

Chapter 3: Computer System Organisation

Data processing: It refers to the operations or activities performed on data to generate information. Data processing proceeds through six stages - Capturing data, Input of data, Storage of data, Processing / manipulating data, Output of information, and Distribution of information.

Capturing Data: Here a source document is designed to collect data.

Input: The data collected through the source documents is fed to the computer for processing.

Storage: The input data are stored before processing.

Process: Various operations like calculation, classification, comparison, sorting, filtering, summarising, etc. may be carried out as part of processing.

Output: The processed data is obtained in the form of information.

Distribution of information: The information obtained from the output stage is distributed to the beneficiaries.

Functional Units of a computer: Input Unit, Central Processing Unit (CPU), Storage Unit and Output Unit.

Input Unit: The data and instructions for their processing are entered into the computer through the input unit. They are stored in the memory (storage unit). Eg: keyboard, mouse, scanner, mic, digital camera, etc.

Central Processing Unit: CPU is the brain of the computer. It consists of three components - Arithmetic Logic Unit (ALU), Control Unit (CU) and registers. ALU performs calculations and logical operations such as comparisons and decision making. CU manages and co-ordinates all other units of the computer. Registers are temporary storage elements that facilitate the functions of CPU.

Storage Unit: It holds data and instructions required for processing, intermediate results for ongoing processing and final results of processing.

Output Unit: The information obtained after data processing is supplied to the outside world through this unit. Monitor and printer are the commonly used output devices.

Computer: An electronic machine designed to accept the data and instructions, performs arithmetic and logical operations on the data according to a set of instructions and output the results or information.

Characteristics of computer: Speed, accuracy, diligence, versatility, huge memory, no IQ, lack of decision making.

Important registers inside a CPU:

- i. **Accumulator:** It is used to store intermediate result while performing arithmetic and logical operations.
- ii. **Memory Address Register (MAR):** It stores the address of a memory location to which data is either to be read or written by the processor.
- iii. **Memory Buffer Register (MBR):** It holds the data, either to be written to or read from the memory by the processor.
- iv. **Instruction Register (IR):** The instructions to be executed by the processor are stored in the Instruction Register.
- v. **Program Counter (PC):** It holds the address of the next instruction to be executed by the processor.



Measuring units of memory:

Binary Digit = 1 Bit	1 MB (Mega Byte) = 1024 KB
1 Nibble = 4 Bits	1 GB (Giga Byte) = 1024 MB
1 Byte = 8 Bits	1 TB (Tera Byte) = 1024 GB
1 KB (Kilo Byte) = 1024 Bytes	1 PB (Peta Byte) = 1024 TB

RAM Vs ROM:

RAM	ROM
<ul style="list-style-type: none">• It is faster than ROM.• It stores the operating system, application programs and data when the computer is functioning.• It allows reading and writing.• It is volatile, i.e. its contents are lost when the device is powered off.	<ul style="list-style-type: none">• It is a slower memory.• It stores the program required to boot the computer initially.• Usually allows reading only.• It is non-volatile, i.e. its contents are retained even when the device is powered off.

Cache memory: It is a small and fast memory between the processor and RAM (main memory). Frequently accessed data, instructions, intermediate results, etc. are stored in cache memory for quick access.

Storage unit of computer: Two types – primary and secondary.

- i. **Primary storage:** It is also known as main memory. It is again divided into two – Random Access Memory (RAM) and Read Only Memory (ROM). RAM holds instructions, data and intermediate results of processing. ROM contains instructions for the start up procedure of the computer. The Central Processing Unit can directly access the main memory at a very high speed. But it has limited storage capacity.
- ii. **Secondary storage:** It is also known as auxiliary storage. It has huge storage capacity and the storage is permanent. Usually we store data, programs and information in the secondary storage, but we have to give instruction explicitly for this. Hard disk, CDs, DVDs, memory sticks, etc. are some examples.

Comparison of Memories:

Storage	Speed	Capacity	Relative Cost	Volatile
Registers	Fastest	Lowest	Highest	No
Cache	More Fast	Low	Very High	No
RAM	Very Fast	Low/Moderate	High	No
Hard Disk	Moderate	Very High	Very Low	Yes

Input devices: These devices feed data and instructions from the user into the computer.

Output devices: These devices present information from a computer system to the user.

Keyboard: Allows the user to input text data consisting of alphabets, numbers and other characters.

Mouse: A small handheld device used to position the cursor or move the pointer on the computer screen by rolling it over a mouse pad / flat surface.

Light pen: A pointing device shaped like a pen. Has the advantage of 'drawing' directly onto the screen.

Touch screen: Allows the user to operate/make selections by simply touching on the display screen.

Graphic tablet: Consists of an electronic writing area and a special 'pen' that works with it. Allows artists to create graphical images with actions similar to traditional drawing tools.

Joystick: Used to play video games, control training simulators and robots.

Microphone: Accepts sound in analogue nature as input and converts it to digital format.

Scanner: Allows capturing of information, like pictures or text and converting it into a digital format that can be edited using a computer.

OMR: Scanning device that reads predefined positions and records where marks are made on the printed form. Useful for applications such as objective type tests and questionnaires.

Bar Code Reader: A bar code is a set of vertical lines of different thicknesses and spacing that represent a number. Barcode readers are used to input data from such set of barcodes. QR (Quick Response) code is similar to barcodes. Barcodes are single dimensional where as QR codes are two dimensional. The QR code can be read using a barcode reader or a mobile with a camera and special software installed.



Biometric sensor: Identifies unique human physical features like fingerprints, retina, iris patterns, etc. to identify, verify and authenticate the identity of the user.

Smart card reader: These are used to access data in a smart card. Smart card is a plastic card that stores and transacts data. Used in banking, healthcare, telephone calling, electronic cash payments and other applications.

Digital camera: Takes pictures and videos and converts it to the digital format. Web camera is a compact and less expensive version of a digital camera.

Monitor: Display devices include CRT monitors, LCD monitors, TFT monitors, LED monitors, gas plasma monitors, Organic Light Emitting Diode (OLED) Monitors, etc.

LCD projector: An LCD projector is a type of video projector for displaying video, images or computer data on a large screen or other flat surface.



Printer: Used to produce hardcopy output. The output printed on paper is known as hardcopy. Classified as Impact or Non-impact printers. Dot-matrix uses impact mechanism. It can print carbon copies with less printing cost. These printers are slow and noisy. Inkjet printers are non-impact printers that form the image on the page by spraying tiny droplets of ink from the print head. Ink jet printers are inexpensive, but the cost of ink cartridges makes them costly. Laser printers are non-impact printers that produce good quality images. Monochrome and colour laser printers are available. Laser printers are faster and their speed is rated in pages per minute (ppm). Thermal printer is a non-impact printer that produces a printed image by selectively heating heat sensitive thermal paper when it passes over the thermal print head. It is popular as a portable printer.

Plotter: A plotter is an output device used to produce hardcopies of graphs and designs on the paper.

3D printer: A 3D printer is an output device used to print 3D objects. It can produce different kinds of objects, in different materials, using the same printer.

e-Waste: Electronic waste may be defined as discarded computers, office electronic equipment, entertainment devices, mobile phones, television sets and refrigerators. The used electronics which are destined for reuse, resale, salvage, recycling or disposal are also considered as e-waste.

e-Waste disposal methods: Re-use, incineration (combustion process in which the waste is burned in incinerators at a high temperature), recycling, (the process of making new products from a product that has originally served its purpose) and land filling.

Software: A general term used to denote a set of programs that help us to use the computer system. Two types - system software, application software.

System software: A set of programs which aids in the execution of a general user's computational requirements on a computer system. The components of system software are Operating system, Language processors and Utility software.

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Operating system (OS): A set of programs that acts as an interface between the user and computer hardware. It controls and co-ordinates the operations of a computer. It acts as the resource manager of the computer system.

Function of OS: Process management, memory management, file management, device management, security management and command interpretation.

Computer languages: Broadly classified into low level languages and high level languages. Machine language and assembly language are the different low level languages. The language, which uses binary digits 0 and 1, is called machine language. Assembly language use mnemonics. Mnemonic is a symbolic name given to an operation. High Level Languages are like English languages and are simpler to understand.

Language processors: These are the system programs that translate programs written in high level language or assembly language into its equivalent machine language.

Types of language processors: Assembler (translates the program code written in assembly language to machine language), Interpreter (converts a HLL program into machine language line by line) and Compiler (translates a program written in high level language into machine language).



Utility software: A set of programs which help users in system maintenance tasks. Some of them are compression tools, disk defragmenter, backup software and antivirus software

Compression utility: Large files can be compressed so that they take less storage area. These compressed files can be decompressed into its original form when needed. Compression of files is known as zipping and decompression is called unzipping. WinZip, WinRAR, etc. are examples.

Disk defragmenter: A program that rearranges files on a computer hard disk. This enables the computer to work faster and more efficiently.

Backup utility: These programs facilitate the backing up of disk.

Antivirus programs: A utility program that scans the computer system for viruses and removes them. Norton Antivirus, Kaspersky, etc. are examples.

General purpose software: These are used to perform tasks in a particular application area. General purpose software is classified as word processors, spreadsheet software, presentation software, database software and multimedia software.

Word processing software: It is designed for creating and modifying documents. It helps to create, edit, format and print textual matters easily. Formatting features include different font settings, paragraph settings, bullets and numbering, alignments and more. In addition to this it can check spelling and grammar in the document, insertion of pictures, charts and tables. We can specify headers and footers for every page in the document. The most

popular examples of this type of software are MS Word, Open Office Writer, Apple iWork Pages, etc.



Spreadsheet software: This software allows users to perform calculations using spreadsheets. It also allows us to insert drawing objects in the worksheet and create different types of charts for graphical representation of numerical data. Microsoft Excel, Open Office Calc, Lotus 1-2-3 and Apple iWork Numbers are some examples of spreadsheet software.

Presentation software: The software is used to display information in the form of a slide show. Presentation software allows preparing slides containing pictures, text, animation, video and sound effects. Microsoft PowerPoint, Apple iWork Keynote and Open Office Impress are examples for presentation software.

Database software: Database is an organised collection of data arranged in tabular form. Database Management System (DBMS) consists of a collection of interrelated data and a set of programs to access those data. They provide privacy and security to data and enforce standards for data. Examples of DBMS software are Microsoft Access, Oracle, Postgres SQL, My SQL, etc.

Multimedia software: Multimedia is the integration of multiple forms of media. This includes text, graphics, audio, video, etc. Some multimedia software allows users to create and edit audio and video files. Audio converters, audio players and video editing software are some forms of multimedia software. Examples are VLC Player, Adobe Flash, Real Player, Media Player, etc.

The Free Software Foundation (FSF) defines the four freedoms for free and open source software:

- Freedom 0 : The freedom to run program for any purpose.
- Freedom 1 : The freedom to study how the program works and adapt it to your needs. Access to source code should be provided.
- Freedom 2 : The freedom to distribute copies of the software.
- Freedom 3 : The freedom to improve the program and release your improvements to the public, so that the whole community benefits.

Freeware Vs Shareware:

Freeware	Shareware
<ul style="list-style-type: none">• Freeware refers to software that anyone can download from the Internet and use for free.• All the features are free.• Freeware programs can be distributed free of cost.	<ul style="list-style-type: none">• Shareware gives users a chance to try the software before buying it.• All features are not available. To use all the features of the software, user has to purchase it.• Shareware may or may not be distributed freely. In many cases, author's permission is needed to distribute the shareware.