1. Explain Classification of Memory

Ans.

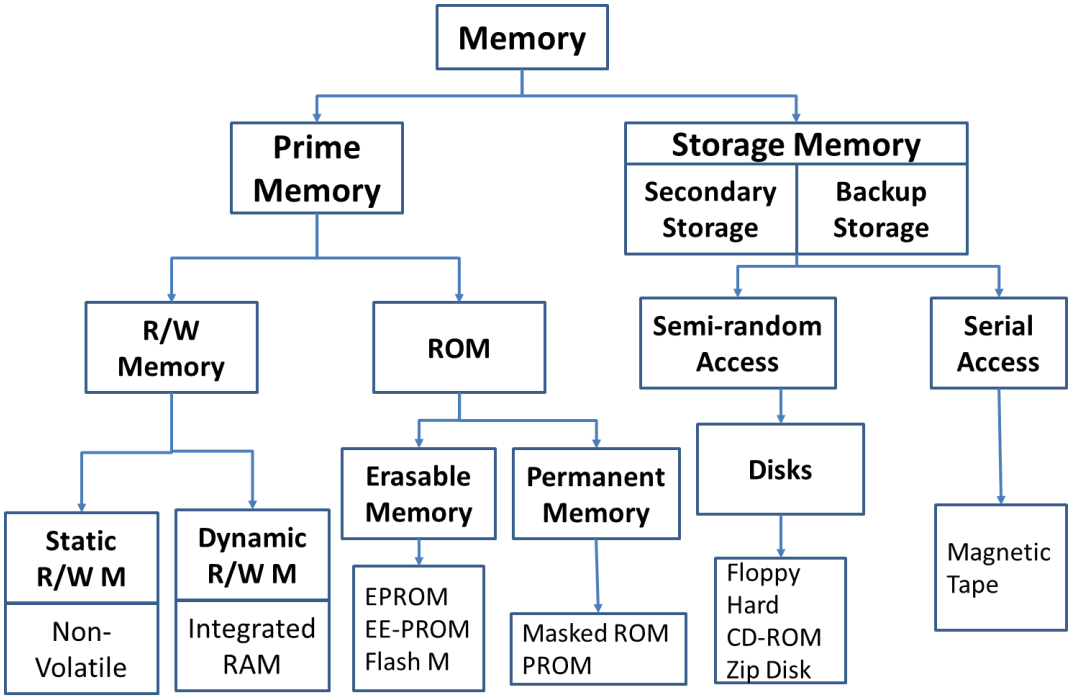

Figure: Classification of Memory

ROM (Read Only Memory):

The first classification of memory is ROM. The data in this memory can only be read, no writing is allowed. It is used to store permanent programs. It is a nonvolatile type of memory.

The classification of ROM memory is as follows:

1. **Masked ROM**: the program or data are permanently installed at the time of manufacturing as per requirement. The data cannot be altered. The process of permanent recording is expensive but economic for large quantities.

2. **PROM (Programmable Read Only Memory):** The basic function is same as that of masked ROM. but in PROM, we have fuse links. Depending upon the bit pattern, the fuse can be burnt or kept intact. This job is performed by PROM programmer.
   To do this, it uses high current pulse between two lines. Because of high current, the fuse will get burnt; effectively making two lines open. Once a PROM is programmed we cannot change connections, only a facility provided over masked ROM is, the user can load his program in it. The disadvantage is a chance of re-growing of the fuse and changes the programmed data because of aging.

3. **EPROM (Erasable Programmable Read Only Memory):** the EPROM is programmable by the user. It uses MOS circuitry to store data. They store 1's and 0's in form of charge. The information stored can be erased by exposing the memory to ultraviolet light which erases the data stored in all memory locations. For ultraviolet light, a quartz window is provided which is covered during normal operation. Upon erasing it can be reprogrammed by using EPROM programmer. This type of memory is used in a project developed and for experiment use. The advantage is it can be programmed erased and reprogrammed. The disadvantage is all the data get erased even if you want to change single data bit.

4. **EEPROM:** EEPROM stands for electrically erasable programmable read only memory. This is similar to EPROM except that the erasing is done by electrical signals instead of ultraviolet light. The main advantage is the memory location can be selectively erased and reprogrammed. But the manufacturing process is complex and expensive so do not commonly used.

R/W Memory (Read/Write Memory):

The RAM is also called as read/write memory. The RAM is a volatile type of memory. It allows the programmer to read or write data. If the user wants to check the execution of any program, user feeds the program in RAM memory and executes it. The result of execution is then checked by either reading memory location contents or by register contents.

Following is the classification of RAM memory.
It is available in two types:

1. **SRAM (Static RAM):** SRAM consists of the flip-flop; using either transistor or MOS. for each bit we require one flip-flop. Bit status will remain as it is; unless and until you perform next write operation or power supply is switched off.

   Advantages of SRAM:
   - Fast memory (less access time)
   - Refreshing circuit is not required.

   Disadvantages of SRAM:
   - Low package density
   - Costly

2. **DRAM (Dynamic RAM):** In this type of memory a data is stored in form of charge in capacitors. When data is 1, the capacitor will be charged and if data is 0, the capacitor will not be charged. Because of capacitor leakage currents, the data will not be held by these cells. So the DRAMs require refreshing of memory cells. It is a process in which same data is read and written after a fixed interval.

   Advantages of DRAM:

   - High package density
   - Low cost

   Disadvantages of DRAM:

   - Required refreshing circuit to maintain or refresh charge on the capacitor, every after few milliseconds.

Secondary Memory

- **Magnetic Disk**: The Magnetic Disk is Flat, circular platter with metallic coating that is rotated beneath read/write heads. It is a Random access device; read/write head can be moved to any location on the platter

- **Floppy Disk**: These are small removable disks that are plastic coated with magnetic recording material. Floppy disks are typically 3.5" in size (diameter) and can hold 1.44 MB of data. This portable storage device is a rewritable media and can be reused a number of times. Floppy disks are commonly used to move files between different computers. The main disadvantage of floppy disks is that they can be damaged easily and, therefore, are not very reliable. The following figure shows an example of the floppy disk. Figure 3 shows a picture of the floppy disk.

- **Hard Disk**: Another form of auxiliary storage is a hard disk. A hard disk consists of one or more rigid metal plates coated with a metal oxide material that allows data to be magnetically recorded on the surface of the platters. The hard disk platters spin at 5 a high rate of speed, typically 5400 to 7200 revolutions per minute (RPM).Storage capacities of hard disks for personal computers range from 10 GB to 120 GB (one billion bytes are called a gigabyte).

- **Optical Disks:** Optical Mass Storage Devices Store bit values as variations in light reflection. They have higher area density & longer data life than magnetic storage. They are also standardized and relatively inexpensive. Their Uses: read-only storage with low performance requirements, applications with high capacity requirements & where portability in a standardized format is needed.

Types of Optical Disk

1. CD-ROM (read only)
2. CD-R: (record) to a CD
3. CD-RW: can write and erase CD to reuse it (re-writable)
4. DVD(Digital Video Disk)

2. Explain I/O devices and their Interfacing

Ans. Input / Output (I/O)

- MPU communicates with outside word through I/O device.
- There are 2 different methods by which MPU identifies and communicates With I/O devices these methods are:
    1- Direct I/O (Peripheral)
    2- Memory-Mapped I/O

The methods differ in terms of the

- No. of address lines used in identifying an I/O device.
- Type of control lines used to enable the device.
- Instructions used for data transfer.

Direct I/O (Peripheral):-

- This method uses two instructions (IN & OUT) for data transfer.
- MPU uses 8 address lines to send the address of I/O device (can identify 256 input devices & 256 output devices).
- The (I/P & O/P devices) can be differentiated by control signals I/O Read (IOR) and I/O Write (IOW).
- The steps in communicating with an I/O device are similar to those in communicating with memory and can be summarized as follows:
    1- The MPU places an 8-bit device address on address bus then decoded.
    2- The MPU sends a control signal (IOR or IOW) to enable the I/O device.
    3- Data are placed on the data bus for transfer.

Memory-Mapped I/O:-

- The MPU uses 16 address lines to identify an I/O device.
- This is similar to communicating with a memory location.
- Use the same control signals (MEMR or MEMW) and instructions as those of memory.
- The MPU views these I/O devices as if they were memory locations.
- There are no special I/O instructions.
- It can identify 64k address shared between memory & I/O devices.