Photoshop.

<i>Home</i>	<i>News & Events</i>
<i>About Us</i>	<i>Calendar</i>
<i>Teacher</i>	<i>Parents</i>
<i>Activities</i>	
<i>Photo Gallery</i>	<i>Contact US</i>



4.1 General Concept

(a) Program and programming

Computer Program

A computer program is a set of instructions given to the computer to perform a particular task. It is written in a programming language such as QBASIC, C, C++ etc. given by the users that are translated into machine level language to obtain the desired result.

Computer Programming

Computer programming is the process of designing, writing, testing, debugging, and maintaining the source code written in a particular computer language.

Programmer

A programmer is a person who is involved in the different processes of computer programming.

(b) Programming Language

It is a coded or artificial language used to write instructions that a computer can understand to do what the user wants.

A programming language is therefore a practical way for us (humans) to give instructions to a computer.

Types of programming language

i) Machine Language

Machine language is the most basic (also called low-level) computer language. It is directly understood by the computer as it uses binary ('1' and '0') code which a computer can run (execute) very fast without using any language translator. But it is very difficult to program using machine language.

```

Program Fragment:      Y = Y + X
Machine Language Code
(Binary Code)
Opcode          Address
1100 0000        0010 0000 0000 0000
1011 0000        0001 0000 0000 0000
1001 0000        0010 0000 0000 0000

Memory Cell Definitions:

Addr.    Name    Cell Contents
1000      X       32
2000      Y       16

```

Advantages of Machine Language

- It is directly understood by computer. So, no translator is required.
- Programs written using machine language runs fast.

Disadvantages of Machine Language

- It is very difficult to write a program in machine language because the programmer has to know all the details of the hardware.

It is difficult to debug the program.

ii) Assembly Language

Machine language is difficult to write programs as it requires knowing the details of hardware. Assembly language was developed to make computer programming easier. It uses letters and numbers (mnemonic codes) for instructions. It is second generation language.

```

; Example of IBM PC assembly language
; Accepts a number in register AX;
; subtracts 32 if it is in the range 97-122;
; otherwise leaves it unchanged.

SUB32 PROC      ; procedure begins here
    CMP AX,97   ; compare AX to 97
    JL DONE     ; if less, jump to DONE
    CMP AX,122  ; compare AX to 122
    JG DONE     ; if greater, jump to DONE
    SUB AX,32   ; subtract 32 from AX
DONE: RET        ; return to main program
SUB32 ENDP      ; procedure ends here

```

FIGURE 17. Assembly language

Fig. Assembly Language

Advantages of Assembly Language

- It is easier to program than machine language.
- It is easier to correct errors.

Disadvantages

- It requires translator (assembler) so it is little slow in execution.

It is machine-dependent. It means a program written for one machine might not run in other machines.

iii) High-Level Language

It is a third-generation programming language written in simple English with some mathematical notations such as +, % etc. It requires a language translator. QBASIC is one of the examples of high-level language.

Advantage of High-Level Language

- It is easy to learn and use.
- It is machine-independent.

```
check.bas - QB64
File Edit View Search
CLS
INPUT "Type any number "; a
r = a MOD 2
IF r = 0 THEN
    PRINT "Even"
ELSE
    PRINT "Odd"
END IF
END
```

Disadvantages of High-Level Language.

It requires a language translator. So, program execution takes more time.

(c) Language processor

Language processor is a program that performs tasks, such as translating and interpreting, required for processing a specified programming language.

Assembler

Translates the program written in assembly language into machine language and vice versa.

Compiler

Translates the whole program into machine language at once.

Interpreter

Translates one statement at a time.

Note:- Computer languages themselves are language processor. We don't require any other software/application as a language processor. For eg. C is a compiler and QBASIC is an Interpreter.

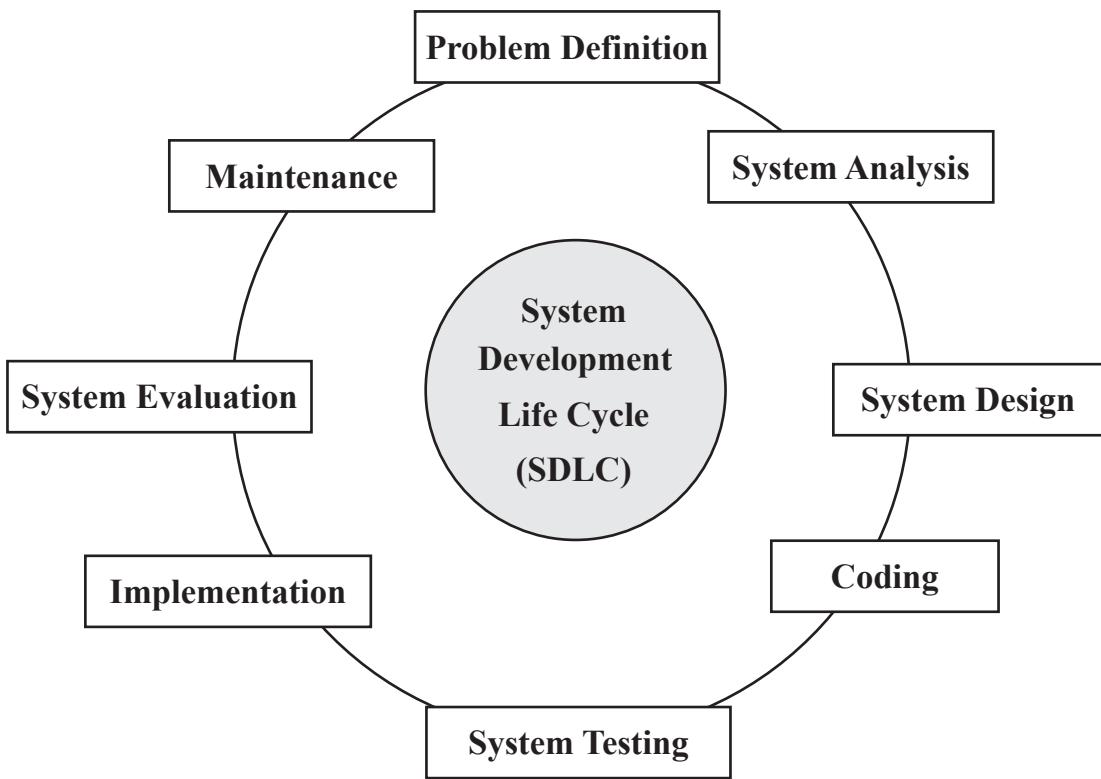
Differences between compiler and interpreter

- A compiler converts the high-level instruction into machine language while an interpreter converts the high-level instruction into an intermediate form.
- Before execution, entire program is executed by the compiler whereas after translating the first line, an interpreter then executes it and so on.
- List of errors is displayed by the compiler after the compilation process while an interpreter stops translating after the first error.
- An independent executable file is created by the compiler whereas interpreter is required by an interpreted program each time.



(d) Software Development Cycle

Application software development is the process of creating such software which satisfies the end user's requirements and needs. The process of developing the application software is called the Software Development Life Cycle (SDLC).



SDLC consists of mainly the following steps

i) Problem Definition

It involves the following tasks

- Defining the current problem
- Specifying the objectives of the program
- Establishing the system boundaries
- Input & output requirements

ii) System Analysis

In this phase, main activities included

- Understanding the problem
- Feasibility analysis or study
- System requirements

iii) System Design

This phase consists of designing a solution of the problem identified in the previous stages using different design tools such as Algorithm, Flowchart, Pseudo Code, Decision Table, Decision Tree, Data Flow Diagram (DFD), Entity-Relationship (ER) Diagram etc.

iv) System Development (Coding)

At this stage, the final program specification and the file design prepared in the previous phase is handed over to the programmer. The programmer will then translate the specification in a programming language. Executable programs are the outputs of this stage.

v) System Testing

Testing is a process of executing a program with the intent of finding an error and fixing them. There are two types of errors (bugs) – syntax errors and logical errors.

A syntax error is a violation of the rules of the programming language whereas the logic error has occurred when the programmer has used an incorrect calculation.

Testing is primarily divided into two types White Box Testing and Black Box Testing.

vi) System Implementation

In this phase, the system or application is installed and used in day to day activities of the organization.

vii) System Evaluation

The newly implemented system will be evaluated at this stage that helps developers and users to analyze and highlight the major strong and weak part of the system.

viii) System Maintenance

After the program has been fully tested and has become operational, it typically will require maintenance to modify or update the system.

(e) Algorithm and Flowchart

Algorithm and Flowchart are the system design tools which are used to solve different problems before coding.

Pseudocode:

Pseudocode is the method in which we begin to write the step necessary to accomplish the task with short English statements. These codes are not ready to be used because they are not standardized as an algorithm.

Example:

Pseudocode to calculate the sum of any two numbers

Start Program

Enter two numbers, A, B

Add the numbers together

Print Sum

End Program

Algorithm:

An algorithm is a precise rule (or set of rules) specifying how to solve a specific problem infinite number of steps. A good algorithm should:

- Be language independent.
- Be simple, complete, unambiguous and step-wise.
- Have no standard format or syntax.
- Be helpful to understand problems.

Example 1:

Algorithm to calculate the sum of any two numbers

Step 1: Start

Step 2: Ask any two numbers and stores into a and b

Step 3: $c = a + b$

Step 4: Display c

Step 4: Stop

Example 2:

Algorithm to find the greater number among any two supplied numbers

Step 1: Start

Step 2: Ask any two numbers and stores into a and b

Step 3: Is $a > b$?

If yes, display a

If no, display b

Step 4: Check more?

If yes, go to step 2

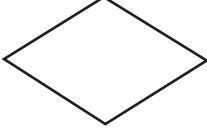
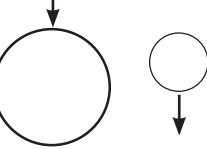
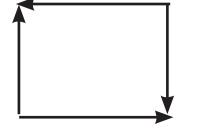
If no, go to step 4

Step 5: Stop

Flow chart:

A diagram of the sequence of operations in a computer program is called flow chart. It uses few standard symbols. They are:

S.N.	Symbol	Name	Description
1.		Start/End Symbol	Represents START and END of the program.
2.		Input/output Symbol	Represents input and output of data.
3.		Process	Process block. Represents process, formula or function.

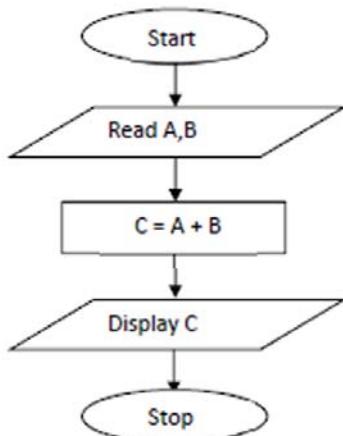
4.		Decision	Decision block. Represents any decision in the program.
5.		Connector	Connector. Used to link to a segment of the flowchart.
6.		Flow Lines	Flow lines. Used to show the direction of flow of the program.

Uses/Advantages of Flow chart:

- a) An efficient means of communication
- b) An analytic tool
- c) A concise form of documentation

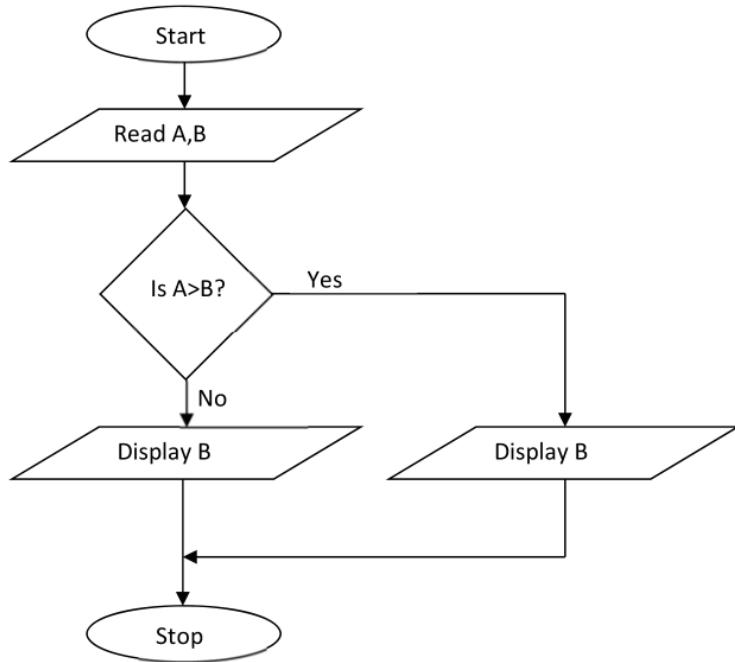
Example 1:

Flowchart to find the sum of any two supplied numbers



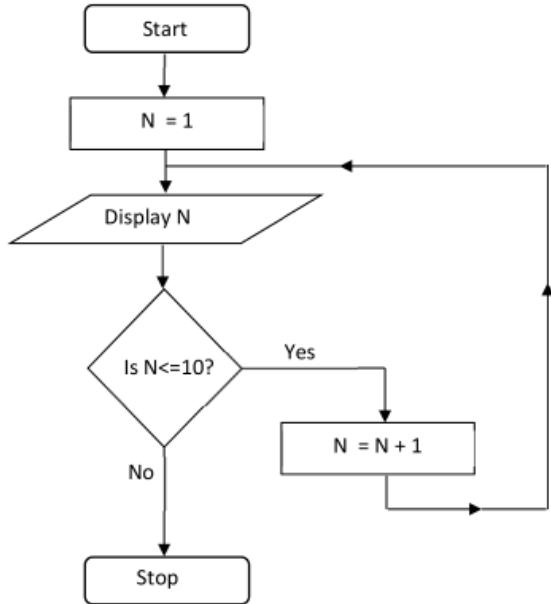
Example 2:

Flowchart to find the greater number among any two supplied numbers



Example 3:

Flowchart to display the first 10 natural numbers



Summary

- A computer program is a set of instructions given to the computer to perform a particular task.
- Computer programming is the process of designing, writing, testing, debugging, and maintaining the source code of computer programs.
- A "programming language" is a coded or artificial language used to write instructions that a computer can understand to do what the user wants.
- A programmer is a person who is involved in the different processes of computer programming.
- Language processor is a program that performs tasks, such as translating and interpreting, required for processing a specified programming language.
- Compiler translates the whole program at once whereas interpreter translates one statement at a time.
- SDLC consists of different phases: Problem definition, System Analysis, System Design, Coding, Testing, Implementation, Evaluation and Maintenance.
- An algorithm is a precise rule (or set of rules) specifying how to solve a specific problem with infinite number of steps.
- A diagram of the sequence of operations in a computer program is called flowchart. It uses few standard symbols.

Exercises

1. Answer the following questions.

- a) Define program and programming.
- b) What is a programming language? Explain with its types.
- c) What are the language processors?
- d) Differentiate between Compiler and Interpreter.
- e) What is SDLC? Explain the various phases involved in SDLC.

- f) What is an algorithm? List the characteristics of algorithm.
- g) What is a flowchart? List the common symbols of flowchart with their function.
- h) List the advantages of the flowchart.

2. Write down the algorithms and draw the flowcharts for the following programs.

- a) To calculate the volume of a room
- b) To calculate Simple Interest and total amount.
- c) To convert the length of your room from cm to meter
- d) To check whether the supplied number is odd or even
- e) To display the smallest number among any 3 supplied numbers

3. Write down the single word for the following statements.

- a) A step of instructions given to the computer to perform a specific task.
- b) The process of designing, writing, testing, debugging and maintaining the source code of computer.
- c) Translates the whole program into machine code at once.
- d) Computer language is written in simple English with some mathematical notation.
- e) A step-by-step solution to a problem
- f) A graphical representation of a solution to a problem.
- g) A flowcharting symbol used while taking decisions.

4.2 Programming in QBASIC

4.2.1. Introduction

QBASIC (Quick Beginner's All-purpose Symbolic Instruction Code) is a high-level programming language developed by Microsoft Corporation in 1985. It is a modular programming language, where program is divided into different modules or procedure. QBasic is simple and easy to learn. It uses English like keywords and mathematical symbols to write a program.

(a) Features of QBasic programming

Some features of QBasic are:

- It is simple and easy to learn.
- It is an interpreter having its own editor.
- It has dynamic program debugging
- It supports the local and global variable.
- It supports modular programming.
- It capitalizes the reserved words automatically.
- The syntaxes of the statements are checked automatically.

(b) QBASIC interface

Starting QBASIC

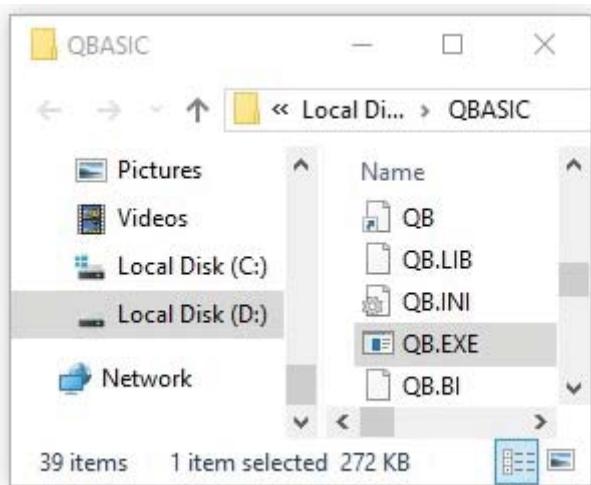
QBASIC may not be on your computer. At first, you need to have QBASIC in your computer. It is freely available. You can download it from the Internet as well.

QBASIC

In Windows XP,

- If you are not using QB64, you can download QBASIC from the Internet and save it in any location inside your computer. For instance, we have saved it in D: drive with folder name QBASIC.

- Go inside the folder D:\QBASIC and double click on the file QB.EXE.
- Now, you will see the QBASIC window where you have to write QBASIC statements to make your program.

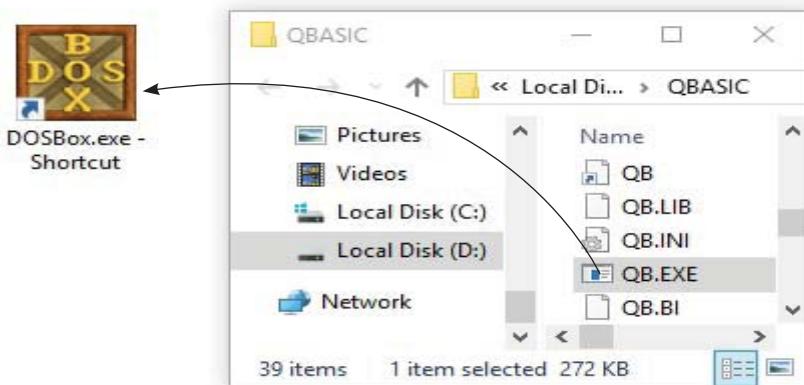
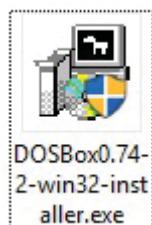


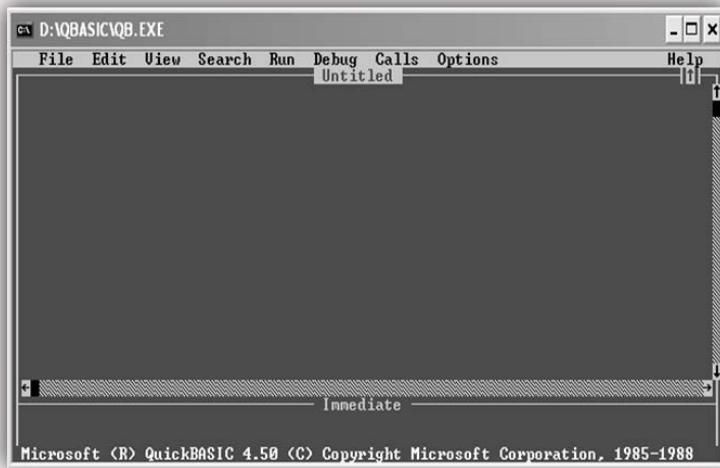
In Windows 7, 8 or 10

Since the QBASIC is an old programming language. You cannot directly open this version of QBASIC like in Windows XP. You need to install an emulator program like DOSBox.

Use the following steps to run QBASIC using DOSBox.

1. Download DOSBox from <https://WWW.dosbox.com/>
2. Install DOSBox by simply double-clicking on the installation file.
3. After the installation of DOSBox, its shortcut icon will appear on the desktop.
4. Open the QBASIC folder and select the file QB.EXE.
5. Drag and drop on the icon of DOSBox on your desktop.





6. QBASIC will open inside DOSBox.

Your First Program

Just type the below statements in the above screen.

PRINT "hello world"

END

```
D:\QBASIC\QB.EXE
File Edit View Search
PRINT "hello world"
END
-
```

Running (executing) your program.

Press F5 button of your keyboard. Now, you will see the output screen as below:

This is a sample program to display the words “hello world” on the output screen.

```
D:\QBASIC\QB.EXE
hello world
```

Saving your file

- Go to the File menu and click on “Save”.
- Give a suitable file name.



Opening your existing file

- Go to the File menu and click on “Open”.
- Select the required file and click on “Ok”.

Getting Out

If you need to leave QBASIC, you can click on "File" on QBASIC's menu and then "Exit".



QBASIC Shortcuts

- Press Alt+F, the sub-menus of “File” menu will be displayed as in the left-side figure.
- You can see several characters in white colour.
For example:
Press ‘O’ to open an existing file as the letter ‘O’ is seen in white colour in “Open Program” sub menu of “File” menu.

Immediate Window

The lower part of the QBASIC editor is called the Immediate window. From this window, single-line commands and expressions are tested. In Immediate window, as soon as you press Enter (\downarrow) key, it displays the output on the screen.

Note: To switch between Program window and Immediate window – Press F6 button.

Exercises

1. Answer the following questions.

- a) Why is QBASIC called high-level programming language?
- b) List any four features of QBASIC.
- c) Differentiate between Program window and the Immediate window.
- d) List the steps of writing and executing a program in QBASIC.

2. List the shortcut keys to do the following tasks.

- a) To run the program
- b) To switch between the program window and Immediate window
- c) To open an existing file
- d) To see the help of QBASIC program
- e) To exit from QBASIC editor

4.2.2 Variables and Constants

(a) Data and Data Type

Data is any value (raw or unprocessed) given to the program for processing.

Basically, QBASIC supports two types of data.

- i) String - any alphanumeric values and valid symbols
- ii) Numeric - only numbers (0-9)

QBASIC supports further sub-types of numeric data:

Integer	Non-floating-point numbers from -32,768 to 32,767
	Examples: -34, 987, 0
Long Integer	Non-floating-point numbers from -2,147,483,648 to 2,147,483,647
	Examples: 340035, 7, -24, 0, -127010, 14, 8, -10
Single-Precision	Floating-point numbers from -3.37×10^{38} to 3.37×10^{38} (up to 7 digits)
	Examples: 3.45, 31.4567, -35.23, 0.45, -3.15, 890, -98
Double Precision	Floating-point numbers from -1.67×10^{308} to 1.67×10^{308} (up to 15 digits)
	Examples: 723661.90226, -128.78, 185321.093423, 2345544, -123456897

Character Set

Characters from the QBASIC character set are combined to form keywords, variables, operators and labels. They are further combined to form instructions that make up a program. The QBASIC character set consists of all alphabetic letters (both uppercase and lowercase), all digits and some special characters having special meaning to the basic translators.

#, \$!, %,&	They are suffixes used at the end of variable names to specify the type of variable.
+,-,*,/,\	They are mathematical operators.
<,>,=	They are relational operators.
(,)	They are parenthesis.
:	It is used to write multiple statements in a single line.

, ;	They are separators and are used to separate the arguments in input and output statements.
^	It is exponentiation and is used to raise power to.
?	It can be used in place of a PRINT statement.
'	It is used to mark a line as a comment instead of a REM statement.
.	It is a decimal point and is used in numbers.

A character denotes any alphabet, digit or special symbol used to represent information. The below table shows the valid alphabets, numbers and special symbols supported by QBASIC.

Alphabets	A,B,C,, X,Y,Z a,b,c,, x,y,z
Digits	0,1,2,3,4,5,6,7,8,9
Special Characters	, =, +, -, _, *, /, \, ^, %, \$, &, !, #, “, ;, ., ‘, ,, ?, <, >

Words

These are mainly the following two types:

Reserved words: Words having a special meaning to QBASIC such as the name of the statements, library functions etc. are termed as reserved words or keywords.

E.g. Statements PRINT, INPUT, LET, CLS etc are reserved words and should not be used as the name of the variables or functions.

User-Defined words: These are the words used in statements as variables or user-defined functions. These variables may have different meanings in different programs.

Example: LET NAME\$="STEVE"

Here, LET is a keyword and is a reserved word while NAME\$ is a variable and is a user-defined word.

(b) Variable

A variable is a small amount of computer memory (RAM) that has been given a name. It stores the value of a particular data type while the program is being executed. The

location of a variable in RAM is called the "address."

Rules for naming variables

- i) Each variable name must start with an alphabetic character though it can contain alphabetic and numeric characters and periods.
- ii) The variable name cannot be a BASIC keyword.
- iii) Variable names can be up to 40 characters long.
- iv) Each variable name is followed by a symbol. The symbol refers to the data type it might hold.

Few Examples:

Variable Name	Valid	Invalid	Reason
1BC		×	The first letter is a numeric character
LET		×	Keyword
ABC\$	√		Starts with alphabets and \$ sign indicates the data type string.
BC+		×	The invalid symbol is used

(c) Constants

A constant is an entity that doesn't change, whereas a variable is an entity that may change.

Example:

a = 4

4

a

Since the location whose name is a can hold different values at different times, so a is known as a variable. As against this, 4 does not change, hence is known as constant.

Types of Constants

Numeric Constant

It has only numbers from 0 to 9. For example: 45,456.35, -44 etc.

String Constant

It accepts both numbers and alphabets (alphanumeric values). Examples: “Nepal”, “45.67”, “A45” etc.

Symbolic Constant

A constant whose value remains the same through the whole program is called a symbolic constant. In QBASIC, CONST statement is used to declare a symbolic constant.

(d) Variable Declaration

QBASIC supports two types of variable declaration.

i) Implicit Declaration

In this type of declaration, the type of variable is defined as certain special declaration characters. We use %,&,!,# and \$ symbols to declare the variable type implicitly.

Example:

A\$=”Nepal”

Here, we use \$ symbol after the variable name A, which indicates the type of variable is string.

INPUT “Type any number “;B%

Here, we use % symbol to declare the variable type integer.

ii) Explicit Declaration

In this type of declaration, we use DIM ...AS statement.

DIM variable AS type

It defines the type of variable and we can use the following keywords.

INTEGER, LONG, SINGLE, DOUBLE, and STRING

Example:

DIM A AS STRING, B AS INTEGER

CLS

```

INPUT "Type your name "; A
INPUT "Your roll number "; B
C$ = MID$(A, 1, 1)
PRINT "First character of your name is "; C$
PRINT "Your roll number is "; B
END

```

Here, in the above program, the declaration characters (\$ and %) are not used for the string-type variable A and integer-type variable B. So, A and B are defined explicitly using DIM...AS statement and C is defined implicitly.

Data types and variable declaration in QBASIC

Data Type	Declaration	Byte Length	Maximum	Minimum
String	\$ [STRING]	1 byte/char	32,767 chars	0 chars
Integer	% [INTEGER]	2 bytes	32,767	-32,768
Long Integer	& [LONG]	4 bytes	2,147,483,647	-2,147,483,648
Single Precision (up to 7 digits)	! [SINGLE]	4 bytes	±3.402823 E+38	±1.401298 E-45
Double Precision (up to 15 digits)	# [DOUBLE]	8 bytes	± 1 . 7 9 7 6 9 3 1 D+308	±4.940656 D-324

Exercises

1. Answer the following questions:

- a) What is QBASIC character set?
- b) Differentiate between reserved word and user-defined word.
- c) Define constant. List its types.
- d) What is a variable? Why is it needed in programming?
- e) Mention the rules for naming variables.
- f) What are the differences between variable and constant?
- g) Define a symbolic constant.
- h) List the different types of numeric variables and describe briefly each of them.
- i) What are implicit and explicit declarations of variables? How are they declared in QBASIC?

2. State whether the following statements are True or False.

- a) In QBASIC, any characters can be used for writing programs.
- b) The word with special meaning defined already in QBASIC is called user-defined word.
- c) Numeric data should be enclosed in double-quotes.
- d) A variable stores data used in a program permanently.
- e) A numeric variable can store alphanumeric value.
- f) An integer variable can store number with a decimal place.
- g) A variable name can be up to 14 characters long.
- h) A double-precision variable allocates 8 bytes of memory.
- i) The declaration of a variable using special symbols is called an explicit declaration.
- j) Integer variables cannot hold negative values.

4.2.3 Operators, expressions and operands

(a) Operators

Operators are the symbols used to represent a particular operation. QBASIC supports three types of operation: arithmetic, relational and logical operators.

i) Arithmetic Operators

These operators represent arithmetic operations such as addition, subtraction, multiplication etc.

Operator	Operation	Example	Result
$^$ (caret)	Exponentiation	10^3	1000
$/$ (slash)	Division	$10/3$	3.333333
\backslash (back slash)	Integer Division	$10\backslash3$	3
$*$ (asterisk)	Multiplication	$10*3$	30
$+$ (plus)	Addition	$10+3$	13
$-$ (minus)	Subtraction	$10-3$	7
MOD	Modular Division	10 MOD 3	1

Sequence of operation in BASIC (Hierarchy/Precedence of operation)

The hierarchy of operation in BASIC is commonly called as the PEDMAS rule where;

P	Parenthesis	$()$
E	Exponentiation	$^$
D	Division	$/, \backslash, \text{MOD}$
M	Multiplication	$*$
A	Addition	$+$
S	Subtraction	$-$

- Multiplication and division has the same hierarchy and hence whichever comes first from left to right has to be dealt first.
- Similarly, addition and subtraction also have the same hierarchy.
 - E.g.: In the expression $A * B / C$; A will be divided by B first after which the result will be divided by C.
- Similarly, in the expression $X - Y + Z$, Y will be subtracted by X after which Z will be added to it.

ii) Relational (Comparison) Operators

Relational operators are used to comparing two values and return either true or false.

Assuming that the values of a and b are 6 and 3 respectively.

Operator	Operation	Example	Result
=	<i>Equal to</i>	$a = b$	<i>False</i>
<	<i>Less than</i>	$a < b$	<i>False</i>
>	<i>Greater than</i>	$a > b$	<i>True</i>
<=	<i>Less than or equal to</i>	$a <= b$	<i>False</i>
>=	<i>Greater than or equal to</i>	$a >= b$	<i>True</i>
\diamond	<i>Not equal to</i>	$a \diamond b$	<i>True</i>

iii) Logical Operator

Logical operators are used to combining two or more relational expressions and return a single value as True or False after evaluating them.

AND Operator

An AND operator returns True (1) at its output only when all of the inputs are high (1). False (0) is returned when one or more of the inputs are low (0).

OR Operator

An OR operator returns True (1) at its output when one or more of its inputs are high (1). False (0) is returned only when all of the inputs are low (0).

NOT Operator

The NOT operator (Inverter) performs the logic function called inversion or complementation. If the input signal is low then the high output signal is obtained and vice versa.

iv) String Operator

+(plus) → Concatenation

Concatenation is the process of joining two string expressions.

A\$ = "Visit" B\$= "Nepal" C\$=A\$+B\$	The value of C\$ is: VisitNepal
--	--

(b) Expressions

An expression is a set of variables and constants having a definite value (operands) in which various mathematical operators are used to show the relationship between the variables and constants.

Example:

$$a+b)^2 - 2*a*b$$

$$X$=MID$(A$,N,1)$$

Types of expression

Algebraic Expression

The expressions that are used in mathematical and other fields are called Algebraic expression.

Example: $S = ut + \frac{1}{2}at^2$

QBASIC Expression:

The expressions that can be used in QBASIC programs are called QBASIC expressions.

Example: $S = u*t + (a*t^2)/2$

Boolean Expression

Any expression that yields true or false value (0 or 1) is known as a Boolean expression. The conditions we check in the programs are Boolean expression.

Example: $a \geq b$

Algebraic Expression into QBASIC Expression

QBASIC has the provision to handle any complex arithmetic expression. However, the system cannot understand terms like X^2 , $A \times B$, etc. in the present form. Certain arithmetic operators (or symbols) which are meaningful to the computer are to be used to evaluate such arithmetic expressions.

Algebraic Expression	QBASIC Expression
$A + B - C$	$A + B - C$
$X \times Y \div Z$	$X * Y / Z$
$I = \frac{PTR}{100}$	$I=(P*T*R)/100$
$(a+b)(a-b)$	$(a+b)*(a-b)$
$\left(\frac{a}{b}\right)x^2$	$(a/b)*x^2$

(c) Operands

Operands are the values on which the operator performs its operation.

For example, in the below expression

$$C = A+B$$

The symbols ‘=’ and ‘+’ are the operators and the variables ‘C’, ‘A’ and ‘B’ are the operands.

Exercises

1. Answer the following questions.

- What is the operator? List the different operators that can be used in QBASIC.
- What are the arithmetic operators? List their operations.
- What are the relational operators? List their operations.
- What are the logical operators? List their operations.
- Define AND operator. Write down the truth table of AND operator.
- Define OR operator. Write down the truth table of OR operator.
- What is an expression? List its types.

2. Write down the QBASIC expression of the following algebraic expression.

- $A = \Pi r^2 h$
- $F = \frac{9C}{5} + 32$
- $I = \frac{PTR}{100}$
- $A = 2h(l+b)$
- $x^3 + x^2y + xy^2 + y^3$
- $X = \frac{-b + \sqrt{b^2 - 4ac}}{2a}$
- $P = \frac{e+m+c+n}{400} \times 100$
- $\sqrt[3]{4xy}$
- $(a+b)^2 = a^2 + 2ab + b^2$
- $\frac{x+y}{x-y} + \frac{x \times y}{x+y}$

3. State whether the following statements are True or False.

- Concatenation is the process of combining two strings.
- The logical operator compares two values.
- The relational operator combines the results of relational expression and returns either True or False.
- An operand is a symbol that represents a particular operation.
- OR operator returns True if any of the input is True.
- AND operator returns False if all the inputs are False.

4.2.4 Program Statements

QBASIC Statements

The instructions within a program are called statements. Each QBASIC instruction is like a sentence. As a sentence must have a verb in it, each QBASIC instruction must have a QBASIC keyword. A QBASIC statement is either executable or non-executable.

Types of Statements

Statements can be categorized into four groups.

- Declaration Statements
- Assignment Statements
- I/O (Input/Output) Statements
- Control Statements

(a) Declaration Statement

i) REM or ‘ statement [Comments]

Comments may be included in a QBASIC program to describe the purpose or to clarify some portion of code in the program. In QBASIC, we use REM or ‘ for comments.

Purpose: To write explanatory remarks (comments) to be inserted in a program

Example:

REM to find the sum of two numbers

CLS

INPUT "Type any two numbers: "; a, b

PRINT "Sum = "; a + b

END

ii) END statement

You have already used the END statement to terminate your program.

Purpose: It is a declaration that ends a QBASIC program, procedure or block.

Syntax:

END [{DEF | FUNCTION | IF | SELECT | SUB | TYPE}]

Note: END statement is also used to terminate function, IF construct, subprocedure etc., which will be covered in the next chapter.

iii) CONST statement [Symbolic Constant]

A symbolic constant is a symbol represented by a name such as a variable which stores one and only one value throughout the whole program.

Symbolic constants may be numbers or strings. A symbolic constant can be declared using keyboard CONST.

Purpose: A non-executable statement that declares symbolic constants to use in place of numeric or string values

Syntax:

CONST constant name = expression

- constant name is a name of a variable.
- expression consists of literals, other constants, or any of the arithmetic and logical operators except exponentiation (^).

Example:

CONST pi=3.14

Here, pi is a symbolic constant and its value remains same as 3.14 throughout the whole program and cannot be changed.

General Constant	Symbolic Constant
$A = 45$	CONST A = 45
$A = A + 5$	$A = A + 5$
Possible to change the value of general constant.	Not possible to change the value of symbolic constant.

iv) DIM statement

Purpose: DIM specifies a data type for a variable (explicit declaration) or declares an array.

We have discussed about explicit declaration of variable in previous chapter. Array will be discussed later on.

Explicit declaration of Variable using DIM statement:

Syntax:

DIM variable [AS type]

- type declares the data type of variable (INTEGER, LONG, SINGLE, DOUBLE, STRING)

Example:

DIM A AS STRING

Here, 'A' is declared explicitly as string variable.

(b) Assignment Statement

These statements are used to assign a value to a variable.

i) LET statement

Purpose: To assign a value to a variable.

Syntax:

[LET] variable=expression

Example:

LET A = 200

C\$ = "SCHOOL"

Here, A is a numeric variable and the value 200 is assigned to A. Similarly, C\$ is a string variable and the value "SCHOOL" is assigned to C\$.

Note: In QBASIC, a value can be assigned to a variable without LET statement also.

Example:

LET A=200

The above statement is equivalent to

A=200

ii) SWAP statement

Purpose: an assignment statement that exchanges the values of two variables of same type.

Syntax:

SWAP variable1, variable2

- variable1 and variable2 must be of exactly the same type

Example:

CLS

a = 5: b = 10

SWAP a, b

PRINT "The value of a = "; a

PRINT "The value of b= "; b

END

(c) I/O (Input/Output) statements

The statements that are used to supply the data during the execution of the program from the keyboard or file are called input statements.

Similarly, the statements that are used to get the result of the processing from the output device or to the file are called output statements.

i) CLS statement

Purpose: To clear the display screen

Syntax:

CLS

Note: It is a good practice to start your every program with CLS statement so that the previous displayed content will be erased before executing your new program.

ii) INPUT statement

Purpose: To read input from the keyboard during program execution and stores it into a list of variables.

Syntax:

INPUT[;]["prompt string" {;|,}]variable list

- variable list is one or more variables separated by commas
- promptstring, if used, is displayed on the screen to tell the user of the program what to enter on the keyboard
- the characters ";" and "," are the separators

Example:

INPUT “Type First Number”;a

Here, a is a numeric variable.

“Type First Number” is a prompt string

Note: You can also ask more than one value from a single INPUT statement.

INPUT “Type any two numbers.”; a, b

Here, comma (,) is used to separate the list of variables.

INPUT a, b

The above statement is also valid without a prompt string.

iii) LINE INPUT statement

Purpose: To input an entire line (up to 255 characters) to a string variable, without the use of delimiters.

Syntax:

LINE INPUT[;] ["promptstring";] stringvariable

Example:

```
CLS  
LINE INPUT "Describe about yourself "; $$  
PRINT $$  
END
```

iv) PRINT statement

Purpose: To display the output on the screen.

Syntax:

PRINT [expressionlist][{,|;}]

- If all arguments are omitted, a blank line is printed.
- If expression list is included, the values of the expressions are printed on the screen.
- The expressions in the list may be numeric or string expressions. (String literals must be enclosed in quotation marks.)
- The optional characters "," and ";" are the separators.

Example:

N = 50

PRINT "I live in Kathmandu."

PRINT 5;6

PRINT (3+2 + N) / 3

Note: You must enclose string constant with double quotes ("").

As a shortcut, use a question mark symbol (?) for PRINT. Try it. Press <Enter> to start typing on a new line. Now

Type this:

? "Programming is fun."

and press <Enter> again.

Other Examples:

RINT

A blank line is printed.

PRINT 2*8+5

Here the expression is $2*8+5$ and the evaluated value of this expression 21 ($2*8+5=21$) is printed.

PRINT “Nepal”

String literals “Nepal” enclosed in quotation marks is printed.

Similarly, the values of variables can be displayed in the following ways.

INPUT “Type your name”; N\$

PRINT “Your name is”; N\$

INPUT “Type your roll number”;r

PRINT “Your roll number is”;r

Or you can write this statement.

PRINT “Your name is”; N\$; “ and your roll number is ”;r

Try these statements:

PRINT N\$;r

PRINT N\$,r

Now find the difference in the output using; and, as a separator.

v) PRINT USING statement

Purpose: To print strings or numbers using a specified format

Syntax:

PRINT USING formatstring; expressionlist[{|};]}

- formatstring, a string-expression, specifies the format.

- expressionlist contains the items to be printed

Characters used to format a Numeric Expression

- # Digit position
- Decimal point position
- ,
- Placed left of the decimal point, prints a comma every third digit
- \$\$ Prints leading \$
- +
- Position of number's sign
- ^^^^ Prints number in exponential format
- ** Fills leading spaces with *
- **\$ Combines ** and \$

Example:

Statement	Output
PRINT USING "##.##"; .12	0.12
PRINT USING "###.##"; 117.614	117.61
PRINT USING "##.## "; 10.2; 5.3; 66.789; .234	10.20 5.30 66.78 0.23
PRINT USING "+##.## "; -68.95; 2.4; 55.6; -.9	-68.95 +2.40 +55.60 -0.90
PRINT USING "***#.# "; 415.4; -.5; 76.14	415.4 *-0.5 *76.1
PRINT USING "\$###.##"; 125.18	\$125.18
PRINT USING "***\$##.##"; 7.69	***\$7.69
PRINT USING "##.##^^^^"; 758.56	7.59E+02
PRINT USING "####,.##"; 1452.9	1.452.90

Characters used to format a String Expression

- & Prints entire string
- !
- Prints only the first character of the string
- \\
\\ Prints first 'n' characters, where n is the number of blanks between slashes + 2

Example:

```
A$ = "LOVE": B$ = "NEPAL"  
PRINT USING "!" ; A$; B$      'First characters of A$ and B$.  
PRINT USING "\ \" ; A$; B$   'Two spaces between backslashes, prints 4  
'characters each from A$ and B$  
PRINT USING "&" ; B$        'all of B$
```

Output:

```
LN  
LOVENEPAL  
NEPAL
```

vi) LPRINT and LPRINT USING statements

Purpose: I/O statements that print data on the printer LPT1

Syntax 1:

```
LPRINT [expressionlist][{;}]
```

Syntax 2:

```
LPRINT USING formatstring; expressionlist[{;}]
```

Example:

```
LPRINT "LOVE"; TAB(76); "NEPAL"
```

vii) READ and DATA statement

READ statement – an I/O statement that reads values from a **DATA** statement and assigns the values to variables

Syntax:

READ variablelist

- Variablelist is made up of one or more variables, separated by commas, which are to receive the data. The variables may be string or numeric.

DATA Statement – a non-executable statement that stores the numeric and string constants used by a program's **READ** statements

Syntax:

DATA constant[,constant]...

- constant is any valid numeric or string constant.

Example 1:

READ a, b, c

PRINT a, b, c

DATA 34,56,78

Example 2:

READ a\$, b

PRINT a\$, b

DATA "Nepal's View",45

Example 3:

FOR i = 1 TO 5

READ n

s = s + n

NEXT i

PRINT "Sum = "; s

DATA 56,78,65,43,21

END

Note:

- READ statement cannot be used without DATA statement.
- DATA statement can be placed anywhere in the program.
- Data and variable types should be same.
- In DATA statement, string data is not necessary to be enclosed by double quotes.
- If number of variable in READ statement is more than number of data in DATA statement, an error message “Out of DATA” will be displayed.

Summary of the chapter

- The instructions within a program are called statements.
- Types of statements: Declaration, Assignment, I/O and Control
- Declaration Statement: REM or ', CONST, DIM
- Assignment Statement: LET, SWAP
- I/O Statement: INPUT, PRINT, INKEY\$, READ - DATA

Sample Programs

1. REM ask name, address & class and display them

```
CLS  
INPUT "Type your name "; n$  
INPUT "Type your address "; a$  
INPUT "Type your phone "; c  
PRINT "Your name is "; n$  
PRINT "You live in "; a$  
PRINT "You study in class "; c  
END
```

2. REM To find the sum of any two integers

```
REM Implicit declaration  
CLS  
INPUT "Type first number "; a%  
INPUT "Type second number "; b%  
c% = a% + b%  
PRINT "Sum = "; c%  
END
```

3. REM To find the area of a circle

```
' Symbolic constant  
CONST pi = 3.14  
  
INPUT "Radius of a circle "; r  
  
a = pi * r ^ 2  
  
PRINT "Area = "; a  
  
END
```

4. REM Explicit declaration

```
DIM a AS INTEGER, b AS INTEGER, c AS LONG  
  
CLS  
  
INPUT "Type first number "; a  
  
INPUT "Type second number "; b  
  
c = a * b  
  
PRINT "Product = "; c  
  
END
```

5. REM find average using READ ... DATA

```
CLS  
  
READ a, b, c  
  
avg = (a + b + c) / 3  
  
PRINT "Average = "; avg  
  
DATA 45,67,52  
  
END
```

Exercises

1. Calculate the output from the following QBASIC expression:

- a) $(3 - 4) + 3 * 2 / 4$
- b) $3 * 5 / 5 + 2 - (14 * 2)$
- c) $(2 + 4 / 2 * 3) * 2$
- d) $(3 + 4 - 2 * 3 / 2) / 2$
- e) $(4 * (4 / 4 + 4 * 4 + 4 - 4))$

2. Write down the syntax and use of the following QBASIC statements.

- a) SWAP statement
- b) CONST statement
- c) PRINT statement
- d) INPUT statement
- e) READ ... DATA statement

3. Debug the following programs.

a) CLS

a\$ = Mount Annapurna

b = "45"

c% = 32.45

d# = 456

e% = 40512

PRINT a\$, b, c%, d#, e%

END

b) CLS

p = Rs. 34045

t = 2 years

r = 6%

I = ptr / 100

PRINT "Simple Interest = "; I

END

c) CLS

READ a\$

READ c, r

PRINT "Your name is "; a\$

PRINT "Your class is "; c

PRINT "Your roll is "; r

READ s\$

PRINT "Your section is "; s\$

DATA Ramesh

DATA 4

DATA 10,A,5

END

4. Write down the output of the following.

PRINT USING "##.##"; 1.36

PRINT USING "###.##"; 17.614

PRINT USING "##.## "; 187.2

PRINT USING "+##.## "; -168.9

PRINT USING "##.#"; 45.4

PRINT USING "\$\$###.##"; 4125.18

PRINT USING "##\$##.##"; 7.69

PRINT USING "##.##^^^^"; 758.56

PRINT USING "####,##"; 1452.9

PRINT USING "!";
"; "Nepal"

5. Write down the QBASIC code for the following problems.

- a) Write a program that asks any two numbers and displays their sum, difference and product.
- b) Write a program that asks any number and calculates its square, cube, square root and cube root.
- c) A salesman has purchased a computer at Rs. 45,000 and he sold it at Rs. 49,850. Write a program to calculate profit percent on sale (use explicit declaration).
- d) Computer book costs Rs. 457. Write a program that asks the number of books to be purchased and calculates the total amount to be paid (use LET statement).
- e) Write a program that asks radius of a circle and calculates its diameter, circumference and area (use symbolic constant).
- f) Write a program that accepts the room temperature in Fahrenheit degree and calculates its equivalent in Celsius degree. [Hint: $F = \frac{9C}{5} + 32$]
- g) Write a program to convert the length from feet into inches.
- h) Write a program that asks the length, breadth and height of a room and calculates the volume of the room.
- i) Write a program that reads the below data and calculates their average value.
DATA 45,64,23,12,54

4.2.5 Program Flow and Control Structures

A program is a set of statements. When we run the program, its statements are executed to perform our tasks. Normally, they are executed one after another from top to bottom. The order of execution of statements of a program is known as the flow of program or program control.

Control Structure

Control structures are used to alter the way of execution of the program or used to control the flow of a program. The controls are classified into three types.

- Sequential Structure
- Selection Structure
- Looping Structure

(a) Sequential Structure

In sequential structure, the statements are executed one after another sequentially from top to bottom without changing the flow of the program. The programs which you have written in previous chapters are based on sequential structure.

(b) Selection Structure

It is also called a branching structure. In this structure, the control of the program is transferred from one part of the program to another on the basis of a specified condition or without condition.

Branching or Jumping: The process of departure of the control of the program conditionally or unconditionally from its sequential flow depending upon the result of the condition used is termed as branching or jumping. There are two types of branching statements.

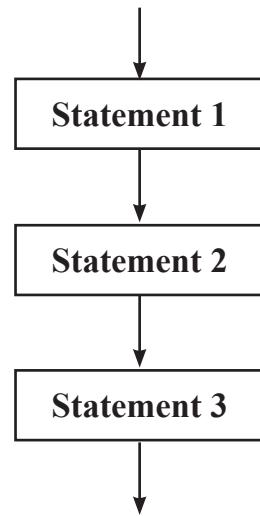


Fig. Flowchart of a sequential structured program

- Unconditional statement
- Conditional statement

Unconditional Statement

The statement that transfers the control of the program from one step to another without testing the condition is called an unconditional statement. In QBASIC, GOTO statement is the unconditional statement.

GOTO statement

Purpose: a control flow statement that branches unconditionally to the specified line

Syntax:

GOTO {linelabel | linenumber}

linelabel or linenumber is the label of the line to execute next. This line must be in the same procedure or subroutine as the GOTO statement

Example:

```
CLS  
PRINT "Kathmandu"  
GOTO abc  
PRINT "Birgunj"  
abc:  
PRINT "Biratnagar"  
END
```

Output:

```
Kathmandu  
Biratnagar  
Biratnagar
```

Here, abc is a linelabel. After displaying “Kathmandu”, the control is transferred to “abc” and displayed “Biratnagar” bypassing the statement PRINT “Birgunj”.

Using linenumber

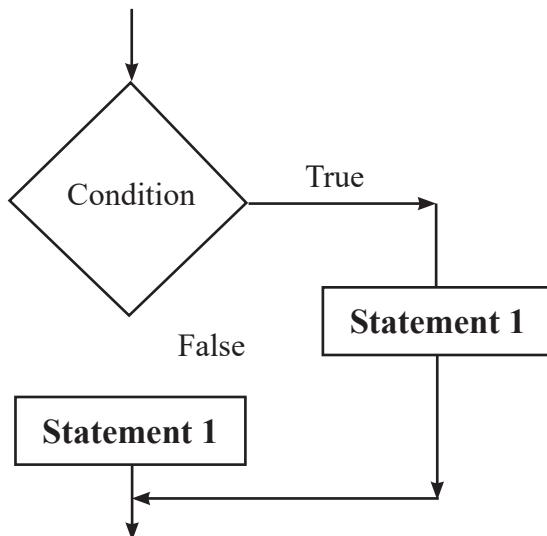
The below program gives the same output using line number.

```
CLS  
PRINT "Kathmandu"  
GOTO 10  
PRINT "Birgunj"  
10 PRINT "Biratnagar"  
END
```

Conditional Statement

a) IF .. THEN ... ELSE statement

Purpose: It is a control flow statement that allows conditional execution or branching, based on the evaluation of an expression that must be either true or false.



QBASIC supports variety of IF statement.

i) Single line IF statement

Purpose: It allows conditional execution based on the evaluation of an expression that must be true.

Syntax:

IF boolean expression THEN [statement]

- booleanexpression is an expression that must return non-zero (true) or zero (false)
- statement consists of a task to be executed if the booleanexpression returns true.

Example:

```
CLS  
INPUT "Type your marks ";m  
IF m>=40 THEN PRINT "Pass"  
END
```

Note: In the above program, if the booleanexpression $m \geq 40$ returns true, it displays "Pass". The program displays nothing if the value is less than 40.

ii) Single line IF ... ELSE statement

Purpose: It allows conditional execution based on the evaluation of an expression that must be either true or false.

Syntax:

```
IF booleanexpression THEN [statement1] ELSE [statement2]
```

Example:

```
CLS  
INPUT "Type your marks";m  
IF m>=40 THEN PRINT "Pass" ELSE PRINT "Fail"  
END
```

Note: statement1 will be executed if the booleanexpression returns true, otherwise statement2 will be executed.

iii) Multiline IF Statement

Purpose: To execute a block of statements based on the evaluation of an expression that must be true.

Syntax:

IF booleanexpression THEN

[statementblock]

END IF

- statementblock consists of any number of statements on one or more lines.

Example:

CLS

INPUT “Type your marks ”;m

IF m>=40 THEN

PRINT “Pass”

PRINT “Congratulations”

END IF

END

Note: END IF terminates the multiline IF statement which is not required in single line IF statement.

iv) Multiline IF ... ELSE statement

Purpose: To execute a block of statements based on the evaluation of an expression that must be either true or false.

Syntax:

IF booleanexpression THEN

[statementblock-1]

ELSE

[statementblock-2]

END IF

Example:

```
CLS  
INPUT "Type your marks ";m  
IF m>=40 THEN  
    PRINT "Pass"  
    PRINT "Congratulations"  
ELSE  
    PRINT "Fail"  
    PRINT "Work hard"  
END IF  
END
```

v) IF THEN ... ELSEIF statement

Purpose: To execute a block of statements based on the evaluation of multiple expressions that must be either true or false.

Syntax:

```
IF booleanexpression1 THEN  
    [statementblock-1]  
ELSEIF booleanexpression2 THEN  
    [statementblock-2]  
    ...  
ELSE  
    [statementblock-n]  
END IF
```

Example:

```
CLS  
INPUT "Type your percentage "; p  
IF p >= 80 THEN  
    PRINT "Distinciton"  
ELSEIF p >= 60 THEN  
    PRINT "First Division"  
ELSEIF p >= 45 THEN  
    PRINT "Second Division"  
ELSEIF p >= 32 THEN  
    PRINT "Third Division"  
ELSE  
    PRINT "Fail"  
END IF  
END
```

b) SELECT CASE statement

Purpose: To execute one of several statement blocks depending on the value of an expression

Syntax:

```
SELECT CASE testexpression  
[CASE expressionlist1  
[statementblock-1]  
[CASE expressionlist2  
[statementblock-2]
```

...

[CASE ELSE

[statementblock-n]

END SELECT

- testexpression is any numeric or string expression
- expressionlist contains one or more expressions of the same type as testexpression
- The IS keyword must precede any relational operators in an expression

Example:

CLS

INPUT "Type your roll number ", r

SELECT CASE r

CASE 1 TO 10

 room = 5

CASE 11 TO 15

 room = 6

CASE 18, 21, 28

 room = 7

CASE IS >= 35

 room = 8

CASE ELSE

 room = 9

END SELECT

PRINT "Your room number is "; room

END

(c) Looping Structure

Looping is the process of repeating the execution of a statement or a block of statements guided by a condition. A loop is terminated when the given condition is satisfied.

Example:

CLS

$n = 1$

top:

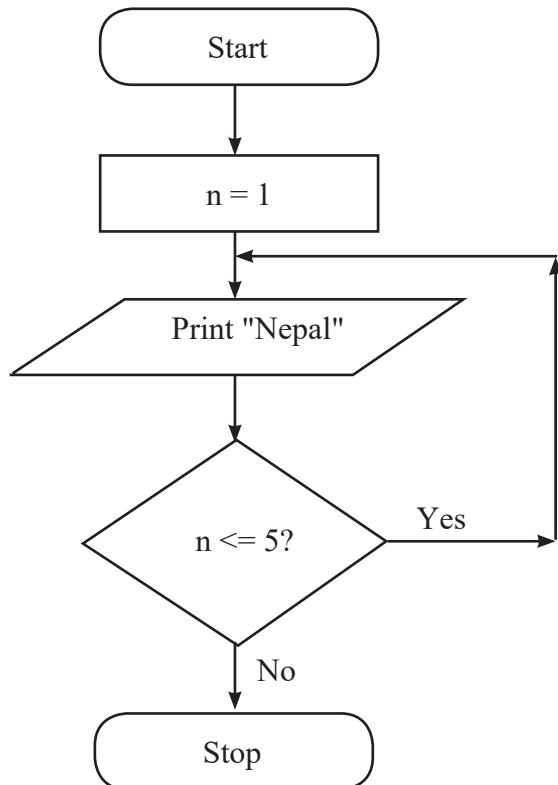
PRINT "Nepal"

$n = n + 1$

IF $n \leq 5$ THEN GOTO top

END

Flowchart of the above program is:



Memory table of dry run

n	OP (Output)
1	Nepal
2	Nepal
3	Nepal
4	Nepal
5	Nepal
6	

∴ The output of the above program is

Nepal
Nepal
Nepal
Nepal
Nepal

Here the statement PRINT “Nepal” is executed 5 times till the condition $n \leq 5$ is true.

QBASIC standard looping statements.

a) DO ... LOOP WHILE statement

Syntax:

DO

[statementblock]

LOOP [WHILE booleanexpression]

- booleanexpression is an expression that will return non-zero (true) or zero (false).
- statementblock is any number of statements on one or more lines which are to be executed as long as boolean expression is true.

Example:

CLS

$n = 1$

DO

PRINT "Nepal"

$n = n + 1$

LOOP WHILE $n \leq 5$

END

Counters, Intermediate Value, Sentinel Value & Accumulators

Counters are the numeric variables which store the number of times a statements or a block of statements is executed in a loop. Counters may have increment or decrement of any numbers.

The mid-values of a counter except initial and final value in a loop are called intermediate value and the final value of a counter is called sentinel value.

Accumulators are the variables in which the intermediate value of another variable is added.

Example:

```
A = 1  
DO  
PRINT A;  
S=S+A  
A = A+1  
LOOP WHILE A<=10  
PRINT "Sum = ";S  
END
```

In the above program, the variable A is used as a counter which counts the number of execution of a block of statements in the loop. Here, the intermediate values of the counter A are 2,3,4,5,6,7,8 & 9. Similarly, the sentinel value of A is 10. The variable S is used as an accumulator which adds the intermediate values of A.

b) DO WHILE ... LOOP statement

Syntax:

```
DO [WHILE booleanexpression]
```

```
[statementblock]
```

```
LOOP
```

Example:

```
CLS
```

```
n = 1
```

```
DO WHILE n <= 5
```

```
    PRINT "Nepal"
```

```
    n = n + 1
```

```
LOOP
```

```
END
```

c) WHILE ...WEND statement

Syntax:

WHILE condition

[statements]

WEND

- condition is an expression that will return non-zero (true) or zero (false)
- statements are one or more QBASIC statements to be executed as long as condition is true

Example:

CLS

n = 1

WHILE n <= 5

PRINT "Nepal"

n = n + 1

WEND

END

d) DO ... LOOP UNTIL statement

Syntax:

DO

[statementblock]

LOOP [UNTIL booleanexpression]

Example:

CLS

n = 1

DO

```
PRINT "Nepal"  
n = n + 1  
LOOP UNTIL n>5  
END
```

Note: The loop will be continued until the condition is true. That is, if the given Boolean expression returns false (0) the loop will be continued. The loop will be terminated if the condition is true.

The above program displays “Nepal” 5 times. When the value of n reaches 6, the given conditions return true (1) value and the loop will be terminated.

e) DO UNTIL LOOP statement

Syntax:

```
DO [UNTIL booleanexpression]
```

```
[statementblock]
```

```
LOOP
```

Example:

```
CLS
```

```
n = 1
```

```
DO UNTIL n>5
```

```
    PRINT "Nepal"
```

```
    n = n + 1
```

```
LOOP
```

```
END
```

f) FOR ... NEXT statement

Syntax:

```
FOR counter = start TO end [STEP increment/decrement]
```

[statements]

NEXT counter

- counter is a numeric variable used as the loop counter
- start is the initial value and end is the final value of the counter
- increment is the amount the counter is incremented each time through the loop

Example:

CLS

FOR n=1 TO 5 STEP 1

PRINT “Nepal”

NEXT n

END

Note: The above program displays “Nepal” 5 times.

Here, the counter is n and its initial value is 1 and final value is 5 and after each iteration, the value of the counter will be incremented by 1.

Similarly, the below program also gives the same output.

CLS

FOR n=10 TO 2 STEP -2

PRINT “Nepal”

NEXT n

END

If the counter has to be incremented by 1, then you don't need to specify it with STEP keyword.

For example, the below program displays “Mount Everest” 5 times.

CLS

FOR n=1 TO 5

```

PRINT "Mount Everest"
NEXT n
END

```

Nested Loop

A loop inside another loop is called a nested loop.

Example of a program using a nested loop.

Program	Output
FOR X=1 TO 5	1
FOR Y=1 TO X	1 2
PRINT Y;	1 2 3
NEXT Y	1 2 3 4
PRINT	1 2 3 4 5
NEXT X	

Sample Program

i) To check whether the supplied number is prime or not

```

CLS
INPUT "Type any number "; n
FOR x = 2 TO n - 1
    IF n MOD x = 0 THEN c = c + 1
NEXT x
IF c = 0 THEN PRINT "Prime" ELSE PRINT "Composite"
END

```

ii) To display the numeric pattern 2,22,222,222,222

CLS

n = 2

FOR i = 1 TO 5

 PRINT n;

 n = n * 10 + 2

NEXT i

END

iii) To display the smallest among three numbers

CLS

INPUT "Type any three numbers "; a, b, c

IF a > b AND a > c THEN

 PRINT a

ELSEIF b > a AND b > c THEN

 PRINT b

ELSE

 PRINT c

END IF

END

iv) To calculate the sum of individual digits of an integer

CLS

INPUT "Type any integer "; n%

WHILE n% <> 0

 r = n% MOD 10

$s\% = s\% + r$

$n\% = n\% \backslash 10$

WEND

PRINT "Sum of individual digits = "; s%

END

Summary

- Control structures are used to control the flow of program. There are three types of control structure: Sequential, Selection and Iteration
- In sequential structure, all the statements are executed from top to bottom sequence without leaving anyone.
- In selection structure (also called branching), the control of the program is transferred from one part of the program to another on the basis of specified condition or without condition.
- In looping structure (also called iteration), statements are re-executed for a definite number of times.

Exercises

1. Answer the following questions.

- What is control structure?
- Define branching statement with its types.
- What is looping? List the standard looping statements of QBASIC.

2. Re-write the programme below using.

- DO ... LOOP WHILE
- DO UNTIL ... LOOP
- FOR ... NEXT

i) CLS

```
n = 1  
top:  
PRINT n;  
n = n + 1  
IF n <= 10 THEN GOTO top  
END
```

ii) CLS

```
n = 10  
top:  
PRINT n;  
n = n - 1  
IF n >= 1 THEN GOTO top  
END
```

iii) CLS

```
c = 1  
n = 5  
top:  
PRINT n;  
n = n * 2  
c = c + 1  
IF c <= 10 THEN GOTO top  
END
```

Note: Re-write the programme below using only do...while and DO UNTIL...LOOP statements

iv) CLS

```
FOR x = 1 TO 5  
    FOR y = 5 TO 1 STEP -1  
        PRINT y;  
        NEXT y  
        PRINT  
    NEXT x  
END
```

3. Debug the following programs.

- a) REM To find the greater number among two

```
CLS  
INPUT "Any two numbers "; a, b  
IF a > b THEN PRINT a ELSE PRINT b  
END IF  
END
```

- b) REM to check odd or even

```
CLS  
INPUT "Type any number "; a  
R = a / 2  
IF R = 0 THEN  
    PRINT "Even"  
ELSE  
    PRINT "Odd"  
END
```

c) REM to display 2,4,6,8,...20

CLS

n = 2

DO

PRINT n;

n = n + 2

LOOP UNTIL n <= 20

END

d) REM to display 20,18,16,14,...2

CLS

FOR n = 20 TO 2

PRINT n;

n = n + 1

NEXT n

END

e) REM to check whether the supplied number is prime or not

CLS

INPUT "Type any number "; n

FOR x = 1 TO n

r= x MOD n

IF r = 0 THEN c = c + 1

NEXT x

IF c = 0 THEN

PRINT "Prime"

ELSE

PRINT "Composite"

END

f) REM to display the smallest among three supplied numbers

CLS

INPUT "Type any three numbers "; a, b, c

IF a > b OR a < c THEN

PRINT a

ELSEIF b > a OR b < c THEN

PRINT b

ELSE

PRINT c

END IF

END

g) REM to print given name 20 times

LET c=1

INPUT "Enter Name; N

WHILE c less or equal to 20

PRINT N

c+1=c

END

4. Write down the output of the following programs.

a) S=0

FOR I=1 TO 10

X=I^2

S=S+X

NEXT I

PRINT S

END

b) FOR I=1 TO 10
READ N
B=N MOD 5
IF B=0 THEN C=C+1
NEXT I
DATA 7,15,6,10,15,32,8,22,25,5
PRINT C
END

c) CLS
FOR x = 1 TO 3
READ n\$, add\$, age
PRINT n\$, add\$, age
NEXT x
DATA "Sushil","Kathmandu",31
DATA "Rajendra",Lalitpur,29
DATA Laxman,Bhaktapur,28
END

d) CLS
n = 15
DO
IF n MOD 3 = 1 THEN PRINT n;
n = n - 1
LOOP WHILE n >= 3
END

e) CLS
 C = 1
 FOR I = 2 TO 8 STEP 2
 PRINT C;
 SWAP B, C
 C = B + 1
 NEXT I
 END

f) FOR X = 2 TO 15 STEP 2
 IF X >= 11 THEN EXIT FOR
 PRINT X ^ 2 + 1
 NEXT X
 PRINT "Done"
 END

g) FOR i=2 TO 10 STEP 2
 FOR j=i TO 10 STEP 2
 PRINT J;
 NEXT j
 PRINT
 NEXT i
 END

5. Write down the QBASIC code for the following problems.

- Write a program that asks the age of a person and tells whether he/she can vote or not. [Note: A person of 18 years old or above is eligible to vote.]
- Write a program that asks any number and checks whether it is divisible by 3 or not.

- c) Write a program that asks any three numbers and displays the greatest number.
- d) Write a program that accepts an alphabet and tells whether it is a vowel or a consonant.
- e) Write a program that asks student's name and marks in English, Nepali and Computer Science and calculates the total marks, percentage, result (pass/fail) and division on the bases given below.

Percentage Division

≥ 80	Distinction
$\geq 60 \text{ and } < 80$	First Division
$\geq 45 \text{ and } < 60$	Second Division
$\geq 32 \text{ and } < 45$	Third Division

Note: Pass mark for all the subject is 40]

- f) Write a program that asks student's roll numbers and tells him/her room number where he/she has to sit to give the exam on the following basis.

Roll No.	Room No.
-----------------	-----------------

1-10	5
11-20	6
22,25,29,31	7
Above 35	8
Others	9

- g) Write a program that asks your name and displays it 10 times.
- h) Write a program to display the first 100 natural numbers with their sum.
- i) Write a program to generate the following series.
 - i) 1,4,7, ..., up to 10th terms
 - ii) 100,95,90,85,.....,5
 - iii) 1,2,4,8,16,...., up to 10th terms

- iv) 999,728,511,342,..., up to 10th terms
 - v) 1,11,111,1111,1111
 - vi) 1,2,3,5,8,13,21,..., up to 10th terms
 - vii) .1,.01,.001,.0001,..., up to 10th terms
- j) Write a program that asks any two integers and calculates their HCF and LCM.
 - k) Write a program that asks any number and displays its multiple table up to 10.
 - l) Write a program that asks any number and checks whether it is Armstrong or not. [A number which is equal to the sum of the cube of its individual digits is called an Armstrong number. Eg. $371 = 3^3 + 7^3 + 1^3$]
 - m) Write a program that checks whether the supplied number is palindrome or not.
 - n) Write a program that asks any number and displays its factors.
 - o) Write a program that asks any number and calculates its factorial. [Hint: Factorial of 5 = $5 \times 4 \times 3 \times 2 \times 1$ i.e. 120]
 - p) Write a program that asks multi-digit integer and displays the product of its individual digits.

4.2.6 Library Functions

Function

Function is a block of statement executed together to perform specific tasks and usually returns a value.

Types of Function

Basically, there are two types of function available in QBASIC.

- Library Function
- User-Defined Function

Library Function

Also called Built-in function or intrinsic function. It is already available with a programming language. The programmer does not need to define this function.

a) String manipulation functions

i) LEN function

Purpose: a string processing function that returns the number of characters in a string or the number of bytes required by a variable

Syntax:

LEN(stringexpression)

or

LEN(variable)

- stringexpression is a string constant or string expression
- variable identifies the object for which you want the number of required bytes

Example:

CLS

a\$ = "Nepal"

b% = 456

```
c& = 23  
d! = 56.789  
e# = 44.55  
PRINT LEN(a$) ' Displays 5  
PRINT LEN(b%)' Displays 2  
PRINT LEN(c&) ' Displays 4  
PRINT LEN(d!) ' Displays 4  
PRINT LEN(e#) ' Displays 8  
END
```

ii) LEFT\$ function

Purpose: a string processing function that returns a string consisting of the leftmost n characters of a string

Syntax:

LEFT\$(stringexpression,n)

- stringexpression is a string constant, string variable, or string expression
- n, a numeric expression, must have a value between 0 and 32,767. If n is zero, the null string (a zero-length string) is returned.

iii) RIGHT\$ function

Purpose: a string function that returns the rightmost n characters of a string

Syntax:

RIGHT\$(stringexpression,n)

iv) MID\$ function

Purpose: a string-processing function that returns a substring of a string

Syntax:

MID\$(stringexpression,start,length)

- stringexpression identifies the string from which the substring is to be extracted
- start, a numeric expression that has an integer value between 1 and 32,767, specifies the starting character position of the substring
- length can be omitted if you want all the characters to the right of start

Example of using **LEFT\$**, **RIGHT\$** and **MID\$** functions:

CLS

S\$ = "BIRATNAGAR"

PRINT LEFT\$(S\$, 5) 'Displays BIRAT

PRINT RIGHT\$(S\$, 5) 'Displays NAGAR

PRINT MID\$(S\$, 3, 5) 'Displays RATNA

PRINT MID\$(S\$, 6) 'Displays NAGAR

END

v) CHR\$ function

Purpose: a string processing function that returns a one-character string whose ASCII code is the argument

Syntax:

CHR\$(code)

- code, a numeric expression that has a value between 0 and 255, is one of the ASCII character codes

vi) ASC function

Purpose: a string processing function that returns a numeric value that is the ASCII code for the first character in a string expression

Syntax:**ASC (stringexpression)**

Characters	ASCII Value
A-Z	65-90
a-z	97-122
0-9	48-57
Space	32
Enter	13

Example:

PRINT CHR\$(65) ‘ Displays A

PRINT ASC("abc") ‘ Displays 97

vii) VAL function

Purpose: a string-processing function that returns the numeric value of a string of digits

Syntax:

VAL(stringexpression)

viii) STR\$ function

Purpose: a string function that returns a string representation of the value of a numeric expression

Syntax:

STR\$(numeric-expression)

Example:

CLS

a = 5

b = 6

c\$ = "7"

```

d$ = "8"

PRINT a + b          ' Displays 11
PRINT c$ + d$        ' Displays 78
PRINT STR$(a) + STR$(b)  ' Displays 56
PRINT VAL(c$) + VAL(d$)  ' Displays 15

END

```

ix) SPACE\$ function

Purpose: a string processing function that returns a string of spaces of length n

Syntax:

SPACE\$(n)

- n, a numeric expression that has an integer value between 0 and 32,767, is the number of spaces you want in the string

Example:

```

CLS

PRINT "Stand-Up"; SPACE$(5); "Online"

END

```

x) STRING\$ function

Purpose: a string processing function that returns a string whose characters all have a given ASCII code or whose characters are all the first character of a string expression

Syntax:

STRING\$(m,n)

STRING\$(m,stringexpression)

- m, a numeric expression, is the length of the string to return
- n, a numeric expression that has an integer value between 0 and 255, is the ASCII character code of the character that fills the string

- stringexpression identifies a string whose first character can be used to fill the string

Example:

```
CLS  
PRINT STRING$(4, 65)      ' prints AAAA  
PRINT STRING$(2, "Nepal")   ' prints NN  
END
```

xi) DATE\$

As a statement

Purpose: To set the current system date

Syntax:

DATE\$ = stringexpression

- stringexpression must have one of the following forms:
mm-dd-yy, mm-dd-yyyy, mm/dd/yy, or mm/dd/yyyy where mm and dd are the month and day, and yy or yyyy are the year

Example:

```
DATE$ = "05-25-1995"
```

Sets the system date as 25th May 1995

As a function

Purpose: To return a string containing the current system date

Syntax:

DATE\$

- a ten-character string is returned, in the form mm-dd-yyyy
mm is the month (01-12),
dd is the day (01-31), and

yyyy is the year (1980-2099)

Example:

PRINT DATE\$

Displays the current system date

xii) TIME\$

As a statement

Purpose: To set the current time

Syntax:

TIME\$=stringexpression

- stringexpression must have one of the following forms:
hh, hh:mm, or hh:mm:ss where hh is the hour on a 24-hour clock, mm is the minutes, and ss is the seconds

Example:

TIME\$ = "05:25:55"

Sets the system time as 5 Hour 25 Minutes and 55 Seconds

As a function

Purpose: To return the current system time

Syntax:

TIME\$

- an eight-character string is returned, in the form hh:mm:ss
hh is the hour (00-23), mm is the minute (00-59), and ss is the second (00-59)

Example:

PRINT TIME\$

Displays the current system time

xiii) LTRIM\$ function

Purpose: a function that returns a copy of a string with leading spaces removed

Syntax:

LTRIM\$(stringexpression)

xiv) RTRIM\$ function

Purpose: a string processing function that returns a string with trailing (right-hand) spaces removed

Syntax:

RTRIM\$(stringexpression)

Example:

B\$ = “ KATHMANDU”

C\$ = “BIRATNAGAR ”

B\$=LTRIM\$(B\$)

C\$=RTRIM\$(C\$)

PRINT LEN(B\$);LEN(C\$)

END

b) Mathematical Function

i) ABS function

Purpose: a math function that returns the absolute value of a numeric expression

Syntax:

ABS(numeric-expression)

Example:

a = -5

PRINT ABS(a)

ii) SGN function

Purpose: a math function that indicates the sign of a numeric expression

Syntax:

SGN(numeric-expression)

- If numeric-expression is positive, the SGN function returns +1.
- If numeric-expression is zero, the SGN function returns 0.
- If numeric-expression is negative, the SGN function returns -1.

Example:

CLS

a = 5

b = 0

c = -9.8

PRINT SGN(a) ' prints 1

PRINT SGN(b) ' prints 0

PRINT SGN(c) ' prints -1

END

iii) SQR function

Purpose: a math function that returns the square root of numeric expression

Syntax:

SQR(numeric-expression)

- numeric-expression must have a value greater than or equal to zero

Example:

CLS

a = 9

b = SQR(a)

```
PRINT "Square root of "; a; " is"; b  
END
```

iv) INT function

Purpose: a math function that returns the largest integer less than or equal to a numeric-expression

Syntax:

INT(numeric-expression)

v) FIX function

Purpose: a math function that returns the truncated integer part of a numeric expression

Syntax:

FIX(numeric-expression)

vi) CINT function

Purpose: a conversion function that converts a numeric expression to an integer by rounding the fractional part of the expression

Syntax:

CINT(numeric-expression)

Example:

	a = 5	a= 5.5	a = -5.5
INT (a)	5	5	-6
FIX (a)	5	5	-5
CINT (a)	5	6	-6

vii) SIN function

Purpose: a math function that returns the sine of an angle given in radians

Syntax:

SIN(numeric-expression)

- numeric-expression is the angle, expressed in radians.

viii) COS function

Purpose: a math function that returns the cosine of an angle given in radians

Syntax:

COS(numeric-expression)

ix) TAN function

Purpose: a math function that returns the tangent of an angle expressed in radians

Syntax:

TAN(numeric-expression)

Example:

a = 45

PRINT SIN(a)

PRINT COS(a)

PRINT TAN(a)

c) Other useful functions and statements**i) SPC function**

Purpose: an I/O function that skips n spaces in a PRINT statement

Syntax:

SPC(n)

- n, a numeric expression that returns an integer value between 0 and 32,767, is the number of spaces you want in print line

Example:

```
CLS  
PRINT "Kathmandu"; SPC(5); "Nepal"  
END
```

Output:

The SPC function returns 5 spaces which are printed as below.

Kathmandu Nepal

ii) TAB function

Purpose: a device I/O function that moves the print position when used in the PRINT statement

Syntax:

TAB(column)

- column, a numeric expression that has an integer value between 1 and (column-width of the display device)

Note: In normal mode, the column-width of the screen is 80.

Example:

```
CLS  
PRINT "Kathmandu"; TAB(5); "Nepal"  
END
```

Output:

The TAB() function moves the print position to the 5th column of the screen. So, the string constant “Nepal” will be printed from the 5 columns i.e. after 4 spaces in the second line as below.

Kathmandu

Nepal

iii) LOCATE statement

Purpose: an I/O statement that moves the cursor to the specified position

Syntax:

LOCATE [row],[column]

- row and column to move the cursor

Example:

CLS

PRINT SPC(5); "NEPAL"

PRINT TAB(5); "NEPAL"

LOCATE 5, 2

PRINT "NEPAL"

END

Output:

Column→ Row ↓	1	2	3	4	5	6	7	8	9	10
1					N	E	P	A	L	
2				N	E	P	A	L		
3										
4										
5		N	E	P	A	L				
6										

Returns 5 spaces by SPC function
Moves the cursor to 5th Column

Prints from 5th row & 2nd column

Sample Program

i) To display the reverse of a string

CLS

INPUT "Type your name "; n\$

```
FOR i = 1 TO LEN(n$)
```

```
    c$ = MID$(n$, i, 1)
```

```
    r$ = c$ + r$
```

```
NEXT i
```

```
PRINT "Reversed = "; r$
```

```
END
```

ii) REM To count the frequency of vowels

```
CLS
```

```
INPUT "Type any string "; s$
```

```
FOR i = 1 TO LEN(s$)
```

```
    b$ = MID$(s$, i, 1)
```

```
    IF b$ = "a" OR b$ = "e" OR b$ = "i" OR b$ = "o" OR b$ = "u" THEN
```

```
        c = c + 1
```

```
    END IF
```

```
NEXT i
```

```
PRINT "Frequency of vowels = "; c
```

```
END
```

iii) To display the below pattern

```
EDUCATION
```

```
DUCATIO
```

```
UCATI
```

```
CAT
```

```
A
```

```
CLS
```

```
b$ = "EDUCATION"  
n = 9  
FOR i = 1 TO 5  
    PRINT TAB(i); MID$(b$, i, n)  
    n = n - 2  
NEXT i  
END
```

iv) To change the letters in uppercase without using UCASE\$() function

```
CLS  
s$ = "nepal"  
FOR i = 1 TO 5  
    b$ = MID$(s$, i, 1)  
    c = ASC(b$)  
    d$ = d$ + CHR$(c - 32)  
NEXT i  
PRINT "In uppercase: "; d$  
END
```

v) REM to calculate hex equivalent of a decimal no.

```
INPUT "DECIMAL NO: "; D  
DO WHILE D <> 0  
    R = D MOD 16  
    IF R < 10 THEN  
        A$ = LTRIM$(STR$(R)) + A$  
    ELSE
```

```
R = R + 55  
A$ = CHR$(R) + A$  
END IF  
D = D \ 16  
LOOP  
PRINT "HEXADECIMAL EQUIVALENT:"; A$
```

Exercises

1. Answer the following questions:

- a) What is a function? Mention its types.
- b) What are library functions? List the functions available in QBASIC library.
- c) Differentiate between library function and user-defined function.

2. Debug the following programs:

a) REM Reversing a string

```
INPUT "Type any number "; n$  
FOR p = LEN(n$) TO 1  
b$ = MID$(n$, 1, p) + b$  
NEXT q  
PRINT "Reversed = "; b$  
END
```

b) REM Printing a string in a pattern

```
DIM S AS STRING  
S = HAMI NEPALI  
FOR P = 1 TO LEN$(S)  
PRINT LEFT (S, P)
```

```
NEXT S  
END  
  
c)  CLS  
BROWSER="BROWSER"  
BROWSERLEN$=LEN(BROWSER$)  
FOR KOUNTER=1 TO BROWSERLEN  
PRINT MID(BROWSER$,KOUNTER,1);  
NEXT BOUNCER  
END
```

3. Write down the output of the following programs:

```
a)  CLS  
FOR i = 1 TO 5  
    PRINT LEFT$("NEPAL", i)  
NEXT i  
END  
  
b)  CLS  
ST$ = "PLNMPBENPLA"  
FOR I = 1 TO 5  
    READ N  
    PRINT MID$(ST$, N, 1);  
NEXT I  
DATA 3,7,9,11,2  
END
```

c) **CLS**

```
FOR I = 1 TO 5
READ N$, A
PRINT MID$(N$, A, 1);
NEXT I
DATA COMPUTER,4,ORACLE,1,WINDOW,6
DATA KEYBOARD,2,FORTRAN,5
END
```

4. Write down the QBASIC code for the following problems:

- a) Write a program that checks whether the supplied string is palindrome or not. [A string is a palindrome if it is same when spelled from reverse order also. Eg. MADAM]
- b) Write a program that asks any string and counts the frequency of the letter ‘a’ present in the supplied string.
- c) Write a program that asks any string value and displays only the vowels from the supplied string.
- d) Write a program that asks any numbers and checks whether it is positive, negative or zero.
- e) Write a program that asks any number and checks whether it is a perfect square or not.
- f) Write a program that checks whether the supplied character is the capital alphabet, small alphabet, numeric character or other symbol.
- g) Write a program that asks any integer and calculates its binary equivalent.
- h) Write a program that asks the date of birth of a person in MM-DD-YYYY format and checks whether he/she was born in the current month or not.
- i) Write a program that asks any decimal number and calculates its hexadecimal equivalent.
- j) Write a program that asks any hexadecimal number and calculates its decimal

equivalent.

- k) Write a program that asks any string and counts the number of characters present in the supplied string without using LEN() function.
l) Write programs to display the following string patterns:

i) N
N E
N E P
N E P A
N E P A L

ii) N E P A L
N E P A
N E P
N E

ii) N E P A L
E P A L
P A L
A L
L

iv) L
A L
P A L
E P A L
N E P A L

v) N E P A L
E P A L
P A L
A L
L

vi) L
A L
P A L
E P A L
N E P A L

vii) N
E
P
A
L

viii) A
P
E
N

ix) A
C A T
U C A T I
D U C A T I O
E D U C A T I O N

1.2.7 Array

It is a special type of variable that holds a collection of related data having the same data-type. The individual data item in an array is called an Element.

Advantages of an Array

- Array can store multiple values of same data type. So, it reduced the number of variables.
- Program will be more efficient and well managed.
- Sorting and searching the data can be done easily.

Array Declaration

Before using an array, it must be declared. For this, we need to use DIM statement.

One dimensional array

Syntax:

DIM Array_Name(subscript)

- A subscript is a value that is used to declare the size of array.

Example:

DIM N%(5)

Here the array name is N with data-type integer and value of subscript is 5, that is you can store maximum 5 integers in this array.

Storing data in an Array

CLS

DIM N%(5)

FOR i = 1 TO 5

 INPUT "Any integer "; N%(i)

 NEXT i

END

Note: If you use an array in your program without including the array in a DIM statement, the maximum value of each subscript of the array is 10.

Here, the statement

```
INPUT "Any integer "; N%(i)
```

will be executed 5 times and if we supply 5 integers 45,67,17,32,12 respectively. The integers will be stored in the array in this way.

45	67	17	32	12
N(1)	N(2)	N(3)	N(4)	N(5)

Sample Program

1. REM To find the sum and average of 10 integers

```
DIM n%(10)  
FOR i = 1 TO 10  
    INPUT "Any integer "; n%(i)  
    sum = sum + n%(i)  
NEXT i  
avg = sum / 10  
PRINT "Sum = "; sum  
PRINT "Average = "; avg  
END
```

Searching data in an Array

Linear search or sequential search

Once the data are stored in an array, we can search a particular data by comparing each element stored in the array one after another in a sequential order. This type of search method is called linear search. The search process stops when either the value is found or the end of the array is encountered.

Program of Sequential/linear search

REM Linear search from the data

```
CLS  
DIM n(10)  
FOR i = 1 TO 10  
    READ n(i)  
NEXT i  
INPUT "Type a number to search"; x  
FOR a = 1 TO 10  
    IF n(a) = x THEN  
        check = 1  
        EXIT FOR  
    END IF  
NEXT a  
IF check = 1 THEN  
    PRINT "Data Found!!!"  
ELSE  
    PRINT "Data Not Found!!!"  
END IF  
DATA 44,34,21,56,76,87,44,51,29,39  
END
```

Sorting data in an Array

Sorting means the arrangement of data in ascending or descending order numerically or alphabetically. Data can be sorted in various methods like Quicksort, Insertion sort, Bubble sort, Heap sort, Shell sort etc. But we are using only bubble sort. Normally, we

sort the data in order to search the data in an efficient manner.

Bubble sort

Bubble sort is a simple sorting algorithm that works by repeatedly stepping through the list to be sorted, comparing each pair of adjacent items and swapping them if they are in the wrong order. The pass through the list is repeated until no swaps are needed, which indicates that the list is sorted. The algorithm gets its name from the way smaller elements "bubble" to the top of the list.

Program of Bubble sort

REM Bubble sort

```
CLS  
DIM n(10)  
FOR i = 1 TO 10  
    READ n(i)  
NEXT i  
FOR x = 10 TO 1 STEP -1  
    FOR y = 1 TO x - 1  
        IF n(y) > n(y + 1) THEN SWAP n(y), n(y + 1)  
    NEXT y  
NEXT x  
PRINT "Sorted data..."  
FOR x = 1 TO 10  
    PRINT n(x);  
NEXT x  
DATA 44,34,21,56,76,87,44,51,29,39  
END
```

Two dimensional array

In two dimensional array, the data are stored in a tabular form in rows and columns.

Syntax:

DIM array_name(m,n)

- m, a number that declares the number of rows
- n, a number that declares the number of columns

Example:

DIM N%(3,4)

CLS

DIM N%(3, 4)

FOR x = 1 TO 3

 FOR y = 1 TO 4

 INPUT "Any number "; N%(x, y)

 NEXT y

NEXT x

END

Here, the number of rows is 3 and number of columns is 4. So, the data will be stored in the following format.

N(1,1)	N(1,2)	N(1,3)	N(1,4)
N(2,1)	N(2,2)	N(2,3)	N(2,4)
N(3,1)	N(3,2)	N(3,3)	N(3,4)

Summary

The array is a data structure that holds a collection of data, all of the same type and accessed using a common name.

- Types of Array: One-dimensional, Two-dimensional

- Array is declared using DIM statement.
- Array makes sorting and searching the data easy and fast.

Exercises

1. Answer the following questions:

- a) What is an array? Write down its advantages.
- b) Differentiate between one-dimensional and two-dimensional array.

2. Write down the QBASIC code for the following problems:

- a) Write a program that asks any 10 numbers and stores into an array and find their sum and average.
- b) Write a program that asks any 10 numbers and stores into an array and displays the smallest number among them.
- c) Write a program that asks any 10 numbers and displays them in descending order.
- d) Write a program that stores name and email address of 5 students and stores them in a two-dimensional array and display all the data in a tabular form.