COMPUTER MEMORY

CHAPTER 2

After completing this lesson, you will be able to:

- Define bit, byte, memory word and memory units.
- Differentiate between main memory and secondary memory.
- Explain the difference between chip memory and magnetic memory.
- Differentiate between volatile and non-volatile memory.
- Describe internal processor memory, RAM and ROM.
- Differentiate between sequential access and direct access memory.
- Describe magnetic tapes, magnetic disks and optical disks.
- Describe flash memory and memory cards.

UNIT INTRODUCTION

Computer memory is one of the important and compulsory components of every computer system. This unit describes memory and memory devices used to store data and programs on a temporary or permanent basis for use in digital computers. The two main types of computer memories i.e. primary and secondary memories are discussed thoroughly.

2.1 INTRODUCTION TO COMPUTER MEMORY

Q.1 Give a brief introduction to computer memory.

Answer

Memory

In computing, memory refers to the physical devices used to store programs (sequence of instructions) or data on a temporary or permanent basis for use in a computer or other digital/computing device. Memory in a digital computer contains the main part of operating system and all the application programs and related data that is being used.

Memory that communicates directly with the CPU (as shown in Fig.2.1) is called main memory or primary memory.

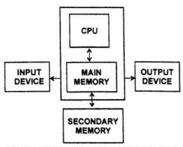

Fig. 2.1 Block diagram of a computer with memory unit

Q.2 Write down the use of secondary memory.

Answer

Secondary memory

Devices that provide backup storage are called secondary memory or mass storage devices. All the information is stored in secondary memory and it is transferred to main memory on a demand basis.

2.1.1 MEMORY CHARACTERISTICS

Q.3 Explain the important characteristics of memory devices.

Answer

Important Characteristics of Memory Device

The important characteristics of any memory device are:

- Access Mode
- Access Time
- Transfer Rate
- Capacity
- Cost

1. Access mode

Memory has two major access modes:

- Sequential Access Mode
- Random Access Mode

i. Sequential Access Mode

In Sequential access mode, memory can be accessed only in serial order. It is also called serial access mode.

Example

If we have to access 4th memory location then first we would have to move to first three locations and skip them and only then we can access the 4th location.

ii. Random Access Mode

In Random access mode, memory location can be accessed at random. It is also called direct access mode.

Example

If we have to access 4th location then we can directly go to 4th location and access it.

2. Access time

It is the time taken to retrieve data from memory. Access time in sequential access memory devices is more than the random access memory devices.

3. Data transfer rate

It is the time taken to transfer data from one memory device to the other.

Example

Time taken to transfer data for hard disk to the main memory (RAM).

4. Capacity

The memory capacity is the amount of space that a memory device has to store data or the amount of memory required for a program to run.

5. Cost

It is the price that computer users have to pay as per capacity of the memory device.

2.1.2 MEMORY TERMINOLOGY

Q.4 Explain some important memory terms, which are related to memory.

Answer

Important Memory Terms

The following are some important memory terms related to memory:

- Bit
- Byte
- Memory Word

1. Bit

The smallest unit of memory in digital computer is a bit, which stands for binary digit 0 or 1.

State of Memory

The memory of a computer consists of millions of memory (or electronic) cells. Each cell contains one bit of information states of memory cell. The memory cell has two states, ON and OFF. The ON state represents a binary 1 and OFF state binary 0.

2. Byte

Byte is the basic unit of computer memory and it is the minimum piece of data to be processed by a computer. A group of 8 bits is known as one byte. One byte of memory is required to store one character in the computer, for example 'A', 'a', 'b', '*', etc.. A byte is generally used to express the memory size of a computer. Computer memory is measured in terms of bytes. The higher units are Kilobyte (KB), Megabyte (MB), Gigabyte (GB) and Terabyte (TB). In future, memories will also be available in Petabyte (PB) and Exabyte (EB).

Relationship between the Memory Units

The relationship between the memory units is shown in Table 2.1.

MEMORY UNIT	EQUIVALENT TO	
1 Byte	8 Bits	
1 Kilobyte (KB)	2^{10} Bytes	= 1024 Bytes
1 Megabyte (MB)	2^{20} Bytes	= 1024 KB
1 Gigabyte (GB)	2^{30} Bytes	= 1024 MB
1 Terabyte (TB)	2^{40} Bytes	= 1024 GB
1 Petabyte (PB)	2^{50} Bytes	= 1024 TB
1 Exabyte	2^{60} Bytes	= 1024 PB

Table 2.1 Memory Units and their Equivalents

3. Memory Word

In computing, the smallest chunk or size of data that a computer can process is called memory word. It is a fixed-sized piece of data handled as a unit by the processor.

Word Size

The number of bits in a word is called the word size. Word size in modern computers typically ranges from 16 to 64 bits, depending on the size of the computer. A computer that has a bigger word size can transfer more bits into the microprocessor at a time for processing and this improves the processing speed of the computer.

Main indication of the word size

The main indication of the word size is how much memory the processor can address. A 32-bit processor is limited to 2^{32} memory addresses. This is a group of bits (cells) in a memory that represents information or data of some type.

2.1.3 MEMORY BUILT-UP AND RETENTION POWER

Q.5 Name some types of computer memory.

Answer

Types of Computer Memories

All types of computer memories, as for as their built-up or manufacturing is concerned, are divided into Chip memory, Magnetic memory and Optical memory. And as far as their retention power is concerned these memories are divided into Volatile memory and Non-Volatile memory.

Q.6 Write a note on chip memory.

Answer

Chip Memory

Chip is a small piece of semi-conducting material (usually silicon). A small circuit called IC (Integrated Circuit) is embedded on it. A typical chip contains millions of electronic components (transistors).

Chip memories are very fast as compared to other memories as there are no mechanical moving parts in them but on the other hand chips rely on electric currents.

Examples of Chip Memory

Examples of chip memory are main memory (RAM, ROM and Cache), Flash memory drives, memory cards and registers.

Special-purpose Chips

Many special-purpose chips, known as application-specific integrated circuits, are also being made today for automobiles, home appliances, telephones, and other devices.

Types of Chip Memory

Different types of chip memory devices are shown in Fig.2.2.

Fig.2.2: Chip Memory devices

Q.7 Write a note on magnetic memory.

Answer

Magnetic Memory

One of the most widely used types of digital data storage is magnetic memory/storage. This refers to any type of data storage using a magnetized medium.

Common Example

Hard disk is the common example of magnetic memory as shown in Fig 2.3.

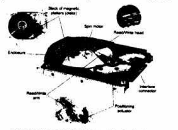

Fig.2.3: Magnetic disk with read/write head

Examples of magnetic memory devices

Magnetic tapes and disks are examples of magnetic memory devices.

Structure of Magnetic memory

A thin layer of magnetic material is coated on the surface of magnetic tape and magnetic disks. Binary information is stored in the form of tiny magnetized and non-magnetized spots on the surface of magnetic tape or disk. A magnetized spot represents a binary 1 and a non-magnetized spot a binary 0.

Working of Magnetic Memory

A read-write head moves very close to the magnetic surface. The head is able to detect and modify the magnetization of the material. Magnetic storage is widely used because it is relatively cheap in comparison with other storage technologies. The storage capacity is also very large, making it attractive for storing very large amounts of data.

Major Limitation of Magnetic Storage

The major limitation of magnetic storage is that accessing the data can be quite slow.

Q.8 Explain optical memory.

Answer

Optical Memory

In optical-storage technology, a laser beam encodes digital data onto an optical disk in the form of tiny pits and lands arranged in concentric tracks on the disk's surface as shown in Fig. 2.4.

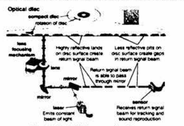
Optical disc
compact disc
rotation of disc
lens focusing mechanism
Highly reflective lands on disc surface create return signal beam
Less reflective pits on disc surface create gaps in return signal beam
lens
Return signal beam is able to pass through mirror
mirror
mirror
laser
Emits constant beam of light
sensor
Receives return signal beam for tracking and sound reproduction

Fig.2.4: Optical Memory technology

Low-Power Laser Scanner

A low-power laser scanner is used to "read" data or information from these pits and lands, and converts it to digital form.

Characteristics of Optical Storage

Optical storage provides cheaper and greater memory capacity than magnetic storage.

Example

An entire set of encyclopaedias, can be stored on a standard 12-centimetre (4.72-inch) optical disk.

Q.9 Describe types of memory based on retention power.

Answer

Types of Memory Based on Retention Power

Memory, on the basis of retention power, can be divided into two types:

- Volatile Memory
- Non-Volatile Memory

1. Volatile memory

Volatile memory is computer memory that requires power (electricity) to maintain the stored information. Volatile memory retains the information as long as power supply is on, but when power supply is off or interrupted the stored memory is lost. It is also known as temporary memory.

Examples

Examples of such memory are RAM (Random access memory), Cache memory and Registers.

2. Non-Volatile memory

Non-volatile memory is a permanent memory that can retain the stored information even when not powered. Non-volatile memory is typically used as secondary storage for long-term or future use.

Examples

Examples of non-volatile memory include ROM (Read-only memory), flash memory, magnetic storage devices (e.g. hard disks and magnetic tape), optical disks, and blue-ray disk.

2.1.4 TYPES OF COMPUTER MEMORY

Q.10 What are the types of computer memory?

Answer

Computer memory can be classified into two main types as shown in Fig. 2.5.

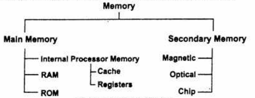

Fig. 2:5 Memory Classification

2.2 MAIN MEMORY

Q.11 Explain main memory of computer.

Answer

Main Memory

Main memory, also called primary or internal memory is the part of the computer system that holds data and instructions for processing. It is mainly used to store data that is used by the system at startup and to run various types of programs such as the operating system and other programs.

Structure of Main Memory

Typically, Main memory is contained on microchips that are either attached or connected to the computer's motherboard.

Range of Memory

Computer memory can range from a couple of megabytes (MBs) to several gigabytes (GBs). When users load software from a storage medium, it is first loaded in the main memory and then executed or processed.

Types of Main Memory

Main memory is divided into the following three types:

- Internal Processor Memory
- RAM
- ROM

2.2.1 Internal Processor Memory

Q.12 Describe internal processor memory and its types.

Answer

Internal Processor Memory

Internal processor memories are directly accessible to the CPU. Cache memory and processor

registers are the examples of such memories. These are extremely fast memories.

Cache Memory

Cache memory is small amount of high-speed semiconductor memory, which exists inside the microprocessor or on the motherboard of the computer. This memory stores some active portion of main memory. It lies between the main memory and the processor. When the processor requires any information, first it will look up in the cache memory, and if it is not available in the cache then it will fetch it from the main memory.

Types of Cache Memories

There are three types of cache memories, Level 1(L1), Level 2(L2) and Level 3(L3) as shown is Fig.2.6.

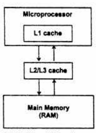

Fig.2.6 L1, L2 and L3 cache memory

L1 cache memory is built inside the microprocessor chip. It has the fastest access time. L2 and L3 cache memories are separate chips on the motherboard. These can be accessed more quickly than the main memory.

Processor Registers

Registers are small memory units. There are a large number of registers inside the processor. Their function is to temporarily store binary information and pass it on to the other parts of the processor or main memory during the execution of program instructions.

Commonly Used Registers

Some commonly used registers inside the microprocessors are:

- Accumulator
- Instruction Register
- Data Register
- Program Counter Register
- Memory Address Register

2.2.2 RAM (Random Access Memory)

Q.13 Define RAM and explain its types.

Answer

RAM

RAM stands for Random Access Memory. When the term RAM is used with semiconductor memories, it is usually taken to mean READ/WRITE memory. It is used in computers for the storage of active programs and data. The contents of RAM change continually as the computer executes a program. RAM plays very important role in the processing speed of the computer. Large RAM size provides larger amount of information to a computer for processing and hence increases the processing speed.

Major Disadvantage of RAM

The major disadvantage of RAM is that it is volatile and will lose all stored information if power is turned off.

Types of RAM

The following are the types of RAM:

- Dynamic RAM (D-RAM)
- Static RAM (S-RAM)

1. Dynamic RAM (D-RAM)

Dynamic RAM (D-RAM) is the most common type of RAM in the computer. Each dynamic RAM chip contains millions of memory cells. A memory cell is an electronic switch, having two states, ON and OFF, representing binary 1 and 0. These memory cells are made up of a transistor and a capacitor. Each memory cell can store one bit of information. A small amount of power is put into the cell to store one bit of information. This energy leaks out quickly. Therefore, computer must recharge all the cells in the memory chip many times per second otherwise the information will be lost. It is used in computers as temporary memory.

2. Static RAM (S-RAM)

Static RAM (S-RAM) works in a different way. Each memory cell of static RAM is like an electronic switch having two states, ON and OFF. ON state represents a binary 1 and OFF state a binary 0. It does not need to be recharged but it requires more transistors than dynamic RAM. It is faster than dynamic RAM and more expensive. Static RAM is used as cache memory in computers.

DO YOU KNOW?
Robert H. Dennard invented first dynamic random-access memory (DRAM) in 1968.

2.2.3 ROM (Read Only Memory)

Q.14 Explain ROM and its types.

Answer

ROM

ROM stands for Read Only Memory.

Programming the ROM

The process of entering data in ROM is called programming the ROM. Some ROMs cannot have their data changed once they have been programmed; others can be erased and reprogrammed as often as required by the manufacturers.

Uses of ROMs

ROMs are used to store programs that are frequently required and are not to change during the operation of the computer.

Non-Volatile ROM

All ROMs are non-volatile because programs stored in them are not lost when the computer is turned off.

Types of ROM

There are three types of ROM, which are as follows:

- PROM
- EPROM
- EEPROM

1. PROM

PROM stands for Programmable Read Only Memory. A PROM is a semiconductor chip that is obtained from the manufacturer in an un-programmed state and the user programs it according to his requirements. It can be programmed only once. PROM is used in electronic machine that require some information to be stored in it permanently.

2. EPROM

EPROM stands for Erasable Programmable Read Only Memory. This type of ROM can have its contents erased by ultraviolet light using special circuitry outside the computer and then reprogrammed. This procedure can be carried out many times. However, the constant erasing and rewriting will eventually make the chip useless. EPROMs are generally used for programs designed for repeated use such as the BIOS but that can be upgraded with a later version of the program.

3. EEPROM

EEPROM stands for Electrically Erasable PROM. EEPROM is also being used for ROM applications. The EEPROM can be altered while being used in a logic board by using special power circuits and write, pulse generators. The EEPROM can work like a read/write semiconductor memory while retaining the non-volatile nature of ROMs and PROMs. This type of ROM works in a similar way to flash memory. It is used to store a computer system's BIOS and can be updated without removing it from the circuit board.

2.3 SECONDARY MEMORY

Q.15 What is secondary memory? Name some types of secondary memory.

Answer

Secondary Memory

Secondary memory is also known as backing storage, auxiliary storage or mass storage. It stores large amount of information permanently.

Types of Secondary Storage

Some types of secondary storage devices are:

- Hard Disk drive
- CD
- DVD
- Blu-Ray Disk
- Flash memory
- Memory cards

2.3.1 SECONDARY STORAGE DEVICES

Q.16 Write a note on secondary storage devices.

Answer

Secondary Storage Devices

Secondary storage devices are used to store information even when the computer is turned off. All the secondary storage devices are non-volatile memory.

2.3.2 SEQUENTIAL ACCESS AND DIRECT ACCESS MEMORY DEVICES

Q.17 Explain the types of memory based on the access mode.

Answer

Memory devices are classified into sequential access memory and direct access memory devices, based on the access mode.

1. Sequential Access Memory

It is a type of memory in which data is accessed sequentially one after the other. A particular stored data is found by sequencing through all locations until the desired data is reached. This produces access times, which are much longer than those of direct access memories.

Examples

Examples of sequential access memory devices include magnetic tapes and audio/video tapes.

2. Direct Access Memory

In this type of memory the data is accessed directly or randomly. Semiconductor memories, disk

memories and optical memories are direct access memories. Direct access memory is also known as random access memory.

Examples

Hard disk, compact disk and flash memory are examples of direct access memory.

2.3.3 TYPES OF SECONDARY STORAGE DEVICES

Q.18 Into how many types, secondary storage devices are classified?

Answer

Types of Secondary Storage Device

Secondary storage devices are classified into the following types:

- Magnetic Tape
- Magnetic Disks
- Optical Disks
- Chip Memory

Q.19 Write a note on magnetic tape.

Answer

Magnetic Tape

Magnetic tape is a plastic strip with a magnetic coated material. Bits are recorded as magnetic spots on the tape along several tracks. Usually 7 or 9 bits are recorded simultaneously to form a character. Read/write heads are mounted one in each track so that data can be recorded and read as a sequence of characters. Magnetic tape is either in the form of cassette or big reels as shown in Fig.2.7.

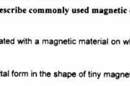

Fig.2.7 Magnetic Tape Cassette and Reel

Magnetic tape is slow in operation as it has sequential access to data but it is a cheap storage device. Magnetic tape drive is used to write data to and read data from a magnetic tape. Tapes are used for storing large amount of data. Modern tapes can store data up to 5 TB. It is used with minicomputers and mainframes for backups and archives.

Q.20 Define magnetic disks and describe commonly used magnetic disks.

Answer

Magnetic Disks

A magnetic disk is a flat disk coated with a magnetic material on which data/information is stored in digital form.

Bits

Data/Information is stored in digital form in the shape of tiny magnetized spots called bits.

Commonly used magnetic disk

Hard disk is the common type of magnetic disk in use today. Some other types of magnetic disks were also used in the past like Floppy disks and Zip disks. These disks are obsolete and not in use nowadays. These disks have been replaced by optical disks and USB flash drives, which are more reliable and have more storage capacity. The only magnetic disk used nowadays is the Hard disk.

i. Hard Disk

Hard disk contains one or many platters (disks) coated with magnetic material on both sides. The platters are attached to a spindle holding them in parallel with equal gap. All the platters rotate together at high speed.

Tracks

Bits are stored on the magnetic surface in spots along concentric circles called tracks. Hard disks contain thousands of tracks.

Sectors

Track is divided into sections called sectors. Each platter has two read/write heads for writing data to and reading data from both surfaces of the platter.

Hard Disk Manufacturing Environment

Hard disks are manufactured in very clean environment. They must be kept dust free. Dust particles can create scratches on the surface of the platters and damage the data stored in it. The storage capacity of modern hard disks is in Tera bytes. A hard disk is shown in Fig.2.8.

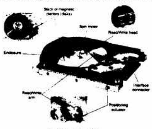

Fig.2.8 Hard Disk

ii. Portable Hard Drive

A portable hard drive is a compact magnetic disk drive that plugs into a USB port on a computer. It is used as portable secondary or backup storage device.

Storage Capacity

Its common storage capacity may range from 500GB to 4TB.

Structure of Portable Hard Drive

Portable hard drive consists of one or more platters, which are air-sealed inside a casing and connected to and powered by USB port of computer.

Use of Portable Hard Drive

Portable hard drive is used for storing data, programs, photos, music, videos and documents.

New models of Portable Hard Drive

New models are using USB 3.0 technology, which provides fast file transfer rate. Some portable hard drives contain built-in wireless functionality to communicate with the computer through Wi-Fi connection. A portable hard drive is shown in Fig.2.9.

Fig. 2.9 Portable Hard Drive

DO YOU KNOW?
In September 1956 IBM launched the 305 RAMAC, the first 'SUPER' computer with a hard disk drive (HDD). The HDD weighed over a ton and stored 5 MB of data.

Q.21 What are optical disks? Explain its types.

Answer

Optical Disks

Optical disk is a plastic-coated disk that can store digital data. Data is stored in optical disk in digital form by laser technology as tiny bumps etched on the surface.

Types of Optical Disks

The following are types of optical disks:

- CDs
- DVDs
- Blu-ray Disk

1. Compact Disks (CDs)

CD is an optical disk used for storing digital data. It was originally developed for storing and playback of sound recording but later on its use expanded to computer data storage.

Structure of CD

A CD is 1.2 millimetres thick with a diameter of 120 millimetres. It is made up of polycarbonate plastic and weighs 15 to 20 grams.

Storage Capacity of CDs

The storage capacity of CDs ranges from 350 MB to 800MB.

Use of CDs

CDs are popular for storing data, application programs, device drivers, Windows operating system, images and videos.

Storing Information in CD

A CD has a single spiral track that spirals from the center to the outside edge. Information is stored on a CD in the form of lands and bumps. A binary 0 is represented by a bump and a 1 by a land.

CD Drive/Player

A CD drive/player is used for reading the data stored on the CD as shown in Fig.2.11.

Fig.2.11 A CD inside *a* CD Player

Job of CD player

The job of CD player is to focus the laser on the track of bumps. The laser beam passes through the polycarbonate layer, reflects off the aluminium layer and hits the censor that detects changes in light. The bump scatters the light and the land reflects it into the censor. The change in reflectivity is transmitted as 0s and 1s into the memory of the computer.

Q.22 Write a note on DVDs.

Answer

Digital Video/Versatile Disks (DVDs)

DVD is very similar to CD but has larger data storage capacity. Its data storage capacity is about seven times more than CD. It has replaced the video tapes that were used in the past for storing movies.

DVD Writer/Player

A DVD writer or player is used to read the data stored on a DVD. DVD players are compatible with CD, which means they can play CDs also.

Structure of DVDs

DVDs have the same diameter and thickness as CDs and are made of the same material and manufacturing methods. Data is also stored just like a CD on a spiral track in the form of lands and bumps.

Storage Capacity of DVDs

The storage capacity of DVDs ranges from 2GB to 16 GB. The MPEG (Moving Picture Experts Group) format is used for storing movies in a compressed form on the DVDs.

Q.23 What is blu-ray disk? State its advantages.

Answer

Blu-ray Disk (BD)

Blu-ray is a new type of optical storage device. Its main advantage over CD and DVD is that it has storage capacity up to 300GB and it is also faster. The bumps on the surface of Blu-ray that represent digital information are much smaller and very densely packed compared to DVD. This increased the storage capacity of Blu-ray.

Advantages of Blu-ray Disk

Blu-ray disks are better storage devices for storing movies because they require a lot more storage. Another advantage of Blu-ray disk is their durability. They have a special coating that helps prevent scratches and marks.

A Blu-ray disk is shown in Fig.2.12.

Blu-ray Disc

Fig.2.12 Blu-ray Disk

Q.24 Define flash memory. Describe its forms and advantages.

Answer

Flash Memory/Chip Memory

Flash memory or Chip memory is a type of EEPROM. It is solid-state storage device, which means that there are no moving parts in it. Everything inside the flash or chip memory is in electronic form. It got its name "Flash" from the fact that it can store chunks of data and also erase large chunks of data in a flash because it is a semiconductor IC chip memory.

Forms of Flash Memory

Flash memory comes in two forms:

- Flash Drive
- Flash Memory Cards

1. Flash Drive

Flash drives are also called USB flash drives. They are small and portable drives that are connected to computers through USB ports. The storage capacity of flash memory ranges from 2GB to 256GB. Flash drives are shown in Fig.2.13.

Fig-2.13: Flash Drive (USB Drive)

2. Flash Memory Cards

Memory cards are used with laptop computers and other electronic devices such as digital cameras, mobile phones and video games. They come in various sizes and with different storage capacity. Flash memory cards are shown in Fig.2.14.

SanDisk
2GB
micro SD

Fig.2.14 Flash Memory Cards

Advantages of using Flash/Chip memory

1. It allows fast read/write operations.
2. It is non-volatile semiconductor memory.
3. It is very light and very small in size.
4. It is very reliable.
5. Its operation is noiseless since it has no moving part.

KEY POINTS

- Computer memory is a storage device that holds instructions, data and the results produced after processing by the computer.
- Main memory is high-speed IC chip memory that stores programs and data that the computer is currently executing.
- Cache memory is small amount of high-speed semiconductor memory, which exists inside the microprocessor and it is faster than main memory.
- Registers are small memory units inside the processor, used to temporarily store binary information and pass it on to the other parts of the processor or main memory during execution of instructions.
- ROM is Read Only-Memory used to store small programs that are frequently required and are not to change during the operation of the computer.
- Secondary memory, also known as backing storage, has huge storage capacity and stores information permanently.
- Optical disk is a plastic-coated disk that can store data in digital form using laser technology as tiny bumps etched on the surface.
- Flash memory is a type of EEPROM. It is solid-state storage device having no moving parts and it is used as hard disk.

EXERCISE

Q.1 Select the best answer for the following MCQs.

i. Which of the following is the fastest memory?
A. RAM B. ROM C. Cache memory D. USB flash drive

ii. How much is 1 MB memory equal to?
A. 1024 Bytes B. 1024TB C. 1024KB D. 1024GB

iii. Which of the following is volatile memory?
A. RAM B. ROM C. PROM D. EEPROM

iv. Which of the following has highest storage capacity?
A. DVD B. Blu-ray Disk C. CD D. Floppy Disk

v. USB flash drive is what type of memory?
A. Magnetic memory B. Optical memory
C. Electronic memory D. Primary memory

vi. Which of the following memory devices has the smallest storage capacity?
A. RAM B. Cache memory
C. CD D. Memory card

vii. Which of the following storage device is obsolete now days?
A. Hard disk B. CD C. Memory card D. Floppy disk

viii. Which memory communicates directly with the CPU?
A. Main memory B. Secondary memory
C. Hard disk D. USB flash drive

ix. Which of the following memory devices has sequential access to data?
A. Magnetic disk B. Optical memory
C. Magnetic tape D. Chip memory

x. Where are the registers located?
A. Inside hard disk B. Inside DVD
C. Inside RAM D. Inside Microprocessor

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A. 1024 Bytes B. 1024TB C. 1024KB D. 1024GB

iii. Which of the following is volatile memory?
A. RAM B. ROM C. PROM D. EEPROM

iv. Which of the following has highest storage capacity?
A. DVD B. Blu-ray Disk C. CD D. Floppy Disk

v. USB flash drive is what type of memory?
A. Magnetic memory B. Optical memory
C. Electronic memory D. Primary memory

vi. Which of the following memory devices has the smallest storage capacity?
A. RAM B. Cache memory
C. CD D. Memory card

vii. Which of the following storage device is obsolete now days?
A. Hard disk B. CD C. Memory card D. Floppy disk

viii. Which memory communicates directly with the CPU?
A. Main memory B. Secondary memory
C. Hard disk D. USB flash drive

ix. Which of the following memory devices has sequential access to data?
A. Magnetic disk B. Optical memory
C. Magnetic tape D. Chip memory

x. Where are the registers located?
A. Inside hard disk B. Inside DVD
C. Inside RAM D. Inside Microprocessor

Answers

i.	C	ii.	C	iii.	A	iv.	B	v.	C
vi.	B	vii.	D	viii.	A	ix.	C	x.	D

Q2. Write short answers of the following questions.

i. State three differences between primary and secondary memory.

Answer

Differences between primary and secondary memory:

Primary Memory	Secondary Memory
1. In primary memory, the processing unit directly accesses data.	1. In secondary memory, data is first transferred to main memory and then routed to processing unit.
2. Information stored is temporary and it can be lost when there is a sudden power cut.	2. Information stored is permanent unless one deletes it intentionally.
3. Primary memory has limited storage capacity.	3. Secondary memory can store bulk amounts of data in a single unit.

ii. Differentiate between sequential access and direct access memory.

Answer

Differences between sequential access and direct access memory:

Sequential Access Memory	Direct Access Memory
1. It is a type of memory in which data is accessed sequentially one after the other. A particular stored data is found by sequencing through all locations until the desired data is reached.	1. In this type of memory, the data is accessed directly or randomly. Semiconductor memories, disk memories and optical memories are direct access memories. Direct access memory is also known as random access memory.
2. Examples of sequential access memory devices include magnetic tapes and audio/video tapes.	2. Hard disk, compact disk and flash memory are examples of direct access memory.

iii. Why data access time in sequential access devices is more than the random access devices?

Answer

Data access time in sequential access devices is more than the random access devices because in sequential access devices, memory can be accessed only in serial order i.e. if we have to access 4th memory location then first we would have to move to first three locations and skip them and only then we can access the 4th location. Whereas, in Random access devices, memory location can be accessed at random i.e. if we have to access 4th location then we can directly go to 4th location and access it.

iv. If cache memory is removed from a computer, what will happen to it?

Answer

If cache memory is removed from a computer, the computer hardware does not store copies of information currently used by programs (data and instructions), loaded from the main memory.

v. Define memory word.

Answer

Memory Word

In computing, the smallest chunk or size of data that a computer can process is called memory word. It is a fixed-sized piece of data handled as a unit by the processor.

vi. Differentiate between RAM and ROM.

Answer

Differences between RAM and ROM:

RAM	ROM
1. The data is not permanently stored in it but it can be altered any number of times.	1. The data is permanently stored in it. It can be altered but only a limited number of times that too at slow speed.
2. It is a high-speed memory.	2. It is much slower than the RAM.
3. The CPU can access the data stored on it.	3. The CPU cannot access the data stored on it.
4. It has large size with higher capacity.	4. It has small size with less capacity.

vii. What is the purpose of secondary memory?

Answer

Purpose of Secondary Storage

The purpose of secondary storage is the long-term retention of data in a computer system. Secondary storage is non-volatile and not cleared when the computer is powered off and back on.

viii. Give few advantages of using flash memory?

Answer

Advantages of using Flash Memory

1. It allows fast read/write operations.
2. It is non-volatile semiconductor memory.
3. It is very light and very small in size.
4. It is very reliable.
5. Its operation is noiseless since it has no moving part.

ix. How the size of RAM affects the processing speed of a computer system?

Answer

With more RAM, more of the program instructions can be loaded and there is less need to keep swapping data in and out to the swap file on the hard disk drive.

The constant swapping of data slows down the speed at which applications can run, so Increasing RAM will increase the speed of operation of the computer.

An increase in RAM will improve the multitasking capabilities of the computer as the instructions of several programs will be able to be stored in RAM at the same time.

Q3. Write long answers of the following questions.

i. What is internal processor memory? Explain different types of internal processor memories used in computers.

Answer

Internal Processor Memory

Internal processor memories are directly accessible to the CPU. These are extremely fast memories.

Types of Internal Processor Memory

Types of internal processor memory are as follows:

- Cache Memory
- Processor Registers

1. Cache Memory

Cache memory is small amount of high-speed semiconductor memory, which exists inside the microprocessor or on the motherboard of the computer. This memory stores some active portion of main memory. It lies between the main memory and the processor. When the processor requires any information, first it will look up in the cache memory, and if it is not available in the cache then it will fetch it from the main memory.

Types of Cache Memories

There are three types of cache memories, Level 1(L1), Level 2(L2) and Level 3(L3) as shown is Fig.2.6.

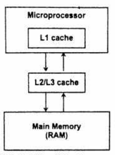

Fig.2.6 L1, L2 and L3 cache memory

L1 cache memory is built inside the microprocessor chip. It has the fastest access time. L2 and L3 cache memories are separate chips on the motherboard. These can be accessed more quickly than the main memory.

2. Processor Registers

Registers are small memory units. There are a large number of registers inside the processor. There function is to temporarily store binary information and pass it on to the other parts of the processor or main memory during the execution of program instructions.

Commonly Used Registers

Some commonly used registers inside the microprocessors are:

- Accumulator
- Instruction Register
- Data Register
- Program Counter Register
- Memory Address Register

ii. Explain magnetic tape and hard disk.

Answer

Magnetic Tape

Magnetic tape is a plastic strip with a magnetic coated material. Bits are recorded as magnetic spots on the tape along several tracks. Usually 7 or 9 bits are recorded simultaneously to form a character. Read/write heads are mounted one in each track so that data can be recorded and read as a sequence of characters. Magnetic tape is either in the form of cassette or big reels as shown in Fig.2.7.

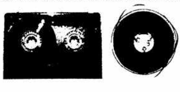

Fig.2.7 Magnetic Tape Cassette and Reel

Magnetic tape is slow in operation as it has sequential access to data but it is a cheap storage device. Magnetic tape drive is used to write data to and read data from a magnetic tape. Tapes are

used for storing large amount of data. Modern tapes can store data up to 5 TB. It is used with minicomputers and mainframes for backups and archives.

Hard Disk

Hard disk contains one or many platters (disks) coated with magnetic material on both sides. The platters are attached to a spindle holding them in parallel with equal gap. All the platters rotate together at high speed. Bits are stored on the magnetic surface in spots along concentric circles called tracks. Hard disks contain thousands of tracks. Track is divided into sections called sectors. Each platter has two read/write heads for writing data to and reading data from both surfaces of the platter. Hard disks are manufactured in very clean environment. They must be kept dust free. Dust particles can create scratches on the surface of the platters and damage the data stored in it. The storage capacity of modern hard disks is in Tera bytes. A hard disk is shown in Fig.2.8.

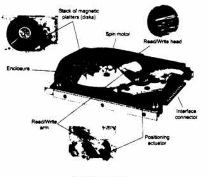

Fig.2.8 Hard Disk

iii. What is optical disk? Describe its types.

Answer

Optical Disk

Optical disk is a plastic-coated disk that can store digital data. Data is stored in optical disk in digital form by laser technology as tiny bumps etched on the surface.

Types of Optical Disks

The following are types of optical disks:

- CDs
- DVDs
- Blu-ray Disk

1. Compact Disks (CDs)

CD is an optical disk used for storing digital data. It was originally developed for storing and playback of sound recording but later on its use expanded to computer data storage.

Fig.2.11 A CD inside *a* CD Player

Structure of CD

A CD is 1.2 millimetres thick with a diameter of 120 millimetres. It is made up of polycarbonate plastic and weighs 15 to 20 grams.

Storage Capacity of CDs

The storage capacity of CDs ranges from 350 MB to 800MB.

Use of CDs

CDs are popular for storing data, application programs, device drivers, Windows operating system, images and videos.

Storing Information in CD

A CD has a single spiral track that spirals from the center to the outside edge. Information is stored on a CD in the form of lands and bumps. A binary 0 is represented by a bump and a 1 by a land.

CD Drive/Player

A CD drive/player is used for reading the data stored on the CD as shown in Fig.2.11.

Job of CD player

The job of CD player is to focus the laser on the track of bumps. The laser beam passes through the polycarbonate layer, reflects off the aluminium layer and hits the censor that detects changes in light. The bump scatters the light and the land reflects it into the censor. The change in reflectivity is transmitted as 0s and 1s into the memory of the computer.

2. Digital Video/Versatile Disks (DVDs)

DVD is very similar to CD but has larger data storage capacity. Its data storage capacity is about seven times more than CD. It has replaced the video tapes that were used in the past for storing movies.

DVD Writer/Player

A DVD writer or player is used to read the data stored on a DVD. DVD players are compatible with CD, which means they can play CDs also.

Structure of DVDs

DVDs have the same diameter and thickness as CDs and are made of the same material and manufacturing methods. Data is also stored just like a CD on a spiral track in the form of lands and bumps.

Storage Capacity of DVDs

The storage capacity of DVDs ranges from 2GB to 16 GB. The MPEG (Moving Picture Experts Group) format is used for storing movies in a compressed form on the DVDs.

3. Blu-ray Disk (BD)

Blu-ray is a new type of optical storage device. Its main advantage over CD and DVD is that it has storage capacity up to 300GB and it is also faster. The bumps on the surface of Blu-ray that represent digital information are much smaller and very densely packed compared to DVD. This increased the storage capacity of Blu-ray.

Advantages of Blu-ray Disk

Blu-ray disks are better storage devices for storing movies because they require a lot more storage. Another advantage of Blu-ray disk is their durability. They have a special coating that helps prevent scratches and marks.

A Blu-ray disk is shown in Fig.2.12.

Blu-ray Disc

Fig.2.12 Blu-ray Disk

iv. What is Flash or Chip memory? Explain its types.

Answer

Flash memory or Chip memory

Flash memory or Chip memory is a type of EEPROM. It is solid-state storage device, which means that there are no moving parts in it. Everything inside the flash or chip memory is in electronic form. It got its name "Flash" from the fact that it can store chunks of data and also erase large chunks of data in a flash because it is a semiconductor IC chip memory.

Types of Flash Memory

Flash memory comes in two types:

- Flash Drive
- Flash Memory Cards

1. Flash Drive

Flash drives are also called USB flash drives. They are small and portable drives that are connected to computers through USB ports. The storage capacity of flash memory ranges from 2GB to 256GB. Flash drives are shown in Fig.2.13.

Fig-2.13: Flash Drive (USB Drive)

2. Flash Memory Cards

Memory cards are used with laptop computers and other electronic devices such as digital cameras, mobile phones and video games. They come in various sizes and with different storage capacity. Flash memory cards are shown in Fig.2.14.

SanDisk
2GB
micro SD

Fig.2.14 Flash Memory Cards

LAB ACTIVITIES

Following lab activities are to be carried out during the practical periods.

1) **Different types of IC chips (like RAM chip) should be shown to the students. Students should know where these are fixed on the motherboard and their functions should also be explained.**

Answer

Practical Work

2) **Magnetic tape in cassette or reel form should be shown to the students and they should know how information is stored on it.**

Answer

Practical Work

3) **Internal and external hard disk should be shown and their operations should be explained.**

Answer

Practical Work

4) **Students should practically use different types of optical disks in the computer.**

Answer

Practical Work

5) **Working of USB flash drive and various types of memory cards is to be demonstrated to the students.**

Answer

Practical Work

Q.1 Select the correct choice from the following questions.

1. **In Sequential access mode, memory can be accessed only in:**
   A. Serial order B. Random order C. Ascending order D. Descending order
2. **In Random access mode memory location can be accessed at:**
   A. Serial order B. Random order C. Ascending order D. Descending order
3. **The smallest unit of memory in digital computer is:**
   A. Bit B. Byte C. Megabyte D. Kilobyte
4. **A group of ______ bits is known as one byte.**
   A. 6 B. 8 C. 10 D. 12
5. **1 Kilobyte (KB) is equal to:**
   A. 2^{10} Bytes B. 2^{20} Bytes C. 2^{30} Bytes D. 2^{40} Bytes
6. **1 Megabyte (MB) is equal to:**
   A. 2^{10} Bytes B. 2^{20} Bytes C. 2^{30} Bytes D. 2^{40} Bytes
7. **1 Gigabyte (GB) is equal to:**
   A. 2^{10} Bytes B. 2^{20} Bytes C. 2^{30} Bytes D. 2^{40} Bytes
8. **1 Terabyte (TB) is equal to:**
   A. 2^{10} Bytes B. 2^{20} Bytes C. 2^{30} Bytes D. 2^{40} Bytes
9. **1 Petabyte (PB) is equal to:**
   A. 2^{50} Bytes B. 2^{60} Bytes C. 2^{30} Bytes D. 2^{40} Bytes
10. **1 Exabyte is equal to:**
    A. 2^{50} Bytes B. 2^{60} Bytes C. 2^{30} Bytes D. 2^{40} Bytes
11. **Word size in modern computers typically ranges from:**
    A. 16 to 64 bits B. 20 to 64 bits C. 16 to 74 bits D. 26 to 74 bits
12. **A 32-bit processor is limited to _____ memory addresses.**
    A. 2^{16} B. 2^{32} C. 2^{8} D. 2^{30}
13. **RAM stands for:**
    A. Read Access Memory B. Random Access Memory
    C. Random Arithmetic Memory D. Random Align Memory
14. **ROM stands for:**
    A. Read Access Memory B. Random Only Memory
    C. Read Only Memory D. Read Output Memory
15. **It is a permanent storage area:**
    A. RAM B. ROM C. CPU D. ALU
16. **It is volatile and will lose all stored information if power is turned off:**
    A. RAM B. ROM C. EPROM D. EROM
17. **These are non-volatile because programs stored in them are not lost when the computer is turned off.**
    A. RAMs B. ROMs C. EPROMs D. EROMs
18. **Types of ROM are:**
    A. 2 B. 3 C. 4 D. 5
19. **PROM stands for:**
    A. Partial ROM B. Permanent ROM
    C. Programmable ROM D. Peripheral ROM
20. **EPROM stands for:**
    A. Enhanced PROM B. Electric PROM
    C. Enterprise PROM D. Erasable PROM
21. **This type of ROM works in a similar way to flash memory:**
    A. EROM B. PROM C. EEPROM D. EPROM
22. **Hard disk drive is a kind of:**
    A. Primary memory B. Secondary memory C. Cache memory D. Internal memory

23. **Compact disk drive is a kind of:**
    A. Primary memory B. Secondary memory C. Cache memory D. Internal memory
24. **DVD is a kind of:**
    A. Primary memory B. Secondary memory C. Cache memory D. Internal memory
25. **Blu-ray disk is a kind of:**
    A. Primary memory B. Secondary memory C. Cache memory D. Internal memory
26. **Flash memory is a kind of:**
    A. Primary memory B. Secondary memory C. Cache memory D. Internal memory
27. **Memory card is a kind of:**
    A. Primary memory B. Secondary memory C. Cache memory D. Internal memory
28. **The storage capacity of CDs ranges from:**
    A. 250 MB to 600 MB B. 350 MB to 800 MB
    C. 450 MB to 999 MB D. 35 MB to 80 MB
29. **The storage capacity of DVDs ranges from:**
    A. 2 GB to 16 GB B. 3 GB to 20 GB
    C. 20 GB to 160 GB D. 45 GB to 80 GB
30. **Blu-ray disk has storage capacity up to:**
    A. 900 GB B. 3000 GB C. 1300 GB D. 300 GB
31. **Flash memory comes in ______ forms:**
    A. Two B. Three C. Four D. Five
32. **The storage capacity of flash memory ranges from:**
    A. 8 GB to 56 GB B. 2 GB to 256 GB
    C. 100 GB to 256 GB D. 5 GB to 100 GB

Answers:

1.	Serial order	**2.**	Random order
3.	Bit	**4.**	8
5.	2^{10} Bytes	**6.**	2^{20} Bytes
7.	2^{30} Bytes	**8.**	2^{40} Bytes
9.	2^{50} Bytes	**10.**	2^{60} Bytes
11.	16 to 64 bits	**12.**	2^{32}
13.	Random Access Memory	**14.**	Random Only Memory
15.	ROM	**16.**	RAM
17.	RAMs	**18.**	3
19.	Programmable ROM	**20.**	Erasable PROM
21.	EEPROM	**22.**	Secondary memory
23.	Secondary memory	**24.**	Secondary memory
25.	Secondary memory	**26.**	Secondary memory
27.	Secondary memory	**28.**	350 MB to 800 MB
29.	2 GB to 16 GB	**30.**	300 GB
31.	Two	**32.**	2 GB to 256 GB

Q.2 Give short answers of the following questions.

Q1: Define secondary memory.

Ans. Devices that provide backup storage are called secondary memory or mass storage devices. All the information is stored in secondary memory and it is transferred to main memory on a demand basis.

Q2: What are the important characteristics of a memory device.

Ans. The important characteristics of any memory device are its:

- ⇨ Access Mode
- ⇨ Access Time
- ⇨ Transfer Rate
- ⇨ Capacity
- ⇨ Cost

23. **Compact disk drive is a kind of:**
A. Primary memory B. Secondary memory C. Cache memory D. Internal memory
24. **DVD is a kind of:**
A. Primary memory B. Secondary memory C. Cache memory D. Internal memory
25. **Blu-ray disk is a kind of:**
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30. **Blu-ray disk has storage capacity up to:**
A. 900 GB B. 3000 GB C. 1300 GB D. 300 GB
31. **Flash memory comes in ______ forms:**
A. Two B. Three C. Four D. Five
32. **The storage capacity of flash memory ranges from:**
A. 8 GB to 56 GB B. 2 GB to 256 GB
C. 100 GB to 256 GB D. 5 GB to 100 GB

Answers:

1.	Serial order	2.	Random order
3.	Bit	4.	8
5.	2^{10} Bytes	6.	2^{20} Bytes
7.	2^{30} Bytes	8.	2^{40} Bytes
9.	2^{50} Bytes	10.	2^{60} Bytes
11.	16 to 64 bits	12.	2^{32}
13.	Random Access Memory	14.	Random Only Memory
15.	ROM	16.	RAM
17.	RAMs	18.	3
19.	Programmable ROM	20.	Erasable PROM
21.	EEPROM	22.	Secondary memory
23.	Secondary memory	24.	Secondary memory
25.	Secondary memory	26.	Secondary memory
27.	Secondary memory	28.	350 MB to 800 MB
29.	2 GB to 16 GB	30.	300 GB
31.	Two	32.	2 GB to 256 GB

Q.2 Give short answers of the following questions.

Q1: Define secondary memory.
Ans. Devices that provide backup storage are called secondary memory or mass storage devices. All the information is stored in secondary memory and it is transferred to main memory on a demand basis.

Q2: What are the important characteristics of a memory device.
Ans. The important characteristics of any memory device are its:
- ⇨ Access Mode
- ⇨ Access Time
- ⇨ Transfer Rate
- ⇨ Capacity
- ⇨ Cost

Q3: What are the major access modes of memory?
Ans. Memory has two major access modes:
i) Sequential Access Mode ii) Random Access Mode

Q4: Define sequential access mode.
Ans. In Sequential access mode, memory can be accessed only in serial order.

Q5: Define random access mode.
Ans. In Random access mode, memory location can be accessed at random.

Q6: Define access time of a memory.
Ans. Access time is the time taken to retrieve data from memory. Access time in sequential access memory devices is more than the random access memory devices.

Q7: Define data transfer rate and give an example.
Ans. Data transfer rate is the time taken to transfer data from one memory device to the other. For example time taken to transfer data for Hard disk to the main memory (RAM).

Q8: Briefly explain bit.
Ans. The smallest unit of memory in digital computer is a bit, which stands for binary digit 0 or 1. The memory of a computer consists of millions of memory (or electronic) cells. Each cell contains one bit of information. The memory cell has two states, ON and OFF. The ON state represents a binary 1 and OFF state binary 0.

Q9: In which terms, computer memory is measured?
Ans. Computer memory is measured in terms of bytes. The higher units are Kilobyte (KB), Megabyte (MB), Gigabyte (GB) and Terabyte (TB). In future, memories will also be available in Petabyte (PB) and Exabyte (EB).

Q10: Define word size and its range.
Ans. The number of bits in a word is called the word size. Word size in modern computers typically ranges from 16 to 64 bits, depending on the size of the computer.

Q11: What is the main indication of the word size?
Ans. The main indication of the word size is how much memory the processor can address. A 32-bit processor is limited to 2^{32} memory addresses. This is a group of bits (cells) in a memory that represents information or data of some type.

Q12: What are the types of computer memories?
Ans. All types of computer memories, as far as their built-up or manufacturing is concerned, are divided into Chip memory, Magnetic memory and Optical memory. And as far as their retention power is concerned these memories are divided into Volatile memory and Non-Volatile memory.

Q13: What is a chip?
Ans. Chip is a small piece of semi-conducting material (usually silicon). A small circuit called IC (Integrated Circuit) is embedded on it. A typical chip contains millions of electronic components (transistors).

Q14: Give some examples of chip memory.
Ans. Examples of chip memory are main memory (RAM, ROM and Cache), flash memory drives, memory cards and registers.

Q15: State the structure of magnetic memory.
Ans. A thin layer of magnetic material is coated on the surface of magnetic tape and magnetic disks. Binary information is stored in the form of tiny magnetized and non-magnetized spots on the surface of magnetic tape or disk. A magnetized spot represents a binary 1 and a non-magnetized spot a binary 0.

Q16: How does magnetic memory work?
Ans. A read-write head moves very close to the magnetic surface. The head is able to detect and modify the magnetization of the material. Magnetic storage is widely used because it is relatively cheap in comparison with other storage technologies. The storage capacity is also very large, making it attractive for storing very large amounts of data.

Q17: What is the major limitation of magnetic storage?
Ans. The major limitation of magnetic storage is that accessing the data can be quite slow.

Q18: What are the characteristics of optical storage devices?
Ans. Optical storage provides cheaper and greater memory capacity than magnetic storage. An entire set of encyclopaedias, for example, can be stored on a standard 12-centimetre (4.72-inch) optical disk.

Q19: Name the types of memory based on retention power.
Ans. Memory, on the basis of retention power, can be divided into two types:
i) Volatile Memory ii) Non-Volatile Memory

Q20: What is main memory?
Ans. Main memory, also called primary or internal memory is the part of the computer system that holds data and instructions for processing. It is mainly used to store data that is used by the system at startup and to run various types of programs such as the operating system and other programs.

Q21: What is the range of computer memory?
Ans. Computer memory can range from a couple of megabytes (MBs) to several gigabytes (GBs).

Q22: What are the types of main memory?
Ans. Main memory is divided into the following three types.
- ⇨ Internal Processor Memory
- ⇨ RAM
- ⇨ ROM

Q23: What are internal processor memories?
Ans. Internal Processor memories are directly accessible to the CPU. Cache memory and processor registers are the examples of such memories. These are extremely fast memories.

Q24: Define cache memory.
Ans. Cache memory is small amount of high-speed semiconductor memory, which exists inside the microprocessor or on the motherboard of the computer.

Q25: What are registers?
Ans. Registers are small memory units. There are a large number of registers inside the processor. Their function is to temporarily store binary information and pass it on to the other parts of the processor or main memory during the execution of program instructions.

Q26: Name some commonly used registers.
Ans. Some commonly used registers inside the microprocessors are:
- ⇨ Accumulator
- ⇨ Instruction Register
- ⇨ Data Register
- ⇨ Program Counter Register
- ⇨ Memory Address Register

Q27: Write a short note on RAM.
Ans. RAM stands for Random Access Memory. When the term RAM is used with semiconductor memories, it is usually taken to mean READ/WRITE memory. It is used in computers for the storage of active programs and data. The contents of RAM change continually as the computer executes a program. RAM plays very important role in the processing speed of the computer. Large RAM size provides larger amount of information to a computer for processing and hence increases the processing speed.

Q28: What is the major disadvantage of RAM?
Ans. The major disadvantage of RAM is that it is volatile and will lose all stored information if power is turned off.

Q29: What are the types of RAM?
Ans. The following are the types of RAM:
i) Dynamic RAM (D-RAM) ii) Static RAM (S-RAM)

Q30: What is meant by programming the ROM?
Ans. The process of entering data in ROM is called programming the ROM. Some ROMs cannot have their data changed once they have been programmed; others can be erased and reprogrammed as often as required by the manufacturers.

Q31: State the uses of ROMs.
Ans. ROMs are used to store programs that are frequently required and are not to change during the operation of the computer.

Q32: What are the types of ROM?
Ans. There are three types of ROM, which are as follows:
- ⇨ PROM
- ⇨ EPROM
- ⇨ EEPROM

Q33: Name some examples of secondary storage devices.
Ans. Some examples of secondary storage devices are:
- ⇨ Hard Disk drive
- ⇨ CD
- ⇨ DVD
- ⇨ Blu- Ray Disk
- ⇨ Flash memory
- ⇨ Memory cards

Q34: State the use of secondary storage devices.
Ans. Secondary storage devices are used to store information even when the computer is turned off. All the secondary storage devices are non-volatile memory.

Q35: Describe the structure of magnetic tape.
Ans. Magnetic tape is a plastic strip with a magnetic coated material. Bits are recorded as magnetic spots on the tape along several tracks. Usually 7 or 9 bits are recorded simultaneously to form a character. Read/write heads are mounted one in each track so that data can be recorded and read as a sequence of characters.

Q36: What is a magnetic disk?
Ans. A magnetic disk is a flat disk coated with a magnetic material on which data/information is stored in digital form.

Q37: Define bits.
Ans. Data/Information is stored in digital form in the shape of tiny magnetized spots called bits.

Q38: Write down the structure of hard disk.
Ans. Hard disk contains one or many platters (disks) coated with magnetic material on both sides. The platters are attached to a spindle holding them in parallel with equal gap. All the platters rotate together at high speed.

Q39: Define tracks.
Ans. Bits are stored on the magnetic surface in spots along concentric circles called tracks.

Q40: Define sectors.
Ans. Track is divided into sections called sectors. Each platter has two read/write heads for writing data to and reading data from both surfaces of the platter.

Q41: Describe the environment where hard disks are manufactured.
Ans. Hard disks are manufactured in very clean environment. They must be kept dust free. Dust particles can create scratches on the surface of the platters and damage the data stored in it.

Q42: What is a portable hard drive?
Ans. A portable hard drive is a compact magnetic disk drive that plugs into a USB port on a computer. It is used as portable secondary or backup storage device.

Q43: What is the structure of portable hard drive?
Ans. Portable hard drive consists of one or more platters, which are air-sealed inside a casing and connected to and powered by USB port of computer.

Q44: Describe the use of portable hard drive.
Ans. Portable hard drive is used for storing data, programs, photos, music, videos and documents.

Q45: Write a short note on optical disk.
Ans. Optical disk is a plastic-coated disk that can store digital data. Data is stored in optical disk in digital form by laser technology as tiny bumps etched on the surface.

Q46: What are the types of optical disks?
Ans. The following are types of optical disks:
- ⇨ CDs
- ⇨ DVDs
- ⇨ Blu-ray Disk

Q47: What is a CD?
Ans. CD is an optical disk used for storing digital data. It was originally developed for storing and playback of sound recording but later on its use expanded to computer data storage.

Q48: Describe the structure of a CD.
Ans. A CD is 1.2 millimeters thick with a diameter of 120 millimeters. It is made up of polycarbonate plastic and weighs 15 to 20 grams.

Q49: What are the uses of CDs?
Ans. CDs are popular for storing data, application programs, device drivers, Windows operating system, images and videos.

Q50: What is the job of CD player?
Ans. The job of CD player is to focus the laser on the track of bumps. The laser beam passes through the polycarbonate layer, reflects off the aluminium layer and hits the censor that detects changes in light. The bump scatters the light and the land reflects it into the censor. The change in reflectivity is transmitted as 0s and 1s into the memory of the computer.

Q51: Describe the structure of DVDs.
Ans. DVDs have the same diameter and thickness as CDs and are made of the same material and manufacturing methods. Data is also stored just like a CD on a spiral track in the form of lands and bumps.

Q52: What is the storage capacity of DVDs?
Ans. The storage capacity of DVDs ranges from 2 GB to 16 GB. The MPEG (Moving Picture Experts Group) format is used for storing movies in a compressed form on the DVDs.

Q53: What are the advantages of Blu-ray disk?
Ans. Blu-ray disks are better storage devices for storing movies because they have a lot more storage. Another advantage of Blu-ray disk is their durability. They have a special coating that helps prevent scratches and marks.

Q54: In which forms, does flash memory come?
Ans. Flash memory comes in two forms:
- ⇨ Flash Drive
- ⇨ Flash Memory Cards

Q55: State any three advantages of using Flash/Chip memory.
Ans.
1. It allows fast read/write operations.
2. It is non-volatile semiconductor memory.
3. It is very light and very small in size.

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