

1. Introduction to Computers

Q.No.1. Write about different generations of computers (Or) Historical Development of computers.

Introduction:

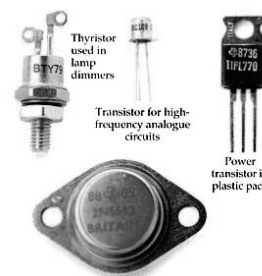
- » The modern computer, which we are using today, is not the invention of a single individual. It is the result of countless inventions, ideas and developments made by many people throughout the last several decades.
- » The history of automatic data processing begins with Charles Babbage's attempt to build a mechanical calculator at Cambridge, England, in 1830.
- » By the end of 1930, punched cards were in wide use in many businesses.
- » In 1937, Howard Aiken, at Harvard, proposed to IBM that a machine could be constructed which would automatically sequence the operations and perform calculations. That was the origin for the development of automatic computers.

First Generation Computers: (1946 to 1959)

- » UNIVAC (Universal Automatic Computer) was the first general purpose electrical computer.
- » These computers employed vacuum tubes.
- » These computers were large in size and required air conditioning (as they produce huge heat).
- » The input and output units were punched cards.
- » The input and output devices were very slow when compared to the speed of CPU.
- » They were very expensive.
- » The medium of internal storage was magnetic drum.
- » Language used was Machine level language.
- » Processors speed used to be measured in milliseconds.
- » IBM-650 was the most popular first generation computer and was introduced in 1950 with magnetic drum memory and punched cards for input and output respectively. It was intended ^(=designed) for both business and scientific applications.

Second Generation Computers: (1959 to 1965)

- » These computers employed transistors and other similar devices.
- » Their circuits were smaller than vacuum tubes and generated less heat. Hence they required less power, were faster and more reliable.
- » There were two separate categories of second generation computers - for business & scientific applications.
- » IBM 1401 was the most popular second-generation computer.
- » They employed magnetic tape as input/output media.
- » Main medium of internal storage was magnetic core memory.
- » Language used was Assembly language.
- » Processor speed started to be measured in microseconds.



Third Generation Computers: (1965 to 1970)

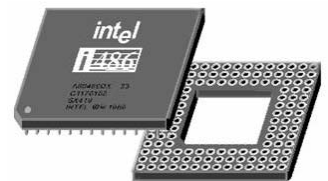
- » They employed integrated circuits, in which all the elements of an electronic circuit are integrated ^(=included) on a tiny silicon wafer.
- » They were much cheaper and more reliable than second-generation computers.
- » Their speed is high and can support variety of peripherals.
- » They are based on the principles of standardization and compatibility.
- » The secondary storage of a particular computer can be easily expanded.
- » They can be used for both scientific and business applications.



- » They permit multi-programming, time-sharing, virtual memory and remote terminals.
- » They also support high level languages such as FORTRAN and COBOL.
- » Mainframes, Mini computers are also one of the developments in third generation computers.
- » Limited communication facilities were also available.
- » Processors speed started to be measured in nanoseconds.

Fourth Generation Computers: (From 1970)

- » They appeared in 1970's. They utilised still newer electronic technology and made the computer still smaller and faster than third generation computers.
- » Many new types of terminals were also developed at this time.
- » One of the major inventions was the large scale Integrated Circuit (LSI). It is a small "chip" consisting of thousands of small electronic components, which function as a complete system. With this technology the entire CPU can be built onto a single chip of size less than 1/3 inch square. This technology helped to reduce cost and increase speed.
- » The speed of microprocessors, the size of main memory and hard disk increased tremendously. Many of the features of mainframe CPU's were introduced in these computers. In 1995 the most popular CPU was Pentium.
- » These computers are being used in various areas like visualization, Parallel computing, virtual reality, Multimedia etc.
- » Object oriented languages were introduced such as C++, VB, etc.
- » Microcomputers and supercomputers are introduced at this time.



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Fifth Generation Computers:

- » It is very difficult to define the fifth generation computers because it is still under development.
- » Introducing "Artificial Intelligence" to computers is the major development in this generation.
- » Artificial Intelligence is a software that tries to imitate ^(=copy) human characters such as reasoning, communicating, seeing and hearing etc. This software can use its accumulated knowledge for decision making. In some cases, these systems can learn from past experiences and can modify its subsequent actions.
- » This artificial intelligence is being used in several areas such as:
 - Natural languages,
 - Voice recognition,
 - Translating from one language to another language,
 - Neural networks,
 - Imitating human voice,
 - Visual recognition,
 - Robotics,
 - Expert systems.
- » At first all these applications seemed to be ^(=looked to be) very simple. When programmers started working, they realised the difficulty.
- » It will take several years for the development of such systems.

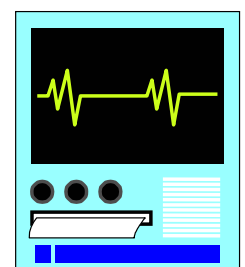
Note: Third generation vs. Fourth generation computers. (M97-5M)

Q.No.2. Write about different types of computers. ^(For academic interest only)

On the basis of signals

Analog Computers: (N95)

- » They represent numbers by a physical quantity i.e. they assign numbers by physically measuring some physical property such as length of an object, angle created by two lines, voltage, temperature, pressure, etc. (Simply saying analog computers measure).
- » Analog computers get input through some measurement. The accuracy of analog



computers is directly related with the accuracy of its measurement.

- » Data such as voltage, resistance, temperature, pressure etc. are represented in a computer as a continuous unbroken flow of information.
- » These are very useful in engineering and scientific applications.
- » But they are less accurate and the storage capacity is also limited. Hence they are not suitable for business data processing.

Digital Computers:

- » Digital computers represent data as numbers. Counting on fingers is the simplest form of digital computer. Adding machines and pocket calculators are common examples of digital computers.
- » They accept input from various input devices, convert them into numbers and perform arithmetic or logical operations on such numbers.
- » It is also capable of storing data, performing logical operations, editing, deleting, printing the output etc.
- » The accuracy is also high. Hence suitable for business data processing applications.
- » Cost is comparatively higher than analog computers.
- » Programming is complex in nature.



Hybrid computers: Hybrid computers combine the best features of analog and digital computers. They have the speed of analog computers and the accuracy of digital computers. They are used in areas where data from analog devices is converted into digits & processed by computer.

For e.g. Analog devices measure patient's vital signs like temperature, heart function etc. These are then converted into numbers and supplied to digital components of the system. Now digital components of the computer will process such data.

On the basis of function

Special Purpose Computers:

- » These computers are designed to perform a special task [restricted class of problems]. Therefore, instructions are inbuilt into the computer circuitry by the manufacturers.
- » Thus a given task is performed quickly and efficiently.
- » They are generally used for applications such as air line reservation system or for solving navigational problems etc.
- » However, these computers are not versatile i.e. it cannot be used for any other purpose.

General Purpose Computers:

- » They can be used for many purposes such as business, scientific, educational, social and other applications. Everything depends on the program it uses.
- » At the same time, they can store different programme instructions.
- » Wide variety of jobs can be handled by these computers i.e. it is completely versatile.
- » On the other hand old programmes can be amended or dropped.

Scientific & Business Computers:

- » Scientific problems involve huge amount of complex computations but involves small amount of input and output. Since input / output volume is low, the speed of input / output peripherals is not so important. But processing speed is very important because some problems may take several man months or even years for computation.
- » Reverse is the case with business applications. Volume of input / output is very high. Arithmetic computations are neither voluminous nor complex. Therefore they need fast peripheral devices.
- » Another difference is the storage requirement. Scientific systems have lengthy programmes but handle very small amount of input data. Therefore storage requirements are less when compared to business applications.

On the basis of capacity

- » Super computer, (1980)
- » Main Frames, (1964)
- » Mini Computer and (1968)
- » Micro computer. (1974)

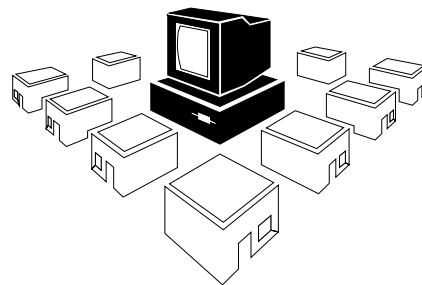
Q.No.3. Write about Super Computers.**Meaning:**

- » Super Computers are the largest and fastest computers available. Generally, they are not used for commercial data processing.
- » Super Computers have huge amount of memory and high processing speed.
- » They can process up to one billion instructions per second.
- » Super Computers can process 64 bits or more at a time. Their processing speed ranges from 10,000 million instructions per second (MIPS) to 1.2 billion instructions per second.
- » They can support up to 10,000 terminals at a time.
- » Super Computers can recover automatically from failures (fault tolerance).
- » Conventional computers have single processor which can process one instruction at a time. But super computers have multiple processors (or CPUs) that process multiple instructions at a time. This is called parallel processing.
- » In olden days high clock rate was considered as the main difference between ordinary computers and super computers. Now the distinguishing feature of super computers is their high degree or parallelism i.e. super-computers consist of several processors, which can process simultaneously.

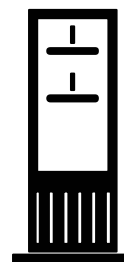
Milestones: The first super computer was the ILLIAC IV made by Burroughs. Other suppliers of super computers are CRAY, CDAC [PARAM 2000 FROM INDIA], Fujitsu, Intel Corporation, Thinking Machine Corporation, Hitachi, IBM and Sun Microsystems, etc.

Where they are used?

- » These computers are used in specialized areas such as Defence, aircraft design, computer generated movies, weather research etc.
- » In medical field, super computers are used to study the structure of viruses, impact of various drugs on human beings etc.
- » Designing an aircraft involves simulating (=to create) and analyzing the airflow around the aircraft. This again requires a super computer.

**Q.No.4. Write about Mainframe Computers.**

- » Mainframes are less powerful and cheaper than Super computers. However, they are big general-purpose computers and they can handle all kind of scientific and business applications.
- » Mainframes can process several million instructions per second.
- » Mainframes can be used for a variety of applications. A typical application of these computers is airline reservation or railway reservation system.
- » It can support many powerful devices. (E.g. a main frame can support more than 1,000 remote terminals.)
- » Mainframes have large secondary storage capacity. Variety of peripheral devices like magnetic tape drives, hard disks, visual display units, plotters, printers and telecommunication devices can be connected to main-frame computers.



- » They have high-speed cache memory which helps to process data at a faster rate than mini or microcomputers.
- » They also offer the facility of multiprogramming.
- » Prices of Mainframe computer ranges from 1 crore to 5 crores depending upon the configuration.
- » Major suppliers of mainframe computers are IBM, HP, Sun Microsystems, Honey well, Burroughs, NCR, CDAC and Sperry etc.
- » Large mainframes can have hundreds of MBs of main memory and hundreds of GBs of secondary storage.

Note: Super computers Vs. Mainframe computers. (M00-5M, RTP)

Q.No.5. Write about Mini Computer. (N93)

- » It is a relatively fast, small and inexpensive computer.
- » The input/output capabilities are some what limited.
- » Data processing is similar to that of mainframe but on a small scale. The cost of minis is low.
- » Usually data is input by means of a keyboard. As the name implies, a minicomputer is small, compared to a mainframe. It is also called as scaled-down mainframe. The processor and the peripherals are physically smaller.
- » Minicomputers cost from Rs.5 lacs to Rs.50 lacs. The most popular minicomputers or minis are Data General Nova, IBM series/1.
- » These computers can support multiple number of users.
- » Small to medium sized organizations use minicomputers for their data processing activities.
- » Primary storage capacity starts at about 640KB and can go up to few MBs.
- » Programming languages include BASIC, PASCAL, COBOL, C and FORTRAN.
- » Minicomputer systems can support most of the input/output (I/O) devices and secondary storage devices that large mainframe systems can handle.
- » They are also used to develop distributed data processing systems. Instead of having large mainframe computer, a company may install mini-computer at each remote location and connect them to each other through telecommunications.

Q.No.6. Write about Micro Computer. (N93)

Micro Computer:

- » A microcomputer is a full-fledged computer system that uses a microprocessor as its CPU. Microprocessor is a small chip which may vary from fingernail size to postage-stamp size.
- » Microcomputers were first available in 1970s. The first microcomputer designed for personal use was 'Altair'.

PC Vs. Micro Computer:

- » The term PC has a more specific meaning. In 1981, IBM named its first microcomputer as IBM PC. Within few years, many companies copied the IBM design, which can function like IBM PC's and are called IBM clones or IBM compatible computers. Thus the term PC includes IBM PC and its compatibles.
- » On the other hand Apple Macintosh computer is neither an IBM PC nor its compatible. It belongs to another family of microcomputers made by Apple computers.

Manufacturers: Currently IBM & Apple are the 2 most popular manufacturers of microcomputers.

Elements of Micro Computers: A microcomputer may consist of the following elements:

- » 8, 16, or 32 bit processor,
- » Internal memory 256 MB expandable to 512 MB and more;

- » Backing storage-cassette, floppy disc, microfloppy discs, micro-drive, silicon disc or hard disc, CD-ROMS, DVDs, pen drives etc.;
- » Keyboard and screen (input and output);
- » Interface (for the connection of peripherals);
- » Bus (communication and control channels);
- » Printer and/or plotter (multicolour text and graphics);
- » Pulse generator (clock);
- » Light pens, mouse, paddles/joysticks, Multimedia (graphics and games);
- » Software (programs)

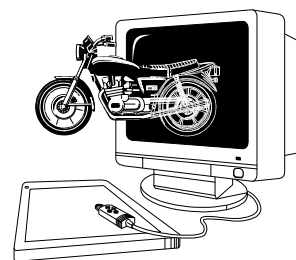
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Usage: Microcomputers are useful even to the smallest businesses. However their primary market is the personal home computer market.

Q.No.7. With reference to computers, explain briefly what is workstation? (N01-3M, M97-1M)

Meaning:

- » Between minicomputer and microcomputers - in terms of processing power – there is a class of computers known as WORKSTATIONS.
- » A workstation looks like a personal computer and is typically used by one person. Workstations are still more powerful than PC. There are 2 major differences between a workstation and a PC.
- » Internally, workstations are constructed differently than microcomputers. They are based on different architecture of CPU called Reduced Instruction Set Computing (RISC), which results in faster processing of instructions.
- » On the other hand most microcomputers can run any of the four major operating systems - DOS, Unix, OS/2 and Microsoft Windows NT. But workstations run on Unix operating system.
- » A disk less workstation does not have floppy disk drive. Data storage is provided by centralized hard disc. This provides control over data storage because it reduces the possibilities of data theft.



Manufacturers: The biggest manufacturer of workstations is Sun Microsystems. Other manufacturers include IBM, DEC, Hewlett Packard, Silicon Graphics, DELL etc.

Conclusion: Many people use the term workstation to refer to any computer or terminal that is connected to another computer. But this is an outdated term. These days, a workstation is powerful RISC based computer and is generally used by scientists and engineers.

Note: Micro computer Vs. Workstation. (N03-4M)

Q.No.8. Write about Server. (N07-1M)

- » A server is a computer system that provides services to other computers in a network, called clients or workstations.
- » Servers occupy a place, similar to that of mini computers. But today servers have largely replaced minicomputers.
- » A typical server is a computer system that operates continuously in a network and serves the requests of other computers in the network.
- » Servers may be broadly classified as dedicated and non-dedicated.
- » A dedicated server is completely reserved for the purpose of serving other computers and no other activity can be performed on such servers. These types of servers are preferred when there are large number of nodes on the network.

- » On the other hand a non dedicated server is not completely reserved for this purpose i.e. it can also be used simultaneously for other purposes. This kind of servers are generally preferred by small organisations. For e.g., in a small office, a large desktop computer may act as both workstation and as a server.
- » Today, Servers are physically similar to most other general-purpose computers. But their hardware configuration is optimized to meet the requirements. In many cases the hardware will be similar to that of a standard desktop PC. However, servers run software that is very much different from that used on desktop computers and workstations.
- » Generally servers are used to host ^(= to provide or to share) hardware resources on a controlled and shared basis to client computers such as printers (print servers) and file systems (file servers). This sharing permits better access control (and thus better security) and can reduce costs by reducing hardware duplication.
- » Servers should not be confused with mainframes. Mainframes are very large computers that centralize certain information processing activities in large organizations. They may or may not act as servers in addition to their other activities.
- » Many large organizations have both mainframes and servers. Usually, servers are smaller and much more numerous and decentralized than mainframes.

Q.No.9. Define the term Computer? State its advantages & disadvantages. (RTP)

Computer: The term “computer” is used to represent a calculating machine. It is an *electronic data processing device* capable of receiving input, storing instructions for solving problems and generating output with high speed and accuracy. Computers consist of switches, wires, motors, transistors and integrated circuits, etc. These components are wired together into a network called computing system or simply *computer*.

Advantages of Computer System:

- a. **Speed:** The smallest unit of time that a human being can experience is second. But Computer operations are measured in milliseconds, microseconds, nanoseconds and picoseconds. Today computers can perform more than 2500 MIPS. They can handle very complex tasks in seconds.
- b. **Accuracy:** Errors occur in computers also but only few errors can be attributed ^(=credited) to a computer. In most of the cases errors occur due to program logic error, procedural error or erroneous data. Really speaking, these are human errors.
- c. **Reliability:** Computers can perform repetitive tasks very well. They don't take sick days and coffee breaks and they rarely make any complaints. Even the error rate of 0.1% is unacceptable.
- d. **Memory capability:** Computer systems can instantly recall the data and their storage capacity is almost unlimited. Today, even ordinary personal computers are coming with 10 to 40 GB of memory. High end computers can support still more memory.
- e. **Flexibility:** Modern digital computers can be used for a variety of purposes and everything depends on the program inside the computer.
- f. **Choice of configuration:** A wide range of optional peripherals are available in the market. A business organisation can select those peripherals which are most suitable for its processing requirements.

Limitations of computer system: Computer is one of the most powerful tools ever developed. But it doesn't mean to say that computers will never fail. Computer failures happen because people fail to consider some basic limitations of computer. They are:

- a. **Program must be reliable:** A computer can do what it is programmed to do and nothing else. But a program that has operated flawlessly ^(=Without any error) for months can suddenly produce non sense. To avoid such problem, the program must be acquired or developed from a reliable source.
- b. **Application logic must be understood:** Computer can only process jobs which can be expressed in a finite ^(=limited) number of steps. Each step must be clearly defined. That is why a computer can't perform a job, where subjective ^(=personal i.e. changes from person to person) decisions are important. For example, it may not tell whether a new product will be successful or not.
- c. Installing a computer requires a difficult and expensive task of system analysis and design. To do this there is a scarcity of computer professionals.

- d. The initial investment is very high.
- e. The lead time of installing is high and the hardware technology is rapidly advancing. Some peripherals / components may become obsolete even before installation.
- f. Standby facilities should be arranged in the event of breakdown of any part of the computer.
- g. Although manual systems are slow, they are very flexible when compared to computerised systems. For example, if the format of a report has to be changed, it can be readily done by communicating the necessary instructions to the concerned staff. But in a computerised system, this may take several months.

Q.No.10. Write about the basic components of a computer system? (RTP, N00-5M)

A computer is a group of integrated parts (sub systems). Following are the four basic operations performed by a computer:

Input devices: A computer must receive both program statements ^(=instructions) and data to solve problems. Input devices are used for this purpose. Some of the most commonly used input devices are keyboard, mouse, mike, etc. These input devices are instruments of interpretation and communication between people and the computer.

CPU: The heart of any computer is the central processing unit (CPU). This central processor makes comparisons, performs calculations, reads, interprets ^(=understands) and controls the execution of instructions. It consists of two separate sub units – control unit and Arithmetic/Logic unit. Control unit supervises the operations of the entire computer. On the other hand ALU performs the actual processing operations.

Memory: Following are the 2 types of memory used in a computer.

Primary Memory:

- » Primary memory acts as volatile memory ^(=temporary memory) and is used to store information which will be used during computations.
- » As the computer processes data, RAM holds both intermediate and final results. Commonly used primary storage device is RAM chips.
- » Primary memory is very fast and expensive and limited in capacity (few MB's).

Secondary Memory:

- » Primary memory storage capacity is limited, expensive and volatile. Hence, it is necessary to have secondary or permanent or auxiliary storage for holding data and programs permanently.
- » Some of the commonly used secondary storage devices are – magnetic tape drives, magnetic disk drives (Hard disks, floppy disks, etc.), optical disk drives (CDs, DVDs, etc.)

Output Devices:

- » Output devices are instruments of communication between people and machines.
- » They are used to present the results of processing to outside world.
- » Most commonly used output devices are printers, graph-plotters, speakers etc.

Q.No.11. what is meant by Central Processing Unit? What are the components of CPU?

Meaning:

- » Central Processing Unit (CPU) - also known as processor - is the heart, soul and brain of the computer.
- » In a microcomputer, the entire CPU is contained on a tiny chip called microprocessor. The processor computes and processes data and delivers the results.
- » Every CPU has at least two basic parts, Control Unit (CU) and Arithmetic Logic Unit (ALU).

Control Unit (N00):

- » All the resources of computer are managed by control unit.
- » The CPU's instructions (for carrying out commands) are built into the control unit.
- » The instructions or instruction set, lists out all operations that a CPU can perform. Each instruction in the instruction set is expressed in the form of microcodes.
- » Every command must be broken down into instructions that correspond to the instructions in the CPU's instruction set.
- » Now each instruction is executed.
- » Although the process is complex, computer can perform it at an incredible ^(=unbelievable) speed i.e. millions of instructions every second (MIPS).

Arithmetic Logic Unit:

- » Computer can perform only two types of operations: Arithmetic and Logical operations.
- » Arithmetic operations include addition, subtraction, multiplication, division, etc.
- » Logical operations include comparisons. (E.g. Determining whether one number is equal to, greater than or less than another number.)
- » ALU consists of temporary storage locations, called storage registers. They store numbers, used in calculations and for storing the results of calculations. Number of registers in ALU depends on the type of microprocessor used and may range from 1 to 32.

Q.No.12. Describe briefly the functions of the Control Unit of a computer system. Also state its four components. (N 00)

Control Unit:

- » Control unit is the most important component of CPU.
- » It supervises the operations of the entire computer.
- » It selects the program statement from the storage unit, interprets the statement and sends the appropriate electronic impulses to the arithmetic/logic unit and storage unit, for the purpose of actual processing.
- » Thus, the control unit does not perform the actual processing operations on the data. Its function is to maintain the order and direct the flow of operations and data within the computer.
- » It also instructs input devices, when to start and stop transferring data to storage unit.
- » It tells the storage unit when to start and stop transferring data to output devices.
- » Hence, it acts as a central nervous system for the computer.

Components of a Control Unit: Control unit comprises the following four components:

- » Instruction register
- » Decoder
- » Address register
- » Instruction counter.

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The instruction register receives instructions, one by one, to be executed in the required sequence. The operation code (OP code) of the instruction in the instruction register is transferred to the decoder. The decoder decodes the operation code (e.g. whether it is addition or subtraction or multiplication or division etc.) and activates the appropriate circuits of the arithmetic/logic unit to perform that operation. Now the address register transfers data to a specific accumulator for arithmetic/logic unit.

Q.No.13. Write about various features of CPU.

Over a period of time, the processor has developed from slow 286s or 386s running at very low speeds of 20 MHz to present day Pentium III and IV running at a speed of 3 GHz (3000 MHz.). Following are some of the important features of a CPU:

Clock Speed: (M08-1M)

- » Clock speed is the speed at which processor can execute ^(=carry out) instructions. Clock speed is measured in megahertz (MHz) - which indicates millions of cycles per second.
- » Therefore, a 450 MHz processor can perform 450 Million instructions per second.
- » Higher the clock speed, faster the processor, better the system performance.

Cache Memory: (M03, N04, M06, M07, N08-1M, RTP)

- » RAM stores data and instructions during processing. The instructions and data are one by one called by CPU, for processing. The processed data is sent back to RAM.
- » During processing there is a constant movement of data and instructions between RAM & CPU.
- » RAM is slower and CPU works at a very high speed. Therefore CPU should slow down to the speed of RAM which reduces the processing speed. To minimise this, Cache memory is provided between RAM and CPU. This is a temporary, high speed memory and can boost processing power significantly.
- » In addition to this, modern processors are coming with inbuilt cache memory. The cache memory that comes along with the processor is called Level One (L1) cache. This cache runs at the processor's clock speed. So, it is very fast. Generally, more the L1 cache, faster the processor.
- » PCs also include slower, secondary or Level Two (L2) cache. This cache memory resides on the motherboard. When compared to L1 cache, L2 cache slower performance.

Slot:

- » Different processors use different sockets or slots to fit onto the motherboard.
- » There are two main types of slots for connecting to the motherboard - Socket 7 and Slot 1.
- » Socket 7 is a 321-pin socket used for Pentium class CPUs like - Pentium MMX, K5, K6 - ranging from 75 MHz to 200 MHz processors. However, Pentium II/III CPUs use Slot 1 for connecting to the motherboard.
- » Slot 1 CPU's fit onto the motherboard as a daughter card, which allows faster communication.

Density: A CPU is made up of millions of small transistors. By synchronising these transistors, CPU performs all calculations. If the distance between two transistors is low, we can integrate more number of transistors. In old CPU's this distance used to be 1 micron. But, new CPUs are being developed with a distance of 0.35 micron, delivering faster performance.

MMX: MMX stands for Multimedia Extensions - a set of instructions built in to the CPU. These instructions are specifically meant for improving the performance of multimedia or graphic applications.

Cooling CPU: While processing, CPU generates lot of heat. If the CPU is not cooled properly, it may lead to different types of errors including system crashes. Therefore, CPU is covered by a heat sink and a small cooling fan to dissipate ^(=disperse) the heat generated by the processor.

Manufacturers: Microprocessors are not made by the manufacturers of micro computers but by companies such as Motorola, Intel, AMD etc. All Apple Macintosh micro computers use Motorola chips: (E.g., Motorola 68000 used in earlier models, Motorola 68020 used in Macintosh II & Motorola 68030 being used in recent models). On the other hand IBM PC's & its compatibles use Intel Processors.

Q.No.14. What is meant by Mother Board? What are the major components of a motherboard? (RTP)

Meaning: Motherboard or system board is the main circuit board on the computer. It acts as a mediator between several components of the computer. For each type of micro processor, there will be corresponding motherboard. Following are some of the important components of motherboard.

1. **Processor slot:** Based on the type of processor used, there are 2 types of slots - Socket-7 & Slot-1.
2. **BIOS:** BIOS stands for Basic Input Output System. It is a small chip on the motherboard that loads the hardware settings of various devices like keyboards, monitors or disk drives. Today most PCs are coming with Flash BIOS. This type of BIOS can be upgraded, to support new devices.
3. **CMOS:** PC uses CMOS memory to store date, time and system setup parameters. These parameters are loaded every time the computer is started. A small Lithium Ion battery located on the motherboard supplies power to CMOS as well as BIOS.
4. **Power supply connectors:** Power supply connectors allow user to connect the power supply unit to the motherboard. It provides power to various components that fit on to the motherboard.
5. **Expansion Slots:** (RTP) PCs are designed in such a way that users can configure ^(=construct) the machine as per their own particular needs. Expansion slots provide such modularity to PC's. Expansion slots are used for any of the following purposes:
 - » It acts as a mediator between Controller cards and computer's built in devices such as hard disks, diskette drives etc.
 - » To provide I/O ports on the back of the computer so as to connect external devices such as monitors, external modems, printers, etc.
 - » To connect special purpose devices to the computer.

Most commonly found expansion slots are given below:

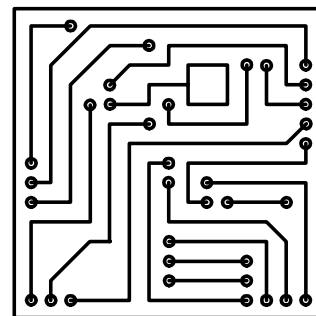
- a. **SIMM / DIMM slots:** SIMM stands for Single Inline Memory Modules, while DIMM stands for Dual Inline Memory Module. SIMM/DIMM slots are used to house ^(=insert) RAM modules.
 - b. **PCI Slots (N05-1M):** PCI (Peripheral Component Interface) slots are used for connecting PCI-based devices like graphics accelerator cards, sound cards, internal modems, etc.
 - c. **AGP Slot:** This is a dedicated slot meant to provide faster access to AGP based graphic accelerator cards. It improves the visual experience of the user.
 - d. **SCSI card:** It is a device interface, used to solve the problem of insufficient number of expansion slots. It is called small computer system interface (SCSI pronounced "scuzzy",). SCSI is like an extension cord for computer bus. IBM developed SCSI in 1970s. The current standard is SCSI-3. With this upto 7 devices can be connected as chain, on a single SCSI port. Now-a-days many devices support the SCSI interface. Generally, high speed hard disk drives have SCSI interface. Similarly scanners, tape drives and optical storage devices are coming with this technology.
6. **Ports and connectors:** Ports & connectors are used to connect external devices like printers, keyboards, scanners etc. to a PC. They are located on the back of the PC, but they are directly or indirectly connected to the motherboard. Following are some of the commonly used ports:
- a. **Parallel ports (N03, N04, M06, N06, N08-1M, RTP):** Parallel ports are used to connect parallel devices like scanners or printers. Parallel ports facilitate parallel transmission of data, usually one byte (8 bits) at a time. Parallel ports use 25 pin RS-232C connector.
 - b. **COM / Serial ports:** They are used for connecting communication devices like modems or other serial devices like mice. There are two varieties of Com ports - 9 pin ports and 25 pin ports. Serial Ports facilitate serial transmission of data i.e. one bit at a time.
 - c. **IDE drive connector:** IDE devices like CD-ROM drives, hard disk drives or Floppy drives are connected to the motherboard through IDE connector.
 - d. **USB ports (M04, M07-1M):** USB stands for Universal Serial Bus. With the help of these ports data can be transferred at a very high speed. Different USB devices are available in the market like keyboards, mice, scanners or digital cameras.
 - e. **PS/2 Connectors:** PS/2 stands for Personal System/2. PS/2 connectors are used to connect PS/2 based input devices like PS/2 keyboards or mice.

New motherboards are coming with integrated graphics cards & sound cards i.e., there is no need to install a separate card.

Note: Interface Vs. Port (N00-5M)

Q.No.15. Define the term BUS? What are the components of bus?**Meaning:**

- » A bus is a collection of wires through which data is transmitted between various components of a PC.
- » If we closely look at the motherboard, we can notice a network of golden electric paths etched on both sides of the motherboard. They form the bus of the PC.
- » A bus acts as the system's expressway - it transmits data between various components on the motherboard.
- » Logically bus consists of two parts - an address bus and a data bus.

**Data Bus: (N07, N08-1M)**

- a. Data Bus is an electrical path that connects the CPU, memory & other hardware devices on the motherboard.
- b. Bus is a group of parallel wires. The number of wires in the bus can affect the speed at which data can travel between hardware components.
- c. Each wire can transfer one bit at a time. Therefore, an eight-wire bus can move eight bits at a time. A 16-bit bus can transfer two bytes and a 32-bit bus can transfer four bytes at a time.
- d. PC buses are designed to match the capabilities of devices attached to it. For e.g. a 32 micro processor must support 32 bit data bus.
- e. Following are different types of data bus used in PCs.
 - ▶ MCA bus – Micro Channel Architecture,
 - ▶ EISA bus – Extended Industry Standard Architecture,
 - ▶ ISA bus – Industry Standards Architecture,
 - ▶ PCI bus – Peripheral Component Interconnect.

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To **Master Minds**, Guntur

Address Bus: Address bus is also a set of wires, similar to the data bus. But it is used to connect CPU and RAM. Data bus always carries data but address bus carries memory addresses. Each byte in RAM is associated with a number, which is the memory address. To request data from RAM, CPU sends the required address.

The number of wires in address bus determines the maximum number of memory addresses. For example, one byte of data is enough to represent 256 different values. If the address bus could carry only eight bits at a time, the CPU could address only 256 bytes of RAM. Actually, most of the early PCs had 20-bit address buses, so the CPU could address 1 MB of data. Today, most CPUs have 32-bit address buses that can address 4 GB of RAM.

Note: Address bus vs. Data bus (N03-4M)

Q.No.16. Write about different types of storage devices. (For academic interest only)

Storage Devices: CPU contains basic instructions needed to operate the computer. But it can't store programs and data. Just like the human brain, Computers also need some blocks of space to store programs and data. This space is called memory or storage.

Types of storage: Various forms of storage have been invented. Till now there is no universal storage medium. Every form of storage has some drawbacks. Therefore, a computer system may contain several kinds of storage, each for a particular purpose.

1. **Primary storage:** Primary storage is directly connected to the central processing unit of the computer. For biological bodies lungs must be present (for oxygen storage) for the heart to function (to pump and oxygenate the blood). Similarly, memory must be present for the CPU to function properly. Primary storage typically consists of 3 kinds of storage:
 - a. **Processor registers:** These are internal to the CPU. Registers contain information that is necessary for ALU to carry out the current instruction. Technically they are the fastest of all forms of computer storage. It consists of switching transistors integrated on the CPU's silicon chip and operates as electronic "flip-flops".

b. Main memory: It contains some programs and data that are currently being run. The arithmetic and logic unit can quickly transfer information between processor register and main memory. It is also known as "memory addresses". In modern computers, electronic solid-state Random Access Memory is used for main memory and is directly connected to the CPU through "memory bus" and "data bus". The memory bus is also known as address bus or Front Side Bus. Both busses are high-speed digital "superhighways". Access methods and speed are the two fundamental, technical differences between memory and mass storage devices.

c. Cache memory: Already discussed.

2. Secondary, tertiary and off-line storage:

- » Secondary storage requires the computer to use its input/output channels to access the information, and is used for permanent storage of information.
- » On the other hand most of the operating systems also use secondary storage devices as virtual memory (to artificially increase the amount of main memory).
- » Secondary storage is also known as "mass storage". Generally the capacity of Secondary or mass storage is much greater than primary memory (main memory). But it is very much slow when compared to primary memory.
- » In modern computers, hard disks are usually used for mass storage.
- » The time taken to access a given byte of information on a hard disk is few thousandths of a second (or milliseconds). But the time taken to access a given byte of information in RAM is measured in thousand-millionths of a second (or nanoseconds). This illustrates the speed difference between RAM and hard disc. Generally Hard disks are million times slower than memory.
- » Rotating optical storage devices (such as CD and DVD drives) are still slower than hard disks.
- » That is why the use of virtual memory significantly degrades the performance of any computer.

3. Tertiary storage: It is a system where a robotic arm will "mount" (connect) or "dismount" (disconnect) off-line mass storage devices according to the demand of computer operating system. Tertiary storage is used in the areas of enterprise storage and scientific computing on large computer systems and business computer networks.

4. Off-line storage: It is a system where the storage medium can be easily removed from the storage device. Off-line storage is used for data transfer and archival purposes. In modern computers, floppy discs, optical discs and flash memory devices including "USB drives" are commonly used for off-line mass storage purposes. "Hot-pluggable" USB hard disks are also available. Off-line storage devices used in the past include magnetic tapes, removable Winchester disks/drums.

5. Network storage: Network storage is any type of computer storage that involves accessing information over a computer network. Network storage allows to centralize the information management in an organization. It helps to reduce the duplication of information. Network storage includes:

- a. Network Attached Storage (M06, N08-5M):** It is secondary or tertiary storage attached to a computer which another computer can access over a local-area network or a private wide-area network or in the case of online file storage over the Internet.
- b. Network computers:** These computers do not contain any internal secondary storage devices. Instead, documents and other data are stored on a Network Attached Storage.

Q.No.17. Write about different characteristics of storage devices. (For academic interest only)

The division of primary, secondary, tertiary and off-line storage is based on **memory hierarchy** or distance from the CPU. There are also other ways to characterize various types of storage.

1. On the basis of volatility of information:

- a. Volatile memory:** It requires constant power to maintain the stored information. Volatile memory is typically used only for primary storage. The best example is RAM.

- b. **Non-volatile memory:** It can retain data even if the power supply is switched off. It is suitable for long-term or permanent storage of information. That is why it is used for secondary, tertiary and off-line storage.
- c. **Dynamic memory:** It is also a volatile memory. It is dynamic because each memory cell quickly loses its charge. So, it must be refreshed for hundreds of times each second.

2. On the basis of ability to access non-contiguous information:

- a. **Random access:** It means that data in any storage location can be accessed in the same amount of time (generally very small amount of time). That is why random access memory is very much suited for primary storage.
- b. **Sequential access:** It means that data in different storage locations can't be accessed in the same time. The access time varies from one file to another file. In these cases access time consists of seek time (e.g. to position the read/write head correctly) and rotational delay (e.g. time taken to rotate the medium in such a way that the required file appears below the read/write head).

3. On the basis of ability to change information:

- a. **Read/write storage, or mutable storage:** In this case information can be erased and fresh information can be rewritten for any number of times. Every computer must have at least some amount of storage of this kind.
- b. **Read only storage:** In this type of memory, data is recorded at the manufacturing and it is stored permanently. The information from the memory can be read but fresh information cannot be written. This is a **write once storage (WORM)**. These are also called **immutable storage**. Immutable storage is used for tertiary and off-line storage. Examples include CD-ROM.
- c. **Slow write, fast read storage:** In this type of memory data can be overwritten for multiple times. But the write operation will be much slower than read operation. Examples include CD-RW.

4. On the basis of addressability of information:

- a. **Location addressable storage:** In this storage each memory location will have a unique address and data can be accessed by its numerical memory address. In modern computers, this method is followed in case of primary memory. This method is very efficient but very burdensome for human beings.
- b. **File system storage:** In this case information is divided into files of variable length, and a particular file is selected from human readable directory and file name. The operating system of a computer will provide the file system abstraction to make the operation more understandable. In modern computers, secondary, tertiary and off-line storage uses this file system.
- c. **Content addressable storage:** In this case each individually accessible unit of information is selected with a hash value or a short identifier. Here, there is no significance of memory address in which information is stored. Content addressable storage can be implemented either using software or hardware. Hardware is faster but more expensive.

5. On the basis of capacity and performance:

- a. **Storage capacity:** It is the total amount of information that a storage device or medium can hold. It is expressed as a quantity of bits or bytes (e.g. 10.4 megabytes)
- b. **Storage density:** It refers to the compactness of stored information. It is the storage capacity of a medium divided with a unit of length, area or volume (e.g. 1.2 megabytes per square centimeter)
- c. **Latency:** It is the time taken to access a particular location in storage. It is generally 1 nanosecond for primary storage, 1 millisecond for secondary storage and 1 second for tertiary storage. We can also differentiate as read latency and write latency.
- d. **Throughput:** It is the rate at which information can be read from or written to the storage. In computer storage, throughput is usually expressed in terms of megabytes per second or MB/second.

Q.No.18. Write about Semi Conductor memories or Integrated circuits (N98-1M, M00-5M)

- » This type of storage devices are based on the principles of storage chips.
- » These are very thin silicon chips, consisting of number of small storage cells that can hold data.

- » These units are constructed as integrated circuits, meaning that number of transistors are integrated or combined together on a thin silicon wafer.
- » Faster and more expensive bipolar semi conductor chips are often used in ALU and high speed buffer storage sections of CPU.
- » Slower and less expensive chips that employ metal-oxide semi-conductor (MOS) technology are used in main memory section.
- » These are again divided into - permanent (Non Volatile) & non permanent (Volatile).
- » Non volatile chips can retain the data permanently i.e. they hold data even when the computer is switched off. (E.g.- ROM BIOS)
- » On the other hand Volatile chips lose their contents when the computer's power is switched off i.e. these chips provide volatile storage. RAM is the best example for this type of memory.



Q.No.19. Define the term RAM. Write about various kinds of it? (N94, M01)

Meaning:

- » The memory system constructed with metal oxide semi conductor storage elements that can be changed is called Random Access Memory.
- » It is used to hold intermediary data in the computer. The contents of this memory chips are temporary and can be easily changed.
- » It is the workspace for the computer's processor. When people talk about computer memory, they usually mean volatile memory.

Why is it called so? It is called random access memory because access time in RAM is independent of the address of the data. Each storage location (address) inside the memory is as easy to reach as any other location and takes the same amount of time. One can reach into the memory at random and insert or remove numbers in any location at anytime.

Types of RAM:

- a. **Dynamic RAM:** It is the most common type of main memory. It is dynamic because each memory cell quickly loses its charge. So it must be refreshed for hundreds of times each second. In olden days refreshing was done by Microprocessor. Due to this, lot of processing power was wasted. But today's dynamic RAM is coming with built in refresh circuits. This saves lot of processing power.
- b. **Static RAM:** Static RAM (SRAM) is like DRAM but it is faster, larger and more expensive. It is static because it is not required to refresh the contents of RAM continuously. Because of its speed, SRAM is mainly used in special area of memory called cache memory.
- c. **Static RAM Vs Dynamic RAM:**
 - » Static RAM can retain the stored data as long as power remains in. Whereas in dynamic RAM, the stored information disappears after every few milliseconds. Therefore, data must be refreshed before it disappears.
 - » The power consumption of dynamic RAM is less than that of static RAM.

Q.No.20. Write about ROM? What are the various kinds of it? (N94)

- » Another type of computer memory is Read-Only-Memory (ROM). It is used for storing micro programs, not available to normal programmers.
- » The information is permanently stored during manufacturing. The information from the memory can be read but fresh information cannot be written.
- » Generally ROM is used to store instructions that are frequently needed, for executing small, extremely basic operations, which will not be available in the computer's circuitry.
- » For e.g. ROM may be used for code converter, function generator (e.g. sine, cosine, tangent etc.) and character generators (e.g. characters displayed in dot matrix form).

Different kinds of ROM:

- PROM (N03, N07-1M):** Programmable Read Only Memory is a non-volatile memory which allows the user to program the chip with a PROM writer. User can record any data or instructions. The only problem with PROM chips is that once data is recorded on them, it cannot be changed.
- EPROM:** EPROM stands for Erasable Programmable Read Only Memory. EPROM chips can be electrically programmed. Unlike ROM and PROM chips, EPROM chips can be erased and reprogrammed. With the help of ultraviolet light, the data or instructions on an EPROM chip can be erased and new data can be recorded in its place.
- EEPROM:** It stands for Electrically Erasable Programmable Read Only Memory. This is the latest addition to the ROM family of chips. For the purpose of reprogramming, they need not be removed from the machine. Changes can be made electrically, under the control of a software.

Note: RAM Vs. ROM (N04, N96, M05-5M, RTP)

Q.No.21. Write about Bubble Memory. (N98-5M, RTP)

Bubble memory consists of small magnetic domains (bubbles) formed on a thin single-crystal film of synthetic garnet. These bubbles are actually magnetically charged cylinders, and can be moved across the garnet film by using electric charge. The presence or absence of a bubble can be used to indicate whether a bit is on or off.

Features of bubble memory:

- It is small in size, lightweight and does not use much power.
- It provides non-volatile memory i.e. data stored in bubble memory is retained even when the power is switched off.
- It allows direct access to data.
- Low production cost.
- Data density of bubble memory is very high.
- It is very much suitable for auxiliary storage in portable computers. Bubble chips are also being used in machine tools, robots and military computers.

Q.No.22. Write about Flash memory? (M08-1M)

- » Flash memory chips are one of the latest storage devices.
- » It is other name given to EEPROM Chips.
- » These chips are a form of Static RAM (SRAM) chips, and they store data similar to that of computer's primary memory.
- » However, the data stays recorded even when the power is turned off. Thus flash memory is non-volatile.
- » Flash memory devices have no moving parts. So, they are very fast.
- » If the technology is still improved, they can replace slower, mechanical hard disk drives.
- » These memory chips are very small in size and consume very less power.
- » Currently these chips are being used in portable devices.

**Q.No.23. Explain the concept of Basic Input Output System (BIOS) (M03, N06-1M, RTP)****Meaning:**

- » Basic Input Output System is a small chip on the motherboard which loads the hardware settings of various devices such as keyboards, monitors, etc.
- » When a computer is switched on, micro computer uses this software to start the system.

Features:

- » BIOS is a program that is made accessible to the microprocessor on an EPROM chip.
- » Theoretically, it is the intermediary between the microprocessor and I/O devices. In some cases, it can transfer data directly from different devices to memory.
- » A small lithium ion battery provides power to BIOS.
- » When the details of a device change, BIOS needs to be changed.
- » It controls the routine functions like clock, input/output devices and manages data flow between the computer's operating system and attached devices such as hard disk, video adapter, keyboard, mouse, printer, etc.
- » When the computer is switched on, BIOS checks whether all devices are attached or not and are operational or not.

Q.No.24. Write about CMOS (N04, M08, N08-1M)

- » CMOS stands for Complimentary Metal Oxide Semiconductor.
- » It is a small memory chip that stores date, time and system setup parameters which are loaded every time the computer is started.
- » The data in the CMOS is maintained with electric power from a small Lithium Ion Battery located on the Motherboard.
- » It is a medium for storage of information which is instantly made available to the BIOS programs during the start up.
- » CMOS should be updated when different or additional hardware components are installed.

Q.No.25. Write short notes on Floppy disks as a secondary storage device. (M07-5M, M97,N99-1M)

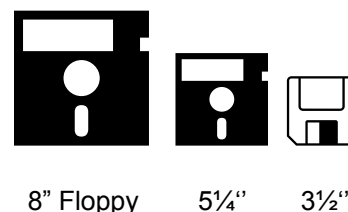
Introduction: It is the most widely used auxiliary storage device in the world. It is used for a variety of purposes like – taking a back up copy of important files, to transfer documents from one computer to another computer, etc. They were invented and introduced by IBM.

What does it contain?

- » It consists of a circular piece of thin plastic material, approximately eight inches in diameter and it coated with metal oxide material.
- » The circular piece of plastic is enclosed in a square protective jacket with a cut out so that the read / write head can access the disk. This is called *a floppy disk or diskette*.

How it works?

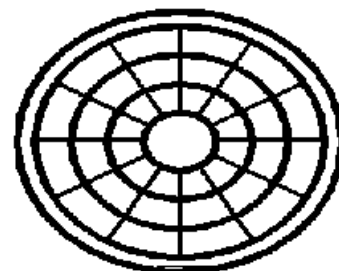
- » The surface of diskette is coated with millions of tiny iron particles so that the data can be stored on them.
- » The drive consists of a motor that can rotate the disk. It also consists of Read/Write heads that can move to any spot on the disk's surface. This allows the heads to access data directly, rather than sequentially.
- » The R/W heads of a diskette drive consists of electromagnets, which generate magnetic field on the iron particles of the diskette.
- » Floppy diskettes spin at around 300 revolutions per minute. Therefore, the longest time required to reach a point on the diskette is nothing but the amount of time required for one revolution i.e. about 0.2 second.
- » The heads can move from the center to the outside edge in less than 0.17 second.
- » Since both operations (rotating the disk and moving the heads) take place simultaneously, the maximum access time is 0.2 second.



8" Floppy 5¼" 3½"

How Data is organised on a disk? (Format –M06-1M)

- » New diskettes must be formatted before they can be used.
- » When the disk is formatted, a set of magnetic concentric circles will be formed, known as tracks. (Most diskettes have 80 tracks).
- » Each track on a disk is also split into smaller segments called sectors. All the sectors on the disk are numbered. Thus each small area on the disk will get a unique number.
- » On most diskettes, each sector can store upto 512 bytes/ 0.5 KB of data.



Tracks & Sectors on Disk

Q.No.26. What are the various factors which determine the storage capacity of a magnetic disk. (M04-5M) (Or) What are the factors to be considered to ascertain the number of characters that can be stored on a diskette?

The storage capacity of a diskette depends upon the following factors:

- a. **The number of sides of the diskette used:** The earlier diskettes and drives were designed to record data on one side of the diskette only. These drives were called single-sided drives. Now-a-days diskette can use both the sides and are called double-sided drives.
- b. **The recording density:** Recording density refers to number of bits that can be recorded on one inch of disk space. This measurement is referred to as bits per inch (bpi). On this basis diskettes may be classified as single density disc (SD) or double density disc (DD). A single density drive can store 2,768 bits per inch on the innermost track. Double density drive can store 5,876 bits per inch. With improved technology, it is anticipated that in future it may exceed 10,000 bpi.
- c. **Number of tracks on the diskette:** The number of tracks depends upon the drive being used. Many drives record 40 tracks on the surface of the diskette. On the other hand, double track drives can record 80 tracks on the diskette.

Q.No.27. How Operating System finds Data on a disk?

A computer's operating system is able to locate data on a disk (diskette or hard drive) because each track and sector is labeled and the location of all data is kept in a special log on the disk. The labeling of tracks and sectors is called format. A commonly used format, performed by DOS or Windows, creates these four disk areas:

1. **The boot record (N03, M07, M08-1M, RTP):** It is a small program that runs when the computer is started. This program determines whether the disk has the basic components of DOS or Windows that are necessary to run the operating system successfully. If it determines that the required files are present and the disk has valid format, it transfers control to the operating system. This process is called booting because the boot program makes the computer "pull itself up by its bootstraps."
2. **The File Allocation Table (FAT) (M03, M04-1M, RTP)** It is a log that records the location of each file and the status of each sector. When a file is stored on a disk, the operating system checks the FAT for an open area, stores the file and then identifies the file and its location in the FAT.
3. **Root folder / Directory:** A folder, also called a directory, is a tool for organizing files on a disk. Folders can contain files or other folders. Thus it is possible to set up a hierarchical system of folders on the computer, just as there are folders within other folders in a filing cabinet. The top folder on any disk is known as root.
4. **Data area:** The part of the disk that remains free after the boot sector, FAT, and root folder have been created is called the data area because that is where the data files (or program files) are actually stored.

Q.No.28. What is the care required to be taken in using and storing diskettes.

Following points focus on the care required to be taken in using and storing diskettes:

- » On receiving a new diskette, it should be inspected for obvious damage. The Surface of the diskette should not be touched with hand or some sharp object.

- » Write-protection tab should be properly observed.
- » Correct insertion of disk in the disk drive is essential, otherwise some data stored on the disk is likely to be destroyed or the disk itself may be damaged.
- » The diskette should be inserted slowly in the disk drive when power to the entire computer system is on. It should be removed prior to turning the system off.
- » As a defensive measure, it is advisable to maintain a back-up copy of information stored on each diskette separately at a safe location.
- » The diskette should be properly labeled.
- » While storing a diskette, both physical and environmental factors should be considered. Diskette should not be stored in such a way that may sag, slump or compress it. The main enemies of a diskette are temperature, direct sunlight, dust, liquids and vapors and electromagnetic interference. Diskette should be protected from them.
- » To remove dust regularly, the disk drive head should be carefully cleaned.

Q.No.29. Write about magnetic disk as a secondary storage device?

Meaning:

- » Magnetic discs (or hard disks) are the most popular direct access medium.
- » A hard disk is a stack ^(=heap) of one or more metal platters that spin on one spindle. Each platter is coated with iron oxide and the entire unit is encased ^(=enclosed) in a sealed chamber.
- » Floppy diskettes and drives are different from each other. But hard disk and drive is a single unit.
- » In both speed and capacity, they are better than diskettes.
- » To achieve best performance, the read/write head must be extremely close to the surface of the disk. It is so close that even a small dust particle or human hair or even a fingerprint can fill up the gap between head and the disk, causing the head to crash. This may destroy the data stored in the area of crash and can destroy read/write head also.

Q.No.30. How data is stored in magnetic discs?

Introduction:

- » Hard discs can store data very closely and they can also store more data, because it uses number of platters. These platters are arranged one on the top of another.
- » In hard disks, the number of read/write heads can indicate the number of sides that the disk uses. For example, a particular hard disk may have six disk platters (that is 12 sides). But bottom side of the last platter and top side of the first platter are unusable. Therefore, there will be only ten read/write heads.
- » Read/write heads move in and out simultaneously. Even though, a record on the first side of the disk is to be accessed, all the ten read/write heads move together.
- » If read/write heads are once moved, all the ten tracks vertically above and below each other should be read or written first. Thus the concept of cylinders developed.
- » Any ten tracks vertically above and below each other will form one hollow cylinder. If there are 200 tracks on each side there will be 200 cylinders in the entire disk pack. Since read/write heads move simultaneously, reading or writing is performed cylinder wise (but not track wise).

File Updation:

- » Only one hard disk is connected to the CPU and can store both input and output.
- » Thus, if a record is picked up from a sector and updated in the CPU, it is deposited back in the same place in that sector. This way of storing updated data is known as overlaying i.e. original data is automatically erased when new updated data is deposited in its place.

- » The major advantage is that a single disc is sufficient for both input and output.
- » The major disadvantage is that it is difficult to trace any errors because it is not possible to reconstruct the latest file from the previous version.

Access time (N04-1M): Access time consists of following 3 components:

- a. **Seek time:** This is the time required to position a movable read-write head over the required track. If the read-write head is fixed, this time will be zero. (through this movement one can reach the required track)
- b. **Rotational time:** This is the time taken to rotate the storage medium underneath the read-write head. Through this movement one can reach the required sector.
- c. **Data transfer time:** This is the time taken to activate the read/write head, read the requested data and transmit them to primary memory, for processing.

The total of these 3 components is known as access time and ranges from 8 to 12 milliseconds.

Q.No.31. Advantages & Disadvantages of Magnetic Disc.

Advantages:

- a. Magnetic disk is a direct access storage medium. Therefore, individual records can be received without searching through the entire file.
- b. The cost of disks is steadily decreasing.
- c. For real-time systems, where direct access is required, disks are the only practical means of file storage. Other new types of storage, such as bubble storage, are not being used widely.
- d. Records can be readily updated by writing new information over old information.
- e. With removable disk packs, a single disk drive can store large quantities of data.
- f. All interrelated files can be processed simultaneously against a single transaction.

Disadvantage: When a master file is updated, it destroys the old version of the file. Therefore, disk does not provide an automatic audit trail. When disk is used, old master file records must be copied to another medium, prior to updation (for the purpose of back-up and audit trail.)

Q.No.32. Describe various factors which determine the storage capacity of a magnetic disc? (M04)

Diskette Storage capacity depends upon the following factors: - Refer to Q.No.26.

In case of hard disk the storage capacity depends on:

- » the number of platters that are stacked on the top of one another,
- » the number of tracks per platter and
- » the number of sectors per track.

Hard disks generally have 6 platters i.e. 12 faces, out of which eleven faces can be used. Each side may have 200 or more tracks, each track having 54, 63 or even more sectors per track and hard disk generally stores 512 bytes of data in a sector.

Data on magnetic disc is stored in cylinders where nth track of each face vertically above and below each other is called nth cylinder. Thus, the storage capacity of hard disk is calculated as

$$= \text{No. of cylinders} \times \text{no. of usable sides} \times \text{No. of tracks} \times \text{No. of sectors per track} \times \text{no. of bytes per sector.}$$

Q.No.33. Write about Removable hard discs.

Removable hard disks and drives combine the speed and capacity of a hard disk with the portability of a diskette. Several types of devices are available in the market, which fall under this category. While choosing a removable hard disk, one has to consider the needs of speed, storage capacity, compatibility, price, etc.

Q.No.34. Write about Hot swappable hard discs.

- » These are used in high end computers, like servers, that require high end performance.
- » These are sometimes used on high-end workstations that require huge storage capacity. They allow the user to remove (swap out) a hard disk and insert (swap in) another hard disk, while the computer is still on (hot).
- » Hot-swappable hard disks are like removable versions of normal hard disks. The removable box includes disk, drive and read/write heads in a sealed container.

Q.No.35. Write about CD – ROM discs.

- » CD-ROM is similar to audio CD technology and it stands for Compact-Disk-Read-Only Memory.
- » An optical disk is a round platter on which small holes are used to store data. Each hole represents the binary digit 1 and the absence of hole represents binary digit 0.
- » CD-ROM disks are used for mastering facility.
- » Most of the commercially produced CD-ROM disks contain some reference material. The master copy is duplicated or copied at the factory and copies are distributed. Once it is inserted into CD-ROM disk drive, text, video images and so on can be read into primary storage or can be displayed on screen.
- » However, the data on the disk is fixed and can't be altered.
- » The capacity of a single CD-ROM is over 650 MB which is equivalent to 2,50,000 pages of text or 1500 floppy disks.
- » These CD-ROMs are tremendously used in multimedia applications, which require huge amount of storage space.
- » CD-ROM provides direct access to any image or data on the disk.
- » CD's can store any type of data i.e. text, images, audio, video, etc.

Note: Floppy disc Vs. CD-ROM disc. (M02-5M)

Q.No.36. Write about CD – Rewritable's.

- » This is the third generation in CD technology. The first technology was CD – ROM. Later on CD-Recordable (CD-R) technology was introduced which was write once medium only. But CD-RW technology is better than CD-R technology because it can be written, erased or even rewritten.
- » This technology was introduced by Hewlett Packard.
- » This technology has got the features of both floppies (rewriting capabilities) and CD's (huge storage capacity). The drive is very simple to use and universally accepted by all.
- » It allows users to store, transport, retrieve, share and modify large files. It also enables sharing of large files. For example, movies, multimedia presentations, etc.
- » CD Rewritable drive can be connected either internally or externally. Internal drive can be connected to IDE connector and an adapter card is not needed. On the other hand external drive can be connected through PC's parallel port.
- » For example, HP Surestore CD-Writer Plus provides users with upto 650 MB of rewritable capacity.

Q.No.37. WORM disk. (N06-4M, N07-1M)

It stands for Write once, Read Many optical laser disks or WORM disks. These are used by end user companies to store their own proprietary information. Once the data have been written to the medium, data can only be read, not updated or changed. The PC version of a WORM disk cartridge, (which looks like a 5¼ inch version of 3¼ inch diskette) can store up to 200 MB.

When compared to hard disks, the access times for CD-ROM and WORM drives are quite slow, ranging from 100 to 300 milliseconds.

WORM disks cartridge is a feasible alternative to magnetic tape for archival storage (i.e. backup storage). Another popular application of WORM disks is in information systems that require the merging of text and images that do not change for a period of time. A good example is an "Electronic Catalogue". A customer can see retailer's electronic catalogue on a VDT, or on a PC and see the item while he/she reads about it. And, with a few keystrokes, the customer can order the item as well. The Library of Congress is using WORM technology to come out of serious shelf-space problem.

Q.No.38. Write about MO Discs.

- » Floppies can be used for number of times. But its storage capacity is very limited. On the other hand optical storage devices can store huge amount of memory. But it can't be rewritten.
- » Magneto-optical discs integrate ^(=combine) optical and magnetic disk technology to enable reading and writing of data. However, the technology must be improved. A 5¼ inch disk can store upto 1000MB.
- » It uses thermo-magnetic technology for recording. With this, Information can't be accidentally erased or corrupted by magnetic fields.
- » At present, magneto-optical disks are too expensive and do not offer reliability that users have experienced from magnetic media.
- » In addition, the access time is relatively slow – equal to that of low end hard disk.
- » If this technology is developed to offer reliable, cost effective medium, it may dominate the secondary storage devices.
- » For example, MCA 640 is a magneto optical drive from Mitsubishi Chemical Corporation, Information Storage Division.

Q.No.39. Write about Video discs / DVD (Digital Versatile Disk)**Introduction:**

- » A digital video disk (DVD) closely resembles ^(=look like) a Compact Disk (CD). It is also a 5¼ inch plastic disk that uses a laser beam to encode microscopic pits on the surface of disk.
- » But the pits on DVD are much smaller and closer than CD. On the other hand a DVD can be used on both sides.
- » Video disks can support both direct and sequential access. Any of the 54,000 tracks on the surface of a video disk can be accessed in just 3 seconds.
- » DVDs can store as much as 17 GB of data - over 25 times the capacity of a standard CD-ROM disk. Thus huge amount of data can be stored in a single, lightweight, removable, reliable, easily-transportable disc.
- » Currently DVD's are used for entertainment - for example, storing movies or large amounts of music etc. Experts predict that in future DVD's will be used to distribute software or large amounts of accounting data.

Some applications:

- | | |
|--------------------------|-------------------------|
| » Real estate agents, | » Automobiles industry, |
| » Training applications, | » Travel agents. |

Q.No.40. Write about Magnetic tapes?**Introduction:**

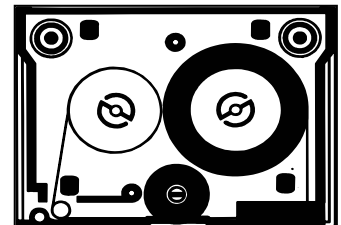
- » Magnetic tape is the oldest secondary storage technology, still in wide use. It is very much similar to audio tape. It is made with plastic material, covered with metallic coating, which can be magnetized at different spots.
- » It can provide sequential access only but not direct access.
- » Following are the 2 most popular forms of magnetic tape: detachable reel magnetic tapes & tape cartridges.

Detachable Reel Magnetic Tapes:

- » Many of the tapes used with mainframes and minicomputers are stored on detachable reels. These plastic tapes are coated with magnetisable material (generally iron oxide) that can be encoded with 0 and 1 bits.
- » The entire surface of the tape is divided into tracks. A character (byte) is represented vertically over the tracks of tape surface. Tapes can be read by a hardware device called tape unit.
- » There will be one empty take up spool and one supply spool. Empty take-up spool accepts the tape, as it is being processed.
- » The tape is processed by passing it under read/write head which is located between two spools. Depending on the instructions given to the computer system, data can be either read from the tape or written to it. Tapes come in various widths, lengths and data densities.
- » Commonly found tapes come with 2400 feet length, $\frac{1}{2}$ inch width and it packs data at 6250 bytes per inch. Recording densities of tapes are expressed in bytes per inch (bpi).
- » The most common one is open reel tape, which is $\frac{1}{2}$ inch wide and usually comes on reels that are 10½ inches in diameter.

Tape Cartridge devices:

- » Cartridge tape is the leading edge of tape technology. Tape cartridges are generally used to back up hard disks. They can backup the contents of hard disk in few minutes.
- » These tapes are sometimes called streaming tapes.
- » These tape cartridges vary in storage capacity but several megabytes of storage space is quiet common.
- » In 1986, IBM introduced a tape cartridge system, IBM 3480, for its 3090 series of mainframes. Each cartridge can store upto 200 MB of data and data-transfer rate is 3 MB / Sec.
- » Conventional detachable-reel tapes consist of 9 tracks. But these $\frac{1}{4}$ inch tapes store data in 18 tracks.
- » In 1992, IBM released 36 track tape cartridges to use in its mainframe computers.
- » Tape cartridges are available for both large and small computer systems.

**Magnetic Tape Cartridge****The End**