Computer

A computer is an electronic device, operating under the control of instructions stored in its own memory that can accept data (input), process the data according to specified rules, produce information (output), and store the information for future use.

A Computer System

All the different parts of a computer, including the devices you plug into it, are known collectively as 'a computer system'.

Monitor (Output)

A monitor, or visual display unit (VDU), displays the information generated by a computer. Touch-screen monitors also allow input from the user.

Webcam (Input)

A webcam enables live video communication over the Internet. Webcams are often integrated within computers.

Optical Disc Drive (Storage)

CD, DVD and Blu-ray disc drives are used to read information on the associated optical discs. To write (record) information onto an optical disc, a writer is required. The optical disc must also be writable (R) or rewritable (RW).

Base Unit (Processing)

A base unit stores the motherboard, Central Processing Unit (CPU), Random-Access Memory (RAM) and other essential components.

Speakers (Output)

Speakers are used to output sound.

Printer (Output)

A printer creates physical copies of on-screen data and information.

Scanner (Input)

A scanner is used to convert physical objects, usually printed images and text, into digital images.

Headset (Input and Output)

A headset is comprised of headphones (speakers) and a microphone. Headsets are commonly used to communicate over the Internet and for online gaming.

Keyboard (Input)

A keyboard is used to enter information into a computer system. Keyboards contain a number of keys, including alphanumeric characters, punctuation symbols and various function keys.

Mouse (Input)

A mouse is used to move the cursor on a monitor, enabling control of the Graphical User Interface (GUI).

USB Flash Drive (Storage)

A USB flash drive is a portable storage device that connects to a computer's USB port.

daydream

CLASSIFICATION OF COMPUTERS

Computers can be classified into two major types based on their way of handling data. These are as follows:

1. Analogue Computers : They work on continuous variables like waves of the signal, their amplitude, etc.

2. Digital Computers : They work on the principle of binary digits i.e. 0 and 1. Any value or symbol is represented through a binary value.

Hybrid Computers : They are a combination of good features of analogue and digital computers. Digital counterparts convert the analogue signals to perform Robotics and other Process control. Hybrid computers are used to control air traffic and radar of national defence.

Digital computers can also be classified according to their physical structure (size) and the purpose of their use. Based on capacity, speed and reliability they are classified into three categories:

I. Microcomputer : The term “Microcomputer” was introduced with the advent of single chip large scale integrated circuit (LSIC) computer processors. It is the smallest single user computer and its CPU is a microprocessor. It can perform the same operations and can use the same type of instructions as other computers. These are the most frequently used computers, better known by the name “Personal Computers.”

Types of Personal Computer

In our everyday use, the term “computer” refers to digital computers, a typical example being the common personal computer (PC). These can be classified mainly as Desktop Computers, Laptop Computers, Palmtop Computers, Personal Digital Assistant (PDA), Tablet PC, etc.

Desktop Computers

Desktop computers are larger and not meant to be portable. They usually sit in one place on a desk or table and are plugged into a wall outlet for power. The case of the computer holds the CPU. When this case lies flat on the desk then it is generally referred to as a Desktop Model else when it stands vertically on the desk in the form of a tower, it is referred to as a Tower Model. The computer usually has a separate monitor. A separate keyboard and mouse allow the user to input data and commands. The main advantage of tower models is that there are fewer space constraints, which makes installation of additional storage devices easier.

Laptop

This is a small, portable computer, small enough that it can sit on the lap. Nowadays laptop computers are also called notebook computers.

Hand-held Computers/Palmtop

This computer is smaller than a laptop. It is so small that it literally fits in a palm, hence, referred to as palmtop. Because of their small size, most palmtop computers do not include disk drives. Compared to full-size computers, palmtops are severely limited, but they are practical for certain functions such as phonebooks and calendars. Sometimes these are also called pocket computers.


Lenovo
ThinkPad

Personal Digital Computers/Assistants

Palmtops that use a pen rather than a keyboard for input are often called PDAs. This is a hand–held device that combines computing, telephone fax and networking features. PDA can function as a cellular phone, fax sender and personal organizer. PDA was pioneered by Apple, which introduced the Newton Message Pad in 1993.

Tablet PC

It is a notebook slate-shaped mobile computer which is equipped with a touchscreen or graphics table which allows the user to operate the computer with a digital pen or stylus or fingertip. A wireless keyboard can be connected to this for extensive text input. Other models of tablet PCs are convertible model (screen can rotate over the keyboard) and hybrid model where the screen is fixed on the keyboard.

Workstation

A powerful, single user computer, a workstation is like a personal computer, but it has a more powerful microprocessor and in general, a higher quality monitor used in computer aided design and other applications requiring a high end, usually expensive, machine with considerable calculating or graphics capability.

Server

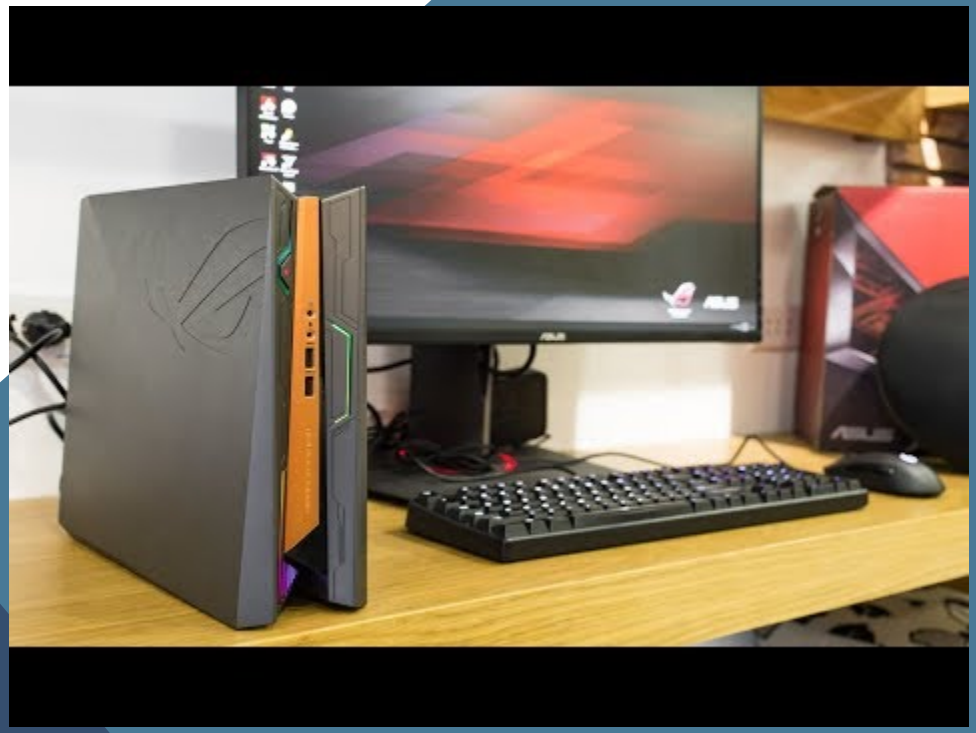
The term server actually refers to a computer's function rather than to a specific kind of computer. A server runs a network of computers. It handles the sharing of equipment like printers and the communication between computers on the network.

For such tasks a computer would need to be somewhat more capable than a desktop computer. It would need:

- more power
- larger memory
- larger storage capacity and
- high speed communications.

II. Mini Computer :

It is a multiuser computer capable of supporting up to hundreds of users simultaneously. They are usually more powerful compared to microcomputers. Minicomputers are also known as mid range computers as their cost and computing powers lie in the middle range between micro and mainframe computers. Minicomputers are used for multiusers and interactive applications.



III. Mainframe Computer :

A powerful multiuser computer, the mainframe computer, is capable of supporting many hundreds or thousands of users simultaneously. They are capable of faster processing and greater storage area. They are used in research organizations, large industries, large businesses and government organizations, banks and airline reservation where a large database is required.

Super Computer

There is another category of computers, the Super Computer which is somewhat similar to the mainframe computer. These are largest, fastest and most expensive. They are used for massive data processing and solving very complicated problems like weather forecasting, weapons research and development, rocketing, atomic, nuclear and plasma physics. The processing speed of super computers lies in the range 400-10000 million instructions per sec (MIPS). Examples of the supercomputer are Eka which was developed by the TATA Group, Pune (India) in November 2007. It is the first in Asia and the 8th fastest supercomputer in the world as of June 2008 PARAM developed by CDAC in Pune (India), CRAY 3 (developed by control data corporation, JAPAN), SX-3R (25.6 GIGA Flops, NEC make) HITAC S-300 (32 GIGAFLOPS, HITACH make) etc. HITAC S-300 is the latest and the fastest Super Computer.

Search on the internet give some examples of super computers and why they use it?

ORGANISATION OF THE COMPUTER SYSTEM

A *computer system* is usually defined as a combination of hardware and software. Computer hardware is the physical equipment. Software is the collection of programs that make the hardware do its job. Each of the hardware and software components has undergone refinements and modifications depending upon the limitations encountered by the users and the endeavours to overcome these limitations to meet new requirements and challenges. Let us therefore understand the computer from two perspectives, namely, the general functions of its components and the evolution these components have undergone.

HARDWARE

In order to accomplish a particular task the computer performs a series of jobs, namely, Input, Storage, Processing and Output, which it handles in a very special way as follows:

- It accepts the data (input) from the user.

- The computer has memory chips, which are designed to hold data until it is needed.

- It processes this data into information. The computer has an electronic brain called the Central Processing Unit, which is responsible for processing all data into information according to the instructions given to the computer.

- It then returns the processed information (output) to the user.

For performing each of the jobs listed above, every computer has special parts/components, for Input Device, Storage Device, Central Processing Unit and Output Device

INPUT DEVICES

General Functions

It provides a means for the machine to communicate with its external environment by accepting (or reading) data and the program. 1. It converts the data based on the program into computer acceptable form through an input interface. 2. It supplies the converted instructions and data to the computer system for further processing. The very scope of computers is enough to understand that there is no limit to the form and type of data that serves as an input. Sometimes the input is in the form of text in normal language, sometimes it is a picture, sometimes it is a voice input like a song. Selection of an appropriate input device will improve efficiency and keep human interaction minimal.

Types of Input Devices

On-line or Direct Data Entry Devices : These devices are under the control of the CPU and communicate directly with the CPU, that is, these are connected via cable to the CPU. This process of data entry may be time consuming and may have errors but by using these devices, we can avoid having to capture data from paper. These are also known as Interactive Input Devices and are classified as:

(a) Keyboard
(b) Locator devices
(c) Interface or pick devices.

(a)
Keyboard

The most common input device is the keyboard . The modern keyboard generally contains 104 keys and is called the QWERTY keyboard because of the sequence of keys in the top row, which are similar to those of a standard typewriter. A keyboard is used for a wide range of tasks but is well known for its capability to enter data, which is copied from the original paper documents (such as name and address details on a form). Keyboards are also used for typing letters, memos, reports and other documents using word processing software.

(b) Locator devices

Locator devices are used to control the location or position of the cursor on the screen and they allow us to provide the necessary input. Generally, locator devices are good for gross movement but not for precision work.

Mouse

It is a small hand-held device used to indicate a position or movement on a computer's display screen by rolling it over the mouse pad/flat surface. There are different types of this device like physical, optical and laser mouse. Physical mouse works on the principle of the movement of a ball, whereas optical and laser mouse works on the bases of light signals (i.e. have no mechanical movement inside.)

Trackball

It is a movable ball mounted on top of a stationary base, which can be rotated manually using a finger and it also has two buttons like a mouse for performing operations similar to mouse. Three dimensional track balls are available that allow the movement not only the traditional left/right and forward/ backward movement but also up and down as well.

Touch pad

It is a flat touch sensitive rectangular surface performing similar operations as a mouse or a track ball.

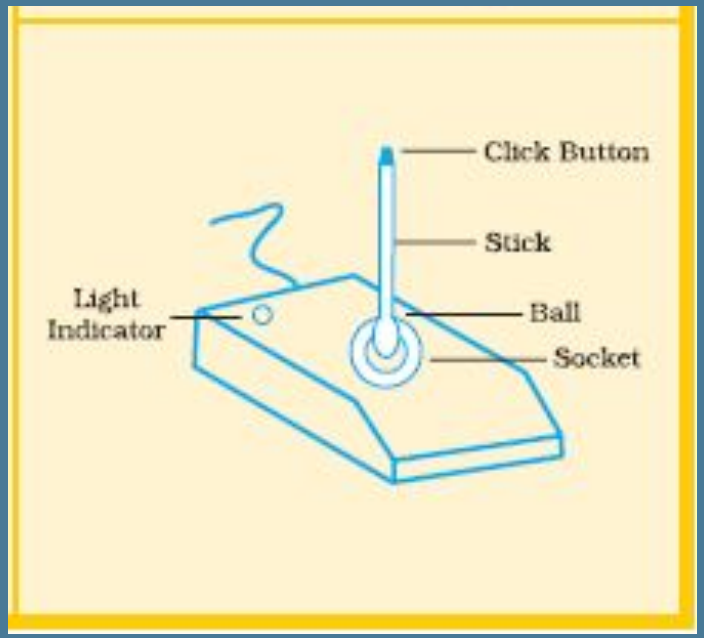
Mouse, track ball and touch pad are point and click devices and are used to start the task by positioning the pointer, selecting and dragging items/objects. They can also be used to draw various simple/complex graphic images/pictures.

Digitising Tablet

Digitising tablet is an electronic plastic board, on which specifying a location corresponds to a location on the computer screen. It is considered to be an absolute locator because it is very precise and when a stylus (pen) is placed in a particular position the same signals are produced each time. It is in this that it differs from other locator devices. Digitisers are used by architects and engineers in Computer Aided Designing (CAD) for designing buildings, cars, mechanical parts,
robots, etc. Moreover, they are used in the Geographical Information System for digitising of maps.

Joystick

Joystick is a wired/wireless control device which is usually used for playing video games. These are relative locators in which the direction of the push determines the change of position and the amount of deflection determines a change of speed (*see* Figure). A joystick not only indicates two dimensional positions by moving the ball rotationally but also three dimensional position, where the third dimension is indicated by the rotation of the rod. Games software, flight simulators, etc. often use joystick as the input device.



(c) Interface/Pick Devices

Pick devices are used to select an object on the screen. The object may be text or graphic. Examples of pick devices are light pens and touch screens.

Light Pens

The light pen is a pen-like light-sensitive device that feeds a narrow electrical pulse generated by a pointing device directed towards the screen. It is connected by a wire to the computer terminal that detects the signals from the screen. Light pens may be used in place of a mouse or a keyboard, particularly for menu based applications where an option may be selected by pointing on it. They are used for Computer Aided Designing (CAD) and drawing purposes.

Moreover, with the help of a light pen, engineers, architects or fashion designers can draw and edit the designs directly on the screen, though for editing a drawing keyboard may be used to select colors, lines with varying thickness, cropping or enlarging the drawings. It is also used to read bar codes from products that are available in big departmental stores.

Touch Screens

Touch screens are monitors on which the user makes selections by touching the screen, rather than moving a cursor to the location with external locator devices. Touch screens are often used in situations where users are likely to have a low level of competence in using computer keyboards. Touch screens are sometimes used in restaurants, building societies and travel information systems.

Source Data Entry Devices :

We have observed that in grocery stores, the clerks merely wave the product over a laser scanner/barcode reader, which automatically enters the product code and retrieves the corresponding price of the product automatically. The earlier practice was to enter the code/ product name by using a keyboard (a time consuming process). The laser scanner/barcode reader comes under source Data Entry Devices category, which increases the efficiency of a user. These devices help us in entering the data directly from the source, without any human intervention.

The devices used in this category are:

(a) Video digitiser
(b) Digital camera
(c) Scanning devices
(d) Voice input
(e) Remote control
(f) Magnetic stripe reader
(g) Sound sensor – microphone
(h) MIDI instrument.

Explain and give an image example of each device ?

Give he advantages and disadvantages of using these devices?

Are those devices input units ?

Optical Mark Readers (OMR)
Optical Character Readers (OCR)

Magnetic Ink Character Recognition (MICR)

Bar–Code Readers

Voice input
Remote Control
Magnetic Stripe Reader
Sound Sensor Microphone
MIDI (Musical Instrument Digital Interface) Instrument

MEMORY OR STORAGE DEVICES

Lecture –1

1. What type of computers work on continuous variables like waves of the signal, their amplitude, etc.?
a) Digital Computers
b) Analogue Computers
c) Hybrid Computers
d) Server Computers
Correct Answer: b) Analogue Computers

2. Which of the following is NOT a type of keyboard?
a) QWERTY keyboard
b) AZERTY keyboard
c) DVORAK keyboard
d) JOHNSON keyboard
Correct Answer: d) JOHNSON keyboard

3. What is a digitizing tablet used for?
a) Gross movement input
b) Precision work input
c) Memory storage
d) Processing data
Correct Answer: b) Precision work input

4. Which of the following is NOT a type of locator device?
a) Keyboard
b) Mouse
c) Digitizing tablet
d) Joystick
Correct Answer: a) Keyboard

5. What is a Laptop computer also known as?
a) Desktop
b) Hand-held Computers/Palmtop
c) Notebook computers
d) Minicomputers
Correct answer: c) Notebook computers

6. Which of the following is NOT a limitation of palmtop computers?
a) Small size
b) Lack of disk drives
c) Limited computing power
d) Large screen size
Correct answer: d) Large screen size

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7. Which of the following is a characteristic of a minicomputer?
a) Single user support
b) Low cost
c) Mid-range computing power
d) Limited to specific applications
Correct answer: c) Mid-range computing power

8. Which of the following is NOT an example of an input device?
a) Keyboard
b) Digitizing tablet
c) Light pen
d) Monitor
Correct answer: d) Monitor

True or False

1. Is a computer an electronic device that can accept data, process it according to specified rules, produce information, and store the information for future use?
2. Are digital computers those that work on continuous variables like waves of the signal, their amplitude, etc.?
3. Is a mainframe the smallest single user computer and its CPU a microprocessor?
4. Is a light pen a pen-like light-sensitive device that feeds a narrow electrical pulse generated by a pointing device directed towards the screen?

Answers:
1. True
2. False (Analogue computers)
3. False (microcomputers)
4. True

1. Is a workstation a type of personal computer?
2. Can an output device convert data into computer acceptable form?
3. Is a digitizing tablet a type of on-line data entry device?
4. Is a laser scanner/barcode reader a source data entry device?

Answers:
1. True
2. False (input devices)
3. True
4. True

Explanation Questions

1. What is a computer and what are its main functions?

2. How does a server computer differ from a desktop computer?

3. What are the characteristics and uses of a minicomputer?

4. What is a supercomputer and what are some examples?

5. What is a keyboard and what are its common uses?

6. How does a trackball differ from a mouse?

7. What is a digitizing tablet and how is it used?

8. What are pick devices and what are some examples?

9. What is a light pen and how is it used?

10. How do touch screens work and where are they commonly used?

11. What are source data entry devices and how do they increase efficiency?

Answers:

1. A computer is an electronic device that can accept data (input), process the data according to specified rules, produce information (output), and store the information for future use.

2. A server computer runs a network of computers and handles the sharing of equipment like printers and the communication between computers on the network. It requires more power, larger memory, larger storage capacity, and high speed communications compared to a desktop computer.

3. A minicomputer is a multiuser computer capable of supporting up to hundreds of users simultaneously. It is more powerful compared to microcomputers and is used for multiusers and interactive applications.

4. A supercomputer is a large, fast, and expensive computer used for massive data processing and solving complex problems like weather forecasting and weapons research. Examples include Eka, PARAM, CRAY 3, and HITAC S-300.

5. A keyboard is the most common input device and is used for a wide range of tasks, including entering data from paper documents, typing letters and memos, and using word processing software.

6. A trackball is a movable ball mounted on top of a stationary base that can be rotated manually using a finger, while a mouse is a handheld device that is moved across a surface to control the movement of the cursor on the screen.

7. A digitising tablet is an electronic plastic board used in Computer Aided Designing (CAD) for designing buildings, cars, mechanical parts, robots, etc. and in the Geographical Information System for digitising of maps.

8. Pick devices are used to select an object on the screen, such as text or graphics. Examples include light pens and touch screens.

9. A light pen is a pen-like light-sensitive device that feeds a narrow electrical pulse generated by a pointing device directed towards the screen. It is used for Computer Aided Designing (CAD) and drawing purposes, as well as reading bar codes from products.

10. Touch screens are monitors on which the user makes selections by touching the screen, rather than moving a cursor with external locator devices. They are often used in situations where users are likely to have a low level of competence in using computer keyboards.

11. Source data entry devices, such as laser scanners/barcode readers, increase efficiency by entering data directly from the source, without any human intervention.

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1. What is the main advantage of tower models of desktop computers?

2. What is a PDA and what was its pioneer?

3. What is a workstation and what are its usual applications?

4. What are the two types of on-line or direct data entry devices?

Answers:

1. The main advantage of tower models of desktop computers is that there are fewer space constraints, which makes installation of additional storage devices easier.

2. A PDA (Personal Digital Assistant) is a hand-held device that combines computing, telephone, fax, and networking features. It can function as a cellular phone, fax sender, and personal organizer. It was pioneered by Apple, which introduced the Newton Message Pad in 1993.

3. A workstation is a powerful, single-user computer with a more powerful microprocessor and a higher quality monitor. It is used in computer-aided design and other applications requiring a high-end, usually expensive, machine with considerable calculating or graphics capability.

4. The two types of on-line or direct data entry devices are keyboard and locator devices.

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1. What is a computer and what are its main functions?
2. What is a laptop and how does it differ from a hand-held computer/palmtop?
3. What is a server and what are its requirements?
4. What are some examples of super computers and why are they used?
5. Describe two locator devices and their functions.
6. What is a pick device and give an example.
7. What is a source data entry device and give an example.

Answers:

1. A computer is an electronic device that operates under the control of instructions stored in its own memory. It can accept data (input), process the data according to specified rules, produce information (output), and store the information for future use.

2. A laptop is a small, portable computer that is small enough to sit on the lap. A hand-held computer/palmtop is smaller than a laptop and is so small that it fits in a palm. Most palmtop computers do not include disk drives and are severely limited in functionality compared to full-size computers.

3. A server is a computer that runs a network of computers and handles the sharing of equipment like printers and the communication between computers on the network. It requires more power, larger memory, larger storage capacity, and high speed communications than a desktop computer.

4. Some examples of super computers include the IBM Blue Gene/Q, the Cray XC40, and the Fujitsu K computer. They are used for scientific research, weather forecasting, and other data-intensive tasks that require high levels of processing power.

5. Two locator devices are the mouse and the trackball. A mouse is a small hand-held device used to indicate a position or movement on a computer's display screen by rolling it over a mouse pad/flat surface. A trackball is a movable ball mounted on top of a stationary base that can be rotated manually using a finger. It has two buttons like a mouse for performing operations similar to a mouse.

6. A pick device is a device used to select an object on the screen, such as text or a graphic. An example of a pick device is a light pen.

7. A source data entry device is a device that helps enter data directly from the source, without any human intervention. An example of a source data entry device is a laser scanner/barcode reader, which is commonly used in grocery stores to automatically enter the product code and retrieve the corresponding price of the product.

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Fill the blanks with a suitable and correct answers:

1- The most common input device is the keyboard The modern keyboard generally contains …….. and called ……..

Answer 104 keys and called QWERTY

2- There are an Interactive Input Devices and are classified as ……., …… and ……

Answer (a)Keyboard, (b) Locator devices (c) Interface or pick devices.

3- …… computers are combination of good features of analogue and digital computers Digital counterparts convert the analogue signals to perform Robotics and other Process Control Hybrid

Answer Hybrid.

4- Servers would need to be somewhat more capable than a desktop computer It would need ……. , ……., ……. And ……

Answer: - more power, larger memory, larger storage capacity and high speed communications

5- ……are also known as mid-range computers as their cost and computing powers lie in the middle range between micro and mainframe computers

Answer: - Minicomputers

Or

6- Minicomputers are also known as mid-range computers as their ……. And ……lie in the middle range between micro and mainframe computers

Answer: - cost and computing powers

7- The processing speed of super computers lies in the range …… million instructions per sec (MIPS)

Answer: - 400 to 10000

8- In order to accomplish a particular task, the Hardware performs a series of jobs, namely, Input, Storage, Processing and Output, which it handles in a very special way as follows: -

Answer: -

- **It accepts the data (from the user The computer has memory chips, which are designed to hold data until it is needed)**
- **It processes this data into information The computer has an electronic brain called the Central Processing Unit, which is responsible for processing all data into information according to the instructions given to the computer**
- **It then returns the processed information to the user**

Lecture 2

الدكتور المهندس محمد سامي محمد

كلية التربية للعلوم الصرفة

قسم علوم الحاسبات

جامعة ديالى

2021-2020

تقنيات وتركيب الحاسوب – المرحلة الاولى

Organization Of the Computer System

1- Input Devices or Input Units
2- Output Devices or Output Units
3- Storage Units (Memory)
4- Central Process Unit

OUTPUT DEVICE

The output devices of the computer are used to display results in electronic or paper medium.

Common output devices which produce output that is easily understood are Printers and Monitors.

Hardcopy Output : They are usually on paper and are generally used to produce reports. The devices which are used to produce hardcopy output are printers, graph plotters, computer output microfilm, etc.

Softcopy Output : Such outputs are electronic, thus they are available either on screen or may be stored digitally on some storage device. The softcopy may be directly seen on screen or may be stored on hard disk/ CD/ DVD for further use.

Other output devices used for specific purposes are Projector, Sound card, Speakers and Video card.

Printers

A printer is an output device that prints characters, images and symbols on paper. On the basis of the printing technique used, printers may be classified as impact or non-impact printers.

Impact printers

Impact printers are like typewriters, as they use some sort of striking/hammering action to press carbon or fabric ribbon against paper to create a character or a pattern.

These devices are noisy and are not capable of producing high resolution graphics.

The most common impact printers are character printers (e.g. daisy wheel, dot matrix) and line printers (e.g. chain printers, drum printers). Among impact printers, line printers print one line at a time, so, these printers are extremely fast.

Impact printers are ideal to be used for carbon copies.

Dot-matrix Printers

Non-impact printers

Non-impact printers overcome the limitations of impact printers.

They form characters or images without making print heads strike the paper.

They use thermal, electrostatic, chemical or inkjet technology to produce printed output.

They are fast and quiet in operation.

The most common non-impact printers are inkjet printers and laser printers.

These printers can come in two categories, one produces output with only one colour (i.e. black colour) and the other one produces output in multicolour.

Inkjet Printers

Laser Printers

Laser Printers (Non-Impact Printer)

Laser printers produce high quality paper prints at a high speed (with an average speed as 6 to 12 pages per minute).

They are almost noiseless and use dry magnetic ink technology.

Plotter

A plotter (also known as a graph plotter) is an output device, which produces high quality diagrams on paper. Colour pens are used to draw lines on the paper which is placed in the plotter.

Some plotters have a flat area (plotter base) to put the paper on. These are known as flatbed plotters. There is another type of plotters, the roller plotter which uses a large roll of paper mounted on a roller. Usually a plotter is capable of producing prints on very large size paper sheets but have a speed slower than printers. Graph plotters are used for drawing building plans, graphs and three-dimensional drawings. They are often used by architects and engineers designing machines, bridges, etc.

Comparison between Impact printers and Non-Impact printers

Impact Printers	Non-Impact Printers
Work like typewriter and use striking/hammering action.	They use thermal, electrostatic chemical and inkjet technologies.
Print in black or single colour.	Produce single colour/multicolouroutput.
Are noisy.	Almost noiseless.
High resolution graphics cannot be produced	High resolution graphics can be produced
Examples: Dot Matrix Printer,	Laser and Inkjet

Softcopy Output Display Devices

Video Display System provides a visual link between the user and the computer. The videos subsystem of a PC consists of two main components:

(a) Monitor and
(b) Video adapter (also called video card or graphic adapter)

monitor is a display device which can produce text and graphic as output.

A monitor may use different display technologies like a Cathode Ray Tube (CRT) and Liquid Crystal Display (LCD).

CRT contains a vacuum tube which is used for display on screen in a computer.

LCD is a technology in which molecules of a liquid crystal line up in such a manner that it creates images on the screen by blocking or transmitting light on the screen.

Audio Response Unit

As a voice recognition system allows the user to talk to a computer, a voice response system permits a computer to talk back to the user. Many organizations use audio response systems to respond to human inquiries that are transmitted over telephone lines to the central computer.

Voice output is useful for people who are partially sighted.

The computer can read word processed documents and communicate by sound output from the computer. Voice output is also useful for those who are physically handicapped and cannot speak.

By typing on a keyboard they are able to communicate using the spoken word. Directory enquiries at Telecom Services use voice output to tell the caller the number that the computer system has found. Voice output is also used in multimedia presentations and provides a valuable means of communication.

Lecture -2

1. What are the two types of output devices based on the method of printing?
a) Laser printers and inkjet printers
b) Impact printers and non-impact printers
c) Dot-matrix printers and daisy wheel printers
d) Chain printers and drum printers
Answer: b) Impact printers and non-impact printers

2. Which of the following is an example of an impact printer?
a) Dot-matrix printer
b) Laser printer
c) Inkjet printer
d) Flatbed plotter
Answer: a) Dot-matrix printer

3. Which of the following is an example of a non-impact printer?
a) Daisy wheel printer
b) Drum printer
c) Inkjet printer
d) Chain printer
Answer: c) Inkjet printer

4. What is an Audio Response Unit?
a) A device that allows the user to talk to a computer
b) A device that permits a computer to talk back to the user
c) A device that produces high-quality diagrams on paper
d) A device that displays results in electronic or paper medium
Answer: b) A device that permits a computer to talk back to the user

5. What are the common output devices which produce output that is easily understood?
a) Printers and Monitors
b) Keyboard and Monitors
c) Printers and Keyboard
d) Scanner and Monitors
Answer: a) Printers and Monitors

6. What type of printers are ideal to be used for carbon copies?
a) Inkjet Printers
b) Laser Printers
c) Impact Printers
d) Non-Impact Printers
Answer: c) Impact Printers

7. Which of the following is a display device which can produce text and graphic as output?
a) Audio Response Unit
b) Video Display System
c) Printer
d) Scanner
Answer: b) Video Display System

8. Which of the following is a technology in which molecules of a liquid crystal line up in such a manner that it creates images on the screen by blocking or transmitting light on the screen?
a) CRT
b) LCD
c) LED
d) Plasma
Answer: b) LCD

9. What are the two main components of the video subsystem of a PC?
a) Monitor and Keyboard
b) Monitor and Mouse
c) Monitor and Video adapter
d) Monitor and Hard Disk
Answer: c) Monitor and Video adapter

10. Which of the following is a type of impact printer?
a) Laser Printer
b) Inkjet Printer
c) Dot-matrix Printer
d) Thermal Printer
Answer: c) Dot-matrix Printer

11. Which of the following is a type of output device used for specific purposes?
a) Sound Card
b) Speakers
c) Video Card
d) All of the above
Answer: d) All of the above

12. Which of the following is a type of display technology used in monitors?
a) Plasma
b) LED
c) CRT
d) OLED
Answer: c) CRT

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13. In the text, which of the following is an example of a hardcopy output device?
a) Printer
b) Monitor
c) Sound card
d) Projector
Answer: a) Printer

14. Which of the following is a characteristic of impact printers?
a) They are quiet in operation.
b) They use thermal, electrostatic, chemical or inkjet technology to produce printed output.
c) They are capable of producing high resolution graphics.
d) They use some sort of striking/hammering action to press carbon or fabric ribbon against paper to create a character or a pattern.
Answer: d) They use some sort of striking/hammering action to press carbon or fabric ribbon against paper to create a character or a pattern.

15. Which of the following is an example of a non-impact printer?
a) Dot-matrix printer
b) Daisy wheel printer
c) Drum printer
d) Inkjet printer
Answer: d) Inkjet printer

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True and False Questions

1. Output devices of a computer are used to display results in an electronic or paper medium.
2. Dot-matrix printers are non-impact printers that use a striking/hammering action to press carbon or fabric ribbon against paper to create a character or a pattern.
3. Impact printers use thermal, electrostatic, chemical or inkjet technology to produce printed output and are fast and quiet in operation.
4. A plotter is an output device that produces high quality diagrams on paper using color pens to draw lines on the paper.

Answers:
1. True
2. False (Impact Printer)
3. False (non-Impact Printer)
4. True

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Explanation Questions:

1. What are the two main categories of output devices?
2. What is the difference between impact and non-impact printers?
3. What are some common non-impact printers?
4. What is the purpose of an audio response unit?

Answers:

1. The two main categories of output devices are hardcopy output and softcopy output.
2. Impact printers use a striking or hammering action to print characters, images, and symbols on paper, while non-impact printers form characters or images without making print heads strike the paper.
3. Some common non-impact printers are inkjet printers and laser printers.
4. The purpose of an audio response unit is to allow a computer to talk back to the user, providing a valuable means of communication for those who are physically handicapped or partially sighted.

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Some review questions from Lecture-1 مراجعة لاسئلة المحاضرة الاولى

1. What is a computer?

a) An electronic device that processes data.

b) A device used for communication.

c) A tool used for cooking.

d) A machine used for transportation.

2. What are the two major types of computers based on their way of handling data?

a) Analogue and Hybrid

b) Digital and Hybrid

c) Analogue and Digital

d) Digital and Micro

3. Which type of computer works on continuous variables like waves of the signal?

a) Digital computer

b) Hybrid computer

c) Analogue computer

d) Microcomputer

4. What is the smallest single user computer called?

a) Microcomputer

b) Digital computer

c) Portable computer

d) Mainframe computer

5. What is a laptop?

a) A portable computer that can sit on the lap.

b) A small device that fits in the palm.

c) A powerful single-user computer.

d) A computer that works on continuous variables.

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6. What are the output devices of a computer used for?

a) Displaying results in electronic or paper medium

b) Storing data digitally

c) Processing data

d) Receiving input from the user

7. Which type of output device produces hardcopy output?

a) Printers

b) Monitors

c) Projectors

d) Sound cards

8. Which type of printers use striking/hammering action to create characters or patterns on paper?

a) Impact printers

b) Non-impact printers

c) Laser printers

d) Inkjet printers

9. What is the main component of a video display system?

a) Monitor

b) Printer

c) Keyboard

d) Central Processing Unit

10. What is the purpose of an audio response unit?

a) To allow the user to talk to the computer

b) To produce sound output from the computer

c) To read word processed documents

d) To find telephone number

Fill the blanks: - المفصل هو الفراغ الذي يجب معرفة اجابته

1. **Impact printers** are noisy and are not capable of producing high resolution graphics.
2. The most common character impact printers are **daisy wheel and dot matrix.**
3. The most common Line impact printers are **chain printers and drum printers**.
4. Non- Impact Printers use **thermal, electrostatic, chemical or inkjet technology** to produce printed output.
5. Non-Impact printers are **fast and quiet** in operation.
6. The most common non-impact printers are **inkjet printers and laser printers**.
7. The smallest unit of data size in computer called **Bit**.
8. Video Display System provides a visual link between **the user and the computer**.
9. **Video Display System** provides a visual link between the user and the computer.
10. **Cathode Ray Tube (CRT)** contains a vacuum tube which is used for display on screen in a computer.
11. **Liquid Crystal Display (LCD)** is a technology in which molecules of a liquid crystal line up in such a manner that it creates images on the screen by blocking or transmitting light on the screen.

Q/ Compare between Impact and non-Impact printers?

Impact Printers	Non-Impact Printers
Work like typewriter and use striking/hammering action.	They use thermal, electrostatic chemical and inkjet technologies.
Print in black or single colour.	Produce single colour/multicolouroutput.
Are noisy.	Almost noiseless.
High resolution graphics cannot be produced	High resolution graphics can be produced
Examples: Dot Matrix Printer,	Laser and Inkjet

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Q1/ why we use Output units in computers? Can you classify it to types? What are the common types of Output units?

Answer:-

The output devices of the computer are used to display results in electronic or paper medium.

It can be classified into Hardcopy and Softcopy Output.

Common output devices which produce output that is easily understood are Printers and Monitors.

Q2/ what printer can print? And according to their technology of printing how many types we have? Just count them.

Answer:-

Printer prints characters, images and symbols on paper.

On the basis of the printing technique used, printers may be classified into two types

1- Impact Printers
2- Non-Impact Printers.

Q3/ What are the characteristics of Impact printers? Give examples of it?

Answer:-

1- They use some sort of striking/hammering action.
2- These devices are noisy.
3- They are not capable of print high resolution graphics

The most common impact printers are:-

1- Character printers (e.g. daisy wheel, dot matrix)
2- Line printers (e.g. chain printers, drum printers).

Q4/ which one is fast than the other:-

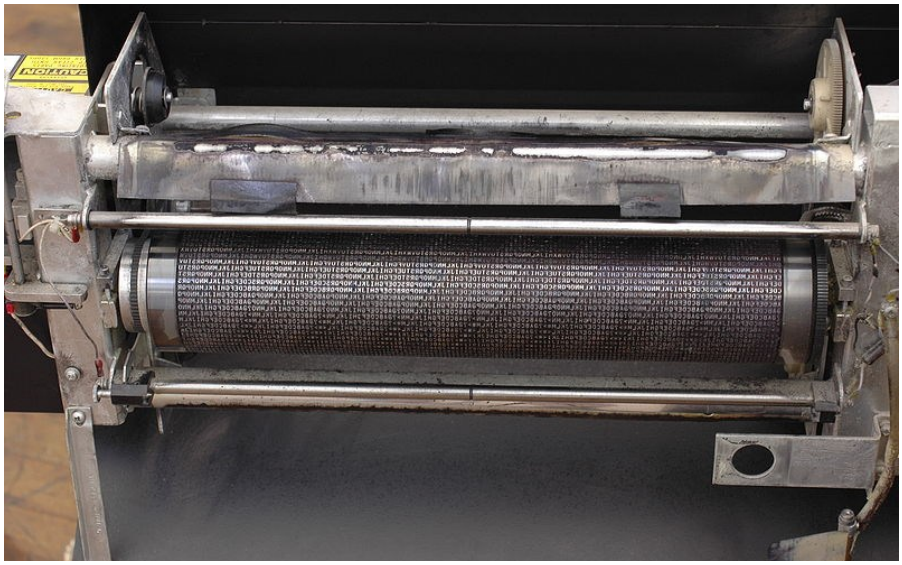
1- Daisy wheel or drum printers.
2- Chain or dot matrix printers.
3- Drum or chain printers.

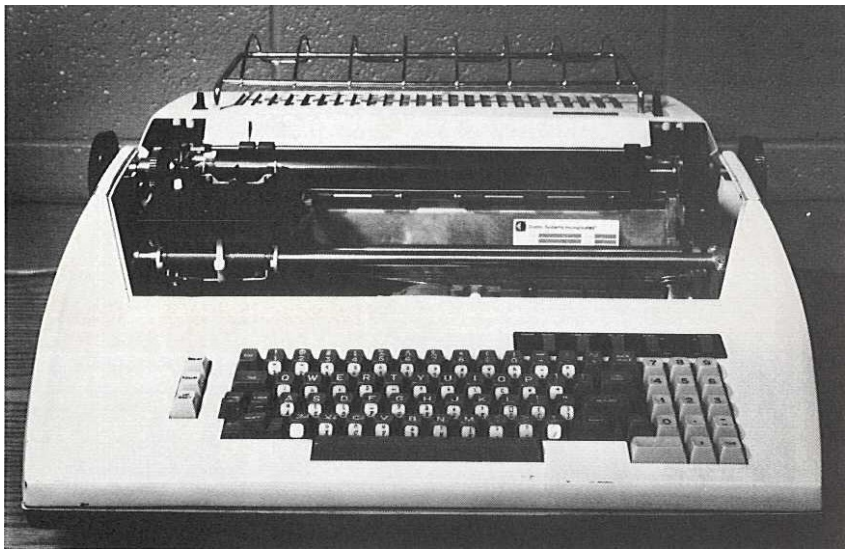
Q5/ which one of these types are Character or Line printers:-

(Daisy wheel Printers, drum printers, Chain Printers or dot matrix printers)

Q6/ can you name these printers:-

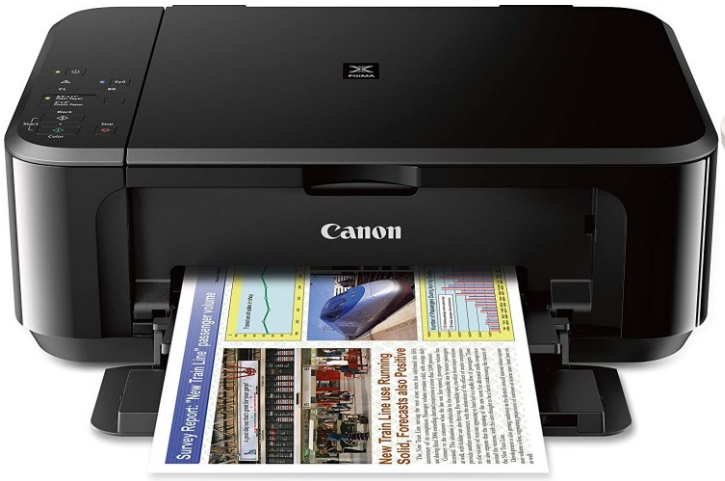
(Search about it)





Q7/ can you name these printers:-

(Search about it)



Q8/ What are the characteristics of non-Impact printers? Give examples of it?

Answer:-

1- They print characters or images without striking/hammering the paper.
2- They use thermal, electrostatic, chemical or inkjet technology.
3- They are fast and quiet in operation.

The most common of non-impact printers are

1- Inkjet printers and
2- Laser printers.

Q9/ Which one is faster:-

a- Chain or laser printer.
b- Dot marix or Inkjet printers.
c- İmpact or non impact printers.
d- Drum or daisy wheel printers.
e- Daisy wheel or laser printers

Q10/ Repeat Q9 to show which one is more quite?

Q11/ Fill in the blanks:-

1- printers called ....., which print black and white papers.
2- printers called ....., which print in colour papers.
3- plotter is also known as a .....which is used for.....and .....

Q12/ compare beween Impact and non impact computers?

Answer:

Impact Printers	Non-Impact Printers
Work like typewriter and use striking/hammering action.	They use thermal, electrostatic chemical and inkjet technologies.
Print in black or single colour.	Produce single colour/multicolouroutput.
Are noisy.	Almost noiseless.
High resolution graphics cannot be produced	High resolution graphics can be produced
Examples: Dot Matrix Printer,	Laser and Inkjet

Q13/ what are the Softcopy Output Display Devices? Give examples of it?

Answer:

(a) Monitor, like a Cathode Ray Tube (CRT) and Liquid Crystal Display (LCD).

(b) Video adapter.

Q14/ what we mean by each one? Just give the english full word?

1- CRT.
2- LCD.

Answer:-

1- Cathode Ray Tube.
2- Liquid Crystal Display.

Q14/can you define this?

A scanner is an input device that scans documents such as photographs and pages of text.

When a document is scanned, it is converted into a digital format. This creates an electronic version of the document that can be viewed and edited on a computer.

Scanner is ideal for photographs, magazines, and various documents.

Lecture 3

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كلية التربية للعلوم الصرفة

قسم علوم الحاسبات

جامعة ديالى

2021-2020

تقنيات وتركيب الحاسوب – المرحلة الاولى

MEMORY OR STORAGE DEVICES

Memory is required in a computer to store programs and the data processed by programs.

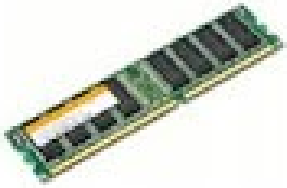
Computer memory is made up of a large number of cells. Each cell is capable of storing one *bit* of information in the form of binary numbers.

Memory in a computer system is required for the storage and subsequent retrieval of instruction and data. A computer system uses a variety of devices for storing instructions and data required for its operations.

MEMORY OR STORAGE DEVICES

COMPUTER STORAGE OR MEMORY DEVICES

Hard Disk



RAM

ROM

CD/DVD

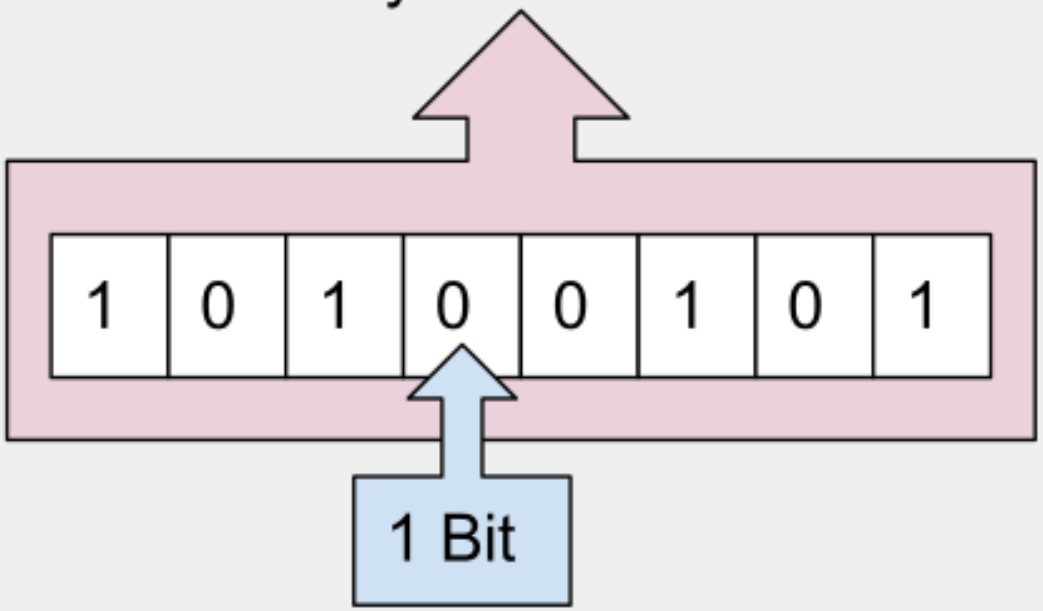
Floppy

Memory Card

Pen Drive

Tape

MEMORY OR STORAGE DEVICES



1 byte	= 8 bits
1 kilobyte	= 1024 bytes
1 megabyte	= 1024 kilobyte
1 gigabyte	= 1024 megabyte
1 terabyte	= 1024 gigabyte

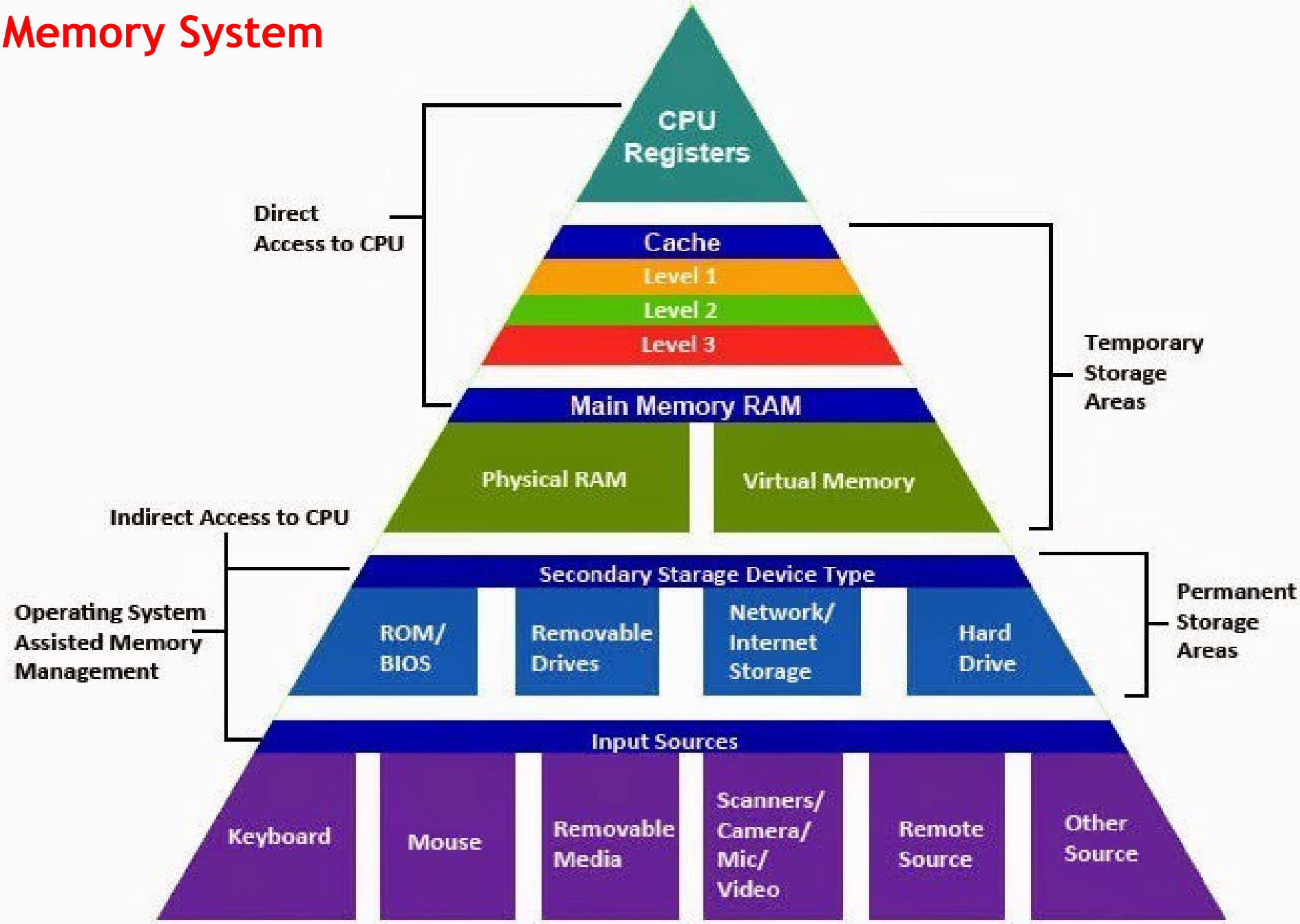
Memory System

Normally, the information to be stored on a computer is classified in two basic categories – data and instructions. Although a memory system is a very simple system, it exhibits a wide range of technology. But unfortunately, faster memory is more costly.

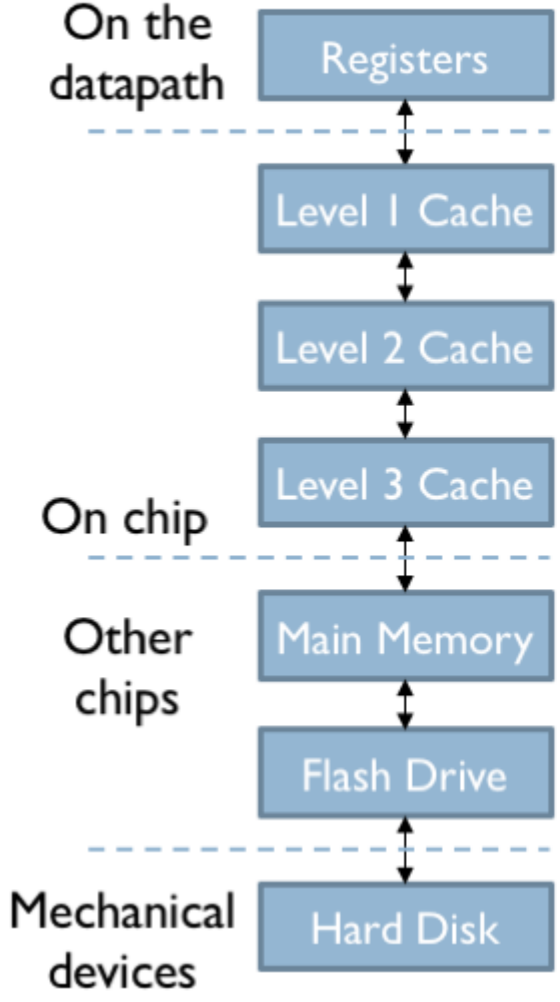
On the other hand, memories with smaller cost have very high access time. This is the time taken by the CPU to access a location in memory. This results in slower operation of the CPU.

Thus, the cost versus access time has led to a hierarchy of memory where we supplement fast memories with larger, cheaper and slower memories. Therefore, memory system may have different types, costs, organisations, technologies and performances.

Memory System



Memory System



Access time	Capacity	Managed By
1 cycle	1 KB	Software/Compiler
2-4 cycles	32 KB	Hardware
10 cycles	256 KB	Hardware
40 cycles	10 MB	Hardware
200 cycles	10 GB	Software/OS
10-100us	100 GB	Software/OS
10ms	1 TB	Software/OS

Memory System

Types of Memory

A memory system can be considered to consist of three types of memories. These are as follows:

1. Internal processor memories
2. Primary memory or main memory
3. Secondary or auxiliary memory

Any storage unit of a computer may have the following characteristics:

Storage capacity is the amount of information/data a storage unit can hold. Accessing the data to/from these memories may be fast or slow.

The speed and availability of inexpensive memory has ad enormous impact on computer technology. The high speed memory devices are more expensive and occupy less space in comparison to the slow speed memory devices.

Memory System

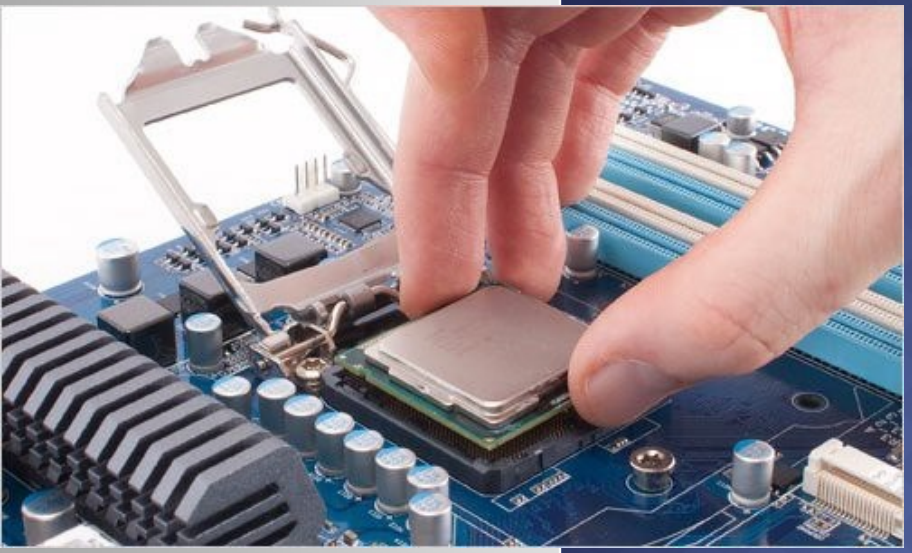
Internal Processor Memories

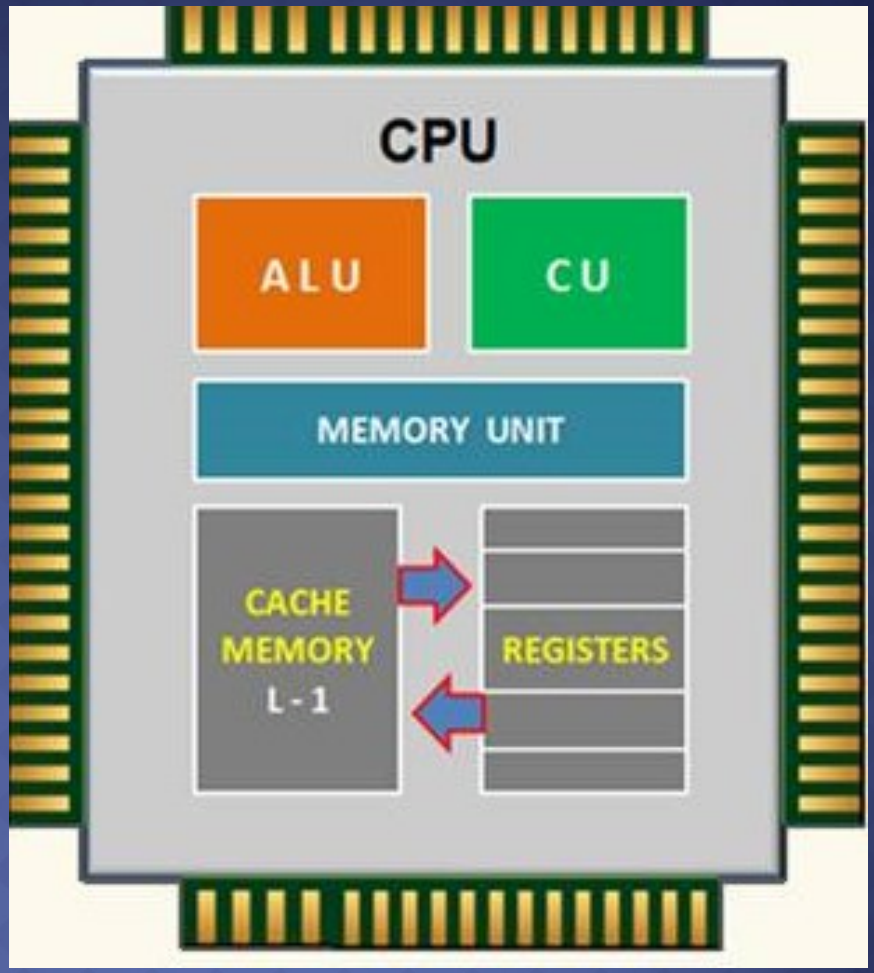
These consist of the small set of high-speed registers and high speed buffer memory (cache) which are internal to a processor and are used as temporary locations where actual processing is done.

Register is a small amount of storage available on the CPU whose contents can be accessed more quickly than storage available elsewhere.

Processor registers are at the top of the memory hierarchy and provide the fastest way for a CPU to access data.

Memory System





Memory System

The important registers, within the CPU are:

Program Counter (PC). A program counter keeps track of the next instruction to be executed.

Instruction Register (IR) is a register which holds instruction to be decoded by the control unit.

Memory Address Register (MAR), is a register which points to the memory location which the CPU plans to access, either for reading or for writing.

MBR (memory buffer register) which is also referred to as memory data register.

(MDR) Memory Data Register is used for storage data either coming to the CPU or data being transferred by the CPU.

Acculmular (ACC) is a general purpose register used for storing variables, temporary results and results produced by arithmetic logic unit of the CPU.

Memory System

Cache Memory

Cache memory is a small high speed buffer memory used to hold instructions temporarily during processing.

The CPU of a computer system commonly uses cache memory where it holds or buffers the contents of the main memory because the CPU runs much faster than the main memory.

Thus to reduce the waiting time of the CPU the cache is used. Cache memory reduces traditional system bottlenecks because system RAM is much slower than CPU.

This prevents the processor from having to wait for a program and data from slower main memory.

A cache typically operates by retaining copies of blocks of storage, each containing recently used information. This memory (or caches) is usually transparent or invisible to the processor.

Memory System

LEVELS OF CACHE MEMORY:

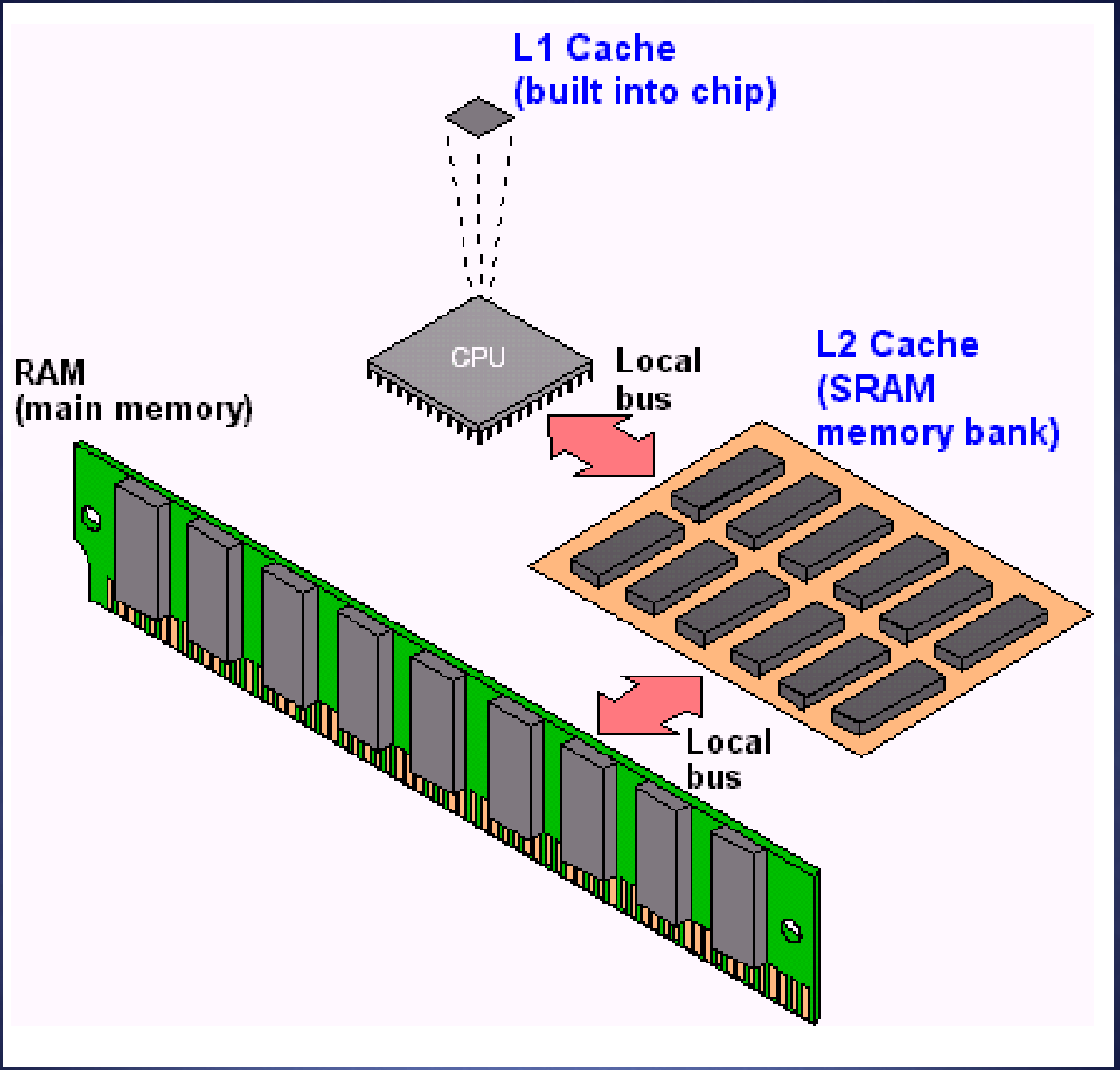
There are levels of cache memory, defined by a chips proximity to CPU.

I. **Level 1:** cache is memory built onto CPU chip for storage of data or commands just been used.

II. **Level 2**: cache is located on CPU chip but slightly father away from CPU or on spate chip next to CPU. Therefore takes longer to access. Contains more storage area than Level 1.

III. **Level 3:** slower for CPU to reach but larger in size, similar to Level 2.

Memory System



Memory System

Cache is a collection of data duplicating original values stored elsewhere or computed earlier, where the original data is expensive to fetch (owing to longer access time) or to compute, compared to the cost of reading the cache.

In other words, a cache is a temporary storage area where frequently accessed data can be stored for rapid access. Once the data is stored in the cache, future use can be made by accessing the cached copy rather than refetching or recomputing the original data, so that the average access time is reduced.

Memory System

Primary Memory

It is a large memory which is fast but not as fast as an internal processor register. The processor directly accesses this memory. The primary memory or the main memory is part of the main computer system.

The processor or the CPU directly stores and retrieves information from it. This memory is accessed by the CPU, in a random fashion. That means any location of this memory can be accessed by the CPU to either read information from it, or store information in it.

The primary memory itself is implemented by two types of memory technologies. The first is called *Random Access Memory (RAM)* and the other is Read Only Memory (ROM).

Memory System

A more appropriate name for RAM is RWM (read write memory), the CPU can write and read information from any primary memory location implemented using RAM.

The other part of primary memory is implemented using ROM which stands for Read Only Memory.

There are two types of built-in memory, permanent and temporary, known as ROM and RAM, respectively, details of each given below:

Memory System

Read Only Memory (ROM)

As we know, in the computer terminology, *read* means transferring data instruction from an input source to the computers, main memory (or CPU) and *write* is transferring data/instruction from computer's main memory to an output device.

Therefore, read only means data/ instruction can be retrieved from the ROM chip but cannot be modified.

Memory System

Types of ROM

Basically, there are two types of ROM, namely, manufacturer programmed and user-programmed.

Manufacturer-Programmed Read Only Memory

Manufacturer-programmed ROM is one in which data is stored in it permanently by the manufacturer of the ROM. For example, a computer manufacturer may store the system boot program permanently in the ROM chip used on the motherboard.

Memory System

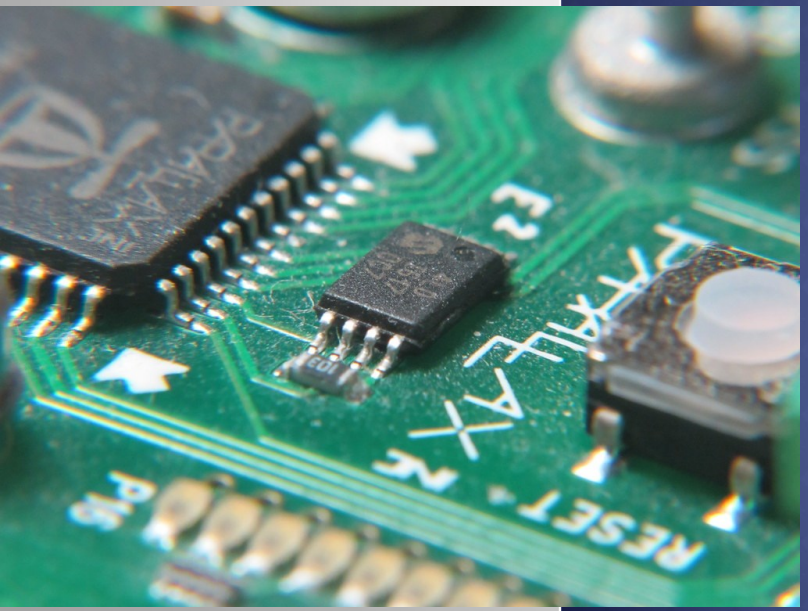
User-Programmed Read Only Memory

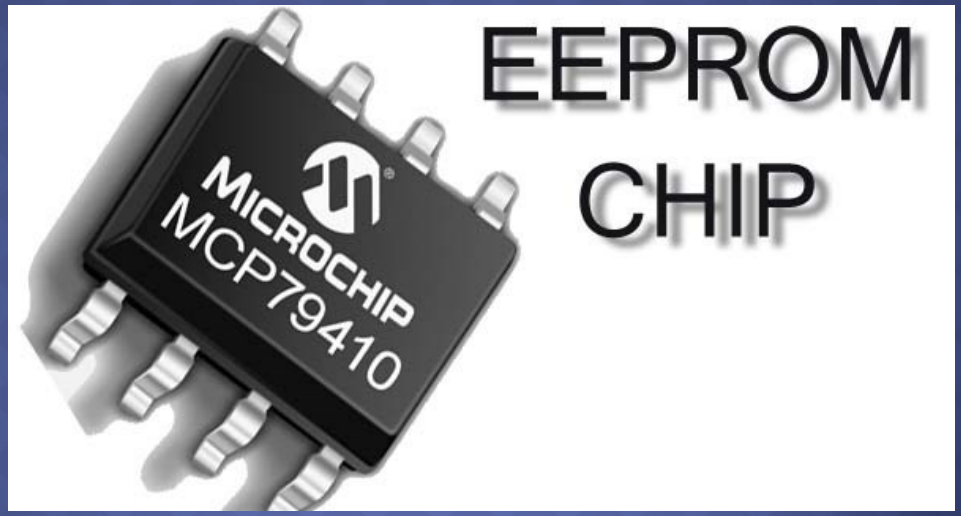
User-programmed ROM is one in which the user can load and store “read-only” programs and data. Such a ROM is commonly known as

PROM (programmable read-only memory), because, a user can program it. PROM is a memory chip on which we can store a program. But once the PROM has been used, we cannot wipe it clean and use it to store something else. Like ROMs, PROMs are non-volatile.

Other kinds of user-programmed ROM are EPROM and EEPROM. Both of these are special types of PROM. EPROM (erasable programmable read-only memory) can be erased by exposing it to ultraviolet light while EEPROM (electrically erasable programmable read-only memory) can be erased by exposing it to an electrical charge.

Memory System



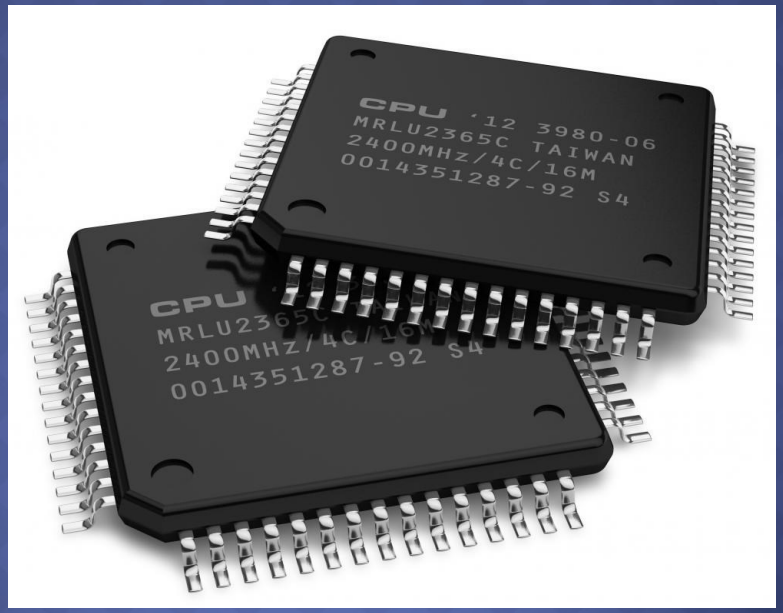


Memory System

Flash EEPROM memory

works much faster than traditional EEPROMs because instead of erasing one byte at a time, it erases a block or the entire chip, and then rewrites it.

The electrons in the cells of a Flash-memory chip can be returned to normal (“1”) by the application of an electric field, a higher-voltage charge.



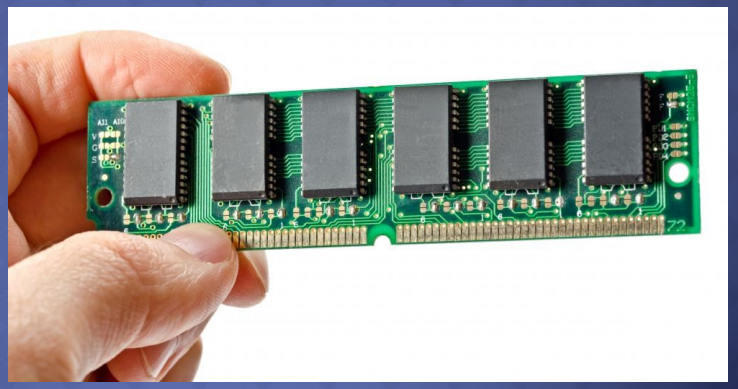
Memory System

Random Access Memory (RAM)

RAM chips are meant for primary storage. They hold temporarily (*a*) software/program instructions and (*b*) data before and after processing.

"Random Access" means that any location can be referenced in the same time and in the same manner, as it is independent of the address or location in the memory. It is a volatile memory. It holds data and instructions, during their execution.

The additional RAM chip can be plugged into the special socket on the motherboard known as Single In-Line Memory Module (SIMM). Random Access Memory capacity ranges from 16 MB to 4 GB on personal computers.



Memory System

Types of RAM

RAM chips are of two types, namely, *static* RAM (SRAM) and *dynamic* RAM (DRAM).

Static RAM (SRAM)

The SRAM can store data as long as power is applied, without the need for periodically rewriting the data into memory.

Contents (memory cell) of this RAM will stay in a given state (store a bit) indefinitely, provided that power to the memory circuit is not interrupted. The main applications of SRAM are in areas where only small amounts of memory are needed or where high speed is required.

Advantage

SRAM can provide very high speed.

Disadvantage

SRAM is costly and has low power packing density.

Memory System

Dynamic RAM (DRAM)

This memory stores data as charges on capacitors. With Dynamic RAM, the stored data will gradually disappear because of capacitor discharge, so that it is necessary to periodically refresh the data (i.e. recharge the capacitors).

In the process of refreshing, the information is read from the memory cell and written back in the same position.
Typically, each memory cell of a DRAM must be refreshed at least every 2 to 10 millisecond or its data will be lost.
Advantage
It has high capacity and power consumption is low.
Disadvantage
The need for refreshing of dynamic RAM because some external refreshing circuits is required.

Memory System

Comparison between ROM and RAM

RAM (Random Access Memory)	ROM (Read only Memory)
It is a volatile memory.	It is a non-volatile memory.
It is a read-write memory.	It is a read-only memory.
It loses the data stored in it when the power is turned off	The data inside it retains even if the power of the CPU is switched off.
It is a temporary storage.	It is a permanent storage.
It is costlier than ROM.	It is cheaper.
It can hold a large amount of data as compared to ROM.	It can only store small amount of data.
It is faster.	It is slower.
The data in RAM can be Modified easily.	ROM can be hardly or never be modified.
It is used in the normal operations of a computer.	It is used primarily in the startup process of a computer

Memory System

Secondary or Auxiliary Memory

Auxiliary memory is much larger in size than main memory but is slower than the latter. It normally stores system programs and data files. These cannot be accessed directly by the processor.

Secondary or auxiliary memory, also known as secondary storage, is the memory that supplements the main storage. This is a long-term, non-volatile memory. The term non-volatile means it stores and retains the programs and data even after the computer is switched off. Unlike RAM which looses the contents when the computer is turned off and ROM to which it is not possible to add anything new,

auxiliary storage device allows a computer to record information semi-permanently. This is to ensure that this information can be read later by the same computer or by another computer.

Memory System

Auxiliary storage devices are also useful in transferring data or programs from one computer to another.

They also function as backup devices which allows backup of the valuable information that we are working on. So, even if by some accident our computer crashes and the data in it is in unrecoverable mode, we can restore it from your backups.

The most common types of auxiliary storage devices are floppy disks, hard disks, magnetic tapes and magnetic disks.

Memory System

Sequential and Random Auxiliary Storage Devices

Based on the type of data access, sequential and random, auxiliary storage devices can be classified as sequential access media and random media.

In case of sequential access media, data stored in media can only be read in sequence.

To get to a particular point on media, we have to go through all the preceding points. Magnetic tapes are examples of sequential access media.

In contrast, disks are random access media, also called direct access media, because a disk drive can access any point at random without passing through intervening points. Other examples of direct access media are magnetic disks, optical disks, etc.

Memory System

Floppy Disk

Floppy disk is a soft magnetic disk. It is called floppy because it flops if we wave it. The data on the floppy disk is organized in terms of tracks and sectors. Unlike most of the hard disks, floppy disks are portable because these can be removed from a disk drive.

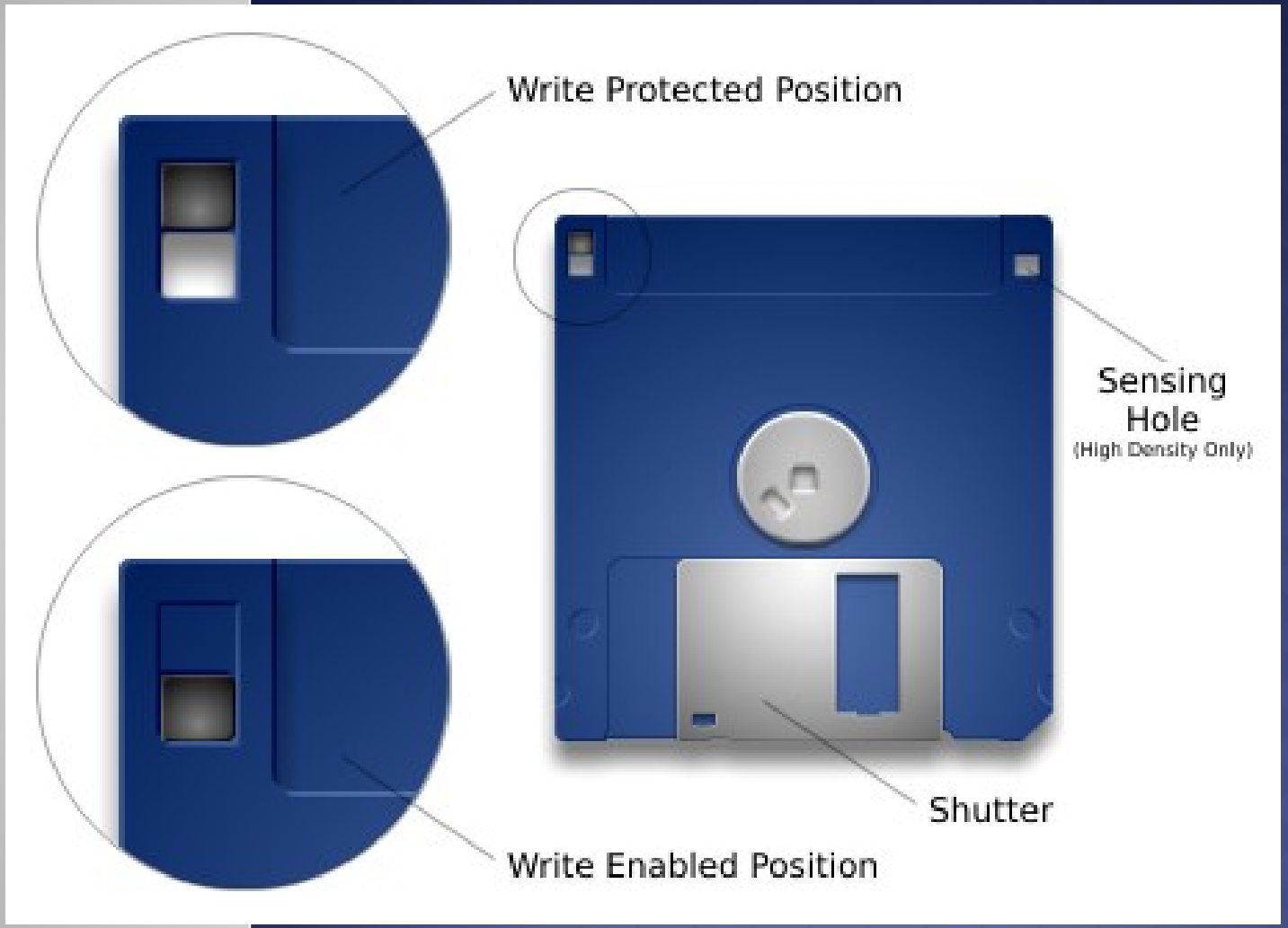
for floppy disks are called floppy drives. Floppy disks are slower to access than hard disks and have less storage capacity but are less expensive and are portable.

There are two basic sizes of a floppy, namely 5¼ inch and 3½ inch.

5¼ inch : This type of floppy is generally capable of storing between l00K and 1.2MB of data. The most common sizes are 360K and 1.2MB.

3½ inch : Despite their small size, these floppies have a large storage capacity than their cousins – from 400K to 1.4MB of data.

Memory System



Memory System

Optical Disk

An optical disc is an electronic data storage medium that can be written to and read using a low-powered laser beam. Optical disk can store much more data, i.e. up to 6 GB. There are three basic types of optical disks namely, CD-ROM, WORM and Erasable.

CD-ROM : Like audio CDs, CD-ROMs come with data already encoded onto them. The data is permanent and can be read any number of times but CD-ROMs cannot be modified.

Memory System

WORM :

This term stands for “Write Once, Read Many” with a WORM disk drive. One can write data only once onto a WORM disk. After that, the disk behaves just like a CD-ROM.

Erasable :

Optical disks that can be erased and loaded with new data are just like magnetic disks. These are often referred to as EO (Erasable Optical) disks.

Memory System

DVD (Digital Versatile Disc or Digital Video Disc)

is a digital optical disc data storage format invented and developed in 1995 and released in late 1996.

The medium can store any kind of digital data and was widely used for software and other computer files as well as video programs watched using DVD players.

DVDs offer higher storage capacity than compact discs while having the same dimensions.

Discs with multiple layers

Like other optical disc formats before it, a basic DVD disc—known as DVD-5 in the DVD Books, while called Type A in the ISO standard—contains a single data layer readable from only one side.

However, the DVD format also includes specifications for three types of discs with additional recorded layers, expanding disc data capacity beyond the 4.7 GB of DVD-5 while maintaining the same physical disc size.

Memory System

Double-sided discs

Borrowing from the LaserDisc format, the DVD standard includes DVD-10 discs (Type B in ISO) with two recorded data layers such that only one layer is accessible from either side of the disc. This doubles the total nominal capacity of a DVD-10 disc to 9.4 GB, but each side is locked to 4.7 GB. Like DVD-5 discs, DVD-10 discs are defined as single-layer (SL) discs.

Double-sided discs identify the sides as A and B. The disc structure lacks the dummy layer where identifying labels are printed on single-sided discs, so information such as title and side are printed on one or both sides of the non-data clamping zone at the center of the disc.

DVD-10 discs fell out of favor because, unlike dual-layer discs, they require users to manually flip them to access the complete content (a relatively egregious scenario for DVD movies) while offering only a negligible benefit in capacity. Additionally, without a non-data side, they proved harder to handle and store.

Memory System

Designation		Sides	Layers (total)	Diameter (cm)	Capacity (GB)
DVD-R	SS SL (1.0)	1	1	12	3.95
DVD-R	SS SL (2.0)	1	1	12	4.70
DVD-RW	SS SL	1	1	12	4.70
DVD+R	SS SL	1	1	12	4.70
DVD+RW	SS SL	1	1	12	4.70
DVD-R	SS DL	1	2	12	8.50
DVD-RW	SS DL	1	2	12	8.54
DVD+R	SS DL	1	2	12	8.54
DVD+RW	SS DL	1	2	12	8.54
DVD-RAM	SS SL	1	1	8	1.46*
DVD-RAM	DS SL	2	1	8	2.47*
DVD-RAM	SS SL (1.0)	1	1	12	2.58
DVD-RAM	SS SL (2.0)	1	1	12	4.70
DVD-RAM	DS SL (1.0)	2	1	12	5.15
DVD-RAM	DS SL (2.0)	2	1	12	9.39*

SS = single-sided, DS = double-sided, SL = single-layer, DL = dual-layer

Designation		Sides	Layers (total)	Diameter (cm)	Capacity (GB)
DVD-1[46]	SS SL	1	1	8	1.46
DVD-2	SS DL	1	2	8	2.65
DVD-3	DS SL	2	2	8	2.92
DVD-4	DS DL	2	4	8	5.31
DVD-5	SS SL	1	1	12	4.70
DVD-9	SS DL	1	2	12	8.54
DVD-10	DS SL	2	2	12	9.40
DVD-14[39]	DS SL+DL	2	3	12	13.24
DVD-18	DS DL	2	4	12	17.08

Memory System

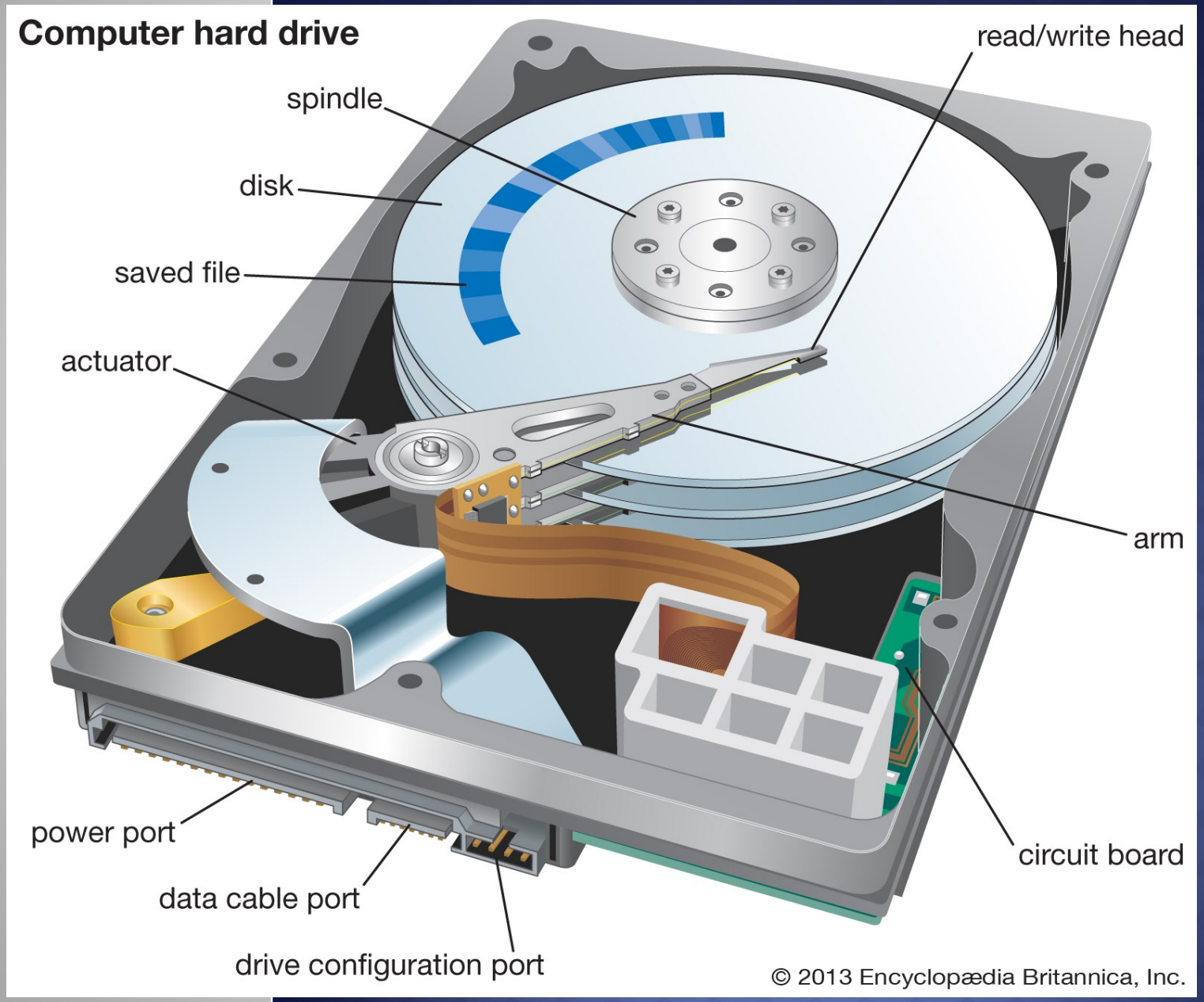
Hard Disk

Hard disk is a magnetic disk on which computer data can be stored. Hard disks hold more data and are faster than floppy disks.

A single hard disk usually consists of several platters. Each platter requires two read/write heads, one for each side.

All the read/write heads are attached to a single access arm so that they cannot move independently. Each platter has the same number of tracks. A track location that cuts across all platters is called a cylinder. For example, a typical 84 MB hard disk for a PC might have two platters (four sides) and 1,053 cylinders.

Memory System



Lecture 4

الدكتور المهندس محمد سامي محمد

كلية التربية للعلوم الصرفة

قسم علوم الحاسبات

جامعة ديالى

2021-2020

تقنيات وتركيب الحاسوب – المرحلة الاولى

Memory System

Read Only Memory (ROM)

As we know, in the computer terminology, *read* means transferring data instruction from an input source to the computers, main memory (or CPU) and *write* is transferring data/instruction from computer's main memory to an output device.

Therefore, read only means data/ instruction can be retrieved from the ROM chip but cannot be modified.

Memory System

Types of ROM

Basically, there are two types of ROM, namely, manufacturer programmed and user-programmed.

Manufacturer-Programmed Read Only Memory

Manufacturer-programmed ROM is one in which data is stored in it permanently by the manufacturer of the ROM. For example, a computer manufacturer may store the system boot program permanently in the ROM chip used on the motherboard.

Memory System

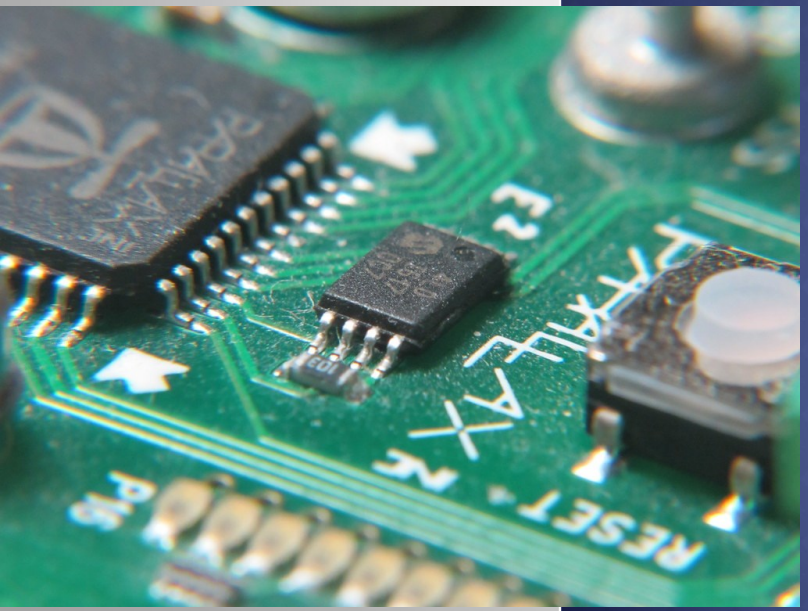
User-Programmed Read Only Memory

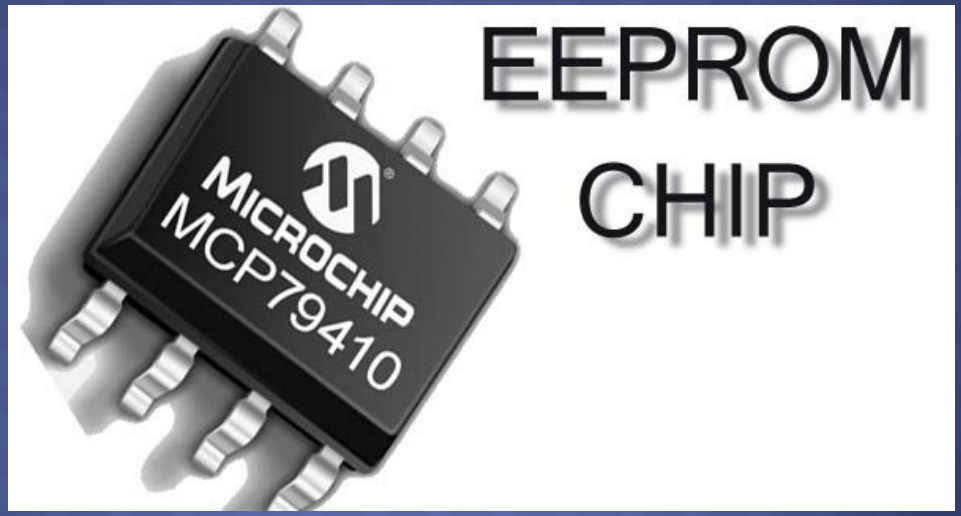
User-programmed ROM is one in which the user can load and store “read-only” programs and data. Such a ROM is commonly known as

PROM (programmable read-only memory), because, a user can program it. PROM is a memory chip on which we can store a program. But once the PROM has been used, we cannot wipe it clean and use it to store something else. Like ROMs, PROMs are non-volatile.

Other kinds of user-programmed ROM are EPROM and EEPROM. Both of these are special types of PROM. EPROM (erasable programmable read-only memory) can be erased by exposing it to ultraviolet light while EEPROM (electrically erasable programmable read-only memory) can be erased by exposing it to an electrical charge.

Memory System



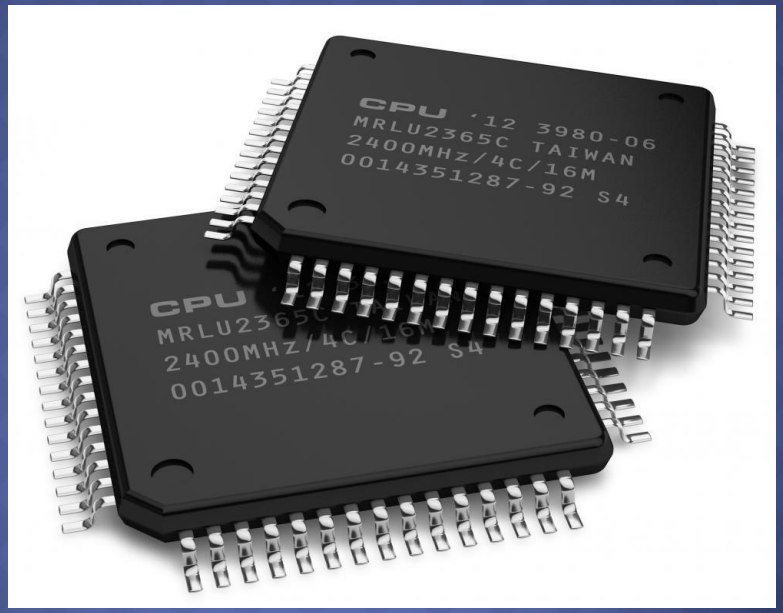


Memory System

Flash EEPROM memory

works much faster than traditional EEPROMs because instead of erasing one byte at a time, it erases a block or the entire chip, and then rewrites it.

The electrons in the cells of a Flash-memory chip can be returned to normal (“1”) by the application of an electric field, a higher-voltage charge.



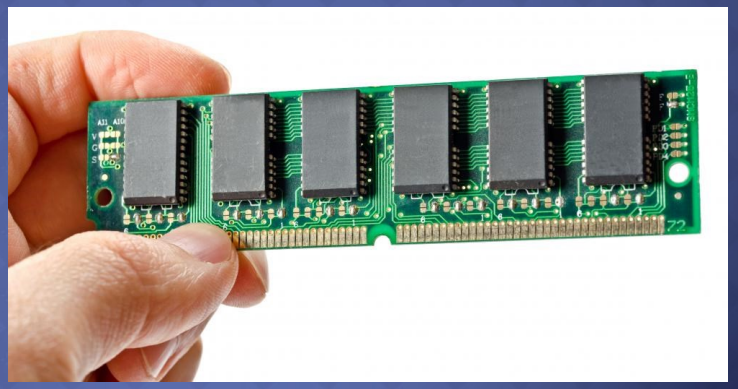
Memory System

Random Access Memory (RAM)

RAM chips are meant for primary storage. They hold temporarily (*a*) software/program instructions and (*b*) data before and after processing.

"Random Access" means that any location can be referenced in the same time and in the same manner, as it is independent of the address or location in the memory. It is a volatile memory. It holds data and instructions, during their execution.

The additional RAM chip can be plugged into the special socket on the motherboard known as Single In-Line Memory Module (SIMM). Random Access Memory capacity ranges from 16 MB to 4 GB on personal computers.



Memory System

Types of RAM

RAM chips are of two types, namely, *static* RAM (SRAM) and *dynamic* RAM (DRAM).

Static RAM (SRAM)

The SRAM can store data as long as power is applied, without the need for periodically rewriting the data into memory.

Contents (memory cell) of this RAM will stay in a given state (store a bit) indefinitely, provided that power to the memory circuit is not interrupted. The main applications of SRAM are in areas where only small amounts of memory are needed or where high speed is required.

Advantage

SRAM can provide very high speed.

Disadvantage

SRAM is costly and has low power packing density.

Memory System

Dynamic RAM (DRAM)

This memory stores data as charges on capacitors. With Dynamic RAM, the stored data will gradually disappear because of capacitor discharge, so that it is necessary to periodically refresh the data (i.e. recharge the capacitors).

In the process of refreshing, the information is read from the memory cell and written back in the same position.
Typically, each memory cell of a DRAM must be refreshed at least every 2 to 10 millisecond or its data will be lost.
Advantage
It has high capacity and power consumption is low.
Disadvantage
The need for refreshing of dynamic RAM because some external refreshing circuits is required.

Memory System

Comparison between ROM and RAM

RAM (Random Access Memory)	ROM (Read only Memory)
It is a volatile memory.	It is a non-volatile memory.
It is a read-write memory.	It is a read-only memory.
It loses the data stored in it when the power is turned off	The data inside it retains even if the power of the CPU is switched off.
It is a temporary storage.	It is a permanent storage.
It is costlier than ROM.	It is cheaper.
It can hold a large amount of data as compared to ROM.	It can only store small amount of data.
It is faster.	It is slower.
The data in RAM can be Modified easily.	ROM can be hardly or never be modified.
It is used in the normal operations of a computer.	It is used primarily in the startup process of a computer

Selection Questions

1. **What does ROM stand for?**

- A) Random Object Memory
- B) Read Only Memory
- C) Read Original Memory
- D) Write Only Memory **Answer:** B) Read Only Memory

2. **Which of the following types of ROM can be programmed by the user?**

- A) EPROM
- B) PROM
- C) Both A and B
- D) Neither A nor B **Answer:** C) Both A and B

3. **What is a characteristic of EEPROM?**

- A) Can only be programmed once
- B) Requires ultraviolet light to erase
- C) Can be electrically erased and reprogrammed
- D) Non-volatile **Answer:** C) Can be electrically erased and reprogrammed

4. **Which type of RAM does not require periodic refreshing?**

- A) DRAM
- B) SRAM
- C) Both A and B
- D) Neither A nor B **Answer:** B) SRAM

5. **What is a key disadvantage of SRAM?**

- A) It is volatile
- B) It is costly
- C) It cannot store small amounts of data
- D) It is slow **Answer:** B) It is costly

6. **How does Dynamic RAM (DRAM) store data?**

- A) Using transistors
- B) In magnetic fields
- C) As charges on capacitors
- D) On permanent disks **Answer:** C) As charges on capacitors

7. **Which type of memory is often used as primary storage in computers?**

- A) ROM
- B) SRAM
- C) DRAM
- D) Both B and C **Answer:** D) Both B and C

8. **What is a significant advantage of DRAM?**

- A) High speed
- B) High capacity
- C) No need for refreshing
- D) Low power consumption **Answer:** B) High capacity

9. **What happens to the data in DRAM if it is not refreshed?**

- A) It remains unchanged
- B) It is permanently saved
- C) It gradually disappears
- D) It can be accessed faster **Answer:** C) It gradually disappears

10. **Which memory technology allows for erasing the entire chip at once rather than one byte at a time?**

- A) EEPROM
- B) SRAM
- C) Flash EEPROM
- D) PROM **Answer:** C) Flash EEPROM

11. **What is the purpose of read-only memory (ROM)?**

- A) To store temporary data
- B) To retrieve data during execution
- C) To permanently store firmware or system boot programs
- D) To erase data **Answer:** C) To permanently store firmware or system boot programs

12. **Which memory type is considered non-volatile?**

- A) DRAM
- B) SRAM
- C) PROM
- D) All of the above **Answer:** C) PROM

13. **What differentiates EPROM from standard ROM?**

- A) EPROM cannot be changed once programmed
- B) EPROM can be erased with ultraviolet light
- C) EPROM requires a power supply to retain data

- D) EPROM has a slower access time **Answer:** B) EPROM can be erased with ultraviolet light

14. **In which scenario would SRAM be generally recommended?**

- A) When a large amount of memory is needed
- B) When low cost is a priority
- C) For applications requiring high speed
- D) For long-term data storage **Answer:** C) For applications requiring high speed

15. **When comparing RAM to ROM, which statement is true?**

- A) RAM is volatile; ROM is non-volatile
- B) RAM stores firmware; ROM stores temporary data
- C) Both RAM and ROM can be written to multiple times
- D) RAM is always faster than ROM **Answer:** A) RAM is volatile; ROM is non-volatile

16. **What advantage does flash memory have over traditional EEPROM?**

- A) Lower cost
- B) Faster erase and reprogram speed
- C) Higher storage capacity
- D) Requirement of external power **Answer:** B) Faster erase and reprogram speed

17. **What does the term "memory cell" refer to in the context of RAM?**

- A) A group of microchips
- B) The basic unit that stores a bit of information
- C) A specific type of ROM
- D) A type of storage device **Answer:** B) The basic unit that stores a bit of information

18. **What is the primary function of RAM in a computer system?**

- A) To permanently store data
- B) To hold data temporarily during processing
- C) To boot the operating system
- D) To provide power to the motherboard **Answer:** B) To hold data temporarily during processing

19. **Which of the following is an example of user-programmed ROM?**

- A) Factory-installed BIOS
- B) PROM
- C) Read-Only Memory used for software installation
- D) CD-ROM **Answer:** B) PROM

20. **What is the main limiting factor of SRAM compared to DRAM?**

- A) Data storage method
- B) Speed of access
- C) Cost and density
- D) Non-volatility **Answer:** C) Cost and density

True and False questions

- True or False: ROM allows users to modify the data stored within it. Answer: False - Correction: **ROM (Read Only Memory) does not allow users to modify the data stored within it; it is read-only.**

- True or False: Static RAM (SRAM) does not need to be refreshed to retain its data. Answer: True

- True or False: EPROM stands for Erasable Programmable Read-Only Memory. Answer: True

- True or False: RAM is considered non-volatile memory. Answer: False - Correction: **RAM (Random Access Memory) is volatile memory, meaning it loses its data when power is turned off.**

- True or False: EEPROM can be erased and reprogrammed using electrical signals. Answer: True

- True or False: Flash memory is slower than traditional EEPROM for erasing data. Answer: False - Correction: **Flash memory is faster than traditional EEPROM for erasing data, as it can erase entire blocks instead of one byte at a time.**

- True or False: PROM is programmable only once after manufacturing. Answer: True

- True or False: The main function of RAM is to permanently store operating system files. Answer: False - Correction: **The main function of RAM is to temporarily store data and programs that are actively being used; it is not used for permanent storage.**

- True or False: DRAM stores data as charges on capacitors. Answer: True

- True or False: SRAM is generally less expensive to produce than DRAM. Answer: False - Correction: **SRAM is generally more expensive to produce than DRAM due to its more complex design.**

Fill the blanks:

1. ROM stands for _____.

- **Answer:** Read Only Memory

2. The two main types of ROM are _____ and _____.

- **Answer:** manufacturer programmed, user-programmed

3. PROM stands for _____, which means it can be programmed by the user only once.

- **Answer:** Programmable Read-Only Memory

4. EPROM can be erased by exposing it to _____ light.

- **Answer:** ultraviolet

5. EEPROM stands for _____, which can be erased and reprogrammed electrically.

- **Answer:** Electrically Erasable Programmable Read-Only Memory

6. Random Access Memory, or _____, is used for primary storage in computers.

- **Answer:** RAM

7. Static RAM (SRAM) retains data as long as _____ is supplied.

- **Answer:** power

8. Dynamic RAM (DRAM) requires _____ to maintain the stored data.

- **Answer:** refreshing

9. Flash memory can erase a _____ or the entire chip at once, making it faster than traditional EEPROM.

- **Answer:** block

10. The main disadvantage of SRAM is that it is more _____ than DRAM.

- **Answer:** expensive

11. In the random access memory architecture, any location can be accessed in the same time and manner, referred to as _____ access.

- **Answer:** random

12. After a PROM has been programmed, its data cannot be _____ or modified.

- **Answer:** erased

13. The main use of SRAM is in situations requiring _____ speed and small amounts of memory.

- **Answer:** high

14. A SIMM stands for _____ and is a special socket on the motherboard for additional RAM.

- **Answer:** Single In-Line Memory Module

15. DRAM stores data as _____ on capacitors, requiring periodic refreshing to maintain data integrity.

- **Answer:** electrical charges

16. The data in ROM is stored _____ by the manufacturer during production.

- **Answer:** permanently

17. To erase an EPROM, it must be exposed to _____ light for a certain period.

- **Answer:** ultraviolet

18. Flash EEPROM works faster than traditional EEPROM because it can erase data in large _____, unlike byte-by-byte erasing.

- **Answer:** blocks

19. The data in RAM is _____ memory, meaning it is lost when the power is turned off.

- **Answer:** volatile

- One of the disadvantages of DRAM is the need for _____ circuits to refresh its data continuously.**Answer:** external

Explaining questions

1. **What is Read Only Memory (ROM), and how does it function in a computer?**
2. **Describe the differences between PROM, EPROM, and EEPROM.**
3. **How does Random Access Memory (RAM) differ from Read Only Memory (ROM)?**
4. **What are the two main types of RAM, and what are their characteristics?**
5. **Explain the concept of "volatility" in memory systems.**
6. **Why is refreshing necessary for Dynamic RAM (DRAM)?**
7. **What advantages does Flash EEPROM memory have over traditional EEPROM?**
8. **In what scenarios would you choose SRAM over DRAM, and why?**
9. **How does data access differ between static RAM and dynamic RAM?**
10. **What role does a Single In-Line Memory Module (SIMM) play in a computer system?**

ترجمة الاسئلة والاجابة باللغة العربية

1. **ما هو ذاكرة القراءة فقط(ROM) ، وكيف تعمل في الكمبيوتر؟**

- **الإجابة :**ذاكرة القراءة فقط (ROM) هي نوع من أنواع الذاكرة في الكمبيوتر المستخدمة لتخزين البيانات أو التعليمات التي تحتاج إلى أن تبقى بشكل دائم. يتم تخزين البيانات في ROM بواسطة الشركة المصنعة بصفة دائمة، وهذا يعني أنه لا يمكن تعديلها أو مسحها. وظيفة ROM الأساسية هي تخزين البرامج الحيوية للنظام، مثل برنامج التمهيد، الذي يحتاج الكمبيوتر إلى تحميله عند التشغيل.

2. **وصف الاختلافات بين PROM و EPROM و.EEPROM**

- **الإجابة** PROM **:**(ذاكرة القراءة فقط القابلة للبرمجة) هي نوع من الذاكرة التي يمكن للمستخدم برمجتها مرة واحدة فقط، ولا يمكن مسح البيانات منها بعد ذلك EPROM .(ذاكرة القراءة فقط القابلة للبرمجة القابلة للمسح) يمكن مسح بياناتها بإexposing ها لأشعة فوق البنفسجية. أما EEPROM (ذاكرة القراءة فقط القابلة للبرمجة القابلة للمسح إلكترونيًا) فيمكن مسحها باستخدام الشحنة الكهربائية، مما يسمح بتعديل البيانات بسهولة أكبر مقارنة بـ PROMو EPROM.

3. **كيف تختلف ذاكرة الوصول العشوائي (RAM) عن ذاكرة القراءة فقط(ROM) ؟**

- **الإجابة :**تتمثل أبرز الاختلافات بين RAM و ROM في أن RAM هي ذاكرة غير دائمة (متطايرة) تفقد البيانات عند إيقاف تشغيل الطاقة، وتستخدم لتخزين البيانات والأوامر قيد المعالجة. بينما ROM هي ذاكرة دائمة (غير متطايرة) تحتفظ بالبيانات دائماً، وتستخدم عادة لتخزين برامج النظام الأساسية التي تحتاج إلى التواجد عند تشغيل الكمبيوتر.

4. **ما هما نوعا RAM الرئيسيان، وما هي خصائصهما؟**

- **الإجابة :**النوعان الرئيسيان من RAM هما SRAM (ذاكرة الوصول العشوائي الثابتة) و DRAM ذاكرة الوصول العشوائي الديناميكية .SRAM (تحتفظ بالبيانات طالما أن الطاقة متصلة، ولا تحتاج إلى تحديث البيانات بشكل دوري، مما يجعلها سريعة ولكنها باهظة الثمن. بينما DRAM تحتاج إلى تجديد البيانات بشكل دوري للحفاظ على المعلومات، وهي أكثر تكلفة وأبطأ من.SRAM

5. **اشرح مفهوم "التطاير" في أنظمة الذاكرة.**

- **الإجابة :**تطاير الذاكرة يعني أن البيانات المخزنة فيها تفقد عند قطع الطاقة. لذاكرة الوصول العشوائي (RAM) هي ذاكرة متطايرة، مما يعني أنها تفقد البيانات بعد إيقاف تشغيل الجهاز. بينما ذاكرة القراءة فقط (ROM) هي ذاكرة غير متطايرة، حيث تحتفظ بالبيانات حتى عند إيقاف التشغيل، مما يجعلها مناسبة لتخزين المعلومات الحيوية.

6. **لماذا يعد التجديد ضرورياً لذاكرة الوصول العشوائي الديناميكية(DRAM) ؟**

- **الإجابة :**يعتبر التجديد ضرورياً لذاكرة DRAM لأنها تستخدم المكثفات لتخزين البيانات، والتي تتلاشى بشكل طبيعي بمرور الوقت. لذلك، تحتاج هذه الذاكرة إلى تجديد البيانات بشكل دوري لضمان عدم فقدانها، أي إعادة كتابة المعلومات فيها للحفاظ على سلامتها.

7. **ما المزايا التي تتمتع بها ذاكرة فلاش EEPROM مقارنةً بـ EEPROM التقليدية؟**

- **الإجابة :**ذاكرة فلاش EEPROM تعمل بشكل أسرع من EEPROM التقليدية، حيث يمكنها مسح البيانات وإعادة برمجتها في كتل كبيرة بدلاً من مسحها ببتات واحدة، مما يجعلها أكثر كفاءة في إدارة البيانات. هذا يجعل فلاش EEPROMمفضلًا في التطبيقات التي تتطلب سرعة أكبر.

8. **في أي سيناريوهات تفضل اختيار SRAM علىDRAM ، ولماذا؟**

- **الإجابة :**يتم اختيار SRAM في التطبيقات التي تتطلب سرعات عالية أو حيث يكون هناك حجم صغير من الذاكرة المطلوبة، مثل الكاش في المعالجات. على الرغم من أن SRAM أغلى مقارنةً بـDRAM ، إلا أنها تقدم أداءً أفضل في التطبيقات الحساسة للوقت.

9. **كيف يختلف الوصول إلى البيانات بين SRAM وDRAM ؟**

- **الإجابة :**الوصول إلى البيانات في SRAM يكون ثابتًا وسريعًا، حيث يمكن قراءة البيانات في كل خلية ذاكرة بدون الحاجة إلى تحديثها. من ناحية أخرى، تتطلب DRAM إجراءً دوريًا لتجديد البيانات ، مما يؤثر على سرعة الوصول إلى البيانات ويجعلها أبطأ مقارنة بـ.SRAM

10. **ما الدور الذي تلعبه وحدة الذاكرة الأحادية (SIMM) في نظام الكمبيوتر؟**

- **الإجابة :**وحدة الذاكرة الأحادية (SIMM) هي عبارة عن شريحة يتم تركيبها في اللوحة الأم للكمبيوتر لتوفير المزيد من الذاكرة العشوائية .(RAM) هي تسهل تركيب الذاكرة وتساعد في رفع سعة التخزين العشوائي، مما يزيد من أداء جهاز الكمبيوتر عند تشغيل البرامج والتطبيقات الثقيلة.

مالفرق بين ال RAMوال ROM مهم جدا من الملزمة باللغة الانكليزية؟

Lecture 5

الدكتور المهندس محمد سامي محمد

كلية التربية للعلوم الصرفة

قسم علوم الحاسبات

جامعة ديالى

2021-2020

تقنيات وتركيب الحاسوب – المرحلة الاولى

Memory System

Auxiliary storage devices are also useful in transferring data or programs from one computer to another.

They also function as backup devices which allows backup of the valuable information that we are working on. So, even if by some accident our computer crashes and the data in it is in unrecoverable mode, we can restore it from your backups.

The most common types of auxiliary storage devices are floppy disks, hard disks, magnetic tapes and magnetic disks.

Memory System

Sequential and Random Auxiliary Storage Devices

Based on the type of data access, sequential and random, auxiliary storage devices can be classified as sequential access media and random media.

In case of sequential access media, data stored in media can only be read in sequence.

To get to a particular point on media, we have to go through all the preceding points. Magnetic tapes are examples of sequential access media.

In contrast, disks are random access media, also called direct access media, because a disk drive can access any point at random without passing through intervening points. Other examples of direct access media are magnetic disks, optical disks, etc.

Memory System

Magnetic Tapes - Sequential Storage Devices

Memory System

Random Auxiliary Storage Devices

Memory System

Floppy Disk

Floppy disk is a soft magnetic disk. It is called floppy because it flops if we wave it. The data on the floppy disk is organized in terms of tracks and sectors.
Unlike most of the hard disks, floppy disks are portable because these can be removed from a disk drive.

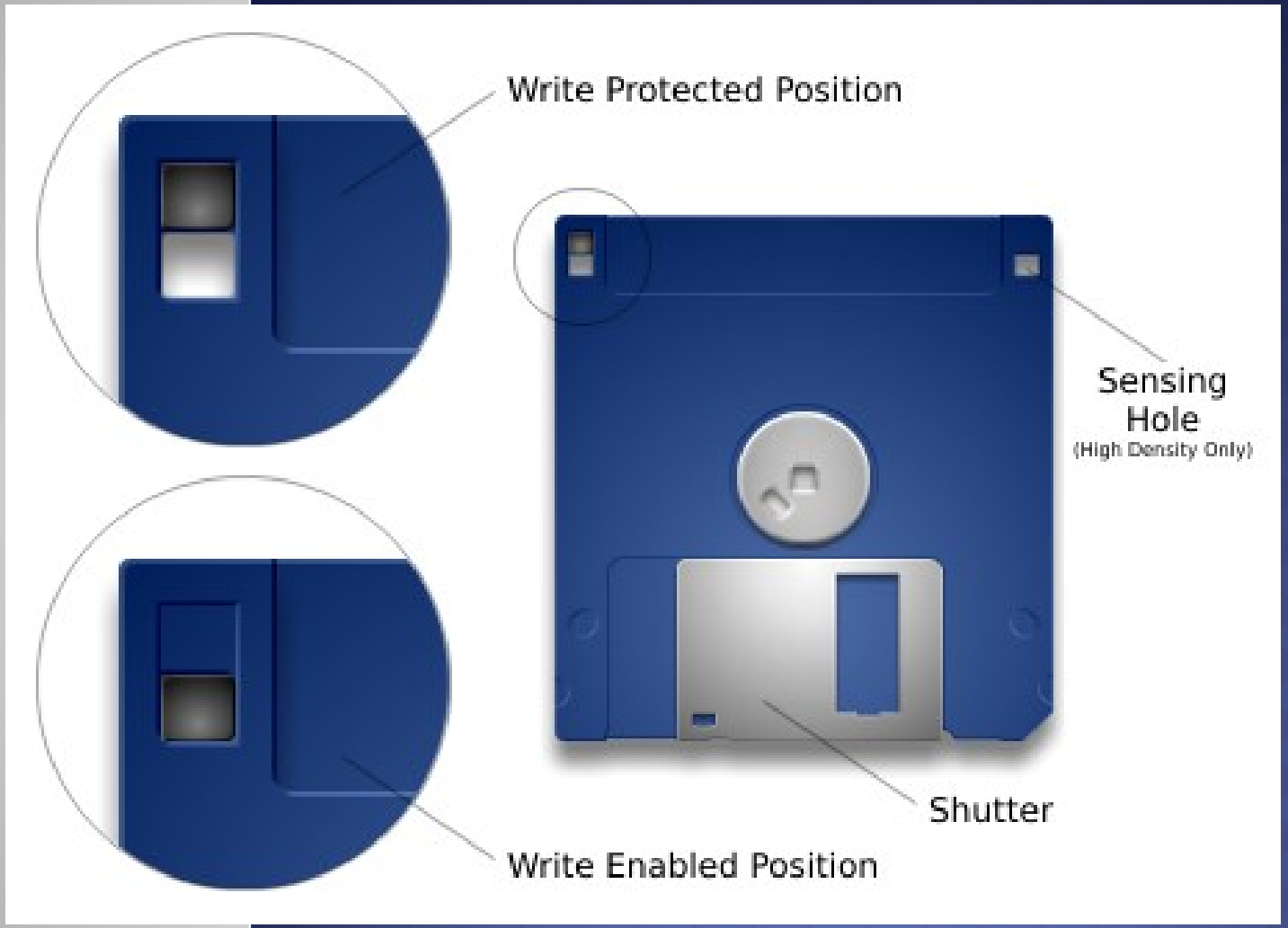
for floppy disks are called floppy drives. Floppy disks are slower to access than hard disks and have less storage capacity but are less expensive and are portable.

There are two basic sizes of a floppy, namely 5¼ inch and 3½ inch.

5¼ inch : This type of floppy is generally capable of storing between l00K and 1.2MB of data. The most common sizes are 360K and 1.2MB.

3½ inch : Despite their small size, these floppies have a large storage capacity than their cousins – from 400K to 1.4MB of data.

Memory System



Memory System

Optical Disk

An optical disc is an electronic data storage medium that can be written to and read using a low-powered laser beam. Optical disk can store much more data, i.e. up to 6 GB. There are three basic types of optical disks namely, CD-ROM, WORM and Erasable.

CD-ROM : Like audio CDs, CD-ROMs come with data already encoded onto them. The data is permanent and can be read any number of times but CD-ROMs cannot be modified.

Memory System

WORM :

This term stands for “Write Once, Read Many” with a WORM disk drive. One can write data only once onto a WORM disk. After that, the disk behaves just like a CD-ROM.

Erasable :

Optical disks that can be erased and loaded with new data are just like magnetic disks. These are often referred to as EO (Erasable Optical) disks.

Memory System

CD-ROM

CD-ROM stands for “Compact Disc Read Only Memory”, and CD-ROM comes in the “Random Access” category’s devices. These types of disc can capable to store almost 800 MB of digital data. These data can’t discard by mistaken.

DVD-ROM

DVD-ROM stands for “Digital Versatile Disc – Read Only Memory”, and it also comes in the “Random Access” category’s devices. DVD-ROM discs can store data up to 4.7 GB, but Dual Layer DVD device’s storage capacity is double. These types of disc are used to store ultra quality video.

Memory System

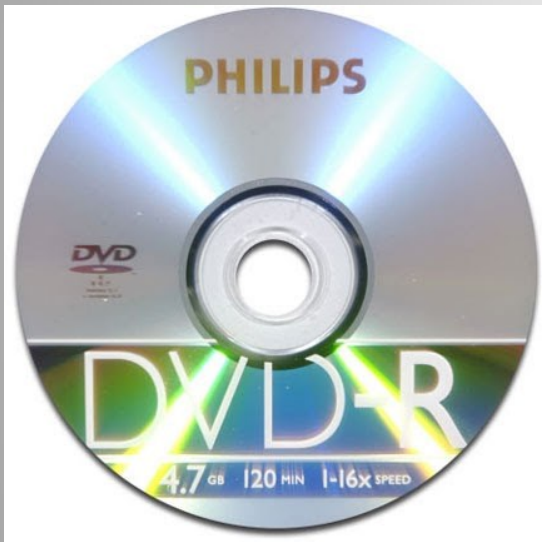
Blue Ray

Blue Ray discs are totally replaced by DVDs, because these discs are capable to hold data up to 25-50 GB, as well as double layer Blue Rays discs can store double data. Due to high storage capacity, Blue Ray discs are used to store HD (High Definition) videos.

HD DVD

HD DVD stands for “High Density DVD”, and these devices are capable to store data up to 15 GB (Dual Layer HD DVDS have storage capacity double). High-Density DVD discs are also used to hold HD Videos.

Memory System



DVD-RAM

DVD-RAM stands for “DVD-Random Access Memory”, and it is able to Re-Write data. DVD-RAM are available in market like as floppy-disc style case. These types of discs have storage capacity of data similar to DVD (up to 4.7 GB).

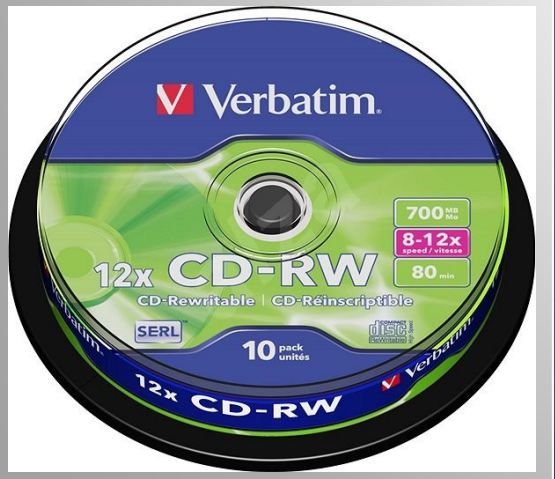
DVD-RAM devices are used in several Camcorders such as “Video Recording Cameras”, and it can be used for data back-up and archiving.

Recordable Optical Devices

There are two types of discs such as “CD-R and DVD-R” and “CD-RW and DVD-RW”.

CD-R & DVD-R

Full form of (CD-R & DVD-R) is “CD-Recordable and DVD Recordable”, and they are able to burn data on to them, but not easy to delete data. Users can add any type of data, but they can’t discard added data or re-use fully disc.



CD-RW & DVD-RW

CD-RW & DVD-RW stands for “CD-Re Writable and DVD-Re Writable”, and they are capable to burn data similar (CD-R and DVD-R) onto them. Users can also delete and Re-Used data.

Memory System

Advantages of Optical Storage Devices

It is capable to store vast amount of data.
Affordable price
It can be recycled (Re-used).
It has ultra data stability.
Countable/uncountable storage units
Best Durability, Transport-ability, and archiving.

Disadvantages Optical Storage Devices

Some traditional PCs are not able to read these disks.
It is getting trouble while recycling.

Memory System

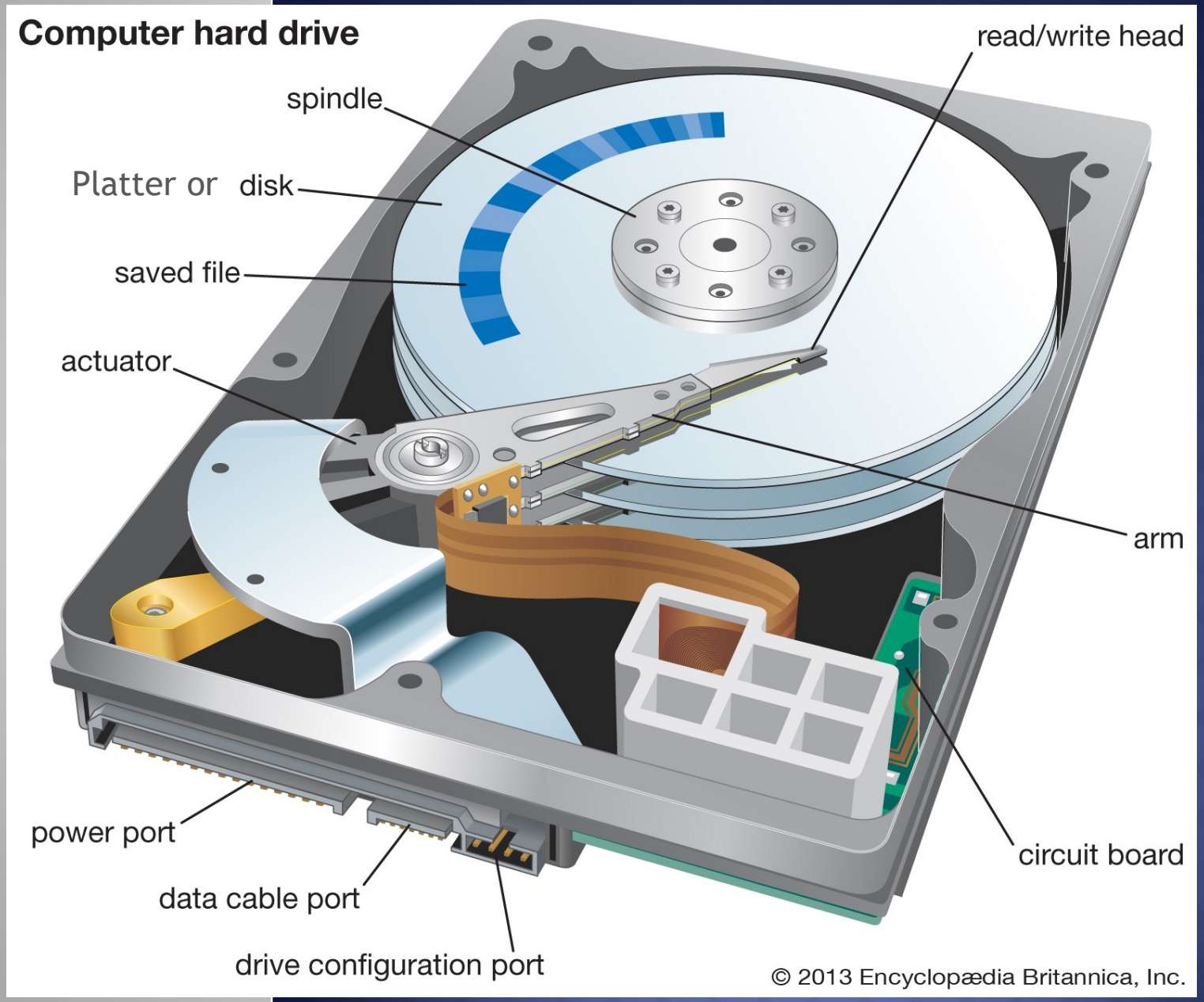
Hard Disk

Hard disk is a magnetic disk on which computer data can be stored. Hard disks hold more data and are faster than floppy disks.

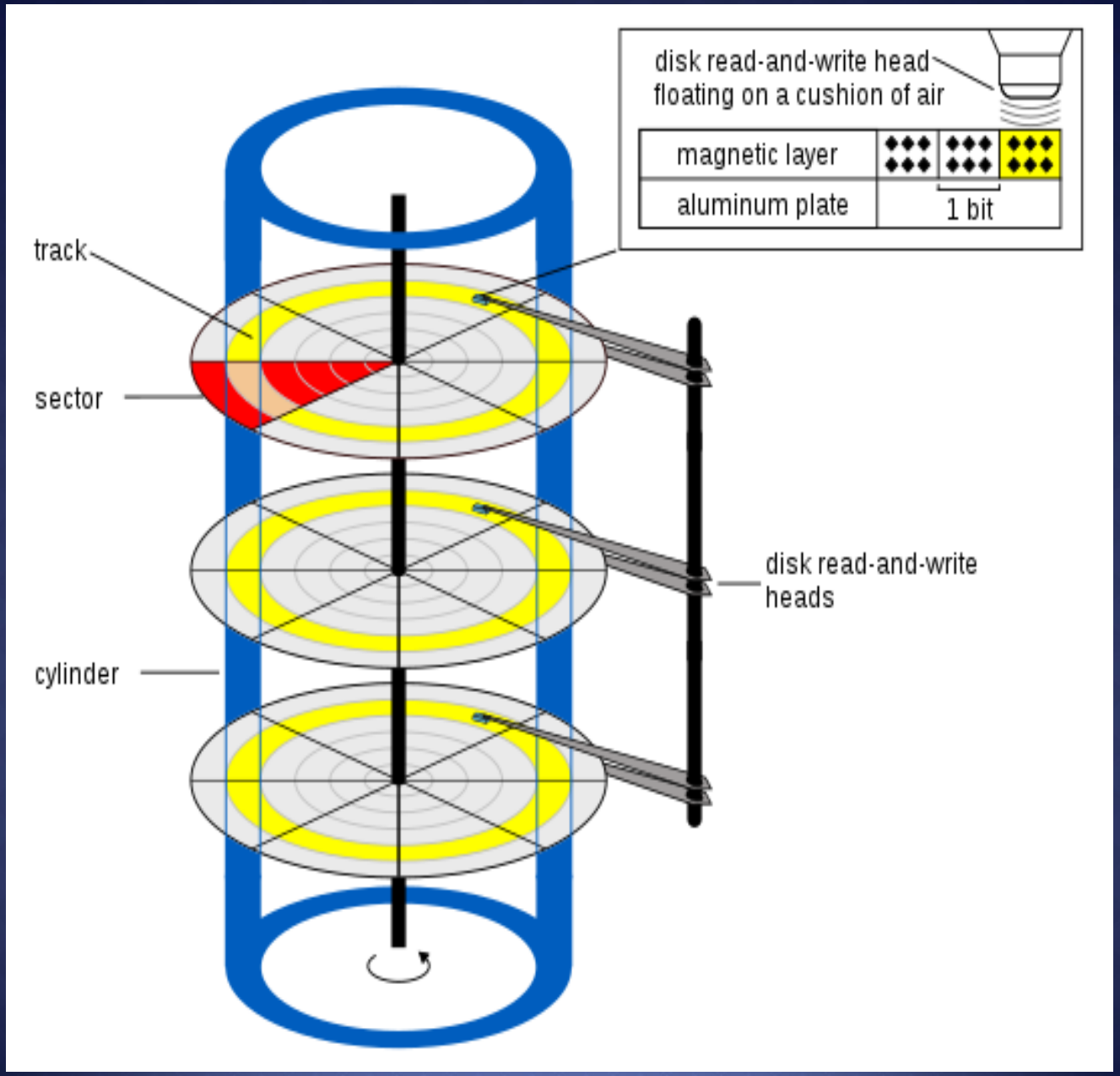
A single hard disk usually consists of several platters. Each platter requires two read/write heads, one for each side.

All the read/write heads are attached to a single access arm so that they cannot move independently. Each platter has the same number of tracks. A track location that cuts across all platters is called a cylinder. For example, a typical 84 MB hard disk for a PC might have two platters (four sides) and 1,053 cylinders.

Memory System



Memory System



CD – DVD Drivers For Laptop

USB CD Drivers External

CD Drivers For Desktop

CD Drivers For Desktop

Selection Questions

1. What is the maximum data storage capacity of a CD-ROM?

A) 700 MB

B) 800 MB

C) 6 GB

D) 4.7 GB

B

2. What type of optical disk can be modified?

A) CD-ROM

B) WORM

C) DVD-ROM

D) Erasable

D

3. What is the primary advantage of optical storage devices?

A) High cost

B) Limited data storage

C) Vast amount of data storage

D) Fragility

C

4. What does DVD-ROM stand for?

A) Digital Versatile Disc – Read Only Memory

B) Digital Video Disc – Read Only Memory

C) Digital Versatile Data – Read Only Memory

D) Digital Video Data – Read Only Memory

A

5. What is a disadvantage of optical storage devices?

A) High durability

B) Compatibility issues with traditional PCs

C) Recyclable

D) Fast data access

B

1. What is the maximum data storage capacity of a CD-ROM?

A) 700 MB

B) 800 MB

C) 6 GB

D) 4.7 GB

B

2. What type of optical disk can be modified?

A) CD-ROM

B) WORM

C) DVD-ROM

D) Erasable

D

3. What is the primary advantage of optical storage devices?

A) High speed

B) Vast amount of data storage

C) Low cost

D) Limited durability

B

4. What does DVD-ROM stand for?

A) Digital Versatile Disc – Read Only Memory

B) Digital Video Disc – Read Only Memory

C) Digital Versatile Data – Read Only Memory

D) Digital Video Data – Read Only Memory

A

5. What is a disadvantage of optical storage devices?

A) High cost

B) Limited data stability

C) Some traditional PCs cannot read these disks

D) High speed

C

True and False questions

- **True or False**: Auxiliary storage devices can serve as backup devices for valuable information. **Answer**: True .

- **True or False**: Floppy disks have a higher storage capacity than most hard disks. **Answer**: False .

- **True or False**: Magnetic tapes are an example of random access storage media. **Answer**: False .

- **True or False**: CD-R and DVD-R discs can have data added to them, but cannot have data deleted. **Answer**: True .

- **True or False**: Optical storage devices are not considered portable due to their fragile nature. **Answer**: False; they are considered portable .

- **True or False**: The storage capacity of a 5¼ inch floppy disk typically ranges from 100K to 1.2MB. **Answer**: True .

- **True or False**: Random access media requires the user to read data in a sequential manner. **Answer**: False .

- **True or False**: DVD-ROMs can store more data than CD-ROMs, with capacities up to 4.7 GB. **Answer**: True .

- **True or False**: Floppy disks are more expensive than hard disks of equivalent capacity. **Answer**: False .

- **True or False**: Auxiliary storage devices can transfer data between different computers. **Answer**: True .

- **True or False**: The data on magnetic tapes can be accessed randomly, similar to hard disks. **Answer**: False .

- **True or False**: Both floppy disks and hard disks use magnetic storage technology. **Answer**: True .

- **True or False**: Optical storage devices are known for their excellent durability and long-term data stability. **Answer**: True .

- **True or False**: The primary function of a floppy drive is to read and write data on hard disks. **Answer**: False; it is for floppy disks .

- **True or False**: In case of data loss, a reliable auxiliary storage device can help restore lost information. **Answer**: True .

- **True or False**: The 3½ inch floppy disk has a smaller storage capacity than the 5¼ inch floppy disk. **Answer**: False .

- **True or False**: DVD-R discs can have their data rewritten multiple times. **Answer**: False; they are read-only .

- **True or False**: The term 'floppy' refers to the flexibility of the floppy disk medium. **Answer**: True .

- **True or False**: It is common for traditional PCs to be unable to read CD-ROMs. **Answer**: False; most can read CD-ROMs.

- **True or False**: Auxiliary storage devices include solid-state drives (SSDs) as a type of backup device. **Answer**: False; SSDs are not specifically mentioned in the content.

True-or-false questions:

1. A WORM disk allows data to be written multiple times.

- True
- False

False

2. Floppy disks are portable and can be removed from a disk drive.

- True
- False

True

3. DVD-ROM discs can store data up to 4.7 GB.

- True
- False

True

4. Optical storage devices are not recyclable.

- True
- False

False

5. The most common types of auxiliary storage devices include floppy disks and hard disks.

- True
- False

True

1. A floppy disk is a type of hard disk.

- True
- False

False

2. CD-ROMs can store almost 800 MB of digital data.

- True
- False

True

3. Erasable Optical disks can be erased and loaded with new data.

- True
- False

True

4. The 5¼ inch floppy disk can store up to 1.2MB of data.

- True
- False

True

5. Optical storage devices are known for their low durability.

- True
- False

False

Fill in the blank

1. Auxiliary storage devices are also useful in transferring data or programs from one computer to **another**
2. The most common types of auxiliary storage devices are floppy disks, **hard disks**, magnetic tapes, and magnetic disks .
3. In the case of **sequential access** media, data stored in media can only be read in sequence .
4. Magnetic tapes are examples of **sequential access** media .
5. Unlike most hard disks, **floppy disks** are portable because they can be removed from a disk drive .
6. An **optical disc** is an electronic data storage medium that can be written to and read using a low-powered laser beam .
7. The term WORM stands for "Write Once, **Read Many**" .
8. **CD-ROM** stands for "Compact Disc Read Only Memory" .
9. Blue Ray discs are used to store **HD (High Definition)** videos .
10. **DVD-RAM** are available in the market like a floppy-disc style case .
11. The full form of (CD-R & DVD-R) is “CD-Recordable and **DVD Recordable**" .
12. A hard disk is a **magnetic disk** on which computer data can be stored .

Explaining questions

1. How do auxiliary storage devices function as backup devices, and why is this important?

Auxiliary storage devices function as backup devices by allowing you to backup valuable information you are working on [2]. This is important because if a computer crashes and the data becomes unrecoverable, you can restore it from the backups on the auxiliary storage device [2].

2. Explain the difference between sequential access media and random access media, providing an example of each.

Sequential access media requires data to be read in sequence, meaning you have to go through all preceding points to get to a particular point. Magnetic tapes are an example [3]. In contrast, random access media (also called direct access media) allows you to access any point at random without passing through intervening points; magnetic disks and optical disks are examples [3].

3. What are the advantages and disadvantages of using optical storage devices?

Advantages of optical storage devices include the ability to store vast amounts of data, affordability, recyclability, ultra data stability, countable/uncountable storage units, and durability and suitability for transport and archiving [14]. Disadvantages include that some traditional PCs are not able to read these disks and that they can be difficult to recycle [14].

4. Describe the physical structure of a hard disk and how data is stored on it.

A hard disk consists of several platters, each requiring two read/write heads (one for each side) [15]. The read/write heads are attached to a single access arm so they cannot move independently. Each platter has the same number of tracks, and a track location that cuts across all platters is called a cylinder [15]. Data is stored magnetically on the platters.

5. Explain the differences between CD-ROM, WORM, and Erasable optical disks.

CD-ROMs come with data already encoded on them, are permanent, and can be read any number of times, but cannot be modified [8]. WORM (Write Once, Read Many) disks allow data to be written only once, after which the disk behaves like a CD-ROM [9]. Erasable optical disks can be erased and loaded with new data, similar to magnetic disks; these are often referred to as EO (Erasable Optical) disks [9].

المحاضرة السادسة في مادة
تقنيات وتركيب الحاسوب

Lecture 6

م.د. مُحَمَّد سامي مُحَمَّد

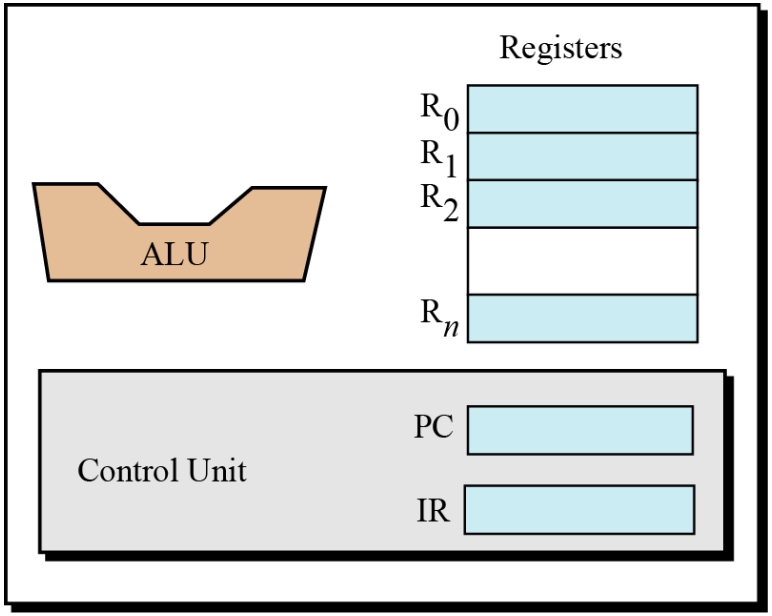
2021-2020

المرحلة الاولى

CENTRAL PROCESSING UNIT

- The central processing unit (CPU) performs operations on data. In most architectures it has three parts: an arithmetic logic unit (ALU), a control unit and a set of registers, fast storage locations.

CENTRAL PROCESSING UNIT



Central Processing Unit (CPU)

The arithmetic logic unit (ALU)

The central processing unit (CPU) performs operations on data.

In most architectures it has three parts: an arithmetic logic unit (ALU), a control unit and a set of registers, fast storage locations.

Registers

Registers are fast stand-alone storage locations that hold data temporarily. Multiple registers are needed to facilitate the operation of the CPU.

- Data registers
- Instruction register
- Program counter

The control unit

The third part of any CPU is the control unit.

The control unit controls the operation of each subsystem. Controlling is achieved through signals sent from the control unit to other subsystems.

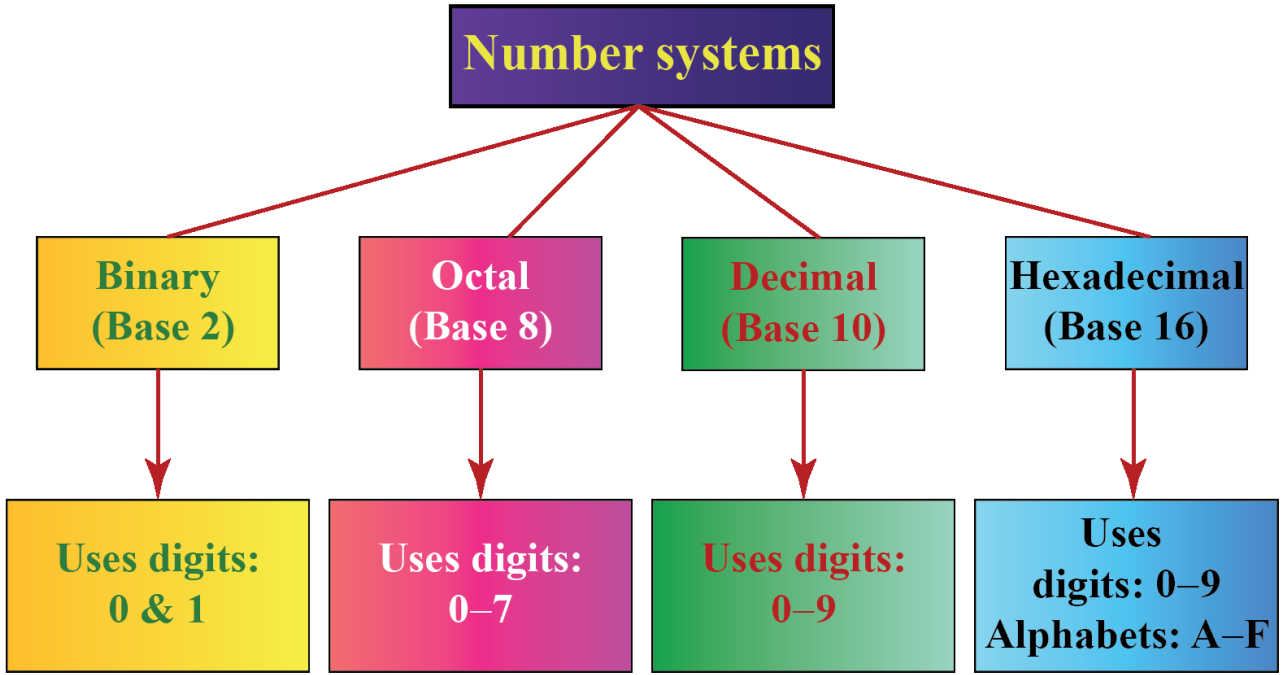
Data Representation
Number system

Number systems are the technique to represent numbers in the computer system architecture, every value that you are saving or getting into/from computer memory has a defined number system.

Computer architecture supports following number systems.

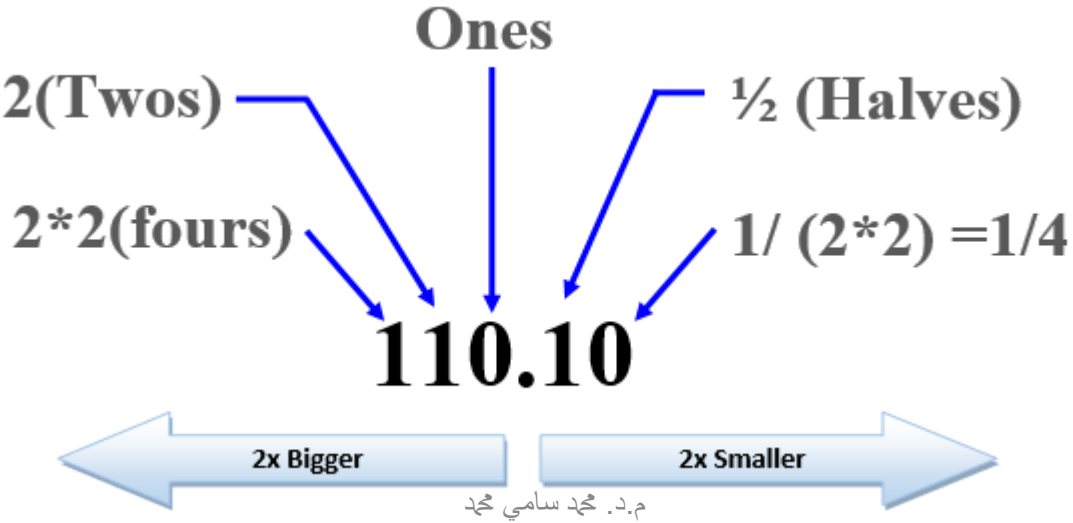
- Binary number system
- Octal number system
- Decimal number system
- Hexadecimal (hex) number system

Data Representation
Number system



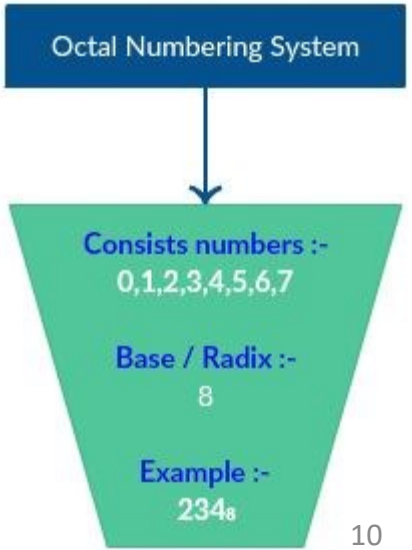
BINARY NUMBER SYSTEM

A Binary number system has only two digits that are 0 and 1. Every number (value) represents with 0 and 1 in this number system. The base of binary number system is 2, because it has only two digits



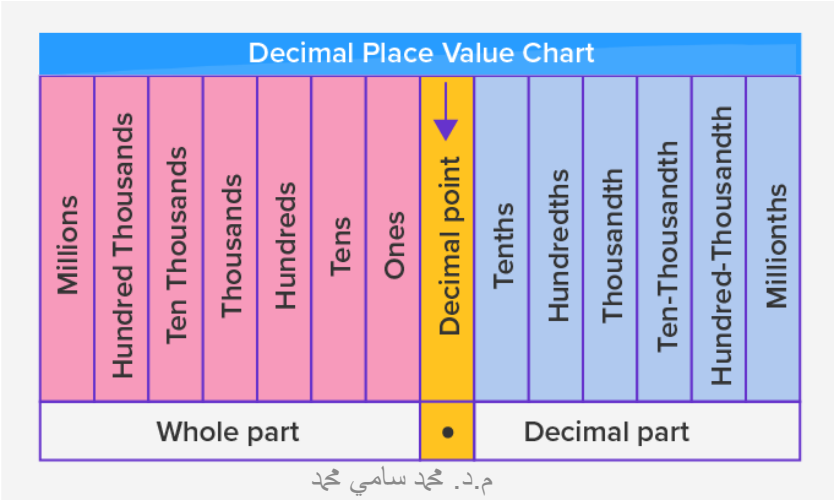
OCTAL NUMBER SYSTEM

Octal number system has only eight (8) digits from 0 to 7. Every number (value) represents with 0,1,2,3,4,5,6 and 7 in this number system. The base of octal number system is 8, because it has only 8 digits



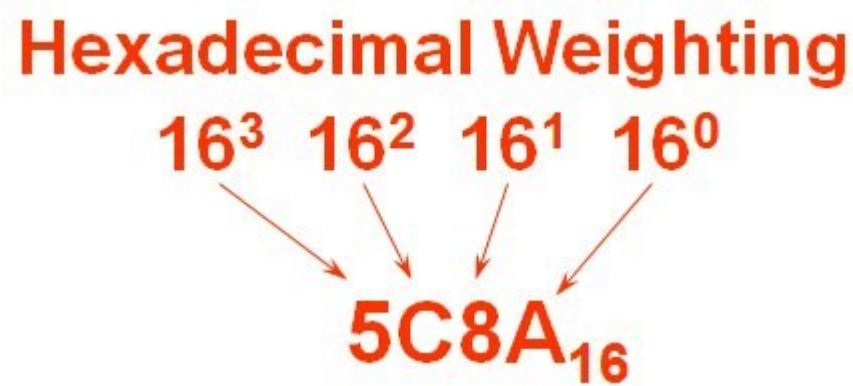
DECIMAL NUMBER SYSTEM

Decimal number system has only ten (10) digits from 0 to 9. Every number (value) represents with 0,1,2,3,4,5,6, 7,8 and 9 in this number system. The base of decimal number system is 10, because it has only 10 digits

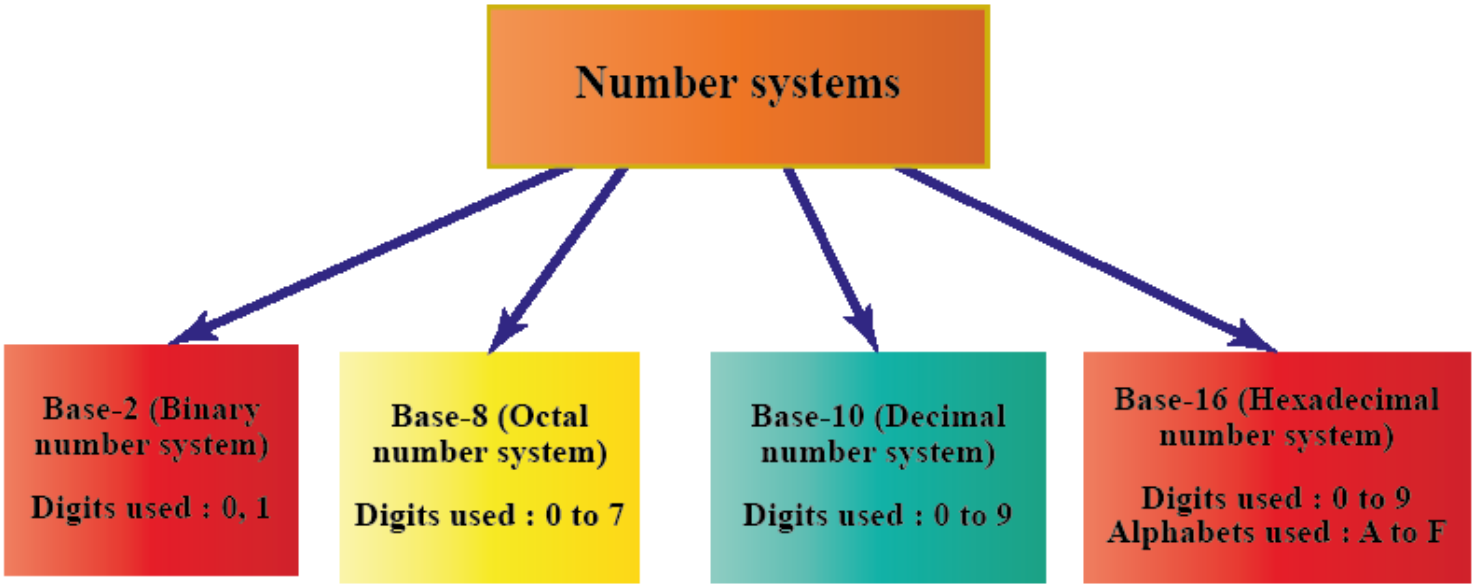


HEXADECIMAL NUMBER SYSTEM

A Hexadecimal number system has sixteen (16) alphanumeric values from 0 to 9 and A to F. Every number (value) represents with 0,1,2,3,4,5,6, 7,8,9,A,B,C,D,E and F in this number system. The base of hexadecimal number system is 16, because it has 16 alphanumeric values. Here A is 10, B is 11, C is 12, D is 14, E is 15 and F is 16.



Data Representation
Number system



CONVERSIONS-DECIMAL TO OTHER

1. DECIMAL TO BINARY

To convert Number system from Decimal Number System to Any Other Base is quite easy; you have to follow just two steps:

A) Divide the Number (Decimal Number) by the base of target base system (in which you want to convert the number: Binary (2), octal (8) and Hexadecimal (16)).

B) Write the remainder from step 1 as a Least Signification Bit (LSB) to Step last as a Most Significant Bit (MSB).

CONVERSIONS-DECIMAL TO OTHER

1. DECIMAL TO BINARY

Decimal to Binary Conversion				Result
Decimal Number is : $(12345)_{10}$				
2	12345	1	LSB	
2	6172	0		
2	3086	0		
2	1543	1		
2	771	1		
2	385	1		
2	192	0		Binary Number is $(11000000111001)_2$
2	96	0		
2	48	0		
2	24	0		
2	12	0		
2	6	0		
2	3	1		
	1	1	MSB	

CONVERSIONS-DECIMAL TO OTHER

2. DECIMAL TO OCTAL

Decimal to Octal Conversion				Result
Decimal Number is : $(12345)_{10}$				
8	12345	1	LSB	Octal Number is $(30071)_8$
8	1543	7		
8	192	0		
8	24	0		
	3	3	MSB	

CONVERSIONS-DECIMAL TO OTHER

3. DECIMAL TO HEXADECIMAL

Decimal to Hexadecimal Conversion	Result
Example 1 Decimal Number is : $(12345)_{10}$ 16 | 12345 — 9 LSB 16 | 771 — 3 16 | 48 — 0 8 | 3 — 3 MSB	Hexadecimal Number is $(3039)_{16}$
Example 2 Decimal Number is : $(725)_{10}$ 16 | 725 — 5 | 5 LSB 16 | 45 — 13 | D 2 — 2 | 2 MSB	Hexadecimal Number is $(2D5)_{16}$ **Convert** **10, 11, 12, 13, 14, 15** **to its equivalent...** **A, B, C, D, E, F**

CONVERSIONS-BINARY TO OTHER

1. BINARY TO DECIMAL

1	1	0	1	1	0	0	1

$1 \times 2^0 = 1 \times 1 = 1$
$0 \times 2^1 = 0 \times 2 = 0$
$0 \times 2^2 = 0 \times 4 = 0$
$1 \times 2^3 = 1 \times 8 = 8$
$1 \times 2^4 = 1 \times 16 = 16$
$0 \times 2^5 = 0 \times 32 = 0$
$1 \times 2^6 = 1 \times 64 = 64$
$1 \times 2^7 = 1 \times 128 = 128$

$1 + 8 + 16 + 64 + 128 = 217$

CONVERSIONS-BINARY TO OTHER

2. BINARY TO OCTAL

Binary: 11100101 =	11 100 101	
	011 100 101	Pad the most significant digits with zeros if necessary to complete a group of three.

CONVERSIONS-BINARY TO OTHER

3. BINARY TO HEXADECIMAL

Binary:	0000	0001	0010	0011	0100	0101	0110	0111
Hexadecimal:	0	1	2	3	4	5	6	7

Binary:	1000	1001	1010	1011	1100	1101	1110	1111
Hexadecimal:	8	9	A	B	C	D	E	F

Binary =	1110	0101	
Hexadecimal =	E	5	= E5 hex

CONVERSIONS-OCTAL TO OTHER

1. OCTAL TO BINARY

Octal:	0	1	2	3	4	5	6	7
Binary:	000	001	010	011	100	101	110	111

Octal =	3	4	5	
Binary =	011	100	101	= 011100101 binary

CONVERSIONS-OCTAL TO OTHER

2. OCTAL TO HEXADECIMAL

Octal =	3	4	5	
Binary =	011	100	101	= 011100101 binary

Binary =	1110	0101	
Hexadecimal =	E	5	= E5 hex

CONVERSIONS-OCTAL TO OTHER

3. OCTAL TO DECIMAL

$$345 \text{ octal} = (3 * 8^2) + (4 * 8^1) + (5 * 8^0) = (3 * 64) + (4 * 8) + (5 * 1) = 229 \text{ decimal}$$

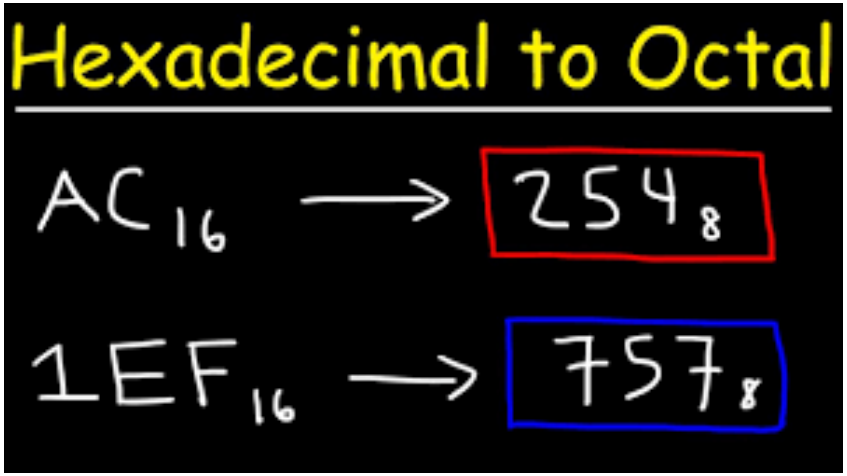
CONVERSIONS-HEXADECIMAL TO OTHER

1. HEXADECIMAL TO BINARY

Hexadecimal =	A	2	D	E	
Binary =	1010	0010	1101	1110	= 1010001011011110 binary

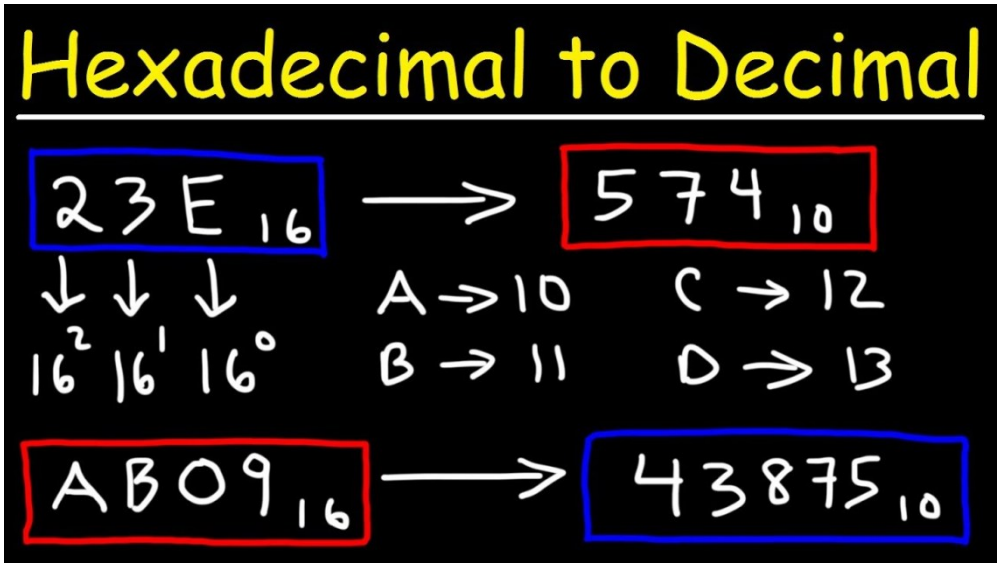
CONVERSIONS-HEXADECIMAL TO OTHER

2. HEXADECIMAL TO OCTAL



CONVERSIONS-HEXADECIMAL TO OTHER

3. HEXADECIMAL TO Decimal



Number System

- **Addition**
- **Subtraction**
- **Multiplication**
- **Division**

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Lecture 8

Programming Language Types

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TYPES OF PROGRAMMING LANGUAGES

There are a lot of programming languages, but very few of them are accepted by the programmers.

Currently, the programmers have numerous options to select the programming language, the ability and implementation of each language is quite different from other, so it is important to understand the functions of each language before selecting it for your career.

So, this Lecture provides you with comprehensive information about different types of programming language, and functions of these languages and differences between languages in a more useful way.

TYPES OF PROGRAMMING LANGUAGES

TYPES OF PROGRAMMING LANGUAGES

Programming languages for computers are developed with the primary objective of facilitating a large number of persons to use computers without the need to know in detail the internal structure of a computer.

The ideal language would be one which expresses precisely the specification of a problem to be solved, and converts it into a series of instructions for a computer.

In actual practice, a detailed algorithm to solve a problem is the starting point and it is expressed as a program in a programming language.

TYPES OF PROGRAMMING LANGUAGES

All modern programming languages are designed to be machine independent.

In other words, the structure of the programming language would not depend upon the internal structure of a specified computer; one should be able to execute a program written in the programming language on any computer regardless of who manufactured it or what model it is.

Such languages are known as high level machine independent programming languages.

Compiler

A compiler is a special program that processes statements written in a particular programming language and turns them into machine language or "code" that a computer's processor uses.

Typically, a programmer writes language statements in a language such as Pascal or C one line at a time using an editor. The file that is created contains what are called the source statements.

When executing (running), the compiler first parses (or analyzes) all of the language statements syntactically one after the other and then, in one or more successive stages or "passes", builds the output code, making sure that statements that refer to other statements are referred to correctly in the final code.

Traditionally, the output of the compilation has been called *object code* or sometimes an *object module* .The object code is machine code that the processor can execute one instruction at a time.

Compiler

In some operating systems, an additional step was required after compilation – that of resolving the relative location of instructions and data when more than one object module was to be run at the same time and they cross-referred to each other's instruction sequences or data.

This process was sometimes called *linkage editing* and the output known as a *load module*.

A compiler works with what are sometimes called 3GL and higher-level languages. An assembler works on programs written using a processor's assembler language.

Interpreter

An interpreter is a computer program that is used to directly execute program instructions written using one of the many high-level programming languages.

The interpreter transforms the high-level program into an intermediate language that it then executes, or it could parse the high-level source code and then performs the commands directly, which is done line by line or statement by statement.

Compiler & Interpreter

Programming languages are implemented in two ways: interpretation and compilation. As the name suggests, an interpreter transforms or interprets a high-level programming code into code that can be understood by the machine (machine code) or into an intermediate language that can be easily executed as well.

The interpreter reads each statement of code and then converts or executes it directly. In contrast, an assembler or a compiler converts a high-level source code into native (compiled) code that can be executed directly by the operating system (e.g. by creating a .exe program).

Compiler & Interpreter

In most cases, a compiler is preferable since its output runs much faster compared to a line-by-line interpretation. Rather than scanning the whole program and translating it into machine code like a compiler does, the interpreter translates code one statement at a time.

While the time to analyze source code is reduced, especially a particularly large one, execution time for an interpreter is comparatively slower than a compiler. On top of that, since interpretation happens per line or statement, it can be stopped in the middle of execution to allow for either code modification or debugging.

Compilers must generate intermediate object code that requires more memory to be linked, contrarily to interpreters which tend to use memory more efficiently.

Compiler & Interpreter

Since an interpreter reads and then executes code in a single process, it very useful for scripting and other small programs. As such, it is commonly installed on Web servers, which run a lot of executable scripts. It is also used during the development stage of a program to test small chunks of code one by one **rather than having to compile the whole program every time.**

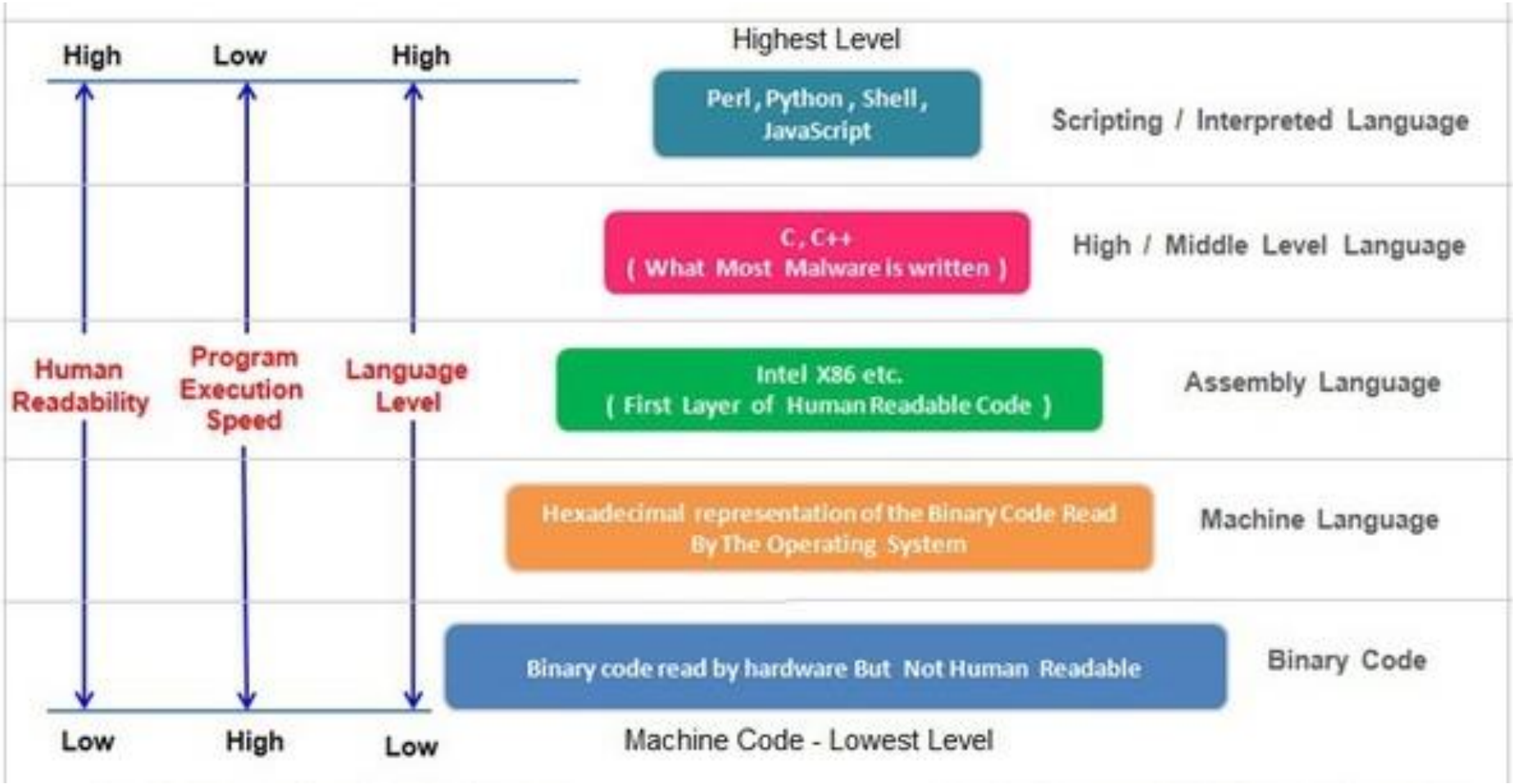
Every source statement will be executed line by line during execution, which is particularly appreciated for debugging reasons to immediately recognize errors. Interpreters are also used for educational purposes since they can be used to show students how to program one script at a time.

Programming languages that use interpreters include Python, Ruby, and JavaScript, while programming languages that use compilers include Java, C++, and C.

TYPES OF PROGRAMMING LANGUAGES

- Low-level Languages
  - -Machine Languages
  - -Assembly Languages
- Middle-level Language
- High-level Languages
- Very High-level Languages
- Higher level Languages

TYPES OF PROGRAMMING LANGUAGES



LOW-LEVEL LANGUAGES

Low-level languages are direct machine codes or very close to the machine. It provides a little or no abstraction from a computer's instruction set architecture. The word “low” here refers to the small or nonexistent amount of abstraction between the language and machine language. Such types of languages are very close to the hardware.

There is no need of the translator such as compiler, interpreter for such type of languages. All the low-level programs are very quickly run able on computer machines and a very few memory space is needed as comparative to the high-level language programs. Such types of languages are simple, but are difficult to use because of so many technical details which must be memorized by the developers.

A computer can only understand and execute the instructions of the languages which are in the form of 0‟s and 1‟s (Binary number system). **Low-level languages are machine oriented and always require the extensive knowledge of the computer architecture (computer hardware & computer configuration).**

LOW-LEVEL LANGUAGES

There are two types of low-level languages named machine languages and assembly languages.

Machine Languages

Assembly Languages

Machine Languages

These are the lowest and most basic level of programming languages. It was the first type of computer language developed. The computer can understand only the special signals, which are the high level current and the low –level current and 1"s and 0"s represent them respectively.

These are the only languages which are directly understood by the computers. A series of codes is supplied to the computer then it identifies the fed code and converts them in to the electrical signals to run it as required. As an example:

1010 0011 0001 1001 (*Machine Language*)
ADD R3, R1, R9 (*Assembly Language*)

Applications of Machine Languages: It was used by the programmers when there was no computer language, but now many options are available for programming. **The programming in machine languages needs a lot of time to learn and to document. So it's always avoided by the programmers. Assembly languages are used in place of them.**

Machine Languages

The language, which uses binary digits, is called the machine level language. Machine language has its own pros and cons.

1. *First Generation Languages:* It is the first generation computer languages.

2. *Machine Dependent:* It says that the program instructions which are designed for one kind of machine cannot be utilized on another kind of machine.

3. *Fast processing:* the machine language programs are very quick to run.

4. *Error prone:* The instructions are written using 0's and 1's, so it is a very cumbersome task. Hence, there are more chances of error prone codes in these languages.

*error prone means able to have a mistakes

Machine Languages

5. *Difficult to use:* The binary digits (0 and 1) are used to represent the complete data or instructions, so it is a tough task to memorize all the machine codes for human beings.

6. *Difficult of debug:* When there is a mistake within the logic of the program then it is difficult to find out the error (bug) and debug the machine language program.

7. *Difficult to understand:* It is very difficult to understand the existing programs; it requires a great knowledge of machine code with the system architecture.

8. *Efficient code for the Machine:* The coding of the machine language programs is very efficient for the machine.

9. *No need of Translator:* The machine code is directly understood by the machines, so no need of the translator.

11. *Need to remember a lot of machine codes:* We have to remember a lot of machine codes for programming in these languages.

12. *Need to remember all memory addresses:* We have to remember all memory addresses for programming.

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Lecture 9

Programming Language Types

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Assembly Languages

This is the next level of programming languages after the machine languages. In assembly languages, we use alphanumeric symbols (as operands and operations) instead of binary digits. **These mnemonics can have up to five letter combinations maximum** e.g. MOV, SUB, ADD, MUL, START etc.

These languages are also known as "***Symbolic Programming Languages***" because of the usage of symbols to represent operation codes and storage locations. The programs written in assembly language are called assembly codes. Assembly language is easier to understand by the humans as compared to its predecessor language (*Machine Language*). The coding of the both of these languages is shown in the Table I.

Table I. The Machine Languages Code and the Corresponding Assembly Language code

Language Code (Machine) (16-BIT INSTRUCTION SET)	*Assembly Language Code (Equivalent)*			
1000000100100101	LOAD	R1	5	
1000000101000101	LOAD	R2	5	
1010000100000110	ADD	R0	R1	R2
1000001000000110	SAVE	R0	6	
1111111111111111	HALT			

Assembly Languages

The symbolic addresses are utilized for the data times by the developers. The assembler programs allot the machine addresses and make certain that the different data items do not overlie in computer memory, an unenthusiastically ordinary incidence in machine language program codes.

The assembly program coding is generally separated into diverse fields which split with spaces or tabs.

A typical assembly code line is shown below:

[Label] [Op-code] [Operand1], [Operand2] ; Comment

Assembly Languages

1. *Labels* are the starting field of assembly language instructions. It may be blank. If it is there then the assembler program describes the label with corresponding to the address.

2. *Op-codes* are basically the Mnemonics. These are operation codes which are assigned to each processor instruction (set). The assemblers translate the op-codes into their binary equivalent code.

3. *Operands* are the objects which are used by the operation represented by the Op-code.

4. *Comments* are used after the semicolon to describe about the coding. These are ignored by the assemblers when they translate the assembly language program.

5. *Processor Instructions (set)* are classified in the following categories:

(a) *Data Transfer Instructions:* These instructions are used to transmit data from one position to another. The data transfer may be register-to-register, register-to-memory, memory-to-register, immediate value to register such as MOV, MOVX, PUSH, POP, etc.

(b) *Arithmetic Instructions:* These are the instructions which are used to do the arithmetic operations like INC, ADD, MUL, SUB, DIV, DEC, etc.

(c) *Logical Instructions:* These are the instructions which are used to do the logical operations like AND, NOT, XOR, ORL, XRL, etc.

5. *Processor Instructions (set)* are classified in the following categories: (Continue)

(d) *Control Transfer Instructions:* Such instructions are jumping ones which are utilized to jump from one place to another in a program and utilized for controlling loops. The instructions are like JZ, JNZ, JE, JMP, AJMP, LJMP, ACALL, LCALL, RET, etc.

The first field is optional. It is the label field. It is used to specify symbolic labels and constants. The few assembler programs always need the labels with the colon as a delimiter ([Label :]). The next field is the op-code (*mnemonic*) field. The 3rd and the next fields are operands. These are usually comma-separated. The comments start with a delimiter semicolon (;) and ends in the same line.

Assembly Languages

Operation code	Address
LOAD	A
ADD	B
STORE	C

Clearly scope of error is very much reduced. However, the computer does not directly understand assembly languages. A program called an assembler translates it into machine language. The mnemonic op-code like ADD is replaced with the equivalent machine code by the assembler. The assembler assigns the addresses to symbols A, B, and C and make sure that all the addresses are different from each symbol. So for making easy process for the programming, an additional process level has expanded.

In the real time applications the assembly language is still utilized for controlling the computer activities with efficiency. So the languages always require a sound knowledge of the machine architecture. For example, different ADD instructions are required for various kinds of data item. **Assembly languages are machine-oriented, so, the developers are always requiring re-writing the programs to implement that on the different computing machine.**

Assembly Languages

The salient features of assembly languages are given below:

1. *2nd Generation Languages:* the second generation languages after machine languages.

2. *Easy to be compared with Machine languages*

3. *Easy to understand:*

4. *Easy to remove errors:* Because of the codes use English alphabets, it's easy to locate and correct errors in an assembly language programs.

5. *Easy to modify:* we can modify them easily as the comparison with machine programs.

6. *Machine dependent:* A program which is written for one machine cannot be rerun of the different machine because every machine has a different architecture.

Assembly Languages

7. *Need of Translator for the execution of the Program:* The Assembly language programs cannot be directly run or execute on the system, they always need the Assemblers.

8. *Programmer Requires the Knowledge of Computer Architecture:* the programmer need to understand the computer architecture as for as the machine languages.

9. *Efficient code for the Machine:* The coding of the Assembly language programs is very efficient for the machine.

10. *Fast processing:* As the assembly instructions are directly converted to the machine code by the assemblers so they are processed (executed) very quickly.

12. *Used for Specific Applications:* Used in applications which are cost sensitive (Washing Machines & Music Systems) & time critical (Aircraft Controls). (H.W.)

13. Assembly Language Programs are not Portable: As we know that every microcomputer has its own assembly language. So one assembly language program cannot be run on another microcomputer.

Applications of Assembly Languages: The languages are used by the programmers when they have to **process the limited data**, when the memory cost factor is accounted (*washing machines*), when the programs are very small, when there is a need of real-time applications (*aircraft control*), and when the applications requires more input or output or control computations.

MIDDLE –LEVEL LANGUAGES

Middle-level languages have been developed in recent years to bridge the gap of high-level and low-level languages. Some of these languages fall in the category of object-oriented e.g. C#, C++, Java, and FORTH.

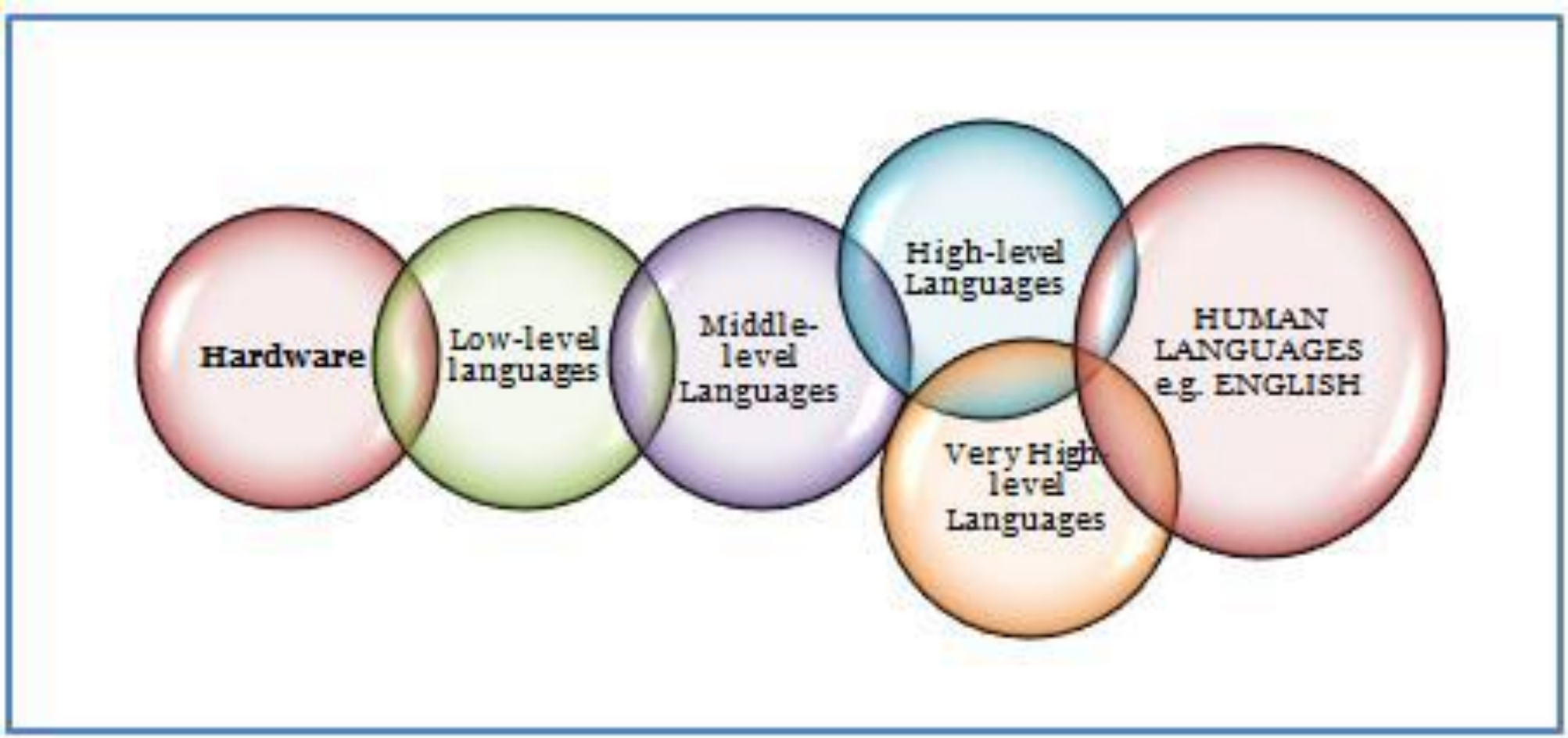
These languages are helpful in developing Graphical User Interfaces (GUIs) that run on personal computers. Middle-level language programmers **need more technical skills** as compared to the high-level language programmers. These languages are closely related to man and machine.

MIDDLE –LEVEL LANGUAGES

Such languages offer a small set of controlling and data-manipulating instructions which can be utilized by the developers. A high-level language is designed to give programmers all they could possibly want already in-built. A low-level programming every function is defined by the developers since nothing is predefined and libraries of them available.

These are the building block programming languages, because all the routines are created firstly for the specific functioning and make a collection or library of them. C and C++ languages allow a programmer to define routines to perform high-level commands. These routines are called functions. These are very important to C and C++. We can tailor a library of C and C++ functions to perform tasks that are carried out by our program. The overlapping of the middle level languages over the other levels is shown in the Figure 2.

MIDDLE –LEVEL LANGUAGES



HIGH –LEVEL LANGUAGES

High – level languages are problem-oriented rather than computer-oriented. There are so many low-level language instructions corresponding to every high-level language instruction. Compilers and Interpreters are used to translate the high – level language source programs into machine language instructions.

To write large pieces of software, like web browsers, word processors, computer games, audio-video players, or a library system, cannot be done effectively by writing all of its instructions with the help of low-level programming languages. Such type of software is written in high-level programming languages. **These languages allow the complex sequences of processor instructions to be expressed briefly.**

HIGH –LEVEL LANGUAGES

High-level programming languages have formats close to English language. The main purpose of developing these languages is to write programs easily. These are basically symbolic languages. Here, English words and/or mathematical symbols are utilized in place of mnemonic codes.

There are so many high-level languages exist for different type of works. FORTRAN (FORmula TRANslation language) is the oldest high-level language which was used for expressing the algebraic notations. COBOL (COmmon Business-Oriented Language) is the language for business applications. C is a system programming language. A few languages are GUI (Graphical User Interface) based to develop applications

HIGH –LEVEL LANGUAGES

Some of the features of high – level languages are given here:

1. *3rd Generation Languages:* This generation is the refinement to the 2nd generation.

2. *Understandability:* The users can easily understand the programs.

3. *Debugging:* We can easily find the errors (bugs) in programs.

4. *Portability:* It is easy to run the same program which is written on one machine and run on the different machine.

5. *Easy to Use:* These languages are programs easily, if we are well know to English language.

6. *Problem-oriented Languages:* We can write the programs like the language of the problem. As there are business-oriented languages and as well as scientific languages.

7. *User-friendliness*

8. *Little time to write Programs:* In these languages the writing of programs requires less time.

9. *Easy Maintenance:* We can easily maintain the programs written in these languages.

10. *Machine Independence*

11. *Need of a Translator:* There is always a need to translate the high-level language program to machine language program.

12. *Less Efficient:* The use of resources (*processor time/memory space*) of the programs written in these languages is high as compared to the low-level language programs.

VERY HIGH –LEVEL PROGRAMMING LANGUAGES

Most of the fourth generation languages (4GLs) are non procedural languages. Here only the encouragement to the users and the developers to describe the results they need. Though, the series of instructions are decided by the computing machines which will provide the required results.

A 4GL is used in six major areas. Those areas include, Data input; Data management; Data analysts; Data output (including reporting); Graphics; user oriented interfacing only that includes the utilization of windows, and predefined screens etc. One example is shown as follows.

All the forth generation programming languages are so much interactive and a dialogue in between the human being and the computer machine is supported. They are powerful system software because they provide default data management, programming, and reporting functions etc. Consecutively, this leads to Decreased Development Time; Decreased Development Costs; Increased Software Quality; Improved Decision Making Capabilities; and Increased Availability of Information.

VERY HIGH –LEVEL PROGRAMMING LANGUAGES

As an example, the Oracle is a 4GE (4th Generation Environment) which has the components like End-user Query Language (e.g. SQL), Screen Formatter (e.g. Oracle‟s screen painter in SQL *Forms), Report Generator (SQL *Report), Data Dictionary (SQL *DD), SQL *Plus, SQL *Forms, SQL *Graph and many more. Other 4GLs are Progress 4GL, AVS, APE, LINC, Build Professional, GEM Base, and Mathematica etc.

4GLs can be classified in five major groups: Programming extensions to the operating system through command interpreters; database management and query; new programming languages such as graphics; productivity-oriented tools, through pre-compilers; and spreadsheet systems and integrated software.

HIGHER –LEVEL PROGRAMMING LANGUAGES

Report

This class of programming languages comes under the category of fifth Generation Languages (5GLs). These are yet to come. These are the subjects of discussion in the programming community. These will use the ideas of Artificial Intelligence (AI) to cause novel software to exists. Therefore, it is very characteristic job to develop such languages. There will be no significance of the algorithms. Only the constraints will be thought carefully in the programming.

Nowadays Fifth Generation systems (5GSs) characteristically have large scale parallel processing (many instructions being executed simultaneously), different memory organizations, and novel hardware operations predominantly designed for symbol manipulation. The concept of parallel processing has come in place of the single central processor. This new hardware organization is often fastened with software that concentrates on representation of knowledge.

Some Programming Languages Description

Language	Description
Ada	Ada was created in the 1970s, primarily for applications used by the U.S. Department of Defense. The language is named in honor of Countess Ada Lovelace, an influential and historic figure in the field of computing.
BASIC	Beginners All-purpose Symbolic Instruction Code is a general-purpose language that was originally designed in the early 1960s to be simple enough for beginners to learn. Today, there are many different versions of BASIC.
FORTRAN	FORmula TRANslator was the first high-level programming language. It was designed in the 1950s for performing complex mathematical calculations.
COBOL	Common Business-Oriented Language was created in the 1950s, and was designed for business applications.
Pascal	Pascal was created in 1970, and was originally designed for teaching programming. The language was named in honor of the mathematician, physicist, and philosopher Blaise Pascal.
C and C++	C and C++ (pronounced "c plus plus") are powerful, general-purpose languages developed at Bell Laboratories. The C language was created in 1972 and the C++ language was created in 1983.
C#	Pronounced "c sharp." This language was created by Microsoft around the year 2000 for developing applications based on the Microsoft .NET platform.
Java	Java was created by Sun Microsystems in the early 1990s. It can be used to develop programs that run on a single computer or over the Internet from a web server.
JavaScript	JavaScript, created in the 1990s, can be used in web pages. Despite its name, JavaScript is not related to Java.
Python	Python, the language we use in this book, is a general-purpose language created in the early 1990s. It has become popular in business and academic applications.
Ruby	Ruby is a general-purpose language that was created in the 1990s. It is increasingly becoming a popular language for programs that run on web servers.
Visual Basic	Visual Basic (commonly known as VB) is a Microsoft programming language and software development environment that allows programmers to create Windows-based applications quickly. VB was originally created in the early 1990s.

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Lecture 10

Programming Language Types

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Procedural-Oriented Language (3GL)

This programing executes a series of statements that lead to an outcome. Usually, this kind of programing uses heavy loops, multiple variables and some other elements, that is also a major difference between procedural and functional languages. The procedural functions can manage the variables, other than the value returns for these functions. For instance, information printing out. In these languages, the instructions of the program are written in order or in a defined direction in which they should be executed to solve some problem. It means that the program instructions are very important in the Procedural-Oriented languages.

Logic Programming Language

The logic programming languages permit the programmers to create declarative statements and formerly let the machine to aim about outcomes of statements. It can be said that this language would not tell the machine to do something but using the margins on what it should consider doing. Logic programming languages are easier to program in C in an object-oriented style. In reality, many languages include features and ideas from numerous domains, that just supports to raise the practicality of this kind of languages. However, there are many programming languages that are not we suited with other types of languages.

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Pascal Language Is an
Easy to Learn and Understand
LANGUAGE FOR BEGINNERS

Object-Oriented Programming

This programming language treats the data as a collection of objects that have some internal data and external portions of that data. This programming aims to think about the problem by separating it into objects collection that offers solutions that can be used to resolve a particular issue. The object-oriented programming language main principles are encapsulation that stated that everything an object will require should be inside an object. This programming stresses on the reusability via inheritance and the ability to spread present executions without having to transform a huge amount of programming code through using the polymorphism.

Problem-Oriented Language (4GL)

The problem-oriented language is said to be a programming language who manage structures and particularly data structures replicate in some characteristics measure of a problems class, such as scientific computation or commercial data processing. By distinction, the machine-oriented structures of a show the internal mechanical structure. It permits the users to stipulate what the result would be, without discussing all the details about the manipulation of data to produce the outcomes. This language is said to be one is one step ahead from Object-oriented Programing Language. These languages include database query language and they are typical result oriented.

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PHP Is A **Scripting** Language That You Can Use to Make A **Website** Rapidly

Scripting Programming Language

The scripting programming languages are often procedural and most of them include some elements of the object-oriented language but have their own category as they are not full-fledged languages for large systems development support in general. For instance, they might not have any checking for the compile-time type. Typically, to get started these type of programming languages needs small syntax. A script or scripting language is a kind of programming that provides a special run-time setting that automates the execution of the task; these are said to be the tasks that alternatively executed one after other by some human operator. Rather than being compiled, the scripting languages are interpreted frequently. The environments that can be computerized via scripting include web pages within a web browser, software applications, embedded systems, using shells of operating systems and also many other games.

Functional Programming

The functional programming usually uses for storing the data, often evading loops in recursive functions favour. This type of programing language also focusses on the functions return values, and there are also some of the side effects and different recommends that state of storing is discouraged powerfully. For instance, functional programing is said to be a useful and pure language, in a function is named, it's expected that the function will perform not or modify operation.

It might create some algorithmic calls and change the parameters of calls. Functional languages are typically easier to figure on abstract matters, though, they will even be "more than the machine" in their model of programming that also makes it hard to know, but the programming code is decoded into machine language that is also troublesome for programing of the system.

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Java Language is A Multi-Platform Language That is Majorly **Helpful** in **Networking**

Java

Java is a general-purpose programming language that is object-oriented, class-based, and made to have some implementation needs as conceivable. It is basically designed to allow the application developers to write the code in Java for once, run anywhere (WORA), it means that Java code when compiled can be executed on all podiums that support Java without any recompilation need. The applications in Java are assembled to bytecode that you can run on Java virtual machine (JVM) irrespective of the system architecture. Some of the programs in Java have a status of being sluggish and consume more memory as compared to the code written in C++ language.

The Java is multi-platform programming that's is an ideal option for networking. Obviously, typically this language is used in the web development with Java applets. Nevertheless, Java is also used to make programs that can be run on different platforms, as it is quite similar to the C++ syntax and structure. For programmers of C++, Java is an easy language to understand and learn and it also provides some benefits offered by the object-oriented programming. You must

PHP

The PHP is a kind of scripting language that can also be used to design web pages. If you want to make some website rapidly, it is the finest option available in the market, and as a result, it also contains features that would allow you to generate a link to databases and HTTP headers easily. PHP is a scripting language that comprises some components allows the programmer to effortlessly get up to speed. Nevertheless, it has more complex features of object-oriented programming.

The PHP is basically designed to make the web pages and from time to time it is used as a scripting language. As a scripting language, it comprises a set of components that allow the developers to improve the overall speed. This language would help you to make a website and by using the amazing features of the PHP you can also create the links to the databases of the website. Nevertheless, Php features are said to be more sophisticated than other object-oriented languages. Other than web development, you can also use the PHP can be used for many other tasks related to programming, for example, it can be

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C++ Programming Language is Used to Manage Projects with Large Scope

C++ Programming

For the project with a larger scope, the C++ is an ideal option because of its object-oriented structure. By using this language, the programmers can cooperate one program into other components or even one separate work on program's all part. The object-oriented structure, in this language also allows the code written in C++ to be reused. So, it can be said that C++ is a well-organized language. When it comes to the selection of programming language, not very much depends on your personal choice and your requirements. For most of the programmers, it is a good option to select.

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The COBOL also supports 3 formats of file: indexed, relative and sequential. In sequential files, all of the data records are adjoining and should be traversed consecutively, just like a connected list. In case of indexed files that have at least one indexed to allow records to be accessed randomly and that can be organized on them. It was planned to be an easy language for the programmers to understand and learn the best thing about this language is that it can be] readable to non-technical staff, for example, the management in the company. The readability of the COBOL is high because of the use of English-like

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Pearl Language Is Used for Searching
Text and Perform Useful **Server Functions**

Pearl Language

The Perl is a UNIX- based file management language. This language is very popular for its common gateway interface programming. It is a term used for programs performed by the web servers can allow added web pages capabilities. Pearl is also said to be a technique text for searching that is also used for valued server functions and databases, and it is easy to select some of the basics in case you have any knowledge and understand of any programing language. As a common gateway interface programming, Perl is selected by the web hosting services over C++. The Perl is more preferred in the web hosts can evaluate the Perl script files. When C++ is executed, although they are text files. Pearl language is used for searching text and perform useful server functions.

PEARL also supports both floating-point and fixed-point character string data, character, and values and also the bit values. It offers more amenities for multi-dimensional arrays and structures. Both untyped and typed pointers are supported under this language, with typecasting. Because of the presence of this language, Wall discovered the current PEARL earlier Perl's release and changed the name spelling.

Pascal Language

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The Pascal was affected by the efforts of ALGOL W, with some of the clear goals of making a language that will be effectual in both the run-time and compiler, permit for the development of the well-structured program, and to be valuable for structured programming teaching to the students. A student's generation used Pascal as a preliminary language in academic courses. The Pascal originally is a completely procedural and comprises the ALGOL-like array control structures with some reserved words for example then, if, while, else, case ranging and for, on a begin-end statements

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Scheme Language is A Popular Language With Simple Syntax and Features

Scheme Language

The scheme is also used as the substitute for the LISP language (LISP is typically used in computer science study and its syntax is easy and simple for the developers for structures implementations.), it has simpler features and syntax. Under the scheme, the project results in LISP language re-implementation. The scheme is one of the most popular preliminary languages in the computer science field. This language simply solves the difficulties rather than worrying about programming syntaxes. If you have no programming knowledge than it is a good language to start your codding with because of its easy and simple syntax. Scheme language is a popular language with simple syntax and features.

So, it can be said that the scheme is a programing language that is supported by various paradigms, with imperative and functional programming. It is one of the 3 major languages of LISP, with the Clojure and Common Lisp. Different from common LISP, it follows a simple philosophy design, stipulating a standard core with influential tools for an extension. This is widely used in schools and other courses related to computer science.

MACHINE CODE

VERSUS

ASSEMBLY LANGUAGE

MACHINE CODE	ASSEMBLY LANGUAGE
A computer program written in machine language instructions that can be executed directly by a computer's central processing unit (CPU)	A low-level programming language in which there is a strong correspondence between the program's statements and the architecture's machine code instructions
Consists of binaries, which are zeros and ones	Follows a syntax similar to the English Language
Only understood by the CPU	Understood by the programmer
Depends on the platform or the operating system	Consists of a set of standard instructions
Can be directly executed by the CPU to perform the defined tasks in the computer program	Used by applications such as real-time systems, and microcontroller-based embedded systems

Compiler	Interpreter
Compiler Takes **Entire** program as input	Interpreter Takes **Single** instruction as input .
Intermediate Object Code is **Generated**	**No** Intermediate Object Code is **Generated**
Conditional Control Statements are Executes **faster**	Conditional Control Statements are Executes **slower**
Memory Requirement : **More** (Since Object Code is Generated)	**Memory Requirement** is **Less**
Program need not be **compiled** every time	Every time higher level program is converted into lower level program
Errors are displayed after **entire program** is checked	**Errors** are displayed for **every instruction** interpreted (if any)
Example : C Compiler	**Example** : BASIC

Computer Organization and Architecture

كلية التربية للعلوم الصرفة / جامعة ديالى

Lecture 10

Software

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Pascal Language Is an Easy to Learn and Understand **LANGUAGE FOR BEGINNERS**

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PHP Is A **Scripting** Language That You Can Use to Make A **Website** Rapidly

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Java Language is A Multi-Platform Language That is Majorly Helpful in Networking

Java

Java is a general-purpose programming language that is object-oriented, class-based, and made to have some implementation needs as conceivable.

It is basically designed to allow the application developers to write the code in Java for once, run anywhere, it means that Java code when compiled can be executed on all podiums that support Java without any recompilation need.

The applications in Java are assembled to bytecode that you can run on Java virtual machine (JVM) irrespective of the system architecture. Some of the programs in Java have a status of being sluggish and consume more memory as compared to the code written in C++ language.

Java

The Java is multi-platform programming that's is an ideal option for networking.

Obviously, typically this language is used in the web development with Java applets. Nevertheless, Java is also used to make programs that can be run on different platforms, as it is quite similar to the C++ syntax and structure.

For programmers of C++, Java is an easy language to understand and learn and it also provides some benefits offered by the object-oriented programming.

You must understand the fact that it can be hard to write a well-organized coding in Java. But currently the Java speed has increased and Java 1.5 version provides some good structures for making the programming easier.

PHP

The PHP is a kind of scripting language that can also be used to design web pages.

If you want to make some website rapidly, it is the finest option available in the market, and as a result, it also contains features that would allow you to generate a link to databases and HTTP headers easily.

PHP is a scripting language that comprises some components allows the programmer to effortlessly get up to speed. Nevertheless, it has more complex features of object-oriented programming.

PHP

The PHP is basically designed to make the web pages and from time to time it is used as a scripting language. As a scripting language, it comprises a set of components that allow the developers to improve the overall speed. This language would help you to make a website and by using the amazing features of the PHP you can also create the links to the databases of the website.

Nevertheless, Php features are said to be more sophisticated than other object-oriented languages. Other than web development, you can also use the PHP can be used for many other tasks related to programming, for example, it can be used in the robotic drone control and standalone graphical applications. Basic functionality of the object-oriented languages is also added in the version PHP 3 and enhanced in PHP 4.

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C++ Programming Language is Used to Manage Projects with Large Scope

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A student's generation used Pascal as a preliminary language in academic courses. The Pascal originally is a completely procedural and comprises the ALGOL-like array control structures with some reserved words for example then, if, while, else, case ranging and for, on a begin-end statements block or a sole statement. Pascal has some of the data structuring theories not comprised of original types of ALGOL 60, like variants, records, enumerations, pointers, and sets and pointers.

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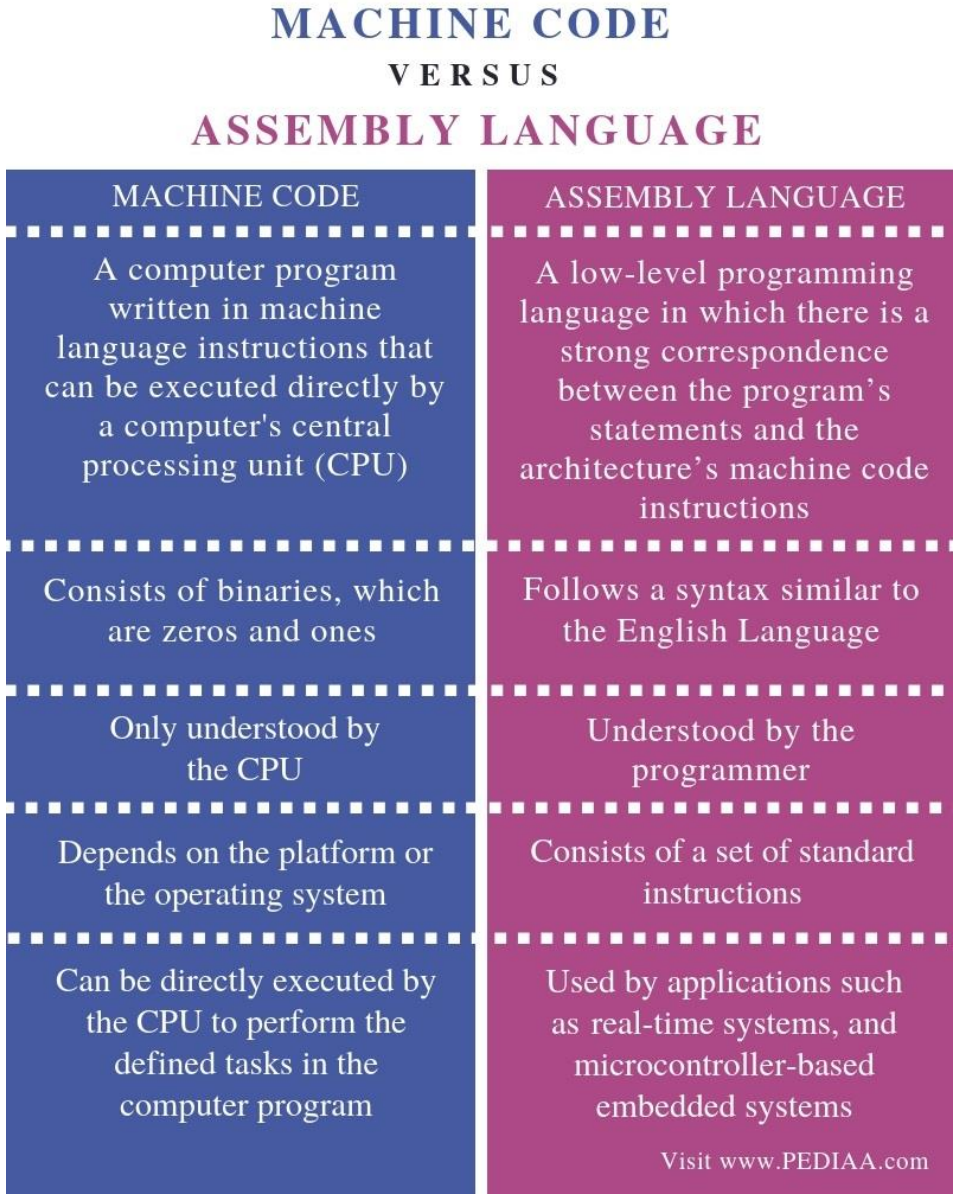
Differences between Machine and Assembly Languages



Differences between Compiler and Interrupter

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Computer Organization and Architecture

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Lecture 11

System Buses

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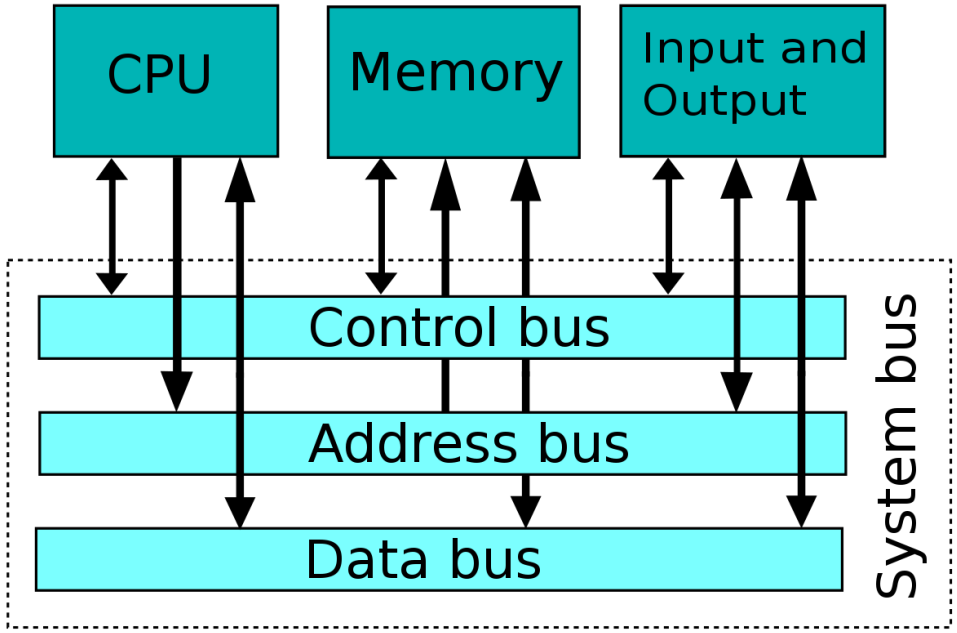
المرحلة الاولى

Types of Computer Buses | Meaning, Components, Functions, Structure, Topology

A computer bus is also known as a local bus, data bus or address bus, a bus is a link between components or devices linked to a computer.

A bus, for instance, carries data through the motherboard between a CPU (Central Processing Unit) and the system memory.



What is a computer bus?

A bus is a communication system in computer architecture that transfers data between components inside a computer, or between computers.

The following are a few points to describe a computer bus:-

A bus is a group of lines/wires which carry computer signals.
A bus is the means of shared transmission.

Lines are assigned for providing descriptive names. — carries a single electrical signal, e.g. 1-bit memory address, data bits series, or timing control that turns the device on or off.

Data can be transferred from one computer system location to another (between different I / O modules, memory, and CPU).

The bus is not only cable but also hardware (bus architecture), protocol, program, and bus controller.

What are the different components of a bus?

Each bus possesses three distinct communication channels.

Following are the three components of a bus: –

The address bus, a one-way pathway that allows information to pass in one direction only, carries information about where data is stored in memory.

The data bus is a two-way pathway carrying the actual data (information) to and from the main memory.

The control bus holds the control and timing signals needed to coordinate all of the computer's activities.

Functions of a computer bus

Below are a few of the functions in a computer bus:-

Data sharing – All types of buses used in network transfer data between the connected computer peripherals. The buses either transfer or send data in serial or parallel transfer method. This allows 1, 2, 4, or even 8 bytes of data to be exchanged at a time. (A Byte is an 8-bit group). Buses are classified according to how many bits they can move simultaneously, meaning we have 8-bit, 16-bit, 32-bit, or even 64-bit buses.

Addressing – A bus has address lines that suit the processors. This allows us to transfer data to or from different locations in the memory.

Power – A bus supplies the power to various connected peripherals.

Structure and Topologies of Computer buses

Lines are grouped as mentioned below –

Power line provides electrical power to the components connected

Data lines carrying data or instructions between modules of the system

Address lines indicate the recipient of the bus data

Control lines control the synchronization and operation of the bus and the modules linked to the bus

What are the different types of computer buses?

Computers normally have two bus types:-

System bus – This is the bus that connects the CPU to the motherboard's main memory. The system bus is also known as a front-side bus, a memory bus, a local bus, or a host bus.

A number of I / O Buses, (I / O is an input/output acronym) connecting various peripheral devices to the CPU. These devices connect to the system bus through a 'bridge' implemented on the chipset of the processors. Other I / O bus names include "expansion bus," "external bus" or "host bus"

ISA – Industry Standard Architecture

The Industry Standard Architecture (ISA) bus is still one of the oldest buses in service today.

Although it has been replaced by faster buses, ISA still has a lot of legacy devices that connect to it such as cash registers, CNC machines, and barcode scanners.

Since being expanded to 16 bits in 1984, ISA remains largely unchanged. Additional high-speed buses were added to avoid performance problems.

EISA – Extended Industry Standard Architecture

An upgrade to ISA is Extended Industry Standard Architecture or EISA. This doubled the data channels from 16 to 32 and allowed the bus to be used by more than one CPU.

Although deeper than the ISA slot, it is the same width that lets older devices connect to it.

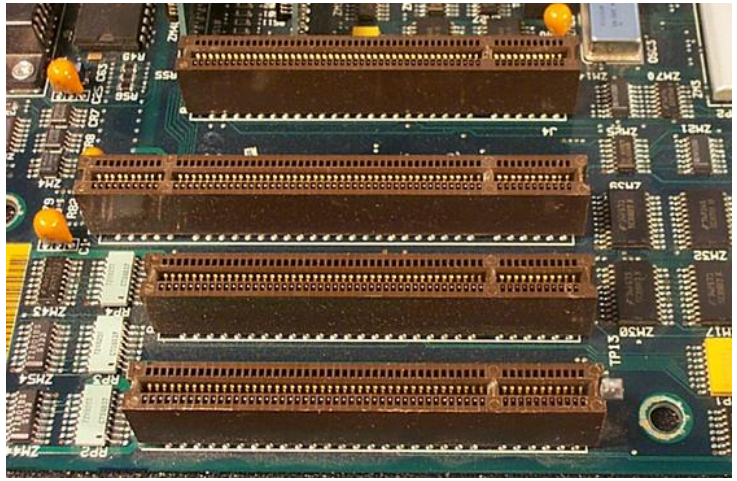
When you compare the pins on an ISA to an EISA card (the gold portion of the card that goes into the slot), you can find that the EISA pins are longer and thinner. That is a quick way to decide if you have an ISA or an EISA card.

MCA – Micro Channel Architecture

IBM developed this bus as a substitute for ISA when they designed the PS/2 PC which was launched in 1987.

The bus provided some technological improvements over the ISA bus. The MCA, for example, ran at a speed of 10MHz faster and supported either 16-bit or 32-bit data.

One advantage of MCA was that the plug-in cards were configurable software; that means they needed minimal user input during configuration



VESA – Video Electronics Standards Association

The Video Electronics Standards Association (VESA) Local bus was created to divide the load and allow the ISA bus to handle interrupts, and the I / O port (input/output) and the VL bus to work with Direct Memory Access (DMA) and I / O memory.

This was only a temporary solution, due to its size and other considerations. The PCI bus was easy to overtake the VL bus.

A VESA card has a range of additional pins and is longer than the ISA or EISA cards.

It was created in the early ’90s and has a 32-bit bus and was a temporary fix designed to help boost ISA ‘s performance.

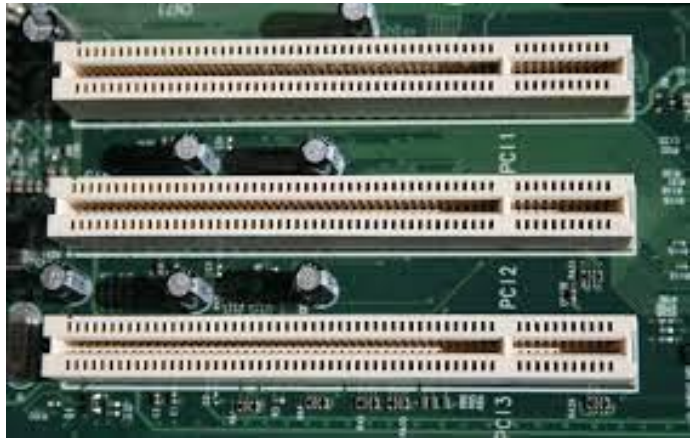
PCI – Peripheral Component Interconnect

The PCI bus was developed to solve ISA and VL-bus related issues. PCI has a 32-bit data path and will run at half the speed of the system memory bus.

One of its enhancements was to provide connected computers with direct access to machine memory. That increased computer efficiency while reducing the CPU ‘s capacity for interference.

Today’s computers mostly have PCI slots. PCI is considered a hybrid between ISA and VL-Bus that provides direct access to the connected devices system memory.

This uses a bridge to connect to the front side bus and CPU and is able to provide higher performance while reducing the potential for CPU interference.

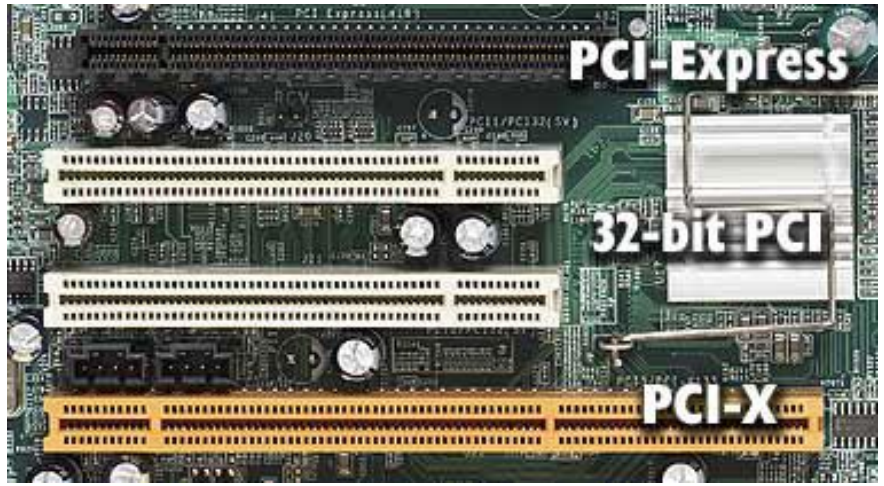


PCI Express (PCI-X)

The most recent added slot is PCI Express (PCIe). It was designed to replace the AGP and PCI bus. It has a 64-bit data path and 133 MHz base speed but incorporating full-duplex architecture was the main performance enhancement.

That allowed the card to run in both directions at full speed simultaneously. PCI Express slots run at 1X, 4X, 8X, and 16X providing PCI with the highest transfer speed of any form of a slot. The multiplier specifies the maximum rate of transfer.

PCI Express is compatible backward, allowing a 1X card to fit into a 16X slot.



PCI Express (PCI-X)

PCMCIA – Personal Computer Memory Card Industry Association (Also called PC bus)
The Personal Computer Memory Card Industry Association was established to give the laptop computers a standard bus.

But it is used in small computers, essentially.

AGP – Accelerated Graphics Port
The Accelerated Graphics Bus (AGP) was designed to accommodate the computers' increased graphics needs. It has a data path that is 32 bits long and runs at maximum bus speed.

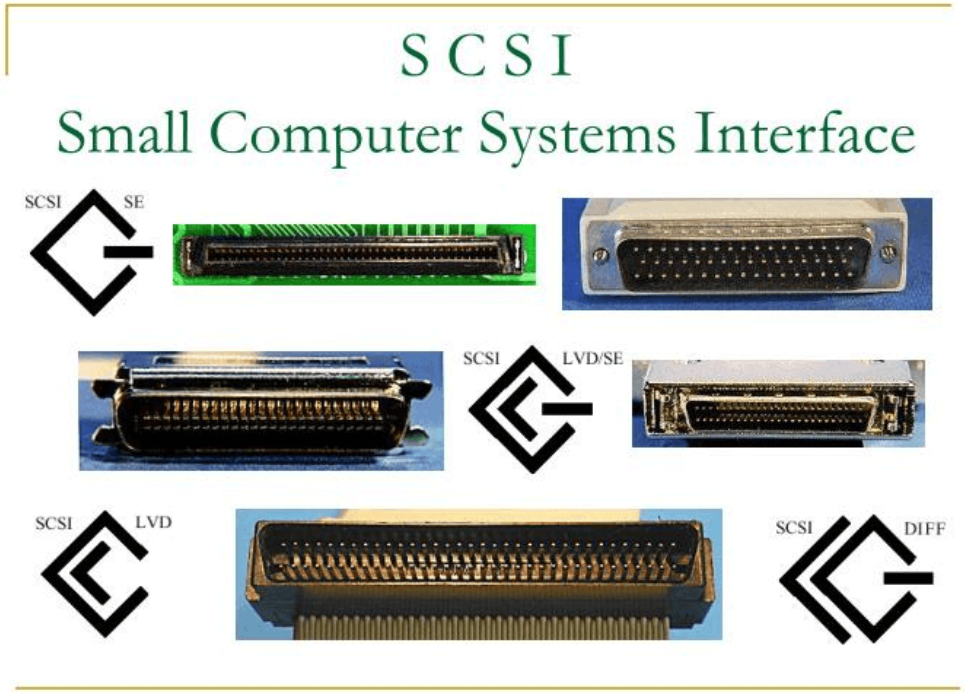
This doubled the PCI bandwidth and reduced the need to share the bus with other components. This means that AGP operates at 66 MHz on a regular motherboard, instead of the 33 MHz of the PCI bus.

AGP has a base speed of 66 MHz that doubles PCI speed. You can also get slots that run at speeds 2X, 4X, and 8X.

It also uses special signaling to allow twice as much data to be transmitted at the same clock speed over the port.

SCSI – Small Computer Systems Interface.

Small Computer System Interface is a standard parallel interface used for attaching peripheral devices to a computer by Apple Macintosh computers, PCs, and Unix systems.



Most common types of computer buses

Most of the listed buses are no longer used or not frequently used today.

Below is a list of the buses that are the most popular ones:-

ESATA and SATA– Hard Drives and Disk Drives computer.

PCIe – Video Cards and Computer Expansion Cards.

USB – Peripherals to a computer.

Thunderbolt – Peripherals that are connected via a USB-C cable.

Computer Organization and Architecture

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Lecture 12

Processor Architecture & Addressing Modes

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المرحلة الاولى

Brief History of 80x86 Family of Microprocessors

Processor	Year Intro.	Transistors	Clock Rate (MHz.)	External Data Bus	Internal Data Bus	Add. Bus
4004	1971	2,250	0.108	4	8	12
8008	1972	3,500	0.200	8	8	14
8080	1974	6,000	3	8	8	16
8085	1976	6,000	6	8	8	16
8086	1978	29,000	10	16	16	20
8088	1979	29,000	10	8	16	20
80286	1982	134,000	12.5	16	16	25
80386DX	1985	275,000	33	32	32	32
80386SX	1988	275,000	33	16	32	24
Pentium C	1993	3,100,000	66 -200	64	32	32
Pentium MMX	1997	4,500,000	300	64	32	32
Pentium Pro	1995	5,500,000	200	64	32	36
Pentium II	1997	7,500,000	233-450	64	32	36
Pentium III	1999	9,500,000	550-733	64	32	36
Itanium	2001	30,000,000	800-...	128	64	64

Brief History of 80x86 Family of Microprocessors

Clock Rate (MHz.)
0.108
0.200
3
6
10
10
12.5
33
33
66 -200
300
200
233-450
550-733
800-…

Units of Clock Speed Measurement

$$1\ \text{hertz} = \frac{1\ \text{cycle}}{1\ \text{second}}$$

$$1\ \text{MHz} = \frac{1{,}000{,}000\ \text{cycles}}{1\ \text{second}}$$

$$1\ \text{GHz} = \frac{1{,}000{,}000{,}000\ \text{cycles}}{1\ \text{second}}$$

$$1\ \text{GHz} = 1{,}000\ \text{MHz}$$

For Example

0.108 MHZ = 0.108*1000,000 HZ
= 108,000 HZ

Then

Number of Cycles

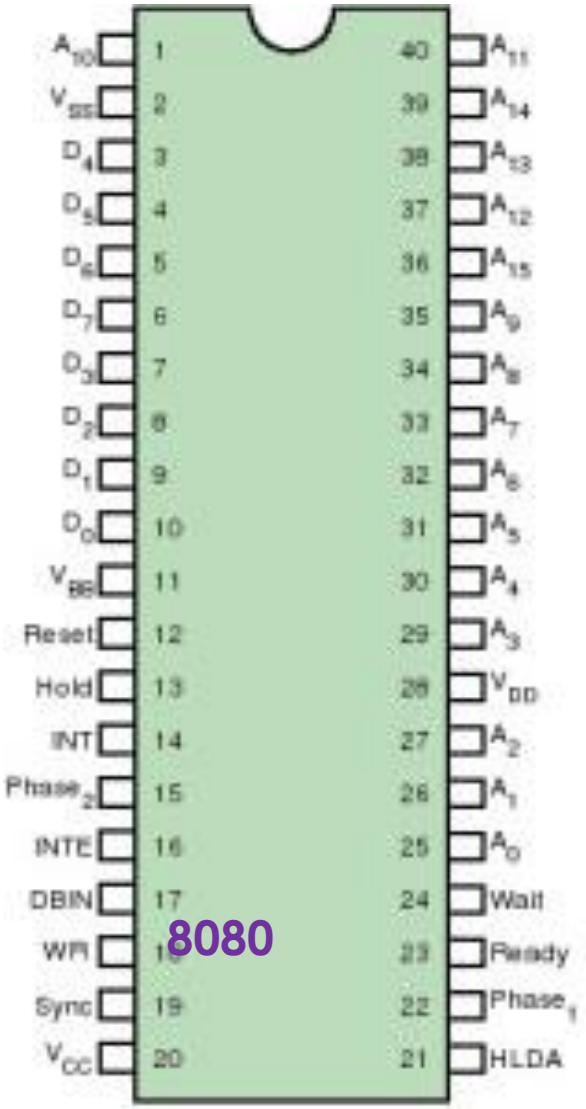
= 108,000 Cycle / Sec.

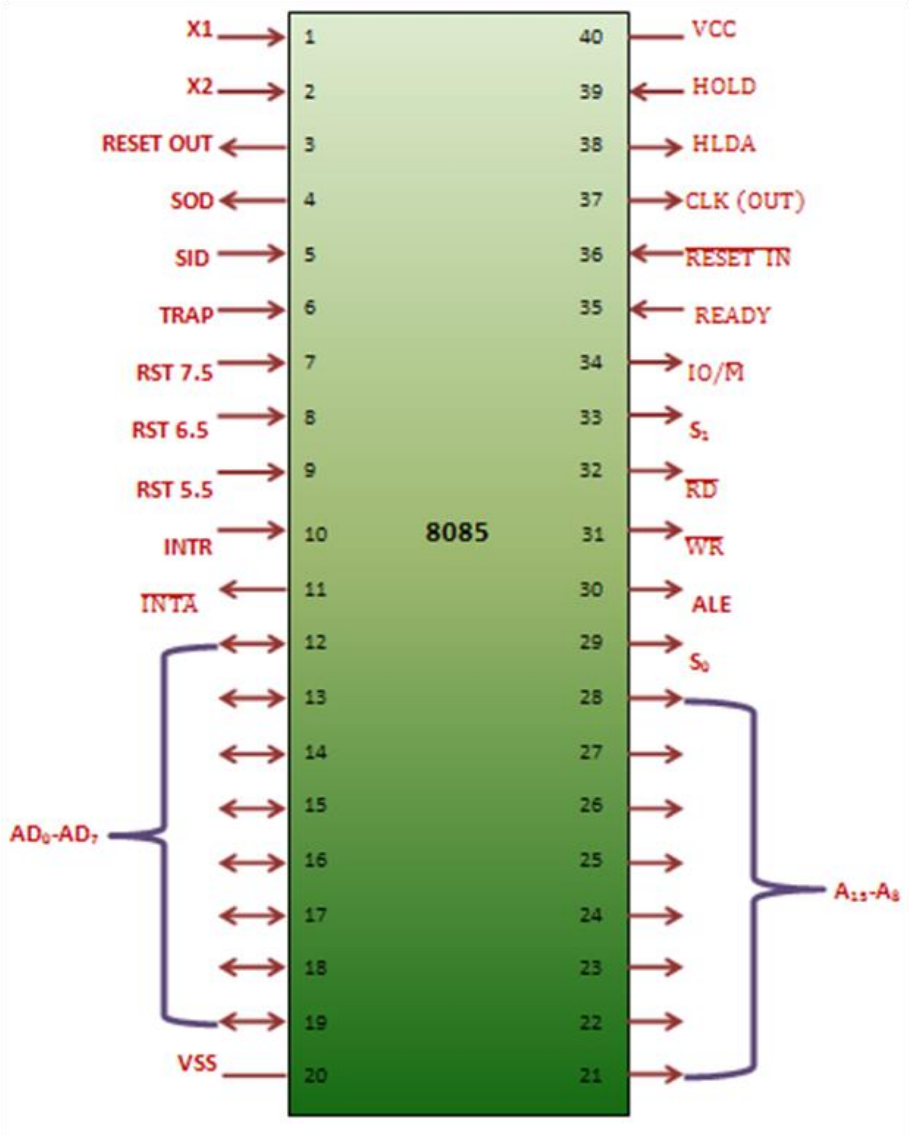
Difference between 8080 and 8085 Microprocessor

The Intel 8080 microprocessor was the predecessor of the 8085. Both was designed and manufactured by Intel, Both was an 8-bit Microprocessor.

Intel 8080 Microprocessor was released on April 1974 and Intel 8085 Microprocessor was introduced in 1976. 8085 is very close to the 8080 microprocessor, but some slight changes and modifications are present.

Difference between 8080 and 8085 Microprocessor





Difference between 8080 and 8085 Microprocessor

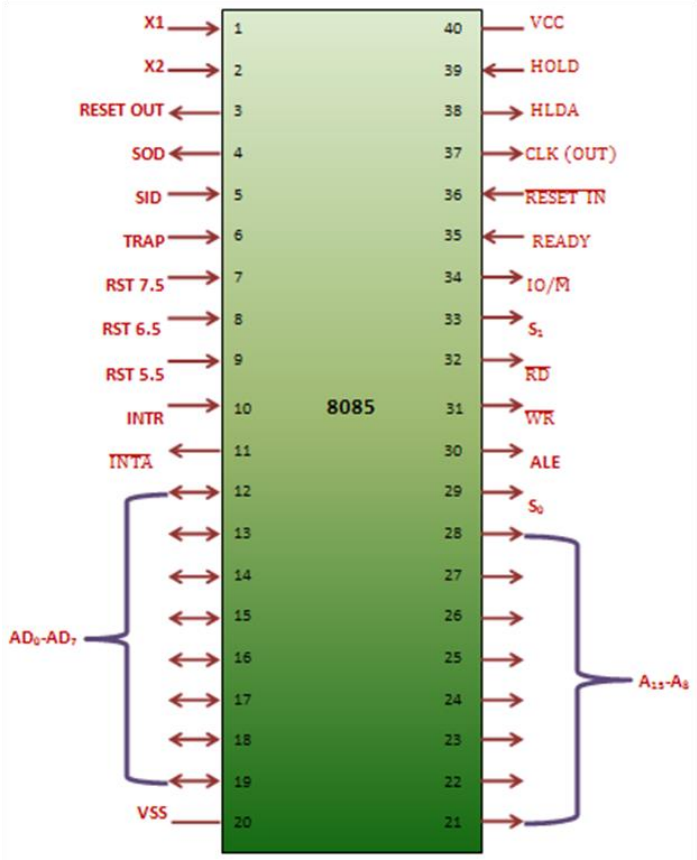
	8080 microprocessor	8085 microprocessor
1	There is 8 dedicated pins are there as Data bus (D0 to D7).	There is multiplexed 8 bit data pins are present for data bus (AD0 to AD7).
2	There is 16 address pins are present (A0 to A15).	There is 8 pins Higher order Address bus (A8 to A15) and 8 multiplexed address bus (AD0 to AD7), and the Address Latch Enable (ALE) pins are present.
3	The power supply voltage is +5, -5 and +12 volts.	The power supply is only +5 volts.
4	Single Interrupt pins are there (INT).	With INT, there are four more interrupt pins (TRAP, RST7.5, RST6.5, RST5.5).
5	Serial Communication facility is not present.	The Serial Communication facility is present with SID, SOD Pins and RIM, SIM instructions.

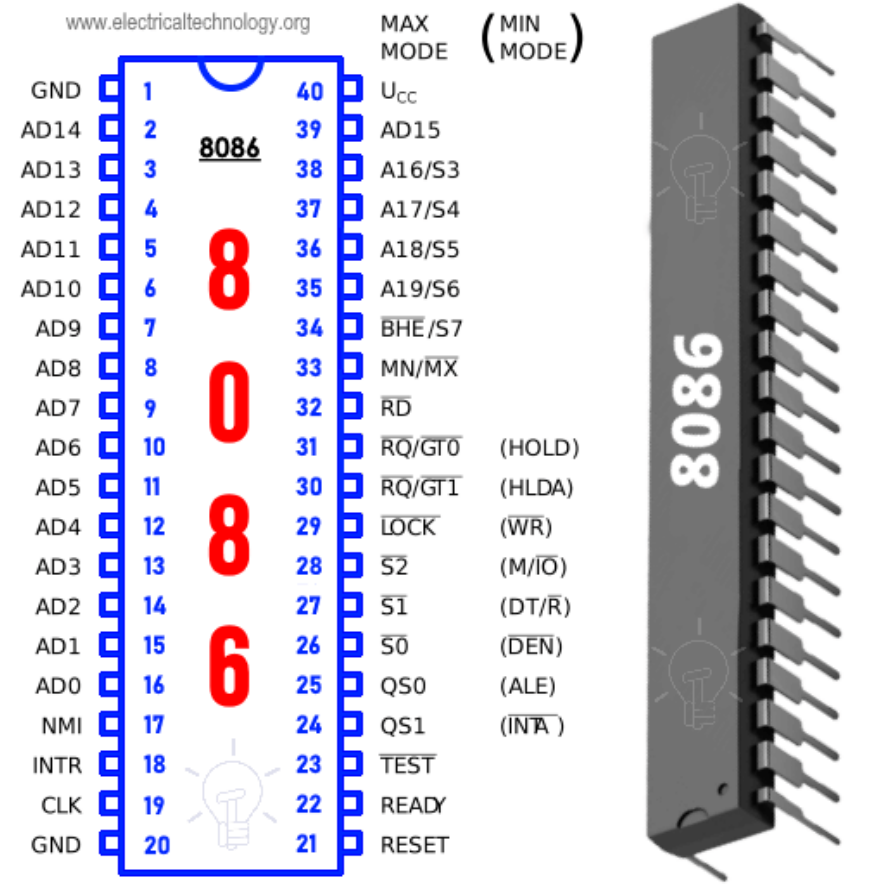
Difference between 8080 and 8085 Microprocessor

6	Additional chips for Clock and system controlling is needed.	No additional chips are needed for clock and system controlling tasks.
7	It consists of 5 flags (Sign Flag, Zero Flag, Auxiliary Carry Flag, Parity Flag, Carry Flag).	It also consists of 5 flags (Sign Flag, Zero Flag, Auxiliary Carry Flag, Parity Flag, Carry Flag).
8	Processor speed is upto 3.1 MHz.	Processor speed is up to 6 MHz
9	8080 requires 8224 clock oscillator as well as 8228 system controller to operates.	8085 is functional with only latches and gates.
10	8080 supports upto 256 Input/Output(I/P) ports.	8085 also supports up to 256 Input/Output(I/P) ports.

Difference between 8085 and 8086 Microprocessor

In the changing world of technologies, the devices used are also changing. Let us take a look at the changes between 8085 series of microprocessors and 8086 series of microprocessors.





Pin Diagram of 8086 Microprocessor

Difference between 8085 and 8086 Microprocessor

	8085 microprocessor	8086 microprocessor
1	The data bus is of 8 bits.	The data bus is of 16 bits.
2	The address bus is of 16 bits.	The address bus is of 20 bits.
3	The memory capacity is 64 KB.Also 8085 Can Perform Operation Upto 2^8 ie. 256 numbers	The memory capacity is 1 MB.Also 8086 Can Perform Operation upto 2^16 ie. 65,536 numbers.
4	The input/output port addresses are of 8 bits.	The input/output port addresses are of 8 bits.
5	The operating frequency is 3.2 MHz	The operating frequency is 5 MHz, 8MHZ,10MHZ.
5	8085 MP has Single Mode Of Operation.	8086 MP has Two Modes Of Operation. 1. Minimum Mode = Single CPU PROCESSOR 2. Maximum Mode = Multiple CPU PROCESSOR.

Difference between 8085 and 8086 Microprocessor

	8085 microprocessor	8086 microprocessor
6	It not have multiplication and division instructions.	It have multiplication and division instructions.
7	It does not support pipe-lining.	It supports pipe-lining as it has two independent units Execution Unit (EU) and Bus Interface Unit (BIU).
8	It does not support instruction queue.	It supports instruction queue.
9	Memory space is not segmented.	Memory space is segmented.
10	It consists of 5 flags(Sign Flag, Zero Flag, Auxiliary Carry Flag, Parity Flag, Carry Flag).	It consists of 9 flags (Overflow Flag, Direction Flag, Interrupt Flag, Trap Flag, Sign Flag, Zero Flag, Auxiliary Carry Flag, Parity Flag, Carry Flag).

Differences between 8086 and 8088 microprocessors

Though the architecture and instruction set of both 8086 and 8088 processors are same, still there are differences between them.

	8086 microprocessor	8088 microprocessor
1	The data bus is of 16 bits.	The data bus is of 8 bits.
2	It has 3 available clock speeds (5 MHz, 8 MHz (8086-2) and 10 MHz (8086-1)).	It has 3 available clock speeds (5 MHz, 8 MHz and 10MHz)
3	The memory capacity is 512 kB.	The memory capacity is implemented as a single 1 MX 8 memory banks.
4	It has memory control pin (M/IO) signal.	It has complemented memory control pin (IO/M) signal of 8086.
5	It has Bank High Enable (BHE) signal.	It has Status Signal (SSO).

Differences between 8086 and 8088 microprocessors

	8086 microprocessor	8088 microprocessor
6	It can read or write either 8-bit or 16-bit word at the same time.	It can read only 8-bit word at the same time.
7	Input/Output voltage level is measured at 2.5 mA.	Input/Output voltage level is measured at 2.0 mA
8	It has 6 byte instruction queue.	It has 4 byte instruction queue as it can fetch only 1 byte at a time.
9	It draws a maximum supply current of 360 mA.	It draws a maximum supply current of 340 mA.

Addressing

The two fundamentals of the computer's universe are data and address.

The data is what you store and the address is where you store it.

Most of the time we concentrate on the data – what is stored and how it is stored - and the address is ignored as a simple number that retrieves the data.

In the real world of practical computers, however, the situation is very different. The data is almost boring but how you find it requires a complex and exciting range of techniques. It's all about knowing where the data lives once you have found it generally what you do with it is fairly simple.

Addressing

Inside the CPU are special areas of storage called “registers”.

Exactly what you call these registers varies from machine to machine but most have something that corresponds to a program counter or PC register and some general purpose registers.

The program counter (PC) is a register that holds the address of the next instruction to be obeyed, i.e. to be fetched from memory, decoded and executed.

Other registers are used to store and operate on the data – the A register or Accumulator, for example.

Notice that the A register can be thought of as a “data register” and the PC register can be thought of as an “address” register.

Memory Division

أن المعالج 8088 يتعامل مع 20 إشارة عناوين (ناقل العناوين Address Bus يحتوي على 20 إشارة) وبالتالي يمكن مخاطبة ذاكرة تصل إلى 2 20 = 1,048,576 أي 1 . Mbytes

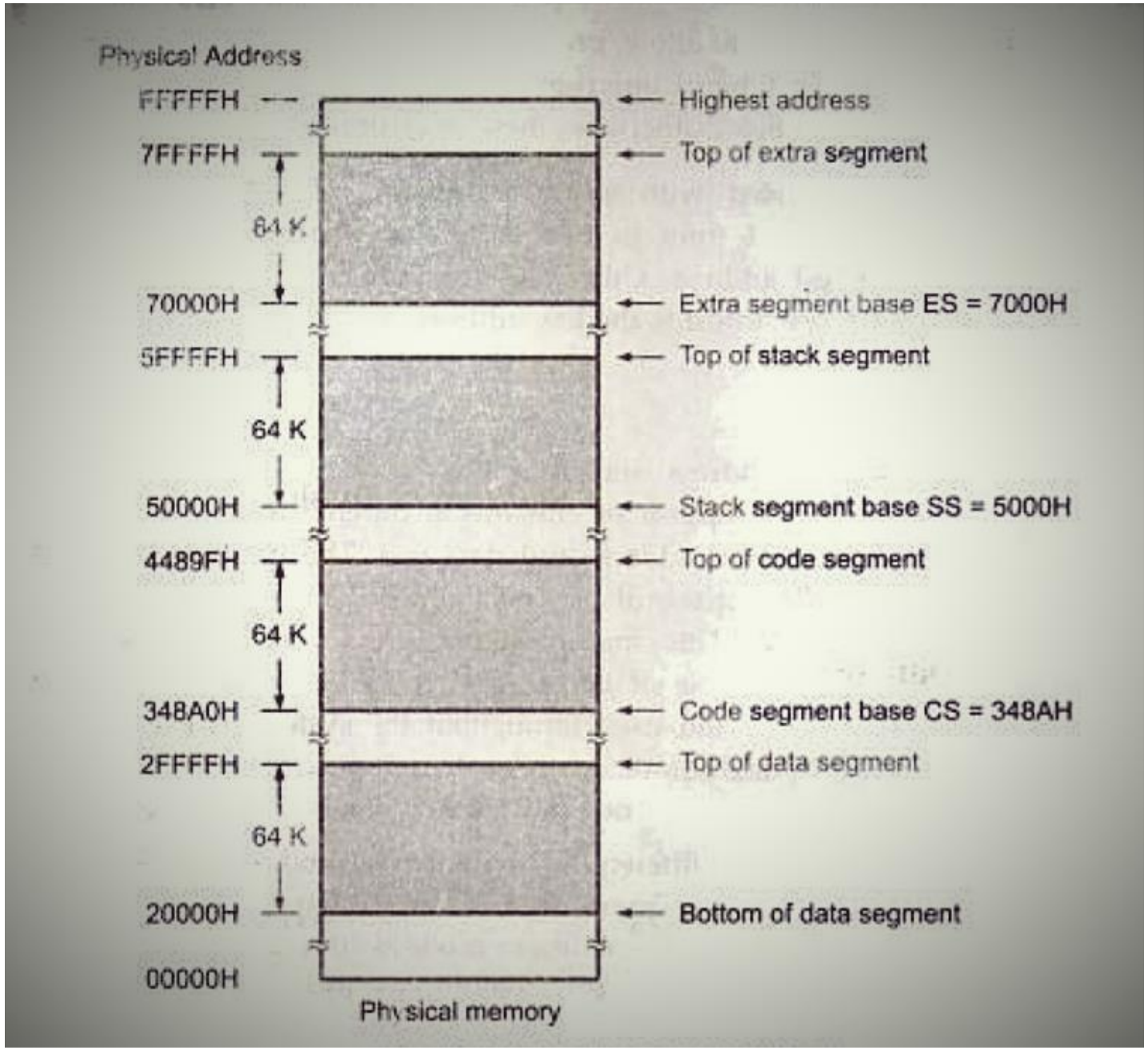
ونجد أن عناوين أول 5 خانات في الذاكرة هي :

0000 0000 0000 0000 0000 => 00000H
0000 0000 0000 0000 0001 => 00001H
0000 0000 0000 0000 0010 => 00002H
0000 0000 0000 0000 0011 => 00003H
0000 0000 0000 0000 0100 => 00004H

ولأن العناوين في الصورة الثنائية تكون طويلة جداً فمن الأسهل التعامل مع العناوين بكتابتها في الصورة السداسية عشر وبالتالي يكون عنوان أول خانة في الذاكرة هو 00000 H وعنوان آخر خانة هو . FFFFF H

Memory Division

ما سبق يتضح أن العنوان يتكون من 20 خانة بينما كل المسجلات الموجودة داخل المعالج ذات طول مقداره 16 خانة فقط مما يجعل مخاطبة الذاكرة كلها مستحيلة باستخدام مسجل واحد فقط (لاحظ أن المسجل الواحد باستطاعته مخاطبة ذاكرة تصل إلي 64 Kbytes فقط) ونتيجة لظهور هذه المشكلة تم تقسيم الذاكرة إلي مجموعة من المقاطع Segments كل مقطع بسعة 64 K Bytes



Addressing Mode

The 8086 Addressing Mode When the 8086 executes an instruction, it performs the specified function on data. The data are called its operands and may be part of the instruction reside in one of the internal registers of the 8086, stored at an address in memory, or held at an I/O port. To access these different types of operands, the 8086 is provided with various addressing modes. Which will be discussed in this lecture.

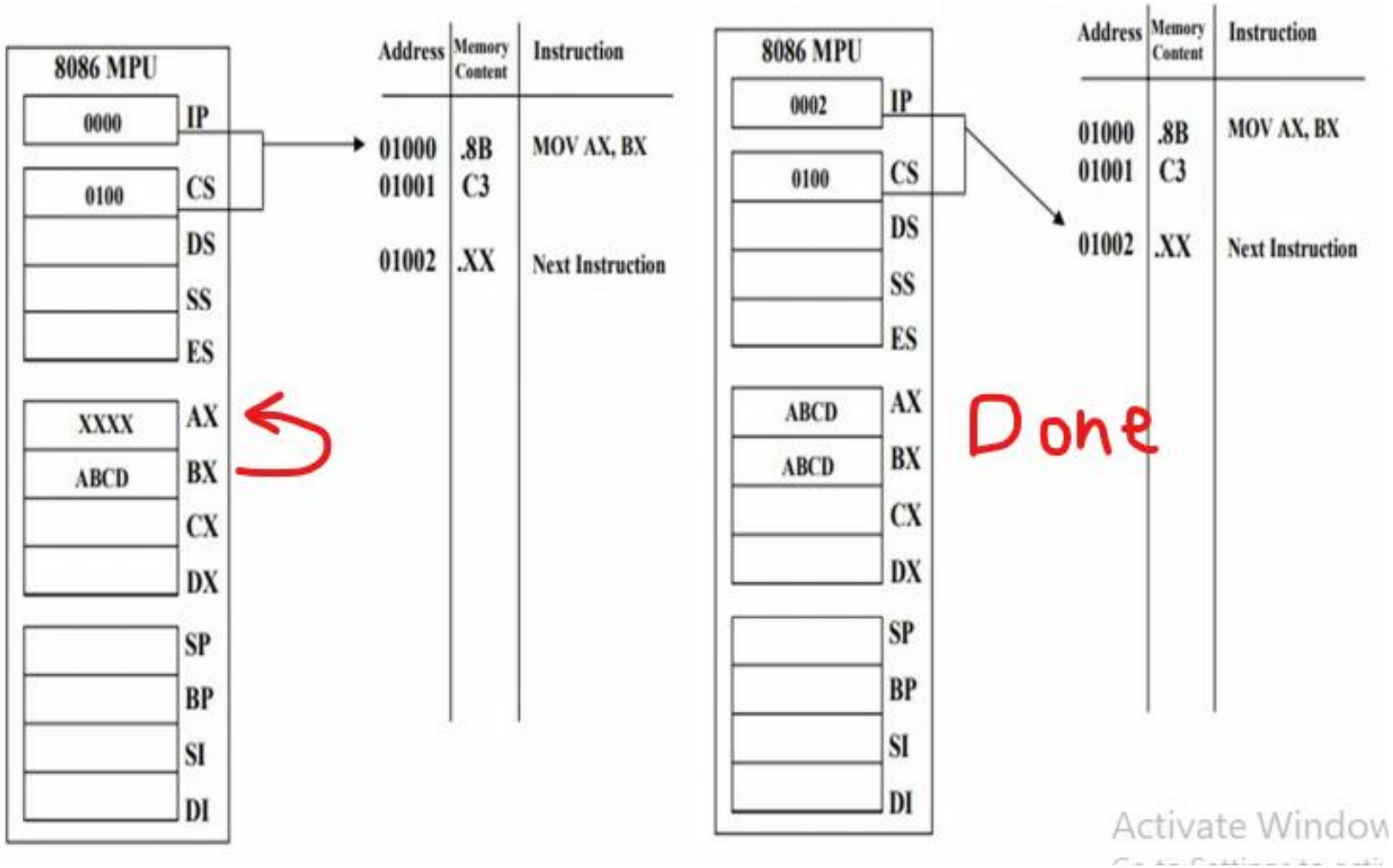
1. Register Addressing Mode

With the register addressing mode, the operand to be accessed is specified as residing in an internal register of the 8086, an example of an instruction that uses this addressing mode is

MOV AX, BX

This stands for move the contents of BX, the source operand, to AX, the destination operand. Both the source and destination operands have been specified as the content of the internal registers of the 8086

1. Register Addressing Mode



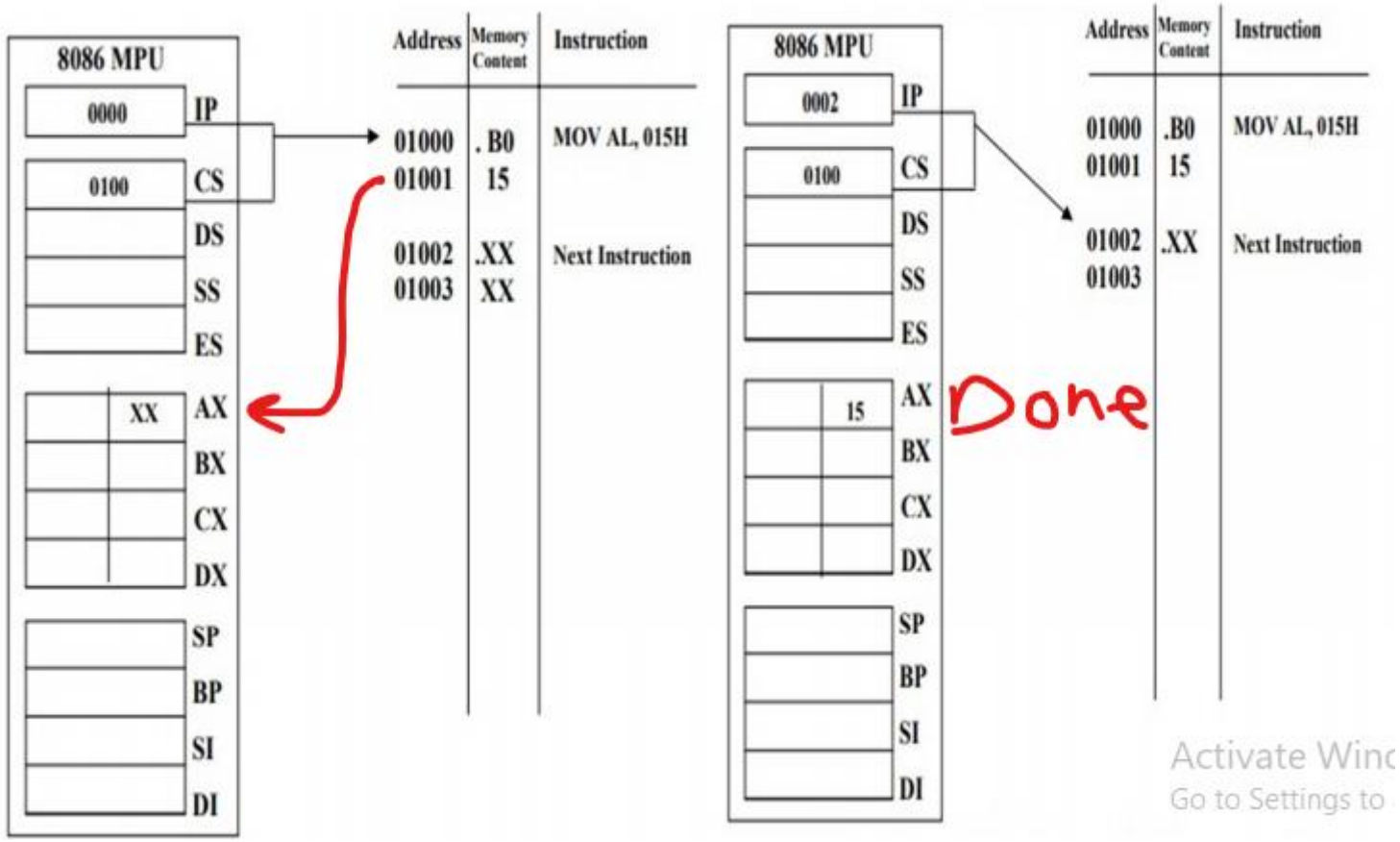
2. Immediate Addressing Mode

If a source operand is part of the instruction instead of the contents of a register or memory location, it represents what is called an immediate operand and is accessed using the immediate addressing mode.

MOV AL, 015H

Typically, immediate operands represent constant data. Immediate operands can be either a byte or word of data.

2. Immediate Addressing Mode



Addressing Modes to be continue……

Home work

Q1/ What are these interrupt pins (TRAP, RST7.5, RST6.5, RST5.5) stand for ?.

Q2/ What are these flags mean Sign Flag, Zero Flag, Auxiliary Carry Flag, Parity Flag, Carry Flag ? What are the new flags which has been added to new processors

Q3/ Are there more addressing modes in 8086?

ايعازات نظام التشغيل الدوز

C:\>

Computer Organization and Architecture

كلية التربية للعلوم الصرفة / جامعة ديالى

Lecture 15

8086 ASSEMBLY LANGUAGE PROGRAMMING

اعداد
م.د. محمد سامي محمد

قسم علوم الحاسوب
المرحلة الاولى

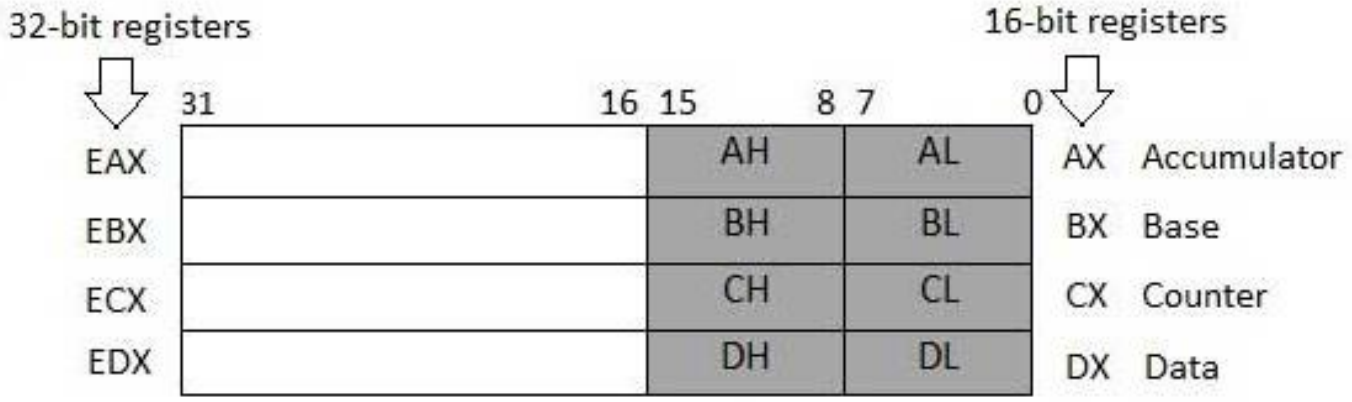
Data Registers

Four 32-bit data registers are used for arithmetic, logical, and other operations. These 32-bit registers can be used in three ways −

•As complete 32-bit data registers: EAX, EBX, ECX, EDX.

•Lower halves of the 32-bit registers can be used as four 16-bit data registers: AX, BX, CX and DX.

•Lower and higher halves of the above-mentioned four 16-bit registers can be used as eight 8-bit data registers: AH, AL, BH, BL, CH, CL, DH, and DL



Data Registers

Some of these data registers have specific use in arithmetical operations.

AX is the primary accumulator; it is used in input/output and most arithmetic instructions. For example, in multiplication operation, one operand is stored in EAX or AX or AL register according to the size of the operand.

BX is known as the base register, as it could be used in indexed addressing.

CX is known as the count register, as the ECX, CX registers store the loop count in iterative operations.

DX is known as the data register. It is also used in input/output operations. It is also used with AX register along with DX for multiply and divide operations involving large values.

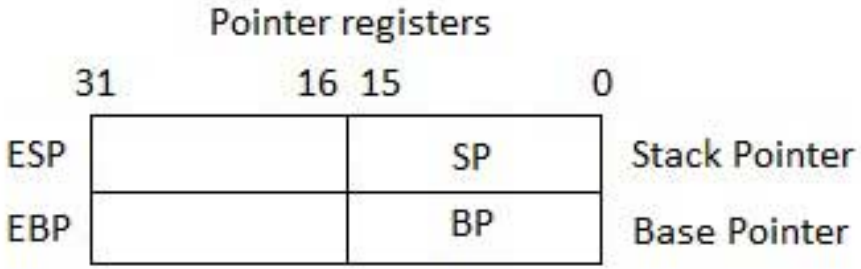
Pointer Registers

The pointer registers are 32-bit EIP, ESP, and EBP registers and corresponding 16-bit right portions IP, SP, and BP. There are three categories of pointer registers −

•**Instruction Pointer (IP)** − The 16-bit IP register stores the offset address of the next instruction to be executed. IP in association with the CS register (as CS:IP) gives the complete address of the current instruction in the code segment.

•**Stack Pointer (SP)** − The 16-bit SP register provides the offset value within the program stack. SP in association with the SS register (SS:SP) refers to be current position of data or address within the program stack.

•**Base Pointer (BP)** − The 16-bit BP register mainly helps in referencing the parameter variables passed to a subroutine. The address in SS register is combined with the offset in BP to get the location of the parameter. BP can also be combined with DI and SI as base register for special addressing.

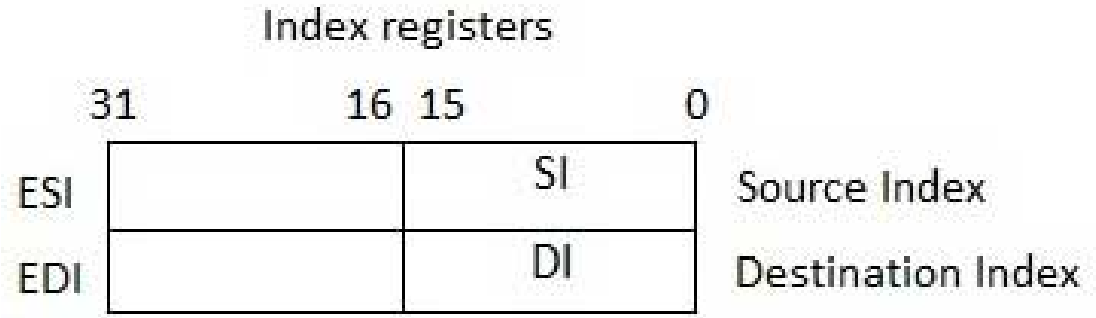


Index Registers

The 32-bit index registers, ESI and EDI, and their 16-bit rightmost portions. SI and DI, are used for indexed addressing and sometimes used in addition and subtraction. There are two sets of index pointers −

•**Source Index (SI)** − It is used as source index for string operations.

•**Destination Index (DI)** − It is used as destination index for string operations.



Segment Registers

Segments are specific areas defined in a program for containing data, code and stack. There are three main segments −

•**Code Segment** − It contains all the instructions to be executed. A 16-bit Code Segment register or CS register stores the starting address of the code segment.

•**Data Segment** − It contains data, constants and work areas. A 16-bit Data Segment register or DS register stores the starting address of the data segment.

•**Stack Segment** − It contains data and return addresses of procedures or subroutines. It is implemented as a 'stack' data structure. The Stack Segment register or SS register stores the starting address of the stack.

Control and Status Registers

The 32-bit instruction pointer register and the 32-bit flags register combined are considered as the control registers.

Many instructions involve comparisons and mathematical calculations and change the status of the flags and some other conditional instructions test the value of these status flags to take the control flow to other location.

The common flag bits are:

•**Overflow Flag (OF)** − It indicates the overflow of a high-order bit (leftmost bit) of data after a signed arithmetic operation.

•**Direction Flag (DF)** − It determines left or right direction for moving or comparing string data. When the DF value is 0, the string operation takes left-to-right direction and when the value is set to 1, the string operation takes right-to-left direction.

•**Interrupt Flag (IF)** − It determines whether the external interrupts like keyboard entry, etc., are to be ignored or processed. It disables the external interrupt when the value is 0 and enables interrupts when set to 1.

Control and Status Registers

•**Trap Flag (TF)** − It allows setting the operation of the processor in single-step mode. The DEBUG program we used sets the trap flag, so we could step through the execution one instruction at a time.

•**Sign Flag (SF)** − It shows the sign of the result of an arithmetic operation. This flag is set according to the sign of a data item following the arithmetic operation. The sign is indicated by the high-order of leftmost bit. A positive result clears the value of SF to 0 and negative result sets it to 1.

•**Zero Flag (ZF)** − It indicates the result of an arithmetic or comparison operation. A nonzero result clears the zero flag to 0, and a zero result sets it to 1.

•**Auxiliary Carry Flag (AF)** − It contains the carry from bit 3 to bit 4 following an arithmetic operation; used for specialized arithmetic. The AF is set when a 1-byte arithmetic operation causes a carry from bit 3 into bit 4.

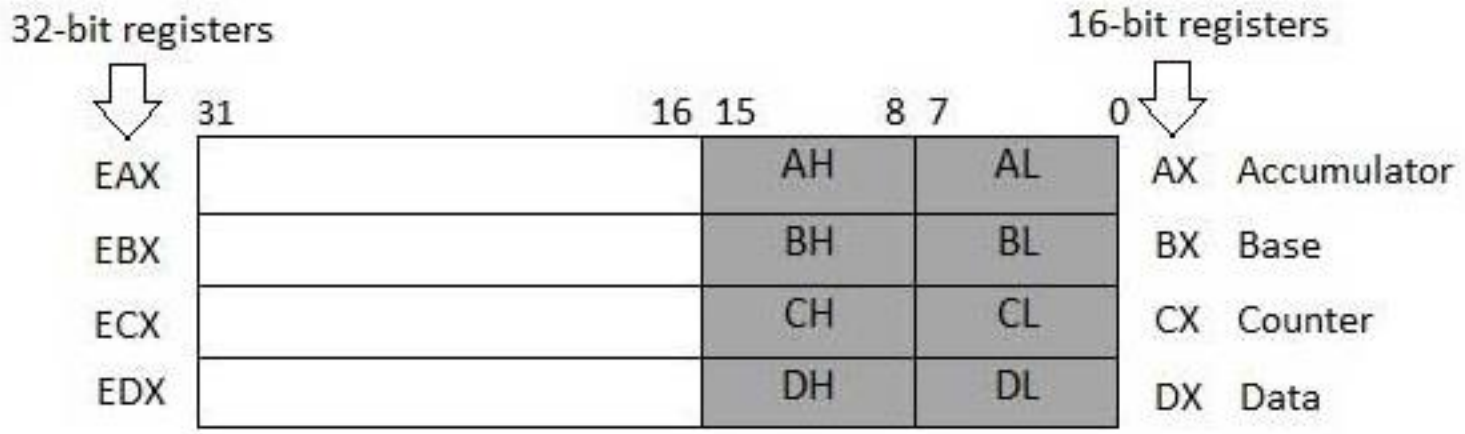
Control and Status Registers

•**Parity Flag (PF)** − It indicates the total number of 1-bits in the result obtained from an arithmetic operation. An even number of 1-bits clears the parity flag to 0 and an odd number of 1-bits sets the parity flag to 1.

•**Carry Flag (CF)** − It contains the carry of 0 or 1 from a high-order bit (leftmost) after an arithmetic operation. It also stores the contents of last bit of a *shift* or *rotate* operation.

Flag registers of 8086 microprocessor

Register representation




```
0000 0001 0010 0011 0100 0101 0110 0111 | ------> EAX

                    0100 0101 0110 0111 | ------> AX

                              0110 0111 | ------> AL

                    0100 0101           | ------> AH
```

INSTRUCTION SET OF 8086

1. Data Copy/ Transfer Instructions:

The following instructions come under data copy / transfer instructions:

MOV, PUSH, POP, IN, OUT, PUSHF, POPF,
LEA, LDS/LES, XLAT, XCHG, LAHF, SAHF

INSTRUCTION SET OF 8086

1. Data Copy/ Transfer Instructions:

MOV: MOVE: This data transfer instruction transfers data from one register / memory location to another register / memory location. The source may be any one of the segment register or other general purpose or special purpose registers or a memory location and another register or memory location may act as destination.

Syntax: 1) MOV mem/reg1, mem/reg2

[mem/reg1] ← [mem/reg2]

Ex: MOV BX, 0210H

MOV AL, BL

MOV [SI], [BX] → is not valid

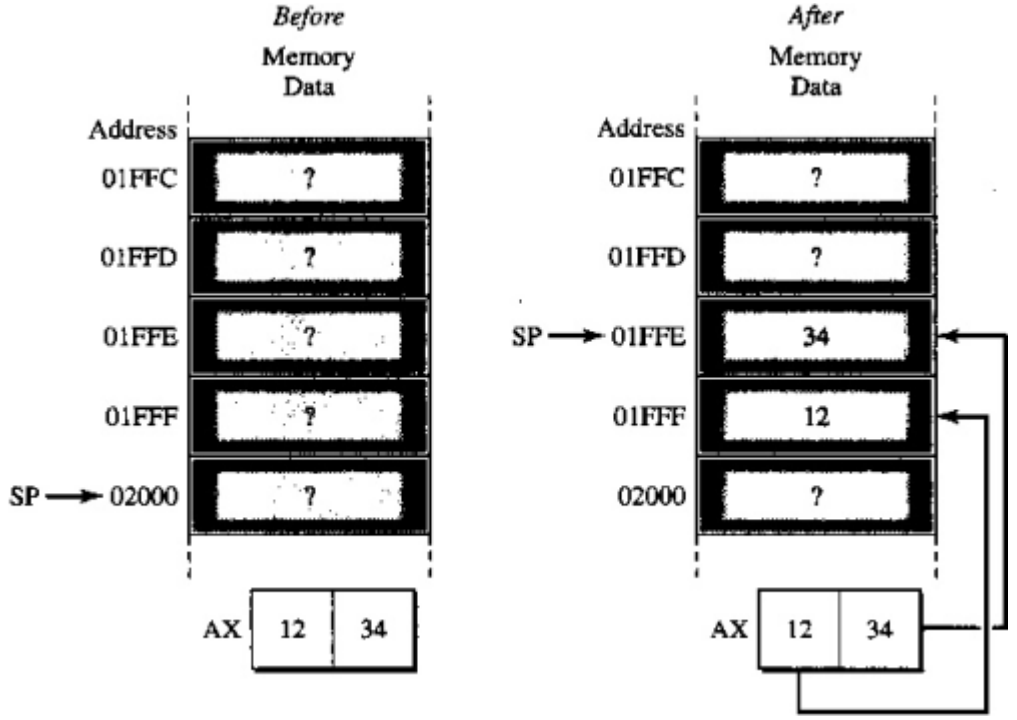
INSTRUCTION SET OF 8086

PUSH: Push to Stack: This instruction pushes the contents of the specified register/memory location on to the stack.

Syntax: PUSH reg

[SP] ← [SP]-2

[[S]] ← [reg]



INSTRUCTION SET OF 8086

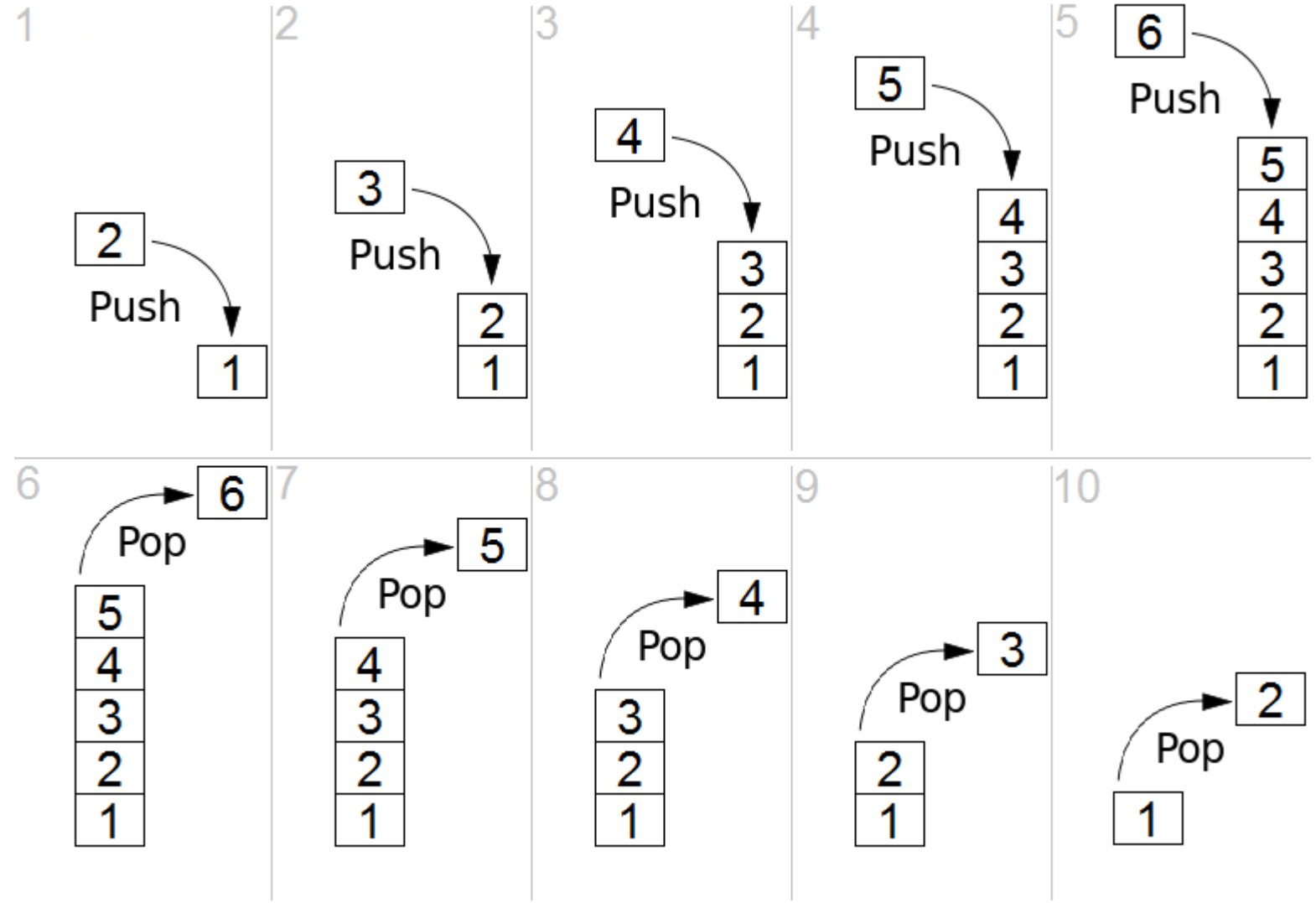
POP: Pop from stack: This instruction when executed, loads the specified register / memory location with the contents of the memory location of which address is formed using the current stack segment and stack pointer as usual. The stack pointer is incremented by 2. The POP instruction serves exactly opposite to the PUSH instruction.

Syntax:

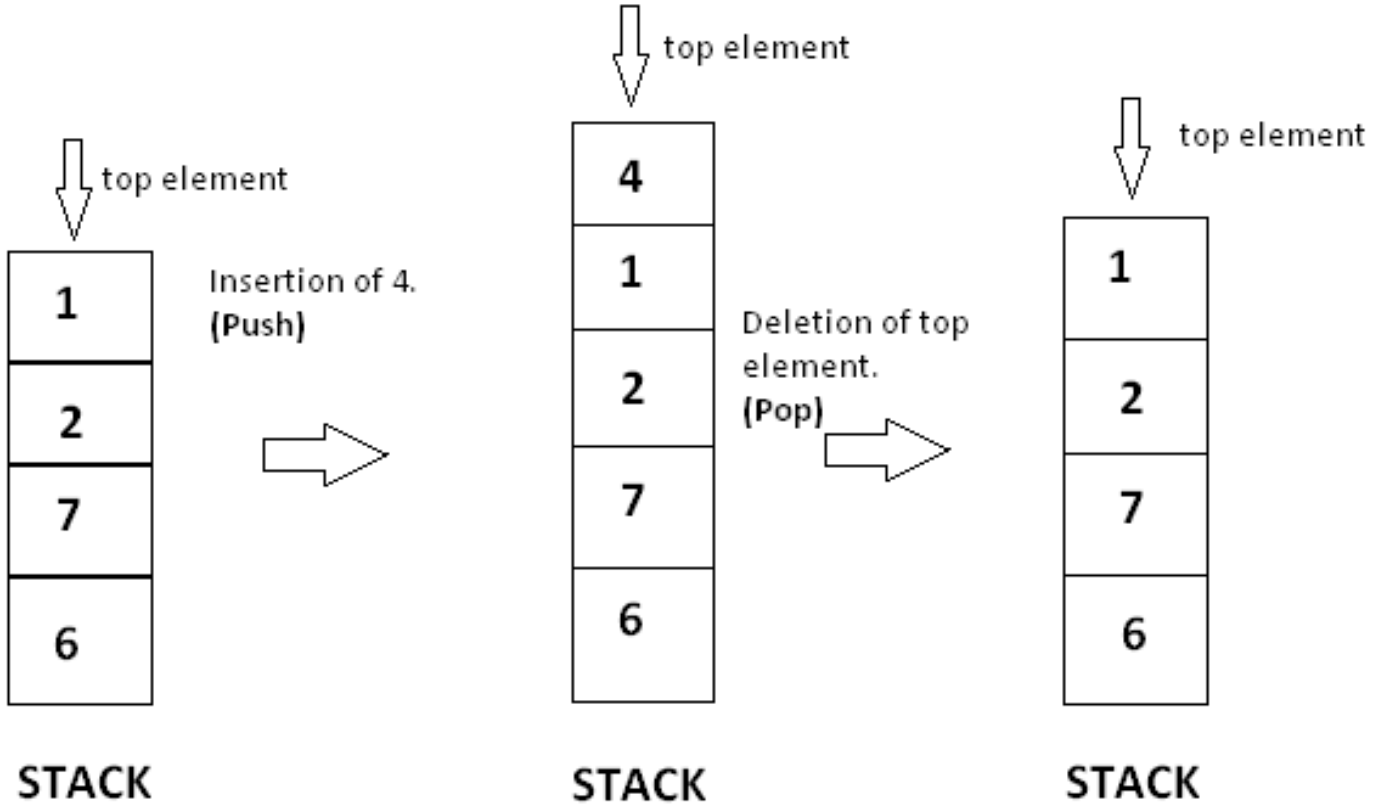
i) POP mem
[SP] ← [SP] +2
[mem] ← [[SP]]

ii) POP reg
[SP] ← [SP] + 2
[reg] ← [[SP]]

INSTRUCTION SET OF 8086



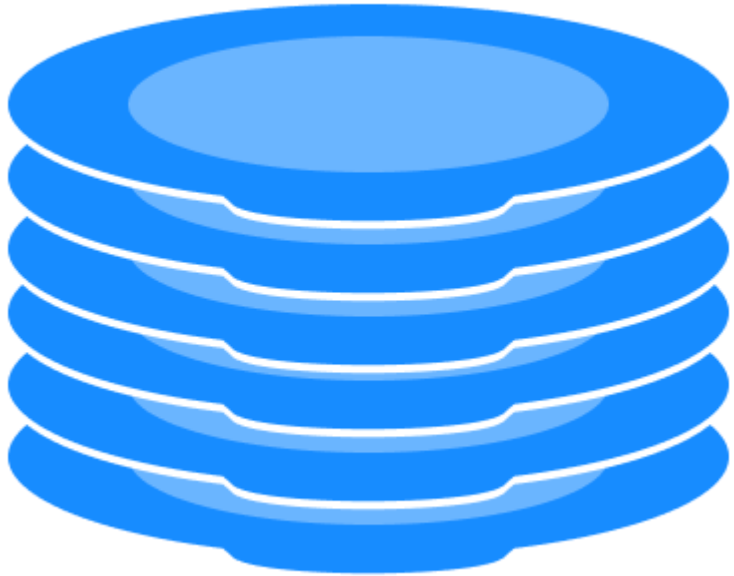
INSTRUCTION SET OF 8086



INSTRUCTION SET OF 8086

A stack is a linear data structure that follows the principle of Last In First Out (LIFO). This means the last element inserted inside the stack is removed first.

You can think of the stack data structure as the pile of plates on top of another.



INSTRUCTION SET OF 8086

Here, you can:

Put a new plate on top

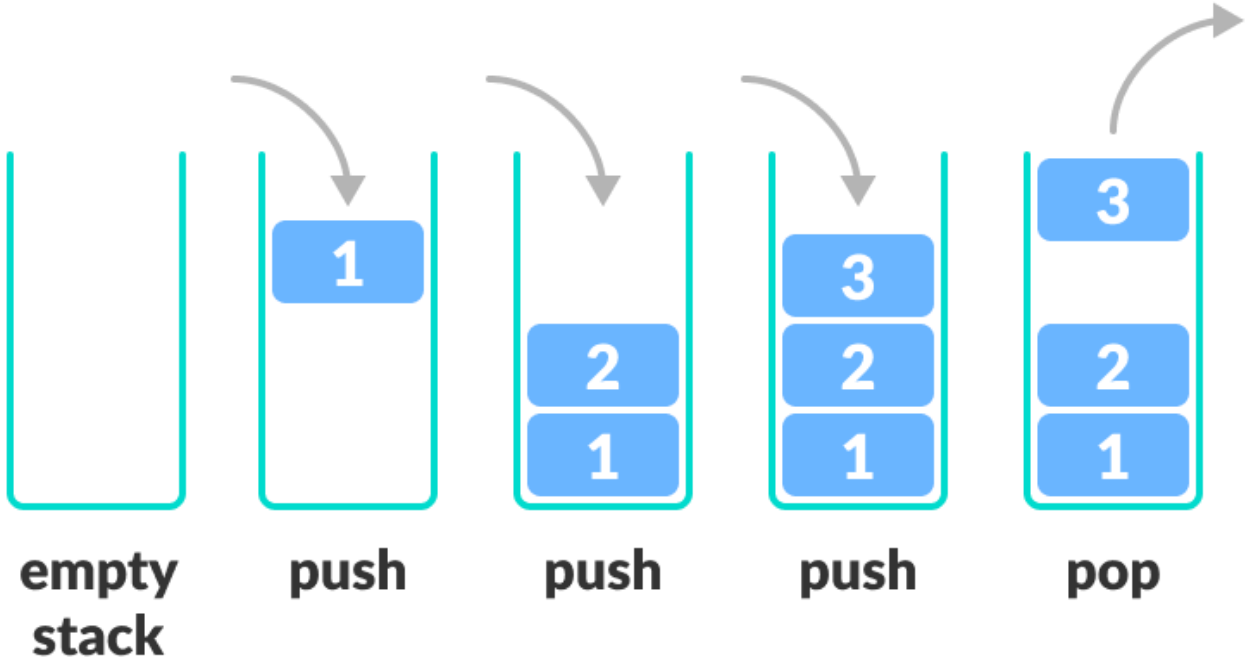
Remove the top plate

And, if you want the plate at the bottom, you must first remove all the plates on top. This is exactly how the stack data structure works.

INSTRUCTION SET OF 8086

LIFO Principle of Stack

In programming terms, putting an item on top of the stack is called push and removing an item is called pop.



INSTRUCTION SET OF 8086

Working of Stack Data Structure

The operations work as follows:

A pointer called TOP is used to keep track of the top element in the stack.

When initializing the stack, we set its value to -1 so that we can check if the stack is empty by comparing TOP == -1.

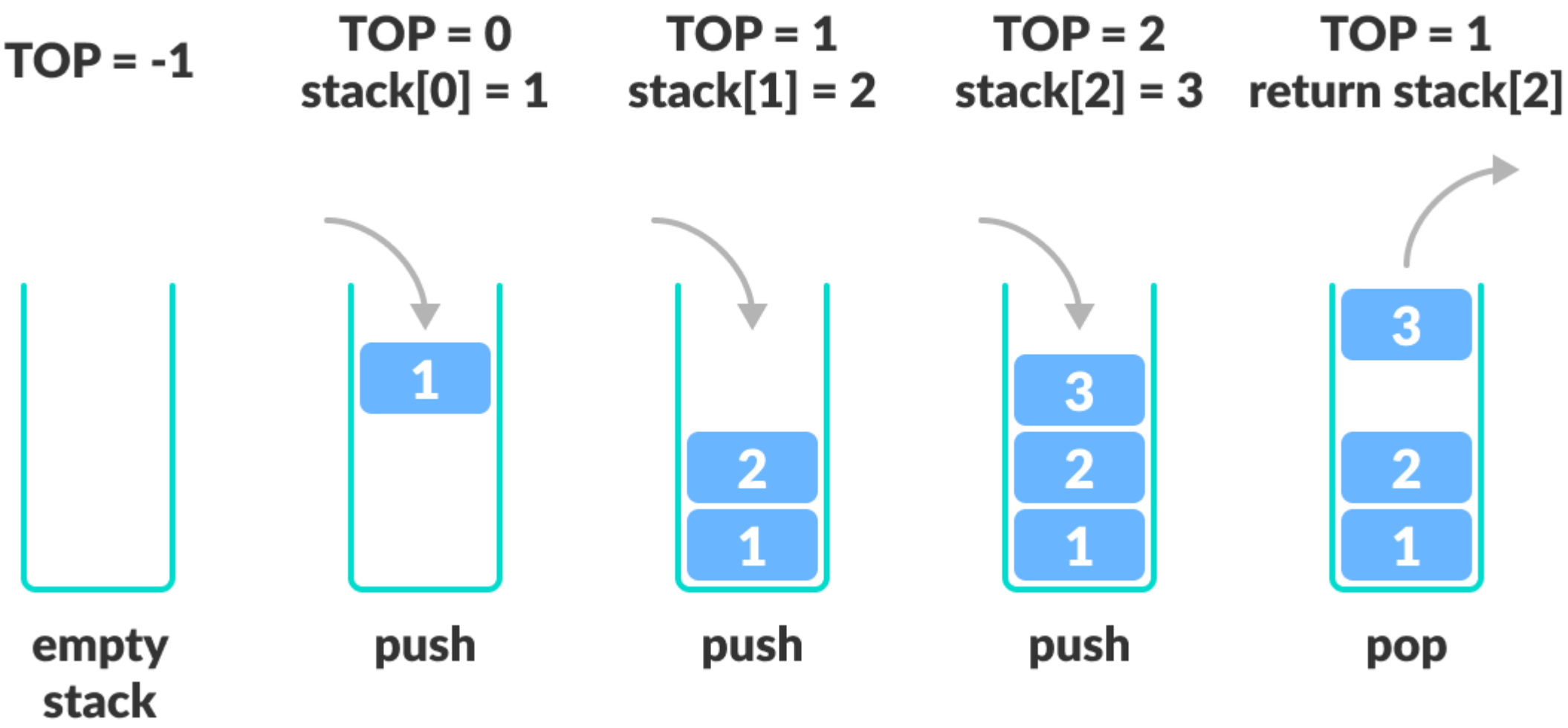
On pushing an element, we increase the value of TOP and place the new element in the position pointed to by TOP.

On popping an element, we return the element pointed to by TOP and reduce its value.

Before pushing, we check if the stack is already full

Before popping, we check if the stack is already empty

INSTRUCTION SET OF 8086



اولا: فئة المعالج

بالنسبة لمعظم الأشخاص، تعد هذه التسمية كل ما يحتاجون لمعرفته عن المعالج لمعرفة إن كان جيداً كفاية لهم أم لا، فالأمر يبدو بسيطاً للغاية مع كون الأرقام الأكبر هي الأفضل وبالتالي يجب أن تكون معالجات i5 أفضل من i3ومعالجات i9 ذات أداء أعلى من i7 ، لكن الأمر هنا ليس حقاً بتلك البساطة بين معالجات إنتل.

الغاية الأصلية لهذه الأرقام هي تمييز الفئات المختلفة لـ معالجات إنتل عن بعضها البعض في الواقع، ومع أن هذا يعني أن معالجات إنتل i7 بالمتوسط أفضل من معالجات i5 مثلاً، فالأمر لا يعني بالضرورة أن أي معالج من نوع i7 سيكون أفضل من أي معالج من نوع i5.

Core i7 8700K

Cate

رموز المعالجات i3 – i5 – i7 – i9

هذه الرموز هي أسماء فئات الأداء في معالجات إنتل، وكل فئة مخصصة لاستخدام مختلف:

الرمز	مستوى الأداء	استخدامه الشائع
Intel Core i3	منخفض - أساسي	التصفح، برامج خفيفة، أوفيس
Intel Core i5	متوسط	ألعاب خفيفة، برامج متوسطة
Intel Core i7	عالي	ألعاب قوية، تحرير الصور
Intel Core i9	عالي جدًا - احترافي	تصميم، مونتاج فيديو، برامج هندسية

عدد الأنوية Core

المعالج ليس شريحة واحدة فقط؛ بل يحتوي على عدة "أنوية".
كل نواة core تشبه "عامل" داخل الحاسوب يقوم بتنفيذ المهام.

- معالجات بسيطة قد تحتوي على نواتين 2 cores
- معالجات متوسطة: 4–8 أنوية
- معالجات قوية: أكثر من 12 نواة
- المعالجات الاحترافية و Workstation قد تصل إلى 18 نواة أو أكثر

عدد الأنوية Core

المعنى	الرمز
نواتان (2)	Dual-Core
أربع أنوية (4)	Quad-Core
ستّ أنوية (6)	Hexa-Core
ثمانِ أنوية (8)	Octa-Core
عشر أنوية (10)	Deca-Core
يُكتب مباشرة بعدد الأنوية	12-Core / 14-Core / 16-Core

- i3 → قليل الأنوية (عادة 2–4)
- i5 → متوسط (4–8)
- i7 → أعلى (6–12)
- i9 → احترافي (8–24 نواة)

النهاية	عدد الأنوية الشائع	نوع الجهاز
U	من 2 إلى 4 أنوية	لابتوبات خفيفة
H / HQ	من 4 إلى 6 أنوية	لابتوبات ألعاب
HK	6–8 أنوية	قوي جدًا
K	4–8 أنوية	أجهزة مكتبية قوية
F / T	حسب الطراز	مكتبي

ثانيًا: ما المقصود بالأرقام التي تلي اسم الفئة؟

في جميع معالجات إنتل ضمن فئة Core هناك أربعة أرقام تتبع الاسم الأساسي له، وعادة ما تتضمن معلومات أساسية عن المعالج ومن الممكن معرفة مستوى وعمر المعالج منها عادة، وهذه الأرقام الأربعة تنقسم لجزئين:

الرقم الأول: إنه يمثل رقم الجيل الخاص بفئة المعالج..

ففي الصورة السابقة على سبيل المثال ستجد أن رقم فئة المعالج 9700 أي أنه من الجيل التاسع من فئة I7 لمعالجات الشركة، فمثلا فئة المعالج التي لها رقم 3220 هي من الجيل الثالث، وهكذا.

حاليًا نحن في الجيل الحادي عشر او اكثر من معالجات الشركة ، وعادة ما يتم إصدار جيل جديد كل عام تقريبًا ، وبناءً على ذلك ، يمكنك بالفعل تقدير عمر أي معالج تراه من رقمه.

الأرقام الثلاثة المتبقية: تشير عادةً إلى مستوى أداء المعالج.

كلما كان هذا الرقم أكبر كلما كان أداء المعالج أفضل، لكن بالطبع الأمر ليس ثابتاً دائماً، ففي حال كان المعالجان من فئتين مختلفتين (اللاحقة الحرفية لهما مختلفة) لا يكفي النظر إلى الأرقام فقط، فمعالج K 5400مثلاً، أفضل بمراحل من معالج U 7500على الرغم من أن رقم المعالج الأول أقل وأنه أقدم بجيلين من المعالج الثاني حتى.

رقم الجيل	أول سنة صدور تقريبًا
1st Gen	2008
2nd Gen	2011
3rd Gen	2012
4th Gen	2013
5th Gen	2014
6th Gen	2015
7th Gen	2016
8th Gen	2017
9th Gen	2017
10th Gen	2019
11th Gen	2020
12th Gen	2021
13th Gen	2022

ثالثًا: ما المقصود باللاحقة الحرفية في تسمية معالجات إنتل؟

كل حرف يعني ميزة أو خاصية موجودة في هذا المعالج سواء كان خاص بالحواسيب اللوحية أو المكتبية.

ولكن في بعض الأحيان، قد تجد أنه لا يوجد حرف في اسم المعالج الذي تبحث عنه. ببساطة، عدم وجود حرف يعني أن هذا المعالج لا يحتوي على أي خصائص تميزه، بل أنه معالج خام لم يتم التعديل عليه.

1- معنى حرف K فى معالجات إنتل.

يدل وجود حرف Kفى نهاية أسم ايًا من معالجات إنتل أن هذا المعالج قابل لكسر السرعة Overclocking بصورة قانونية.

معنى أن الشركة قد صممته بهدف أن يكون قادرًا على العمل تحت ترددات أعلى من التردد الافتراضي حسب رغبة المستخدم، وبالتالي فإن قيامك برفع تردد هذا المعالج لن يؤدي إلى فقدان الضمان كما هو الحال إذا رفعت تردد أي معالج آخر.

ولكن خذ بعين الإعتبار أن رفع التردد لديه بعض المتطلبات مثل مذربورد تدعم تغيير تردد المعالج، بالإضافة إلى باور سبلاي يستطيع أن يمد الطاقة الكافة إلى المعالج بعد رفع ترددة إلى أقصى حد، جنبًا إلى جنب نظام تبريد فعال لتوفير التهوية المناسبة للمعالج بعدما تزداد حرارته بسبب رفع التردد.

فإذا كانت هذه الشروط غير مستوفية فى جهازك، لا أنصحك بالاستثمار في معالج يحمل أسمه حرف Kوإلا سيكون إهدار للمال.

Core i7 6700K

Overclocking Or Unlocked

2- معنى حرف Uفى معالجات إنتل.

حرف Uهُنا يرمز إلى Ultra-low powerويوحي من الاسم أنها معالجات موفرة للطاقة بشكل كبير لكن هذا على حساب الأداء، حيث يكون أدائها بين منخفض ومتوسط وذلك يعود غالبًا إلى كونها تحتوي على نواتين فقط.

عمومًا، القدرة على توفير الطاقة هذه جعلتها منتشرة جدًا في الحواسيب المحمولة التي تعتمد على البطارية بحيث تمنحها إمكانية الصمود لفترات أطول. وبالتالي فهي غير مناسبة للألعاب أو للاستخدام الثقيل بغض النظر عن الفئة أو الجيل.

Core i3 7100U

Ultra-low power

3- معنى حرف Y فى معالجات إنتل.

معالجات إنتل التي تحمل حرف Y في اسمها تصنف على أنها الأسوأ من ناحية الأداء والأفضل من ناحية توفير الطاقة، حيث تصممها شركة Intelبهدف أن تقدم أقل مستوى مطلوب من الأداء وتستهلك أقل قدر ممكن من الطاقة لدرجة تصل إلى 5 واط فقط.

لهذا السبب تستعين بها الشركات المصنعة للحواسيب المحمولة ذات التكلفة المتدنية (الرخيصة) وكذلك الأجهزة اللوحية، بينما أدائها يكفي لإنجاز المهام العادية كتصفح الانترنت ومشاهدة الأفلام ... إلخ.

Core i7 3689Y

Extremely Low Power

4- معنى حرف Xفى معالجات إنتل.

إذا كنت تبحث عن معالج يستطيع أن يقدم لك أقصى أداء ممكن في فئة Intel Coreفأختر واحدًا يحمل اسمه حرف Xوذلك ببساطة لأن هذه المعالجات تكون فائقة القوة والسرعة بمستوى غير مسبوق في أي معالج آخر، وهذا يفسر سبب وجود هذا الحرف فى معالجات i7و i9فقط من إنتل.

الأمر لا يقتصر فقط على أن هذه المعالجات تقدم أداء خرافي، وإنما أيضًا قابلة لكسر السرعة مثل المعالجات التي تحمل حرف Kفي اسمها بحيث إذا كان الأداء الأصلي غير مناسب، يمكنك رفع التردد وزيادة مستوى الأداء إلى الحد الأقصى.

Core i9 7900X

Extreme Performance

5- معنى حرف Hفى معالجات إنتل.

المعالجات التي تحمل حرف Hهي في الغالب معالجات موجهة للحواسيب المحمولة المصممة للألعاب، حيث أن حرف Hهنا لا يشير إلى أداء المعالج نفسه وإنما يعود على كارت الشاشة المدمج في المعالج والذي يكون بأداء عالى.

من ناحية الطاقة فهو يستهلك طاقة منخفضة، وأدائه ليس بضعيف رغم أنه يحتوي على نواتين فقط، ولهذا السبب تقوم شركات صناعة الحواسيب المحمولة بتضمينه في أجهزتها من الفئة المتوسطة أو العليا.

Core i7 8850H

High Performance Graphic

6- معنى حرفي HKفى معالجات إنتل.

لا تختلف المعالجات التي تحمل حرفي HKفي أسمها عن معالجات حرف Hكثيرًا، فهي موجهة كذلك للحواسيب المحمولة فقط وتحتوي على كارت شاشة مدمج بأداء عالي وموفرة للطاقة إلى حد ما.

لكن الاختلاف الوحيد يكمن في قابلية كسر السرعة، حيث تكون هذه المعالجات Unlockedوبالتالي يمكنك رفع التردد بشكل قانوني وآمن بدون مشاكل للحصول على المزيد من الأداء.


intel
Core i9 8950HK
High Performance Graphic, Unlocked

7- معنى حرفي HQفى معالجات إنتل.

معالجات HQلا تختلف كثيرًا هي الأخرى عن معالجات حرف الـ Hفهي موجهة للحواسيب المحمولة المخصصة للالعاب بالدرجة الأولى وتحتوي على معالج رسوميات بأداء عالي.

لكن الاختلاف الذي يعنيه حرف Qهو أن هذه المعالجات تحتوي على 4 أنوية بدلًا من 2 فقط، لذلك تكون هذه المعالجات من فئة i5أو i7حصرًا ولا توجد في .i3

Core i5 7300HQ

High Performance Graphic, Quad Core

8- معنى حرف Tفى معالجات إنتل.

تُستخدم المعالجات التي تحمل حرف Tبشكل أكبر في الحواسيب المكتبية "الكل في واحد" (أي أن الشاشة وجميع الأجزاء الخاصة بالحاسوب موجودة ضمن وحدة واحدة فقط).

حيث تكون هذه الأجهزة مزودة بأنظمة تبريد ضعيفة إلى حدٍ ما مقارنة بالحواسيب المكتبية العادية، وذلك لأن هذا المعالج يركز على إنتاج حرارة أقل من أي معالج آخر في فئة Intel Core

ولكن في المقابل يكون الأداء منخفض جدًا ويكفي فقط لإنجاز المهام الأساسية، لذلك لا ننصح به للألعاب.


intel
Core i3 6300T
Power-Optimized Lifestyle

9- معنى حرف Fفى معالجات إنتل.

تأتي المعالجات التي تحمل حرف Fضمن اسمها مواصفات مشابهة للمعالجات العادية أو الخام، لكن عنصر الاختلاف الوحيد هنا أنها لا تحتوي على كارت شاشة مدمج، ولذلك يتطلب استخدامها وجود كارت شاشة خارجي.

ومع ذلك فهي شائعة جدًا بين محبي الألعاب نظرًا لكونها أرخص بشكل ملحوظ من المعالجات الأخرى في نفس مستوى الأداء، ومع كون حواسيب الألعاب تتضمن معالجات رسوميات مستقلة على أي حال فلا فائدة من وجود معالج رسوميات مدمج.

Core i7 8850F

Requires Discrete Graphic

10- معنى حرف Mفى معالجات إنتل.

المعالجات التي تحمل حرف Mموجهة بشكل خاص إلى أي جهاز محمول، سواء Ultrabooksأو Notepadsأو Laptopأو الحواسيب اللوحية الهجينة، فهي معالجات مدمجة في اللوحة الام وتقدم أداء منخفض ولا تستهلك الكثير من طاقة البطارية.

Core i7 8850M

Mobile

الذاكرة العشوائية — (RAM) سرعة التعامل مع البرامج

كلما زاد حجم الرام ← زادت قدرة الجهاز على فتح برامج أكثر بدون بطء.

الرام المطلوب	الاستخدام
4–8 GB	تصفح وإنترنت
8–16 GB	طلاب وأعمال وبرمجة
16 GB	ألعاب خفيفة
16–32 GB	تصميم ومونتاج
32+ GB	3Dوذكاء اصطناعي

❌ HDD

- بطيء جدًا
- يسبب تعليق

✅ SSD

- سريع جدًا (أسرع 10× من HDD)
- يفتح النظام خلال 5–10 ثوانٍ
- الأفضل دائمًا SSD NVMe

إذا كان الجهاز SSD → سيكون سريعًا مهما كان المعالج متوسطًا.

Integrated (مدمج): مثل Intel UHD / Iris → للاستخدام العادي

NVIDIA GTX / RTX: للألعاب والتصميم

AMD Radeon RX: قوي للألعاب أيضًا