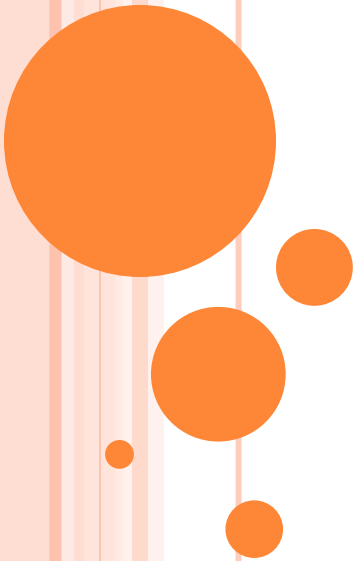


System Unit

CS-305

Data Representation

- Computer is an electronic device that works with digital signals such as ON and OFF.
- Digit 0 represents OFF and 1 represents ON.
- Computer works for a binary system.
- This system consists of two digits 0 and 1called bits.
- It is smallest unit of data can be represented in the computer.
- Collection of 8 bits is called byte.
- One byte can represents 256 different characters.

Data Representation

- Different combinations of 0 and 1 are used to represent different characters.
- Different coding schemes are used to represent different characters.
- Popular coding schemes are as follows:

1. BCD Code (Binary Code Decimal)
2. EBCDIC Code (Extended Binary Coded Decimal Interchangeable Code)
3. ASCII code (American Standard Code for Information Interchange)
4. Unicode

Data Representation

1. BCD Code (Binary Code Decimal):

- ✓ It's a 4 bit code.
- ✓ It means that each decimal digit is represented by 4 binary digits.
- ✓ It was used by early computers.

Data Representation

2. EBCDIC Code (Extended Binary Coded Decimal Interchange Code):

- It's a 8 bit code.
- Divided in two groups of 4 bits.
- Each group represent one hexadecimal digit.
- Developed by IBM.
- Normally used in Mainframe Computers.
- It can represent 256 characters.

Data Representation

3. ASCII (American Standard Code Information Interchange):

- Published in 1968 By ANSI(American national Standard Institute).
- Most widely used coding scheme for personal computers.
- 7 bit code can represents 128 characters.
- It is not enough to represent some graphical characters displayed on computer screens.
- An 8-bit code can represent 256 characters.

Data Representation

4. Unicode

- 16-bit code
- It can represents 65536 characters.
- It has started to replace ASCII code.
- It can represents the characters of all languages in the world.

Memory

- An area of computer that stores data and instructions to be accessed by processor as well as the results of processing.
- Consists of one or more chips on motherboard.

Memory

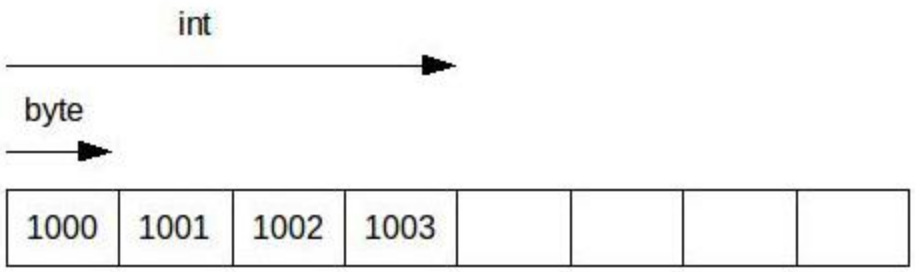
Structure of Memory:

- Main memory of a computer consists of thousands or millions of cells of storage location.
- Each cell can store a bit.
- One bit can represent 0 or 1.
- Bit stands for binary digit.
- Memory cells are logically organized into groups of 8 bits known as byte.

Memory

Structure of Memory:

- Each memory has unique number assigned to it.
- The number is known as address of that byte.
- The scheme of arranging the cells into a byte and bytes into memory chips is shown in the following figure.



Memory

Types of Memory:

- Volatile Memory:
  - ✓ Loses its contents when the computer is turned off.
  - ✓ Ram is the most common type of Volatile memory.
- Non-Volatile Memory:
  - ✓ Does not lose its contents when the computer is turned off.
  - ✓ ROM, flash memory etc.

Memory

RAM:

- Stands for random access memory.
- Also called direct access memory.
- Random access means that each individual byte in entire memory can be accessed directly.
- Used to store data and instructions temporarily.
- A program must be loaded into RAM before execution.
- Volatile memory

Memory

RAM:

- Ram is read/write memory.
- Also called main memory or primary memory.
- Plays important role in the processing speed of the computer.
- A bigger Ram size provides larger amount of space for processing.
- Space 4GB or more.

Memory

RAM:

Types of Memory

- DRAM(Dynamic RAM)
- SRAM(Static RAM)
- MRAM (Magnetoresistive RAM)

Memory

RAM:

Types of Memory

- DRAM(Dynamic RAM)
  - ✓ used in most of the computers.
  - ✓ Least expensive kind of memory.
  - ✓ It requires an electric current to maintain its electrical state.
  - ✓ Electrical charge decreases with time that may result in loss of data.
  - ✓ Recharged again and again to maintain its data.

MEMORY

RAM:

Types of Memory

- SRAM(Static RAM)
  - ✓ It can store data without any need of frequent recharging.
  - ✓ CPU does not need to wait to access data from SRAM during process.
  - ✓ That is why it is faster than DRAM.
  - ✓ Utilize less power than DRAM.
  - ✓ More expensive.
  - ✓ Normally used to build a very fast memory known as cache memory.

Memory

RAM:

Types of Memory

- MRAM(Magnetoresistive RAM)
  - ✓ It stores data using magnetic charges instead of electrical charges.
  - ✓ MRAM uses far less power than other RAM technologies so it is ideal for portable devices.
  - ✓ Greater storage capacity.
  - ✓ Faster access time.
  - ✓ It retains contents when the power is removed from computer.

Memory Modules

- Small circuit boards that hold RAM chips.
- These modules are plugged into memory slots on them motherboard.
- Most Personal Computers have slots for two to four memory modules.
- They come in different sizes and have different configuration.

Memory Modules

- SIMM (single inline memory module)
- ✓ Older standard of RAM.
- ✓ Developed in 1983 at Wang Laboratories
- ✓ Used in old computers during 1980s and 1990s.
- ✓ SIMM module has 72 pins and it only supports 32 bit data.
- ✓ SIMM module is 4.25 inches in length and 1 inch in width.

Memory Modules

- DIMM(Dual inline memory module)
- ✓ It provides faster data transfer speed and better features.
- ✓ It typically supports 64-bit data transfer.
- ✓ Most common pin configuration of DIMM module is 168 pins.
- ✓ Some other DIMM configuration are 100, 172, 184, 204, 214 and 240.

Memory

ROM (Read only memory)

- The instruction in ROM prepare the computer for use.
- These instructions can only be read but cannot be changed or deleted.
- Not possible to write new instruction or information into the ROM.
- Store data and instructions permanently.

Memory

ROM (Read only memory)

- When the power is switched off, the instruction stored in ROM are not lost.
- Non-Volatile Memory.
- The information in ROM is stored by the manufacturer.
- When the computer is switched on, the instructions in the ROM are automatically loaded into the memory of computer.

Memory

ROM (Read only memory)

- When the computer is on, the instructions in the ROM are automatically loaded into memory of the computer.
- ROM contains a small set of instructions called ROM BIOS.
- BIOS stands for Basic input/output System.
- Instruction tells the computer how to access hard disk, find the operating system and load the operating system in RAM.

Memory

ROM (Read only memory)

- Types of ROM
- PROM

- ✓ Stands for programmable read only memory.
- ✓ This form of ROM is initially blank.
- ✓ The user or manufacturer can write data and programs on it using special devices.
- ✓ The user can write instruction on it only once.
- ✓ It is typically used in electronic machines to store some information permanently.

Memory

- EPROM
  - Stands for Erasable Programmable Read Only Memory.
  - The user can write data and programs on it using special devices.
  - The data and programs written on it.
  - It can be erased using ultraviolet light.
  - The ROM then can be reprogrammed.

Memory

- EEPROM
- ✓ Electronically Erasable Programmable Read Only Memory.
- ✓ In this memory, user can erase and write instructions with the help of electrical pulses.
- ✓ It is similar to flash memory.
- ✓ The data can be written to EEPROM in multiple times.
- ✓ The contents of EEPROM can be updated without removing it from circuit board.

Memory

- Cache Memory
- ✓ Small and very fast memory.
- ✓ Designed to speed up the transfer of data and instructions.
- ✓ Located inside or close to the CPU chip.
- ✓ Faster then RAM.
- ✓ The data and instructions that are most recently or most frequently used by CPU are stored in Cache.

Memory

- Cache Memory
  - The data and instructions are retrieved from RAM when CPU uses them first time.
  - A copy of that data or instructions is stored in cache.
  - Next time CPU needs that data or instructions, it first look in cache.
  - If required data is found there, it is retrieved from cache memory instead of main memory.

Memory

- Flash Memory

- ✓ Consists of non-volatile memory chips.
- ✓ Used it to store start-up instructions as it allows computer to update its contents easily.
- ✓ Flash memory chips are also built into many devices such as tablets, mobile phones, digital cameras and printers.
- ✓ The data in smart phone stored on flash memory.
- ✓ Some portable media players store music on flash memory.

Memory

- CMOS
  - ✓ Complementary metal-oxide semiconductor.
  - ✓ It stores configuration information of computer.
  - ✓ The information include the type of disk drives, keyboards, monitor, current data and other start up information required during booting process.

Memory

- Memory Access Time

- ✓ The amount of time required by processor to read data, instructions and information from memory.
- ✓ Access time defined by different terminologies:

Terminology	Equal	Denoted
Millisecond	One thousandth sec.	ms
Microsecond	One millionth sec.	µs
Nanosecond	One billionth sec.	ns
Picosecond	One trillionth sec.	
Megahertz	Converted into ns by dividing it into 1 billion ns	MHz.