PVKN Govt. College (A), Chittoor

I B.Sc., SEMESTER –I: COMPUTER SCIENCE PAPER – I

Problem Solving in C

W.E.F. 2021-2022

Subject Code: 21-CSC-1C1 Credits: 04 Teaching Hrs/Week : 4

SYLLABUS

Objectives:

This course aims to provide exposure to problem-solving through programming. It introduces the concepts of the C Programming language.

Course Learning Outcomes:

Upon successful completion of the course, a student will be able to:

1. Understand the evolution and functionality of a Digital Computer.
2. Apply logical skills to analyse a given problem
3. Develop an algorithm for solving a given problem.
4. Understand 'C' language constructs, Iterative statements, Array processing, Pointers.
5. Apply 'C' language constructs to solve real time problems.

UNIT I

General Fundamentals: Introduction to Computers: Block diagram of a Computer, Characteristics and Limitations of Computers – Applications of Computers – Types of Computers – Computer Generations

I/O Devices – Primary, Auxiliary and Cache Memory – Memory Hierarchy – Definition and Types of Software – Definition and Types of Operating System

UNIT II

Introduction to Algorithms, Flowcharts, and Programming Languages: Algorithms, Key features of Algorithms, – Flow Charts, Symbols used in Flowcharts, Guidelines for developing Flowcharts – Programming Language definition, Generations of Programming Languages.

Introduction to C: Introduction – Structure of C Program – Keywords – Identifiers – Basic Data Types in C – Variables – Constants – I/O Statements in C – Operators in C – Programming Examples.

UNIT III

Decision Control and Looping Statements: Conditional Branching Statements – Iterative Statements – Nested Loops – break and continue Statements – goto Statement.

Arrays and Strings: Definition of Array, Declaration of Arrays, Types of Arrays – Operations on Arrays – Declaration of Strings, String handling functions.

UNIT IV

Functions: Introduction – Function Definition, Implementing User Defined Functions – Scope of variables – Storage Classes – Recursive functions.

Structure, Union, and Enumerated Data Types: Structures – Nested Structures – Arrays of Structures – Unions – Arrays of Unions – Enumerated Data Types.

Pointers: Introduction to Pointers – declaring Pointer Variables – Null Pointers – Passing Pointers to Functions – Pointers and Arrays.

UNIT V

Files: Introduction to Files – Opening and Closing a file – Reading Data from Files – Writing Data to Files – Detecting the End-of-file.

Introduction to C++: Object Oriented Programming Concepts, Difference between OOP and POP, Basic Structure of a C++ program.

TEXT BOOKS:

1. Computer Fundamentals by P.K. Sinha – Sixth Edition, BPB Publications.
2. Yashvant Kanetkar - Let Us ‘C’ – BPB Publications.

UNIT I

General Fundamentals: Introduction to Computers: Block diagram of a Computer, Characteristics and Limitations of Computers – Applications of Computers – Types of Computers – Computer Generations

I/O Devices – Primary, Auxiliary and Cache Memory – Memory Hierarchy – Definition and Types of Software – Definition and Types of Operating System

Introduction to computers

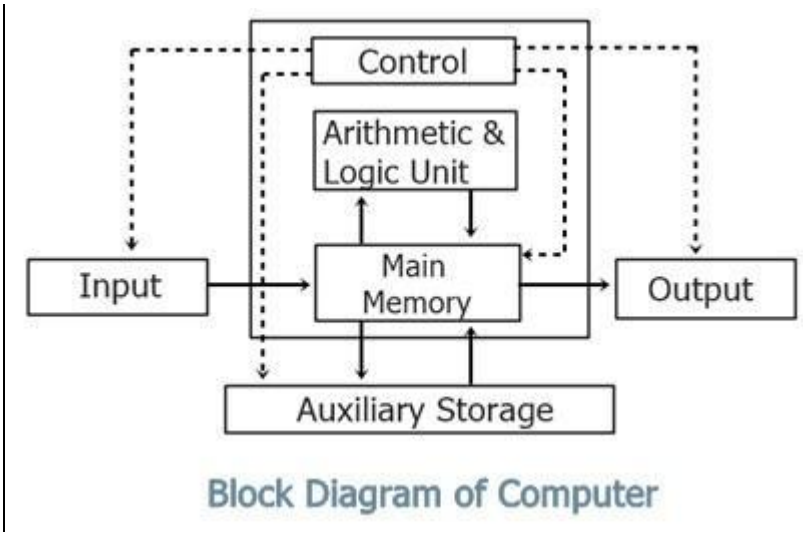
- The word "computer" comes from the word "compute" which means to calculate.
- So a computer is normally considered to be a calculating device that performs arithmetic operations at enormous speed.

- **Modern Definition of computers** : A computer is an electronic device which is used to perform operation on raw data as per instructions given by user.

Block diagram of computer

Block diagram of a computer gives you the pictorial representation of a computer that how it works inside. Or you can say that, in computer's block diagram, we will see how computer works from feeding the data to getting the result.

Here is the block diagram of a computer system:



Block Diagram of Computer

In the above diagram, both **control (control unit or CU)** and **arithmetic & logic unit (ALU)** combinely called as **Central Processing Unit (CPU)**.

Let's describe about all the parts as included in the above diagram one by one.

The Processor Unit (CPU)

It is the brain of the computer system.

All major calculation and comparisons are made inside the CPU and it is also responsible for activation and controlling the operation of other unit.

This unit consists of two major components, that are arithmetic logic unit (ALU) and control unit (CU).

Arithmetic Logic Unit (ALU)

Here arithmetic logic unit performs all arithmetic operations such as addition, subtraction, multiplication and division. It also uses logic operation for comparison.

Control Unit (CU)

And the control unit of a CPU controls the entire operation of the computer. It also controls all devices such as memory, input/output devices connected to the CPU.

CU fetches instructions from memory, decodes the instruction, interprets the instruction to know what the task are to be performed and sends suitable control signals to the other components to perform for the necessary steps to executes the instruction.

Input/Output Unit

The input/output unit consists of devices used to transmit information between the external world and computer memory.

The information fed through the input unit is stored in computer's memory for processing and the final result stored in memory can be recorded or display on the output medium.

Memory Unit

Memory unit is an essential component of a digital computer. It is where all data intermediate and final results are stored.

The data read from the main storage or an input unit are transferred to the computer's memory where they are available for processing.

This memory unit is used to hold the instructions to be executed and data to be processes.

Disk Storage Unit

Data and instruction enters into a computer system through input device have to stored inside the computer before actual processing start.

Two types of storage unit are primary and secondary storage unit.

Primary Storage Unit

Primary memory has direct link with input unit and output unit. It stores the input data, calculation result.

Secondary Storage Unit

The primary storage is not able to store data permanently for future use. So some other types of storage technology is required to store the data permanently for long time, it is called secondary or auxiliary storage.

Characteristics or Features of Computer

1. **Speed:** A computer is a very fast device. The computer takes a fraction of seconds to perform any operation. The speed of computer is measured in micro seconds (10^{-3}), Milliseconds (10^{-6}), nanoseconds (10^{-9}) and even Picoseconds (10^{-12}).A powerful computer is capable of performing about 3-4 million simple operations per second.
2. **Accuracy:** The accuracy of computer is very high and the degree of a particular computer depends upon its design. But for a particular computer, each and every calculation is performed with the same accuracy. Errors can occur in a computer but these are mainly due to human rather than technological weakness.
3. **Storage Capacity :** Computers can store data and instruction with a lot of volume and very high efficiency.
4. **Diligence:** unlike human being a computer is free from monotony, tiredness, lack of concentration etc. and hence can work for hours together without creating any error. A computer can perform the last calculation with exactly the same accuracy and seed as the first one.
5. **Automation:** Once a Program is in the computer's memory, CPU follows the instructions until it meets the last instruction. Through the program concept many tasks can be performed simultaneously, some on foreground and some on background. Thus automation bring the program execution fast
6. **Reliability:** Because, computer is an electronic device thus it perform all operations with 100 % accuracy and reliability. Reliability can affect only error prone by human mind.
7. **Versatility:** versatility is one of the most wonderful things about the computer. One moment it can do any one operation and next moment it can perform any other

operation. A computer is capable of performing almost any task according to given instructions.

Limitation or Drawback of Computer

1. **No I.Q. :** Computer is not a magical device. It performs only those works which man can does but the main difference is that computer can work those operations with very high speed and reliable accuracy. It has no any intelligence quality or thinking power
2. **No Feeling:** Because computer is only a machine, it has no feeling like human being. It has no brain for thinking as man can does. Man had successes to make computer memory be different inventions of technology but he couldn't make heart.
3. **Data Machine Readable :** Computer data is read by machine, meaning data obtained from the computer can be read by the computer itself.
4. It required power to operate.
5. Problem may occur due to system breakdown.

Applications of Computers:

Computers play a role in every field of life. They are used in homes, business, educational institutions, research organizations, medical field, government offices, entertainment, etc.

Home

Computers are used at homes for several purposes like online bill payment, watching movies or shows at home, home tutoring, social media access, playing games, internet access, etc. They provide communication through electronic mail. They help to avail work from home facility for corporate employees. Computers help the student community to avail online educational support.

Medical Field

Computers are used in hospitals to maintain a database of patients' history, diagnosis, X-rays, live monitoring of patients, etc. Surgeons nowadays use robotic surgical devices to perform delicate operations, and conduct surgeries remotely. Virtual reality technologies are also used for training purposes. It also helps to monitor the fetus inside the mother's womb.

Entertainment

Computers help to watch movies online, play games online; act as a virtual entertainer in playing games, listening to music, etc. MIDI instruments greatly help people in the entertainment industry in recording music with artificial instruments. Videos can be fed from computers to full screen televisions. Photo editors are available with fabulous features.

Industry

Computers are used to perform several tasks in industries like managing inventory, designing purpose, creating virtual sample products, interior designing, video conferencing, etc. Online marketing has seen a great revolution in its ability to sell various products to inaccessible corners like interior or rural areas. Stock markets have seen phenomenal participation from different levels of people through the use of computers.

Education

Computers are used in education sector through online classes, online examinations, referring e-books, online tutoring, etc. They help in increased use of audio-visual aids in the education field.

Government

In government sectors, computers are used in data processing, maintaining a database of citizens and supporting a paperless environment. The country's defense organizations have greatly benefitted from computers in their use for missile development, satellites, rocket launches, etc.

Banking

In the banking sector, computers are used to store details of customers and conduct transactions, such as withdrawal and deposit of money through ATMs. Banks have reduced manual errors and expenses to a great extent through extensive use of computers.

Business

Nowadays, computers are totally integrated into business. The main objective of business is transaction processing, which involves transactions with suppliers, employees or customers. Computers can make these transactions easy and accurate. People can analyze investments, sales, expenses, markets and other aspects of business using computers.

Training

Many organizations use computer-based training to train their employees, to save money and improve performance. Video conferencing through computers allows saving of time and travelling costs by being able to connect people in various locations.

Arts

Computers are extensively used in dance, photography, arts and culture. The fluid movement of dance can be shown live via animation. Photos can be digitized using computers.

Science and Engineering

Computers with high performance are used to stimulate dynamic process in Science and Engineering. Supercomputers have numerous applications in area of Research and Development (R&D). Topographic images can be created through computers. Scientists use computers to plot and analyze data to have a better understanding of earthquakes.

TYPES OF COMPUTERS

A computer is an electronic device which is used to perform operation on raw data as per instructions given by user.

TYPES OF COMPUTERS

Computers can be broadly classified by their speed and computing power.

S.No.	Type	Specifications
1	PC (Personal Computer)	It is a single user computer system having moderately powerful microprocessor
2	Workstation	It is also a single user computer system, similar to personal computer however has a more powerful microprocessor.
3	Mini Computer	It is a multi-user computer system, capable of supporting hundreds of users simultaneously.
4	Main Frame	It is a multi-user computer system, capable of supporting hundreds of users simultaneously. Software technology is different from minicomputer.
5	Supercomputer	It is an extremely fast computer, which can execute hundreds of millions of instructions per second.

1. PC (Personal Computer)

- A PC can be defined as a small, relatively inexpensive computer designed for an individual user.
- PCs are based on the microprocessor technology that enables manufacturers to put an entire CPU on one chip.
- Businesses use personal computers for word processing, accounting, desktop publishing, and for running spreadsheet and database management applications.
- At home, the most popular use for personal computers is playing games and surfing the Internet.

2. Workstation

- Workstation is a computer used for engineering applications (CAD/CAM), desktop publishing, software development.
- Workstations generally come with a large, high-resolution graphics screen, large amount of RAM, inbuilt network support, and a graphical user interface.
- Most workstations also have mass storage device such as a disk drive.
- Common operating systems for workstations are UNIX and Windows NT.

3. Minicomputer

It is a midsize multi-processing system capable of supporting up to 250 users simultaneously.

- A minicomputer is a type of computer that possesses most of the features and capabilities of a large computer but is smaller in physical size.
- A minicomputer fills the space between the mainframe and microcomputer, and is smaller than the former but larger than the latter.
- Minicomputers are mainly used as small or mid-range servers operating business and scientific applications.

4. Mainframe

- Mainframe is very large in size and is an expensive computer capable of supporting hundreds or even thousands of users simultaneously.
- Mainframe executes many programs concurrently and supports many simultaneous execution of programs.

5. Supercomputer

- Supercomputers are one of the fastest computers currently available.
- Supercomputers are very expensive and are employed for specialized applications that require immense amount of mathematical calculations (number crunching).

- For example, weather forecasting, scientific simulations, (animated) graphics, fluid dynamic calculations, nuclear energy research.

Workstation

Minicomputer

Mainframe

Supercomputer

COMPUTER GENERATIONS

A computer is an electronic device which is used to perform operation on raw data as per instructions given by user.

COMPUTER GENERATIONS

There are five definable generations of computers.

1940 – 1956: First Generation – Vacuum Tubes

- These early computers used vacuum tubes as circuitry and magnetic drums for memory.
- As a result they were enormous, literally taking up entire rooms and costing a fortune to run.
- These were inefficient materials which generated a lot of heat, sucked huge electricity and subsequently generated a lot of heat which caused ongoing breakdowns.
- These first generation computers relied on 'machine language' (which is the most basic programming language that can be understood by computers).
- These computers were limited to solving one problem at a time. Input was based on punched cards and paper tape. Output came out on print-outs.

1956 – 1963: Second Generation – Transistors

- The replacement of vacuum tubes by transistors saw the advent of the second generation of computing.
- Although first invented in 1947, transistors weren't used significantly in computers until the end of the 1950s.
- They were a big improvement over the vacuum tube, despite still subjecting computers to damaging levels of heat.
- However they were hugely superior to the vacuum tubes, making computers smaller, faster, cheaper and less heavy on electricity use.
- They still relied on punched card for input/printouts.

1964 – 1971: Third Generation – Integrated Circuits

- By this phase, transistors were now being miniaturised and put on silicon chips (called semiconductors).
- This led to a massive increase in speed and efficiency of these machines. T
- These were the first computers where users interacted using keyboards and monitors which interfaced with an operating system, a significant leap up from the punch cards and printouts.
- This enabled these machines to run several applications at once using a central program which functioned to monitor memory.

1972 – 2010: Fourth Generation – Microprocessors

- This revolution can be summed in one word: Intel.
- The chip-maker developed the Intel 4004 chip in 1971, which positioned all computer components (CPU, memory, input/output controls) onto a single chip. What filled a room in the 1940s now fit in the palm of the hand.
- The Intel chip housed thousands of integrated circuits.
- The year 1981 saw the first ever computer (IBM) specifically designed for home use and 1984 saw the MacIntosh introduced by Apple.
- Microprocessors even moved beyond the realm of computers and into an increasing number of everyday products.

2010- Future : Fifth Generation – Artificial Intelligence

- Computer devices with artificial intelligence are still in development, but some of these technologies are beginning to emerge and be used such as voice recognition.
- AI is a reality made possible by using parallel processing and superconductors. Leaning to the future, computers will be radically transformed again by quantum computation, molecular and nano technology.
- The essence of fifth generation will be using these technologies to ultimately create machines which can process and respond to natural language, and have capability to learn and organise themselves.

Input and Output Devices:

Input Devices

The devices which are used to give data and instructions to the computer are called **Input Devices.** Various types of input devices can be used with the computer depending upon the type of data you want to enter in the computer, e.g., keyboard, mouse, joystick, light pen, etc.

Keyboard
It is the most commonly used input device. It is used to enter data and instructions directly into the computer. There are 104 buttons on the keyboard which are called keys.

Mouse
Mouse is another input device which is commonly found connected with the computers. It is basically a pointing device which works on the principle of Point and Click.

Nowadays cordless mouse is very popular. it does not have wires.

Joystick and Game-pad

Joystick and game-pad are also input devices which are used to control the movement of object on the screen. Just like mouse, these are also pointing devices. Mostly they are used for playing games on the computer.

Light Pen

Light pen is another pointing type input device. It is a pen shaped device which can be used by directly pointing the objects on the screen. It can also be used for making drawings directly on the monitor screen.

Scanner
We can store pictures, photographs, diagrams into the computer with the help of scanner. The scanner reads the image and saves it in the computer as a file.

Touch-screen
Touch-screen is a special computer screen that takes the input by sensing the touch of a human finger, or any other pointing device. The user gives instructions to the computer just by touching the screen.

Microphone
This is an input device which is used to record sound or voice into the computer system. You can store voice data in the computer by speaking in front of this device.

Trackball
A trackball is similar to a mouse but is mounted in a fixed position. The user spins the ball with fingers to move the pointer on the screen.
A Trackball technology was used in earlier laptop computer which is now replaced with track-pad.

Output Devices

The devices which are used to display the results or information are called **Output Devices**. You can view the output on the monitor or you can print it on a paper using a printer. Monitor and the printer are the commonly used output devices.

Monitor
This is the most common output device connected with the computer to display the processed information. It looks like a TV and is also know as **VDU(Visual Display Unit).**

Printer
This is an important output device of the computer system. It gives a printed output of the results that appears on the monitor screen. Printed output is also called Hard Copy output because unlike monitor, this output can be preserved even if the computer is switched off.

Speaker

Speakers are categorised as output devices. These are used to listen to the music and sounds played by the computer. Normally they come in a pair and have different shapes and sizes.

Plotter

We can get the print of a photograph, drawing, image stored in the computer, by using a plotter. It is an output device which provides a high quality of printed output. It is generally used by engineers and architects.

Headphones

Also known as earphones, headphones allow you to listen to audio without disrupting other people in the vicinity.

Projector

As its name suggests, this output device "projects" computer images onto a wall or screen. Projectors are typically used for presentations, watching movies, or as a teaching aid.

Computer Memory

- A memory is just like a human brain.
- It is used to store data and instructions.
- Computer memory is the storage space in the computer, where data is to be processed and instructions required for processing are stored.
- The memory is divided into large number of small parts called cells.
- Each location or cell has a unique address, which varies from zero to memory size minus one.
- For example, if the computer has 64k words, then this memory unit has 64 * 1024 = 65536 memory locations. The address of these locations varies from 0 to 65535.

Memory is primarily of three types –

- Cache Memory
- Primary Memory/Main Memory
- Secondary Memory/Auxiliary Memory

Cache Memory

- Cache memory is a very high speed semiconductor memory which can speed up the CPU.
- It acts as a buffer between the CPU and the main memory.
- It is used to hold those parts of data and program which are most frequently used by the CPU.
- The parts of data and programs are transferred from the disk to cache memory by the operating system, from where the CPU can access them.

Advantages

The advantages of cache memory are as follows −

- Cache memory is faster than main memory.
- It consumes less access time as compared to main memory.
- It stores the program that can be executed within a short period of time.
- It stores data for temporary use.

Disadvantages

The disadvantages of cache memory are as follows −

- Cache memory has limited capacity.
- It is very expensive.

Primary Memory (Main Memory)

- Primary memory holds only those data and instructions on which the computer is currently working.
- It has a limited capacity and data is lost when power is switched off.
- It is generally made up of semiconductor device. These memories are not as fast as registers.
- The data and instruction required to be processed resides in the main memory.
- It is divided into two subcategories RAM and ROM.

Characteristics of Main Memory

- These are semiconductor memories.
- It is known as the main memory.
- Usually volatile memory.
- Data is lost in case power is switched off.
- It is the working memory of the computer.
- Faster than secondary memories.
- A computer cannot run without the primary memory.

Secondary Memory

- This type of memory is also known as external memory or non-volatile.
- It is slower than the main memory.

- These are used for storing data/information permanently.
- CPU directly does not access these memories, instead they are accessed via input-output routines.
- The contents of secondary memories are first transferred to the main memory, and then the CPU can access it.
- For example, disk, CD-ROM, DVD, etc.

Characteristics of Secondary Memory

- These are magnetic and optical memories.
- It is known as the backup memory.
- It is a non-volatile memory.
- Data is permanently stored even if power is switched off.
- It is used for storage of data in a computer.
- Computer may run without the secondary memory.
- Slower than primary memories.

Question: Differentiate between primary memory and auxiliary memory

PRIMARY MEMORY

1. Primary memory is also known as Main memory or Internal memory
2. In primary memory, data is directly accessed by the processing unit.
3. Semi conductor chips are used to store information in primary memory.
4. Information stored is temporary and it can be lost when there is a sudden power cut.
5. Data operated and stored in uniform manner.
6. Primary memory devices are more expensive than secondary storage devices.
7. Nature of Parts of Primary memory varies. RAM- volatile in nature. ROM- Non-volatile
8. It is very fast in interacting with micro processor.
9. Primary memory has limited storage capacity.
10. Examples: RAM, ROM, Cache memory, PROM, EPROM, Registers etc

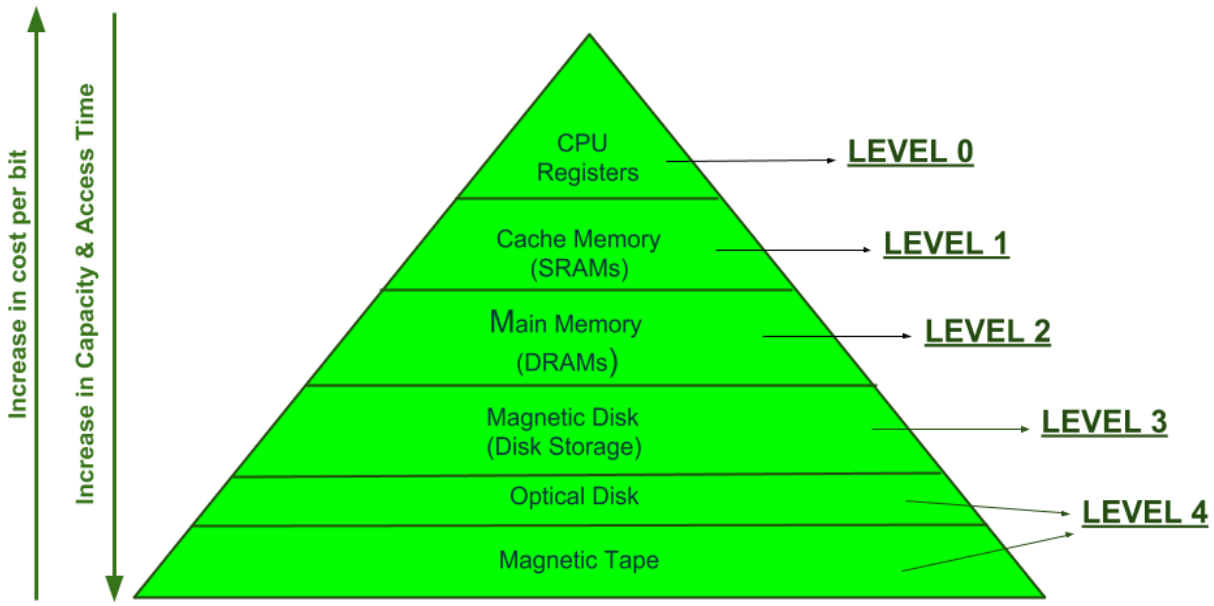
SECONDARY or AUXILIARY MEMORY

1. Secondary memory is also known as External memory or Auxiliary memory
2. In secondary memory, data is first transferred to main memory and then routed to processing unit.

3. Magnetic disk, optical disks are used to store information in secondary memory.
4. Information stored is permanent unless one deletes it intentionally.
5. Data stored is not uniform in secondary memory.
6. Secondary memory devices are less expensive when compare to primary memory devices.
7. It's always Non-volatile in nature.
8. It is little slow in interacting with micro processor.
9. Whereas secondary memory can store bulk amounts of data in a single unit.
10. Examples: Magnetic Tapes, Optical Disc, Floppy Disks, Flash memory [USB drives], Paper Tape, Punched cards etc.

Memory Hierarchy

- In the Computer System Design, Memory Hierarchy is an enhancement to organize the memory such that it can minimize the access time.
- The Memory Hierarchy was developed based on a program behavior known as locality of references.
- The figure below clearly demonstrates the different levels of memory hierarchy :



MEMORY HIERARCHY DESIGN

This Memory Hierarchy Design is divided into 2 main types:

1. **External Memory or Secondary Memory –**
   Comprising of Magnetic Disk, Optical Disk, Magnetic Tape i.e. peripheral storage devices which are accessible by the processor via I/O Module.
2. **Internal Memory or Primary Memory –**
   Comprising of Main Memory, Cache Memory & CPU registers. This is directly accessible by the processor.

Definition and Types of Software

Software is a set of programs, which is designed to perform a well-defined function. A program is a sequence of instructions written to solve a particular problem.

1. System software

- System software also known as background software as most of them runs at background to support foreground process.
- It acts as an interface between a computer user, computer hardware and application software.
- There are four types of system software as follows.

  a)Operating System
  b)Utilities
  c)Device drivers
  d)Language translators.

2. Application software

- Application software also known as end user software as these software used by end users to complete their task.
- There are two types of application software as follows.

a) Basic application software
b) Specialized application software

a) Basic application software
Basic application software are also known as general purpose applications and productivity applications.
Example - Microsoft office 2007

b) Specialized application software
Specialized application software are also known as special purpose application software.
Example - graphics programs, audio and video editor programs

3. Commercial software

- Commercial software is any software or program that is designed and developed for licensing or sale to end users or that serves a commercial purpose.
- Commercial software was once considered to be proprietary software, but now a number of free and open-source software applications are licensed or sold to end users.
- Off-the-shelf software programs, such as games or those sold in computer specialty stores or even music stores and grocery stores, are some examples of commercial software.

- Microsoft products such as the Windows Operating System and MS Office are some of the most well-known examples of commercial software.

4. Open source software

- Open source software is software with source code that anyone can inspect, modify, and enhance.
- "Source code" is the part of software that most computer users don't ever see; it's the code computer programmers can manipulate to change how a piece of software—a "program" or "application"—works.

- Programmers who have access to a computer program's source code can improve that program by adding features to it or fixing parts that don't always work correctly.

5. Domain and Freeware Software

- Public domain software is any software that has no legal, copyright or editing restrictions associated with it.
- It is free and open-source software that can be publicly modified, distributed or sold without any restrictions.
- SQLite, I2P and CERN httpd are popular examples of public domain software.

- Freeware means that there are no paid licenses required to use the application, no fees or donations necessary, no restrictions on how many times you can download or open the program, and no expiration date.
- Freeware, however, can still be restrictive in some ways. Free software, on the other hand, is completely and totally void of restrictions and allows the user to do absolutely whatever they want with the program.

Definition and Types of Operating System

What is an Operating System?

- An **Operating System (OS)** is a software that acts as an interface between computer hardware components and the user.
- Every computer system must have at least one operating system to run other programs.
- Applications like Browsers, MS Office, Notepad Games, etc., need some environment to run and perform its tasks.
- The OS helps you to communicate with the computer without knowing how to speak the computer's language.
- It is not possible for the user to use any computer or mobile device without having an operating system.

Types of Operating System (OS)

Following are the popular types of OS (Operating System):

- Batch Operating System
- Multitasking/Time Sharing OS
- Multiprocessing OS
- Real Time OS
- Distributed OS
- Network OS
- Mobile OS

Batch Operating System

Some computer processes are very lengthy and time-consuming. To speed the same process, a job with a similar type of needs are batched together and run as a group.

The user of a batch operating system never directly interacts with the computer. In this type of OS, every user prepares his or her job on an offline device like a punch card and submit it to the computer operator.

Multi-Tasking/Time-sharing Operating systems

Time-sharing operating system enables people located at a different terminal(shell) to use a single computer system at the same time. The processor time (CPU) which is shared among multiple users is termed as time sharing.

Real time OS

A real time operating system time interval to process and respond to inputs is very small. Examples: Military Software Systems, Space Software Systems are the Real time OS example.

Distributed Operating System

Distributed systems use many processors located in different machines to provide very fast computation to its users.

Network Operating System

Network Operating System runs on a server. It provides the capability to serve to manage data, user, groups, security, application, and other networking functions.

Mobile OS

Mobile operating systems are those OS which is especially that are designed to power smartphones, tablets, and wearables devices.

Some most famous mobile operating systems are Android and iOS, but others include BlackBerry, Web, and watchOS.