

# INFORMATION TECHNOLOGY – ADDITIONAL STUDY MATERIAL

## CHAPTER 1 A – INTRODUCTION TO COMPUTERS

### Characteristics that differentiate Microprocessors

1. **Instruction Set:** The set of instructions that the microprocessor can execute.
2. **Bandwidth:** The number of bits processed in a single instruction.
3. **Clock Speed:** Given in megahertz (MHz), the clock speed determines how many instructions per second the processor can execute.

### Concepts in Artificial Intelligence

1. **Games playing:** programming computers to play games such as chess and checkers.
2. **Expert Systems:** programming computers to make decisions in real-life situations. (for example, some expert systems help doctors diagnose diseases based on symptoms)
3. **Natural Language:** programming computers to understand natural human languages.
4. **Neural Networks:** Systems that simulate intelligence by attempting to reproduce the types of physical connections that occur in animal brains
5. **Robotics:** programming computers to see and hear and react to other sensory stimuli.
6. The important area of artificial intelligence is neural networks, which are proving successful in a number of disciplines such as voice recognition and natural-language processing. There are several programming languages that are known as AI languages because they are used almost exclusively for AI applications. The two most common are LISP and Prolog.

### Classification of Computers based on Working Principle

1. **Analog Computer:**  
It is unique in terms of operation, as it utilizes continuous variables for the purpose of mathematical computation.
2. **Digital Computer**  
A digital computer can store the results of its calculations for later use, can compare results with other data, and on the basis of such comparisons can change the series of operations it performs. Digital computers are used for reservations systems, scientific investigation, data-processing and word-processing applications, desktop publishing, electronic games, and many other purposes.
3. **Hybrid Computer (Analog + Digital)**  
A hybrid computer may use or produce analog data or digital data. A hybrid computer capable of real-time solution has been less expensive than any equivalent digital computer. Hybrid computers have been necessary for successful system development. An example of a hybrid computer is the computer used in hospitals to measure the heartbeat of the patient.

### History and Evolution of Mainframe Computers

1. ENIAC mainframe had thousands of vacuum tubes, relays resistors, capacitors, and inductors inside it.
2. It could process the digits in serial mode
3. The concept of virtual memory, was introduced in mainframes making the system even more powerful.
4. Mainframe system had various powerful specialized features like multiprogramming, multiprocessing and virtual memory.

### Super Computers

Supercomputers are mainly being used for Defense, whether forecasting, biomedical research, remote sensing, aircraft design and other areas of science and technology. In the medical field, super computers are used to study the structure of viruses, such as those causing AIDS. Designing an aircraft involves simulating and analyzing the airflow around the aircraft. This again requires a super computer.

### Workstations

They are optimized for the visualization and manipulation of different types of complex data such as 3D mechanical design, engineering simulation (e.g. computational fluid dynamics), animation and rendering of images, and mathematical plots. Workstations are the first segment of the computer market to present advanced accessories and collaboration tools. One peculiar feature of the machine was that it lacked any actual arithmetic circuitry. To perform addition, it required a memory-resident table of decimal addition rules. This saved on the cost of logic circuitry, enabling IBM to make it inexpensive.

### Servers

1. Servers often run for long periods without interruption and availability. Although servers can be built from commodity computer parts, mission-critical servers use specialized hardware with low failure rates in order to maximize uptime.
2. For example, servers may incorporate faster, higher-capacity hard drives, larger computer fans or water cooling to help remove heat, and uninterruptible power supplies that ensure the servers continue to function in the event of a power failure. These components offer higher performance and reliability at a correspondingly higher price.
3. Some popular operating systems for servers such as FreeBSD, Solaris and Linux are derived from or are similar to UNIX. UNIX was originally a minicomputer operating system, and as servers gradually replaced traditional minicomputers, UNIX was a logical and efficient choice of operating system.
4. Many of these derived OSs are free in both senses, and popular. Server-oriented operating systems tend to have certain features in common that make them more suitable for the server environment, such as
  - (a) GUI not available or optional,
  - (b) Ability to reconfigure and update both hardware and software to some extent without restart,
  - (c) Advanced backup facilities to permit regular and frequent online backups of critical data,
  - (d) Transparent data transfer between different volumes or devices,
  - (e) Flexible and advanced networking capabilities,
  - (f) Automation capabilities such as daemons in UNIX and services in Windows, and
  - (g) Tight system security, with advanced user, resource, data, and memory protection.

### Advantages of Computers

1. **Automation:** Without interfering the user during the operations it executes automatically the program instructions one by one.
2. **Versatility:** Modern computer can perform different kind of tasks one by one or simultaneously. At one moment we can play games on computer, the next moment we can compose and send emails etc. The talent of computer is dependent on the software.
3. **Communications:** Today computer is mostly used to exchange messages or data through computer networks all over the world.
4. **Diligence:** It does not get tired while working after hours of work it performs the operations with the same accuracy as well as speed as the first one.
5. **No Feelings:** Their judgments are totally based on instructions given to them.
6. **Consistency:** People often have difficulty to repeat their instructions again and again. A computer will carry out the activity with the same way every time.
7. **Precision:** Computers are not only fast and consistent but they also perform operations very accurately and precisely.

### Limitations of Computers

1. **Programmed by human: Though** computer is programmed to work efficiently and accurately, but it is programmed by human beings to do so.
2. **No Intelligence:** Its performance is depends on instructions given to it.
3. **No decision making power:** The computer can take only those steps which are entered by the programmer.
4. **Emotionless:** They are simply machines which work as per the instruction given to them.
5. **Curtail human Capabilities:** Excessive use of computers is causing various types of health injuries, calculating capacity, storage or human memory capacity is reduced etc.

### Basic Computer Functions

1. It accepts data or instructions by way of input,
2. It stores data,
3. It can process data as required by the user,
4. It gives results in the form of output, and
5. It controls all operations inside a computer.

### Components of a Computer System – CPU

1. A system consisting of interconnected computers that share a central storage system and various peripheral devices such as a printer, scanner, or router. Each computer connected to the system can operate independently, but has the ability to communicate with other external devices and computers.
2. Every CPU has at least two basic parts, the control unit and the arithmetic logic unit. Control Units are either **hardwired** (instruction register is hardwired to rest of the microprocessor) or **micro-programmed**. All the computer's resources are managed from the control unit.

### Level 3 Cache

Level 3 cache is now the name for the extra cache built into motherboards between the microprocessor and the main memory. L3 cache is specialized memory that works hand-in-hand with L1 and L2 cache to improve computer performance.

### Slot

A CPU socket provides many functions, including providing a physical structure to support the CPU, providing support for a heat sink, facilitating replacement (as well as reducing cost) and most importantly forming an electrical interface both with the CPU and the PCB.

### Motherboards

1. The motherboard contains the CPU, BIOS, memory, mass storage interfaces, serial and parallel ports, expansion slots, and all the controllers required to control standard peripheral devices, such as the display screen, keyboard, and disk drive.
2. An important component of a motherboard is the microprocessor's supporting chipset, which provides the supporting interfaces between the CPU and the various buses and external components. This chipset determines, to an extent, the features and capabilities of the motherboard.
3. **Processor slot:** It is rectangular connector into which the processor is mounted vertically. It also refers to a square-shaped connector with many small connectors into which the processor is directly inserted.
4. **ISA (Industry Standard Architecture):** The ISA enables controllers connect directly to the bus to communicate directly with the other peripherals without going through the processor. However, the ISA bus only allows hardware to address the first 16 megabytes of RAM.
5. **AGP slot:** These slots allow AGP card to directly access computer system memory, which speeds up graphics processing.

6. **Sound Cards:** A **sound card** (also known as an **audio card**) is a computer expansion card that facilitates the input and output of audio signals to and from a computer under control of computer programs. Uses of sound cards include providing the audio component for multimedia applications such as music composition, editing video or audio presentation, education, and entertainment (games). Many computers have sound capabilities built in, while others require additional expansion cards to provide for audio capability. It allows computers to produce sound like music and voice. The older sound cards were 8 bit. Now-a-days 32 bit or more sound cards are being used.
7. **Colour Cards:** It allow computers to produce colours and graphics on the screen. The first colour cards were 2 bit which produced 4 colours [CGA]. It was amazing what could be done with those 4 colours. Next came 4 bit and 6 bit allowing for 16 and 64 [EGA] colours. Then came 8 bit allowing for 256 [VGA] colours. Then MCGA was introduced which is similar to VGA , had a 256-color mode, but that was the extent of the chipset's abilities which produces almost 17 million colours and now XGA allowing monitors to display almost a billion separate colours.
8. **Com/Serial ports:** A serial port is a serial communication physical interface through which information transfers in or out one bit at a time. In modern personal computers the serial port has largely been replaced by USB and Firewire for connections to peripheral devices. Serial ports are commonly used in applications such as industrial automation systems, scientific analysis, shop till systems and some industrial and consumer products. Server computers may use a serial port as a control console for diagnostics. Network equipment (such as routers and switches) often use serial console for configuration. Serial ports are still used in these areas as they are simple, cheap and their console functions are highly standardized and widespread. A serial port requires very little supporting software from the host system.
9. **Control bus (Command Bus):** It transports orders and synchronize signals coming from the control unit and traveling to all other hardware components. It is a bidirectional bus, as it also transmits response signals from the hardware. A control bus is a computer bus, used by CPUs for communicating with other devices within the computer. The control bus is used by the CPU to direct and monitor the actions of the other functional areas of the computer. It is used to transmit a variety of individual signals (read, write, interrupt, acknowledge, and so forth) necessary to control and coordinate the operations of the computer. The individual signals transmitted over the control bus and their functions are covered in the appropriate functional area description.

### Storage Devices

1. **Robotic Storage:**

Robotic storage is a new type of storage method used for backups, and for high capacity archives in imaging, medical, and video industries. Robotic-access storage devices may have a number of slots, each holding individual media, and usually one or more picking robots that traverse the slots and load media to built-in drives. The arrangement of the slots and picking devices affects performance.
2. **Network Storage:**
  - (a) **Direct Attached Storage (DAS)** refers to a network storage system on which data is saved to the server computer's internal hard drive. The network workstations access the server to connect to the storage. These files are saved directly onto the computer's disk space and can be readily pulled up at any time. This is the most commonly used means of network storage. The disadvantages of DAS include its inability to share data or unused resources with other servers.
  - (b) **Network Attached Storage (NAS)** is a type of network storage system that saves data onto another computer system attached to a group of computers through a network, or onto a special server attached to the network. A NAS device is typically a stand alone, high performance, single purpose system or component. It serves specific storage needs with its own operating system and integrated hardware and software. NAS devices are well suited to serve heterogeneous networks. The advantages of NAS over other methods of storage are performance and connectivity.
  - (c) **Storage Area Network (SAN)** is an architecture to attach remote computer data storage devices (such as disk arrays, tape libraries, and optical jukeboxes) to servers so the devices appear as locally attached to the operating system. A SAN typically has its own network of storage devices that are generally not accessible through the regular network by regular devices. SAN reduces data traffic and improves data access by using Fiber connections.



### Characteristics of Storage and Primary Storage

1. **Differentiation of Information:** Dynamic Memory and Static memory
2. **Integrated Circuits:**  
Integrated circuits are used for a variety of devices, including microprocessors, audio and video equipment, and automobiles. Integrated circuits are often classified by the number of transistors and other electronic components. The ICs can be scaled according to the capacity of the chip used in storing the data in computer system.
  - (a) **SSI (Small-Scale Integration):** Up to 100 electronic components per chip.
  - (b) **MSI (Medium-Scale Integration):** From 100 to 3,000 electronic components per chip.
  - (c) **LSI (Large-Scale Integration):** From 3,000 to 100,000 electronic components per chip.
  - (d) **VLSI (Very Large-Scale Integration):** From 100,000 to 1,000,000 electronic components per chip.
  - (e) **ULSI (Ultra Large-Scale Integration):** More than 1 million electronic components per chip.
3. **Random-Access-Memory (RAM):**
  - (a) Random access memory is volatile memory, meaning it loses its contents once power is cut. This is different from non-volatile memory such as hard disks and flash memory, which do not require a power source to retain data.
  - (b) When a computer shuts down properly, all data located in random access memory is committed to permanent storage on the hard drive or flash drive. At the next boot-up, RAM begins to fill with programs automatically loaded at startup, and with files opened by the user.
  - (c) **Dynamic RAM:**
    - Fast Page Mode (FPM) DRAM Introduced in 1987, this is an early form of DRAM that was once very common because it was slightly faster than DRAM. This computer memory type was frequently mounted on a SIMM in 486 and early Pentium computers
    - Extended Data Out (EDO) DRAM is slightly faster than FPM. EDO offers a slight performance boost over FPM DRAM by cutting a few steps when addressing memory. Introduced in 1995, EDO requires a specific chip set and is limited to bus speeds of 66 MHz. Once again, these chips are mounted on SIMM modules.
    - Double Data Rate SDRAM (DDR SDRAM) is a newer form of SDRAM that can theoretically improve memory clock speed to 200 megahertz (MHz) or more. DDR shuffles data over the bus over both the rise and fall of the clock cycle, effectively doubling the speed over that of standard SDRAM. Due to its advantages over RDRAM, DDR-SDRAM support was implemented by almost all major chipset manufacturers, and quickly became the new memory standard for the majority of PC's.
  - (d) **Static RAM:**
    - **Asynchronous RAM:** It is an older type of SRAM used in many PC's for L2 cache. It is asynchronous, meaning that it works independently of the system clock. This means that the CPU found itself waiting for data from the L2 cache.
    - **Synchronous RAM:** This type of SRAM is synchronous, meaning it is synchronized with the system clock. While this speeds it up, it makes it rather expensive at the same time.
    - **Pipeline Burst SRAM:** This is Commonly used SRAM that requests pipelined data processing method, meaning larger packets of data is resent to the memory at once, and acted on very quickly. This breed of SRAM can operate at bus speeds higher than 66MHz, so is often used.

### Data Storage – Limitations

1. In spite of all the capacity and speed advantages, hard disks have one major drawback. To achieve optimum performance, the read/write head must be extremely close to the surface of the disk.
2. In fact, the heads of hard disks fly so close to the surface of the disk that if a dust particle, a human hair, or even a fingerprint were placed on the disk it would bridge the gap between the head and the disk, causing the heads to crash.
3. A head crash, in which the head touches the disk, destroys the data stored in the area of the crash and can destroy a read/write head, as well.

### Digital Video Disk (DVD)

Various types of DVDs can be used for storing images, text, movies, high resolution graphics etc. They are –

1. DVD-5 holds 4.7 GB data and is supported by the DVD+R/RW and DVD-R/RW formats. It is also known as Single-Sided Single Layer.
2. DVD-10 holds 8.75 GB data and is supported by the DVD+R/RW and DVD-R/RW formats. It is also known as Double-Sided Single Layer.

3. DVD-9 holds 8.5 GB data and is supported by the DVD+R and DVD-R formats. It is also known as Single-Sided Double Layer (sometimes called Dual Layer). The official names are DVD-R DL and DVD+R DL.
4. DVD-18 holds 15.9 GB data and is supported by the DVD+R format. It is also known as Double-Sided Double Layer (or Double-Sided Dual Layer).

### **Blu Ray Disc**

1. Blu-ray (and not Blue-ray) also known as Blu-ray Disc (BD), is the name of a next-generation optical disc format jointly developed by the Blu-ray Disc Association (BDA), a group of the world's leading consumer electronics, personal computer and media manufacturers.
2. The format was developed to enable recording, rewriting and playback of High Definition Video (HD), as well as storing large amounts of data. The format offers more than five times the storage capacity of traditional DVDs and can hold up to 25 GB on a single-layer disc and 50 GB on a dual-layer disc. This extra capacity combined with the use of advanced video and audio codes that will offer consumers an unprecedented HD experience.
3. While current optical disc technologies such as DVD, DVD±R, DVD±RW, and DVD-RAM rely on a red laser to read and write data, the new format uses a blue-violet laser instead, hence the name Blu-ray.
4. Despite the different type of lasers used, Blu-ray products can easily be made backwards compatible with CDs and DVDs through the use of a BD/DVD/CD compatible optical pickup unit.
5. The benefit of using a blue-violet laser (405nm) is that it has a shorter wavelength than a red laser (650nm), which makes it possible to focus the laser spot with even greater precision. This allows data to be packed more tightly and stored in less space, so it's possible to fit more data on the disc even though it's the same size as a CD/DVD. This together with the change of numerical aperture to 0.85 is what enables Blu-ray Discs to hold 25 GB/50 GB data. Recent development by Pioneer has pushed the storage capacity to 500 GB data on a single disc by using 20 layers.
6. Blu-ray is currently supported by about 200 of the world's leading consumer electronics, personal computer, recording media, video game and music companies. Consumers initially were also slow to adopt Blu-ray due to the cost. By 2009, 85% of stores were selling Blu-ray Discs. A high-definition television and appropriate connection cables are also required to take advantage of Blu-ray disc. Some analysts suggest that the biggest obstacle to replacing DVD is due to its installed base; a large majority of consumers are satisfied with DVDs.

## **CHAPTER 1 B – INPUT AND OUTPUT DEVICES**

### **Mouse**

1. Mouse connects to PCs in one of several ways:
  - (a) **Serial mice** connect directly to an RS-232C serial port or a PS/2 port. This is the simplest type of connection.
  - (b) **PS/2 mice** connect to a PS/2 port.
  - (c) **USB mice**
2. **Cordless Mice:**
  - (a) Cordless mice aren't physically connected at all. Instead they rely on infrared or radio waves to communicate with the computer. Cordless mice are more expensive than both serial and bus mice, but they do eliminate the cord, which can sometimes get in the way.
  - (b) One of the most interesting mouse technologies invented is the **wireless mouse** which relies infrared, radio signals or Bluetooth to communicate with the computer. Using no cord, the wireless mouse contains a transmitter to send information to a receiver itself connected to the computer. The wireless mouse is usable from 2m to 10m of the computer. The **cordless mouse** uses the wireless communication technology (via infrared, radio or Bluetooth) to transmit data to the computer. And like the wireless, it doesn't use any cord.

### **Joystick**

1. The joystick is a vertical stick which moves the graphic cursor in a direction the stick is moved. It has a button on top that is used to select the option pointed by the cursor. Joystick is used as an input device primarily used with video games, training simulators and controlling robots.
2. The joystick is used for flight control in the cockpit of many aircraft, controlling machines such as cranes, trucks, underwater unmanned vehicles, wheelchairs and surveillance cameras. Miniature finger-operated joysticks have been adopted as input devices for smaller electronic equipment such as mobile phones.

### Scanner

1. It is an input device used for optically scans images, printed text, handwriting, or an object, and converts it to a digital image. The common examples found in offices are variations of the desktop (or flatbed) scanner where the document is placed on a glass window for scanning.
2. Capturing information in this way reduces the possibility of errors typically experienced during large data entry. Hand-held scanners are also commonly seen in big stores to scan codes and price information for each of the items. They are also termed the bar code readers. Mechanically driven scanners that move the document are typically used for large-format documents, where a flatbed design would be impractical.

### Camera

1. Two types of cameras are used for input on a computer.
2. The digital camera is a device that takes digital images and saves them to memory. The user then connects the camera to the computer where images are uploaded and saved.
3. Web cams are the other type of camera that is known as video capture device that is connected to a computer or computer network, often using a USB port. Web cams are ways for people to take images from the computer and communicate visually with other users on the Internet.

### Digitizing Tablets

1. It is also known as graphics tablet which is a computer input device that allows hand-draw images and graphics, similar to the way one draws images with a pencil and paper. These tablets may also be used to capture data or handwritten signatures. It can also be used to trace an image from a piece of paper which is taped or otherwise secured to the surface.
2. Capturing data in this way, either by tracing or entering the corners of linear polylines or shapes is called digitizing.
3. A graphics tablet consists of a flat surface upon which the user may "draw" or trace an image using an attached stylus, a pen-like drawing apparatus. The image generally does not appear on the tablet itself but, rather, is displayed on the computer monitor.

### Musical Instrument Digital Interface (MIDI)

MIDI (Musical Instrument Digital Interface) is a system designed to transmit information between electronic musical instruments. A MIDI musical keyboard can be attached to a computer and allow a performer to play music that is captured by the computer system as a sequence of notes with the associated timing (instead of recording digitized sound waves).

### Kinds of Bar Code Readers

There are Five basic kinds of Barcode Readers – Pen Wands, Slot Scanners, Charge-Couple Device (CCD) Scanners, Image Scanners, and Laser Scanners.

1. A **Pen Wand** is the simplest barcode reader. It contains no moving parts and is known for its durability and low cost. A pen wand can present a challenge to the user, however, because it has to remain in direct contact with the bar code, it must be held at a certain angle, and has to be moved over the bar code at a certain speed.
2. A **Slot Scanner** remains stationary and the item with the bar code on it is pulled by hand through the slot. Slot scanners are typically used to scan bar codes on identification cards.
3. A **CCD Scanner** has a better read-range than the pen wand and is often used in retail sales. A CCD scanner has a "gun" type interface and has to be held no more than one inch from the bar code. Each time the bar code is scanned, several readings are taken to reduce the possibility of errors. A disadvantage of the CCD scanner is that it cannot read a bar code that is wider than its input face.
4. An **Image Scanner**, also called a Camera Reader, uses a small video camera to capture an image of the bar code and then uses sophisticated digital image processing techniques to decode the bar code. It can read a bar code from about 3 to 9 inches away and generally costs less than a laser scanner.
5. A **Laser Scanner**, either hand-held or stationary, does not have to be close to the bar code in order to do its job. It uses a system of mirrors and lenses to allow the scanner to read the bar code regardless of orientation, and can easily read a bar code up to 24 inches away. To reduce the possibility of errors, a laser scanning may perform up to 500 scans per second. Specialized long-range laser scanners are capable of reading a bar code up to 30 feet away.

**Monitors**

1. A monitor is also called as video display terminal (VDT). The visual display of the processed data, which the users can view, is got through the monitor. There are two types of computer monitors, namely CRT and Flat panel. CRT stands for cathode ray tube, describing the technology inside an analog computer monitor or television set. The CRT monitor creates a picture out of many rows or lines of tiny colored dots. These are technically not the same thing as pixels, but the terms are often used interchangeably. The more lines of dots per inch, the higher and clearer the resolution.
2. The **Refresh Rate** indicates how many times per second the screen is repainted. Lower resolutions normally have higher refresh rates because it takes less time to paint a lower resolution.
3. **Flat panel displays (Flat screen)** encompass a growing number of technologies enabling video displays that are much lighter and thinner than traditional television and video displays that use cathode ray tubes, and are usually less than 100 mm (4 inches) thick. They can be divided into **Volatile** and **Static**.
4. **Advantages and Limitations of CRT, LCD and Plasma display devices:**

| Category                | CRT                                                                                                                                                                                                                                                                                                                                                                                                                                                        | LCD                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | PLASMA                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|-------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. <b>Advantages</b>    | <ol style="list-style-type: none"> <li>1. Having high dynamic range of colors, wide gamut and low black level.</li> <li>2. It can display natively in almost any resolution and refresh rate.</li> <li>3. It has low response time generally in Sub-milliseconds.</li> <li>4. It has zero color, saturation, contrast or brightness distortion as well as excellent viewing angle.</li> <li>5. Usually much cheaper than LCD or Plasma screens.</li> </ol> | <ol style="list-style-type: none"> <li>1. Very compact and light weighted.</li> <li>2. Low power consumption.</li> <li>3. No geometric distortion.</li> <li>4. Little or no flicker depending on backlight technology.</li> </ol>                                                                                                                                                                                                                                                                                                        | <ol style="list-style-type: none"> <li>1. Compact and light weighted.</li> <li>2. High contrast ratios, excellent color, wide gamut and low black level.</li> <li>3. High speed response time.</li> <li>4. Near zero color, saturation, contrast or brightness distortion as well as excellent viewing angle.</li> <li>5. No geometric distortion.</li> <li>6. Highly scalable, with less weight gain per increase in size.</li> </ol> |
| 2. <b>Disadvantages</b> | <ol style="list-style-type: none"> <li>1. Large size and weight, especially for bigger screens (a 20-inch unit weighs about 20 to 30 Kg).</li> <li>2. High power consumption.</li> <li>3. Geometric distortion caused by variable beam travel distances.</li> <li>4. Older CRTs are prone to screen burn-in.</li> <li>5. Produces noticeable flicker at low refresh rates.</li> </ol>                                                                      | <ol style="list-style-type: none"> <li>1. Limited viewing angle, causing color, saturation, contrast and brightness to vary.</li> <li>2. Uneven backlighting in some monitors, causing brightness distortion</li> <li>3. Slow response times, which cause smearing and ghosting artifacts.</li> <li>4. Only one native resolution.</li> <li>5. Fixed bit depth.</li> <li>6. Thermalization may occur, which is when only part of the screen has overheated and therefore looks discolored compared to the rest of the screen.</li> </ol> | <ol style="list-style-type: none"> <li>1. Large pixel pitch, meaning either low resolution or a large screen.</li> <li>2. Noticeable flicker when viewed at close range.</li> <li>3. High operating temperature and power consumption.</li> <li>4. Only has one native resolution.</li> <li>5. Fixed bit depth.</li> <li>6. Dead pixels are possible during manufacturing.</li> </ol>                                                  |

**Additional Characteristics of Printers**

1. **Capacity:**  
Most modern printers use FireWire or USB to connect to personal computers. Older printers use serial cable connections, but they did not allow the speed and bandwidth as computer processors grew in speed and hard drives increased in capacity.
2. **Buffer:**  
Print buffers are used to store print jobs within the printer, freeing up the computer to continue work. With faster computers and larger print file sizes such as photographs, modern computer printers have much larger buffers than their predecessors.



### Factors Determining the Purchase of Printer

When deciding between an inkjet and a laser printer, it is a good idea to evaluate several factors before proceeding with the purchase. Some of them are as follows –

1. One of the main considerations when looking at both inkjet printers and laser printers is the amount of usage one can anticipate with the device. An inkjet printer works very well for relatively low demands that are primarily text documents. However, inkjets are not designed for a large amount of production each day. Ink cartridges for inkjet types of printers simply do not last that long. For environments where there will be a high volume of daily usage, there is no doubt that the laser printer is the better option.
2. Another important consideration when choosing between an inkjet and a laser printer is the initial cost. Good quality inkjets can be purchased for a relatively low amount of money.
3. Lastly, the type of paper that will be used is also important when deciding whether to purchase an inkjet or a laser printer. A laser printer usually can accommodate various weights of paper with little or no problem. Inkjets tend to work best with standard twenty weight paper.
4. **Conclusion:** If all three of these factors are highly important, then the laser printer is the best choice. For price, low usage, little color and use of only standard paper, then the inkjet printer will work very well.

### Other Types of Printers – Multifunctional Printers (MFP) or Multifunction Peripheral

A single device that serves several functions, including printing. Multifunction Printers can act as a printer, a scanner, a fax machine and a photocopier. It provides centralized document management / distribution / production in a large-office setting.

### Speaker

Just as microphones are now important input devices, speakers and their associated technology are key output systems.

1. The speakers attached to the systems are similar to ones that are connected to a stereo. The only difference is that they are usually smaller and they contain their own small amplifiers. Otherwise, they do the same thing that any speaker does. They transfer a constantly changing electric current to a magnet, which pushes the speaker cone back and forth.
2. The moving speaker cone creates pressure vibrations - in other words, sound. The more complicated part of the sound output system is in the **sound card**. The sound card translates digital sounds into the electric current that is sent to the speakers. When the sound is played back, the sound card reverses this process, translating the series of numbers into electric current that is sent to the speakers.

## CHAPTER 1 C – SOFTWARE

### Programming Languages

Programming Languages are vocabulary and set of grammatical rules for instructing a computer to perform specific tasks. The term programming language usually refers to highlevel languages, such as BASIC, C, C++, COBOL, FORTRAN, Ada, and Pascal. Each language has a unique set of keywords (words that it understands) and a special syntax for organizing program instructions.

### Flavors of Windows Operating System

1. **Windows 2000:**  
An operating system produced by Microsoft for use on personal computers, business desktops, laptops, and servers released on 17 February 2000. It was the successor to Windows NT 4.0, and is the final release of Microsoft Windows to display the "Windows NT" designation.
2. **Windows XP (eXPerience):**  
It is an operating system produced by Microsoft for use on personal computers, including home and business desktops, laptops, and media centers. It was first released in August 2001, and is currently one of the most popular versions of Windows. Windows XP has new features to the Windows line, including:
  - (a) Faster start-up,
  - (b) More user-friendly interface
  - (c) Fast user switching
  - (d) The ClearType font rendering mechanism
  - (e) Remote Desktop functionality
  - (f) Support for most DSL modems and IEEE 802.11 connections

**3. Windows Vista:**

- (a) In 2007 Microsoft released Windows Vista. It contains a number of new features, from a redesigned shell and user interface to significant technical changes, with a particular focus on security features.
- (b) Windows Vista contains many changes and new features, including an updated graphical user interface and visual style dubbed Aero, a redesigned search function, multimedia tools including Windows DVD Maker, and redesigned networking, audio, print, and display sub-systems.

**4. Windows 7.0:**

It is the latest release of Microsoft Windows, a series of operating systems produced by Microsoft for use on personal computers, including home and business desktops, laptops, notebook, tablet PCs, and media center PCs.

**5. UNIX OS:**

- (a) The UNIX environment and the client-server program model were essential elements in the development of the Internet and the reshaping of computing as centered in networks rather than in individual computers. As a result, UNIX became synonymous with "open systems".
- (b) UNIX is seen as the operating system on a workstation or a network server. UNIX systems formed the backbone of the early internet, and they continue to play an important part in keeping the internet functioning. UNIX originally set out to be an incredibly portable system, capable of allowing a computer to have multiple processes going on at once, and with multiple users logged in at the same time. UNIX was designed to be portable, multi-tasking and multiuser in a time-sharing configuration.

**6. Mac OS:**

- (a) It is a graphical user interface-based operating systems developed by Apple Inc. for their Macintosh line of computer systems.
- (b) The "classic" Mac OS is characterized by its total lack of a command line; it is a completely graphical operating system. Noted for its ease of use and its cooperative multitasking, it was criticized for its very limited memory management, lack of protected memory, and susceptibility to conflicts among operating system "extensions" that provide additional functionality (such as networking) or support for a particular device.
- (c) The server edition, Mac OS X Server, is architecturally identical to its desktop counterpart but usually runs on Apple's line of Macintosh server hardware.

**7. Linux OS:**

Linux is the generic name for a UNIX-like operating system that can be used on a wide range of devices from supercomputers to wristwatches. The Linux kernel is released under an open source license, so anyone can read and modify its code. Linux has superseded UNIX in most places, and is used on the 10 most powerful supercomputers in the world.

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**Multi – Threading**

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- 1. It is an application implemented as a separate process with several threads of control. In some situations a single application may be required to perform several similar tasks, for example a web server accepts client requests for web pages, images, sound, and so forth.
- 2. A busy web server may have several of clients concurrently accessing it. If the web server runs as a traditional single-threaded process, it would be able to service only one client at a time. The amount of time that a client might have to wait for its request to be serviced could be enormous. So it is efficient to have one process that contains multiple threads to serve the same purpose. This approach would multithread the web-server process.
- 3. The server would create a separate thread that would listen for client requests when a request was made rather than creating another process it would create another thread to service the request.
- 4. Multithreading allows a process to keep running even if some threads within the process are stalled, working on a lengthy task, or awaiting user interaction, thus improve the performance of processing the task.

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**Time Sharing**

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- 1. Time sharing is a methodology created to satisfy the processing needs of multiprogramming and batch operating system. In time sharing systems, the execution time is divided into small slots called "**Time Slice**". Each process is processed for a time slice and then the other process is taken for processing by the processor.
- 2. This process goes on till all the jobs are processed. The process of shifting a microprocessor from processing of one job to the other is so rapid that the user can't even notice it.

3. In these systems, the processes that are waiting for processor time are placed in a special memory area called "**Ready Queue**". When a process has some input or output requirements, it is shifted from this area. Whenever the time slice becomes over, the processor looks for the next ready process for processing and starts its processing.
4. The main objective of the time sharing systems is to reduce the response time. The response time is time in which the operating system responds to the commands supplied by the user.
5. Time sharing systems are more complex than multiprogramming operating systems. In these systems, a large amount of memory is required to store various running processes. Several memory management schemes are used. Methods like virtual memory are used to use a part of secondary memory as main memory.

#### Other Systems Software

1. **Device Drivers:**

- (a) Device drivers are small files that act as an interface between hardware in a computer system and the operating system (OS). Hardware requires device drivers so that the OS can "see" the devices and handle them effectively and efficiently. A driver communicates with the device through the computer bus or communications subsystem to which the hardware connects.
- (b) Common components that require drivers include keyboards, mice, controllers, graphics cards, audio hardware, Ethernet hardware, wireless cards, ports, card readers, card slots and CD/DVD drives.

2. **Utility Programs or Service Programs:**

**Debugging Program:**

These programs are usually written and provided by the computer manufacturers. They assist in program debugging. They usually trace the processing of the program being debugged. The diagnostic routines are however also often treated as a category of the utility or service programs

## CHAPTER 2 – DATA STORAGE, RETRIEVAL & DATABASE MANAGEMENT SYSTEMS

#### Unicode

Unicode is a worldwide character code standard. In this code system, 16-bits (2 bytes) are used to represent a single character or symbol. Using this code system, 65,536 different characters can be represented inside the computer. The first 256 codes in Unicode are identical to the 256 codes used by ASCII system.

#### Integer Number

An integer data type can hold a whole number, but no fraction. Integers may be either signed (allowing negative values) or unsigned (non-negative values only). Various sizes of integer vary from 8 bit to 64 bit word length. Byte, Word, Long and Double are the types of Integer data types.

#### Parts of DBMS

Both the database and DBMS software is called Database System. A database system has four major parts. They are –

1. **Data:** Being an important component of the system, most organizations generate, store and process a large amount of data. The data acts as a bridge between machine parts i.e. hardware and software and the users, who access it directly or through some application programs. The data stored in the system is partitioned onto one or more databases. A database, then, is a repository for stored data. In general, it is both integrated and shared. By integrated, it is meant that the database is a unification of several otherwise distinct data files. The individual pieces of data in the database may be shared among several different users in the sense that each of them may have access to the same piece of data. Such sharing is really a consequence of the fact that the database is integrated.

2. **Hardware:** The hardware consists of the secondary storage devices such as magnetic disks (hard disk, zip disk, floppy disks), optical disks (CD-ROM), magnetic tapes, etc. on which data is stored together with the I/O devices (mouse, keyboard, printers), processors, main memory, etc. which are used for storing and retrieving the data in a fast and efficient manner.
3. **Software:** The software part of a DBMS acts as a bridge between user and the database. In other words, software interacts with users, application programs, and database and files system of a particular storage media (hard disk, magnetic tapes etc.) to insert, update, delete and retrieve data.
4. **Users:** The broad classes of users are:
  - (a) **Application Programmers and System Analysts:** System analysts determine the requirements of end users; especially naive and parametric end users, and develop specifications for canned transactions that meet these requirements. Application programmers implement these specifications as programs, and then they test, debug, document, and maintain these canned transactions.
  - (b) **End Users:** These are the people who require access to the database for querying updating and generating reports. The database exists primarily for /their use.
  - (c) **Database Administrator (DBA):** DBA is responsible for authorization access to the database, for coordinating and monitoring its use, and for acquiring the needed software and hardware resources.
  - (d) **Database Designers:** These are responsible for identifying the data to be stored in the database for choosing appropriate structures to represent and store this data.

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### **Relational Database**

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1. A relational database allows the definition of data and their structures, storage and retrieval operations and integrity constraints that can be organized in a table structure. A table is a collection of records and each record in a table contains the same fields.
2. Three key terms are used extensively in relational database models: **relations, attributes, and domains**. A relation is a table with columns and rows. The named columns of the relation are called attributes, and the domain is the set of values the attributes are allowed to take. All relations (and, thus, tables) in a relational database have to adhere to some basic rules to qualify as relations.
3. A relational database contains multiple tables, with at least similar value occurring in two different records (belonging to the same table or to different tables), implies a relationship among those two records. The relationships between records in tables can also be defined explicitly, by identifying or non-identifying parent-child relationships characterized by assigning cardinality (1:1, 1 : M, M:M). Tables can also have a designated single attribute or a set of attributes that can act as a "key", which can be used to uniquely identify each record in the table.
4. A key that can be used to uniquely identify a row in a table is called a primary key. Keys are commonly used to join or combine data from two or more tables. Keys are also critical in the creation of indexes, which facilitate fast retrieval of data from large tables.

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### **Entity – Relationship Model or Database**

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1. An E-R model is a specialized graphic that illustrates the interrelationships between entities in a database. It is an abstract and conceptual representation of data. Entity-relationship modeling is a database modeling method, used to produce a type of conceptual schema of a system.
2. The entity is defined as a distinguishable object that exists in isolation and is described by a set of attributes.
3. A relationship is the association among several entities.
4. Entities and relationships can both have attributes. An attribute is a data element that describes an entity. The set of all entities or relationships of the same type is called the entity set or relationship set. The degree of relationship indicates the link between the two entities for a specified occurrence of each. The degree of relationship is also called "**Cardinality**".