CHAPTER # 01

BASIC CONCEPTS OF INFORMATION TECHNOLOGY

COMPUTER:

The word computer is derived from an English word „COMPUTE‟ which means "To Calculate". The basic objective to build-up a computer is the formation of an electronic machine which can solve human problem in very efficient way. It can be define as:

"Computer is an electronic device that accepts data and instructions (In form of programs) as input, process the data according to the given instructions and produce information as output."

COMPUTER SCIENCE:

Computer science or computing science is the study of the theoretical foundations of information and computation, data processing, system control and of practical techniques for their implementation and application in computer systems.

INFORMATION TECHNOLOGY:

Information technology is a general term that describes any technology that helps to produce, manipulate, store, and communicate information. It describes the combination of the computer technology with the telecommunication.

CHARACTERISTICS OF A COMPUTER:

A Computer can achieve many objectives better then a human, means it is too quick, accurate and reliable as compare to a human. Some of the important characteristics and capabilities of a computer are shown below.

SPEED:

It is the prime factor of a computer due to which it is used it is used now days. Any task which a normal person can complete in days, weeks and months a computer can complete it in seconds or less without any error.

ACCURACY:

Computer generated results are too much accurate. If any calculation is made by human then chances of error was there but computer never make any mistake by the time user provide wrong information.

MEMORY:

In terms of memory computer is also superior over humans. It can store information quite safely and securely and can retrieve and can retrieve it upon user‟s request.

ARTIFICIAL INTELLIGENCE:

This is the latest area in computer science. Its purpose is to develop a machine which can think and behave like humans or to produce such qualities in a computer.

SELF-CHECKING:

A computer has a built-checking it means itself continuously or analyze progress by its own self.

SELF-OPERATING:

During the execution of any program computer never need human help anymore it means once the

program start computer executes it automatically.

DISADVANTAGES / LIMITATIONS OF A COMPUTER:

HUMAN DEPENDENT:

A computer cannot do anything by its own self. It always needed some information from user then on the basis of it produces output. It has no feeling senses.

EFFICIENCY:

It can only execute correct instructions but have no tendency to correct wrong instruction.

DECISION MAKING:

During the execution of a program if computer got stuck then it has no ability to resolve the problem by its own. IT has no IQ.

THE COMPUTER SYSTEM:

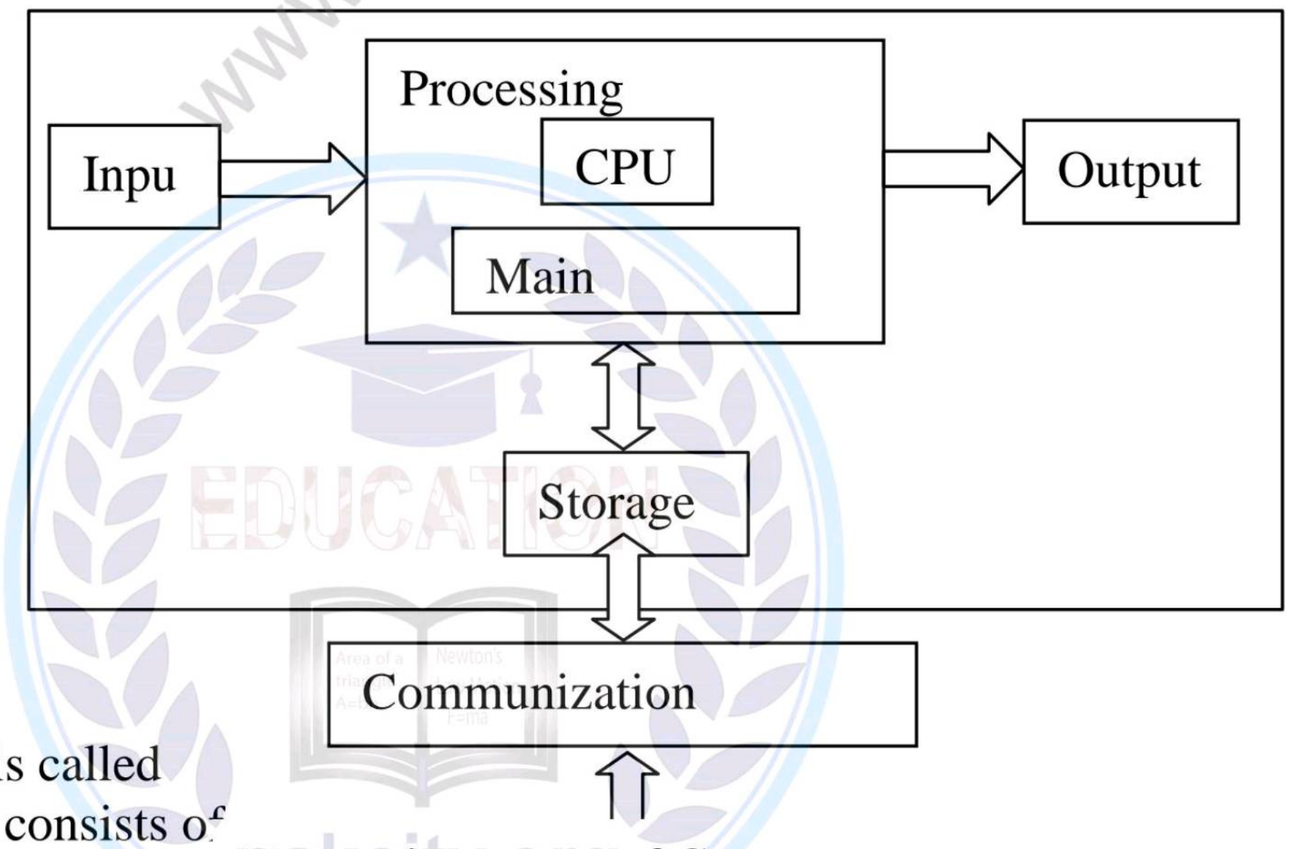
A system is a group of integrated parts that have the common purpose of achieving the same objective there are following characteristics of a computer system.

- ★ A system has more than one element
- ★ All the elements parts are logically related
- ★ All the elements are used in such a way that the goal is achieved.

ELEMENTS OF A COMPUTER SYSTEM:

A system is a group of integrated parts that have the common purpose of achieving the same objective there are following characteristics of a computer system.

- ★ Hardware
- ★ Software
- ★ Data/Information
- ★ Produres
- ★ People Communication



HARDWARE:

The physical equipment is called the hardware. Hardware consists of the following categories:

a. Input hardware
b. Processing hardware
c. Output hardware
d. Storage hardware
e. Communication hardware

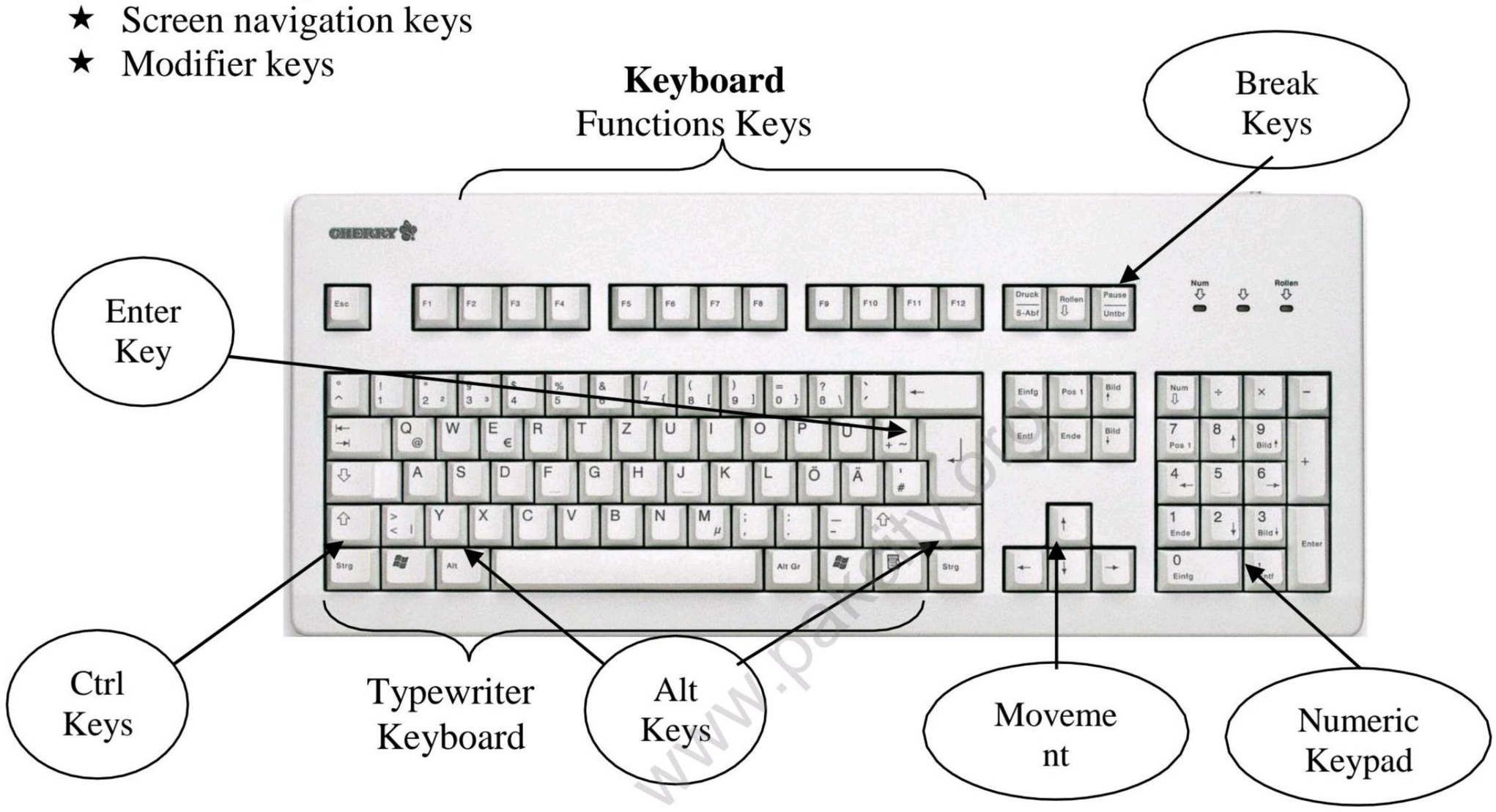
a. INPUT HARDWARE:

The function of input hardware is to collect data and convert it into a form suitable for computer processing. Examples are keyboard, mouse, trackball, microphone etc.

1. KEYBOARD:

The most common input device used all over the world is Keyboard. It is text based input device because by using it we can only input text data. It is just like a type writer and its working is also like a typewriter. It is sometime pronounced as QWERTY keyboard.
It is because of the reason that starting first character of the alphabetic portion consist on these six letters.
A keyboard is divided into many parts of which are as follows:

- ★ Alphanumeric keypad
- ★ Numeric keypad
- ★ Function keys
- ★ Screen navigation keys
- ★ Modifier keys



ALPHANUMERIC KEYPAD:

This name is consisting of two different word “Alphabets” and “Numeric”. As its name shows it consist on alphabets from A – Z and numeric digits. It also contain some special characters like !, @, #, $, ^, &, *, (,), :, “, <, >, ? Etc. It also contain some very important keys like Enter, Spacebar. These keys are also known as execution keys.

NUMERIC KEYPAD:

The numeric keypad, at the right side of keyboard and also at the top of keyboard is responsible for all numeric operation on computer so called numeric keys. It also contain basic numeric operations like +, -, *, /.

FUNCTION KEYS:

Keys from F1 to F12 at the top of keyboard called function keys because they perform some extra functions like open, save and to run a program directly from keyboard. These are called function keys because each key contain a special function.

SCREEN NAVIGATION OR CURSOR MOVEMENT KEYS:

All those keys use to change screen properties like cursor and display properties are called Screen Navigation or Cursor Movement Keys. It contains;

- ★ Arrow keys
- ★ Home and End keys

★ Page up and Page Down keys

★ **ARROW KEYS:**

There are four arrow keys to change arrow position. These keys are right, left, up and down keys to more cursor from one place to another according to user.

★ **HOME & END:**

HOME key move cursor at the beginning of a line and ENO key at the last character of the line.

★ **PAGE UP AND PAGE DOWN KEYS:**

Page-up key move the cursor from 8 to 12 lines up from its current position. Just opposite page-Down key moves the cursor from 8 to 12 lines down from its current positions.

MODIFIER KEYS:

Shift, Alt, Ctrl these keys are normally use in combination with other keys to enhance their working so normally called Modifier keys. Some other keys are,

★ **Delete Key:** Use to delete a character.
★ **Insert Key:** Use to insert a character between two letters without deleting any one of them.
★ **Esc Key:** The function of this key varies from program to program.
★ **Print Screen:** Print the current screen position either m soft or hard format.

2. MOUSE:

The most common pointing input device is Mouse. It is called pointing device because it is used to point a place on display screen and the select one or more action. The concept of mouse was first given by APPLE COMPUTERS with its brand new PC APPLE MACHINTOSH. But now it is a basic need of each and every GUI (Graphical user interface) based operating system.

STRUCTURE:

Its body is made up of hard plastic with a ball at its base, and has a cable from the front. This structure is very similar to the real nice therefore this device is known as Mouse. It also contains two buttons relatively called LEFT and RIGHT buttons. Normally we use left button for most of the task. In between both buttons a scroll wheel is placed which is used to scroll up and scroll down the page without disturbing the actual position of the mouse.

3. TRACKBALL:

Trackball is another pointing device work on exactly on the principle of mouse. Its structure is just the opposite structure of a mouse. Its ball is at the top while buttons are at the base. In order to use trackball user use its fingers to rotate Advantage of trackball over mouse is simply that it require less space to use as compare to a mouse and it can use any where on any surface. Majority of the Trackball users have to face wrist pain. This is due to the reason during using mouse our whole hand moves while in trackball only our wrist is working which is its only disadvantage.

4. SCANNER:

Scanner is the third most common input device after keyboard and mouse. It can input only image base data and convert it into digital signals. Normally scanners are available in black and white" and "Colored" modes. The most common type of scanner are;

- ★ Hand-Held scanner
- ★ Flatbed scanner
- ★ Sheet-Fed scanner

HAND-HELD SCANNER:

These scanners can be used by means of human hands. They are normally common and relatively cheap but their output quality is not so good because they require steady hand movement. These scanners are easy to use by passing it over the surface in steady position.

FLAT-BED SCANNER:

This is the most common type of scanner also known as horizontal scanners. It produces relatively good result as compare to handheld scanners. It is due to the reason as compare to handheld scanners. It is due to the reason that object is static at its place and machine scan it automatically so both are steady at there places so end result is good. Their working is just like Photostat machine. The difference is it copy image into computer.

SHEET-FED SCANNER:

It contain a long continues sheet and print it continuously. It is normally used to scan large images like portraits but this is the type of scanner which is normally not used for official purpose. It is different from the above two scanners because it scan both side of images simultaneously. So their speed is also greater then any other scanners.

5. JOYSTICK:

Joystick is also a pointing device. It consists of a vertical handle like a gearshift lever mounted on a base with one or two buttons. These buttons are generally known as triggers. They are primarily used for playing games. Joysticks are popular for flight simulator and driving games. Today joystick is consider as the basic device in order to design computer animations because its working is much smooth as compare to mouse.

6. LIGHT PEN:

It is a light sensitive, or pen-like device, connected by a wire to the terminal. It contains a photo detector which allow user to interact with the computer with a special design monitor. It is approximately 3.5 inches in length and0.5 inches in width. It also contains cord at one of its end through which it connect to the computer. The user brings the pen closer to a desired point on the display screen and presses the pen button, which identifies that screen location to the computer.

7. MICROPHONE:

Microphone or MIC is another widely used input device but it is categorized in the multimedia family. Microphone is only use to input sound signals. Sound signals are transformed into digital signals by microphone so that computer can understand it. Now days it is widely used for communication purpose over internet and video conferencing.

8. DIGITAL CAMERA:

The only input device which can input both still and motional pictures is Digital Camera. The basic difference between normal and digital camera is we have to use a thin sheet of film in normal camera white there is no concept of film in digital camera. Data store in it electronically and then can be store in computer. The image quality of digital camera is quite better as compare to normal camera.

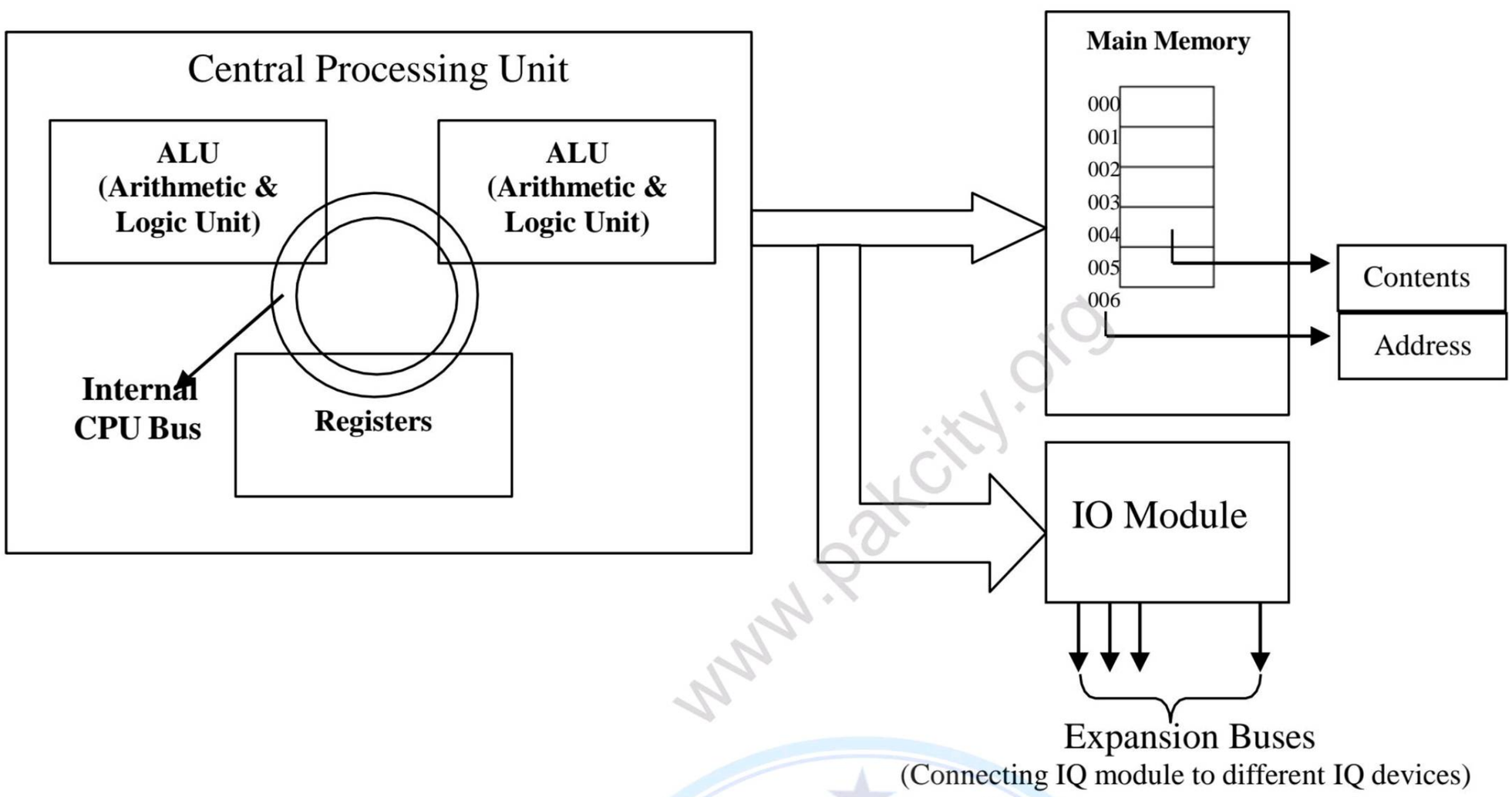
9. DIGITIZING TABLET:

A digitizing tablet, or digitizer, consists of a flat drawing surface and a pointing tool, which creates images that are converted to computer-usable form. The tablet, which is covered by a gird of tiny wires, is connected by cable to the computer screen, Later the drawing can be printed out Digitizing tablets are used in aircraft design and computer-chip design.

b. PROCESSING HARDWARE:

The function of processing hardware is to retrieve and execute (interpret) instructions provided to the computer. Processing may consist of performing calculations and other logical activities. Its components are central processing unit and main memory.

INTERNAL ARCHITECTURE OF THE PROCESSING UNIT:



CENTRAL PROCESSING UNIT (CPU):

CPU performs the main function of processing. It is contained on an IC (Integrated Circuit) chip. It is composed of the following main parts:

a) CONTROL UNIT, CU:

Control unit tells the rest of the computer how to carry out a program‟s instruction. It directs the movement of the electronic signals between main memory and the arithmetic / logic unit. It also directs the electronic signals between main memory and the IO devices.

b) ARITHMETIC AND LOGIC UNIT, ALU:

It performs arithmetic operations (like addition, subtraction, multiplication, division) and logical operations (like comparison and gate operations).

c) REGISTERS:

These are special, temporary storage areas that enhance the performance of the system. They store data during processing and provide working area for computation. Memory is the area that stores data to be processed a bit later whereas registers hold material that is to be processed immediately. Control unit loads data and instructions from main memory into these registers, which helps the computer process faster.

BUSES:

Buses are electrical path ways through which bits are transmitted within the CPU and between CPU and other device in the system unit. Typically a bus consists of multiple communication pathways, or lines.

According to location, buses are classified as follows:

Internal CPU: These lines are internal to the CPU and used to connect ALLI, control unit and various registers.

System Bus: It connects the CPU with the main memory and the main IO module the serves as the interface to the slower IO devices.

Expansion Buses: It connects the CPU with peripheral devices via IO module. Bus lines are also classified into three functional groups as follows:

- ★ Data lines provide a path for moving data between system modules. These lines collectively are called data bus.
- ★ Address lines carry addresses generated by the CPU to access a memory location or an IO device.
- ★ Control lines are used to control the access and the use of the data and address lines. In addition, there may be power distribution lines that supply power to the attached module.

MAIN MEMORY:

Main Memory is the primary storage medium;. It holds.

- ★ Data to be processed
- ★ Instructions to process data
- ★ Processed data

Main memory is contained on an IC chip. Memory is divided into locations. Each location is uniquely identified by an address. The contents of a memory location can change but the addresses always remain constant.

IO (INPUT / OUTPUT) MODULE:

The purpose of an IO system is to enable user to communicate with the computer. IO devices are attached to the computer by means of an IO module, whose function is to control data transfers between IO devices and the rest of the system. The reason for using the IO module is that IQ devices are extremely slow as compared to CPU therefore it is a sheer wastage of CPU‟s time to connect it directly with the IO devices. The CPU accesses both main memory and IO module in the same way, however, it usually takes much longer by the CPU to access data from IO module than to access data from memory because most IO operation are quite slow.

INSTRUCTION PROCESSING:

Machine Cycle:

Machine cycle is the shortest internal in which an elementary operation can take place within the process. It comprises a series of operations performed to execute a single program instruction.

Instruction Cycle:

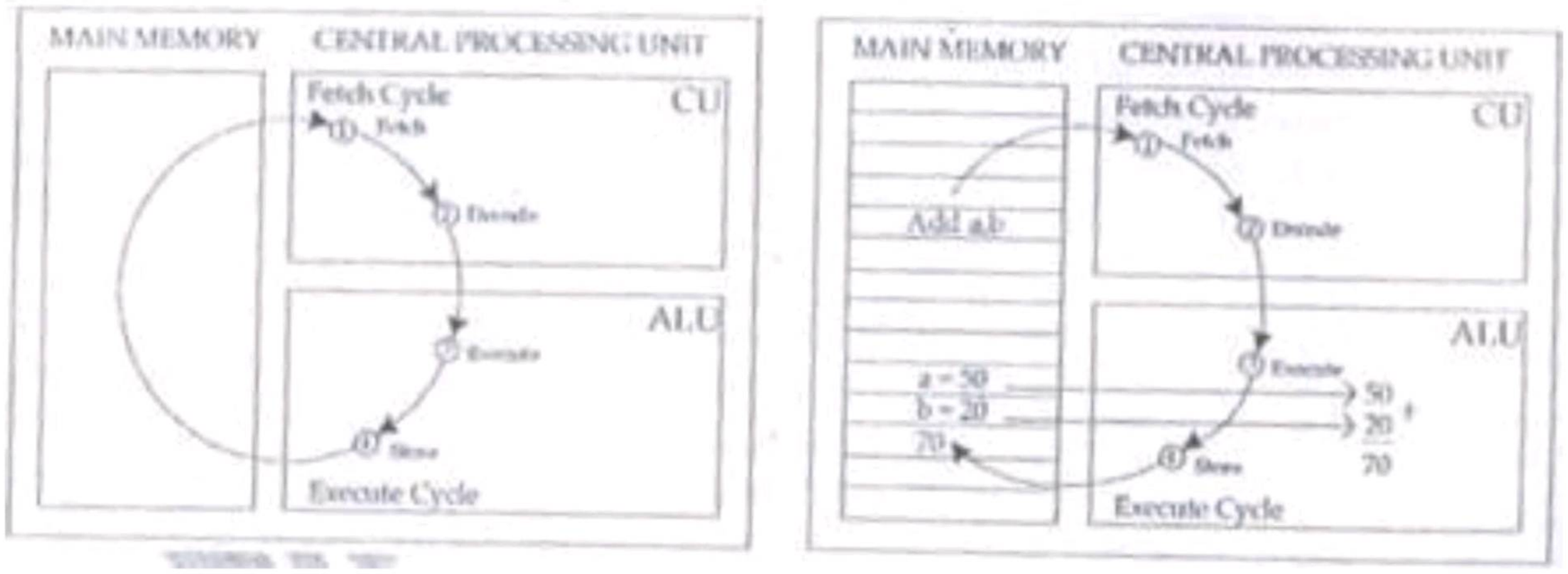
The processing required for a single instruction is called instruction cycle. The instruction cycle consists of two parts.

a) Fetch Cycle: During this stage the Control Unit

- ★ Fetches the instruction from main memory
- ★ Decodes the instruction (determines what the instruction means)

b) Execute Cycle: During this stage the Arithmetic/Logic Unit

- ★ Executes the instruction
- ★ Stores the result in a register or main memory



MEMORY CAPACITY:

The following terms are used to express memory capacity:

★ **Bit:** Each 0 or 1 is called a bit. IT is denoted by „b".

★ **Byte:** A group of 8 bits is called a byte. IT is denoted by „B".

KB (Mega byte):	1024 B	$= 2^{10}$ B = 1 KB.
MB (Mega byte):	1024 KB	$= 2^{20}$ B = 1 MB.
GB (Giga byte):	1024 MB	$= 2^{30}$ B = 1 GB.
TB (Tera byte):	1024 GB	$= 2^{40}$ B = 1 TB.
PB (Peta byte):	1024 TB	$= 2^{50}$ B = 1 TB.
EB (Exa byte):	1024 PB	$= 2^{60}$ B = 1 EB.

REPRESENTATION OF DATA AND PROGRAMS:

Computers use binary system to represent data. The binary system has only two digits. 0 and 1, representing the two states on and off. In the computers these two number are represented by electrical voltage. Thus, in the computer the binary 0 can be represented by a low voltage and 1 by a high voltage. All data and programs that go into the computer are represented by these two numbers.

BINARY CODING SCHEMES:

Letters, numbers and special characters are represented within a computer system by means of binary coding schemes. That is, the on/off and 1s are arranged in such a manner that they can be made to represent the characters, digits, or other values. Following are the coding schemes most commonly used:

a) ASCII (American Standard Code for Information Interchange):

It is an 8-bit code that means it uses different combinations of 8 bits to represent each character. These 8 bits can represent at most 256 (=28) characters. This is the most widely used coding system with microcomputers. Windows 95 users ASCII coding system.

b) EBCDIC (Extended Binary Coded Decimal Interchange Code):

This is another 8-bit code. Here also, the maximum number of characters that can be represented is 256 (=28) characters. This system is used in large computers like mainframes.

c) UNICODE (Universal Code, Universal Character Set):

This is a 16-bit code, that is, it can represent 65536 (=216) characters. Thus it allows almost all the written language of the world to be represented using a single character set. Windows NT used this coding system.

THE POWER OF PERSONAL COMPUTER:

The power of the personal computer is measured according to three main units of measurement:

- ★ RAM Capacity
- ★ Word Size Capability
- ★ Processor Speed

THE SYSTEM CABINET/UNIT:

The system unit consists of the motherboard (including the processor chip and memory chips), the power supply, and storage devices.

A. The Power Supply:

The electricity available from a standard wall outlet is alternating current (AC), but a microcomputer runs on direct current (DC), The power supply is a device that converts AC to DC to run the computer. The on/off switch in the computer turns on or shuts off the electricity to the power supply. Because the electricity can generate a lot of heat, a fan inside the computer keeps the power supply and other components from becoming too hot.

Electric power drawn from a standard AC outlet can be quite uneven. For example, a sudden surge, or spike, in AC voltage can burn out the low voltage DC circuitry in your computer. Instead of plugging the computer directly into the wall electrical outlet, the computer is plugged into a power protection device. The three principal types are:

a. Surge Protectors

A surge protectors, or surge suppressor, is a device that protects a computer from being damaged by surges (spikes) of high voltage. The computer is plugged into a surge protector, which in turn is plugged into a standard electrical outlet.

b. Voltage Regulators:

A voltage regulator, or line conditioner, is a device that protects a computer from being damaged by insufficient power brownout in voltage. Brownouts can occur when a large machine such as a power tool starts up and causes the light in the house to dim.

c. UPS (Uninterruptible Power Supply):

A UPS is a battery operated device that provides a computer with electricity if there is a power failure. The UPS will keep the computer going 5 – 10 hours or more. It goes into operation as soon as the power to the computer fails.

B. The Motherboard:

The motherboard or system board is the main circuit board in the system unit. It contains the microprocessor, RAM chips, ROM chips and some sockets called expansion slots where Mother Board showing above mentioned details.

The Microprocessor Chip:

Most microprocessors today use microprocessor of two kinds.

- ★ Made by Intel
- ★ Made by Motorola

Intel Chips: Input makes chips for personal computers such as Compaq, Dell, Gateway, Tandy, Toshiba, and Zenith. Variations of Intel chips are made by other companies, such as Advanced Micro Devices (AMD), Gyrix Inc Chips and Technologies.

Intel used to identify its chips by numbers 8086, 8088, 80286, 80386, 80486; the X86 series. Intel‟s successor to X86 chips is the Pentium family of chips. Listed from slowest to fastest, the current chip models available from Intel are the Pentium, Pentium with MMX technology, Pentium Pro, Pentium II, Pentium III, Pentium IV, Dual Core, and Core 2 Due.

Motorola Chips: Motorola produces the family of chips for Apple Macintosh computers. These RISC architecture.
RISC architecture
Most new chips are downward/backward compatible with older chips.
Downward/backward compatible means that you can run the software written for computers with older CPU chips on a computer with newer chips. For example, the word processing program and all the data files that you used for your 386 machines will continue to run on a 486 machines, thus 486 machines are downward compatible. However the reverse compatibility is not necessarily is not necessarily true. Upward compatible means that software written for a machine with a never chip will run on a machine with an older chip. Thus if you have a 486-powered PC and buy an old 286 portable, you may or may not be able to run your software on both.

RAM (Random Access Memory) chips:

Microcomputers come with different amounts of RAM, The more RAM you have, the faster the software can operate. If, for instance, you type such a long document in a word processing program that it will not all fit into your computer‟s RAM, the computer will put part of the document into your disk (either hard disk or diskette). This means you have to wait while the computer swaps data back and forth between RAM and disk. Microcomputers with 1GB RAM are common these days.
Additional RAM chips can be added by plugging memory modules, which are circuit boards that contain memory chips, into a memory socket on the motherboard. There are two types of RAM: SRAMs and DRAMs.

SRAMs – Static RAMs: In SRAM‟s binary values are stored using traditional flip-flops (a flip flop is a logical storage element made up of logic gates that can a single binary bit). A SRAM can hold its data as long as power is supplied to it. Since they do not require any refreshing, they are fast. They are more expensive than DRAMs. Examples of such memories are cache memories.
DRAMs – Dynamic RAMs: These memories are made with cells that store data as charge on capacitors. The presence or absence of charge on a capacitor is interpreted as a binary 0 or 1. As, the capacitors have natural tendency to discharge, DRAMs require periodic charge refreshing to maintain data storage. Hence they are slow. Examples of these memories are the traditional RAMs used in the PCs.

Types of DRAM Module
SIMM – Acronym for Single Inline Memory Module, a small circuit board that can hold a group of memory chips. Typically, SIMMs holds up 8 (on Macintoshes) or 9 (on PCs) RAM chips. On PCs, the ninth chip is often used for parity error checking. SIMMs, are easier to install than individual memory chips A SIMM is either 30 or 72 pins.
DIMM – Acronym for Dual Inline Memory Module, a small circuit board that holds memory chips. A single in-line memory module (SIMM) has a 32-bit path to the memory chips whereas a DIMM has 64-bit path., because the Pentium processor requires a 64-bit to memory. A DIMM contains 168 pins.
RIMM – The memory module used with RDRAM chips. It is similar to a DIMM package but uses different pin settings. Rambus trademarked the term RIMM as an entire word. It is the term used for a module using Rambus technology. It is sometimes incorrectly used as an acronym for Rambus Inline Memory Module. A RIMM contains 184 pins. Note must use all sockets in RIMM installation.

Types of DRAM

SDRAM – Short for Synchronous DRAM, A new type of DRAM that can at much higher clock speed than conventional memory. SDRAM actually synchronizes itself with the CPU‟s bus and is capable of running at 133 MHz. SDRAM delivers data in high speed burst.

DDR SDRAM – Short for Double Data Rate Synchronous DRAM, a type of SDRAM that supports data transfers on both edges of each clock cycle effectively, doubling the memory chip‟s data throughput. DDR – SDRAM is also called SDRAM II.

RDRAM – Short for Rambus DRAM, a type of memory (DRAM) developed by Rambus. Inc. In 1997, Intel announced that it would license the Rambus technology for use on its future motherboards, thus making it the likely de factors standard for memory architectures.

ROM (Read Only Memory) Chips:

ROM contains permanent pattern of data that cannot be changed. It is also known as firmware. They are non-volatile and non-erasable. While it is possible to read a ROM, it is not possible to change its data.

In microcomputer systems, one ROM chip holds the boot-up sequence of instructions called the ROM bootstrap, another ROM chip helps the processor transfer information between the keyboard, screen printer, and other peripheral devices to make sure all units are functioning properly. These instructions are called ROM BIOS, or basic input/output system. ROM BIOS is an interface, a connector and a translator between the computer hardware and the software programs.

Three variations of ROM chips are: PROM, EPROM and EEPROM.

a. PROM (Programmable Read-Only Memory)

A PROM is a memory chip on which data can be written only once, Once a program has been written onto a PROM, it remains there forever. Unlike RAM, PROM retain their contents when the computer is turned off. The difference between a PROM and a ROM (Read-Only Memory) is that a PROM is manufactured process. To write data onto a PROM chip, you need a special device called a PROM programmer or PROM burner. The process of programming a PROM is sometimes called burning the PROM.

b. EPROM (Erasable Programmable Read-Only Memory)

- ★ EPROMs are erased when exposed to ultraviolet light.
- ★ Erasure time is 20min or more.
- ★ Smaller in size / more dense as compared to EEPROM.
- ★ Their endurance is 100 programming cycles, i.e. EPROMs can be reprogrammed 100 times before the chip gets damaged.
- ★ Portions of EPROMs cannot be erased. The erasure process erases whole contents of the chip.

c. EEPROM (Electrically Erasable Programmable Read-Only Memory)

- ★ EEPROMs are erased when they are subjected to certain electrical voltage.
- ★ Erasure time is 10ms.
- ★ Larger in size as compared to EPROM.
- ★ Their endurance is 100,000 programming cycles.
- ★ Byte level erasure is possible in these chips.

C. Output Hardware:

The function of output hardware is to provide the user with the means to view information

produced by the computer system.

OR

All those devices which are used to translate computer generated signals into user understandable form are called Output Devices. Output could be of two types.

SOFTCOPY OUTPUT:

It is the temporary taken on monitor screen. Which can only be visualized.

HARDCOPY OUTPUT:

Hardcopy means the output is in a form can be physically touched. It is the permanent output taken on a paper by means of printer. It can be both visualized and storable physically.

MONITORS:

Monitor is the most common and most basic softcopy device. The basic structure of a PC is not complete without this component. The size of monitor screen is starting from 14 inches to onwards. If monitor screen is horizontal then called LAND SCAPE monitor and in case of vertical it is known as PORTAIR MONITOR.

TYPES OF MONITORS:

"By Structure"

According to structure monitors are divide into two types

- ★ CRT monitors
- ★ Flat-Panel display. OR LCD (Liquid crystal display) monitors.

CRT MONITORS:

CRT (cathode ray tube) monitors contain a tube its center by using which electrons are fired at phosphor dots on the screen. The dots are grouped into pixels, which glow when struck by electrons. In color CRTs; each pixel contains a red, green and blue dot. So by different combination of these colors many other colors appear. These are still the most common type of monitors used today.

FLAT – PANEL DISPLAY:

Most flat-panel monitors use liquid crystal display (LCD) technology or electro-luminescent (EI.). It is a new semiconductor technology in which monitor contains a special liquid at the top of the screen instead of CRT. Due to which its size reduces. This is the reason flat-panel monitors take up less desk space and are less in weight.

BY COLOR:

According to color the basic type of computer monitors are

- ★ Monochrome monitors
- ★ Gray-scale monitors.
- ★ Color monitors.

Monochrome Monitors:

Mono means one and chrome stands for color. These are called monochrome monitors because it can show data by using only one color (normally dirty white or bright white). It has black color on its background. This is the most basic type of monitors.

Gray-Scale Monitor:

As its name shows gray-scale is a special type of monitor which can shows almost 16 different shades of gray color it is not famous as compare to other two.

Color Monitors:
Today the mostly used type of computer monitors is Color monitor. It has the capability to show 16 to 1 million different colors. These are also called RGB monitors because their working based on three basic colors Red, Green, Blue. All

Properties of a Monitor Screen:
Resolution: Resolution means number of pixel on a screen. It tells about the sharpness of image of a monitor screen. As much as the pixels as good as the image.
Bandwidth: Bandwidth means the no of signal a monitor can handle at a time. As much as the bandwidth as higher will be refresh rata and as good will be the output.
Refresh Rate: Refresh rate is the number of times each second that the electron guns scan pixels. Refresh rate is measured in Hertz (Hz), or cycle per second. If refresh rate of a monitor is 72 Hz or higher then it is consider as a good monitor.
Dot Pitch: Dot pitch is the distance between the phosphor dots that make up a single pixel. In color monitors, three dots (red, green, and blue) make each pixel. Dots pitch no greater than. 31 millimeters consider reliable.
Convergence: the clarity and sharpness of each pixel known as Convergence. It means how greater the picture quality is.

PRINTERS:

The most famous hardcopy output device is printer. It accepts data in the form of both text and graphics from the CPU and then produces its hardcopy on paper. In early days it was not consider as important device with a computer system but now it is an essential device. With respect to structure, size, and cost printers are divided into two basic types,

- ★ Important Printer
- ★ Non-impact printers

IMPACT PRINTERS:

Impact means effect; it means these printers work by producing striking effects. Its basic structure contains a hammer behind an ink ribbon and in front of ink ribbon we place our paper so whenever hammer strikes the ribbon, it produce its impact on the paper. During the whole process they produce a great noise. There basic types are

- ★ Daisy-Wheel
- ★ Dot-matrix
- ★ Line printers

Daily Wheel:

As its name shows this type of printer contain a wheel over which all the alphabets and different symbols are written. A hammer sticks the wheel from back on a particular character and as a result it produces the impact of that particular character. Daisy wheel can only print data in text format.

Dot-Matrix:

Dot matrix printers are the most common. Type of impact printer. A dot matrix printers head contains a cluster of pins. The printer can push the pins out to form patterns in rapid sequence. The pins press an inked ribbon against the paper, creating an image on the paper. Some dot matrix printers print 500 cps (characters per second). These printers are still popular due to their low printing cost.

Line Printer:

Printers which can print a whole line on a single strike of hammer are called Line Printers. Their hammer size is relatively larger then the others printers. They are fast but printing quality is not too good. Drum and chain printers are the examples are the examples of line printers.

NON – IMPACT PRINTERS:

These printers are also known as hammerless printers. They print by means of laser and ink spread technology. Examples are

- ★ Ink jet printers
- ★ Laser printers
- ★ LCD and LED printers
- ★ Thermal printers

Inkjet Printers:

These printers print by means of ink cartridge. Its head spray ink on sheet of paper. These printers can print very high quality image and text output. Ink jet printers are available for color and black-and white printing. Due to their efficient working they are widely used for offices and home use.

Laser Printers:

Laser printers are the most famous type of non-impact printers. They use heat and pressure to bond particles to paper. Laser printers are available for color and black and white printing. Laser printers provide resolutions from 300 – 1200 dpi (dots per inch) and higher. Black and white laser printers usually produce 4 – 16 ppm (pages per minute). Laser printers produce higher quality print than ink jet printers, but are more expensive.

LCD & LED Printers:

LCD (liquid crystal display) and L.E.D. (light emitting diode) work on the same mechanism of laser but in these we different diodes for printing instead of laser beam.
Normally they are not use for commercial purposes. Most of the LED and LCD printers are used in research laboratories.

Thermal Printers:

Thermal means heat energy. It means this printer print by means of heat. These types of printer contain their head at hot state. So on making contact with a surface they produce their impact on it. They are widely used on industrial level.

Characteristics of a Printer:

Basic characteristics of a printer are

- ★ Quality of print
- ★ Speed
- ★ Graphics
- ★ Fonts
- ★ Color

Quality of print:

The quality of print is divided into two types, either “LETTER” or “DRAFT”. Daisy wheel, inkjet and laser printers produce letter quality (relatively good) while
most of the printers produce draft quality.

Speed: Speed is another very important issue in printing. Printers speed is measured in CPS (characters per second) and PPM (pages per minute). Daisy wheel is the slowest printer print with 30 cps. Still Laser printers are the fastest printers which can print about 4 to 20 or more pages per minute. Line printer can print 3,000 lines in a minute. Generally speed of the printer is directly proportional to its cost.

Graphic: Now-a-days graphic printing is another very important issue. Printer like laser, inkjet done this task with high quality while other like matrix are not capable of such kind of printing.

Fonts: Font means size, shape and design of a letter. New printers are capable of working with different fonts. Old printers like dot-matrix can deal with a limited number of fonts.

Color: In modern printing, color printing is very important. In different documents like maps, presentations and banners these color are of great importance. Some printers can print in only using thousands of colors.

Resolution: It is measured in DPI (dots per inch).It means how sharp and good is the printing. Printing resolution from 600dpi to onwards consider as a better one.

PLOTTERS:

Plotters are specialized output devices to produce high-quality graphics in a variety of colors. They are mostly used for print-outs that are too large to be printers. Plotters use mechanical, ink jet, or thermal technology to create large-format images for architectural or engineering uses. Now-a-days there are two basic types of plotters,

- ★ Pen plotters
- ★ Electrostatic plotters

PEN PLOTTERS:

Pen plotters structure based on a pen to do all the task regarding printer either images or text. Pen plotters are further divided into two types,

- ★ Drum plotters
- ★ Flatbed plotters

Drum Plotters:

It consists on a pen which writes over a paper which is roll over a drum. This kind of plotters are using for the printing of those banners of a fixed width with large length.

Flatbed Plotters: It is a plotter in which paper is fixed over a surface and pen is move over its surface. It is normally used in engineering purposes because of its high quality image.

ELECTROSTATIC PLOTTERS:

They work like a photocopy machine. They are faster and more expensive. They work by using electric charges (electricity). They consume a large amount of electricity but image quality is not so great as compare to drum or flatbed plotters.

SOUND OUTPUT DEVICES:

Sound-output device produce music, special-effect, noise, or other sounds. Sound capabilities can be added to some microcomputers by inserting a sound circuit board or by other means. Appropriate software and speakers are also required.

VOICE OUTPUT DEVICES:

Voice-output devices, or voice synthesizers, convert data in the computer into vocalized sounds understandable to human.

Computer Output Micro Film/Microfiche (COM) System:

Computer output microfilm/microfiche (COM) is computer output produced as very small images on rolls or sheets of films.

The principal advantages of this technology are:

1. Speed: COM systems can easily handle output at a rate in excess of 30,000 lines per minute. This is about 50 percent faster than most large laser printers.

2. Size: The output is condensed in size (compared to hardcopy output) by a factor ranging from 20 to 100.

3. Cost: The cost per page of printed material is less than that of regular hardcopy output methods.

The principal disadvantage of this technology is:

The major disadvantage of COM system is that, because of the reduced visual size of the output, special equipment – that is a microfilm/microfiche reader – is needed to rend the output.

D. Storage Hardware:

It is also called secondary stage. The function of this storage hardware is to provide a means of storing instructions and data in a form that is relatively permanent i.e. nonvolatile and easy to retrieve when needed for processing (nonvolatile memories are those which retain their contents even after the power is turned off).

Examples are Hard disks, floppy disks, Compact Disks (CDs), etc.

SECONDARY MEMORY:

Secondary storage is known as Auxiliary storage/external memory that is used to store large quantity of data. It is nonvolatile type of memory means data will not lost when power is turned off. Secondary memory is relatively slow and cheap as compare to primary memory. It cannot be processed directly by the CPU. Secondary storage devices used magnetic tape, magnetic disks and some optical disks like CDs etc.

FLOPPY DISK:

It is the most commonly used secondary storage device used in the 1990‟s. It is made up of polyester films coated with metal oxide compound. The rotation speed of the film is from is from 45 to 70 rps (rotation per minute). It is available in two sizes 5.25 inches and another one is 3.5 inches. With respect to storage ability floppies are available in two types single sided and double sided. Those floppies which can store data on a single side called single sided floppy disk. While floppies can store data on both sides are known as double sided floppies. Today two new terms HD (high density) and DD (double density) are also associated with the storage capability of a floppy disk.

HARD DISK:

Hard disk is the most commonly used secondary storage device used now a days. Today without hard disk concept of computer is not getting complete. As compare to floppy hard disk is less portable (transferable). But due to its large capacity it is used widely. It is made up of rigid aluminum or glass disk of about 3.5 inches in diameter. They are also coated with oxide or any ferromagnetic substance. A hard disk is consisting of many magnetic plates. On the surface of these plates there are circular spaced area called TRACKS. That track over which writing and reading process is going on is simply known as sectors. The reading and writing process is done by means of a head and the process is termed as “SEEK”. The rotation speed of hard disk is normally from 4500 to 7200 rpm (rotations per minute). While is seeking time is measured in milliseconds.

MAGNETIC TAPE:

All those devices in which data stored follow a single pattern or data store in a straight path are known as SERIAL SATORAGE DEVICE. A magnetic tape is also serial storage device. Serial storage devices are always slower then dynamic storage devices. In serial to access data at the last of the magnetic tape we have to cover the complete length in order to catch the desired position. The width of the tape is normally 1.27cm (0.5 inches) and the length is about 731.5 meters. On the back there is a ring used to write data on the disk. The magnetic tape is divided into logical blocks. A file consists of a single block at least. There are two other gaps known as

Interlock gap: It separates logical block and at very small distance to each other.

Inter record gap: They are relatively wider and separate different records. Magnetic tape is used today because they are still the cheapest technology. They can store large amount of data for long periods. All the telecom companies in Pakistan use magnetic tape to store there called records. The only

disadvantages of magnetic tape is that it is a sequential or serial media which means that you have to start from the beginning of the tape to access a record in the middle.

DIFFERENCE BETWEEN PRIMARY MEMORY & SECONDARY MEMORY

PRIMARY MEMORY	SECONDARY MEMORY
It is a faster memory area.	It is relatively slow.
It consists on both volatile (RAM) and non-volatile memory areas.	It consists on only non-volatile memory areas.
Usually primary memory is not portable.	Secondary memory is mostly portable except HDD.
It is relatively costly.	It is cheaper as compare to primary memory.

OPTICAL STORAGE:

Optical storage techniques make use of the laser beams to write and read data – which can consist of text, graphics, audio clips, or video images – at densities many times finer than those of a typical magnetic disk. A single optical disk of the type called CD-ROM can hold up to about 700 megabytes of data. This works out to about 269,000 pages of text, or more than 7500 photos or graphics, or 20 hours of speech, or 77 minutes of video. Although some disks are used strictly for digital storage, many combine text, visuals, and sounds.

Some of important optical devices are as follows:

- ★ CD – ROM
- ★ CR – R
- ★ CD – RW
- ★ DVD – ROM

CD – ROM:

CD – ROM (compact disk read only memory) formally known as CD. It can store data in both formats text graphics and audio or visual based data. It is a non-volatile optical disk. Its storage capacity is from 650MB to 1GB. Today it is the most common device for distribution of bulky (large) amount of data. Its speed is measured in "X" where 1X = 150 kilo bytes/second.

Structure of CD-Rom consist of a spiral originate from the center and ending at outermost edge of the disc. These circular paths are called PITS. The distance between two consecutive pits is from 1.5 to 1.7 microns. In the initial period of CD – ROM there were some heating and vibration problems but now they are completely resolved.

CD – R:

A CD – R (Compact Disc-Recordable) is a variation of the Compact Disc invented by Philips and Sony. CD – R is a Write Once Read Many (WORM) optical medium, though the whole disk does not have to be entirely written in the same session.

CD – R retains a high level of compatibility with standard CD readers.

The whole CD – R is written in one session with no gaps and the disc is "closed" meaning no more data can be added and the CD – R effectively becomes a standard read-only CD. With no gaps between the tracks the Disc At Once format is useful for "live" audio recordings. Data are written to the CD – R one track at a time but the CD is left "open" for further recording at a later stage. It also allows data and audio to reside on the same CD – R.

COMPACT DISC RE – WRITABLE (CD – RW)

Compact Disc Re0-Writable (CD – RW) is a rewritable optical disc format. Known as CD-Erasable (CD-E) during its development, CD-RW was introduced in 1997. CD-RW discs are usually

produced in the most common CD-R disc capacities such as 650 and 700 MB, while smaller and larger capacities are rarer. CD – RW recorders typically handle the most common capacities best. In theory a CD-RW disc can be written and erased roughly 1000 times, although in practice this number is much lower. CD-RW recorders can also read CD-R discs.

DVD ROM:

DVD – R is a DVD recordable format. A DVD-R typically has a storage capacity of 4.71 GB (or 4.38GiB), although the capacity of the original standard developed by Pioneer was 3.95 GB (3.68 GB). Both values are significantly larger than the storage capacity of its optical predecessor, the 700 MBCD-R – a DVD – R has 6.4 times the capacity of a CD-R.

Data on a DVD-R cannot be changed. Whereas a DVD – RW (DVD-rewritable) can be rewritten multiple (1000+) times. DVD-R(W) is one of three competing industry standard recordable formulas; the others are DVD+R(W).

SUMMARY OF STORAGE DEVICES:

Magnetic disk	
Floppy disk,	used for off-line storage
Hard disk drive,	used for secondary storage
Magnetic tape data storage,	used for tertiary and off-line storage

SUMMARY OF OPTICAL STORAGE:

CD, CD-ROM, DVD, BD-ROM: Read only storage used for mass distribution of digital information (music, video, computer programs)

CD-R, DVD-R, DVD+R, BD-R: Write once storage, used for tertiary and off-line storage.

CD-RW, DVD-RW, DVD+RW, DVD-RAM, DB-RE: Slow write, fast read storage, used for tertiary and off-line storage.

SOFTWARE:

Computer hardware is useless without electronic instructions called software, which tells hardware what to do. Software is composed of programs and programs are in turn composed of instructions. Software generally comes on disks, purchased off-the-shelf (ready made from the market) or custom written. There are two types of software.

a) Application Software b) System Software

a) Application Software:

Application software performs general-purpose tasks for users. Examples are word processing, spread sheet programs, payroll processing, etc.

b) System Software:

System software runs basic computer operations, manages computer resources and enables application software to run on the computer. It does not solve problems related to business or a profession. Examples are operating systems, device drivers and utility programs.

The components of System Software:

There are three basic components of system software:

- ★ Operating System
- ★ Device drivers
- ★ Utility programs

THE OPERATING SYSTEM:

The operating system (OS), also called the software platform, consists of the master system of programs that manage the basic operations of the computer.

Operating system provides resources management services of many kinds. It handles the control and use of hardware resources, such as:

- ★ Disk space
- ★ Memory
- ★ CPU time allocation &
- ★ Peripheral devices

In general, an operating system written for one kind of hardware will not be able to run on another kind of machine. In other words, different operating system are mutually incompatible.

TASKS PERFORMED B OPERATING SYSTEM:

- ★ Booting
- ★ User Interface
- ★ CPU Management
- ★ Memory Management
- ★ File Management
- ★ Task Management
- ★ Formatting
- ★ Security Management

TASK MANAGEMENT:

A computer is required to perform many different tasks at once. In word processing, for example, it accepts input data, stores the data on a disk, and prints out a document – seemingly simultaneously. Some computers‟ operating systems can also handle more than one program at the same time – word processing, spreadsheet, database searcher. Each program is displayed in a separate window on the screen. Others can accommodate the needs of several different users at the same time. All these examples illustrate tasks management. A “task” is an operation such as storing, printing, or calculating.

Among the ways operating systems manage tasks in order to run more efficiently are:

- ★ Multitasking
- ★ Multiprogramming
- ★ Time-sharing
- ★ Multiprocessing

Multitasking:

Multitasking is the execution of two or more programs by one user concurrently on the same computer with one central processor.

Earlier microcomputers could do only single-tasking, whereby an OS could run only one application program at a time. Thus, users would have to shut down the application program they were working in before they opened another application, which was inconvenient. Today, multitasking operating systems are used.

You may be writing a report on your computer with one program while another program plays a music CD. How does the computer handle both programs at once?

The answer is that the operating system directs the processor to spend a predetermined amount of time executing the instructions for each program, one at a time. Thus, a small part of the first program is processed, and then the processor moves to the remaining programs, one at a time, processing small parts of each. The cycle is repeated until processing, is complete. Because the processor is usually very fast, it may appear that all the programs are being executed at the same time. However, the processor is still executing only one instruction at a time.

Multiprogramming:

Multiprogramming is the execution of two or more programs concurrently on a multi-user operating system.

As with multitasking, the processor spend a certain amount of time executing each user‟s program. Once again, because the processor works so quickly, it seems as though all the programs are being run at the same time.

Time-Sharing:

In time-sharing, a single computer processes the tasks of several users at different stations in round-robin fashion.

Time-sharing is used when several users are linked by a communications network to a single computer.

The computer will first work on one user‟s task for a fraction of a second, then go on to the next user‟s tasks, and so on.

This is accomplished through time slicing. Because computers operate so quickly, they can alternately apportion slices of time (frictions of a second) do various tasks. Thus, the computer may rapidly switch back and forth among different tasks, just as a hairdresser or dentist works with several clients or patients concurrently. Users are generally unaware of the switching process. Multitasking and time-sharing differ slightly. With multitasking, the processor directs the programs to take turns accomplishing small tasks or events, such as making a calculation, searching for a record, or printing out part of a document. Each event may take a different amount of time to complete. With time-sharing, the computer spends a fixed amount of time with each program before going on the next one.

Multiprocessing:

Multiprocessing is processing done by two or more computers or processors linked together to perform work simultaneously – that is, at precisely the same time.

As in multitasking, which involves only a single processor, the processing should be so fast that, by spending a little bit of time working on each program in turn, several programs can be run at the same time. With both multitasking and multiprocessing, the operating system keeps track of the status of each program so that it known where it left off and where to continue processing. But an operating system capable of multiprocessing is much more sophisticated than that required for multitasking.

Two possible approaches to multiprocessing are:

- ★ Co-Processing
- ★ Parallel Processing

In co-processing, the controlling CPU works with specialized microprocessors called co-processing, each of which handles a particular task.

In parallel processing several full-fledged processors work together on the same tasks, sharing memory.

	Definition Processing of two or more programs	Number of Users	Number of Processors	Order of Processing
Multitasking	By one user concurrently on one processor	One	One	Concurrently
Multiprogramming	By multiple users concurrently on one processor	Multiple	One	Concurrently
Time sharing	By multiple users in round-robin fashion on one processor	Multiple	One	Round Robin
Multiprocessing	By one or more users simultaneously on two or more processors	One or more	Two or more	Simultaneously

- ★ Common Operating Systems
- ★ Windows 3.x
- ★ Windows 9x
- ★ Windows NT/Windows 2000/ Windows Millennium
- ★ Windows Vista
- ★ OS/2 warp
- ★ UNIX
- ★ Linux (Developed by Linus Torvalds in 1990 while he was a computer science students at Helsinki
- ★ University in Finland
- ★ Mac OS
- ★ Netware

Device Drivers: Running Peripheral Hardware:

Device drivers are specialized software programs that allow input and output devices to communicate with the rest of the computer system.

Many basic device drivers come with system software when you buy a computer, and the system Software will guide you through choosing and installing the necessary drivers.

If you buy a new peripheral device, such as a mouse, scanner, or printer, the package will include a device driver (probably on a CD-ROM). You „ll need to install the diver on your computer‟s hard-disk drive (by following the manufacturer‟s instructions) before the device will operate.

Data/Information:

The purpose of computer system is to convert data into information. Data consists of raw facts and figures. Information is processed data. For example, the raw data of employees‟ hours worked and wage rate is processed by a computer into information of paychecks and payrolls.

Information produced by one program can be used as data for another program. For example, the information of paychecks and payrolls may become data that goes someone‟s yearly financial projections and tax returns.

Procedure:

Procedures are description of how things are done, steps for accomplishing a result. Procedures for computer systems appear in documentation manuals, also called reference manuals/or CD-ROMs which contains instruction, rules and guidelines to follow when using hardware and software.

People / Personnel:

They are the most important component of a system. They operate the hardware and create the software. They can be generally categorized as:

- ★ Computer operator
- ★ Programmer
- ★ System analyst

Computer Operator is a person who runs computer. They are capable of handling computers when hey malfunction.

Programmer is a person who writes software.

System Analyst is information specialist who performs system analysis, design and implementation. He studies the information and communication needs of an organization to determine how to deliver information that is more accurately, timely and useful. He is responsible for the development of an information system. (Information system is an organization‟s framework of standards and procedures for processing data into usable information. It can be manual or computer based).

Utilities: Service Programs

Utility programs, also known as service programs, perform tasks related to the control and allocation of computer resources. They enhance existing functions or provide services not supplied by other system software programs.

PROGRAMMING LANGUAGE:

A Computer language by means of which we can write a computer program to instruct computer to do some particular job is known as PROGRAMMING LANGUAGE.

A program is a set of instruction that directs the computer. It is a set of rule which directs a computer towards a certain goal.

There are too many types of computer language as follows.

MACHINE LANGUAGE (LOW LEVEL LANGUAGE)

A computer language which can easily understandable by a computer system is known as machine language. IT is in binary format means 0‟s and 1‟s. Machine language is consisting on a series of 0‟s and 1‟s which is computer readable format.

For a computer programmer it is very difficult to understand this format.

ASSEMBLY LANGUAGE:

Assembly language is the modified form of a low level language using few instructions and symbols. Statements are written in symbolic codes (mnemonics). The main reason to write program in assembly language because it is very close to low level language so computer can easily understand it. All the hardware related computer programs (soundcard driver, VGA card driver) are written in assembly language. E.g. MASM, TASM etc.

HIGH LEVEL LANGUAGE:

Language which is closer to human language (user understandable) but difficult for a computer to understand. All the programs written in high level language first translate into machine language by using any language translator. In High-level languages, common English words are used as instructions to the

computer. High-level language statements resemble English phrases combined with the mathematical terms needed to express the problems or task being programmed.
Example: COBO, PASCAL, BASIC, ADA, FORTRAN etc.

VERY HIGH LEVEL LANGUAGES OR 4GL'S

These languages provide all the facilities of high-level languages along with enhanced facilities of file handling and report preparation. And application generation Thus, they are regarded as the evaluation of 3rd generation high level languages, and are called Very-High-Level Languages, 4GL"s (4th Generation Language).
Example: SQL, FoxPro, ORACLE, PROLOG etc.

NATURAL LANGUAGES OR A.I. LANGUAGES OR 5GL'S:

Natural Languages are highly sophisticated programming languages, which can interact with humans and situations in natural way. The main goal of these languages is to simplify the human"s task and to communicate with the computer easily.
Example: PROLOG, AJAX.

LANGUAGE TRANSLATION:

The software which translates codes of human understandable programming languages into computer"s machine language is called Language Translators.

TYPES OF LANGUAGE TRANSLATORS:

- ★ Interpreter
- ★ Compiler
- ★ Assembler

★ INTERPRETER:

"A program that translates instructions of high-level language into machine language, one instruction at a time, is called a Interpreter."
The interpreters are slow in speed as compared to compilers. It takes a single line of the source code, translates that line into object code and carries it out immediately. The process is repeated line by line until the whole program has been translated and run. If the program loops back to earlier statements, they will be translated afresh (once again) each time round. This means that both the source program and the interpreter must remain in the main memory together, which may limit the space available for data. Perhaps the biggest drawback of an interpreter is the time it takes to translate and run a program including all the repetition, which can be involved.

★ COMPILER:

"A program that translates the entire code of a high-level language into machine code is known as Complier. The original program is called "Source Program" and its machine translation is known as "Object Program".
A compiler can translate only that program which has been written in the language for which the computer is meant e.g., FORTRAN compiler is only capable of translating source program, which have been written in FORTRAN. Each machine requires a separate compiler for each high level language. Compiler can diagnose the following kinds of errors in a source program during translation.

- ★ Illegal characters.
- ★ Illegal combination of characters
- ★ Improper sequence of instruction in a program.

A source program containing an error diagnosed by compiler will not compiled into an object program. The computer will print (display) a suitable message.

★ ASSEMBLER

"A program that translates instructions of Assembly Language (low level symbolic language) into machine language is known as ASSEMBLERS."

In Assembly language, there is exactly one code corresponding to a machine code, called "MNEMONIC". The assembly program is known as "SOURCE PROGRAM" while its translation into machine code is termed as "OBJECT PROGRAM". Thus, the assembler"s task is relatively easier than that of interpreters or compilers. Since each computer has its distinct machine code, thus has its own mnemonic. As a result, each computer has its own assembler. Liking process is always required in the end to execute the object program.

GENERATIONS OF COMPUTERS

Generations of computer science is divided into many distinct generations which are as follows.

TYPES OF GENERATIONS:

- ★ First Generation (1940 – 1956)
- ★ Second Generation (1956 – 1963)
- ★ Third Generation (1965 – 1971)
- ★ Fourth Generation (1971– 1981)
- ★ Fifth Generation (1981 – Onward)

★ FIRST GENERATION (1940 – 1956)

First generation computers were consists on thousands of Vacuum Tubes.

Computers size was large because of the great number of tubes that was used in it. The vacuum tubes required great amount of energy and they generated a lot of heat. Most of the data were entered into the computer through punch cards. UNIVAC was the first computer of this generation developed in the U.S in 1951.

Remaining are ENIAC, EDVAC, IBM-709 etc.

Advantages:

Vacuum tubes were used as electronic components. They were declaring as the first Electronic digital computers. This generation computers were the fastest calculating devices of that time.

Disadvantages:

Computers are too much heavy in size. They require air conditioning. First generation computers produced large amount of heat due to vacuum tubes.

★ SECOND GENERATION (1956 – 1963)

In the second-generation computers the "Transistor" technology was implemented. Transistors are electronic devices that are built in 1947, and used in different digital electronic components.

Usually it consists of small layers of silicon or germanium. Transistor was faster, less expensive, smaller and emitted less heat than vacuum tubes.

Examples of 2nd generation computers are IBM-1401, UNIVAC-III, NCR 300 etc.

Advantages:

Computers of 2nd generation are smaller. In size as compare to first generation computers. They are much more reliable. They generate less and Computations were performed in microsecond"s. Due to above reason they are widely used commercially.

Disadvantages:

Computers of this age required Air conditioning. They require heavy maintenance work. Commercial production was difficult and costly as compare to the third generation computers.

★ THIRD GENERATION (1965 – 1971)

Third generation is the Integrated Circuits (IC‟s) generation. Computers of this generation were smaller, more efficient and more reliable than previous generations. Unlike transistors and vacuum tubes, integrated circuits (IC‟s) were used. Programming becomes easy in this generation of computers. Computers prices also decrease and computer becomes a very popular counting machine. Examples of 3rd generation computers are INTEL 4004 etc.

Advantages:

They are smaller in size as compare to previous generations. Reliability increase as compared to previous generations. Heat generations was decreasing. Hardware failure was also reduces. Very easy to shift from one place to another. Their production start on a very vast scale.

Disadvantages:

Air conditioning is still a great problem in it. IC chips production is a costly process so computer in this generation was a bit costly.

★ FOURTH GENERATION (1971– 1981)

Integrated circuits were also used in this generation of computers. Initially they were used on a very small scale termed as Small Scale Integration (SSI). After some time the technology became more sophisticated and known as Large-Scale Integration (LSI). In LSI each chip consists of thousand of small electronic components on a single small board. These boards are known as microprocessor. In 1971, a powerful microprocessor chip INTEL 8008 was introduced. It was the first microprocessor, which is used in PC, Examples of Computers of 4th generation are IBM-3033, IBM system 34 etc.

Advantages:

In fourth generation size reduces a lot. Computer becomes Very reliable. Heat generation was reduced. Much faster computation was possible. Easily portability because of their small size. Commercial production of computer was easier and cheaper.

Disadvantages:

Technology of IC manufacturing becomes too complex.

★ FIFTH GENERATION (1981 – ONWARD)

In fifth generation two new technologies are used for the production of IC chips, these technologies are,

- ★ Very Large Scale Integration (VLSI)
- ★ Ultra Large Scale Integration (ULSI)

In fifth generation computers become much faster as well as smaller as compare to the previous generations. The goal of the fifth generation is to have the computer which can understand human language and also can recognize voices. Artificial Intelligence (AI) is the basic field of interest in fifth generation. In this generation computer size and weight reduces and it becomes more and more popular among the computer users like Laptop or potable computers. The new versions of laptop were introduced named as “Note Book” while the smallest laptops are termed as “Palmtop”.

Advantages:

This is the best generation according to computer‟s size and speed. Long bit processors were built. Small size Laptop computers introduced. Artificial intelligences developed directing us toward robotic world.

Disadvantage:

The only disadvantage of this generation computers are they make humans too much busy.