MODULE 5

**I.MEMORY**

* Memory is the workspace for the processor. It is a temporary storage area where the programs and data being operated on by the processor must reside.
* Memory storage is considered temporary because the data and programs remain there only as long as the computer has electrical power or is not reset.
* Before the computer is shut down or reset, any data that has been changed should be saved to a more permanent storage device (usually a hard disk) so it can be reloaded into memory in the future.

**Primary Memory or Main Memory**

* The [main memory](http://generalnote.com/Basic-computer/Primary-Memory.php) is used to store data and instructions currently required for processing.   
  **Primary Memory are divided into two subcategories :**1. [Random Access Memory](http://generalnote.com/Basic-computer/Primary-Memory.php) (RAM)  
  2. [Read Only Memory](http://generalnote.com/Basic-computer/Primary-Memory.php) (ROM)

**A.Random Access Memory (RAM)**

* RAM is volatile as any interruption in power supply results in loss of data in RAM.
* The contents of the memory remain there as long as electrical current is available to sustain the memory's pattern of positive and negative charges which represent the two bits 1 and O.
* lf power fails, all the contents in the memory will be lost.   
  Types of RAM :   
  • Dynamic Random Access Memory (DRAM)  
  • Static RAM  
  • Video RAM

**DRAM**

* Dynamic RAM (DRAM) is the type of memory chip used for most of the main memory in a modern PC.
* The main advantages of DRAM are that it is very dense, meaning you can pack a lot of bits into a very small chip, and it is inexpensive,.
* The problem with DRAM is that it is dynamic—that is, its contents can be changed. because of the design, it must be constantly refreshed; otherwise, the electrical charges in the individual memory capacitors will drain and the data will be lost.

**SRAM**

* Static Random Access Memory (Static RAM or SRAM) is a type of RAM that holds data in a static form, that is, as long as the memory has power.
* Unlike dynamic RAM, it does not need to be refreshed.
* DRAM continuously refreshes 100+ times per second.
* Static random access memory (SRAM) is a lot faster and does not require refreshing like dynamic RAM.

**Video RAM**

* VRAM (video RAM) is a reference to any type of random access memory ([RAM](http://searchstorage.techtarget.com/definition/RAM-random-access-memory)) used to store image data for a computer [display](http://whatis.techtarget.com/definition/display).

**B.Read Only Memory (ROM)**

* Read-only memory (ROM) is a type of storage medium that permanently stores data on personal computers (PCs) and other electronic devices.
* It contains the programming needed to start a PC, which is essential for boot-up; it performs major input/output tasks and holds programs or software instructions
* This memory uses MetaL Oxide Semiconductor TechnoLogy.
* RAM is read-write memory whereas ROM is Read-OnLy-Memory.
* This memory is used to store frequently used programs in the system.
* **Types of ROM :**

i.Mask ROM

ii. Programmable read-only memory (PROM)  
iii.Erasable programmable read-only memory (EPROM)  
iv.Electrically erasable programmable read-only-memory (EEPROM)

v.Flash Memory

**i.Mask ROM**

* It is also known as MROM.
* It is a static ROM which comes programmed into an integrated circuit by its manufacturer.
* Network operating systems and server operating systems make use of this type of Mask ROM chips.

**II.Programmable read-only memory (PROM)**

* PROM or programmable read only memory is the ROM memory with a small difference.
* At the time of manufacturing,this chip is made as a blank ROM chip and later using special PROM programmers the information is stored into them.
* Initially when the PROM is manufactured it contains row and address connections,ie.all the locations contains a binary 1.Later to store any information,the connection between the row and column is broken to store a binary 0,and the connection is made to remain as it is to store a binary number 1.
* Once some information is stored into the PROM by ‘burning’ the information into it,it becomes equal to a ROM,ie.now the information stored into it cannot be changed or removed and removal of the power to the chip will not clear the data stored into it.

**iii.Erasable programmable read-only memory (EPROM)**

* **EPROM (erasable programmable read-only memory) is programmable** read-only memory (programmable ROM) that can be erased and re-used.
* Erasure is caused by shining an intense ultraviolet light through a window that is designed into the memory chip.

**iv.Electrically erasable programmable read-only-memory (EEPROM)**

* EEPROM (electrically erasable programmable read-only memory) is user-modifiable read-only memory ([ROM](https://whatis.techtarget.com/definition/read-only-memory-ROM)) that can be erased and reprogrammed (written to) repeatedly through the application of higher than normal electrical voltage.
* Unlike [EPROM](https://whatis.techtarget.com/definition/EPROM) chips, EEPROMs do not need to be removed from the computer to be modified
* It also has a limited life - that is, the number of times it can be reprogrammed is limited to tens or hundreds of thousands of times.

v.**Flash Memory**

* Flash memory is a type of electronically erasable programmable read only memory (EEPROM), but may also be a standalone memory storage device such as a USB drive.
* Flash memory is a distinct type of EEPROM, which is programmed and erased in large blocks.

**Secondary Memory**

* This [type of memory](http://generalnote.com/Basic-computer/Computer-Memory.php) is also known as [external memory](http://generalnote.com/Basic-computer/Secondary-Memory.php) or non-volatile.
* It is slower than [main memory](http://generalnote.com/Basic-computer/Primary-Memory.php).
* These are used for storing data/Information permanently.
* 0CPU directly does not access these memories instead they are accessed via input-output routines.
* Contents of secondary memories are first transferred to main memory, and then CPU can access it.   
    
  Main secondary memory are:  
  1. Magnetic Disk  
  2. Floppy Disk  
  3. Hard Disk  
  4. Optical Disks  
  **1.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

**2. 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.

**3.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.

**4.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. **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)**

**Cache Memory**

* [Input- Output](http://generalnote.com/Basic-computer/Function-of-computer.php) operations are very slow.
* To speed up fetching of instructions to CPU, a buffer or cache (pronounced as cash) is used.
* To reduce the processing time, certain computers use costlier and higher speed memory devices to form a buffer or cache.
* This memory is called cache and it stores data and instructions currently required for processing.
* Cache memory thus makes [main memory](http://generalnote.com/Basic-computer/Primary-Memory.php) appear much faster and larger than it really is. It improves the memory transfer rates and thus raises the effective processor speed.   
  Advantages of Cache Memory :  
  1. Cache memory is faster than main memory.  
  2. It stores the program that can be executed within a short period of time.  
  3. It consumes less access time as compared to main memory.  
  4. It stores data for temporary use.
* Disadvantages of Cache Memory :  
  1. It is very expensive.  
  2. Cache memory has limited capacity.

**II.Physical memory organization**

* The main memory is divided into a number of sets or banks and normally nine  
  chips are used per bank, 8 chips for eight bit of data and one additional chip for  
  the parity information.
* The memory module is a set of number of RAM chip on a single plug-in circuitboard .
* The memory modules are available in the following type of memory packing

1. DIP (Dual Inline Package)

2.SIPP (Single In-line Pin Package Modules)  
3.SIMM (Single In-line Memory Modules)  
4.DIMM (Dual In-line Memory Modules)

* Out of these packing the DIMM modules are in the most common use.
  1. **DIP or Dual Inline Package**
* It was used to be the most common packing for the memory chips,

It resembles a small flat, rectangle box with metal legs on both sides.

* A typical size would be 1 inch length and 1/2 inch width and both the sides may  
  contain 8 legs each to connect this chip to the computer circuitry, or to insert this chip into the socket on the computer motherboard.
  1. **SIPP or Single Inline Pin Package**
* SIPP contains pins at the bottom to connect them into the motherboard memory socket.
* Most of the time these SIPPs are directly soldered onto the mother board itself rather than inserting them into the socket.
* SIPP and SIMM have only one difference and ie. their packaging on the SIMM memory chips are soldered on to the circuit board, and the  
  connection to the socket is done using the edge connectors
* On the SIPP, the discrete memory chips are first soldered onto a small Circuit board and then it is connected to the main board using small IC like pins these pins are either directly soldered onto the motherboard or installed into their socket.)
* SIPPs are usually associated with memory modules.

**3.SIMM**

* A **SIMM** (single in-line **memory module**) is a **module** containing one or several random access **memory** (RAM) chips on a small circuit board with pins that connect to the computer motherboard.
* DIMM and SIMM are two major types of random-access memory standards for personal computers. DIMM is an acronym for “dual in-line memory module,” while SIMM stands for “single in-line memory module."
* The edge connector of this expansion board is plugged into a special SIMMsockets on the motherboard.This design allows the memory to be added and removed from theComputer without the risk of destroying it.
* SIMMs are available in SRAM, DRAM, VRAM etc.

**Different type of SIMM are**

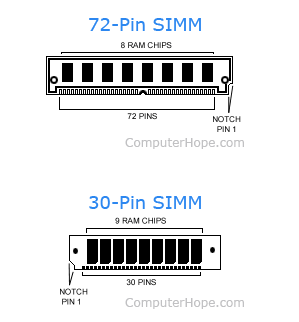
* + 1. 30-pin SIMM
    2. 72 pin SIMM

**30-pin SIMM30**:IT is the first SIMM introduced with the PC system.

* + - * The 30-pin SIMM measures about 3.5 inches wide and an inch tall.
      * 30-pin SIMMs use one byte-wide data buses

**72- pin SIMM**:  a new SIMM with more pins to accommodate wider data buses was required .This lead IBM to introduce 72-pin SIMMs

* Its 72-pin could pack four byte-widebanks on a single module
* The notch in the center of the SIMM edge connector prevents one from accidentally sliding a 30-pin SIMM into a 72-pin socket
* To achieve higher capacities, 72-pin SIMMs are often double-sided.



**4.DIMM**

* DIMM (dual in-line memory module) is a type of computer memory that is natively 64 bits, enabling fast data transfer.
* DIMM is a module that contains one or several random access memory ([RAM](https://searchstorage.techtarget.com/definition/RAM-random-access-memory)) chips on a small circuit board with pins that connect it to the computer [motherboard](https://whatis.techtarget.com/definition/motherboard).
* The DIMM stores each data bit in a separate memory cell.
* DIMMs use a 64-bit data path, since processors used in personal computers have a 64-bit data width.
* DIMMs are typically used in desktop PCs, laptops, printers and other devices.
* Another evolution in DIMMs is the use of cooling fins or structures attached directly to the DIMM.
* The increase in chip density in typical 8 GB or 16 GB DIMMS, and the increase in clock speed, led to an increase in heat production.

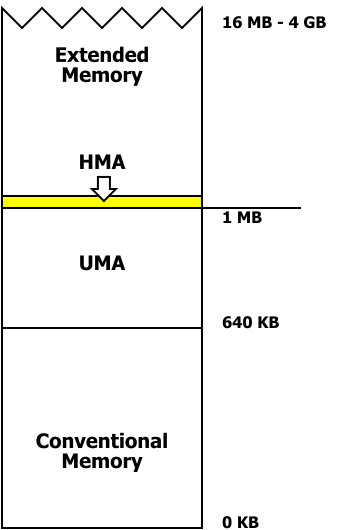
**Types of DIMM:**The most common standard DIMMs, with a typical length of 5.5 inches and height of 1.18 inches, are:

* **Unbuffered DIMMs (UDIMMs)** -- Used mainly on desktop and laptop computers. Although they run faster and cost less, UDIMMs aren’t as stable as registered memory.
* **Fully-buffered DIMMs (FB-DIMMs)** – Usually used as main memory in systems that require large capacities, such as servers and workstations
* **Registered DIMMs (RDIMMs)** -- Also known as buffered memory, RDIMMs are often used in servers and other applications that require robustness and stability.

**5.RIMM**

* In a computer, a **RIMM** is a **memory module** developed by Kingston Technology Corp. that takes up less space inside the computer than the older DIMM **module** and has different pin characteristics.
* A **RIMM** has a 184-pin connector
* Used in inter Pentium 4 motherboards.

**III Logical Memory**



**Conventional Memory**  
•The first 640 KB of system memory is called  Conventional Memory.

•Conventional Memory is also called as Base Memory.

•This area available for use by standard DOS programs, along with many drivers, memory-resident programs, and most anything else that has to run under standard DOS.

•Conventional Memory occupies addresses 00000h to 9FFFFh.

•The bottom 1k area is used to store DO  interrupt vector pointers.

•**Extended Memory:**

•The memory above 1 MB area is called extended memory as shown in fig.

•It is used for programs and data when using an operating system running in protected mode.

•This memory is available from addresses 10FF0H to the last memory location.

**Extended memory specification(XMS)**

* This specification works with all the processors that can address extended memory
* This specification also allows the real mode dos programs to use the extended memory,and to use a special area in the extended memory called High memory area(HMA)

**VIRTUAL CONTROL PROGRAM INTERFACE(vcpi)**

* This specification was mainly developed to make the DOS programs in the virtual 86 mode to work without any conflicts.
* **Upper Memory Area(UMA):**
* •The upper 384 KB of the first megabyte of system memory just above the Conventional Memory is called as *upper memory area.*
* •Function of UMA is ROM shadowing and loading drivers.
* •**High Memory Area(HMA):**
* •The first 64 KB of extended memory are termed as HMA.
* •It can accessed also when the processor is in real mode.
* •It is usually used for DOS.
* •It occupies addresses 100000h to 10FFEFh.
* The HMA starts at the 1 megabyte limit.ie the location 1024KB and goes up to 1088KB of memory
* BZ it is not contiguous with the address range of lower memory,it cannot be used as extra memory by ordinary DOS applications.
* **Expanded Memory** Specification (EMS), or **expanded memory**, is a technique for utilizing more than 1MB of main **memory** in DOS -based computers.
* The limit of 1MB is built into the DOS operating system. The upper 384K is reserved for special purposes, leaving just 640K of conventional **memory** for programs.
* The EMS is not part of the main memory it is a separate memory installed into the system which can be accessed in a fixed sized pages using a method called “bank switching”.