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WRITTEN BY

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Table of Contents

UNIT : 1
OVERVIEW OF COMPUTER SYSTEM

Q.1 What are computing devices? Explain early and modern computing devices.

Answer:

Term Computing Devices:

The term "Computing Device" is used for all those machines which can perform calculations (حساب کتاب).

These machines include mechanical as well as electronic devices. Among all these, computer is considered to be the fastest (تیز ترین) and most accurate (درست) computing device.

Importance: These machines could perform very simple calculations like addition of two numbers or complex calculations like electronic banking system, managing the stock control system, for a big shopping mall.

Computing Devices: Computing devices can be classified into:

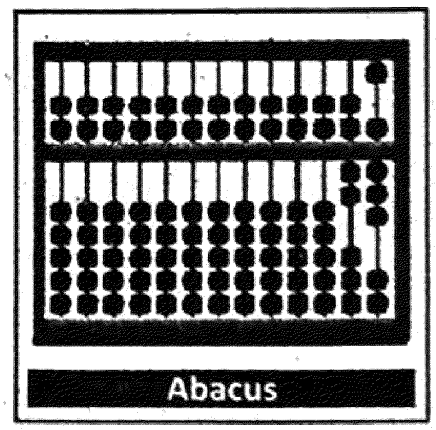
A) Early Computing Devices
B) Modern Computing Devices

A) EARLY COMPUTING DEVICES:

1. Abacus: The abacus may be considered the first computer, which was developed about 5000 years ago by Chinese.

Construction:

It consisted of a wooden frame having parallel (متوازی، مماثل) rods as shown in the figure. These rods had a number of wooden beads (لکڑی کے موتیوں کی مالا) which moved up and down with fingers along the length of rods.


Abacus

Tasks Performed by Abacus:

Abacus was used to perform addition, subtraction, multiplication and division.

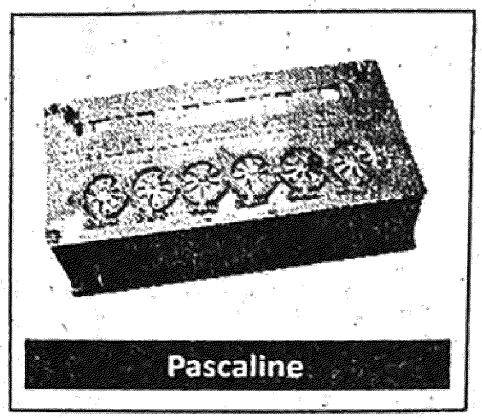
3. PASCALINE:

This device was one of first mechanical calculator, which is

invented by 19 years old French mathematician Blaise Pascal in 1642. Pascaline is also called Pascal's Adder.

Construction:

Pascaline consisted of rotating wheels as shown in the figure. Each wheel is divided into ten parts having digits from 0 to 9. Calculations were performed by the rotation of wheels.



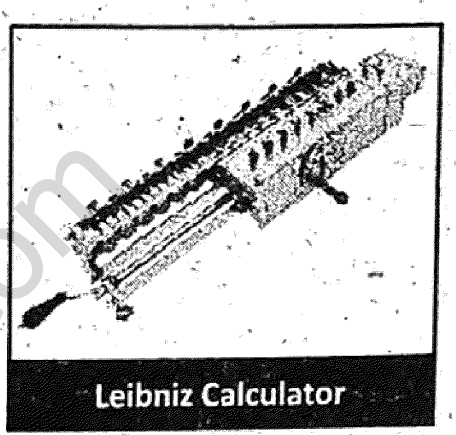
Pascaline

Tasks Performed by Pascaline:

This machine was used to add and subtract numbers and had the ability to carry 10s, 100s and 1000s.

3. Leibniz Calculator:

In 1694, a German mathematician and philosopher, Gottfried Wilhem Von Leibniz created a computing machine that could add, subtract and multiply. Leibniz's mechanical multiplier worked by a system of gears and dials.



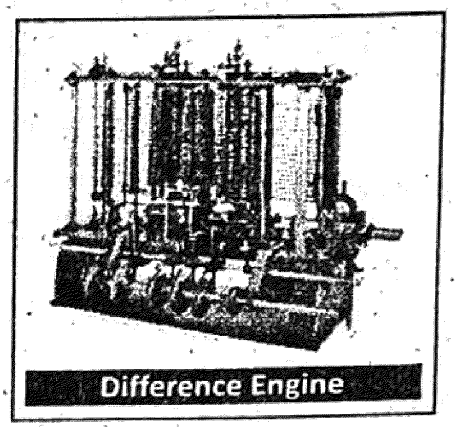
Leibniz Calculator

4. DIFFERENCE ENGINE:

The first mechanical computer was developed by the English mathematician Charles Babbage in 1822.

Father of Modern Computer:

Charles Babbage is considered to be the "father of modern digital computer". He developed the first automated calculating machine (خودکار حساب لگانے والی مشین) called difference engine which is shown in the figure.



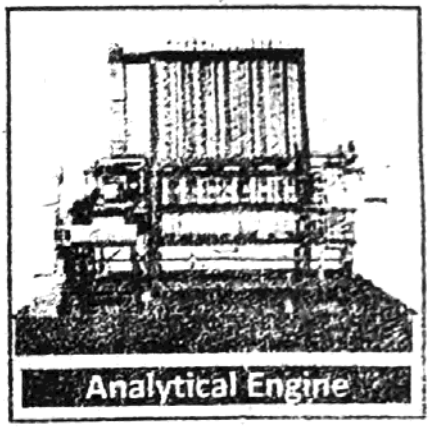
Difference Engine

Function of Difference Engine:

Difference engine was able to calculate the table of numbers and also provides the hard copy of the results. In other words, it is designed to calculate and tabulate polynomial functions or to

perform differential equations.

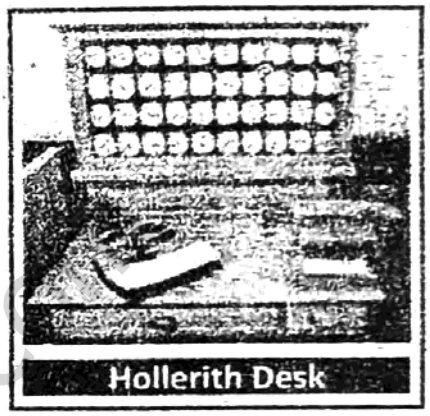
5. ANALYTICAL ENGINE:


Analytical Engine

Charles Babbage began to imagine (خیال کرنا یا تصور کرنا) ways how to improve difference engine. He thought about generalization of its operations so that it could perform other kind of calculations. Thus, he was inspired to work on first general purpose computer called the analytical engine.

6. Tabulating Machine (Hollerith Desk):

In 1890, Herman Hollerith built a tabulating machine called Hollerith Desk as shown in figure.


Hollerith Desk

Function:

Hollerith Desk was recorded and stored data on punch cards. It was used for the United States (US) census (مردم شماری) in 1890.

7. Vannervor Bush Differential Analyzer:

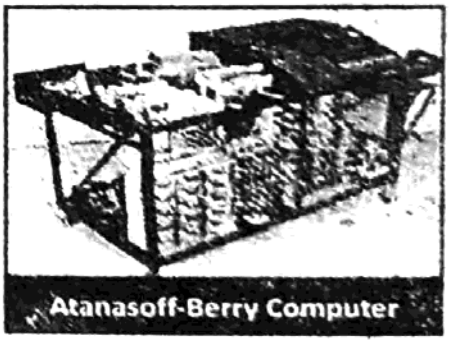
Vannevor hush developed a calculator for a solving differential equations in 1931. This machine was also used for complex differential problems.

8. Clifford E.Berry (1918-1963):

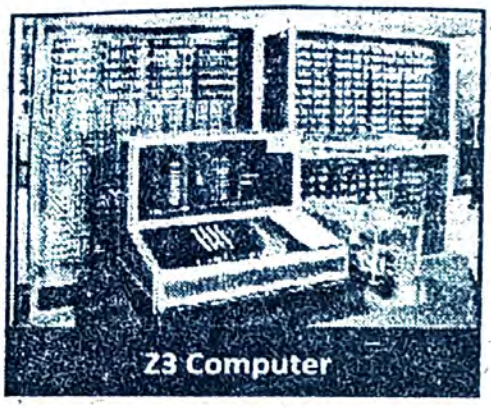
Clifford E.Berry was American computer designer who envisioned (تصور کرتا) on All Electronic Computer that applied Boolean algebra to computer circuitry.

9. Atanasoff-Berry Computer (ABC):

In 1940, Professor John Atanasoff and his student Clifford-Berry invented (ایجاد کیا) the ABC (Atanasoff-Berry Computer) that was the electronic digital computer.

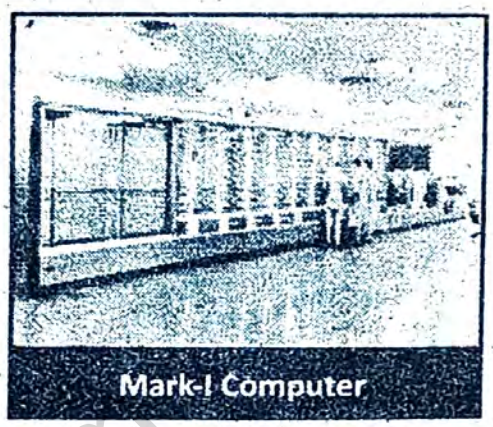

Atanasoff-Berry Computer

10. The Z3 Computer:


Z3 Computer

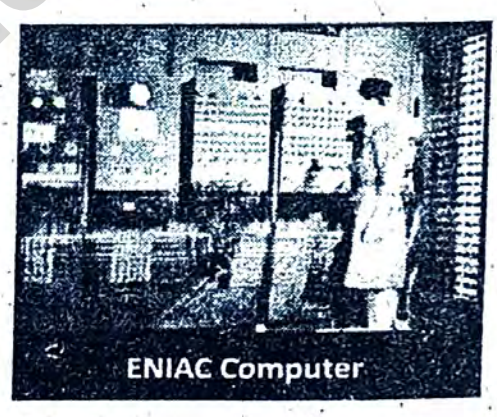
In 1941, German computer Pioneer Konrad Zuse developed the word's first programmable computer, the Z3, which was used to design air-planes and missiles.

11. Mark-1 Computer:


Mark-I Computer

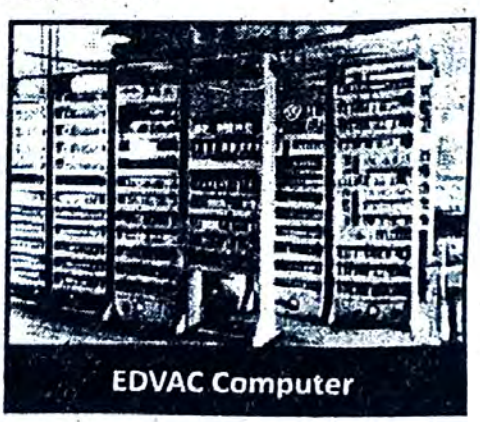
Howard H. Aiken, a Harvard engineer working with IBM, succeeded (کامیاب ہوتا) in producing an All-Electronic Calculator by 1944. The Harvard-IBM Automatic Sequence Controlled Calculator, or Mark-I, was an electronic relay computer. It used electromagnetic signals to move mechanical parts to perform basic arithmetic (ریاضی) as well as more complex equations (پیچیدہ مساوات).

12. The ENIAC:


ENIAC Computer

Another computer development was the Electronic Numerical Integrator and Computer (ENIAC). It was developed by John Presper Eckert and John W. Mauchly, ENIAC was a general-purpose computer that computed at speed 1,000 times faster than Mark-I.

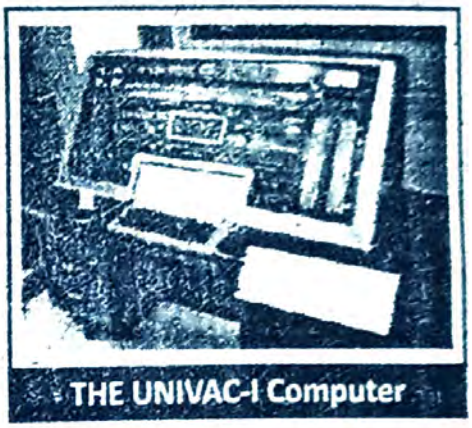
13. The EDVAC:


EDVAC Computer

Von Neumann designed the Electronic Discrete Variable Automatic Computer (EDVAC) in 1945 with a memory to hold both a stored program as well as data.

14. The UNIVAC-I:

In 1951, the UNIVAC-I (Universal Automatic Computer), built by Remington Rand, It's the first commercially available computer.

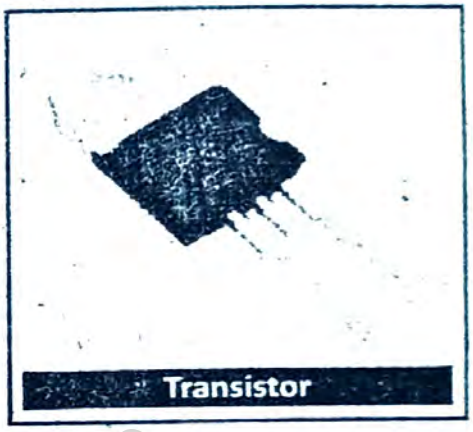


THE UNIVAC-I Computer

B) MODERN COMPUTING DEVICES:

1. Invention of Transistors:

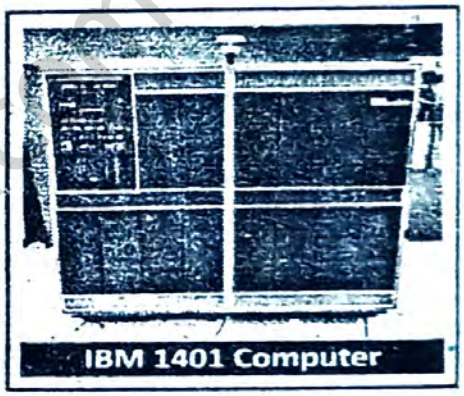
The invention (ایجاد) of transistors greatly changed the computer's development. They were used in early supercomputers, stretched by IBM and LARC by Spary-Rand. These computers are designed for atomic energy laboratories, which can handled large amount of data.



Transistor

2. IBM 1401:

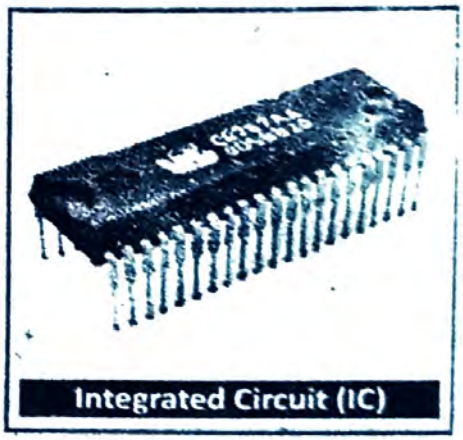
There were a number of computing devices used in business, universities and government up to 1960. One important example was the IBM 1401 computer, which was universally accepted throughout industry.



IBM 1401 Computer

3. Invention of Integrated Circuits (ICs) :

The invention of integrated circuits (ICs) in 1958 by Jack Kilby greatly revolutionized (انقلاب لایا) the era of modern computing devices, in terms of processing speed, memory and supporting input/ output devices.



Integrated Circuit (IC)

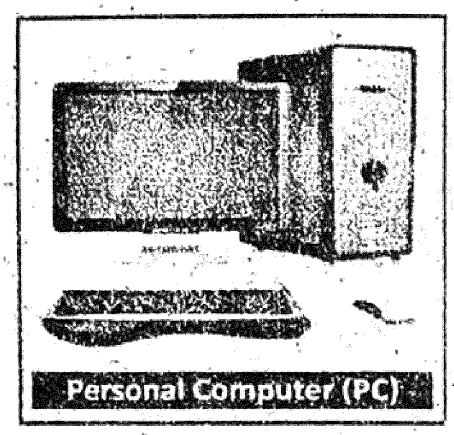
4. Development of Intel 4004 Chip:

The development of intel 4004 chip in 1971 by Intel further developed all the components of a computer like CPU,

memory, input/output controls on a single chip which is called microprocessor.

5. Personal Computer (PC):

In 1981, IBM introduced (متعارف کرایا) its Personal Computer (PC) for use at homes, offices and schools. Computing devices continued their trend (رجحان) toward a smaller size such as from desktop to laptop computers and then to palmtop or tablet PCs, which can fit inside a pocket.



Personal Computer (PC)

Q.2 What is processing operation?

Answer: Processing Operation:

Definition: The process of performing different operations on existing data is called processing operation.

Explanation:

Processing operation is the transformation process to convert the input into output. The central processing unit (CPU) performs processing tasks under the directions of a program. It includes arithmetic and logic operations (ریاضی اور منطقی کاروائی). The CPU stores the program instructions and the data in the computer's memory and then processes the data.

Q.3 Show basic operations of a computer with the help of a block diagram.

Answer: Four Basic Operations of a Computer:

A computer block diagram as shown in figure performs basically four major computer operations or functions. These are:

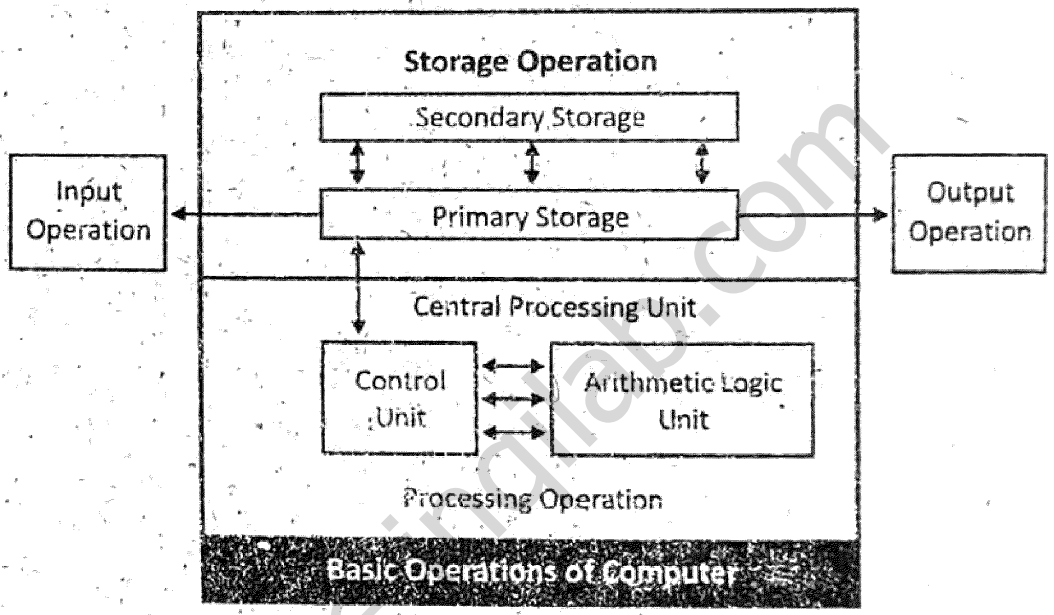
1) **Input Operation:** It is the process of capturing or accepting data or information, by using input devices.
2) **Processing Operation:** It is the transformation process to convert the input into output. The central processing unit (CPU) performs processing tasks under the direction of a program. It includes arithmetic and logical opera-

tions. CPU is called the brain of computer.

3) **Output Operation:** It is the result, which comes from the transformation process or it is the outcome of the processing. **For example,** the monitor shows the results of processing operations on the screen and the printer generates output on paper.

4) **Storage Operation:** It is the process of storing the data or information or instructions on storage device, so that the user can retain and retrieve it whenever required. Computer data storage is referred to as storage or memory, which can save digital data.

Examples: i) RAM ii) Hard disks iii) DVD
iv) SSD v) USB flash drive etc.



Basic Operations of Computer

Q.4 Explain different classifications of computers.

Answer: Classification of Computers:

Computers can be classified into the following four types on the basis of size, performance and application areas.

a) Microcomputers b) Mainframe computers
c) Supercomputers d) Mobile computers

a. MICROCOMPUTERS:

Microcomputers are also called Personal Computers (PC). They are small in size, inexpensive (سستا), and used by a single individual (واحد فرد) at a time. These computers are based on a

single microprocessor chip which controls all the operations like input/ output, processing and storage of the computer.

Applications:

1. Microcomputers can be used by businesses for word processing, accounting, desktop publishing, and for running spreadsheet and database management applications.
2. They are used at home to playing games and surfing the internet (انٹرنیٹ پر سرچ کرنا).
3. Microcomputers are particularly created for general applications like entertainment (تفریح), education, and healthcare departments.
4. The computers can be used for communication (مواصلات) by connecting them together in a network.

Types of Microcomputers:

Microcomputers include the following types:

i. Desktop computers ii. Notebook computers
iii. Laptop computers iv. Handheld computers

i. Desktop Computers:

A desktop computer is the most common type of microcomputer. It is a computer that fits on or under a desk. These computers have separate components, the system unit, keyboard, mouse and monitor.

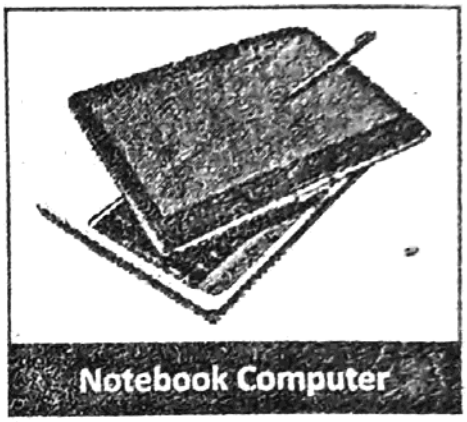

Desktop Computer

Low-Cost Computers: Desktop microcomputers are generally cheaper (سستا) than laptops or notebooks. The components/ parts of desktop computers can be easily replaced if they failed to work.

ii. Notebook Computers:

These computers can be easily used in cars, offices, libraries, classrooms etc. They are specially designed for mobile computing and wireless connectivity.

Advantages: They are easily to carry around and preferred by students in business people. Most notebooks have built-in microphones and webcams for video conferences.


Notebook Computer

iii. Laptop Computers:

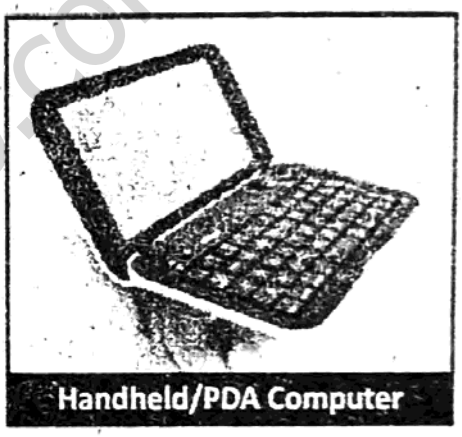
Laptops are slightly bigger and heavier than the notebooks. The laptops have larger screens and are more convenient (آسان) for longer work. They have more features than a notebook.


Laptop Computer

Advantages: The main advantage of the laptop is its portability (لے جانے کے قابل) and easy access to the Internet.

iv. Handheld (PDA Computers):

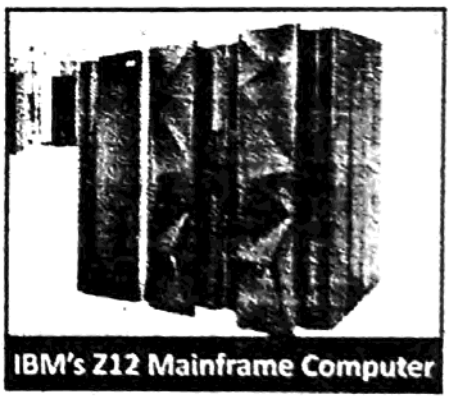
Handheld computers are a unique type of portable computers that allow users to work "on the go". These computers can easily be placed on the top of the palm (ہتھیلی), so they are also known as palmtop computers and are lightweight.


Handheld/PDA Computer

Examples: The most popular types of handheld computers include personal digital assistants (PDAs) and smartphones, iPhones etc.

b. MAINFRAME COMPUTERS:

These are larger, more expensive and more powerful computers compared to minicomputer but less powerful than supercomputer. They are used in large corporations,


IBM's Z12 Mainframe Computer

banks, universities, governments and scientific laboratories. Mainframe computer can be installed in a large room because they include many types of peripheral devices e.g., mouse, keyboard, webcam, microphone, monitor, speakers, printer etc.

Processing Speed: A typical mainframe can execute about billion instructions per second (BIPS). They can support thousands of users, and many terminals at same time.

Examples:

Some examples of mainframe are IBM's Z12, EC12, EC 196 and HP 16500 Series.

c. SUPER COMPUTERS:

Super computers are the fastest and most powerful computers. They are biggest in size and more expensive in price than other computers. It is used to perform complex tasks. These computers are designed for scientific, engineering and business applications.

Processing Speed: Super computers can process billions or even trillions of instructions per second (BIPs or TIPs), thus they have high computing speed.

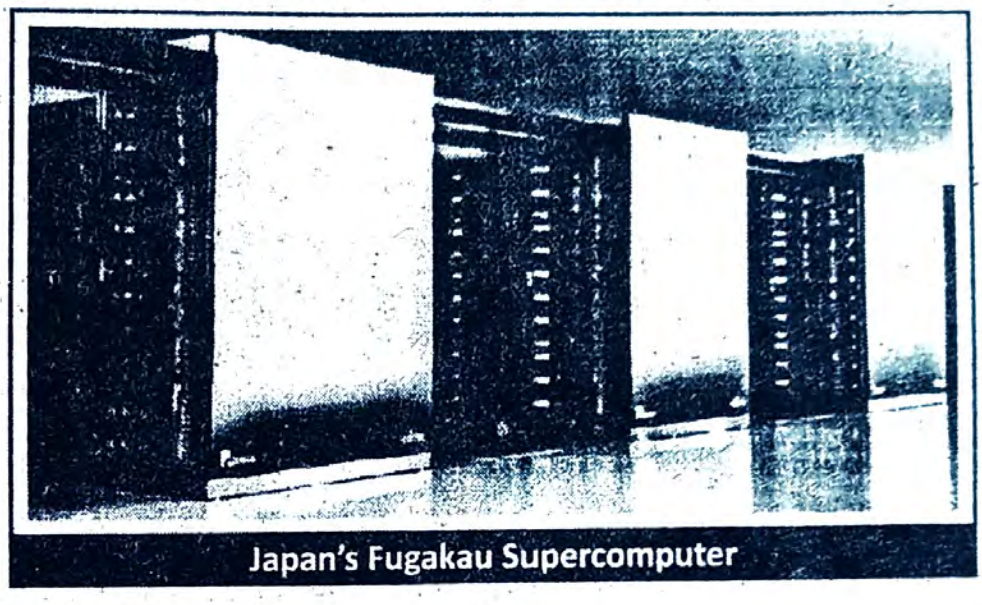
Uses:

1. They are used for weather forecasting (موسم کی پیشگوئی).
2. They are used for animated graphics, fluid dynamic calculations.
3. They are used in nuclear energy research, petroleum exploration and weapon research.
4. They can be used for stock analysis, automobile designing and complex mathematic calculations.
5. NASA uses supercomputers for launching space shuttles, controlling them and for space exploration (خلائی ریسرچ) purpose.

Examples:

1. Japan's **Fugaku** is a world's fastest supercomputer with a speed of 442 quadrillion instructions per second.

2. Mars 2020 Perseverance Rover is the latest example of supercomputer used for space research.

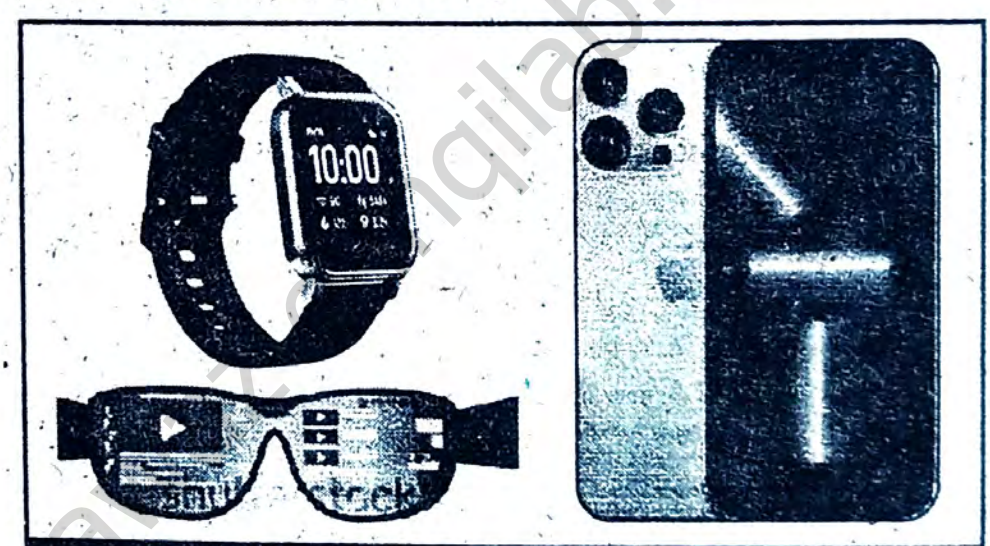


Japan's Fugakau Supercomputer

d. MOBILE COMPUTERS:

Mobile computing is a technology that allows processing and transmission of data, voice and video via a computer or any other wireless enabled device without having to be connected to a fixed physical link.

Examples: Mobile computer includes Smart watches, Fitness band, Smart glasses and Smartphones etc.



Different Types of Mobile Computing Devices

Q:5 What is hardware and software?

Answer:

HARDWARE:

Definition: Hardware can be defined as the physical compo-

nents that a computer system needs to function. (OR)
Hardware refers to the physical components of the computer required to store and execute the software.

Examples: Monitor, hard disk, mouse, CPU, scanners, routers, RAM, modems etc.

SOFTWARE:

Definition: Software is a set of instructions (ہدایات) that tells a computer exactly what to do. (OR)
Software is a set of instructions that enables a user to interact with the computer. (OR)
Software is a set of instructions that guides the hardware for performing a task.

Examples: Windows, word, excel, games, graphic programs, McAfee, JAVA etc.

Q6: What is software? Explain its two main types with examples.

Answer:

COMPUTER SOFTWARE:

Definition: Software is a set of instructions that guides the hardware for performing a task. (OR)
Software is a set of instructions that enables a user to interact with the computer.

Explanation:

Software or computer program is an interface between user and hardware. Software and hardware both are dependent on each other. The computer is a dumb (گونگا یا بے زبان) machine without the software.

For example: You cannot create, edit, save or open the file/folder without installing the relevant software. Most software needs to be installed on the hard disk before it can be used, but some can be loaded into memory directly from the storage media.

TYPES OF SOFTWARE:

A. System Software
B. Application Software

A. System Software:

Definition: Software that controls the working and the operations of the computer hardware is known as system software. It acts as an interface between the user, the application software and hardware with the help of device drivers.

Main Features of System Software:

- It is fast in terms of speed
- It is complex in design.
- It has close interaction with system.
- It is user friendly.
- It is implemented (تافذکرتا) in low-level language.

Examples of System Software:

Windows, MacOS, ubuntu, Linux, Android, JAVA etc.

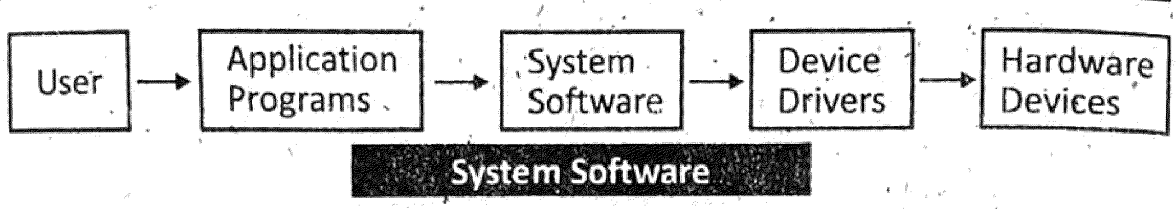
B. Application Software:

Definition: Application software is a set of programs often called a software package, which works together to accomplish a task. (OR)
Application software is also known as end user software because it is used by end users to complete their task.
Examples: Include enterprise software, spreadsheet package, accounting software, office suites, graphics software, acrobat reader, web browsers and media players.

Q.7 What is system software? Explain the major categories of system software.

Answer: SYSTEM SOFTWARE:

Introduction: System software controls the working and operations of computer hardware. It also works as the interface between the user, the application software and hardware with the help of device drivers as shown in figure.



TYPES OF SYSTEM SOFTWARE:

System software can be divided into the following categories:

a. Operating System b. Device Driver
c. Utility Software d. Language Processor

a. Operating System:

Definition: Operating system is the set of specialized programs used to control overall resources and operations of computer system. (OR)

It is the system software that is responsible for the management (انتظام) and coordination (منظم کرنا/ترتیب دینا) of all the activities performed by the computer.

Tasks of Operating System:

Operating system perform the following tasks (کام):

1. It recognizes (پہچانتا) input from the keyboard.
2. It sends output to the display screen.
3. It controls network operations.
4. It keeps track of files and directories on the disk.
5. It controls peripheral devices such as disk drives and printers.
6. It maintains security.

Examples of Operating System:

i) Windows ii) Mac OS
iii) Linux iv) DOS
v) Ubuntu vi) OS/2
vii) UNIX etc.

b. Device Drivers:

Definition: A device driver is a system software that controls hardware and peripheral devices of a computer and enables them for communication with operating system.

Devices that require Drivers:

Printers, CD-ROM, network card, modem card reader, sound

card, scanner, etc.

Devices that do not require Drivers (Plug and Play Devices): Hard drive, mouse, monitor, keyboard, RAM, speakers, thumb drive, power supply, joystick are plug-and-play devices. They are automatically recognized by computer.

c. Utility Software:

Definition: A utility software is a program that performs a specific task related to the management of computer functions, resources, or files.

Examples of Utility Programs:

i) Windows Explorer: It is used to manage files and folders.
ii) Backup Utility: It is used to make backup of data.
iii) WinZip Utility: It is used to compress files.
iv) Diagnostic Utility: It is used to detect hardware and software problems.
v) Antivirus Software: It is used to detect and remove viruses.
vi) Update Utility: It is used to update software.
vii) Disk Defragmenter: It is used to organize all the files in the hard drive.

d. Language Processor (or) Language Translator:

Language processors translate programming code or programming instructions into machine code so that computer can understand and process it.

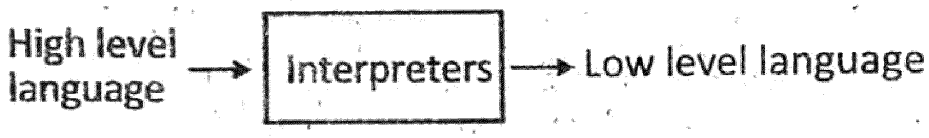
Types of Language Translator: There are further three types of language translator.

i. Interpreter
ii. Compiler
iii. Assembler

i. Interpreter:

Interpreter is a software that translates high level language into machine language but it translates one instruction at a time and executes it immediately (فوری طور پر) before translating the next instruction. It translates and runs the program at the same time. it converts one program statement into machine

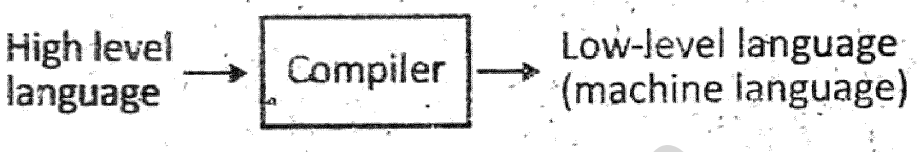
language, executes it, and then proceeds to the next statement.



Examples: Examples of languages that use interpreters include BASIC, LISP, Smalltalk, PHP and PERL.

ii. Compiler:

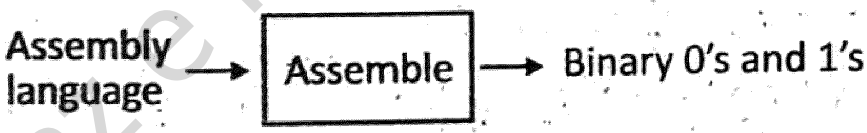
Compiler is a translator which is used to convert programs written in high-level language to low-level language. It translates the entire program and also reports the errors in source program encountered during the translation.



Examples: Examples of languages that use compilers include COBOL, FORTRAN, C/C++, JAVA, etc.

iii. Assembler:

Assembler is software that translates assembly language program into machine language. Assembly language consists of symbolic abbreviations called mnemonics which must be translated into machine language before execution by the computer. Each computer has its own assembly language.



Q8: What are the types of application software?

Answer: Types of Application Software:

There are two types of application software:

1. General Purpose Application Software
2. Special Purpose or Customized Application Software

1. General Purpose Application Software:

General Purpose Application Software is type of software that can be used for a verity of tasks. It is not limited to one par-

ticular function but can perform common information processing jobs for end users.

Examples:

i) Productivity Software ii) Business Software
iii) Entertainment Software iv) Education Software

b) Special Purpose Application Software or Customized Application Software:

Special Purpose Application Software packages are used for specific applications for the end-users in business and other fields. For example, business application software with strategic e-business applications allows the automation and reengineering of business processes.

Examples: Some examples of Special Purpose Software are:

i) Banking Management System
ii) Library Management System
iii) Examination Information System
iv) Stock and Sales Management System etc.

Q9: Explain different types of general purpose application software.

Answer: General Purpose Application Software:

General Purpose Application Software is type of software that can be used for a verity of tasks. It is not limited to one particular function but can perform common information processing jobs for end users.

Types of General Purpose Application Software:

Types of General Purpose Application Software:

1. PRODUCTIVITY SOFTWARE:

Productivity Software is used for producing information, such as documents, presentation, worksheets, databases, charts, graphs and digital video.

Types of Productivity Software:

i. Word Processing Software: Word Processing Software can be used to create, add, format and print documents.

Examples: Microsoft Word and Notepad.

ii. Spread Sheet Software: Spread Sheet Software Applica-

tions, sometimes called electronic spread sheets, perform calculations based on numbers and formulas entered by users.

Examples: Lotus 1-2-3 and Microsoft Excel.

iii. **Database Software:** Database Software is used for creating database. It allows a user to store, retrieve and update data in database.

Examples: Microsoft Access, MySQL, Oracle and Microsoft SQL Server.

iv. **Presentation Software:** Presentation Software's are used to combine text, graphics and animations into a series of electronic slides.

Examples: Common presentation software is Microsoft PowerPoint.

v. **Graphics Software:** Graphics Software helps users to create, edit and manipulate images.

Examples: Adobe Photoshop and Corel Draw.

vi. **Multimedia Software:** They allow the users to create and play audio and video media.

Examples: Example of this type of software include photos, audacity and adobe products.

2. BUSINESS SOFTWARE:

Business Software is any software that used by business users to increase productivity (پیداواری), to measure productivity and to perform business functions accurately.

Examples: Marketing software, payroll software, inventory control system, accounting software, communication software etc.

3. ENTERTAINMENT SOFTWARE:

Entertainment Software is any software that supports a hobby (تفریحی مشغلہ) or provides a form of enjoyment.

Example: Common entertainment software includes Video Games, Media Players etc.

4. EDUCATIONAL SOFTWARE:

Educational Software is used for the purpose of teaching and learning process. Some educational software's are:

i. Computer Based Training (CBT): Computer Based Training means training through computer system.

Example: A training software for pilots how to fly an airplane and also for doctors to train them in surgeries.

ii. Computer Aided Learning (CAL): Computer Aided Learning is used to help teaching and improve learning process. There are some computer programs being used in schools, colleges and offices. Teachers can use this audio/video software to prepare lectures and lesson plans.

iii. Encyclopedia: Encyclopedia is program that contains information about many different subjects or a lot of information about a particular subject. It contains pictures, audio and animation in order to develop interest (دلچسپی) of the readers.

Examples: Encarta and Britannica are popular encyclopedia software.

iv. Some other educational software are:

- Learning management system (LMS)
- Campus management system (CMS)
- Classroom management software

Q10: What is licensed software?

Answer: Licensed Software:

Introduction:

A licensed software means giving right to use the software under certain conditions but restricted (محدود) from other uses such as modification, further copying and distribution etc. under exclusive legal right (خصوصی قانونی حق) of the copyright (کاپی رائٹ قانون) holder.

Explanation:

The software license deals with the copyright law. Copyright law prevents illegal (غیر قانونی) copying of computer software. It allows creators of computer software to benefit (فائدہ) financially from their software and to retain (برقرار رکھنا) some control over how it is

used. Software that is copied and sold without the permission of the owner is known as pirated software and it is violation (خلاف ورزی) of copyright.

Examples: Licensed software includes Microsoft windows, Adobe Photoshop, Skype, MS office, Adobe Flash Player, Google Earth, Skype and WinZip etc.

Q.11: Write a short note on the following:
i) Open source software ii) Shareware iii) Freeware

Answer: 1. Open Source Software:

Open source software is a computer software that is available to users free of cost in source code form with rights to access, change, and improve the software.

Examples of Open Source Software:

i)	Linus	ii)	Apache
iii)	Firefox browser	iv)	Squirrel mail
v)	Open office	vi)	VCL media player
vii)	Word press	vii)	Content management system
viii)	Ubuntu	ix)	Magento
x)	Open source initiative		

2. SHAREWARE:

Shareware is commercial and copyrighted software which is distributed free of cost for a limited trial period (آزمائشی مدت) of time. However, its full version can be purchased (خریدنا) by the user.

Examples of Shareware:

i)	WinZip	ii)	Fireball
iii)	Camtasia studio	iv)	WinRAR
v)	Internet download manager (IDM)		

3. FREEWARE:

Freeware is computer software which is made available free of cost. It is full version of software for an unlimited period of time. It may have some restrictions such as allowed for personal or academic use only.

Examples of Freeware:

i) Apache HTTP server ii) CCleaner
iii) Skype iv) AOMEI back upper
v) Google chrome vi) Mozilla firefox
vii) Libre office viii) Dropbox

Q12: What is firmware?

Answer: Firmware:

Firmware is an intermediate form between hardware and software. It consists of software embedded (لگانا یا نصب کرنا) in electronic devices during their manufacturing.

Explanation:

Firmware programs are written in machine languages and are permanently (مستقل طور پر) embedded in the hardware for which it is developed. Examples of devices containing firmware are ROM, mobile phones, digital cameras, toys, etc. In all such devices firmware is used to enable the device's basic operation as well as functions. Users cannot change such software by their own. Firmware cannot be changed but in some cases, the whole chip can be completely replaced by a technician when it becomes outdated or obsolete (جو استعمال میں نہ ہو یا ناکارہ).

Q13: Classify the general computer hardware components.

Answer: Computer Hardware:

Definition: Hardware can be defined as the physical components that a computer system needs to function. (OR) Hardware refers to the physical components of the computer required to store and execute the software.

Classification:

Generally, all hardware components are classified as follows:

a) Input Devices b) Output Devices
c) CPU d) Memory

a) Input Devices:

Input: Input is any data or instructions entered into the memory of a computer with the help of input devices.

Input Devices: An input device is any hardware component that allows a user to insert data and instructions into a computer. The data can be in any form such as in text, graphics, audio or video.

Examples of Input Devices: Keyboard, mouse, joystick, touch screen, light pen, scanner etc.

b) Output Devices:

An output device is any hardware component that can display information to a user.

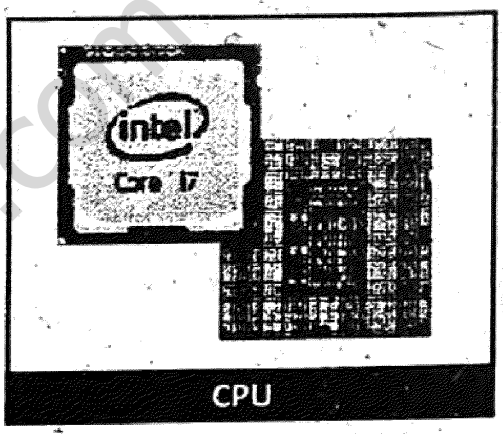
Examples of Output Devices: Monitors, printers, plotters, speakers etc.

c) CPU (Central Processing Unit):

The Central Processing Unit (CPU) is the main part of the computer hardware. it is also called the processor or microprocessor. It is called "brain" of the computer.

1st Microprocessor:

The 1st microprocessor was the Intel 4004, introduce in 1971.



Parts of CPU:

i) The control unit (CU)
ii) Arithmetic logic unit (ALU)

i) The Control Unit (CU):

The CU is responsible for controlling the overall activities (مجموعی سرگرمیاں) of the computer system.

ii) Arithmetic Logic Unit (ALU):

The ALU performs two types of operations i.e., the arithmetic operations such as addition, subtraction, multiplication, division etc. and logical operations such as comparisons like greater than, smaller than, equal to, etc.

d) Memory:

Computer memory is a semiconductor hardware device used to store data or programs permanent or temporary basis. Da-

ta or program in computer is represented as binary code, written as a stream of 0s and 1s. Each binary digit or "bit" has two states, ON and OFF. The ON state represents a binary 1 and OFF state binary 0.

Examples: RAM and ROM are common examples of computer memory.

Q14: Write short note on any five input devices.

Answer: Input:

Input is any data or instructions entered into the memory of a computer with the help of input devices.

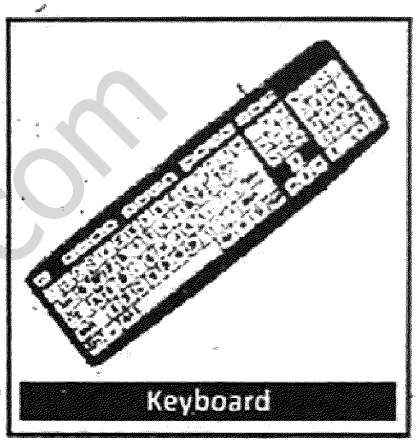
Input Devices:

An input device is any hardware component that allows a user to insert data and instructions into a computer.

Examples of Input Devices:

1. KEYBOARD:

A keyboard is used to enter the data in the form of text and numbers into the computer. It has more than 100 buttons called keys.


Keyboard

Classification of Keyboard Keys:

The keys are arranged in different groups:

i) Functions Keys: They are F1, F2, F3, etc.

ii) Numeric Keys: They are 1, 2, 3, etc.

iii) Normal Keys: They are a, b, c, d, etc.

iv) Direction Keys: They are used to move the cursor.

v) Lock Keys: They are caps lock, num lock, scroll lock.

vi) Special Keys: They are added to keyboard to provide shortcuts for some tasks e.g. print screen button.

Layout of Keyboard:

A standard computer keyboard has a QWERTY layout because they are the topmost alphabetic keys.

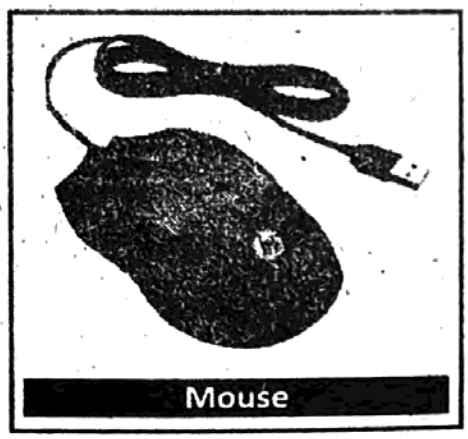
Types of Keyboard:

i) Wired Keyboard: It is connected to a computer through USB port.

ii) Wireless Keyboard: Nowadays wireless keyboard is also used.

2. MOUSE:

Mouse is a pointing input device with two or more buttons used to open and close files, navigate the screen or websites. It was introduced by Douglas Engelbart in 1963.


Mouse

Buttons of Mouse:

Mouse has two buttons and scroll wheel. Pressing the left button is called left click. Pressing the right button is called right click.

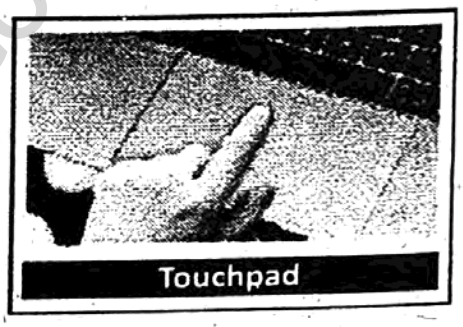
Types of Mouse:

i) Old Mouse: Old mouse has a rubber inside its body to track (کھوج کرنا یا پیچھا کرنا) the movement of the user's hand.

ii) Laser Mouse: Laser mouse uses a laser beam rather than a ball to track the movement of user's hand.

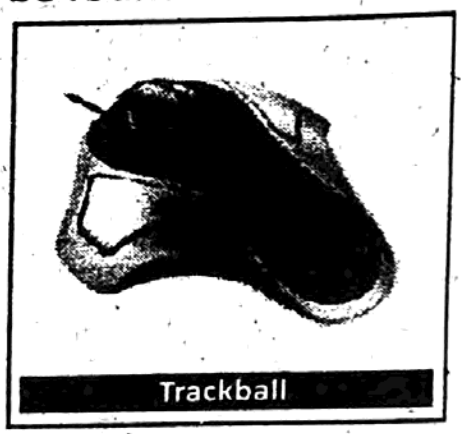
3. TOUCHPAD:

It is also called trackpad. It is a pointing device consisting of specialized surface that can translate the motion and position of a user's fingers to a relative position on screen. They are commonly used in laptop. They can also be found in PDAs.


Touchpad

4. TRACKBALL:

Trackball is a pointing input device. This is like an upside-down mouse where the users roll the wheel in the direction they want the pointer to go. They are often used with video games and information kiosks. It works in the same way as a mouse except when there is not enough space for a mouse. e.g., in portable computers or laptops.


Trackball

5. JOYSTICK:


Joystick

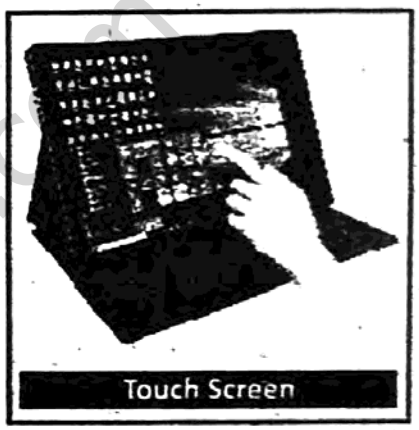
A joystick was invented in naval research laboratory by C.B. Mirick in 1926. It is a pointing input device with a vertical lever mounted (نصب ہوا) on a base. The lever usually includes buttons called triggers, which activate certain events when pressed.

Uses: Joysticks are used for computer games or controlling a machine or character in a flight simulator.

Joystick Ports: Common joystick ports are given below:

i) Game Port ii) Serial Port
iii) USB Port
iv) Bluetooth technology is also available

6. TOUCH SCREEN:


Touch Screen

The first touch screen was developed by CERN engineer Frank Beck and Bent Stumpe in 1970s. A touch screen is an electronic visual display that can detect the presence and location of a touch within the display area with the help of pressure sensitive sensors. It can be touched with a finger or pointing stick or stylus. It takes input from user and displays output at same time.

Uses:

It is used for information kiosks, in department store, hotels, airports and museums. It is used in ATM machines. It is commonly used in mobile phones and tablets as a screen.

7. LIGHT PEN:


Light Pen

Light pen is invented in early 1960s. It is a pointing input device which is used draw lines or figures on the screen. The tip of the light pen con-

tains a light-sensitive element which detects (ڈیٹیکٹ) the light from the screen enabling the computer to highlight or modify the text on the screen.


Webcam

8. WEBCAM:

Webcam is an input device that is used to input photos and live videos to the computer. Desktop computer have an external webcam while laptop computers have inbuilt webcams.

Uses: Webcams are commonly used for online charts / meeting and video conferencing etc..

9. DIGITAL CAMERA:

A digital camera is an input device.

Uses: It is used for taking videos or photographs, or both. Pictures/videos taken by a digital camera can be downloaded to a computer for viewing and editing.


Digital Camera

10. MICROPHONE:

A microphone was invented by Emile Berliner in 1877. In desktop computers, it is used as an external input device and connected through 3.5mm audio jack or USB connector. In laptops, it is built-in along with the webcam.

Uses: It is used to input audio data to a computer.


Microphone

Q15: What is scanner? Explain its common types.

Answer: Scanners:

A scanner or optical scanner is a light-sensing input device that reads text or image from a surface and converts it into a digital form. The quality of a scanner is determined by its resolution and color depth. Most scanners are provided with

Optical Character Recognition (OCR) software, which can convert an image of text into a text file that can be edited.

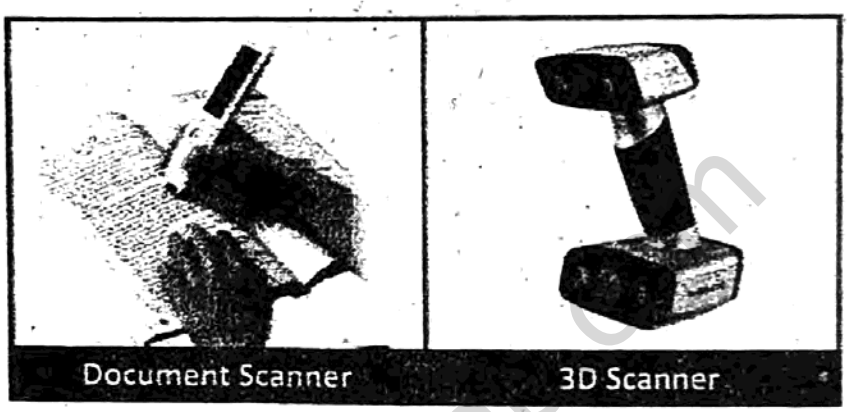
Types: The following are some common types of scanners:

i. Handheld Scanner:

There are two forms of handheld scanners:

a. Document Scanner: The document scanners are dragged (کھینچنا) across the surface of the image to be scanned and requires a steady hand (مستحکم ہاتھ).

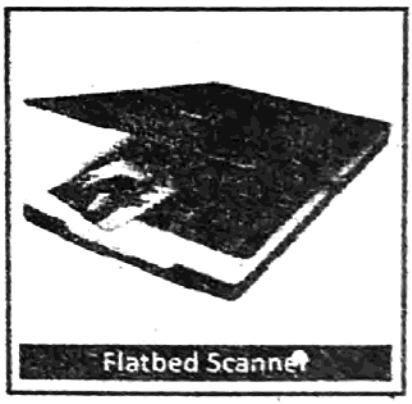
b. 3D Scanner: The 3D scanners are used for producing three-dimensional models of objects. These scanners are used in industrial design, digital manufacturing and medical applications.



Document Scanner 3D Scanner

ii. Flatbed Scanner:

A flatbed scanner is a glass pane (شیشے کی تختی) which is illuminated (روشن ہوتا) by a bright light. It has a moving optical array in CCD (Charged Couple Display) scanning. Images to be scanned are placed face down on the glass. The sensor array and light source move across the pane, reading the entire area.



Flatbed Scanner

iii. Optical Scanner:

Optical scanner uses optical light to read text or illustrations (خاکہ یا تصویر) printed on paper and transform the

Optical Scanner

information by digitizing an image, which is then stored on a file of computer for further processing.

Q16: What is the importance of magnetic cards/devices based systems? Explain different types of magnetic cards.

Answer:

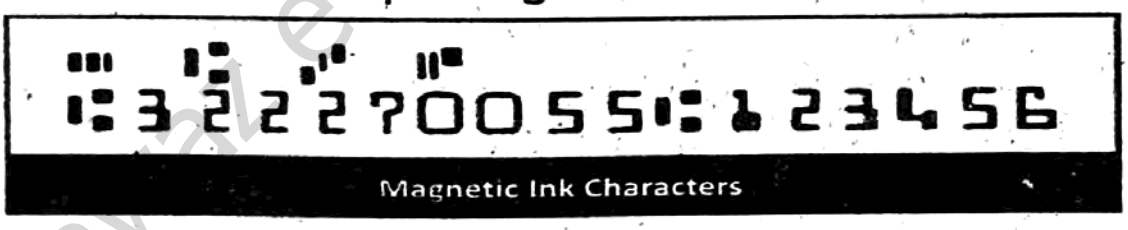
Importance of Magnetic Cards/Device Based Systems:

1. These cards are widely used by different organizations for convenience (سہولت) and security (حفاظت).
2. These cards are used for room access (رسائی) in hotels.
3. These cards (credit cards) are used for shopping in big malls or online shopping.
4. These cards are also used for attendance (حاضری) in colleges or universities.
5. These cards are also used for government building access.
6. Magnetic cards are also used for online banking or online transactions.

1. Magnetic Ink Character Recognition (MICR):

Magnetic Ink Character Recognition (MICR) is a technique that enables special characters printed in magnetic ink to be read and input rapidly to a computer. The main users of MICR are banks. They use it to read information from cheques into their computers so that the cheques can be cashed.

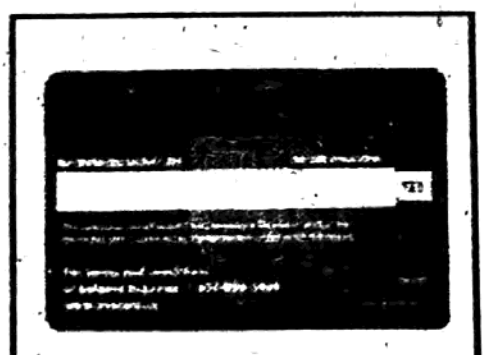
Examples: The following figure shows some information stored on a bank cheque using MICR.



Magnetic Ink Characters

2. Magnetic Stripe Card:

A magnetic stripe card reader is an input device that reads the information encoded in the magnetic stripe located on the back of a plastic card. The stripe can contain up to 60 characters (numbers or digits) in the form of tiny magnet-



Magnetic Stripe Card

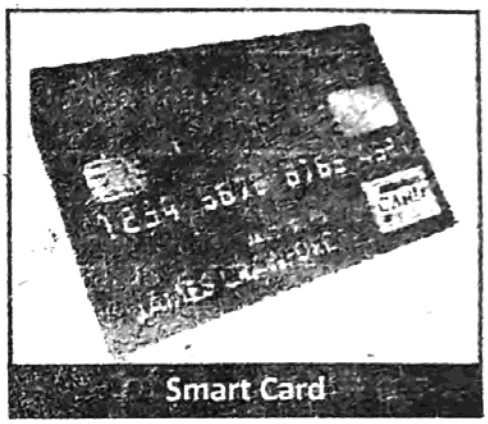
ized particles.

Examples:

Examples of these cards include credit cards, ATM cards, VISA and MasterCard, deriver's license and membership cards. A magnetic stripe card reader as shown in figure:

3. Smart Card:

A smart card contains a small RAM chip. When the card is put into a smart card reader data can be read from the card or written onto it. A smart card can store much more data than a magnetic stripe. It is more secure (محفوظ) than magnetic stripes.



Smart Card

NADRA has also introduced smart card as CNIC.

Q17: What is output? Briefly explain softcopy output devices.

Answer: Output:

Definition: Output means the result or the processed form of anything. So we can define that output is the processed form of input. Computer also provides us output of the data which we enter it after processing. Output is the result of input.

Soft Copy:

A Soft Copy is a copy of text stored on the computer and only accessible (قابل رسائی) through the computer. The most common method of displaying a soft copy is through a computer monitor or other display.

Examples of Softcopy output devices:

Monitor:

A monitor sometimes called a visual display unit, is an electronic output device for computers.

Functions of Monitor:

- It displays the result of the user activities.
- The output produced by monitors called softcopy out-

put.

Monitor Features:

Monitors can be distinguished on the basis of the following features:

Size: Size of monitor is measured diagonally. Standard size is 15 to 19 inches.

Color: The monitor can be either monochrome (one color) or color monitor.

Resolution: The number of pixels (or dots) per square inch is called resolution.

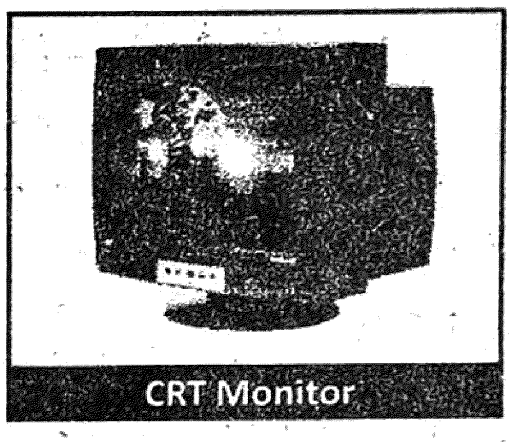
Refresh Rate: It is the speed with which the monitor redraws the screen per unit time.

Dot Pitch: The distance between the pixels on the monitor is called dot pitch. The lesser dot pitch monitors have sharp images:

Types of Monitor: Two main common types of monitor are:

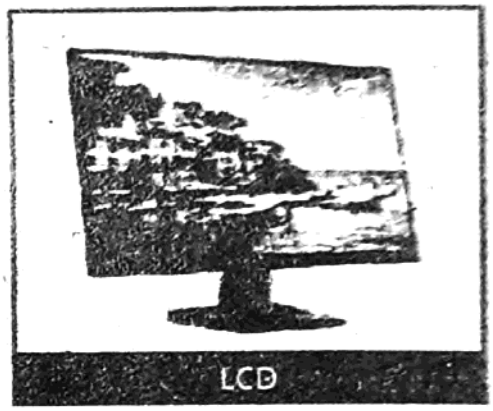
1. Cathode Ray Tube (CRT)
2. Liquid Crystal Display (LCD)

1. Cathode Ray Tube (CRT):


CRT Monitor

- CRT monitors are similar to the standard television sets because they contain Cathode Ray Tube.
- The CRT is a vacuum tube containing an electron gun and a phosphors coated screen.
- Electron gun, fires a beam of electrons which falls repeatedly on the phosphors coated screen and it glows for a fraction of second.
- In color CRT monitors there are three electron guns while the phosphors atoms are in three different colors i.e. Red, Green, Blue (RGB). Others colors are produced by the combinations of these three colors.

2. Liquid Crystal Display (LCD):


LCD

- Liquid Crystal Display (LCD) is a thin and light weight monitor.
- It contains a substance called liquid crystal between two sheets.
- The molecules of this substance are lined up in such a way that the light behind the screen is blocked or allowed to create an image on the screen.
- LCDs provide a sharper image than CRT monitors and emit less radiation.
- They are used in a wide range of applications including computer monitors, televisions and clocks.
- They are more compact, lightweight, portable, more reliable and easier on the eyes than CRT monitors.

Q18: What are impact and non-impact printers? Explain any two types of printers in each category.

Answer: Printers:

Introduction: Printers are output devices which are used to print characters, symbols and graphics on physical media such as paper. The output produced by printers is called hardcopy output.

Types of Printers:

Printers are divided into the following two categories:

1. Impact Printers
2. Non-Impact Printers

1. IMPACT PRINTERS:

An printer creates an image by pressing an inked ribbon against the paper, using pins or hammers to shape the image. It works like a typewriter, which uses small hammers (ہتھوڑے) to strike the ribbon. Each hammer is embossed with the shape of an alphanumeric character; that shape is transferred

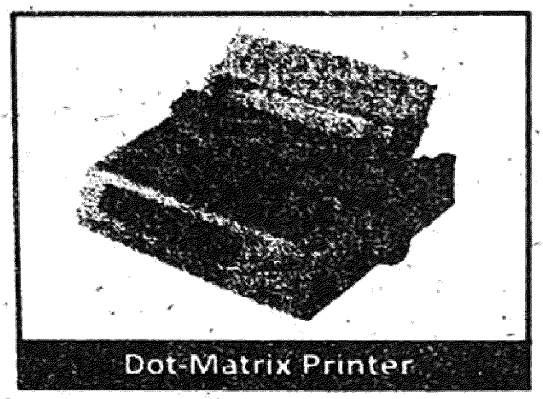
through the inked ribbon onto the paper, resulting in a printer character.

Types:

Types of impact printers are:

i) Dot Matrix Printer ii) Drum Printer

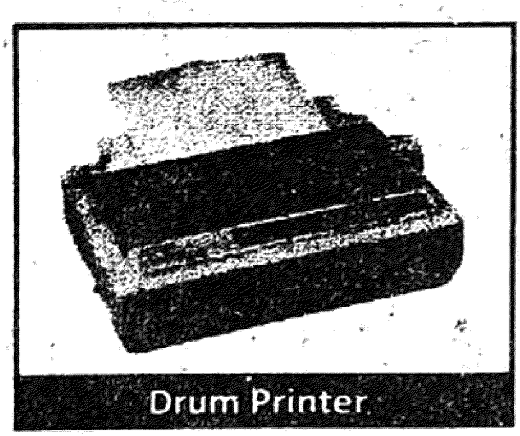
iii) Chain Printer



Dot-Matrix Printer

i. Dot Matrix Printer: It is a type of impact printer that produces text and graphics by striking pins against an ink ribbon to print closely spaced dots in the appropriate (مناسب) shape. The printer receives the data from the computer and translates it to identify which character is to be printed and the printing head prints dots on the paper. Dot matrix printers have 24 pins. Dot matrix printer with 24 pins offers the best print quality.

Uses: Dot matrix printers are commonly used for printing invoices (رسیدیں), purchases orders, shipping forms and labels.

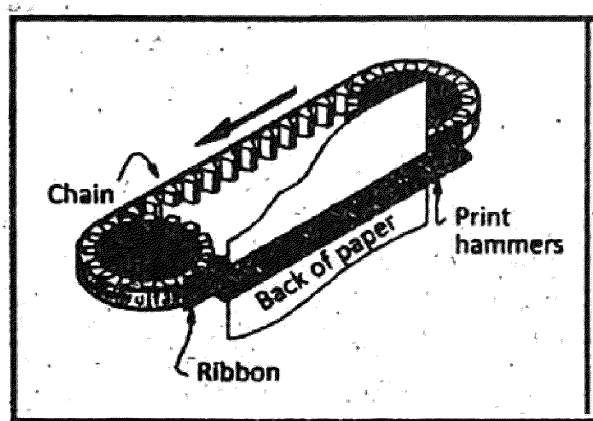


Drum Printer

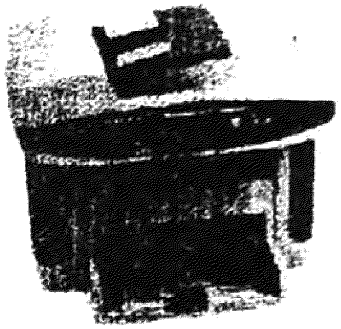
ii. Drum Printer: In these printers a fixed font character set is engraved (کندہ شدہ) onto a number of print wheels. The wheels, joined to forma large drum, spin at high speed. As the desired character for each column passes the print position, a hammer strikes the paper from the rear. As a result the required character is printed on the continuous paper. A full set of hammers delivers (600 lines-per-minute of output) and a half set of hammers delivers (300 LPM).

iii. Chain Printer: A chain printer uses a printing mechanism that uses embossed characters in a chain. The chain spins hor-

izontally around a set of hammers aligned (قطار میں لگنا) with each position. When the required character is in front of the selected print position, hammer in that position hits the paper into the ribbon against the character in the chain.



Chain Printer Mechanism



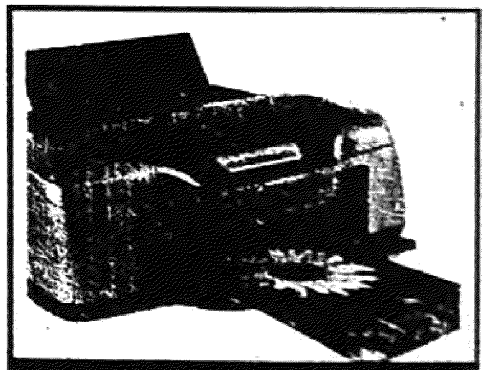
Chain Printer

2. NON-IMPACT PRINTERS:

Non-impact printers print characters and graphics on the paper with Laser or with sprayed ink or with heat and pressure without striking the paper. These printers are faster, not noisy and have high quality of print.

Types: (i) Laser-jet or inkjet and (ii) laser printers are two common types of non-impact printers.

I. Inkjet Jet Printer:

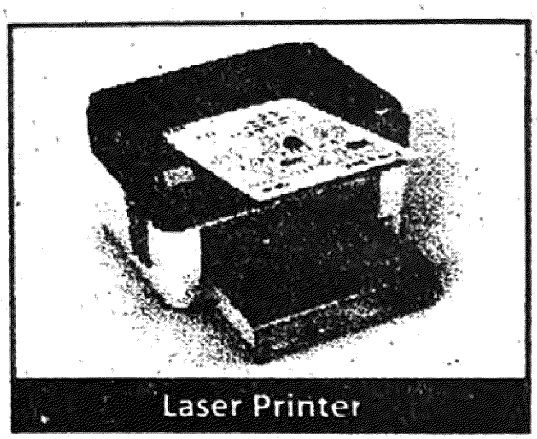


Inkjet Printer

Inkjet jet printer is the most popular printer. It sprays tiny drops of ink onto a page to create an image. This is achieved by using magnetized plates which direct the ink's path onto the paper in the desired pattern. Ink-jet printers are capable of producing high quality print which almost matches the quality of a laser printer.

Resolution: A typical ink-jet printer has a resolution of 300 to 600 dots per inch (dpi).

ii. Laser Printer:


Laser Printer

Laser printer utilizes a laser beam to produce an image on a drum. The drum is then rolled through a toner (containing dry ink), and the electrically charged portions of the drum pick up ink. Finally, using a combination of heat and pressure, the ink on the drum is transferred onto the page. Laser printers print very fast and produce very high-quality print. Laser printers are sometimes called page printers. One of the important characteristics of laser printers is their resolution. The available resolutions range from 300 dpi to 1200 dpi.

Q.19: How a plotter is different from a printer? Explain different types of plotters.

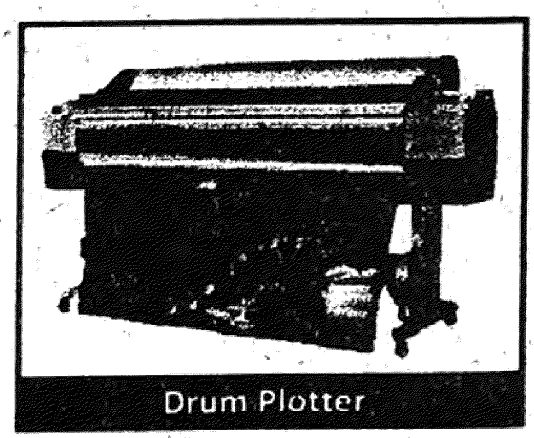
Answer: Plotter:

Introduction: Plotters are hardcopy output devices. They are mainly used by architects, engineers, and others who need to generate high-precision graphical output of large sizes on papers. Plotters are more expensive than printers.

Types of Plotter:

There are two common types of plotters:

1. Drum Plotter
2. Flatbed Plotter

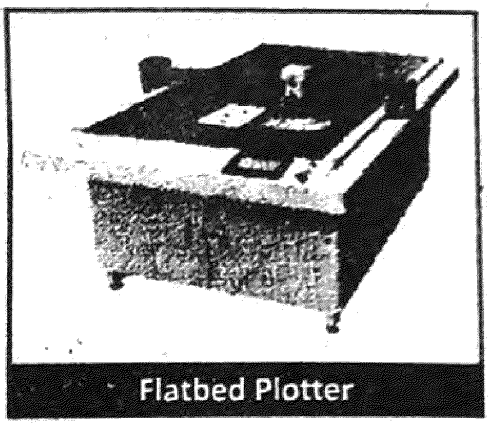

Drum Plotter

1. Drum Plotter: In the drum plotter the paper, on which the design has to be made is placed over the drum, which can rotate in both clockwise and anti-clockwise direction. The drawing pens are mounted on the drum. During rotation of the drum the pens move left and right and create the desired image on the paper.

Advantages: The advantage of drum plotter is that the length of the plot is almost unlimited and the width of the image de-

pends on the width of the drum. These plotters are used to print large size of panaflexes.

2. Flatbed Plotter: A flatbed plotter plots a design on a sheet in such a way that the sheet is spread and fixed over a rectangular flatbed table. In these plotters, the pens of different colours are mounted in the pen holding mechanism that moves on the surface to draw the image.



Flatbed Plotter

Q20: Write down the differences between soft copy and hard copy.

Answer: Difference Between Soft Copy and Hard Copy:

Soft Copy	Hard Copy
1. The output which is stored in a memory and displayed on the screen is called soft copy.	**1.** The output which is printed on a paper is called hard copy.
2. It is easy to modify and correct.	**2.** It is hard to modify and correct.
3. An electronics medium is required to read out soft copy output.	**3.** No electronics medium is required to read out hard copy output.
4. Soft copy is intangible (غیر مادی).	**4.** Hard copy is tangible (چھو کر محسوس کرنے کے قابل).
5. Soft copy is electronic/digital version of a document.	**5.** Hard copy is a physical version of a document printed on paper.
6. Soft copy can be transmitted electrically to any place.	**6.** Hard copy can only be transmitted physically from one place to other.

EXERCISE MCQS

Q#1: Select the best choice for the following MCQs.

1. Which of the following device is considered to be the first computer?
   a. Difference Engine b. ABACUS
   c. Tabulating Machine c. Marks 1

2. Which of the following is the process of storing the data, information and instruction?
   a. Input Operation b. Processing Operation
   c. Output Operation d. Storage Operation

3. _____ Computers are the second powerful and expensive computers than supercomputers.
   a. Microcomputers b. Mini Computers
   c. Mainframe Computers d. Laptops

4. Which of the following are set of programs that operate and control the computer system?
   a. Freeware b. Shareware
   c. System Software d. Application Software

5. _____ is not a portable computer.
   a. Laptop b. PDA
   c. Notebook d. Mainframe

6. _____ is a program that controls a particular type of devices that is attached to the computer.
   a. Operating System b. Device Driver
   c. Utility Software d. Language Processor

7. Which software is used to analyze, optimize and maintain the computer?
   a. Operating System b. Device Driver
   c. Utility Software d. Language Processor

8. _____ translates a high level language program line-by-line.
   a. Interpreter b. Compiler

c. Assembler d. Processor

9. Which of the following is not an input device?
   a. Mouse b. Scanner
   c. Digital Camera d. Speaker

10. Which software is delivered to the user without payment for trial uses with limited functionality and for a specific period of time?
   a. Open Source b. Firmware
   c. Shareware d. Freeware

11. _____ is a term often used for the fixed, small programs that control various electronic devices.
   a. Open Source b. Firmware
   c. Shareware d. Freeware

12. The number of pixel (or dots) per square inch area of a monitor is called_____.
   a. Size b. Resolution
   c. Dot Pitch d. Refresh Rate

13. The distance between the pixels on the monitor is called:
   a. Size b. Resolution
   c. Dot pitch d. Refresh rate

14. The output produced by printers is called_____
   a. Hardcopy output b. Softcopy output
   c. Plain output d. Rough output

15. _____printer creates an image by pressing an inked ribbon against the paper.
   a. Laserjet printer b. Plotter
   c. Laser printer d. Dot-matrix printer

Answers:

1	2	3	4	5	6	7	8
b	d	c	c	d	b	a	a
9	10	11	12	13	14	15	
d	c	b	b	c	a	d	

Short Questions

Q2: Give short answers to the following questions.

Q:i. What is computer?

Answer: Word Computer:

The word "computer" is derived from Latin word "Computa-re", which means to calculate or programmable machine.

Definition:

Computer is an electronic device that takes raw data as input from the user with the help of input devices and processes the data and gives the result as output with the help of output devices and saves output for future use if needed. (OR)

A computer is an electronic device that accepts data (as input), performs operations (as processing) on data at very high speed and produces results (as output).

Explanation:

Computers are composed of the central processing unit (CPU), input devices, output devices, primary storage, secondary storage, and communication devices. The CPU is the main component of a computer that interprets and executes instructions. All computers perform four basic operations:

i) Input Operation ii) Output Operation
iii) Processing Operation iv) Storage Operation

Q:ii. What is processing operation?

Answer: Processing Operation:

Definition: The process of performing different operations on existing data is called processing operation.

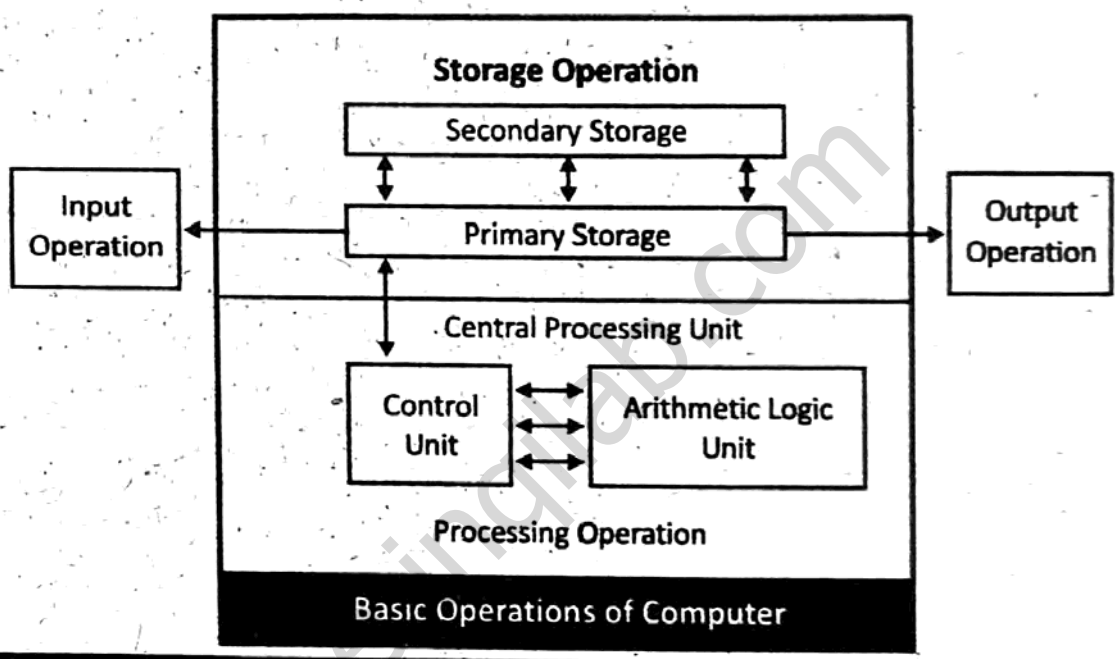
Explanation: Processing operation is the transformation process to convert the input into output. The central processing unit (CPU) performs processing tasks under the directions of a program. It includes arithmetic and logic operations The CPU stores the program instructions and the data in the computer's memory and then processes the data.

Q:iii. Show basic operations of a computer with the help of a block diagram.

Answer: Four Basic Operations of a Computer:

A computer block diagram as shown in figure performs basically four major computer operations or functions. These are:

1) **Input Operation:** It is the process of capturing or accepting data or information, by using input devices.
2) **Processing Operation:** It is the transformation process to convert the input into output.
3) **Output Operation:** It is the result, which comes from the transformation process or it is the outcome.
4) **Storage Operation:** It is the process of storing the data or information or instructions on storage device.



Basic Operations of Computer

Q:iv. What is notebook computer?

Answer: Notebook Computer:


Notebook Computer

A notebook computer is a battery or AC powered personal computer, generally smaller than a briefcase. These computers can be easily used in cars, offices, libraries, classrooms etc. They are specially designed for mobile computing and wireless connectivity. Notebook computers are preferred by students

and business people to meet their assignments and other tasks.

Q.v. State five difference between hardware and software.

Answer:

	Hardware	Software
1	Hardware refers to the physical components of the computer required to store and execute the software.	1. Software is a set of instructions that enables a user to interact with the computer.
2	It is physical in nature	2. It is logical in nature
3	Hardware understand only binary data or digits i.e. 0s and 1s in the form of voltage pulses.	3. Software tells the hardware everything in the form of binary data or digits i.e. 0s and 1s only.
4	Hardware faults are physical.	4. Software faults are logical.
5	Hardware starts functioning once software is loaded.	5. Software includes the programs that run on the hardware, such as Windows 11 is the software that makes the computer functional.
6	**Examples:** Monitor, Printer, Hard disk, Video Card, scanners, Routers and modems etc.	**6. Examples:** Windows, Word, Excel, Games, Graphics Programs and many more
7	**Types of hardware:** input, storage processing, output and communication devices.	**7. Types of software:** System software and application software.
8	Hardware starts functioning once software is loaded.	8. Software runs on hardware.

Q:vi. Differentiate between an interpreter and a compiler.

Answer:

	Interpreter	Compiler
1	It translates program one statement at a time.	1. It scans the entire program and translates it as a whole into machine code.
2	It takes less amount of time to analyze the source code but the overall execution time is slower.	2. It takes large amount of time to analyze the source code but the overall execution time is comparatively faster.
3	It does not generate intermediate object code, hence requires less memory.	3. It generates intermediate object code which further requires linking, hence requires more memory.
4	It reports the error as soon as the first error is occurred and stops working.	4. It reports the error only after scanning the whole program.
5	It reports the error quickly and stops working, thus debugging is easy.	5. Its language is more difficult, thus debugging is comparatively hard.
6	Programming language like Python, Ruby use interpreters.	6. Programming language like C, C++ use compilers.

Q:vii. How application software help users?

Answer: Use of Application Software:

Application software is used in a variety of fields in daily life. Some of the fields in which application software is mostly used are given below:

1. In Offices:

In many offices, application software is used for word processing instead of using typewriter.

Examples: MS Word, Word Pad and Notepad ae commonly used in offices.

2. In Banks:

Banks keep most of their record and data in database and other application software like MS Word and MS Excel, through which fast services are provided to the costumers.

Examples: Business software include: marketing software, payroll system, inventory control system etc.

3. In Business:

Today commercial business cannot be run without the use of application software. Different offices communicate with each other through latest application software.

Examples: Examples of education software are computer based training (CBT), computer aided learning (CAL), Encyclo-pedia etc.

4. In Education:

Application software is playing a very important role in the education. It is being used in schools, colleges and universities for education purpose.

Q:viii. Differentiate between Shareware and Freeware.

Answer:

	Freeware	Shareware
1	Freeware is software that can be download by user from internet free of cost for unlimited time.	1. Shareware is software that can be used at no cost for a trial period.
2	Freeware provides all the feature to be used with no fee.	2. Shareware does not provide all the features, so user must purchase the software with all features.
3	These software can be distributed free of cost.	3. These software may or may not be distributed freely. They may require permission from developer.

4	**Examples:** i) Adobe PDF ii) Google Talk iii) MSN messenger etc.	**4. Examples:** i) Winzip ii) Cuteftp iii) Gtright etc.

Q:ix. What is licensed software?

Answer: Licensed Software:

Introduction:

A licensed software means giving right to use the software under certain conditions but restricted from other uses such as modification, further copying and distribution etc. under exclusive legal right of the copyright holder.

Explanation:

The software license deals with the copyright law. Copyright law prevents illegal copying of computer software. It allows creators of computer software to benefit financially from their software and to retain some control over how it is used. Software that is copied and sold without the permission of the owner is known as pirated software and it is violation of copyright.

Examples: Licensed software includes Microsoft windows, Adobe Photoshop, Skype, MS office, Adobe Flash Player, Google Earth, Skype and WinZip etc.

Q:x. What is firmware?

Answer: Firmware:

Firmware is an intermediate form between hardware and software. It consists of software embedded in electronic devices during their manufacturing.

Explanation:

Firmware programs are written in machine languages and are permanently embedded in the hardware for which it is developed. Examples of devices containing firmware are ROM, mobile phones, digital cameras, toys, etc. In all such devices firmware is used to enable the device's basic operation as well as functions. Users cannot change such software by their own. Firmware cannot be changed but, in some cases, the whole

chip can be completely replaced by a technician when it becomes outdated or obsolete.

Detailed Questions

Q3: Give detailed answers to the following questions.

i. What are computing devices? Explain early and modern computing devices.

Answer: See Question # 1, Page # 3

ii. Explain different classification of computers.

Answer: See Question # 4, Page # 9

iii. What is software? Explain its two main types with examples.

Answer: See Question # 6, Page # 14

iv. Explain different types of general purpose application software.

Answer: See Question # 9, Page # 19

v. Write short note on any five input devices.

Answer: See Question # 14, Page # 25

vi. What is output? Briefly write about softcopy output devices.

Answer: See Question # 17, Page # 31

vii. What is the importance of magnetic cards/devices based systems? Explain different types of magnetic cards.

Answer: See Question # 16, Page # 30

viii. What are impact and non-impact printers? Explain any two types of printers in each category.

Answer: See Question # 18, Page # 33

ix. How a plotter is different from a printer? Explain different types of plotters.

Answer: See Question # 19, Page # 36

Additional MCQs

Q: Select the best answer for the following MCQs.

1. _____of the following is the smallest computer.
   a. Mainframe b. Minicomputer
   c. Microcomputer d. Supercomputer
2. How many instructions per second a minicomputer can execute?
   a. Thousands of instructions
   b. Millions of instructions
   c. Billions of instructions
   d. Above trillion instructions
3. What type of software MS Word is?
   a. System software **b. Application software**
   c. Utility software d. Language software
4. _____device is most suitable for playing games.
   a. Mouse b. Keyboard
   c. Joystick d. Light pen
5. Which of the following is an impact printer?
   a. Dot matrix printer b. Laser printer
   c. Ink-jet printer d. Plotter
6. _____software controls the operation of a hardware device.
   a. Utility software b. Language processor
   c. Application software **d. Device driver**
7. Which of the following devices is used to print large size hard copy?
   a. Plotter b. Ink-jet printer
   c. Laser printer d. Chain printer
8. Which of the following devices converts spoken words into electrical form?
   a. Touch pad **b. Microphone**
   c. Scanner d. Digital camera
9. _____software converts computer programs to machine

language.

a. Utility program b. Device driver
c. Language processor d. Application software

10. Which of the following is productivity software?
a. Spreadsheet software b. Utility software
c. Windows 7 d. Compiler

11. Who called the father of digital computer?
a. Charles Babbage b. John Napier
c. Turing d. Blaise Pascal

12. PDA stands for:
a. Personal digital assistant
b. Palm digital assistant
c. Paper digital assistant
d. Pen digital assistant

13. Which is an example of pointing device?
a. Mouse b. Pointer
c. Cursor d. HDMI port

14. Resolution of monitor is often expressed in:
a. dot per inches b. dot per centimeters
c. inches per dot d. none of these

15. Which memory is a volatile memory?
a. RAM b. ROM
c. Cache d. none

16. Non-volatile memory is:
a. RAM **b. ROM**
c. Cache d. none

17. The process of accepting the input data is called:
a. Input operation b. Process operation
c. Output operation d. Storing operation

18. A program that controls a particular type of device:
a. Operation system **b. Device driver**
c. Utility program d. Language operator

+++++

UNIT : 2
COMPUTER MEMORY

Q1: What is computer memory?

Answer: Computer Memory:

Introduction: Computer memory is one of the important and compulsory components of every computer system. It is the electronic holding place for instructions and data which can be accessed (رسائی) by computer.

Uses: Computer memory is used to store data or programs on a temporary or permanent basis for use in a computer.

Types of Computer Memory:

Computer memory is divided into two main types:

1. Primary or main or internal memory
2. Secondary or auxiliary or backing storage memory

1. Primary Memory:

Memory that holds instructions and data when program is executed is known as primary memory. (OR)

Memory that communicates directly with the CPU is called primary memory.

2. Secondary Memory:

Devices that provide backup storage are called secondary memory or mass storage device. All the information is stored in secondary memory and it is transferred to main memory on a demand basis (مطالبہ کی بنیاد پر).

Units of Memory:

The following are basic memory measurement units:

(i) Bite (ii) Byte
(iii) Memory word

Q2: Define Bit, Byte and Memory Word.

Answer: 1. Bit: A Bit or binary digit is the basic unit of information in computing. A bit is the smallest amount of memory.

A bit can represent only one of two values, either '0' or '1'. Computers represent information in binary code, written as sequences of 0s and 1s. In computers many bits are combined together to hold more information.

2. Byte:

A byte is a unit of data that is eight bits long. A byte is the unit most computers use to represent a character such as an alphabet, a number, or a special symbol. For example; A, h, 6, 4, #, @, *, etc. Computer storage is measured in multiples of bytes. For example, a 500 Gigabyte (GB) hard drive holds 500 billion bytes of data.

Higher Units of Memory:

The following are higher units of memory.

Unit	Representation	Description
1 KiloByte (KB)	2^{10} Bytes	1024 Bytes
1 Megabyte (MB)	2^{20} Bytes	1024 KiloByte
1 GigaByte (GB)	2^{30} Bytes	1024 MegaBytes
1 TeraByte (TB)	2^{40} Bytes	1024 GigaBytes
1 PetaByte (PB)	2^{50} Bytes	1024 TeraBytes

3. Memory Word:

A word is simply a fixed sized group of bits that are handled together by the system. Modern computers usually have a word size of 32 or 64 bits.

Q3: Explain briefly chip memory and magnetic memory.

Answer: Chip Memory and Magnetic Memory:

Computer memory on the basis of manufacturing can be divided into two types:

a) Chip Memory
b) Magnetic Memory

a) Chip Memory:

Chip or microchip is a small piece of semi-conducting material which is used for digital data storage. It is usually made of

silicon. A small circuit called integrated circuit (IC) is embedded into it. A typical chip contains millions of electronic components (transistors). These microchips are built using Very Large-Scale Integration (VLSI) and Ultra Large-Scale Integration (ULSI) technologies.

Fast Speed Memory: Chip memories are very fast as compared to other memories because there are no mechanical moving parts in them but depends on electric currents.

Examples:

Examples of chip memory are main memory:

i) RAM, ROM and Cache ii) Solid State Drive (SSD)
iii) Flash memory drives iv) memory cards and registers

❖ Chip memory is the main memory or primary memory.

b) Magnetic Memory:

Magnetic core memory was the most widely used form of digital computer memory since 1950s till 1970s. Magnetic memories are non-volatile memory. They store information permanently.

Slow Speed Memory: They are slower than semi-conductor memory.

Examples:

i) Floppy disks ii) Magnetic tapes
iii) Zip disks

❖ Magnetic memory is not in use as main memory nowadays.

c. Volatile and Non-Volatile Memory:

Volatile Memory	Non-Volatile Memory
1. It requires a power source to retain (برقرار رکھنا) information.	1. It does not require a power source to retain information.
2. When power source is disconnected, information is lost or deleted.	2. When power is disconnected, information is not deleted.

3. It is often used for temporary retention (برقرار رکھنا) of data, such as with RAM.	3. It is often used for long-term retention of data, such as files and folders.
4. Its speed is faster.	4. Its speed is slower.
5. Example: i) RAM ii) Registers	5. Example: i) ROM ii) Optical disks iii) Hard Disk iv) Flash Drive etc.

Q4: Briefly explain the processor internal memory and its types.

Answer: Internal Processor Memory:

Internal Processor Memory is extremely fast and is directly accessible to CPU.

Types: There are two main types of internal processor memory:

1) Cache Memory
2) Register

1) CACHE MEMORY:

Cache memory is small amount of high-speed semiconductor memory which exists inside the microprocessor or on the motherboard of the computer.

Importance:

This memory stores some active portion of main memory. It lies between the RAM and the CPU. When any information is required by the CPU, first it will look up in the cache memory, and if it is not available in the cache then it will fetch it from the RAM.

Level of Cache Memory: There are three levels of Cache Memory:

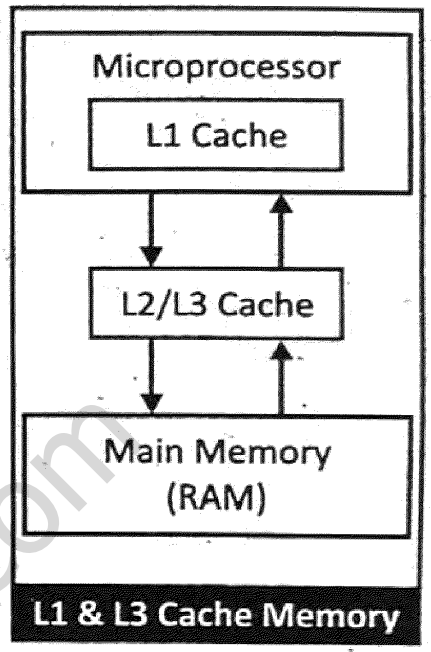
i. L1 (Level-1) Cache
ii. L2 (Level-2) Cache
iii. L3 (Level-3) Cache

(i) L1 Cache: L1 cache is built into the actual processor core. A

processor core is a processing unit which reads instructions to perform specific actions. It is a part of high-speed memory which operates at high speed as CPU. It is very expensive and small in size.

Storage Capacity: It can store data up to 8 Mbytes. It holds data that the processor needs to execute.

(ii) L2 Cache: L2 Cache pulls information from RAM, which is then accessed by the L1 cache. It is bigger in size and slower in speed the L1 cache.



L1 & L3 Cache Memory

Storage Capacity: It can store up to 16 MB data and instructions. The basic purpose of L2 cache is to regularly read larger quantities of data from RAM which is then available to L1 cache.

(iii) L3 Cache: L3 Cache is specialized memory that works hand-in-hand with L1 and L2 cache to improve computer performance. It is the largest cache and faster than RAM but slower than L1 and L2 cache. L3 cache has typically been built into the motherboard while L1 and L2 cache are built into Processor. Processor first looks for the instructions in L1 cache and then it checks L2 and L3 cache respectively.

2) REGISTERS:

Introduction: Registers are small memory units. These are a large number of registers inside the processor.

Function: Registers temporarily store binary information and pass it to the other parts of the processor or main memory during the execution of program instructions. They store the operands and the result of an operation.

Numbers of Registers: The number of registers varies from processor to processor. The more is the number the faster is the

instruction execution.

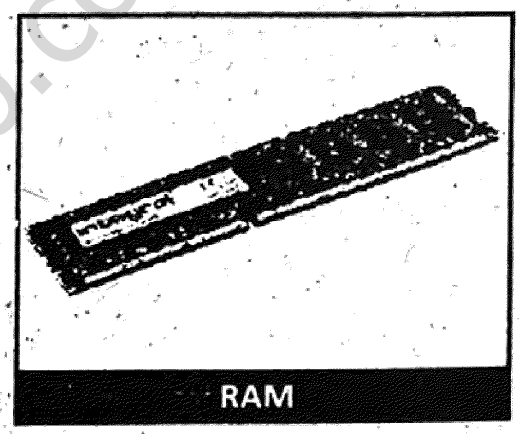
Main Registers and Their Role:

- **Accumulator Register (AC):** It stores the results of arithmetic and logical operations.
- **Status Register (also called PSW, Processor Status Word):** It holds system status indicators (carry digits, overflow).
- **Instruction Register (IR):** It contains the current instruction being processed.
- **Program Counter (PC):** It contains the address of the next instruction to process.
- **Buffer Register:** It temporarily stores data from the memory.

Q5: Explain RAM and ROM along with their types in detail.

Answer: A. Random Access Memory (RAM):

RAM stand for Random Access Memory. It is also called internal memory, primary memory or system memory. Random Access means that each individual byte in entire memory can be accessed directly.



RAM

Function: RAM is used to store data and instructions temporarily.

Volatile Memory: RAM is volatile memory. It means that data are lost when power is turned off.

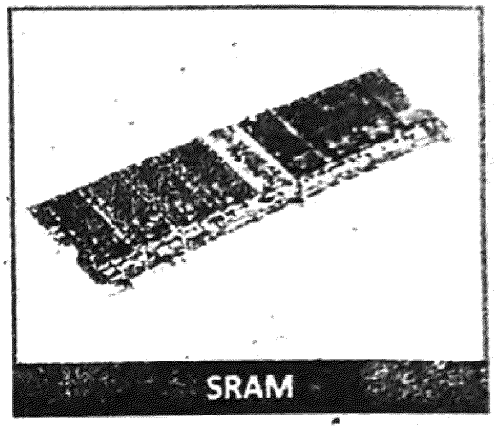
Read/Write Memory: RAM is a Read/Write Memory. CPU can read data from RAM and write data to RAM. When a computer is turned on, the data transfer from Hard disk to RAM.

Types of RAM:

There are two basic types of RAM:

i) Static RAM (SRAM)
ii) Dynamic Ram (DRAM)

i) Static RAM (SRAM):

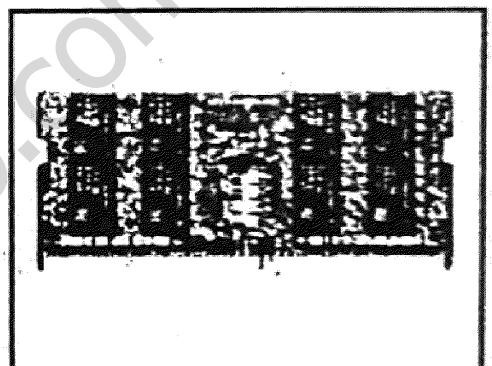

SRAM

SRAM stands for Static Random Access Memory. SRAM is a type of semiconductor memory where the word "Static" indicates that it does not need to be periodically (وقتاً فوقتاً) refreshed to retain its data.

Fast in Operation: SRAM is more expensive and faster. CPU does not need to wait to access data from SRAM during processing. Thus it is faster and requires iess power than DRAM.

Example: CPU's cache is an example of SRAM.

ii) Dynamic RAM (DRAM):


DRAM

DRAM stands for Dynamic Random Access Memory. DRAM is a type of semiconductor memory where the word "Dynamic" indicates that it needs to be periodically refreshed to retain its data.

High Storage Capacity: It stores each bit of data in a separate capacitor within an integrated circuit. The capacitor can be either charged or discharged; these two states represent the two values of a bit, called 0 and 1. It has high storage capacity and low cost as compared to SRAM.

Types of DRAM:

a) SDRAM
b) DDR SDRAM

a) SDRAM:

SDRAM stands for Synchronous Dynamic RAM. SDRAM operates synchronously, which means that it operates in sync (ہم آہنگ کرنا) with the system data bus. Therefore, it can operate at much

greater speeds than non-synchronous RAM.

b) DDR SDRAM:

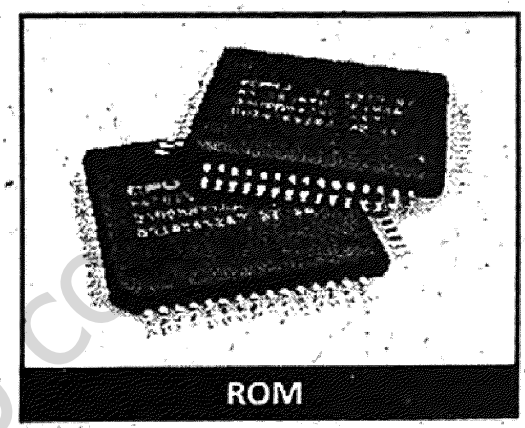
(Double Data Rate SDRAM) is an improved SDRAM which allows a computer to transfer data at twice the speed. It reads or writes two consecutive words per clock cycle.

Types: There are many types of DDR SDRAMs used for computers today, including DDR1, DDR2, DDR3, DDR4 and DDR5 RAM having speed from 100 MHz to 8400 MHz.

Size: SDRAM comes in sizes of 512 MB to 16 GB for use in today's computers.

B. Read Only Memory (ROM):

ROM stands for Read Only Memory. The instruction in ROM prepares the computer for use. These instructions can only be read but cannot be changed or deleted. It is not possible to write new information or instructions (ہدایات) into ROM.

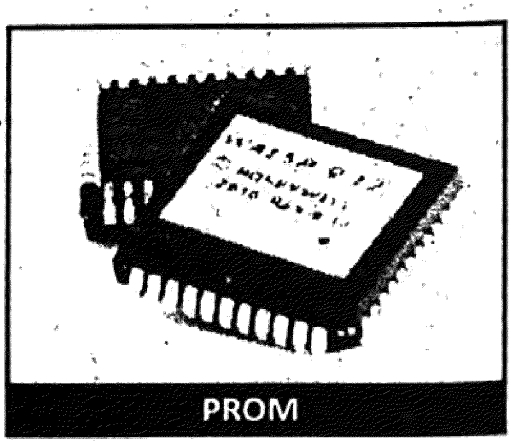


ROM

Non-Volatile: It stored data permanently (مستقل طور پر). When the power switched off, the instructions stored in ROM are not lost. That is why ROM is known as non-volatile. The information in ROM is stored by the manufacturer. When the computer is switched on, the instruction in ROM is automatically loaded into RAM.

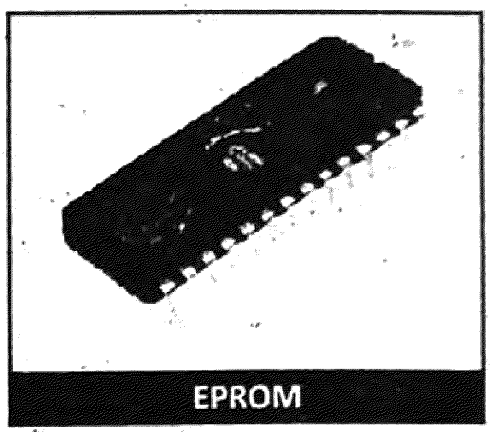
Types of ROM:

i) PROM: PROM stands for Programmable Read Only Memory. This form of ROM is initially (ابتدائی طور پر خالی) blank. The manufacturer or user writes data and program on it using the special device only once. It is programmed just once by

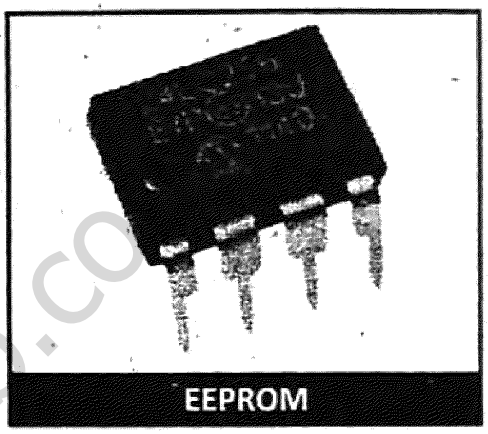


PROM

blowing (اُڑانا) its fuses. The process is irreversible (ناقابل واپسی). If any error found, it cannot be removed from it. The chip becomes unusable (ناقابل استعمال).


EPROM

ii) EPROM: EPROM stands for Erasable Programmable Read Only Memory. It is blank initially and then user or manufacturer writes data and program on it using a special device. Data written on it can be erased (مٹادینا) with a special device using ultraviolet rays (UV) for about 20 minutes. Then the user will able to write new data.


EEPROM

iii) EEPROM: It stands for Electronically Erasable Programmable Read Only Memory. In this type, a user can erase and write with the help of electrical pulses. If there is any error in a program, the user can erase content (مواد) electronically. It is easy to modify content.

Q6: What is meant by Secondary Storage Devices also explain the difference between Sequential Access and Random Access.

Answer: Secondary Storage Devices:

Introduction: Secondary storage is used to hold data or information permanently. It is also called auxiliary storage, external storage or backing storage. It lies outside the CPU.

Non-Volatile: Secondary storage does not lose the data when the device is powered off and it is non-volatile.

Examples: Examples of secondary storage devices are Hard Disk drive, CD, DVD, Blue Ray Disk, Flash memory & Memory cards.

Types: Secondary storage can be divided into two main types:

i) Sequential Access Storage

ii) Direct Access Storage

Difference between Sequential Access and Direct Access Storage: The following table shows the difference between the sequential access and direct access storage:

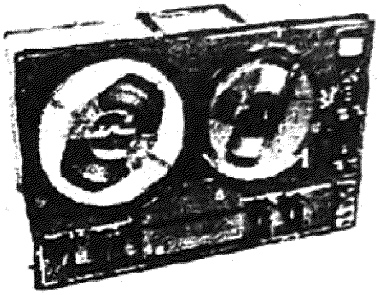
Sequential Access Storage	Direct Access Storage
1. Sequential access is a storage mechanism where the data is storage and read in a fixed or linear order.	**1.** Direct access is a storage mechanism where the data is storage and read directly from storage devices.
2. In this system all data items are not addressed/ searched independently but in a sequence e.g., when playing back a cassette.	**2.** In this system all data items are addressed independently.
3. It is usually less expensive storage mechanism.	**3.** It is more expensive storage mechanism.
4. It is less efficient (موثر) to access particular piece of data.	**4.** It is more efficient to access particular piece of data.
5. In sequential access storage devices, retrieval (دوبارہ حاصل کرنا) of information is indirect i.e., scanning is involved to access record.	**5.** In direct access storage devices, retrieval of information is direct without having to scan a series of records.
6. Magnetic tape, audio or video cassette have sequential access mechanism.	**6.** Magnetic disks, compact disks and all latest memory devices have direct access storage mechanism.
7. Examples: Cassette tape, magnetic tape	**7. Examples:** DVD, CD, hard drive, flash drive

Q7: Describe the following along with their advantages and disadvantages.
b. Magnetic Tapes b. Magnetic Disks
c. Optical Disks (CD, DVD, Blue Ray)

Answer:

a. MAGNETIC TAPES:

Magnetic Tape is sequential access storage device used for data collection and backup. It is a type of secondary memory. It consists of thin tape coating of a fine magnetic material used for storing analog or digital data.



Magnetic Tape

Advantages:

- Magnetic tape can be recorded over and reused repeatedly.
- These are used to store large amount of data e.g. modern tapes can storage data upto 30 Terabytes.
- Magnetic tape is inexpensive.
- Magnetic tape is durable (پائیدار).
- Magnetic tape is used for backup (مدد کرنا) of data.

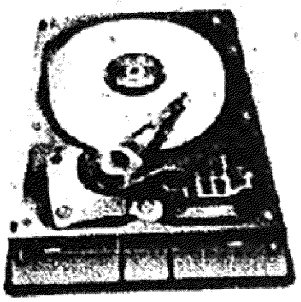
Disadvantages:

- Magnetic tape transfers data slower than hard drives.
- Special equipment must be purchased and set up for storing data.
- It is sequential in nature
- If the data is stored near a strong magnetic field or a large speaker, the tape can be damaged.
- Magnetic tape has a lifespan of 15 years.

b. MAGNETIC DISKS:

The most common type of secondary storage devices are magnetic disks. These are made of either flexible plastic material (Old Floppy Disks) or rigid metal (Hard Disks). Magnetic disks are

coated with a magnetic substance.



Magnetic Disk

Advantages:

- Very fast access of data.
- Data can be read directly from any part of the hard disc.
- In most of the magnetic storage devices the access speed is about 1000kb/s.
- Some of magnetic storage devices are very cheap for example floppy disks.
- Most of the magnetic storage devices store very large amounts of data.

Disadvantages:

- Data can be disturbing (خلل ڈالنا) by magnetic fields, dust, mechanical problems.
- Gradually lose their data with the passage of time.
- Hard disks eventually (آخرکار) fail which stops the computer from working.
- Scratches can damage the surface of the disk, leading to loss of data in that sector.
- The disk is fixed inside the computer and cannot easily be transferred to another computer.

Types of Magnetic Disks:

Some common types of magnetic disks are:

i) Floppy Disks and Zip Disks
ii) Hard Disks

i) Floppy Disks and Zip Disks:

Floppy Disks:

They are old type of magnetic storages. These disks were very popular during the 1980 and early 1990s as portable storage device. Floppy disks are flexible plastic disks coated with magnetic material on both sides. They are packed inside a plastic jacket for protection. Digital information is stored in floppy

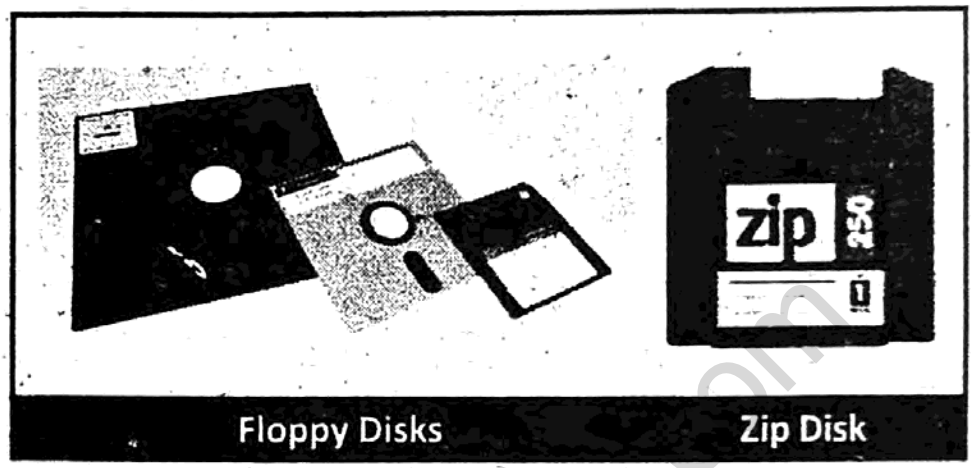
disks in the form of small magnetized spots.

Storage Capacity: Maximum storage capacity of a floppy disk was 1.44 MB.

Zip Disks:

They are also old type of removable storage devices. A zip disk is somewhat like floppy disk.

Storage Capacity: A zip disk can hold around 100 MB to 250 MB of data. Nowadays flash memory and CDs are commonly used due to large storage capacity and low cost.



Floppy Disks Zip Disk

ii) Hard Disks:

A hard disk is a large backing magnetic storage device. It consists of several inflexible, circular disks called platters on which data / information are stored electronically. It is fixed inside the desktop and laptop computes with sealed steel packing to avoid (بچاؤ) hard disk from dust and smoke particles. Portable hard disk drive is also available which can be connected to computers through USB ports. Todays, HDDs operate on high speed serial interface i.e. serial ATA (SATA).

Hard Disk Design:

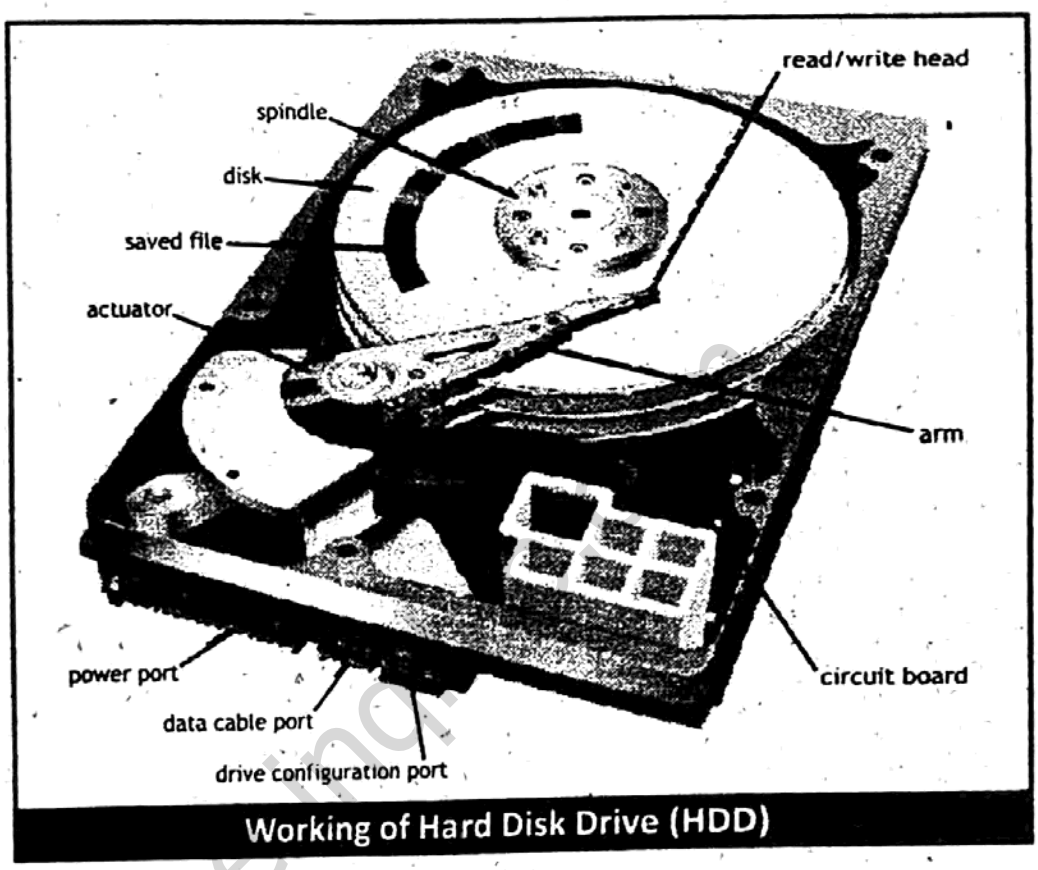
A typical HDD is made of circular disks which are called platters. These platters hold the recorded data. The spinning speed of platters is ranging from 4200 rpm to 15000 rpm (rpm means revolution per minute). Today, HDDs operate at speed of 7200 rpm. A typical HDD has two electric motors; a disk motor that

spins the disks and an actuator (motor) that positions the read/write head assembly across the spinning disks.

The surface of the disks is divided into tracks and sectors before writing data.

Tracks are concentric circles (circles within circles). The data bits are recorded as tiny magnetic spots on the tracks.

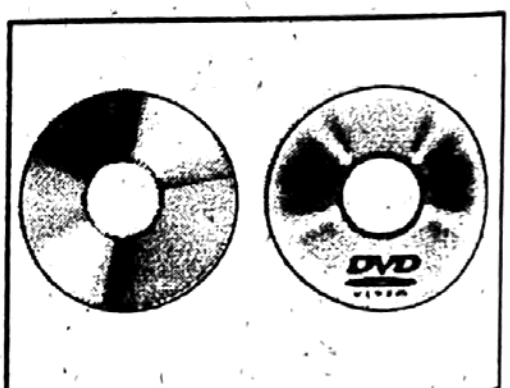
Sectors are the further divisions of tracks, which hold a block of data that is read or written at one time.



Working of Hard Disk Drive (HDD)

c. OPTICAL DISK:

Optical disk is a flat, usually circular disk which encodes binary data in the form of pits and lands on a aluminum material on one side of its flat surfaces. The pits represent "0" or "OFF" in binary computing due to lack of laser beam reflection during reading of disk and the lands



DVD

represent "1" or "ON" in binary computing due to reflection of laser beam during reading of disk.

An optical disc drive spins the disc at a speed of about 200 rpm to 4000 rpm or more depending on the drive type, disc format, and the distance of the read head from the center of the disc.

Advantages:

- Easy to store more data in less space
- Small and portable
- Less expensive

Disadvantages:

- They require special drives to read or write data.
- They are breakable, and easy to scratch
- They are slower to access than hard disk
- They are mostly have fragile nature (ٹوٹ جانے کی صلاحیت)
- Blue-ray disk cannot be used on the CD and DVD drive.

Types: The following are different types of optical disks:

i) CD (Compact Disk)
ii) DVD (Digital Versatile Disk)
iii) Blue Ray Disk (BD)

a) Compact Disk (CD): A Compact Disk (CD) is a type of optical memory. Compact disk uses circular disc to store software's, audio and video and computer data.

Storage Capacity: It can store about 700 MB of data.

Types: A compact disk is available in following types:

- CD-ROM (Read Only CD)
- CD-R (Record Able CD)
- CD-RW (Re Writable CD)

b) **Digital Versatile Disk (DVD):** DVD is an optical disk technology with a 4 to 16 Gigabyte storage for video, audio or other information. DVDs require special drives to read/write data.

Storage Capacity: DVD has storage capacity from 4 GB to 16 GB. However, it does not provide enough data storage as compared to today latest storage devices.

c) Blue-Ray Disk (BD): Blue-Ray is also an optical memory designed to store large amount of data.

Blue-ray disk drive uses blue laser light to read and write data on disk rather than the red laser of DVD player.

Data is stored on the surface of Blue-ray disk in the form of lands (1) and pits (0) and are very densely packed which increases Blue-ray disk capacity.

Storage Capacity: Blue-ray disk has storage capacity of 50GB to 100GB. It is also faster and more durable than CDs and DVDs.

Q8: Describe the advantages and disadvantages of flash memory.

Answer: Flash Memory:

Flash memory is a non-volatile computer storage chip that can be electrically erased and reprogrammed. It is a specific type of EEPROM that is erased and programmed in large blocks.

Flash Memory Drive

USB Flash Drive: Flash memory drive is also known as USB flash drive. It is a data storage device that includes flash memory with an integrated Universal Serial Bus (USB) interface. USB flash drives are typically removable and re-writable, and physically much smaller than other storage media. Documents, presentations, and any other form of data can be stored on a flash drive. Flash drives are also known as USB Memory Pens, USB Pen Drives, and USB Memory Sticks.

Storage Capacity: It has the capacity upto 128 GB.

Advantages:

1. Flash memory is more durable than CD and DVD.

2. It is less expensive than hard disk.
3. It is very compact (پوسٹ یا ٹھوس) and can store large amount of data in a small space.
4. It is faster in read and write than hard disk or DVD.
5. It uses less power than other types of storage media.
6. The great advantage of flash memory is its portability.
7. They can be used in laptops, tablets, digital audio players, digital camera, and smartphones.

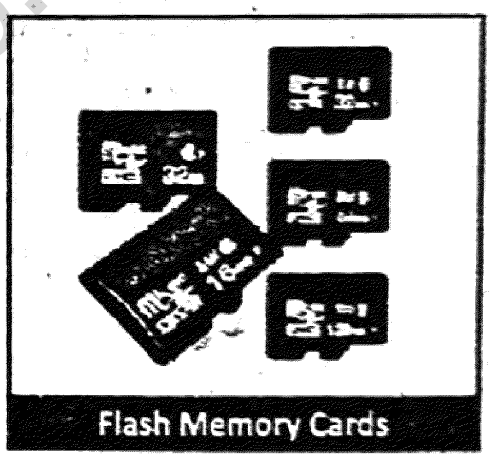
Disadvantages:

1. More expensive than CD or DVD.
2. They can easily be lost.
3. Most flash drives do not have a write-protection mechanism.
4. It has a limited number of write and erase cycles.
5. It costs more per gigabyte as compared to traditional hard drives for large storage capacities.

Q9: What is flash memory card?

Answer: Flash Memory Card:

A flash memory card is an electronic flash memory data storage device used for storing data such as text, pictures, audio, and video.



Flash Memory Cards

Uses: They are commonly used in many electronic devices, including digital cameras, mobile phones, laptops, MP3 players and video game consoles.

Size: They come in various sizes and with different storage capacity ranging from 1GB to 128GB or 256GB.

EXERCISE MCQS

Q#1: Select the best choice for the following MCQs.

1. _____ memory holds data and programs not currently in use and provides long term storage.
   a. Primary b. Secondary
   c. Main d. Internal
2. _____ is the smallest amount of memory a computer can hold?
   a. Byte b. KB
   c. Bit d. MB
3. Which of the following is the fastest memory?
   a. RAM b. ROM
   c. Cache Memory d. PROM
4. How much 1-megabyte memory equal to?
   a. 1024 K Bytes b. 1000 K Bytes
   c. 1024 K Bits d. 1024 G Bytes
5. Which materials is used to make memory chips?
   a. Iron b. Gold
   c. Silver d. Silicon
6. Which of the following is volatile memory?
   a. RAM b. ROM
   c. PROM d. EEPROM
7. Which of the following is called internal processor memory?
   a. RAM b. ROM
   c. Cache d. DRAM
8. _____ has the highest storage capacity.
   a. DVD b. Blue-ray Disk
   c. CD d. Zip-disk
9. _____ type of optical storage?
   a. Hard Disk b. Blue-ray Disk
   c. Floppy Disk d. Zip-disk
10. Which of the following is sequential access storage devices?

a. Magnetic Disk b. Blue ray Disk
c. Magnetic Tape d. Zip disk

Answers:

1	2	3	4	5	6	7	8	9	10
b	c	c	a	d	a	c	b	b	c

Short Questions

Q2: Give short answers to the following questions.

Q:i. What is computer memory?

Answer: Computer Memory:

Introduction: Computer memory is one of the important and compulsory components of every computer system. It is the electronic holding place for instructions and data which can be accessed by computer.

Uses: Computer memory is used to store data or programs on a temporary or permanent basis for use in a computer.

Types of Computer Memory:

Computer memory is divided into two main types:

3. Primary or main or internal memory
4. Secondary or auxiliary or backing storage memory

1. Primary Memory:

Memory that holds instructions and data when program is executed is known as primary memory. (OR)

Memory that communicates directly with the CPU is called primary memory.

2. Secondary Memory:

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

Units of Memory:

The following are basic memory measurement units:

(i) Bit (ii) Byte

(iii) Memory word

Q:11. Define bit, byte and memory word.

Answer: 1. Bit:

A Bit or binary digit is the basic unit of information in computing. A bit is the smallest amount of memory. A bit can represent only one of two values, either '0' or '1'. Computers represent information in binary code, written as sequences of 0s and 1s. In computers many bits are combined together to hold more information.

2. Byte:

A byte is a unit of data that is eight bits long. A byte is the unit most computers use to represent a character such as an alphabet, a number, or a special symbol. For example; A, h, 6, 4, #, @, *, etc. Computer storage is measured in multiples of bytes. For example, a 500 Gigabyte (GB) hard drive holds 500 billion bytes of data.

Higher Units of Memory:

The following are higher units of memory.

Unit	Representation	Description
1 KiloByte (KB)	2^{10} Bytes	1024 Bytes
1 Megabyte (MB)	2^{20} Bytes	1024 KiloByte
1 GigaByte (GB)	2^{30} Bytes	1024 MegaBytes
1 TeraByte (TB)	2^{40} Bytes	1024 GigaBytes
1 PetaByte (PB)	2^{50} Bytes	1024 TeraBytes

3. Memory Word:

A word is simply a fixed sized group of bits that are handled together by the system. Modern computers usually have a word size of 32 or 64 bits.

Q:iii. What is the importance of cache memory in computer?

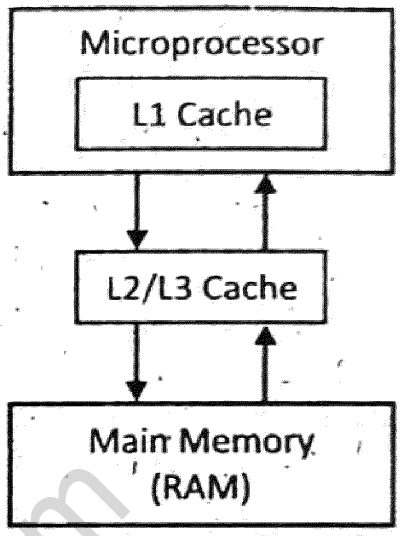
Answer: Cache Memory:

Cache memory is small amount of high-speed semiconductor memory which exists inside the microprocessor or on the motherboard of the computer.

Importance of Cache Memory in a Computer (OR)

Role of Cache Memory in a Computer

This memory stores some active portion of main memory. It lies between the RAM and the CPU. When any information is required by the CPU, first it will look up in the cache memory, and if it is not available in the cache then it will fetch it from the RAM. There are three types of cache memories, level 1 (L1), level 2 (L2) and level 3 (L3) as shown below.



L1 & L3 Cache Memory

L1 cache memory is built inside the microprocessor chip. It has the fastest access time.

L2 and L3 cache memories are separate chips on the motherboard. These can be accessed more quickly than the RAM.

Q:iv. Give some uses of secondary memory.

Answer: Secondary Memory:

Secondary Memory is a type of computer memory that is not directly accessed by the central processing unit (CPU) of a computer and is usually available as non-volatile memory.

Uses of Secondary Memory:

1. It is used to provide permanent storage.
2. It is used to provide large and cheap storage.
3. It is used to carry data from one computer to another.
4. Its data can be reused for several years.
5. It can be used for backup of software and storage of other files/data.

6. It can store data up to several terabytes.
7. Its storage is non-volatile storage device.
8. It allows fast read/write operations.
9. It can store information even when the computer is turned OFF.

Secondary memory is used in hard drive, magnetic tapes, memory cards etc.

Q:v. What is the role of registers in computer?

Answer: Registers in Computer:

Introduction: Registers are small memory units. These are a large number of registers inside the processor.

Function: Registers temporarily store binary information and pass it to the other parts of the processor or main memory during the execution of program instructions. They store the operands and the result of an operation. The number of registers varies from processor to processor. The more is the number the faster is the instruction execution.

Main Registers and Their Role:

- **Accumulator Register (AC):** It stores the results of arithmetic and logical operations.
- **Status Register (also called PSW, Processor Status Word):** It holds system status indicators (carry digits, overflow).
- **Instruction Register (IR):** It contains the current instruction being processed.
- **Program Counter (PC):** It contains the address of the next instruction to process.
- **Buffer Register:** It temporarily stores data from the memory.

Q:vi. Differentiate between DRAM and SRAM.

Answer: "DRAM" stands for Dynamic Random Access Memory. "SRAM" stands for Static Random Access Memory.

DRAM	SRAM
1. It is slower than SRAM	1. It is faster that DRAM

2. It is less expensive	2. It is more expensive
3. It needs to be periodically refreshed to retain its data.	3. It does not need periodically refreshed to retain its data.
4. It utilizes more power	4. It utilizes less power
5. Use as computer main memory	5. Use as cache memory in computer
6. It has high storage due to their simple structure.	6. It has less storage capacity due to their complex structure.

Q:vii. Give few characteristics of secondary storage devices.

Answer: Secondary Storage:

Introduction: Secondary storage is used to hold data or information permanently. It is also called auxiliary storage, external storage or backing storage. It lies outside the CPU. Secondary storage does not lose the data when the device is powered off and it is non-volatile.

Examples: Examples of secondary storage devices are Hard Disk drive, CD, DVD, Blue Ray Disk, Flash memory & Memory cards.

Characteristics of Secondary Storage Devices:

Secondary storage devices are used for storing the data permanently. These devices have the following characteristics:

1. **Non-Volatile:** They are non-volatile as the data is not lost when power goes off.
2. **High Capacity:** The capacity of these devices is very high. It goes to terabytes.
3. **Cost Effective:** They are cost effective as compared to the main memory.
4. **Reusable:** They are reusable as data can be erased and stored any time the user requires.
5. **Portability of Durability:** They are portable and durable for long time.
6. They have sequential access storage and direct access storage.

Detailed Questions

Q#3: Give detailed answers to the following questions.

i. Briefly write about the processor internal memory and its types.

Answer: See Question # 4, Page # 52

ii. Explain RAM and ROM along with their types in detail.

Answer: See Question # 5, Page # 54

iii. What is meant by secondary storage devices also explain the difference between sequential access and random access.

Answer: See Question # 6, Page # 57

iv. Describe the following along with their advantages and disadvantages.
(a) Magnetic tapes (b) Magnetic disks
(c) Optical disks (CD, DVD, Blue-ray)

Answer: See Question # 7, Page # 59

v. Describe the advantages and disadvantages of flash memory.

Answer: See Question # 8, Page # 64

Additional MCQs

Q: Select the best answer for the following MCQs.

1. Which of the following is the fastest memory?
   a. RAM b. ROM
   c. Cache memory d. USB flash drive
2. How much is 1MB memory equal to?
   a. 1024 bytes b. 1024 TB **c. 1024 KB** d. 1024 GB
3. Which of the following is volatile memory?
   a. RAM b. ROM c. PROM d. EEPROM
4. Which of the following has highest storage capacity?
   a. DVD **b. Blue-ray disk**
   c. CD d. Floppy disk
5. USB flash drive is what type of memory?
   a. Magnetic memory b. Optical memory
   c. Solid state memory d. Primary memory
6. Which of the following memory devices has the smallest storage capacity?
   a. RAM **b. Cache memory**
   c. CD d. Memory card
7. Which of the following storage device is obsolete now days?
   a. Hard disk b. CD
   c. Memory card **d. Floppy disk**
8. Which memory communicates directly with the CPU?
   a. Main memory b. Secondary memory
   c. Hard disk d. USB flash drive
9. Which of the following memory devices has sequential access to data?
   a. Magnetic disk b. Optical memory
   c. Magnetic tape d. Chip memory
10. Where are the registers located?
    a. Inside hard disk b. Inside DVD
    c. Inside RAM **d. Inside microprocessor**

+ + + + +

UNIT : 3
CENTRAL PROCESSING UNIT

Q1: What is CPU? Describe basic components of CPU in detail.

Answer: Central Processing Unit (CPU):

The Central Processing Unit (CPU) is the main part of the computer which performs all its activities. It is also called the processor or microprocessor. It is called "brain" of the computer. CPU is connected to all parts of the computer. CPU not only execute instructions but also controls the storage of data, input output activities and functions of different devices attached.

Basic Components of CPU:

CPU consists of the following basic components:

1. Arithmetic and Logic Unit (ALU)
2. Control Unit (CU)
3. Registers
4. Cache
5. Internal Buses

1. Arithmetic and Logic Unit (ALU):

Arithmetic Logic Unit is the main processing unit of CPU.

Function: ALU performs the arithmetic and logic operations on data. Arithmetic means addition, subtraction, multiplication, division and logical operation is the comparison between two data items. ALU processes the data and then gives back the results. The results of an operation are stored in registers. Nowadays CPUs have more than one ALUs which increase efficiency of computer system.

2. Control Unit (CU):

Control unit is the most important component of computer which coordinates and controls the overall computer system.

Function: Control Unit manages the functions performed by different parts of the computer. It executes the program instructions, controls and directs the input informs ALU for

processing, manages storage and directs the data to the output device.

Control unit is responsible (کے انچارج) for directing the flow of instructions and data within the CPU. It directs the operation of the other units by providing timing and control signals. The control unit contains the necessary logic to interpret instructions and to generate the signals necessary for the execution of those instructions. In short, it can be said, this component decodes, stores results and manages execution of data that flows through the CPU.

3. Registers:

Registers are the temporary storage areas which are responsible for holding the data that is to be processed. They store the instructions and data in processor. This data is further used by Control Unit. Each register is designed for a special purpose and have different size. Registers are measured by the number of bits they can hold, like 16-bits, 32 bits or a 64-bits register.

Function: Registers temporarily stores binary information and pass it to the other parts of the processor or main memory during program execution.

Registers are divided into two categories:

- General Purpose Registers
- Special Purpose Registers

4. Cache Memory:

It is very fast memory located in between processor and RAM. The CPU uses cache memory to store instructions and data that are repeatedly (بار بار یا متواتر) required to run programs, improving (بہتر کرتا) overall system speed.

Levels of Cache Memory:

There are three levels of cache memory:

- L1 (Leve-1) Cache
- L2 (Level-2) Cache
- L3 (Level-3) Cache

Level 1 (L1) Cache Memory: L1 cache resides inside the processor and is very fast from other memories. Processor first checks the Level 1 cache memory.

Level 2 (L2) Cache Memory: L2 cache lies just outside the microprocessor, it is slow as compared to Level 1 cache but fast from rest of the memories. If data or instruction not found in Level 1 cache memory, then microprocessor will look Level 2 cache memory.

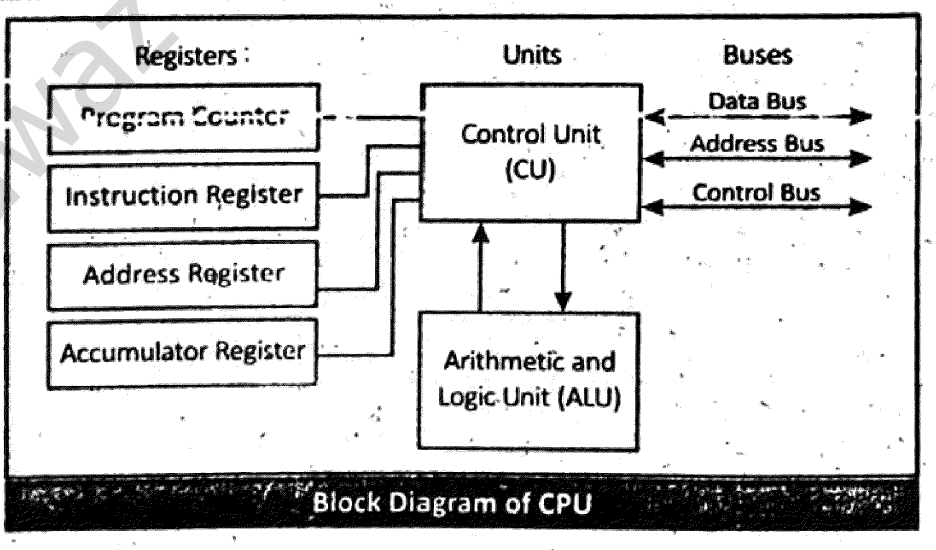
Level 3 (L3) Cache Memory: L3 cache is specialized memory that works hand-in-hand with L1 and L2 cache to improve computer performance. It is the largest cache and faster than RAM but slower than L1 and L2 cache. L3 cache has typically been built into the motherboard while L1 and L2 cache are built into processor. Processor first looks for the instructions in L1 cache and then it checks L2 and L3 cache respectively.

5. Internal Buses:

A bus is a group of parallel (متوازی) lines that transfers data between components inside a computer. An internal bus is a bus inside the processor, moving data, instruction and other information between registers and other internal components of processor.

Parallel and Serial Buses: Modern computer buses can use both parallel and serial-bit connections. Parallel buses are those which carry data in parallel on multiple wires (Conventional PCI, extended ISA, PCI-104) and serial buses are those that carry data in serial-bit form (PCI express, SATA).

Size of Buses: The buses size in computers are from 8-bits to 128 bits.



Block Diagram of CPU

Q2: What are registers? Explain different types of registers.

Answer: REGISTERS:

Definition: Register refer to the group of latches that store a single memory word. (OR)
Registers are high-speed storage locations inside the microprocessor.

Uses: Registers are special purpose, high-speed temporary storage units for storing information such as data, instructions, addresses and the intermediate results of calculations.

SIZE OF REGISTERS:

Registers are measured by the number of bits they can hold. For example: 8-bits register, 16-bits register, 32-bits register or 64-bits register.

TYPES OF REGISTERS:

According to their purpose and function, registers are classified into two types:

A. General Purpose Register
B. Special Purpose Register

A. General Purpose Registers:

General purpose registers are used to store data as well as addresses. These registers are used in arithmetic and data movement. Typically these registers are 8-64 bit registers.

Four Common General Purpose Registers:

i) Accumulator (AX)
ii) Base Register (BX)
iii) Counter Register (CX)
iv) Data Register (DX)

i) Accumulator (AX):

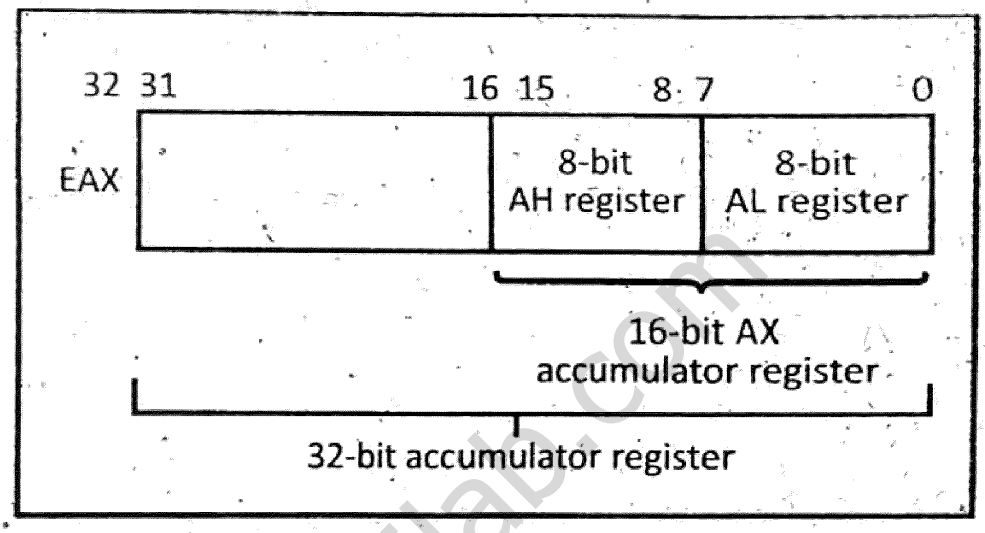
Accumulator is a general purpose register. It is used by CPU for performing arithmetic and logic operations and also stores these operations. It acts as a temporary storage location which holds an intermediate value in mathematical and logical

calculations.

Complete 32-Bit Accumulator Register:

A complete 32-bit register can be used in three ways as shown in figure.

- As complete 32-bit data register: **EAX** (Extended Accumulator Register)
- Lower half of the 32-bit register can be used as 16-bit data register: **AX**
- Lower and higher of the 16-bit register (AX) can be used as two 8-bit data registers: **AH, AL.**



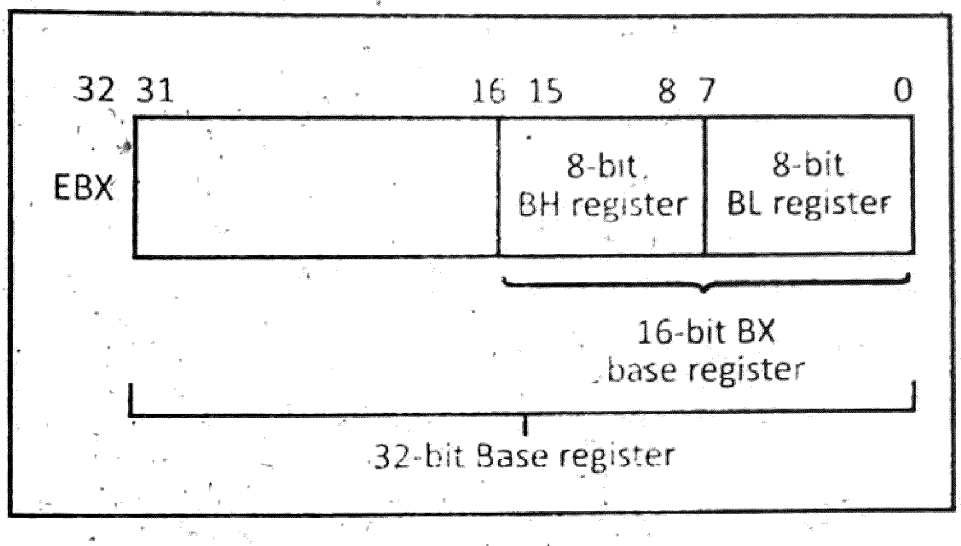
ii) Base Register (BX):

The base register can perform arithmetic and data movement and it has some special addressing abilities. This register can hold a memory address and usually contains a data pointer.

Complete 32-Bit Base Register:

A complete 32-bit register can be used in three ways as shown in figure.

- As complete 32-bit data register: **EBX** (Extended Base Register)
- Lower half of the 32-bit register can be used 16-bit data register: **BX.**
- Lower and higher halves of 16-bit register (BX) can be used as two 8-bit data registers: **BH, BL.**



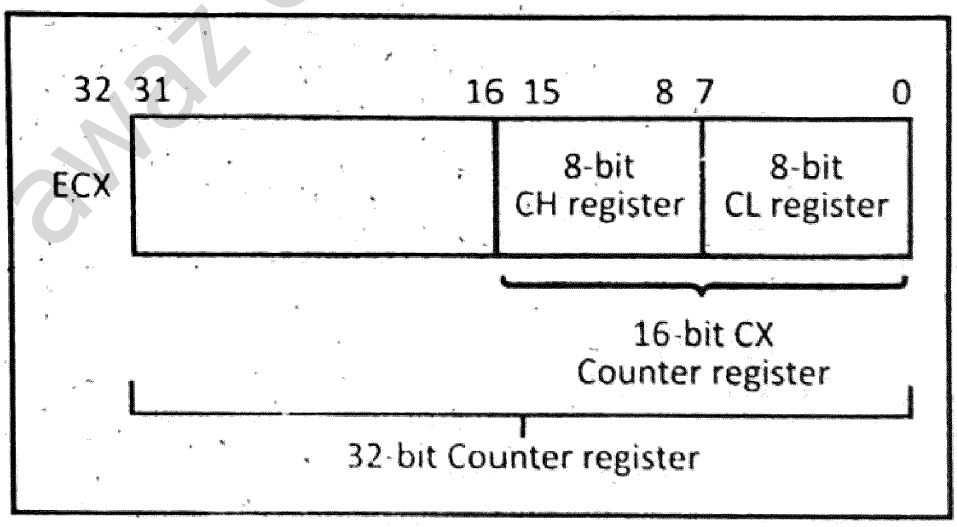
iii) Counter Register (CX):

The counter register can be used as a counter for repeating or looping instructions. The given instructions are automatically repeated and decrease the value of CX and then stops when it is equal to 0.

Complete 32-Bit Counter Register:

A complete 32-bit counter register can be used in three ways as shown in figure.

- As complete 32-bit data register: **ECX** (Extended Counter Register)
- Lower half of the 32-bit register can be used as 16-bit data register: **CX**.
- Lower and higher halves of the 16-bit register (CX) can be used as two 8-bit data registers: **CH, CL**.



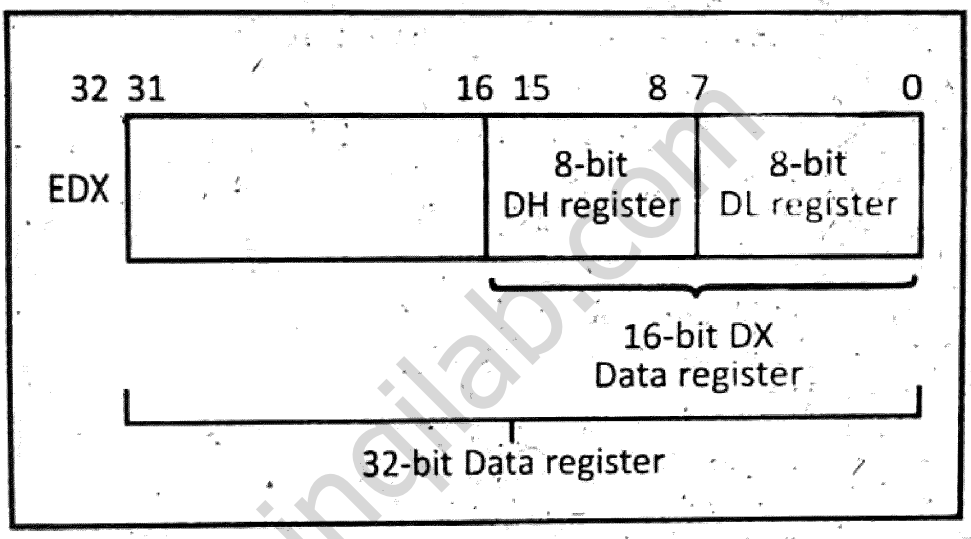
iv) Data Register (DX):

Data register has a special role in multiply and divide operations. It holds anything that is copied from the memory which is then ready to use by processor.

Complete 32-Bit Data Register:

A complete 32-bit data register can be used in three ways as shown in figure.

- As complete 32-bit data register: **EDX** (Extended Data Register)
- Lower half of the 32-bit register can be used as 16-bit data register: **DX**.
- Lower and higher halves of the 16-bit register (DX) can be used as two 8-bit data registers: **DH, DL**.



B. Special Purpose Registers:

The Special Purpose Registers (SPR) are used to control the operations of CPU. The operating system also used these registers to control the execution of programs. These registers hold the status of a program.

Commonly used Special Purpose Registers:

i) Instruction Register (IR)
ii) Memory Address Register (MAR)
iii) Memory Buffer Register (MBR)
iv) Program Counter (PC) or Instruction Pointer (IP)

i) Instruction Register (IR):

It is part of control unit which stores the instructions currently being executed. Each instruction is loaded into instruction register before execution. This register is also called current instruction register (CIR).

ii) Memory Address Register (MAR):

MAR holds the memory addresses of data and instructions. This register is used to access data and instructions from memory during the execution phase of an instruction. Suppose CPU wants to store some data in the memory or to read the data from the memory. It places the address of the required memory location in the MAR.

iii) Memory Buffer Register (MBR):

MBR holds the contents of data or instruction read from or written in memory. It means that this register is used to store data/instruction coming from the memory or going to the memory.

iv) Program Counter (PC):

The Program Counter (PC) also called the instruction pointer (IP). It keeps track of the next memory address of the instruction that is to be executed once the execution of the current instruction is completed. In other words, it holds the address of the memory location of the next instruction when the current instruction is executed by the microprocessor.

Q3: What is system bus? Explain different types of busses used in computers.

Answer: System Bus:

Buses Definition: The CPU moves data around the computer on pathways that interconnect it to all the other components on the motherboard. These pathways are called 'buses'. (OR)
In other words, a bus is a data communication path over which information is transferred a byte or word at a time.

Number of Lines in Bus: Most of buses are made up 50 to 100

different lines for communication.

Internal and External Bus: The internal bus carries data within the motherboard. External buses carry data to peripherals and other devices attached to the motherboard.

Types of Buses: There are three types of Busses:

1. Data Bus
2. Address Bus
3. Control Bus

1. Data Bus:

Data bus is the most common type of bus. It is used to transfer data between different components of computer. The number of lines in data bus affects the speed of data transfer between different components.

Number of Lines in Data Bus: The data bus consists of 8, 16, 32, or 64 lines. A 64-line data bus can transfer 64 bits of data at one time.

Bidirectional Bus Line: The data bus lines are bi-directional. It means that:

- CPU can read data from memory using these lines
- CPU can write data to memory locations using these lines

2. Address Bus:

Address bus is used to transmit or carry an address. An address is defined as a label, symbol, or other set of characters used to designate a location or register where information is stored. First address is transmitted to memory before data/instruction loaded from memory by CPU or input/output sections.

Number of Lines in Address Bus: The number of lines on the bus determines the number of addressable memory elements.

Example:

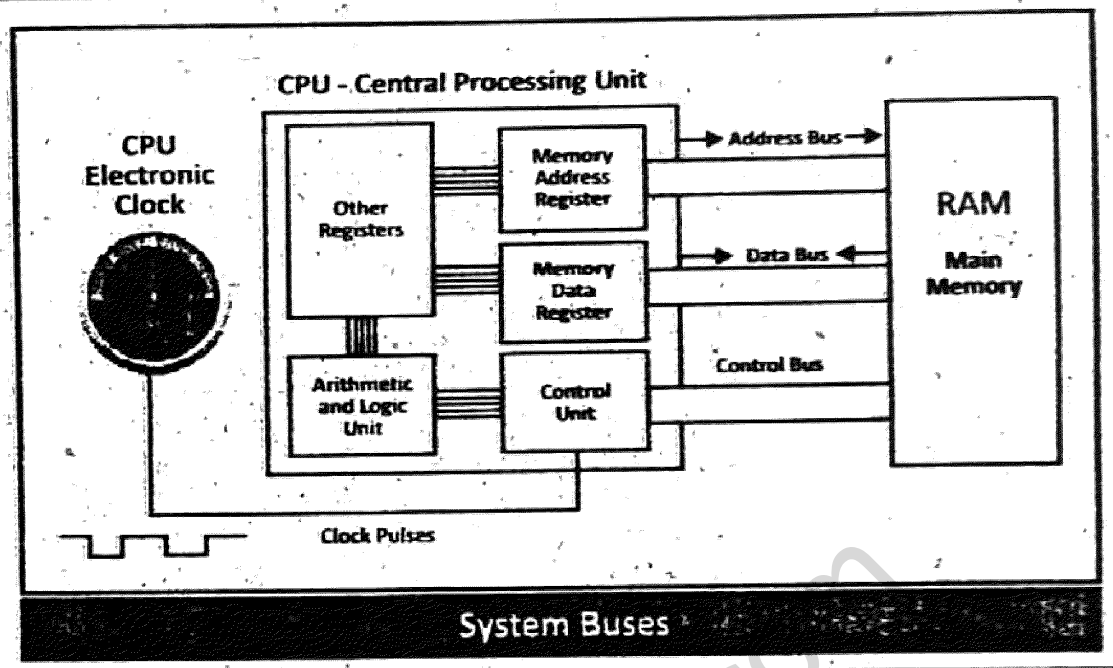
i) An 8-bit bus can represent 256 ($2^8 = 256$) unique addresses.

ii) A 16-bit bus can address 65536 unique addresses.

3. Control Bus:

The control bus is used by the CPU to direct and monitor the actions of other devices of computer. It is used to transmit a variety (مختلف قسم) of individual signals e.g., read, write, interrupt, acknowledge signals and coordinate the operations of the computer.

Size of Control Bus: The size of control bus is from 8 to 16 bits.



Q4: Explain different types of CPU instructions. Also give examples.

Answer: Instruction:

Definition: An instruction is a collection of bits that tells the computer what to do and how to how to do. (OR)

An instruction or instruction ode is a group of bits that tells the computer to perform a specific operation.

Instructions are stored in the main memory which is then to be processed by the processor.

Instruction Fields: An instruction has two fields:

Operating Code: It represents the action that the processor will execute.

Operand: It defines the parameter of the action. The operand depends on the operation code. It can be data or a memory address.

Operation Code	Operand

Types of CPU Instructions:

There are three types of CPU Instructions:

1) Data Transfer Instructions
2) Data Processing Instructions
3) Program Control Instructions

1) Data Transfer Instructions:

These instructions are used when the data needs to be move from memory location to register. In computer, these instructions transfer data from one location to another without changing the data.

Types: The most common transfers are between:

- Registers and Memory
- Registers and I/O
- Registers and Registers

Examples: Examples of data transfer instructions are MOV and LOAD and STORE.

i) MOVE (MOV): It transfer data from memory to register, register to memory or register to register.

For example: MOV A, B (move the items of register A to B)

ii) LOAD (LD): It loads data to register from memory. For example: LD A (Load the data to register "A" from memory).

iii) STORE (STO): It stores information from register to memory location.

2) Data Processing Instructions (Data Manipulation Instructions):

Data Manipulation Instructions perform arithmetic and logic operations on the values of two registers.

Types: The data manipulation can be divided into three types:

i) Arithmetic Instructions

ii) Logical Instructions
iii) Shift Instructions

i) Arithmetic Instructions: These instructions consist of four basic operations i.e. AD (Addition), SUB (Subtraction), MAL (Multiplication) and DIV (Division). These instructions may be available for different types of data e.g. binary, decimal or floating-point data. The other possible operations include ABSOLUTE, NEGATE, INCREMENT, DECREMENT.

ii) Logical Instructions: Logical instructions are useful for individual bit or group of bits that represent binary data. For example, AND, OR, NOT etc.

iii) Shift Instructions: These instructions are used to transfer bits of an operand to the left or right in operation.

- Logical Shift Right (SHR)
- Logical Shift Left (SHL)

3) Program Control Instruction:

Program Control Instructions allow the flow of the program to change. It is a method of altering (بدلنے والا) the order in which statements are executed in a program. In computer programs, there are various instructions used. For example, JMP and LOOP etc.

JMP: The JMP instruction is used to by the programmer to skip program sections and jump to any part of memory for the next instruction.

LOOP: The LOOP instruction is used when any statement is to be repeated.

Q5: What is instruction cycle? Explain different phases of CPU instruction cycle.

Answer: Instruction Cycle:

Definition: Also known as the "fetch execute cycle" it is the time in which a single instruction is fetched from memory, decoded and executed. It is also known as "Fetch execute cycle". (OR)

It is the process by which a computer retrieves (دوبارہ حاصل کرنا) a program instruction from memory, determines what actions the instruction requires and carries out those actions.

Instruction cycle (sometimes called fetch-and-execute cycle, fetch-decode-execute cycle) is a basic operation cycle of a computer.

The instruction cycle is constantly repeated by the processor from booting till shut down of computer.

Phases of Instruction Cycles:

There are four phases of Instruction Cycle:

1) Fetch the Instruction
2) Decode the Instruction
3) Execute the Instruction
4) Store the Result

1) Fetch the Instruction:

In the first step, the processor fetches the instruction from the memory using data bus. The instruction is transferred from memory and stores it in instruction register (IR).

2) Decode the Instruction:

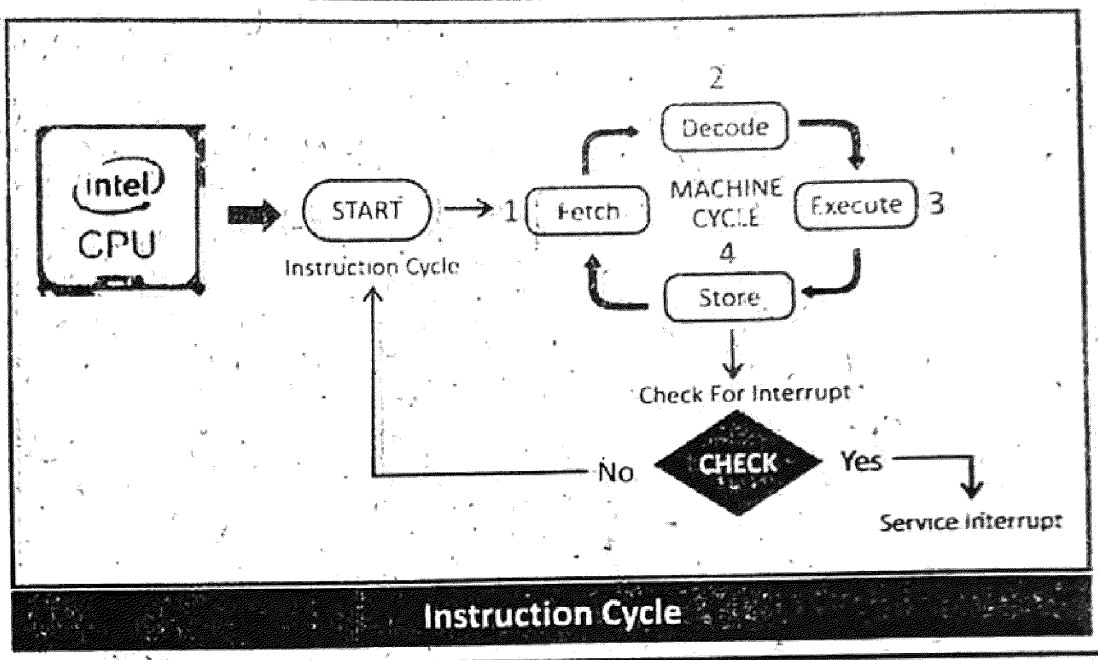
In this step, the instruction inside the instruction register (IR) is decoded by the processor. If the instruction has an indirect address, the effective address is loaded from main memory and required data is also fetched from the main memory and placed into data registers.

3) Execute the Instruction:

The decoded information is passed to control unit (CU) as a sequence of control signals to central processing unit (CPU) where actions are performed according to instruction. The mathematical or logic functions are performed in arithmetic logical unit (ALU). After this, the result is written back into register.

4) Store Result:

It is an optional phase. The generated result is stored in the main memory or sent to an output device.



Instruction Cycle

Q6: Describe instruction format.

Answer: Instruction Format:

Introduction: An instruction format defines the layout of an instruction. An instruction format must include an Op-code (Operation-Code) and zero or more Operands. The Op-code will always be present.

Types of Instruction Formats:

Different instruction formats are used. A few of them are explained below:

a) Zero-Address Instruction
b) One-Address Instruction
c) Two-Address Instruction

a) Zero-Address Instruction:

The zero address instruction format requires only Op-code. Example of the zero address instruction format is HALT, STOP, which do not have any address.

0.....7 bits

Op-code

Examples: STOP, HALT

b) One-Address Instruction:

One address instruction format requires one Op-code and one

operand.

Examples of the one address instruction format is LDA (Load Accumulator), JMP (Jump) etc. These instructions require one address to do the operation.

0.....7, 8.....20 bits

Op-code	Operand

Example: JMP, AX, LDA

c) Two-Address Instruction:

Two address instruction format requires one Op-code and two operands.

Examples: Examples of such instruction format is the MOV (Move), which moves data from the memory location to the register and vice versa.

0.....7, 8.....19.....31

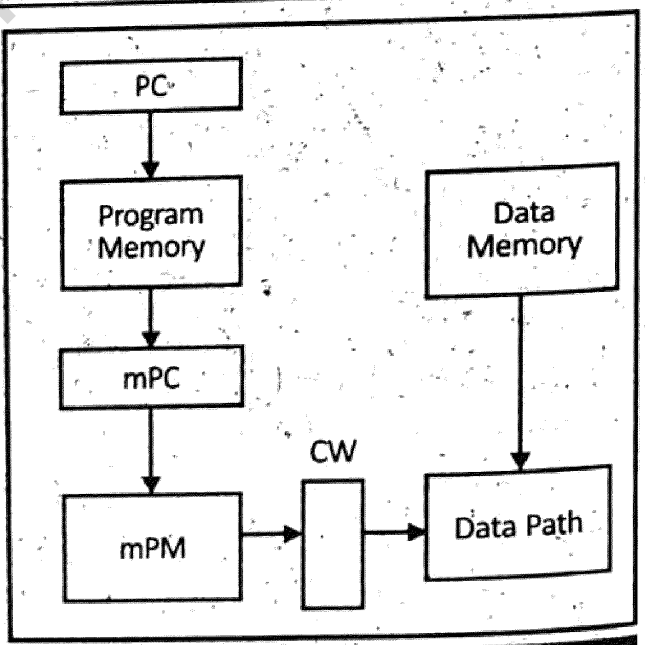
Op-code	Operand	Operand

Examples: ADD, A, B

Q7: Describe CISC architecture.

Answer: CISC (Complex Instruction Set Computer):

CISC is processor architecture developed by Intel and the instructions were built into the chip. In common CISC, chips are relatively slow per instruction. CISC have a large amount of different and complex instructions. CISC architecture is complex because of the instructions used at the hardware level. CISC emphasizes (زور دیتا) on hardware.



CISC Architecture

Examples:

Examples of CISC processors are the Motorola 608x0 families and Intel x86, AMD, VAX, and the System/360.

Advantage:

The advantage of CISC processor is that the compiler requires little effort to translate high-level programs or statement languages into assembly or machine language.

Disadvantage:

The disadvantage is that CISC chips are slower than RISC chips to execute per cycle instruction of each program.

Q8: Write down features of CISC processor.

Answer: Features of CISC Processor:

CISC stands for complex instruction set Computer.

Following are the main characteristics of the CISC processor:

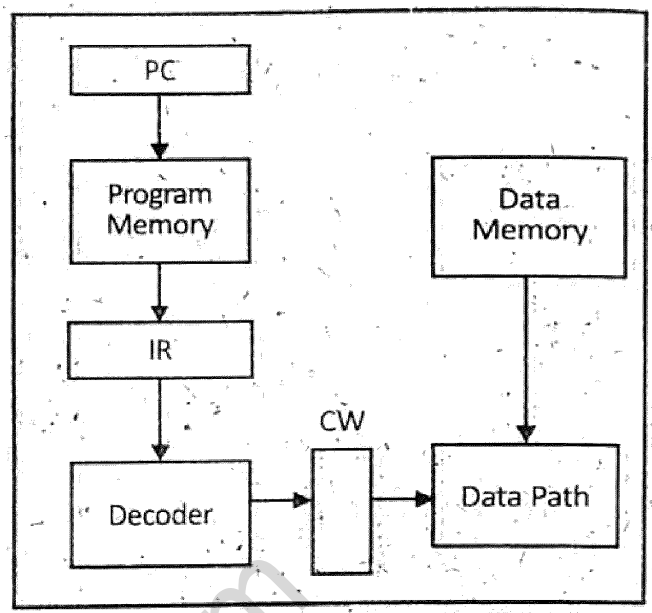
1. **Requires Low Storage RAM:** CISC processor requires little RAM due to its short length code.
2. **Slow Per Instruction:** CISC processor is relatively slow to execute per cycle instruction of each program.
3. **Needs Less Instruction:** CISC processor needs less instruction to write an application.
4. **Easy Programming:** CISC provides easier programming in assembly language.
5. **Complex Data Structure:** CISC processor supports complex data structure.
6. **Compilation of Language:** CISC processor easily supports compilation of high-level language.
7. **Number of Registers and Addressing Codes:** CISC processor composed of fewer registers and more addressing nodes, typically 5 to 20.
8. **Large Instruction:** In CISC processor, instructions are larger than a single word.

9. **Instruction on Hardware:** CISC uses the building of instruction on hardware because it is faster to create than the software.

Q9: Describe RISC architecture.

Answer: RISC (Reduced Instruction Set Computer):

Development: RISC architecture was developed around mid 1980 as a reaction to the CISC chips.



RISC Architecture

RISC is a microprocessor architecture that is designed to perform a smaller number of instructions. It is built to minimize the instruction execution time by optimizing and limiting the number of instructions. It means each instruction cycle requires only one clock cycle, and each cycle contains three parameters: fetch, decode and execute. The RISC processor is also used to perform various complex instructions by combining them into simpler ones.

Examples:

Examples of RISC processor are IBM PowerPC, Sun SPARC, Microchip, PIC processors, RISC-V.

Advantage:

RISC processors are faster than CISC chips to execute per cycle instruction of each program.

Disadvantage:

RISC processor puts a lot of burden on software due to its small size of instruction set.

Q10: Write features of RISC processor.

Answer: Features of RISC Processor:

Following are the main characteristics of the RISC processor:

1. **One Cycle Execution Time:** For executing each instruction in a computer, the RISC processors require one CPI (Clock Per Cycle).

2. **Pipelining Technique:** The pipelining technique is used in the RISC processors to execute multiple parts or stages of instructions to perform more efficiently.

3. **A Large Number of Registers:** RISC processors are optimized (ت.ر) with multiple registers that can be used to store instruction and quickly respond to the computer and minimize interaction with computer memory.

4. **Addressing Mode and Fixed Length of Instruction:** It supports a simple addressing mode and fixed length of instruction for executing the pipeline.

5. **Use of Load and Storage Instruction:** It uses LOAD and STORE instruction to access the memory location.

6. Simple and limited instruction reduces the execution time of a process in a RISC.

Q11: What are the differences between intel Pentium IV processor and AMD Athlon processor?

Answer: 1. Intel Pentium 4 Processor:

The Pentium 4 brand refers to Intel's line of CPUs introduced in November 20, 2000.

Speed: The first Pentium 4 processor cores were capable of speeds from 1.3 to 2 GHz.

Examples of Latest Intel's Core Processor:

Core i3, Core i5, Core i7

2. AMD Athlon:

AMD stands for (Advanced Micro Devices). Athlon is the brand

name applied to a series of x86-compatible microprocessors designed and manufactured by AMD.

Speed: Typical speed for these processors ranges from 1333 MHz to 2.33 GHz and their bus speed lies in between 100 and 200 MHz. The original Athlon processors were 32 bit, later on Athlon 64 bit processor was also developed.

Examples of Lates AMD Processor:

Ryzen3, Ryzen5, Ryzen7 and Ryzen thread ripper.

Comparison of Intel Core i9 and AMD Ryzen7:

	Intel Core i9	AMD Ryzen7
Clock Speeds (MHz)	1300 – 3800	1333 – 2333
Front Side Bus Speeds (MHz)	400 – 1066	100 – 200
Cache Size (KB)	256 – 2048	64 – 512
Bus Width (bits)	32, 64	32, 64

EXERCISE MCQS

Q#1: Select the best choice for the following MCQs.

1. Which of the following performs the arithmetic and logic operations on data?
   a. ALU b. Control Unit
   c. Bus d. Memory Unit
2. _____coordinates and controls the computer system, just like the brain controls the human body.
   a. Bus b. Control Unit
   c. Output Unit d. Register
3. Where are the logical operations performed in the CPU?
   a. CU b. Register
   c. ALU d. Memory
4. _____is the small memory device available in the CPU to store data temporarily.
   a. CU b. Register
   c. ALU d. Memory
5. _____is the small amount of memory located between main memory and processor.
   a. RAM b. ROM
   c. Cache d. PROM
6. Which of the following cache memories resides inside the microprocessor and is very fast from the other memories?
   a. L1 Cache b. L2 Cache
   c. L3 Cache d. L4 Cache
7. _____register can perform arithmetic and data movement and it has some special addressing abilities.
   a. Base Register b. Memory Buffer Register
   c. Data Register d. Counter Register
8. Which of the following register has a special role in multiply and divide operations?
   a. Base Register b. Memory Buffer Register
   c. Data Register d. Count Register

9. _____register holds either the address of the instruction being executed or the address of the next instruction to be executed.
   a. Program Counter b. Memory Buffer Register
   c. Data Register d. Count Register
10. System bus connects the Central Processing Unit to _____on the motherboard.
   a. Register b. Main Memory
   c. ALU d. Input Unit
11. Which of the following steps, in instruction cycle, interprets the instruction?
   a. Fetch b. Decode
   c. Execute d. Write-back
12. _____the instruction is used when number of statement is to be repeated.
   a. LD b. LOOP
   c. JMP d. MOV
13. _____is a microprocessor architecture that is design to perform a smaller number of types of computer instructions.
   a. RISC b. CISC
   c. DISK d. LIST
14. How many op-codes do a Zero-Address instruction has?
   a. 1 b. 2
   c. 3 d. 0
15. Which of the following is not an arithmetic instruction?
   a. DIV b. MUL
   c. SUB d. JMP

Answers:

1	2	3	4	5	6	7	8
a	b	c	b	c	a	a	c
9	**10**	**11**	**12**	**13**	**14**	**15**	
a	b	b	b	a	a	d	

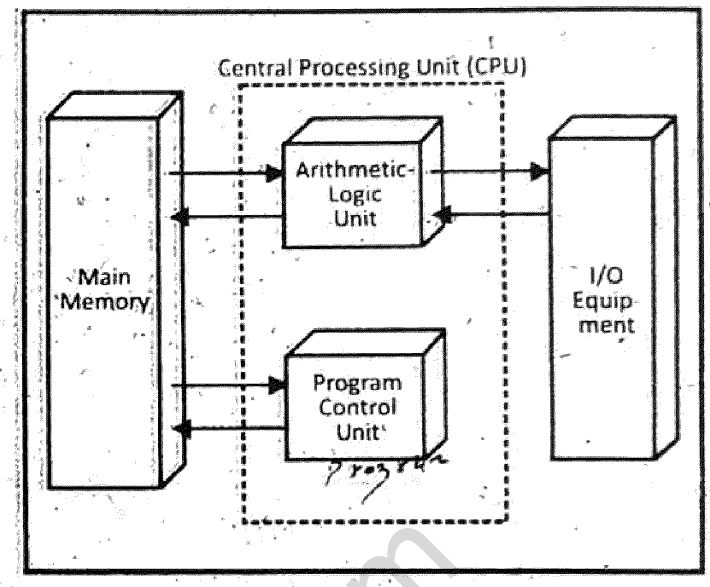
Short Questions

Q2: Give short answers to the following questions.

Q:i. What is the function of ALU in the computer?

Answer: Arithmetic Logic Unit (ALU):

Arithmetic logic unit (ALU) is the part of the CPU where the actual processing takes place. ALU is capable of performing arithmetic, logical and data manipulation operations on data. Nowadays CPUs have more than one ALUs which increase efficiency of computer system.



Functions of ALU:

The ALU consists of logic circuitry that performs operations such as addition, subtraction, multiplication, division, exponentials, data manipulations (for example; shifting), comparisons and logical operations such as AND, OR, NOT, etc. on the data contained in the registers.

Q:ii. What is the function of control unit in the computer?

Answer: Control Unit:

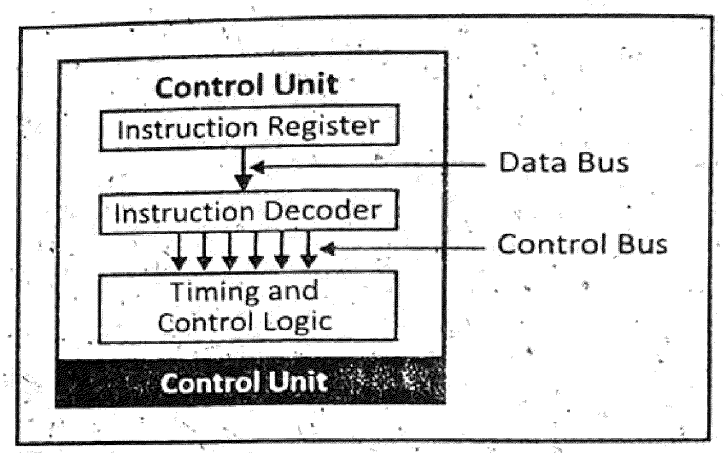
The Control Unit (CU) is a component of a computer's central processing unit (CPU) that directs the operation of the processor.

Functions of Control Unit:

1. Control Unit manages the functions performed by different parts of the computer.
2. It coordinates and controls the overall computer system.
3. It executes the program instructions, controls and directs the input, informs ALU for processing, manages storage and directs the data to the output device.

4. It is responsible for directing the flow of instructions and data within the CPU.

5. It directs the operation of the other units by providing timing and control signals. The control unit contains the necessary logic to interpret instructions and to generate the signals necessary for the execution of those instructions.



In short, it can be said, this component decodes, stores results and manages execution of data that flows through the CPU.

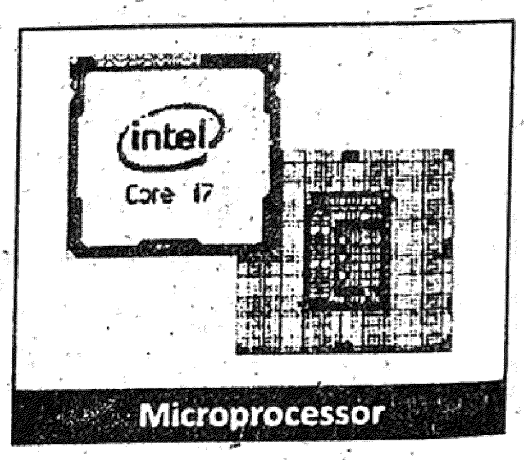
Q:iii. What is a microprocessor?

Answer: Microprocessor: The microprocessor is the main part of the computer which performs all its activities. It is also called the processor or central processing unit (CPU). It is called "brain" of the computer.

1st Microprocessor: The 1st microprocessor was the Intel 4004, introduce in 1971.

Functions of Microprocessor:

It carries out the instructions by performing the basic arithmetical, logical, and input/output operations of the system. Arithmetic operations include addition, subtraction, multiplication, division etc. while logical operations include greater than, smaller than, equal to etc. The fundamental operation of most CPUs is to execute a program. The program is kept in computer memory.



Steps of CPU:

There are four steps that CPUs use in their operation:

i) Fetch ii) Decode

iii) Execute iv) Store

Q:iv. Define system bus.

Answer: System Bus:

Definition: A bus is a data communication path over which information is transferred a byte or word at a time.

Most of buses are made up 50 to 100 different lines for communication.

Internal and External Bus: The internal bus carries data within the motherboard. External buses carry data to peripherals and other devices attached to the motherboard.

Types of Buses: There are three types of Busses:

1. Data Bus
2. Address Bus
3. Control Bus

1. Data Bus:

Data bus is the bidirectional bus. It can sent data from the microprocessor to memory (write operation) of from the memory to the microprocessor (read operation).

2. Address Bus:

Address bus is used to transmit or carry an address. For example, an 8-bit bus can represent 256 unique addresses. A 16-bit bus can address 65536 unique addresses.

3. Control Bus:

The control bus is used by the CPU to direct and monitor the actions of other devices of computer. It is used to transmit signals e.g., read, write, interrupt, acknowledge signals.

Q:v. Write short note on memory buffer register (MBR).

Answer:

Memory Buffer Register (MBR): MBR is a type of register that holds the contents of the memory which are to be move from memory to other components or from components to the memory.

Function: To store the word in memory it must be transmitted to MBR and then it will go to the specific memory location. It works as a buffer allowing the processor and memory unit to act independently.

Q:vi. What is CPU operation?

Answer: CPU Operation:

The basic operation of most CPUs is to execute a program (a sequence of stored instruction). The program is kept in computer memory. There are four steps that almost all CPUs follow in their operation.

1. **Fetch Operation:** In this operation, CPU fetches an instruction from main memory and stores it in instruction register (IR).
2. **Decode Operation:** In this operation, the operations are decoded accordingly by the processor.
3. **Execute Operation:** In this operation, the decoded operation is executed.
4. **Store:** The result generated by the operation is stored in the main memory or sent to an output device.

Q:vii. What is meant by an instruction?

Answer: Instruction:

Definition: An instruction is a collection of bits that tells the computer what to do and how to how to do. (OR)

An instruction or instruction ode is a group of bits that tells the computer to perform a specific operation.

Instructions are stored in the main memory which is then to be processed by the processor.

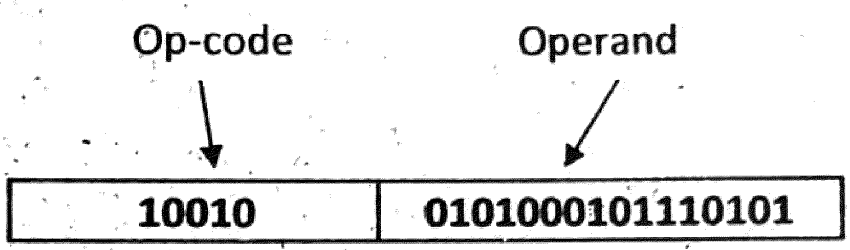
Instruction Fields: An instruction has two fields:

Operating Code: It represents the action that the processor will execute.

Operand: It defines the parameter of the action. The operand depends on the operation code. It can be data or a memory address.

Operation Code	Operand

Example:



The Op-code (10010) specifies the code for ADD operation to be performed on the operand at the address specified in Operand part.

Types of CPU Instructions:

There are three types of CPU Instructions:

1) Data Transfer Instructions
2) Data Processing Instructions
3) Program Control Instructions

Q:viii. Differentiate between Op-Code and Operand.

Answer:

Instruction: An instruction (or instruction code) is a group of bits that tells the computer to perform a specific operation. Every instruction contains two parts: operation code (op-code) and operand.

An instruction has two fields:

i) Operation Code (Op-code): Operation code represents the action that the processor will execute such as LOAD,STORE,ADD and SHIFT on some data stored in registers or memory.

ii) Operand Code: Operand code defines the parameters of the action. The operand code depends on the operation. It can be data or a memory address.

Example:

The Op-code (10010) specifies the code for ADD operation to be performed on the operand at the address specified in Operand part.

Op-code	Operand
10010	0101000101110101

ix. Show computer instruction format with the help of a diagram and label its parts.

Answer: Computer Instruction Format:

Introduction: An instruction format defines the layout of an instruction. An instruction format must include an Op-code (Operation-Code) and zero or more Operands.

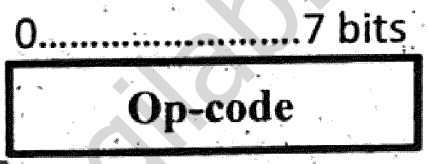
Types:

Different instruction formats are used. A few of them are explained below:

a) Zero-Address Instruction
b) One-Address Instruction
c) Two-Address Instruction

a) Zero-Address Instruction:

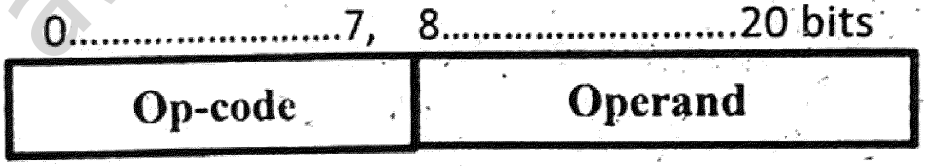
The zero address instruction format requires only Op-code. Example of the zero address instruction format is HALT, STOP, which do not have any address.



Example: STOP, HALT

b) One-Address Instruction:

One address instruction format requires one Op-code and oen operand. Examples of the one address instruction format is LDA (Load Accumulator), JMP (Jump) etc. These instructions require one address to do the operation.



Example: JMP, AX, LDA

c) Two-Address Instruction:

Two address instruction format requires one Op-code and two

operands. Examples of such instruction format is the MOV (Move), which moves data from the memory location to the register and vice versa.

0.....7, 8.....19.....31

Op-code	Operand	Operand

Example: ADD, A, B

Q:x. Differentiate between CISC and RISC architecture

Answer: **CISC** stands for Complex Instruction Set Computer.
RISC stands for Reduced Instruction Set Computer.

CISC Processor Architecture	RISC Processor Architecture
1. CISC instructions utilize more cycles.	**1.** RISC instructions utilize less cycles.
2. In CISC hardware plays important role.	**2.** In RISC software plays important role.
3. CISC has more complex instructions.	**3.** RISC has less complex instructions.
4. CISC typically has fewer instructions.	**4.** RISC typically has greater instructions.
5. CISC implementations tend to be slower.	**5.** RISC implementations tend to be faster.
6. CISC uses less registers.	**6.** RISC uses more registers.
7. Computers typically use CISC.	**7.** Tablets, smartphones and other devices use RISC.
8. Examples of CISC Processor: Motorola 680, Intel x86, AMD, VAX, System/360	**8.** Examples of RISC Processor: IBM Power Pc, Sun SPARC, RISC-V, Microchip PIC processor

Detailed Questions

Q3: Give detailed answers to the following questions.

i. What is CPU? Describe basic components of CPU in detail.

Answer: See Question # 1, Page # 74

ii. What is a register? Explain different types of registers.

Answer: See Question # 2, Page # 77

iii. What is a system bus? Explain different types of buses used in computers.

Answer: See Question # 3, Page # 81

iv. Explain different types of CPU instructions. Also give examples.

Answer: See Question # 4, Page # 83

v. What is instruction cycle? Explain different phases of CPU instruction cycle.

Answer: See Question # 5, Page # 85

Additional MCQs

Q: Select the best answer for the following MCQs.

1. Which part of computer performs fetch, decode and execute cycle?
   a. ALU **b. Control unit**
   c. Output unit b. Registers
2. Where are the results of ALU operations transferred?
   a. Counter register b. Base register
   c. Data register **d. Accumulator register**
3. Which of these buses selects a memory word for a read or write operation?
   a. Data bus b. Control bus
   c. Address bus d. System bus
4. Which of these registers controls the sequence in which instructions are fetched from memory for execution?
   a. Program counter b. Memory buffer register
   c. Data register d. Counter register
5. A memory word that is to be stored in or fetched from memory must first be transferred into which register?
   a. Accumulator b. Data register
   c. Memory buffer register
   d. Program counter
6. Which instruction causes transfer of instruction execution to a specified address?
   a. Comparison instruction
   b. Branch instruction
   c. Shift instruction
   d. Data movement instruction
7. Which of these instructions will perform addition of two numbers?
   a. Operation instruction
   b. Shift instruction
   c. Comparison instruction

d. Data movement instruction

8. Through which bus, instructions are transferred from main memory to instruction register?
   a. Control bus b. Address bus
   c. Instruction bus **d. Data bus**

9. How many distinct operations can be performed if op-code of a microprocessor consists of 4 bits?
   a. 4 b. 8
   c. 16 d. 32

10. Which part of computer decodes instructions?
   a. ALU b. Main memory
   c. Program counter **d. Control unit**

11. Main components of motherboard is/are:
   a. CPU b. Memory
   c. System unit **d. Both a & b**

12. The hard disk in most laptop and desktop computers are housed inside:
   a. System unit b. CPU
   c. ALU d. none of these

13. Microprocessor usually contains:
   a. Control unit b. Arithmetic and logic unit
   c. Registers **d. All of these**

14. Arithmetic operation like addition, subtraction, multiplication, division are performed in:
   a. Control unit **b. Arithmetic unit**
   c. Logic unit d. System unit

15. The outcome of process is called:
   a. Input operation b. Process operation
   c. Output operation d. Storing operation

+ + + + +

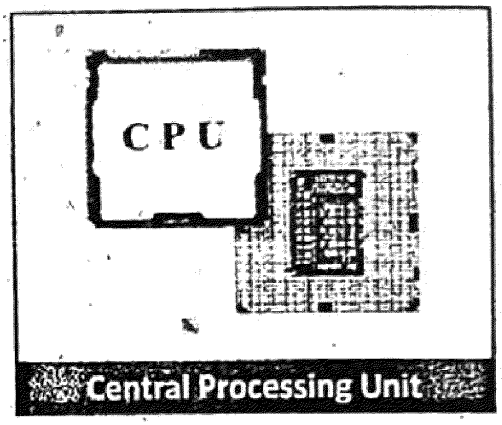
UNIT : 4
INSIDE SYSTEM UNIT

Q1: Differentiate between CPU and system unit.

Answer: 1. Central Processing Unit (CPU):

CPU Stands for "Central Processing Unit."

Explanation: The CPU is the primary component of a computer that processes instructions (ہدایات). It runs the operating system and applications, constantly receiving input from the user or active software programs. It processes the data and produces output, which may store in storage or displayed on the screen.

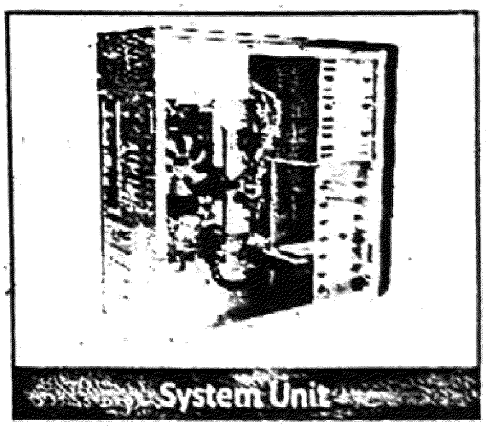


Central Processing Unit

Number of Processors in CPU: The CPU contains at least one processor, which is the actual chip inside the CPU that performs calculations (حساب کتاب). A CPU with two processing cores is called a dual-core CPU and models with four cores are called quad-core CPUs. High-end CPUs may have six (hexa-core) or even eight (octo-core) processors.

2. System Unit:

The System Unit, also known as a "tower" or "chassis," is the main part of a desktop computer.


System Unit

Components of System Unit: System unit includes the motherboard, CPU, RAM, and other components. The system unit also includes the case that houses the internal components of the computer. The system unit does not include keyboard, mouse and monitor.

Q2: Define two main types of computer casings.

Answer: Computer Casings:

A computer case also known as computer chassis, cabinet, box, tower, enclosure, housing, system unit or simply case. It contains most of the components of computer system. Cases are usually constructed from steel or aluminum. Plastic and other materials such as wood or Lego are also used.

Types of Computer Casings:

1. Desktop Casing 2. Tower Casing

1. Desktop Casings:

Desktop casing is the old type of casing which is designed to keep on the desk and usually monitor is placed over it.

2. Tower Casings:

Tower casing is the modern type of casing which is more attractive and common. Monitor is kept side by side with the tower casing.

Q3: Explain the two main parts of system unit:
(a) Power supply (b) Motherboard of system unit

Answer: System Unit:

System unit is the case which contains main parts of a computer system. Following are the two main parts of system unit:

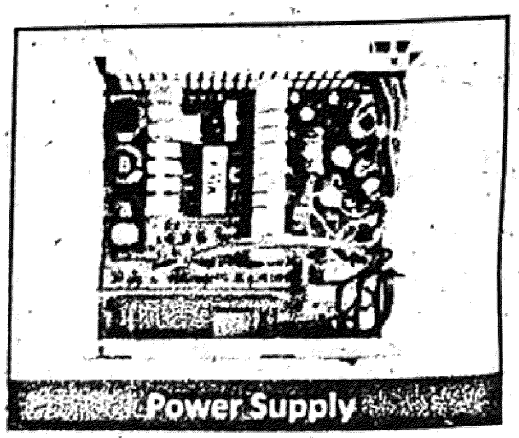
Main Parts of System Unit:

a) Power Supply Unit
b) Motherboard of System Unit

a) Power Supply Unit:

A power supply unit is a hardware component that supplies power to other components of a computer system.

Abbreviation: It is abbreviated as PS or P/S, a power supply or PSU (power supply unit).


Power Supply

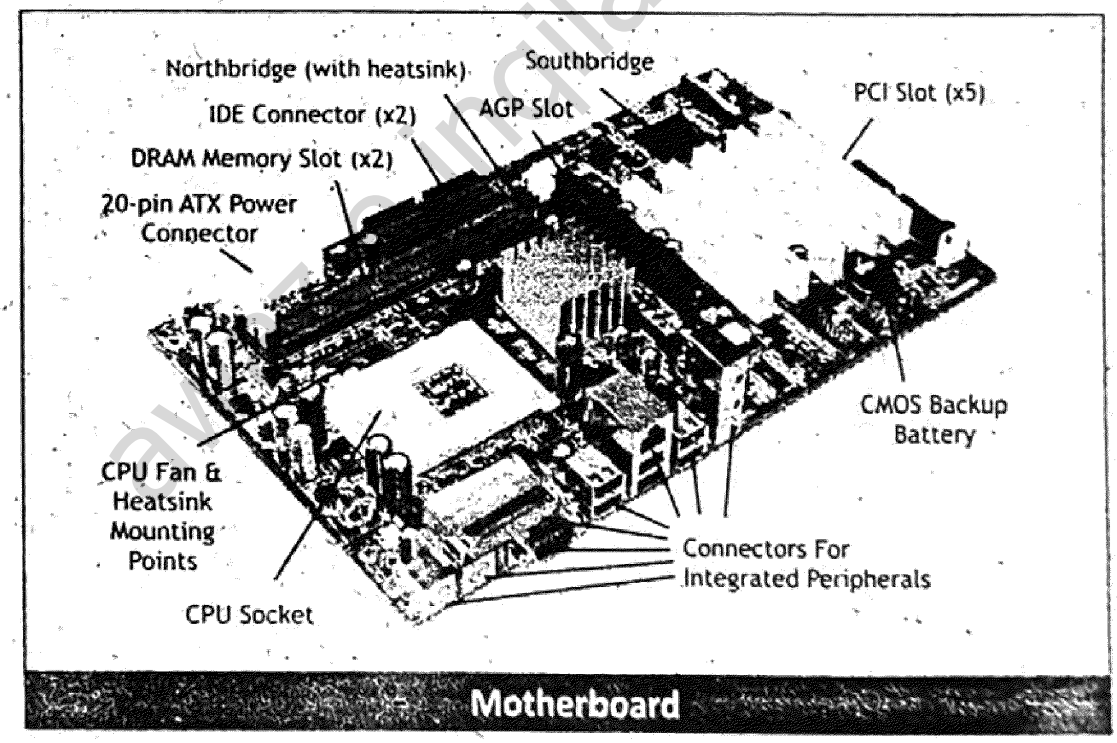
Function: The power supply converted a 110-115 or 220-230 volt AC (alternating current) into a steady (مستقل) low-voltage DC (direct current) usable by the computer.

Power supply is rated in watts i.e., 350, 550, 800 watts etc. Voltage levels of 3, 3.5, 5, 9, 12 volts etc. can be identified by different cables colours in power supply. Nowadays all power supplies follow advanced technology extended standards (ATX).

b) Motherboard of System Unit:

The motherboard or mainboard is a large printed circuit board in a computer chassis.

Function: It distributes power and provides connectivity between the hardware components of a computer, like the processor (CPU), memory (RAM), hard drive, and video card etc. The motherboard also contains expansion slots into which other circuit boards can be inserted for the expansion of the computer system. Other devices such as sound card, video controller and peripheral devices may be connected to motherboard through plug-in cards or via cables. Laptop, tablets, smart phones have built-in peripherals with motherboard.



Q4: List different parts of a motherboard.

Answer: Different Parts of Motherboard:

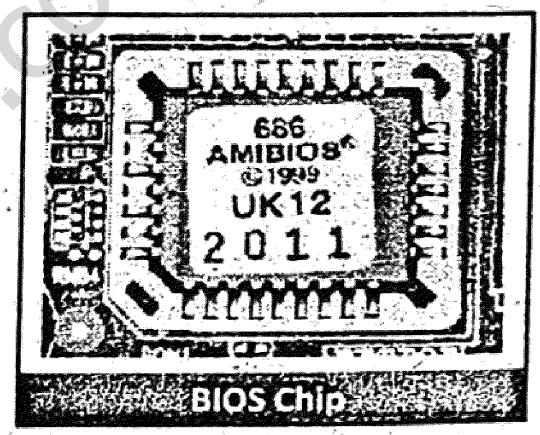
1. Central processing unit (CPU) chip
2. Random access memory (RAM) slots
3. Southbridge and Northbridge
4. Basic input/output system
5. Expansion slots
6. Ports
7. Cooling system (heat sink)
8. Peripheral component interconnect (PCI) slot
9. Accelerated graphics port (AGP) slot
10. Complementary metal-oxide semiconductor (CMOs) battery
11. Integrated drive electronics (IDE) connector
12. Disk controller etc.

Q5: What is the role of BIOS in computer system?

Answer:

BIOS:

BIOS stands for basic input output system. It is the firmware built into the computer system and automatically executes whenever the power is switched ON.



BIOS Chip

Role of BIOS (Functions of BIOS):

1. **Load and Start of OS:** The main function of BIOS in computer system is to load and start an operating system (OS). This process is called booting or booting up the system.
2. **Management of Data Flow:** BIOS also manages data flow between the computer's operating system (OS) and attached devices such as the hard disk, video, adopter, keyboard, mouse and printer.
3. **Setup Utility for User:** BIOS also has a setup utility that

allows a user to:

i) Configure computer hardware
ii) Select boot device
iii) Set password
iv) Set the clock
v) Enable or disable system components

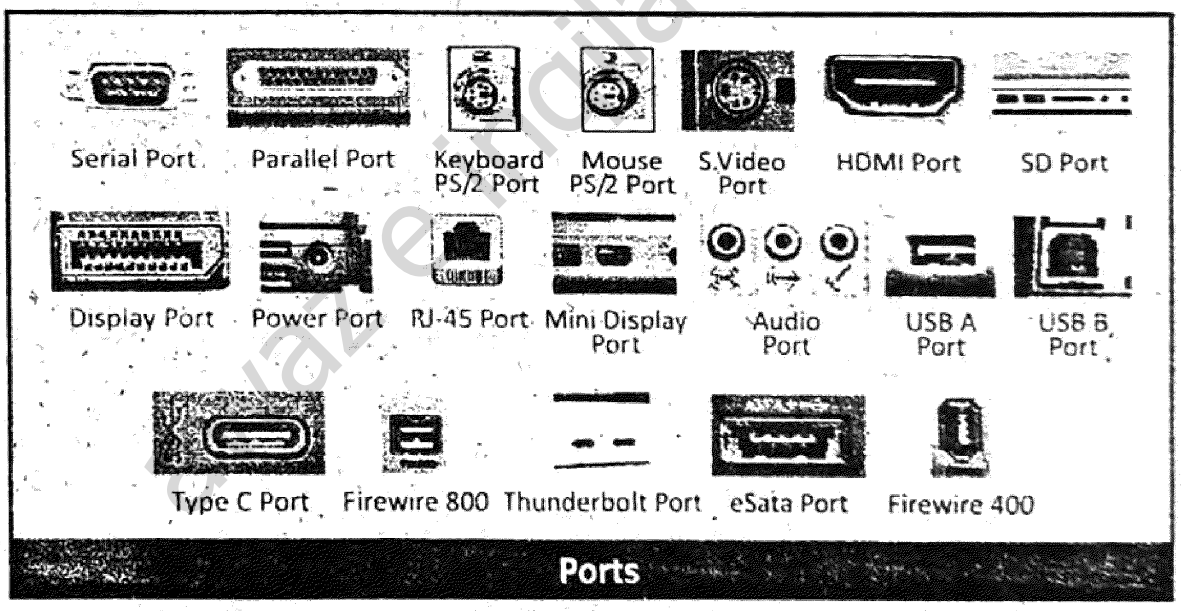
Q6: What are ports?

Answer: Ports:

Definition: A port is an interface or connection at the back of the computer to connect external devices. (OR)
A port is a piece of equipment to which a plug or cable is connected.
There are various types of ports on the motherboard for connecting peripheral devices to the computer system.

Most Common Ports:

Serial port, parallel port, keyboard PS/port, mouse PS/2 port, S-video port, HDMI port, SD port, display port, power port, RJ-45 port, mini display port, audio port, USB A port, USB B port, type C port, firewire 800, mini display port, thunderbolt port, eSata port, firewire 400.



Ports

Q7: Explain different types of expansion slots.

Answer: Slot (Expansion Slot):

These are openings or sockets in a computer motherboard

where a circuit board or expansion card can be inserted to add new functionalities to the computer. Nearly all computers contain expansion slots. The devices inserted into the expansion slots are called expansion boards, cards, add-ins or add-ons.

Common Computer Slots:

The common standard of expansion slots includes AGP, PCI and PCI Express.

1. AGP (Accelerated Graphics Port)
2. PCI (Peripheral Component Interconnect)
3. PCI Express Slot

1) Accelerated Graphics Port (AGP):

It is high speed expansion slot and primarily used for 3D computer graphics. The AGP enable computer to have a dedicated way to communicate with the graphics card.

Advantages: The main advantage of AGP over PCI is that it provides dedicated pathway between the slot and the processor while PCI bandwidth is shared by various devices.

2) Peripheral Component Interconnect (PCI):

The peripheral component interconnect (PCI) is a computer bus for attaching hardware device in a computer.

Examples of PCI Cards: Typically PCI cards used in computers include networks cards, sound cards, MODEM, extra ports such USB or serial, TV tuner cards and disk controllers.

3) PCI Express Slot:

Peripheral component interconnect express (PCI express), is a computer card expansion standard developed by Intel, Dell, IBM and HP in 2004 to replace older PCI and AGP standards.

Advantages: PCIe has many improvements over conventional PCI, AGP which includes more bandwidth, (6400 MB/s where a PCI has 133 MB/s and AGP has 2100 MB/s) maximum system bus throughput, good error detection and reporting

mechanism and hot plugging. It is the latest standard expansion slot used in micro and laptop computers. PCIe also supports latest sound cards, TV tuner cards, fire-wire cards, etc.

Q8: Explain different types of ribbon cables.

Answer: Ribbon Cable:

A ribbon cable also known as multi-wire planar cable is a cable with many conducting wires running parallel to each other on the same flat plane. As a result the cable is wide and flat as ribbon.

Uses: Ribbon cables are usually used for internal peripheral of computer, such as hard drives, CD drives and floppy drives.

Types of Ribbon Cable:

The following are the main types of ribbon cables:

1. IDE Cable
2. SATA Cable
3. FD Cable

1. IDE Cable:

IDE short for integrated drive electronics is more commonly known as ATA/ATAPI (Advance Technology Attachment/ATA Packet Interface) or PATA (Parallel ATA) is a ribbon cable. They are used for connecting hard drives developed by Western Digital. Original IDE was designed only for hard drives. ATAPI a new version was developed to connect CD-ROM, tapes drives and Zip drive. The parallel ATA cable has two or three connectors. Each connector has 40 pins. Each IDE has largely been replaced by Serial ATA (SATA) in newer systems. Digital introduced new hard drives in 1994 with enhancements to IDE interface and named it Enhanced IDE (EIDE).

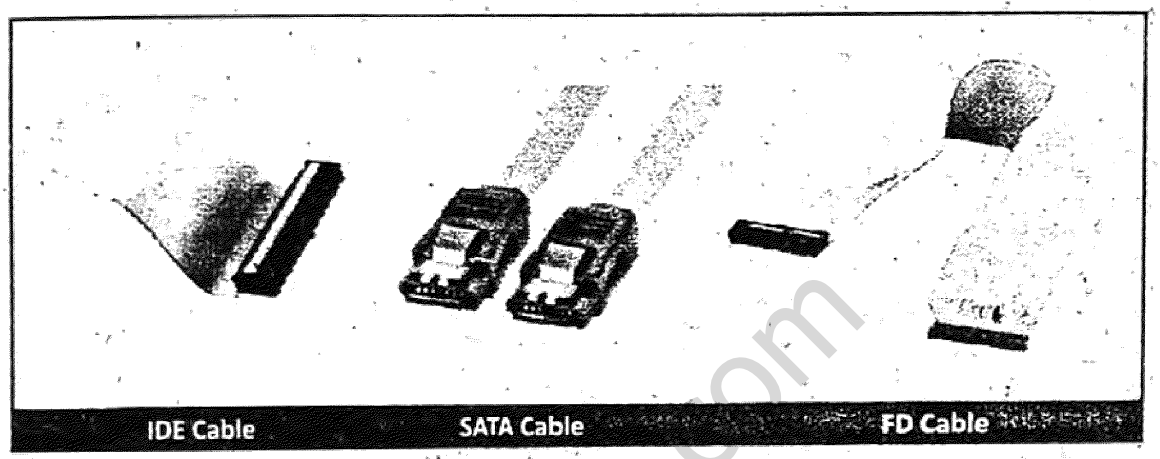
2. SATA Cable:

SATA (Serial Advanced Technology Attachment) is a new technology cable for connecting storage drives to computer. It was designed to replace IDE bus interface. SATA bus interface is used in all the modern laptop and desktop computers. SATA

drives communicate with high speed. These cables transfer data at high rates (from 1.5 to 6 gigabytes per second). SATA1, SATA2 and SATA3 interfaces provide communications at rates of 1.5 GB/Sec, 3 GB/Sec and 6 GB/Sec respectively. eSATA (external SATA) is used to support external drives.

3. FD (Floppy Disk) Cable:

FD (Floppy Disk) cable was used in the past to connect floppy drives to the motherboard. Floppy drives are almost obsolete nowadays. Due to this reason FD cable is no more used with modern microcomputers.



Q9: What is port? Explain different types of ports in computers.

Answer: Port:

Definition: A Computer Port is an interface or a point of connection between the computer and its peripheral devices.

Common Peripherals: Some of the common peripherals are mouse, keyboard, monitor or display unit, printer, speaker, flash drive etc.

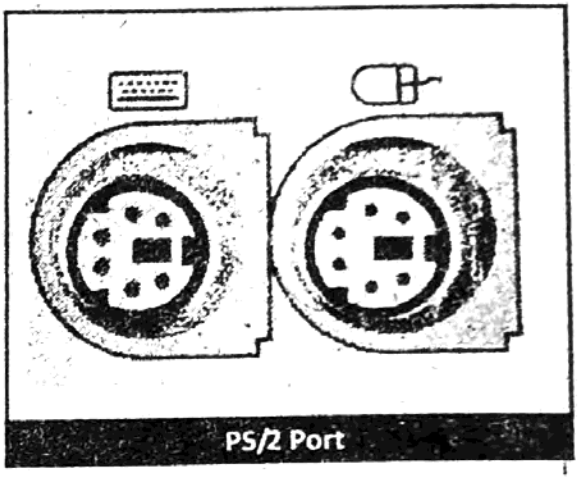
Function: The main function of a computer port is to act as a point of attachment, where the cable from the peripheral can be plugged in and allows data to flow from and to the device.

Types of Ports:

1. PS/2 port
2. Parallel port
3. Serial port
4. Firewire port
5. Universal serial port (USB)

1. PS/2 Port:

PS/2 stands for Personal System/2 port. It is also known as mouse port or keyboard port. PS/2 system introduced a new type of port for connecting keyboard and mouse which are still used in many computers.

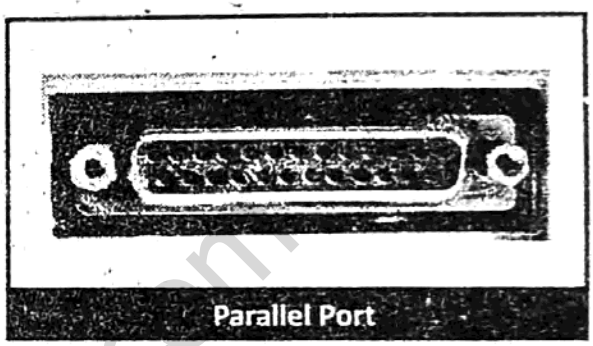


PS/2 Port

Shape: It is a round shaped serial port.

2. Parallel Ports:

Parallel ports are also known as printer ports. They can transmit multiple bits over several wires at a time.



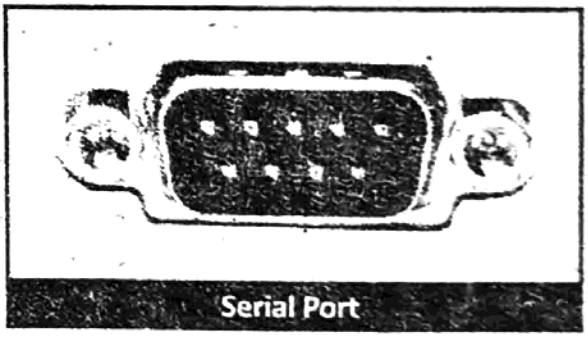
Parallel Port

Number of Pins: These ports have 25 pins in which 8 pins transmitted one byte of information and the others were used for transmitting control signals.

Naming: Parallel ports were named as LPT1, LPT2 and LPT3.

3. Serial Port:

A serial port is a serial communication physical interface through which information transfers in or out one bit at a time. These ports were used in old types of computers to connect devices like modems.



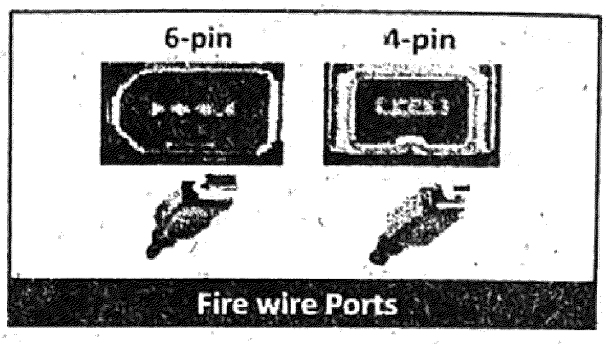
Serial Port

Number of Pins: Serial ports have 9 or 25 pins in which one pin is used for transmitting data and the rest are used to transmit control signals.

Naming: These ports are called COM1, COM2 and COM3. These ports have been replaced with USB ports in modern computers.

4. Firewire Port:

Firewire is a high-speed port which is used to connect video devices such as video cameras, camcorders, etc. to the computer system.



Fire wire Ports

Pins: Firewire port has four or six pins. In a six pin connection, 2 extra pins are used to provide electric power. Laptop computers have 4-pin firewire port because they do not provide electric power to devices connected to it.

5. Universal Serial Port (USB Port):

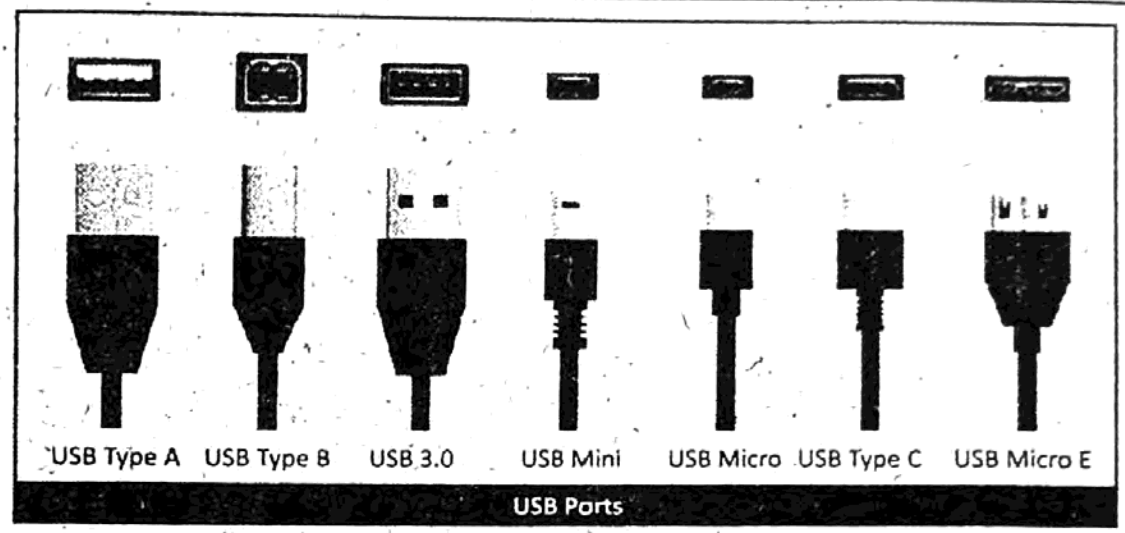
USB stands for Universal Serial Bus. It is a serial port which provides a fast serial transmission between devices and computers.

Plug-and-Play Feature: USB ports are plug-and-play ports. Plug-and-play ports automatically detect (پتہ لگانا، معلوم کرنا) and determine what type of device is attached to the computer.

Data Transfer Speed: USB 3.0 has a data transfer speed of 4.8 Gbps, which is almost 10 times faster than USB 2.0. USB port has replaced old serial and parallel ports in computer system.

Uses:

1. It is the most commonly used port in modern computers for connecting a large variety of devices to the computer such as printers, scanners, cameras, mouse, keyboard and USB flash drives.
2. USB may also be used to send power to certain devices, such as powering smartphones and tablets and charging their batteries.



USB Ports

Q10: Discuss different types of expansion cards.

Answer:

Expansion Cards:

Introduction: An Expansion Card (expansion board) is an add-on circuit board that is used to connect devices such as modems, sound cards, graphics cards, and network interface cards to the computer. Expansion boards fit into sockets on the computer motherboard called expansion slots. These expansion slots connect the expansion board or card to the main components of the computer.

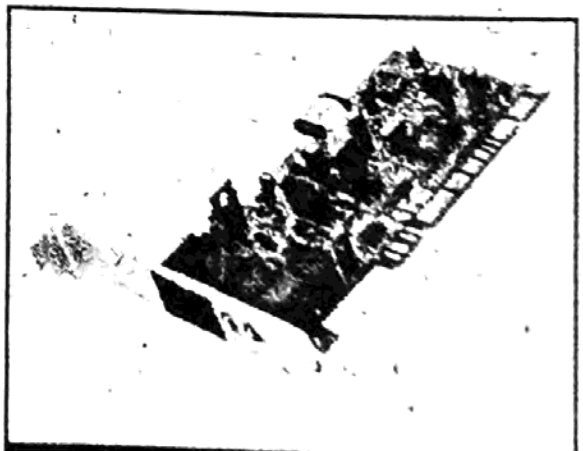
Types of Expansion Cards:

Some commonly used Expansion cards are:

1. Modem Card
2. Network Interface Card (NIC)
3. Sound Card
4. Graphics Card

1. Modem Card:

A modem is a communication device that makes possible the transmission of data between computers via telephone line or other communication lines. It is abbreviation of modulator-DEModulator. Modem


Modem Card

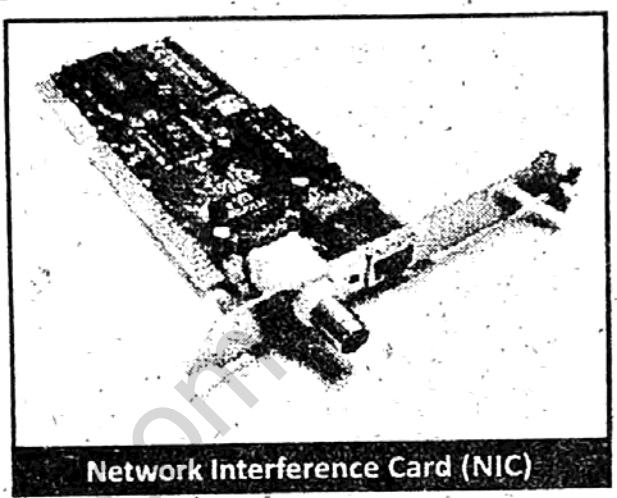
converts digital data into analog signals before sending it over the transmission line and convert it to digital signal on the receiving computer.

Speed: The modem card speed is limited upto 56 Kbps.

Types: There are three types of modems.

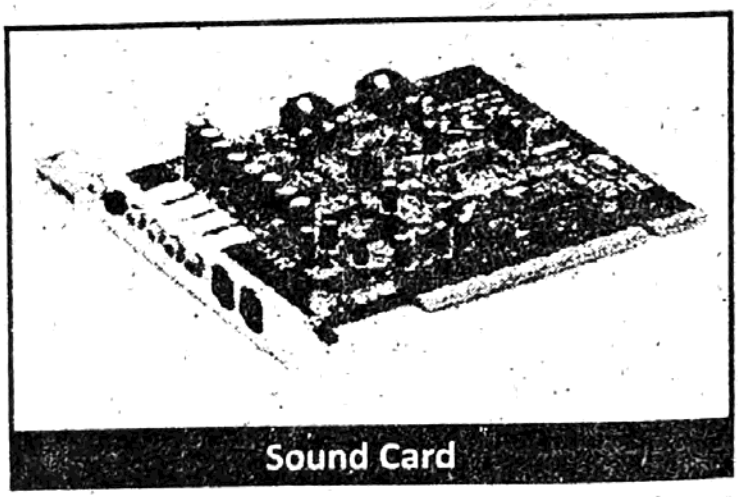
i) Dial-up modem ii) ISDN modem
iii) DSL modem

2. Network Interface Card (NIC):


Network Interference Card (NIC)

A Network Interface Card also known as network interface controller. Network adapter and LAN adapter. These cards are used for connecting a computer to a computer network. Usually NIC is installed as expansion card in the expansion slot, but most modern computers have built-in network interface cards on the motherboard. It is also called ethernet card. Every NIC has a 48-bit unique serial number called a MAC address which is stored in ROM. A computer must have NIC to connect to the internet.

3. Sound Card:

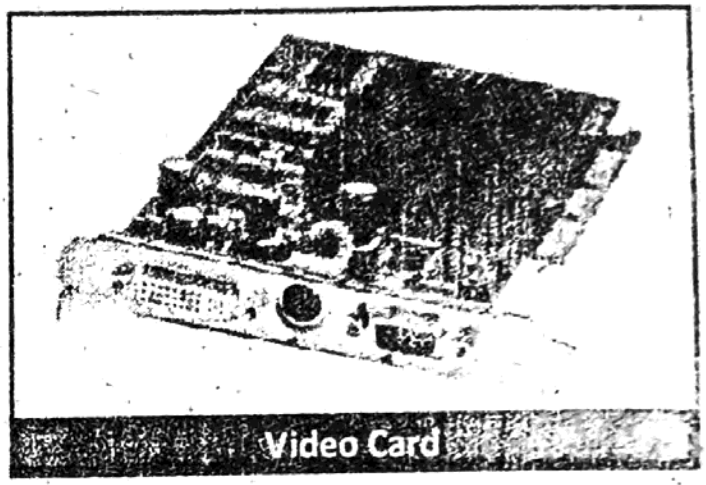

Sound Card

Sound card also known as an audio card is an internal expansion card that facilitates (سہولت فراہم کرتا) the input and output of audio signals to and from a computer. Sound cards enable (فعال) the computer to output sound through speakers connected to the board, to record sound input from a microphone connected to the computer, and to manipulate sound stored on a disk. Motherboards of modern computers

are manufactured with integrated sound card. The modern sound cards can output 3D sound and surround sound of increasingly high quality.

4. Video Card:

A video card also known as video adapter, graphics processing unit (GPU), display card or graphics card. These are expansion cards whose function is to generate output images or video to a display unit. Some cards contain dual GPUs for additional performance. Video cards have built-in fans or heat sink to pull heat away from graphic unit.



Video Card

Video Card Ports: The video card ports are DVI, HDMI, S-Video, VGA.

Q11: Discuss different types of memory chips.

Answer: Memory Chips:

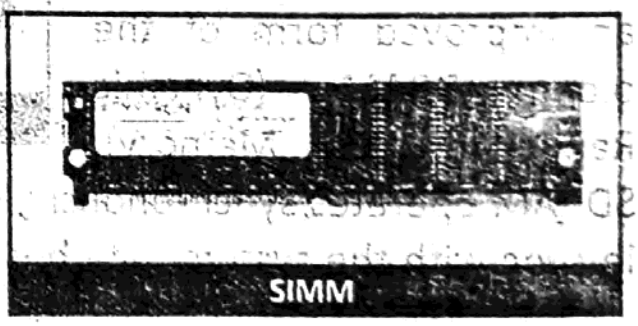
Memory chips are integrated circuits that can either temporarily or permanently store data and code for processing. RAM chips (SIMM, DIMM, SDRAM, and DDR-SDRAM) are the computer's temporary workspace, while flash memory chips are permanent.

Different Types of Memory Chips are:

1. SIMM
2. DIMM
3. SDRAM
4. DDR SDRAM

1. Single In-line Memory Module (SIMM):

A SIMM or single in-line memory module is type of RAM used in the computers from the early 1980s to the late 1990s.



SIMM

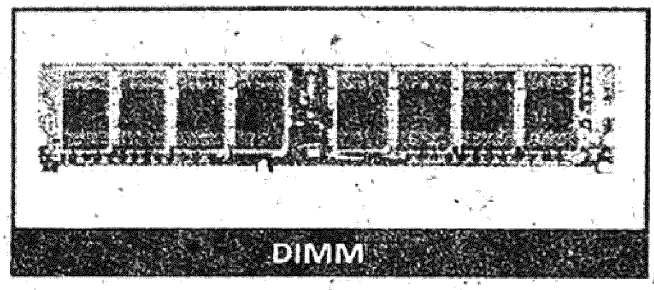
Number of Pins and Data Rate of SIMM:

SIMMs were available in 30 pins connector and 72 pin connector. 30-pin SIMMs provides 9 bits of data and was used in 286, 386, 486 models of computers and in some Macintosh models. The second variant, 72 pins SIMMs provides 32 bits of data and was used in 486, Pentium, Pentium Pro and even some Pentium II systems.

Storage Capacity: SIMMs had storage capacity ranging from 56KB to 32MB.

2. Dual In-Line Memory Module (DIMM):

DIMM is he upgraded form of SIMM. It has more storage capacity and operates at faster speed than SIMM.



DIMM

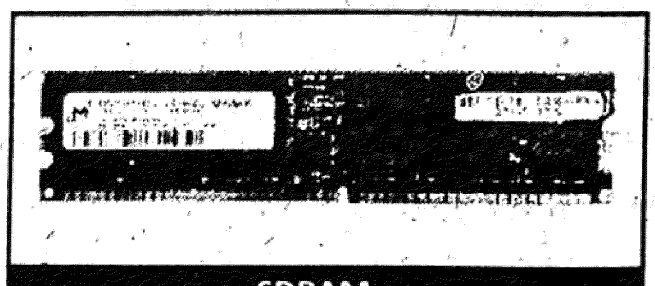
Number of Pins and Data Rate of SIMM:

It uses a 64-bit bus to the memory, whereas single in-line memory module (SIMM) only has a 32-bit path. A DIMM memory module has a 168-pin connector and can transfer data at a rate of 64 bits.

Memory Capacity: Memory capacities of DIMMs range from 4GB to 16GB. One DIMM module can do the job of two SIMM modules.

3. Synchronous Dynamic Random Access Memory (SDRAM):

SDRAM also known as Single Data Rate (SDR) SDRAM, is dynamic random RAM. SDRAM is a high speed semiconductor memory. It is an improved form of the older DRAM (Dynamic Random Access Memory).

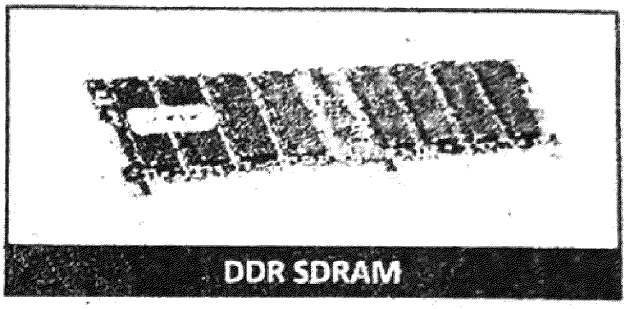


SDRAM

SDRAM operates synchronously, which means that it operates in sync with the system data bus. Therefore, it can operate at

greater speeds than non-synchronous RAM.

4. Double Data Rate Synchronous Random Access Memory (DDR SDRAM):

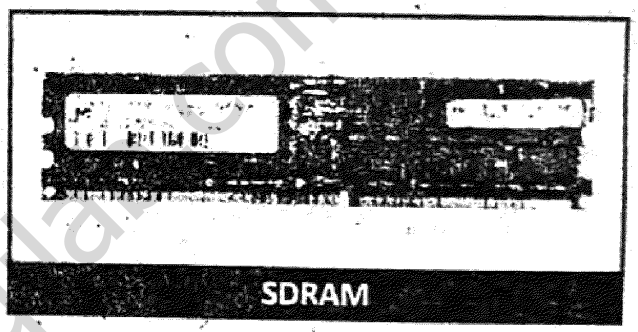

DDR SDRAM

DDR SDRAM (Double Data Rate SDRAM) is synchronous dynamic RAM that has improved memory clock speed as compared to simple SDRAM. It improves SDRAM, so a computer can transfer data at double speed. It reads or writes two consecutive words per clock cycle. New type of SDRAMs, known as DDR2 and DDR3. DDR2 reads or writes 4 words of data per clock cycle whereas DDR3 reads or writes 8 data words per clock cycle.

Q12: Write note on SDRAM and DDR SDRAM.

Answer:

1. Synchronous Dynamic Random Access Memory (SDRAM):


SDRAM

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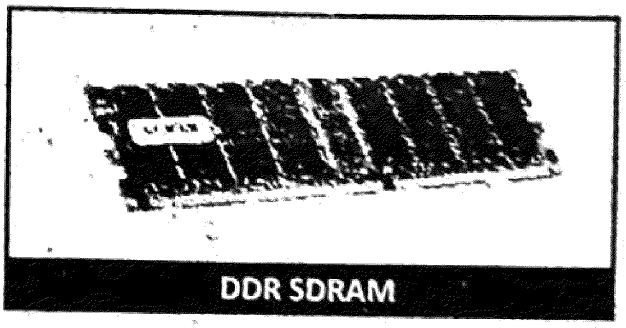
2. Double Data Rate Synchronous Random Access Memory (DDR SDRAM):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Q13: What is bus? Explain different types of busses in computer.

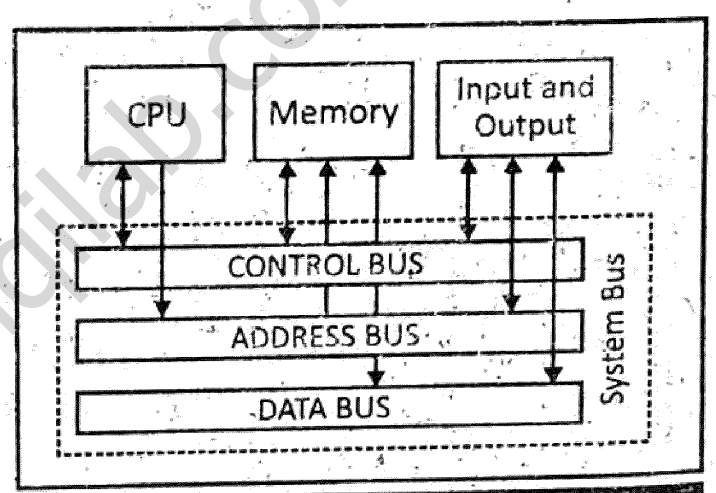
Answer: Computer Bus:

Computer bus is an electrical pathway or channel though which the processor communicates with internal and external device attached to the computer. Bus transfers data and instruction from and to processor from various devices. It connects all internal components to the main memory and central processing unit (CPU). The size of the computer bus is important because it determines that how much data can be transferred at a time. Its speed is measured in the MHz and

Types of Buses:

There are three types of Busses:

1. Data Bus
2. Address Bus
3. Control Bus



Computer Buses

1. Data Bus:

Data bus is the most common type of bus. It is used to transfer data between different components of computer.

Number of Lines in Data Bus:

The number of lines in data bus affects the speed of data transfer between different components. The data bus consists of 8, 16, 32, or 64 lines. A 64-line data bus can transfer 64 bits of data at one time.

Bi-Directional: The data bus lines are bi-directional. It means

that:

- CPU can read data from memory using these lines
- CPU can write data to memory locations using these lines

2. Address Bus:

Address bus is used to transmit or carry an address. An address is defined as a label, symbol, or other set of characters used to designate (نشاندہی کرنا) a location or register where information is stored. First address is transmitted to memory before data/instruction loaded from memory by CPU or input/output sections. The number of lines on the bus determines the number of addressable memory elements.

Example:

i) An 8-bit bus can represent 256 ($2^8 = 256$) unique addresses.
ii) A 16-bit bus can address 65536 unique addresses.

3. Control Bus:

The control bus is used by the CPU to direct and monitor (نظر رکھنا) the actions of other devices of computer. It is used to transmit a variety of individual signals e.g., read, write, interrupt, acknowledge signals and coordinate the operations of the computer.

Size: The size of control bus is from 8 to 16 bits.

EXERCISE MCQS

Q#1: Select the best choice for the following MCQs.

1. _____changes alternating current (AC) to low-voltage direct current (DC) to operate the processor and peripheral devices.
   a. Motherboard b. Power Supply
   c. Output Unit d. Register
2. Which of the following is the firmware built into computer system?
   a. Slot b. RAM
   c. Port d. BIOS
3. _____ are opening or sockets in a computer motherboard where a circuit board or expansion card can be inserted to add new functionalities to the computer.
   a. BIOS b. Ports
   c. Power Supplies d. Expansion Slots
4. Which of the following port is a high-speed point-to-point channel (pathway), primarily used for 3D computer graphics?
   a. AGP b. PCI
   c. PCIe d. ISA
5. _____ is a new technology cable for connecting storage devices to computer.
   a. IDE b. PCIe
   c. FD d. SATA
6. Which of the following is the fastest slot?
   a. AGP b. PCI
   c. PCIe d. ISA
7. _____ is the circuit which enables the CPU to communicate with disk drives.
   a. Memory b. Disk Controller
   c. Bus d. Port
8. _____is the most commonly used port in modern

computers for connecting a large variety of devices to the computer.

a. USB b. PS/2
c. Fire Wire d. LPT1

9. Which of the following cards facilitates the input and output of audio signals to and from a computer?
a. Video Card b. Modem Card
c. Sound Card d. Network Interface Card

10. What does SIMM stand for?
a. System in-line memory module
b. Synchronous in-line memory module
c. Single in-line memory module
d. Serial in-line memory module

Answers:

1	2	3	4	5	6	7	8	9	10
b	d	d	a	d	c	b	a	c	c

Short Questions

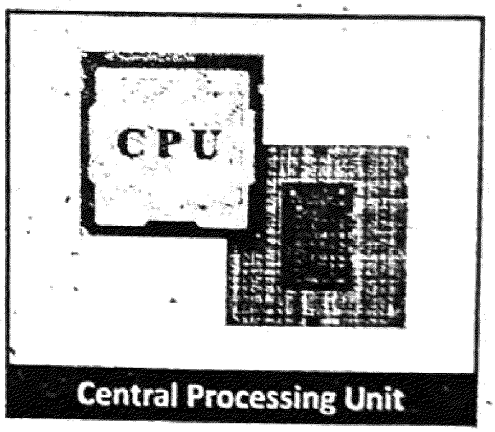
Q2: Give short answers to the following questions.

Q:i. Differentiate between CPU and system unit.

Answer: Central Processing Unit (CPU):

CPU Stands for "Central Processing Unit."

Explanation: The CPU is the primary component of a computer that processes instructions. It runs the operating system and applications, constantly receiving input from the user or active software programs. It processes the data and produces output, which may store by an application or displayed on the screen.



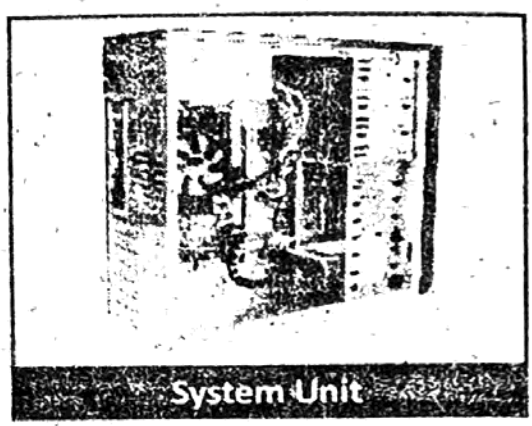
Central Processing Unit

Number of Processor in CPU: The CPU contains at least one

processor, which is the actual chip inside the CPU that performs calculations. A CPU with two processing cores is called a dual-core CPU and models with four cores are called quad-core CPUs. High-end CPUs may have six (hexa-core) or even eight (octo-core) processors.

System Unit:

The System Unit, also known as a "tower" or "chassis," is the main part of a desktop computer.



System Unit

Components of System Unit:

It includes the motherboard, CPU, RAM, and other components. The system unit also includes the case that houses the internal components of the computer. The system unit does not include keyboard, mouse and monitor.

Q:ii. Define two main types of computer casings.

Answer: Computer Casings:

A computer case also known as computer chassis, cabinet, box, tower, enclosure, housing, system unit or simply case. It contains most of the components of computer system. Cases are usually constructed from steel or aluminum. Plastic and other materials such as wood or Lego are also used.

Types of Computer Casings:

1. Desktop Casing
2. Tower Casing

1. Desktop Casings:

Desktop casing is the old type of casing which is designed to keep on the desk and usually monitor is placed over it.

2. Tower Casings:

Tower casing is the modern type of casing which is more attractive and common. Monitor is kept side by side with the tower casing.

Q:iii. List different parts of a motherboard.

Answer: Different Parts of Motherboard:

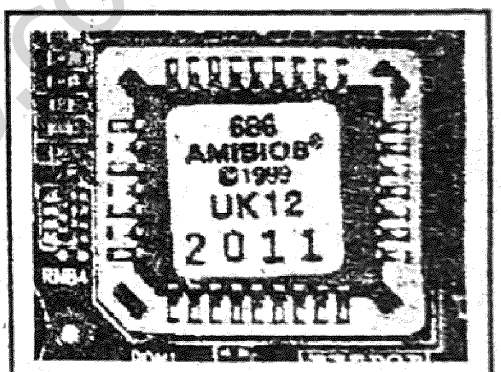
1. Central processing unit (CPU) chip
2. Random access memory (RAM) slots
3. Southbridge and Northbridge
4. Basic input/output system
5. Expansion slots
6. Ports
7. Cooling system (heat sink)
8. Peripheral component interconnect (PCI) slot
9. Accelerated graphics port (AGP) slot
10. Complementary metal-oxide semiconductor (CMOs) battery
11. Integrated drive electronics (IDE) connector
12. Disk controller etc.

Q:iv. What is the role of BIOS in computer system?

Answer:

BIOS:

BIOS stands for basic input output system. It is the firmware built into the computer system and automatically executes whenever the power is switched ON.



BIOS Chip

Role of BIOS (Functions of BIOS):

1. **Load and Start of OS:** The main function of BIOS in computer system is to load and start an operating system (OS). This process is called booting or booting up the system.
2. **Management of Data Flow:** BIOS also manages data flow between the computer's operating system (OS) and attached devices such as the hard disk, video, adopter, keyboard, mouse and printer.
3. **Setup Utility for User:** BIOS also has a setup utility that

allows a user to:

i) Configure computer hardware
ii) Select boot device
iii) Set password
iv) Set the clock
v) Enable or disable system components

Q:v. Differentiate between a port and a slot.

Answer: 1. Ports:

Definition: A port is an interface or connection at the back of the computer to connect external devices. (OR)

A port is a piece of equipment to which a plug or cable is connected.

There are various types of ports on the motherboard for connecting peripheral devices to the computer system.

Most Common Ports:

Serial port, parallel port, keyboard PS/port, mouse PS/2 port, S-video port, HDMI port, SD port, display port, power port, RJ-45 port, mini display port, audio port, USB A port, USB B port, type C port, firewire 800, mini display port, thunderbolt port, eSata port, firewire 400.

2. Slot (Expansion Slot):

These are openings or sockets in a computer motherboard where a circuit board or expansion card can be inserted to add new functionalities to the computer. Nearly all computers contain expansion slots. The devices inserted into the expansion slots are called expansion boards, cards, add-ins or add-ons.

Common Computer Slots:

The common standard of expansion slots includes AGP, PCI and PCI Express.

1. AGP (Accelerated Graphics Port)
2. PCI (Peripheral Component Interconnect)
3. PCI Express Slot

Q:vi. Name different types of data cables with their purpose of use.

Answer: Data Cables:

Data Cables are used to transmit electronic information from a source to destination.

Types of Data Cables:

There are different types of data cables.

1. IDE (Integrated Drive Electronics Cables):

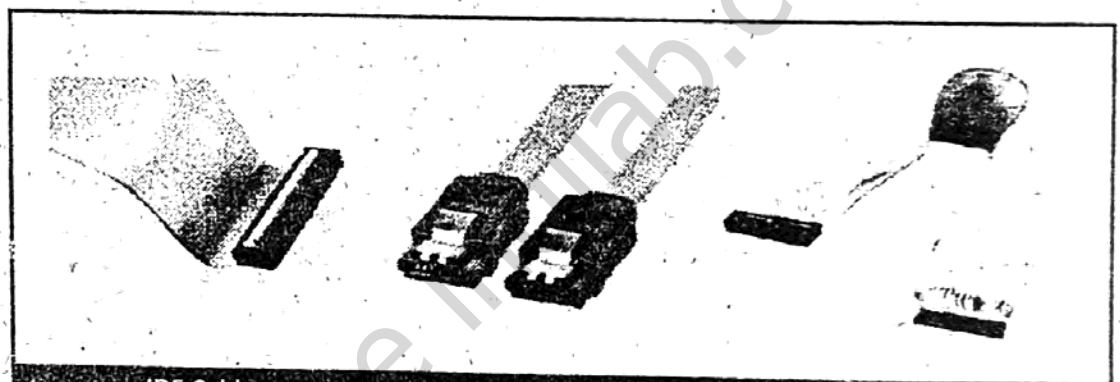
IDE cables were used to connect storage devices to a motherboard. The Parallel ATA cable is a ribbon cable with two or three connectors. Each connector has 40 pins.

2. SATA (Serial Advance Technology Attachment):

The Serial ATA cables are used in modern computers and laptops to transfer data up to 6 GB p/s.

3. FD (Floppy Disk) Cable:

FD is a 34-wire ribbon cable used in the past to connect floppy drives to motherboard.

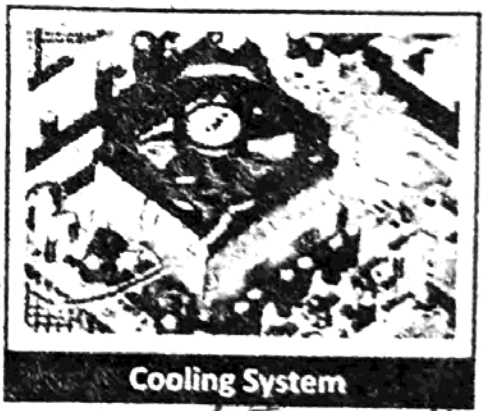


IDE Cable SATA Cable FD Cable

Q:vii. Why cooling system is important for a computer?

Answer: Importance of Cooling System in Computer:

Inside system unit, different hardware such as processor, video card and hard disk generate heat. If the temperature inside the system unit reaches a certain point, it can damage the parts. In modern computers, cooling system is used to maintain an optimal operating



Cooling System

temperature.

Example of Cooling System: Cooling system in computer includes: i) Exhaust fans ii) Heat ink iii) CPU fan

Q:viii. Differentiate between SIMM and DIMM.

Answer:

SIMM	DIMM
1. SIMM stands for single in-line Module	**1.** DIMM stands for dual In-line Memory Module
2. It is used in 286, 386, 486, Pentium and some Macintosh models.	**2.** It is installed in all modern computers.
3. It has storage capacity from 56 KB to 32 MB.	**3.** It has storage capacity from 64 MB to 512 MB.
4. It has 30 or 70 pins.	**4.** It has double number of pins.
5. It uses 32 bit bus.	**5.** It uses 64 bit bus.
6. Its data transfer rate is slower.	**6.** Its data transfer rate is faster.

Detailed Questions

Q3: Give detailed answers to the following questions.

i. Discuss different types of expansion cards.

Answer: See Question # **10**, Page # **115**

ii. What is port? Explain different types of ports in computers.

Answer: See Question # **9**, Page # **112**

iii. Explain different types of ribbon cables.

Answer: See Question # **8**, Page # **111**

iv. Discuss different types of memory chips.

Answer: See Question # **11**, Page # **117**

v. What is bus? Explain different types of buses in computers.

Answer: See Question # **13**, Page # **120**

vi. Write note on SDRAM and DDR SDRAM.

Answer: See Question # **12**, Page # **119**

Additional MCQs

Q: Select the best answer for the following MCQs.

1. Which port is generally used to connect video devices to the compute?
   a. Firewire port b. USB port
   c. PS/2 port d. Parallel port
2. What is computer casing with all the components installed inside t called?
   a. Computer system b. CPU
   c. Motherboard **d. System unit**
3. What is the interface that provides connection to external devices called?
   a. Expansion slot b. Memory slot
   c. Disk controller **d. Port**
4. Which of the following provides interface to network?
   a. NIC b. Modem
   c. Parallel port d. BIOS
5. Which part of computer protects and organizes all the main parts of a computer?
   a. Power supply b. Motherboard
   c. Casing d. Expansion slots
6. What is the purpose of power supply in the computer?
   a. To convert low-voltage to high-voltage
   b. To convert DC to AC
   c. To convert AC to low-voltage DC
   d. To generate power
7. Which circuit board connects all the components of computer?
   a. Motherboard b. Ports
   c. Network card d. Cables
8. What is BIOS?
   a. Programs in RAM b. Port
   c. Interface **d. Non-volatile ROM chip**

9. Which of these provides high-speed channel for attaching video card to motherboard?
   a. IDE interface **b. AGP**
   c. Disk controller d. Memory slot
10. Which card displays text, graphics and images on the screen?
   a. Network card b. Gigabit card
   c. Modem card **d. Video graphics card**
11. Which of the following is not inside the system unit?
   a. Motherboard **b. Monitor**
   c. Hard disk d. RAM
12. The instruction needed to start the computer are stored in:
   a. RAM b. Port
   c. Cache **d. ROM**
13. Which of the following is not a type of motherboard expansion slot?
   a. AGP b. PCI
   c. PCI Express **d. ATX**
14. Which of the following is not a port?
   a. USB b. Firewire
   c. Serial **d. SATA**
15. Modem stands for:
   a. Modulator-Demo
   b. Modules-De Modules
   c. Modulator-Demodulator
   d. Mode-Modeless
16. DSL stands for:
   a. Direct service lease
   b. Domain server link
   c. Distant service line
   d. Digital subscriber line

+ + + + +

UNIT : 5
NETWORK COMMUNICATION & PROTOCOLS

Q1: Explain basic data communication components.

Answer: Definition: The data communication is the movement or transmission of data between two devices or computers. (OR) It is the transfer of data between two points either in analog or digital form via a communication medium.

Components: A data communication system consists of five basic components:

1. Sender
2. Message
3. Medium
4. Protocol
5. Receiver

1. Sender:

Sender or transmitter is a computer/device that sends the message (data or information) from source to destination (وہ جگہ جہاں بھیجا ہو) in a communication network. It may be a computer, workstation, cell phone or camera. The sender device converts the electrical signal into a form that is suitable (موزوں) for transmission over the communication network.

2. Message:

Message is the data or information that is to be transmitted. Message can be in the form of text, audio, video, or any combination of these.

3. Medium:

Medium is the physical path through which message travels from source to destination. It is also called a channel. Medium can be wired, for example telephone cable, coaxial cable and fibre optics. It can also be wireless for example Bluetooth,

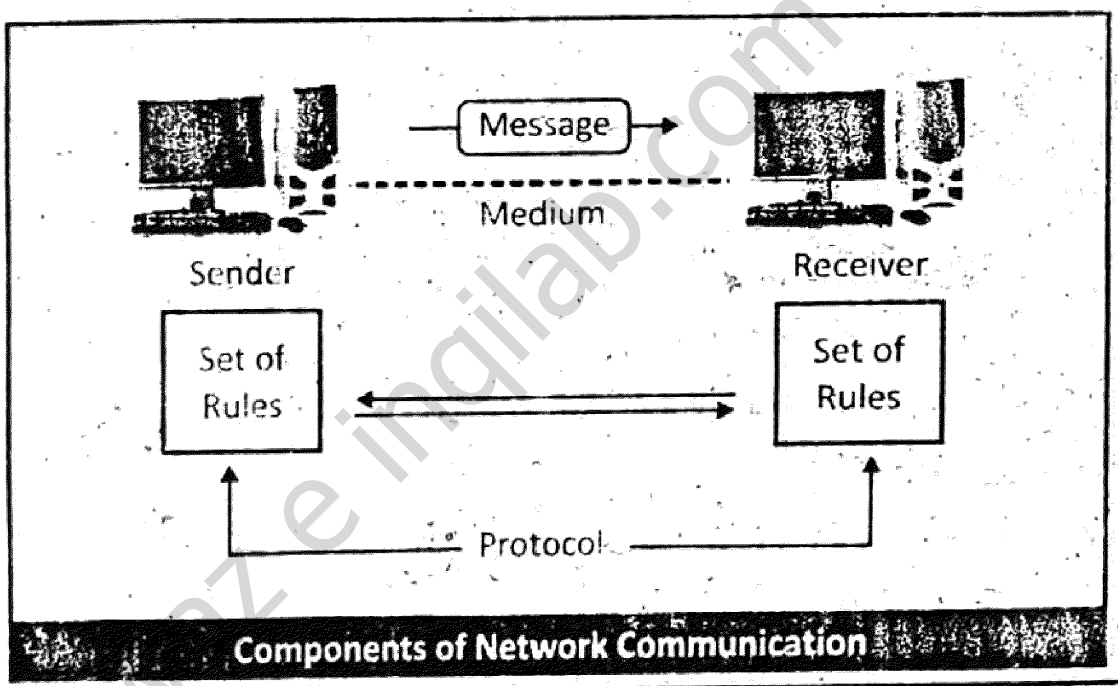
Wi-Fi, microwave, radio wave, television broadcasting and satellite.

4. Receiver:

Receiver is the device which receives transmitted message. It can be a computer, workstation, telephone handset or television set. The data received from the transmission medium may not be in proper form to be accepted to the receiver and it must be converted to appropriate (مناسب) form before it is received.

5. Protocol:

A protocol is a set of rules that governs data communications. It represents an agreement (معاہدہ) between the communicating devices. Without a protocol, two devices are connected but may not communicating with each other.



Components of Network Communication

Q2: Explain various modes of data communication.

Answer: Modes of Data Communication:

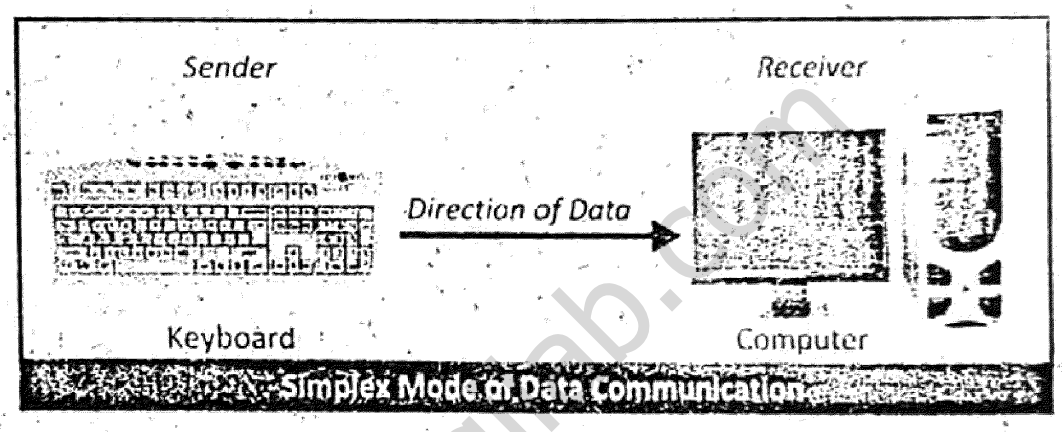
The way in which data or information is transmitted from one place to another is called data communication mode. (OR) Modes of data transmission refer to the methods or ways information is transmitted from one place to another.

1. Simplex:

A Simplex Communication channel only sends information in one direction, so it is also called one-way transmission or unidirectional mode. A radio station usually sends signals to the audience but never receives signals from them.

Examples:

i. Communication from a central computer to a dumb terminal.
ii. Data send to an electronic notice board in train stations and airports.
iii. Transmission of information from computer to printer is also example of simplex communication.
iv. Communication between keyboard and CPU represents simplex mode of communication.



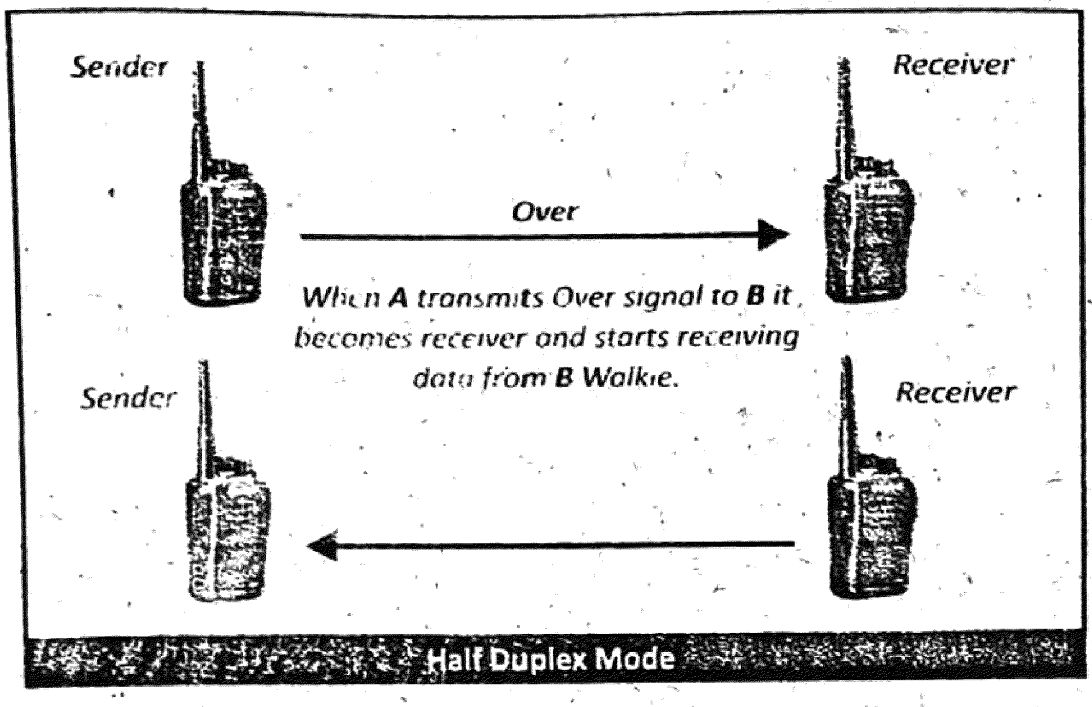
Simplex Mode of Data Communication

2. Half Duplex:

In Half Duplex mode, each station can both transmit and receive data, but not at the same time. Each end of the communications link acts as sender and receiver. In this type of communication e.g., use of walkie-talkies, where each of the persons communicating must indicate when they have finished speaking.

Examples:

i. Walkie-Talkies is a typical example of half-duplex made of communication.
ii. Communication between a computer and credit card machine.



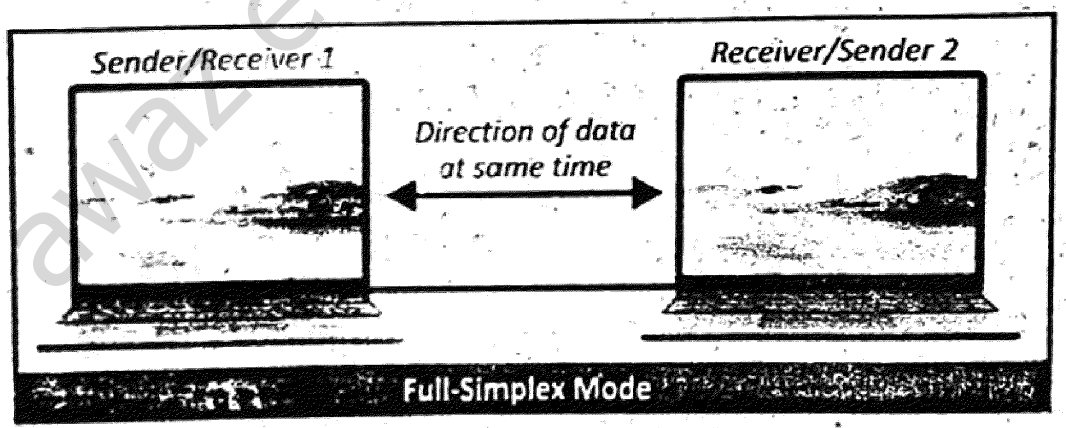
Half Duplex Mode

3. Full duplex:

In full duplex mode, both stations can send and receive the data simultaneously. It is the fastest bi-directional mode of communication. In full duplex mode, signals going in one direction share the bandwidth of the medium with signals going in the other direction. This sharing can occur in two ways, with separate transmission paths, one for sending and the other for receiving. In other words, the bandwidth of the channel is divided between signals travelling in both directions.

Examples:

Communication through telephone or mobile, both person can talk at same time.



Full-Simplex Mode

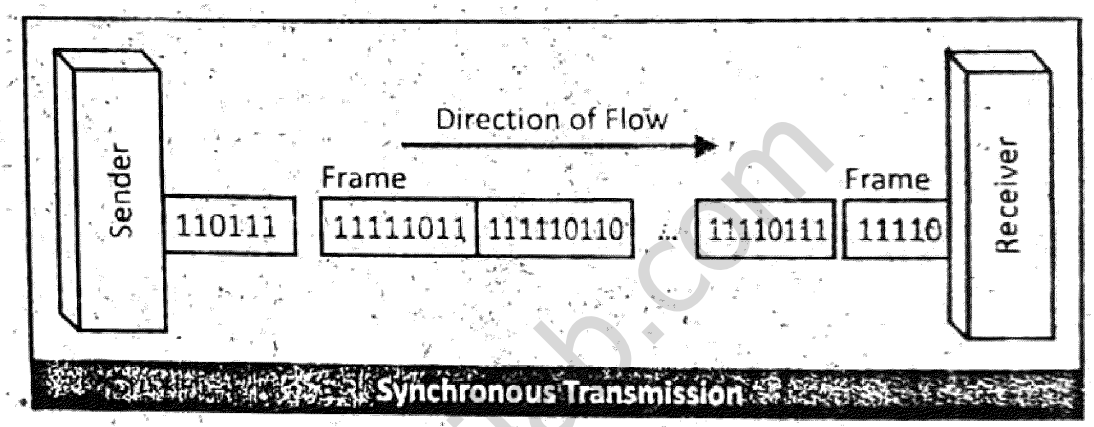
4. Synchronous Transmission:

In synchronous transmission, large volumes of information can

be transmitted at a time. in this type of transmission, data is transmitted block-by-block or word-by-word simultaneously. Each block may contain several bytes of data. In synchronous transmission, a special communication device known as synchronized clock is required to schedule the transmission of information. With synchronous transmission, large blocks of bytes are transmitted at regular intervals without any start/stop signals. Synchronous transmission requires that both the sending and receiving devices be synchronized before data is transmitted.

Examples:

i. Face-to-face interactions
ii. Telephonic conversations
iii. Video conferencing and chatrooms



5. Asynchronous Transmission:

In asynchronous transmission, data is transmitted one byte at a time. The data is transmitted character-by-character and does not occur at regular intervals. A sending device can transmit bytes at any time, and the receiving device must be ready to accept them as they arrive. A start bit marks the beginning of a byte and a stop bit marks the end of the byte. In general, the size of a character sent is 8 bits to which a parity bit is added i.e. a start and a stop bit that gives the total of 10 bits. Asynchronous transmission usually involves communications in which data can be transmitted intermittently (وقفے وقفے سے) instead of in a steady (مسلسل کارکردگی) steam. It is so named because the timing of the signal is not important. Therefore, this type of

transmission is relatively slow.

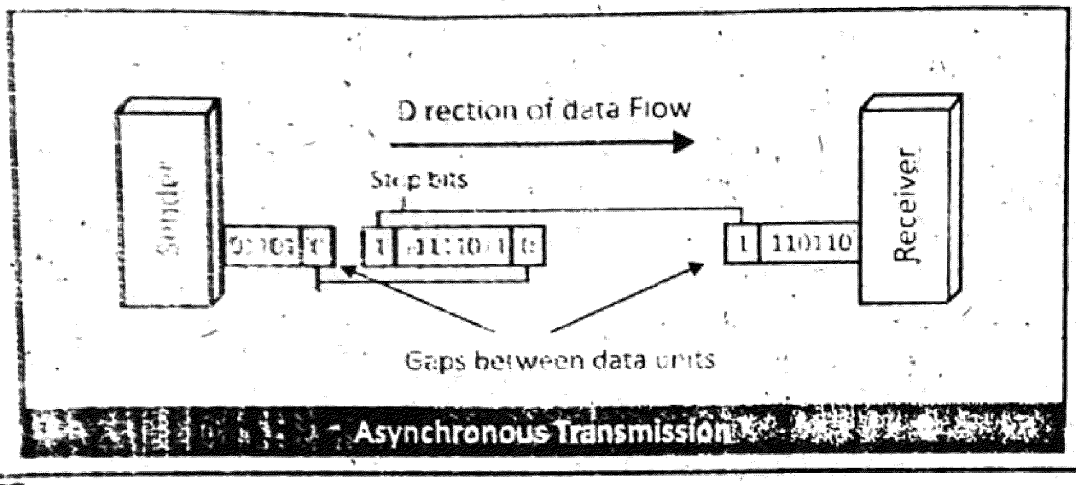


Fig 5.3 - Asynchronous Transmission

Q5: What is guided media? Explain different types of guided media.

Answer: Guided Media:

It is also called physical or bounded or wired communication media. In this type of media signals pass through a physical path. It uses cables that guide the data signals along a specific path.

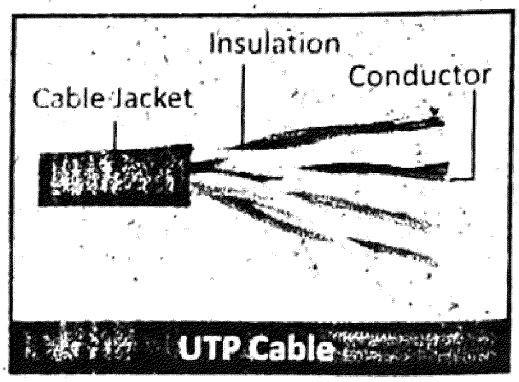
Types of Guided Media:

The following are some important guided media:

1. Twisted Pair Cable
2. Coaxial Cable
3. Fibre Optic Cable

1. Twisted Pair Cables:

Twisted pair cables are twisted together in pairs. It provides shielding from outside interference. Cables with a shield are called shielded twisted pair (STP) cables. Cables without shields are called unshielded twisted pair (UTP) cables. These cables are shown below:



UTP Cable

Types of Twisted Pair Cable:

i) Unshielded Twisted Pair (UTP) Cables: UTP is the most commonly used networking wire. It is inexpensive, flexible, and light,

thus making it very easy to work with. The cable has four pairs of wires inside the jacket.

Transmission Speed of UTP:

The unshielded twisted pair provides a bandwidth of 100 Kbps (Cat 1) to 1000 Mbps (Cat 7).

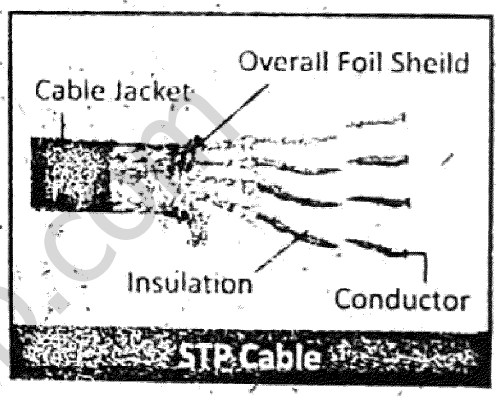
Connector for UTP:

The standard connector for unshielded twisted pair cabling is an RJ-45 connector.

ii) Shielded Twisted Pair (STP) Cables: The difference between the UTP and STP is that the STP uses metallic shield wrapped to protect the wire from interference. Shielded cables can help to extend the maximum distance of the cables.

Transmission Speed of STP:

Data rate of STP is from 16 to 155 Mbps. It costs more than UTP.

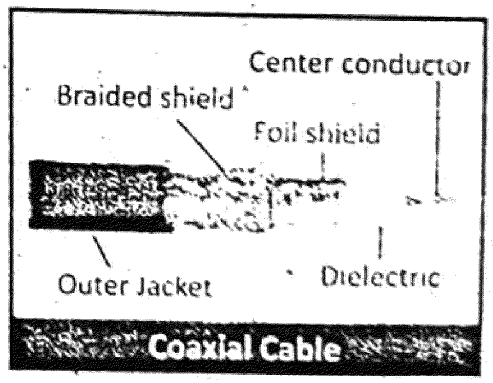


Advantages of Twisted Pair Cable:

i) It is less costly.
ii) Its installation is easy.
iii) It (STP) reduces EMI.
iv) It reduces cross talk.
v) It is used for both analog and digital signal transmission.
vi) In case of damage in some part does not effect entire computer network.

2. Coaxial Cable:

Coaxial cable consists of a single solid copper wire, which is called the inner conductor. the insulated copper wire is covered by copper mesh. The mesh protects the signals from electromagnetic interference (EMI).



The inner conductor is surrounded by three layers

i) An insulating material, which covers the inner conductor.
ii) An outer conductor of solid metal foil (shield).
iii) An insulating material, which covers the outer conductor.
iv) The whole cable is protected by an external plastic cover.

Transmission Speed:

Transmission speed of twisted pair cable ranges from 2 million bits per second to 10 billion bits per second.

Advantages of Coaxial Cable:

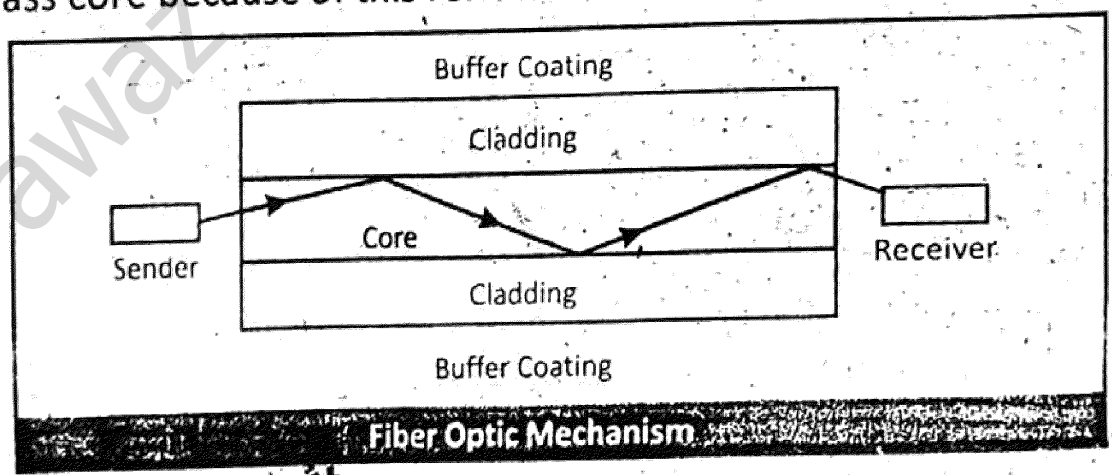
i) It is faster in speed than twisted pair cable.
ii) Its installation is easy.
iii) It reduces electromagnetic interference (EMI).
iv) It carries signals of higher frequency than twisted pair cable.

3. Optical Fiber Cable:

It is new technology that is replacing the conventional (روایتی) cable in communication system.

Structure of Optical Fiber Cable: An optical fiber consists of a very narrow strand or fiber of glass called the core. The core is surrounded by a concentric layer of glass called cladding. The cladding is covered by a protective coating of plastic jacket.

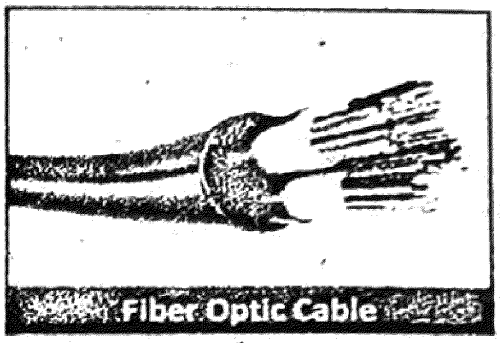
Mechanism: Optical fiber transmits signals in the form of light rather than electronic signals. This eliminates the problem of electrical interference. The fiber optic uses total internal reflection to guide light signals through a channel. A glass or plastic core is surrounded by a cladding of less dense glass or plastic. The difference in the density of the two materials causes the beam of light moving through the core. No light escapes the glass core because of this reflective cladding.



Fiber Optic Mechanism

Transmission Speed of Optical Fiber Cables (Bandwidth):

The transmission speed of data of data is more than 2 Giga bits per second (Gbps). Nowadays, telephone, internet and television companies use optic fiber cables.



Fiber Optic Cable

Advantages of Fiber Optic Cable:

i) It transmits data at a high speed than other cables.
ii) It is not suffered from electromagnetic interference (EMI).
iii) It is smaller in size.
iv) It is very resistance (مزاحمت) to noise.
v) It has high band width capability (صلاحیت).
vi) It is more secure than other cables.
vii) It is immune (روکنا) to cross talk.

Q4: Explain radio wave and microwave communications.

Answer: Radio Wave and Microwave Communications:

Radio wave and microwave communications are common examples of unguided communication media. They are also known as wireless transmission media. They do not use cables for data transmission. They have three types:

i) Radio wave ii) Microwave
iii) Infrared waves

i) RADIO WAVE TRANSMISSION:

Introduction: Radio wave transmission is a wireless transmission medium that is used to communicate information through radio signals in air, over long distance such as between cities and countries. It is also known as broadcast radio transmission medium.

Explanation:

Radio waves are electromagnetic waves that are propagated (پھیلانا) by antennas. Radio transmission consists of a transmitter and a receiver. To receive the broadcast radio signals, the receiver has an antenna that is located in the range of signal.

When an antenna transmits (منتقل کرنا) radio waves, they are propagates in all directions. This is called multi-directional characteristics of radio waves. Therefore, radio transmission is multicasting in which there is one sender and many receivers.

Range of Radio Waves:

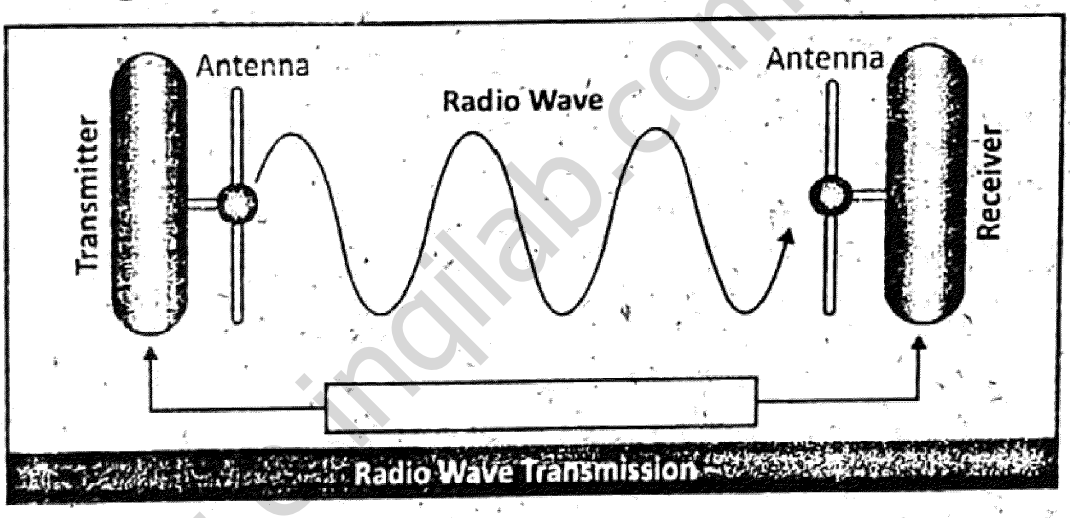
They have frequency range from 10KHz to 1GHz.

Data Transmission Speed:

The data transmission speed of radio wave is up to 54 mega bits per second (Mbps).

Examples:

i) AM (Amplitude Modulation) and FM (Frequency Modulation) radio stations.
ii) Cordless phones
iii) Television broadcasting
iv) Navigation and Air-traffic control use radio waves.



Radio Wave Transmission

2. MICROWAVE TRANSMISSION:

Introduction: Microwave transmission is also one of the type of unguided media. This transmission uses microwave signal for communication.

Explanation: Microwave are radio waves which have high speed of transmission. Microwaves station contains an antenna, transceiver and other equipments. In this type of transmission system the data signals travel in a straight path without bending. It means microwaves are unidirectional (یکطرفہ).

Microwave stations or antenna are usually installed on the high towers or buildings. Therefore stations must be installed in direct site of each other.

Range of Microwaves:

They have frequency range from 1Ghz to 300GHz.

Data Transmission Speed:

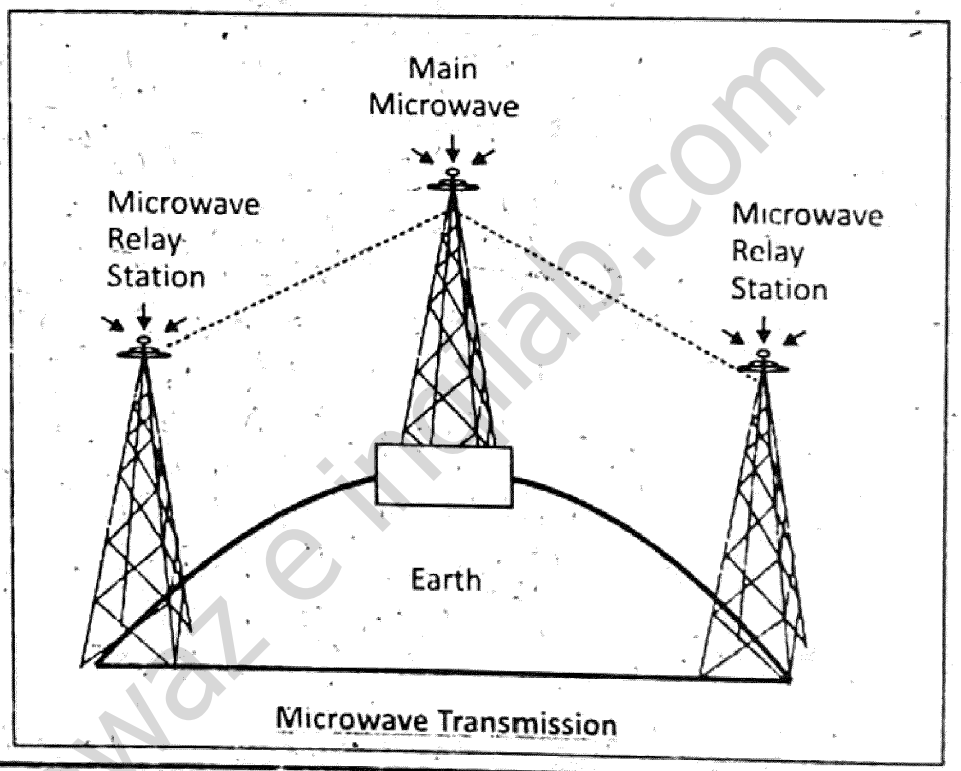
The data transmission speed of microwave is about 16 Giga bits per second (gps).

Example:

Mobile, telephone companies use microwave technology.

Applications:

Microwaves are used for satellite communication and other long distance wireless communications.



Microwave Transmission

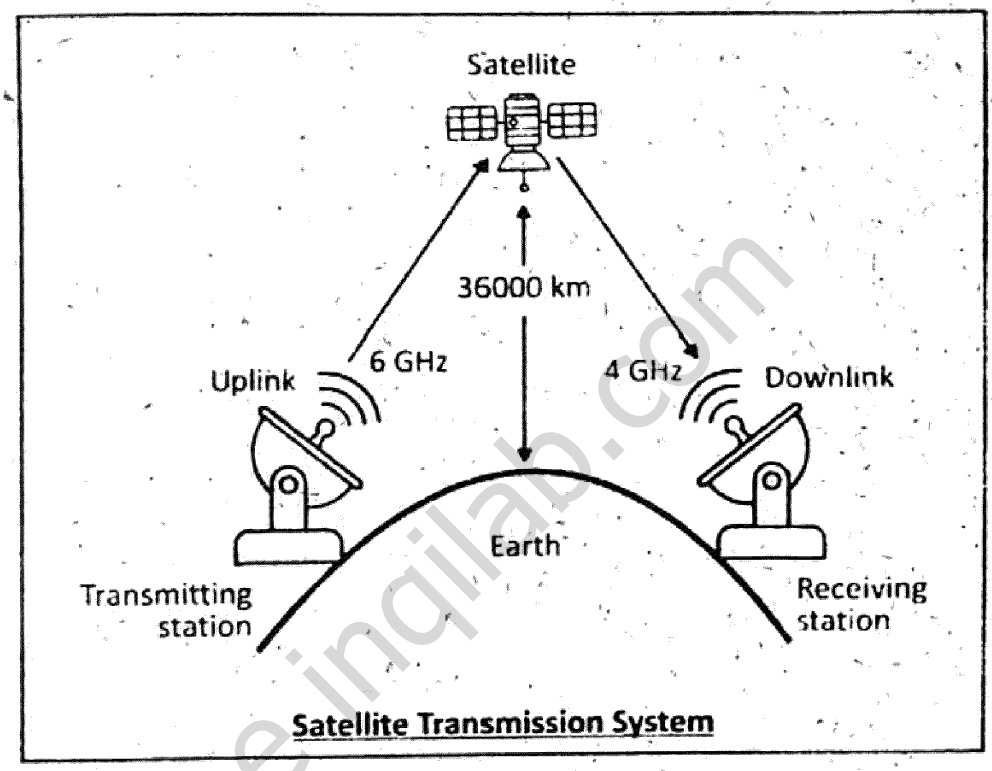
Q5: Briefly explain satellite communication.

Answer: Satellite Communication:

Introduction: Satellite communication also involves microwaves for transmission of signals. The transmission of signals takes place between a satellite station in space and microwave station in earth.

Explanation: A satellite is an object that is placed in an orbit around the earth and revolves (چکر کاٹنا) around it. It is a wireless receiver and transmitter. Therefore, it is said to be a satellite station. The transmission of signals from earth station to a satellite station in space is called up-linking and the reverse is called the down-linking. Earth station transmits signal through antenna to satellite.

High speed Transmission: Satellite microwave transmission has high speed and therefore it is used to transmit signals throughout the world.



Satellite Transmission System

Q6: Write short note on infrared technology.

Answer: Infrared:

Infrared technology is a short range wireless transmission communication mode.

Line of Site Transmission: Computer infrared network adapters both transmit and receive data. Infrared adapters are installed in many laptops, handheld personal devices and mobile phones. Infrared technology is a line-of-site transmission.

Uses: It is used to transfer files and other digital data between computing devices.

Transmission Speed:

It supports data rate from 100 Kbps to 4 Mbps.

Examples:

(i) Infrared technology is used to exchange data between a notebook computer and mobile.

(ii) Infrared technology is used in television remote control.

(iii) Infrared technology is used to transfer image/file to a printer.

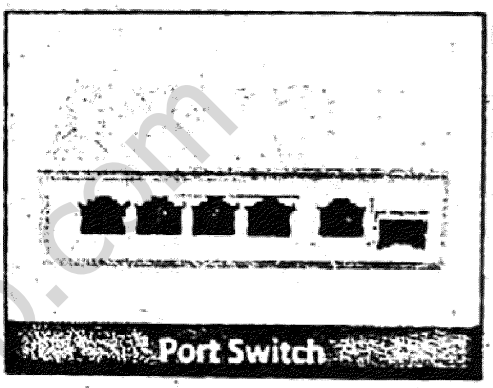
Q7. Write notes on switch, router and gateway.

Answer: Communication Devices:

Switch, router and gateway are communication devices.

1. Switch:

A Switch in the context of networking is a high-speed device that receives incoming data packets and redirects (نئی ہدایت دینا) them to their destination on a local area network (LAN). A LAN switch operates at the data link layer (Layer 2) or the network layer of the OSI Model.



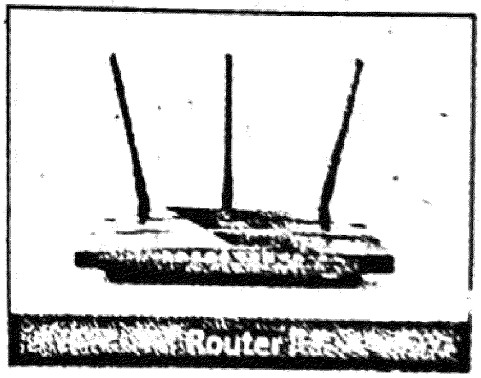
Port Switch

MAC Address: Every computer in the network has unique address for identification which is called **MAC address**. MAC stands for media access control. Switch uses MAC address for communication so it is more intelligent than hub.

Inspection Capacity: Switch has the capacity of inspecting (جانچنا) received data, determining the source and destination device of the particular data.

2. Router:

Router is a communication device that connects local area networks (LANs) and wide area network (WANs) through routing table.

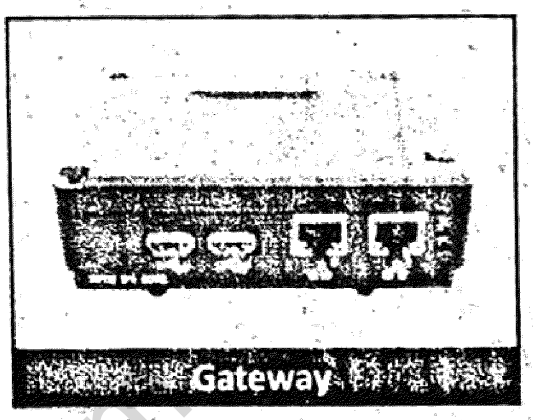


Router

Function: It forwards data packets across networks and performs traffic directing functions on the internet. When a data packet comes to router, the router cheeks its destination address. A data packet is typically (عام طور پر) passed from node to node until reaches its destination. Router operates on network layer of OSI model.

Example: A router is used in college or university LAN to distribute one internet connection to many computers.

3. Gateway:


Gateway

A gateway is a hardware device or a computer running software that allows communication between networks with dissimilar network protocols or architectures. The gateway has an interface to each of the networks to which it is connected. The gateway has the responsibility (ذمہ داری) of acting as the switch that allows such packets to go from one network to another.

Gateways are very intelligent devices. A gateway can translate information between different network data formats or network architectures. It can translate TCP/IP to AppleTalk so computers supporting TCP/IP can communicate with Apple brand computers. Most gateways operate at the application layer, but can also operate at the network or session layer of the OSI model.

Q8: Explain in detail client/server and peer-to-peer networks.

Answer: Server:

Definition: A Server is a powerful computer that provides data and services to other computers over the network, such as printers and files. (OR)

A server is a main computer in a network which is used to manage network resources and facilitates other computers

Client:

A client is a computer that receives data or services made available by a server. Clients are also called workstation.

1. Client-Server Network:

Introduction: A computer network in which each computer on the network acts as either a server or a client is called client/server or dedicated server network.

Explanation: Each server computer on the network is called a dedicated server. Servers are not used as client computers. Figure illustrates (وضاحت کرنا) how a dedicated server network may be designed. The computer at the top of the figure is the dedicated server, sharing files and applications. The remaining computers in the illustration are clients that access resources shared by the server. Similarly, in a dedicated server network, client computers never act as servers.

The client/server architecture is particularly recommended (تجویز کرنا) for networks requiring a high degree of reliability (اعتبار). The term client/ server refers to the concept of sharing the work involved in processing data between the client computer and the server computer.

Example: One example of a client/server network is a corporate environment where employees use a company e-mail server to send, receive and store e-mail. The e-mail client on an employee computer issues a request to the e-mail server for any unread mail. The server responds (جواب دینا) by sending the requested e-mail to the client. Data transfer from a client to a server is referred to as an upload and data from a server to a client as a download.

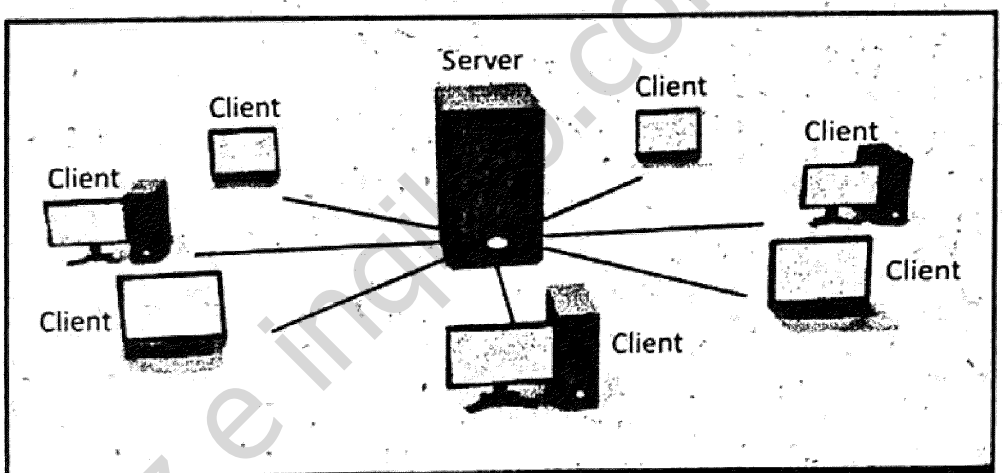
Advantages of Client/Server Networks:

1. **Centralized Resources:** Server is the centre of the network and it can manage resources that are common to all users.
2. **Improved Security:** Server provides better security to network users.

3. **Scalable Network:** It is possible to remove or add clients without affecting the operation of the network and without the need for major changes.
4. **Flexibility:** New technology can be easily integrated into the system.
5. **Interoperability:** All components (client/network/server) work together.

Disadvantages of Client/Server Networks:

1. It requires specialized servers with large memory and secondary storage. This leads to increase in the cost.
2. **Expensive:** Requires high initial investment (سرمایہ کاری) in dedicated server.
3. **Maintenance:** It also requires train staff for its maintenance and efficient operation.
4. **Dependence:** It depends on server capability once server goes down, all the operations will stop across the network.



Client-Server Network

2. Peer-to-Peer Networks:

Introduction: In peer-to-peer networking there are no dedicated servers or hierarchy among the computers. Peer-to-peer network allows users to share resources and files located on their computers and also to access shared resources found on other computers. In a peer-to-peer network, all computers have equal status and therefore, known as peers. They all have the same abilities to use the resources available on the network.

Explanation: Peer-to-peer networks are designed primarily for small to medium local area networks. Nearly all modern desktop operating systems, such as Macintosh OSX, Linux, and Windows, can support peer-to-peer network.

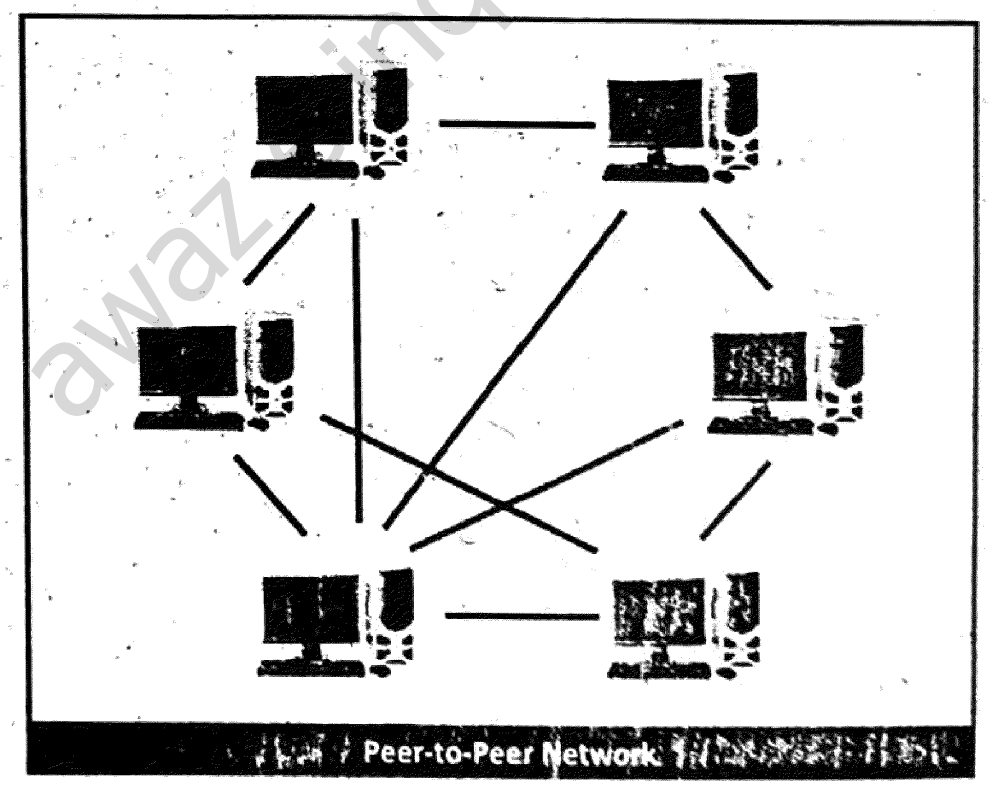
The only requirements for building a peer-to-peer network include installing an operating system on the PCs that supports peer-to-peer networking and then physically connecting the PCs through some medium.

Advantages of Peer-to-Peer Networks:

1. **Easy Setup:** Peer-to-peer networks are easy to set up because they require operating system that support this type of networks.
2. **Less Expensive:** Peer-to-peer networks are less expensive because they do not need a dedicated server.

Disadvantages of Peer-to-Peer Networks:

1. **Decentralization:** In peer-to-peer network, the absence of centralized server makes it difficult to backup data as data is located on different workstations.
2. **Less Secure:** Security is weak as each system manages itself only.
3. **Less Storage:** There is no central point of data storage for file archiving.



Peer-to-Peer Network

Q: Explain different types of network.

Answer:

Network Types: Network can be classified into following types:

1. Local Area Network (LAN)
2. Metropolitan Area Network (MAN)
3. Wide Area Network (WAN)
4. Virtual Private Network (VPN)

1. LAN (Local Area Network):

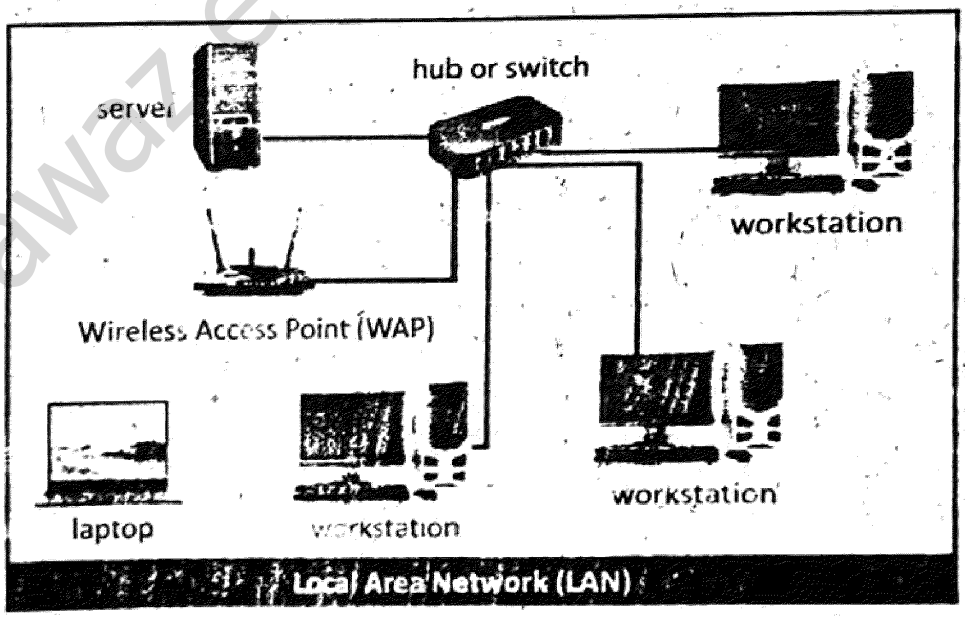
Introduction: LAN (Local Area Network) is a network that connects computers and devices in a limited geographical area like home, school, and office building. Each computer or device on the network is called a node.

Explanation: LANs are most likely to be based on Ethernet technology. A LAN is useful for sharing resources like files, printers, games, e-mail, group scheduling or other applications. A LAN can be wired or wireless. A wired LAN requires Ethernet cable to physically connect all computers on the network to a central device called a switch or hub.

LAN Users: A wireless LAN uses radio waves to communicate. A local area network can reach as many as 100, or even 1000, users.

Data Transfer Speed: Data transfer speeds over a local area network can reach up to 10 Mbps (such as for an ethernet network) and 1 Gbps (as with FDDI or Gigabit ethernet).

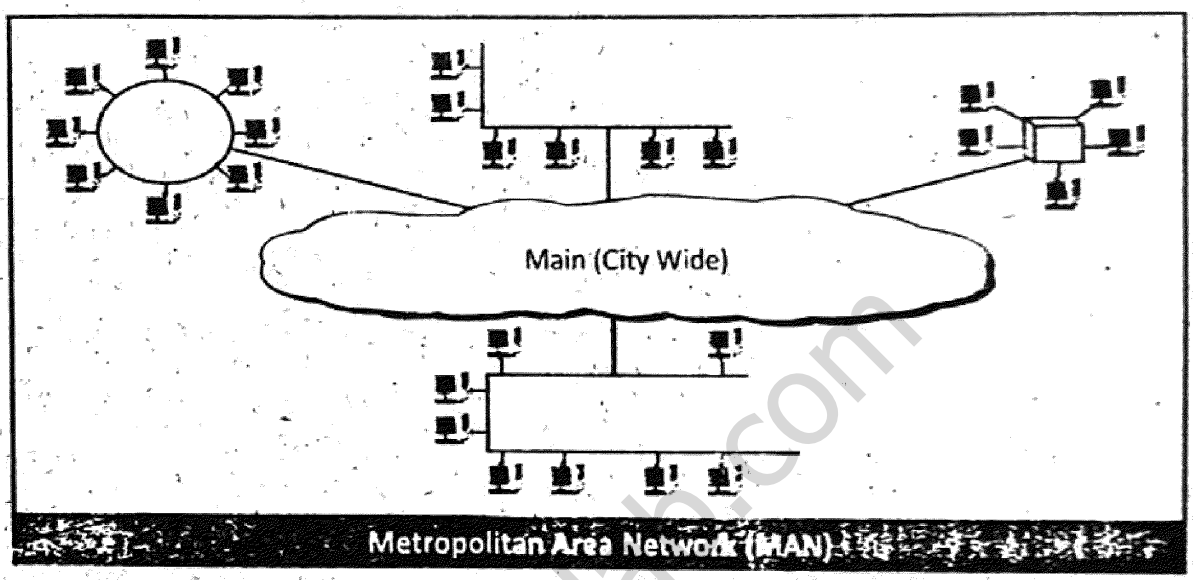
- FDDI stands for Fiber Distributed Data Interface.



2. MAN (Metropolitan Area Network):

Introduction: A metropolitan area network (MAN) is a computer network that usually spans a city or in a large metropolitan area.

Explanation: MAN usually interconnects a number of local area networks (LANs) using a high-capacity backbone technology. Metropolitan area network connects multiple geographically nearby LANs to one another. Recent use of MAN technology has been the rapid development of cellular phone systems.

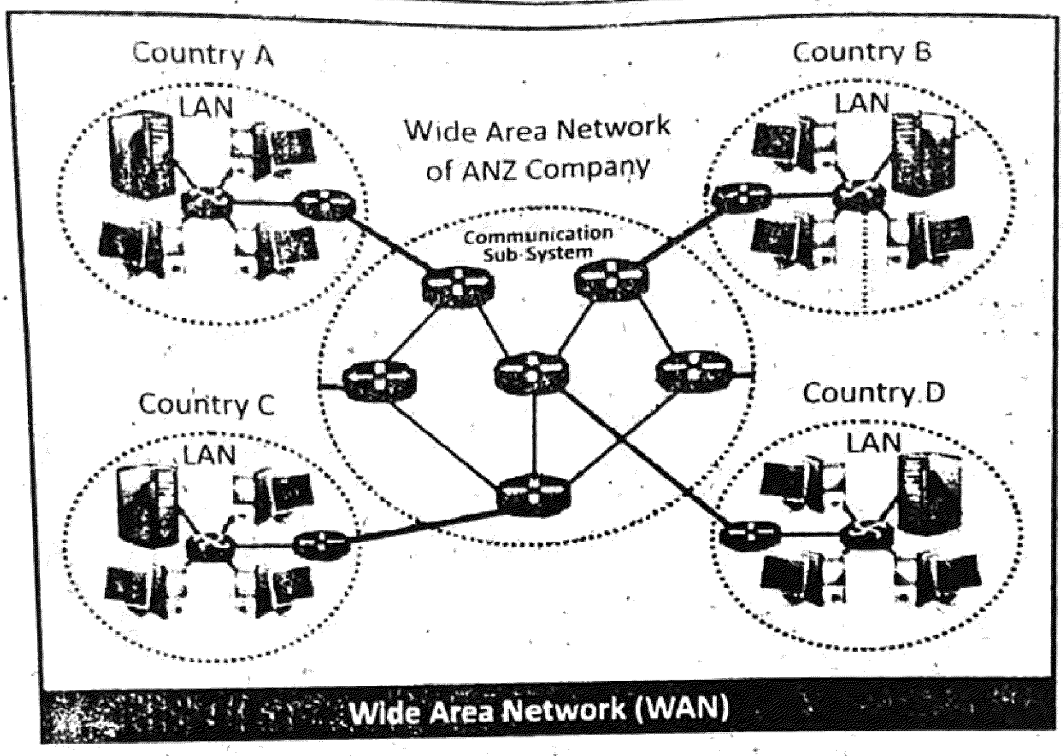


Metropolitan Area Network (MAN)

3. WAN (Wide Area Network):

WAN (Wide Area Network) covers large distance for communication between computes. It connects several sites of an organization across cities, countries and continents. It interconnects many LANs and MANs. WAN uses fiber optics, microwaves and satellites technology for communication.

For example: Nationwide ATM (Automated Teller Machines) used in banking represent a common application of a wide area network. The most well-known WAN is the internet, which may cover the entire globe.



Wide Area Network (WAN)

4. VPN (Virtual Private Network):

Introduction: VPN (Virtual Private Network) is a computer network that provides remote access to individuals and offices to their organization's networks.

Uses: It provides cheap communication by using public telecommunication infrastructure such as internet instead or expensive leased lines.

Advantages:

1. The goal of a VPN is to provide the organization with the same capabilities, but at a much lower cost.
2. A VPN works by using the shared public infrastructure while maintaining privacy through security procedures.
3. Large corporations, educational institutions, and government agencies use VPN technology to enable remote users to securely connect to a private network. In order to gain access to the private network, a user must be authenticated using a unique identification and a password.

Q10: Define network topology and explain its types.

Answer:

Network Topologies: The arrangement of network nodes and connections between them is called the network's topology. A

node represents any device on the network. (OR)
Network topology refers to the physical layout and connectivity of computers in a network.

Types of Network Topologies:

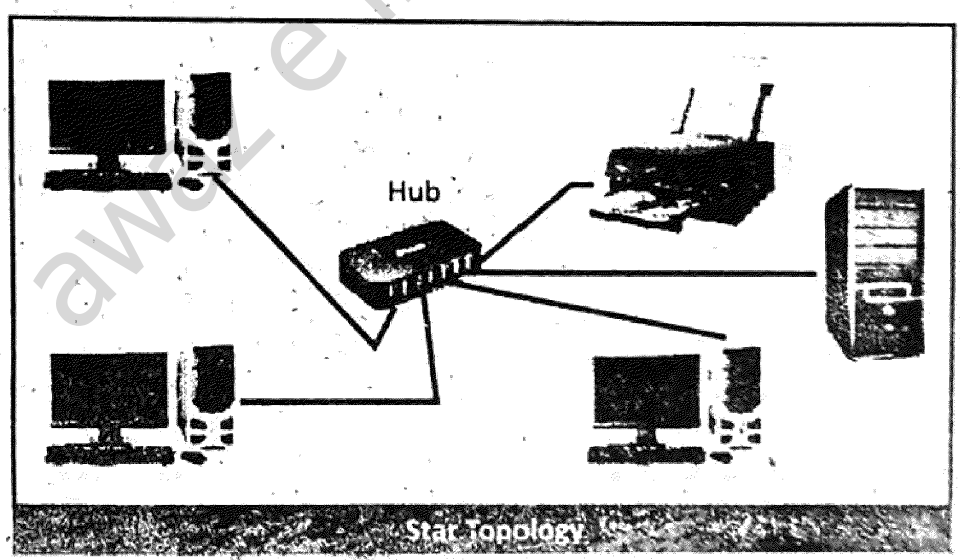
1. Star Topology
2. Ring Topology
3. Bus Topology
4. Mesh Topology

3. Star Topology:

In a star topology all the nodes (server, workstations, peripherals) on the network are connected directly to a centralized connectivity device called a hub, switch, or router. Each computer is connected with its own cable to a port on the hub. Data on a star network passes through the hub, switch, or router before continuing to its destination. The hub, switch, or router manages and controls all functions of the network.

Advantages of Star Topology:

1. It is easier to add new node or modify any existing node without disturbing network i.e. expansion is easier.
2. Addition of new node does not increase communication delay (تاخیر).
3. If any local computer or link fails, the entire system does not collapse. Only that link or computer is affected.
3. It is easy to find device and cable problems i.e. fault identification and isolation is easier.
4. Media faults (غلطیاں) are automatically isolated to the failed segment.



Disadvantages of Star Topology:

1. If the central controller or hub fails, entire system collapses.
2. It requires more cable than other topologies because each node is connected individually to the hub.
3. It is more expensive than linear bus topologies, because of the cost of hubs.
4. It is moderately (میڈیم) difficult to install.

2. Ring Topology:

The physical Ring Topology is a circular loop of point-to-point links. Each device connects directly to the ring or indirectly through and interface device or drop cable. Message travel around the ring from node to node in a very organized manner. Each workstation checks the message for a matching destination address. If the address doesn't match the node, simply regenerates the message and sends it on its way. If the address matches, the node accepts the message and sends a reply to the originating sender.

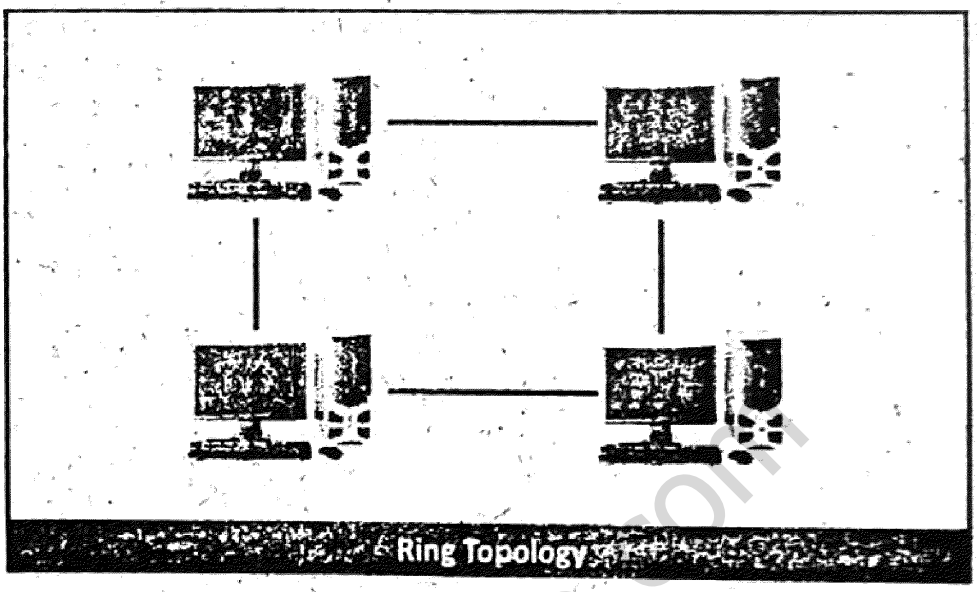
Advantages of Ring Topology:

1. Its performance is better than bus topology in case of load on network.
2. Its implementation (لاگو کرنا/ تکمیل) is less expensive.
3. There is no need for network server to control the connectivity between workstations.
4. Addition of new computers do not affect the performance of network.
5. Each computer has equal access to resources.
6. It is easier to locate the problems with device and cable i.e. fault isolation is simplified.

Disadvantages of Ring Topology:

1. A ring network requires more cable than a bus network.
2. If the ring is broken at any point, the entire network goes down.

3. In ring topology adding or removing the node disturbs the network activity.
4. Ring network, communication delay is directly proportional to the number of nodes in the network. Hence addition of new nodes in the network also increases communication delay.
5. Its troubleshoot is difficult.
6. It depends highly on the wire which is connected to various components.



Ring Topology

3. Bus Topology:

The physical Bus Network Topology is the simplest and most widely used of the network designs. It consists of one continuous length of cable (trunk) that is shared by all the nodes in the network and a terminator at each end of cable. Terminator absorbs the signal when it reaches the end of line. Without a terminator the electrical signal would reach the end of copper wire and bounce back, causing errors on the network.

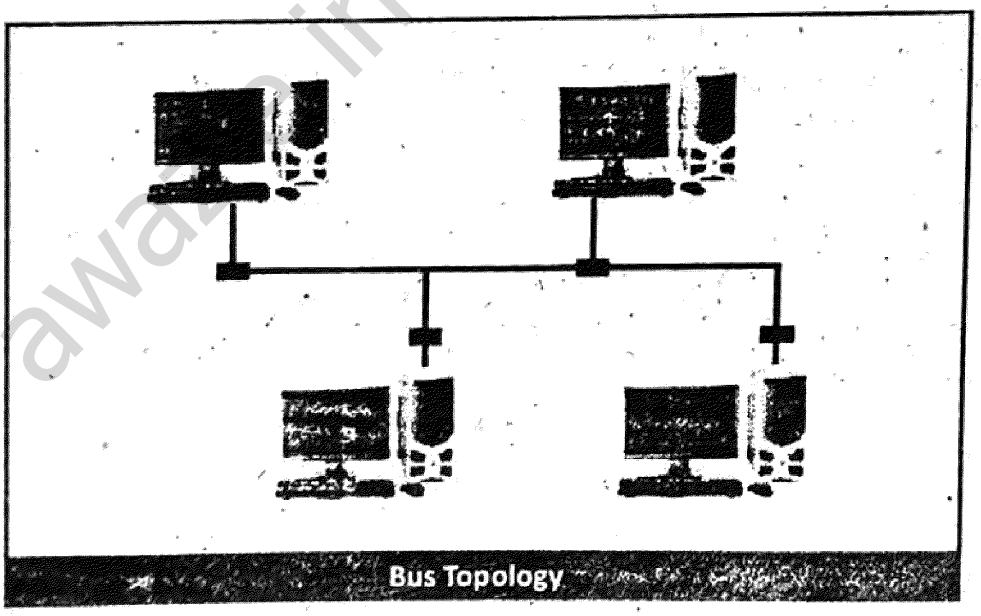
Data communication message travels along the bus in both directions until it is picked up by a workstation or server NIC. If the message is missed or not recognized, it reaches the end of cable and absorbs by terminator. Bus network typically uses coaxial networking cable hooked into each computer using a T-connector.

Advantages of Bus Topology:

1. Bus topology costs very less.
2. It is easy to connect a computer or peripheral device to the network.
3. It requires less cable length than a other topologies, so it is less expensive.
4. It is easy to set-up and extend bus network.
5. Linear bus network is mostly used in small networks.
6. Failure of one node does not affect the network functioning.

Disadvantages of Bus Topology:

1. If the main central line fails, the entire network collapses.
2. The bus networks are difficult to reconfigure, especially when the acceptable number of connections or maximum distances have been reached.
3. They are also difficult to troubleshoot because everything happens on a single media segment.
4. Sharing a single communication channel results in slower access time.
5. In this topology, higher network traffic slows down the bus speed.
6. Proper termination is required to dump signals. Use of terminators is must.
7. It is difficult to detect and troubleshoot fault at individual station.



Bus Topology

4. Mesh Topology:

In Mesh Topology, each node is connected to every other node in the network i.e. each node has a dedicated point to point link to every other node as shown in figure. Dedicated means that the link carries the traffic only between two connected devices.

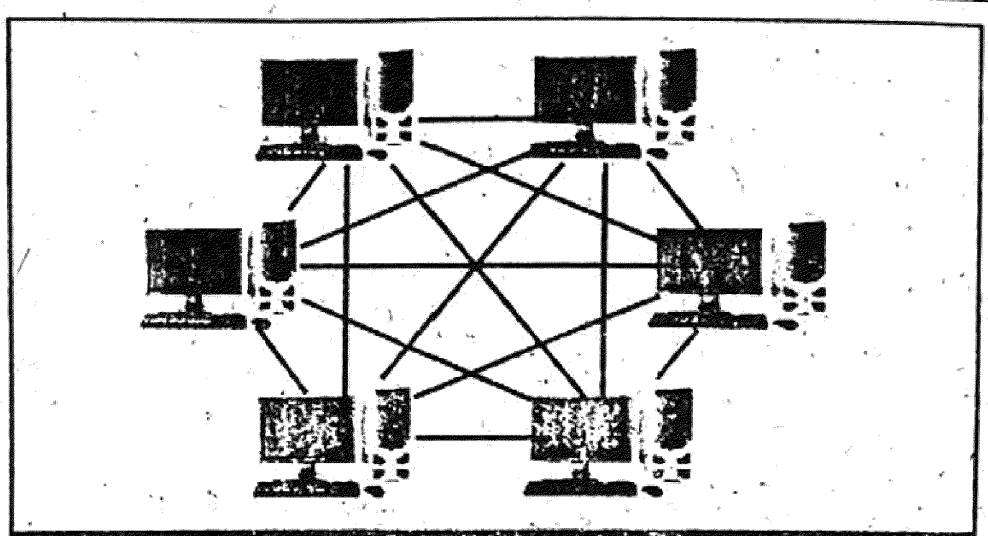
In this way there exist multiple paths between two nodes of the network. In case of failure of one path, the other one can be used. It is commonly used in wireless networks. Flooding or routing technique is used in mesh topology.

Advantages of Mesh Topology:

1. It is robust (مضبوط) as the failure of one node does not collapse (گر پڑنا) the entire system. If one link fails, the entire system continues to work.
2. There is no traffic congestion (بھیڑ) problem as dedicated links are being used.
3. In this network, dedicated links ensure faster transmission without any delay.
4. In this topology, dedicated links also ensure data privacy and security.
5. In this network, point to point links makes fault identification and isolation easier.
6. It is the most reliable (قابل اعتماد) network topology.

Disadvantages of Mesh Topology:

1. Connecting each device to every other device in the network makes installation and reconfiguration difficult.
2. It has high cabling cost as every links are required to connect to nodes.
3. Installation and reconfiguration in star topology is very difficult because each device should be connected to other device in the network.
4. It requires high cost as compared to other network topologies.
5. Its setup and maintenance (دیکھ بھال) is very difficult.



Mesh topology

Q1: Describe the seven layers of OSI model.

Answer: Seven Layers of OSI Model:

Introduction: The international standards organization (ISO) developed standards for international data communications. ISO developed a standard model of a data communication system and called it the Open Systems Interconnection (OSI) model.

Explanation:

The OSI model consists of seven layers. Each layer performs a specific task during data communication.

In OSI model, control is passed from one layer to the next, starting at the application layer in one station and proceeding to the bottom layer (the physical layer), over the physical link to the next station and back up to the application layer.

Seven Layers of OSI Model:

The OSI model divides communications into seven different layers, where each include multiple hardware standards, protocols, or, other types of services. The OSI model has following seven layers:

1. Layer 7 – Application layer
2. Layer 6 – Presentation layer
3. Layer 5 – Session layer

4. Layer 4 – Transport layer
5. Layer 3 – Network layer
6. Layer 2 – Data link layer
7. Layer 1 – Physical layer

Layer-7: Application Layer:

The application layer serves as the user interface for users and application processes to access network services. The application layer is responsible for displaying data and images to the user in a human recognizable format. It provides an interface with the presentation layer.

Functions of Application Layer:

- Resource sharing and device redirection.
- Remote file access.
- Remote printer access.
- Inter-process communication.
- Network management.
- Directory services.
- Electronic messaging (such as mail).

Layer-6: Presentation Layer:

The presentation layer converts incoming and outgoing data from one presentation format to another for example, from a text stream into a popup window with the newly arrived text. The presentation layer is sometimes called as the syntax layer. It can be viewed as the translator for the network.

Functions of Presentation Layer:

- Character Code Translation: for example, ASCII to EBCDIC.
- Data Conversion: bit order, integer-floating point, and so on.
- Data Compression: reduces the number of bits that need to be transmitted on the network.
- Data Encryption: encrypt data for security purposes. For example, password encryption.

Layer-5: Session Layer:

Session Definition: Session Layer has the primary responsibility of beginning, maintaining and ending the communication between two devices, which is called Session.

The session layer sets up, coordinates, and terminates conversations, exchanges, and dialogues between the applications running on different stations. It provides:

- Session establishment, maintenance and termination.
- It performs the functions that allow these processes to communicate over the network, performing security, name recognition, logging.

Functions of Session Layer: This layer provides:

- Session Establishment
- Maintenance
- Termination
- Session Support
- Dialog Control
- Security performance

Layer-4: Transport Layer:

Transport layer handles the transparent transport of data segments between network devices. It is responsible for flow control, error control, data segmentation, and communication reliability. The transport layer ensures that messages are delivered error-free, in sequence, and with no losses or duplications.

Functions of Transport Layer:

Transport layer has the following functions:

- Segmentation of message into packet and reassembles then packets into message at destination station.
- Message acknowledgment
- Message traffic control
- Service point addressing
- Provides flow control and error recovery mechanism.
- Provides connectionless oriented packet delivery.

- Tells the transmitting station to "back OFF" when no message buffers are available.

Layer-3: Network Layer:

Network layer allows the data called packets or datagram to go from one physical network to another. This layer also has its own network logical address, so that devices can communicate with other devices across multiple networks. Therefore, it is also responsible for path determination. The network layer establishes the route between the sender and receiver across switching points, which are typically routers.

Functions of Network Layer:

- Translates logical addresses, or names, into physical addresses.
- Manages the connectivity and routing between hosts or networks.
- Determines how data are transferred between network devices.
- Routes packets according to unique network device addresses.
- Provides flow and congestion control.
- Responsible for addressing determining for sending and managing network problems.

Layer-2: Data Link Layer:

It is responsible for reliable node-to-node delivery of data. It receives the data from network layer and creates frames, add physical address to these frames and pass them to physical layer.

The data link layer provides error-free transfer of data frames from one node to another over the physical layer, allowing layers above it to assume virtually error-free transmission over the link. Data Link layer defines the format of data on the network. A network data frame, packet, includes checksum, source and destination address, and data.

Sub-Layers: Data link layer consists of two sub-layers:

1. Logical Link Control (LLC) sublayer
2. Medium Access Control (MAC) sublayer

Functions of Data Link Layer:

Data link layer has the following functions:

- Physical addressing
- Frame Traffic Control
- Frame Sequencing
- Frame Acknowledgment
- Frame Error Checking
- Flow control
- Error control
- Bit ordering
- Concerned with network topology

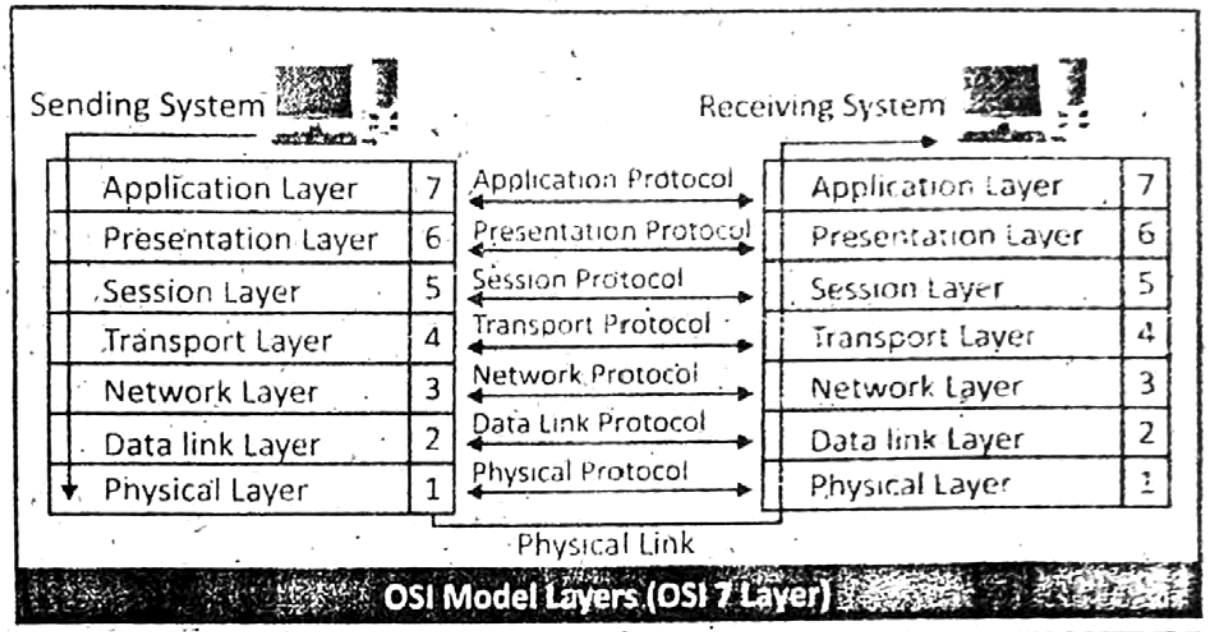
Layer-1: Physical Layer:

The physical layer, the lowest layer of the OSI model, is concerned with the transmission and reception of the unstructured raw bit stream over a physical medium. It describes the electrical/optical, mechanical, and functional interfaces to the physical medium, and carries the signals for all of the higher layers.

Functions of Physical Layer:

It provides the following functions:

- Defines physical means of sending data over network devices.
- Defines the characteristics of the physical medium.
- Transmission and receipt of data from the physical medium is managed at this layer.
- Interfaces between network medium and devices.
- Defines optical, electrical and mechanical characteristics.
- Conversion of the raw bit stream into electrical impulse, light or radio signals.
- Manages the encoding and decoding of data.
- Determines whether the encoded bits will be transmitted by baseband (digital) or broadband (analog) signaling.



OSI Model Layers (OSI 7 Layer)

Q12: What are examples of devices and protocols implementation in OSI model?

Answer: The following are some common network devices and protocols and where they are implemented in the OSI model:

OSI Layer	Devices	Protocols
Application Layer 7	Gateway	SNMP, SMTP, FTP, TELNET, HTTP, NCP, SMB, AppleTalk, FTAM, X.400, X.500, DAP, DNS
Presentation Layer 6	Gateway	NCP, AFP, TDI, XDR, SSL, ISO, 8823 TLS, PAP, X.226
Session Layer 5	Gateway	NetBIOS, ASP, ADSP, ZIP, ISO, 8327, X.225, SAP, SDP
Transport Layer 4	Gateway	NetBEUI, TCP, SPX, NW link, UDP, RTP, SCTP, TP0, TP1, TP2, TP3, TP4, OSPF, SPX, RIP, ATP, NBP, AEP, RTMP
Network Layer 3	Routers, layer 3 (or IP) switches	IP, IPX, NWlink, NetBEUI, ICMP, Ipsec, ARP, RIP, BGP, X.25 (PLP), CLNP, DDP, IGRP

Data link Layer 2	Bridges and switches, ethernet incorporates both this layer and the physical layer.	X.25 (LAPB., Token Bus, IEEE 802.3 framing, Ethernet II framing, LocalTalk, TokenTalk, EtherTalk, Apple Remote Access, PPP, HDLC, Q.921
Physical Layer 1	Hubs, repeaters, network adapters, parallel SCSI buses, various physical-layers ethernet incorporates both this layer and the data-link layer. Token ring, FDDI, and IEEE 802.11	X.25 (X.21bis), EIA/TIA-232, EIA/TIA-449, EIA-530, G.703

Q.13: What is TCP/IP? Explain TCP/IP protocol suite.

Answer:

TCP/IP: TCP/IP stands for transmission control protocol/internet protocol.

Protocol Suite:

A protocol suite is a group of protocols that all work together to allow software or hardware to perform a function. The TCP/IP protocol suite is a good example of it.

Three Important Points of TCP/IP Protocol Suite:

TCP/IP protocol suite is associated with three important points:

1. TCP/IP Architecture
2. TCP/IP Ports
3. TCP/IP Applications

1: TCP/IP Architecture:

TCP/IP protocol suit consists of a layered architecture. Each

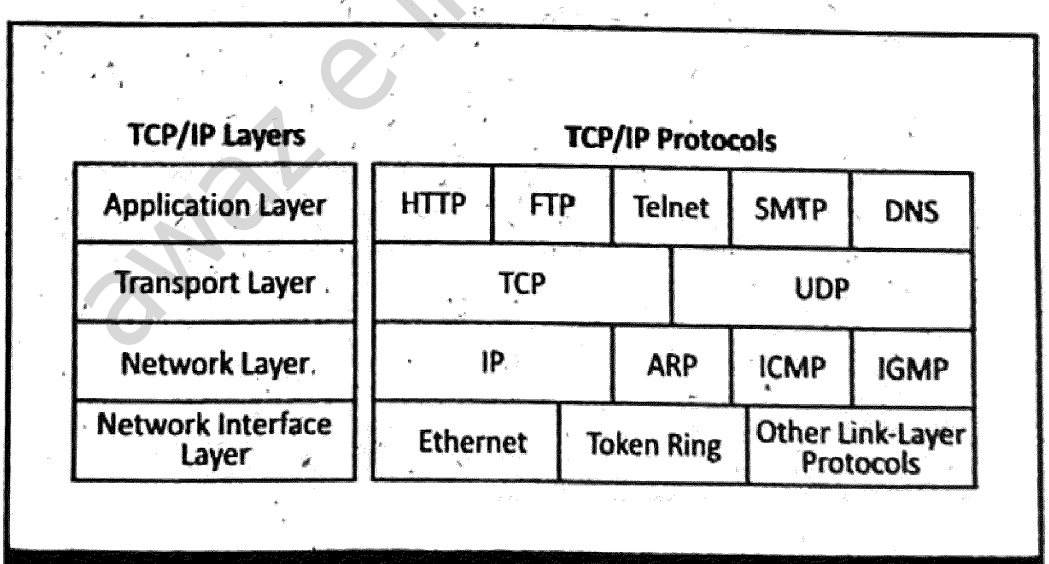
layer usually has more than one protocol options. It is named from two of the most important protocols in it. That is transmission control protocol and internet protocol. TCP/IP is normally considered to be a 4 layer system. These layers are:

(i) Application Layer: This is the top layer of TCP/IP protocol suite. This layer deals with application network processes. These processes include FTP (File Transfer Protocol), HTTP (Hypertext Transfer Protocol), and SMTP (Simple Mail Transfer Protocol).

(ii) Transport Layer: The transport layer provides the means for the transport of data segments across the internet. The transport layer is concerned with host-to-host communication and provides reliable, connection-oriented transport of data between two endpoints (sockets) on two computers.

(iii) Internet Layer: The internet layer provides a global logical addressing scheme, a packetization of data, data destination and connectivity between networks. The main protocol used at this layer is IP.

(iv) Network Access Layer: The network access layer provides access to the physical network. The data is transmitted and received across the physical network in network access layer. This layer combines the physical and data link layers and routes the data between devices on the same network.



The Architecture of the TCP/IP Protocol Suite

2. TCI /IP Ports:

Every computer or device on the internet must have a unique number assigned to it called the IP address. This IP address is used to recognize each particular computer out of the millions of other computers connected to the internet. The information sent over the internet to a particular computer is received by using TCP or UDP ports.

Total TCP/IP Ports: There are a total of 65,535 TCP ports and another 65,535 UDP ports. The Internet Assigned Numbers Authority (IANA) is responsible for assigning TCP and UDP port numbers to specific uses.

Port 23 is used for telnet services, HTTP uses port 80 for providing web browsing service and FTP servers use TCP ports 20 and 21 to send and receive information.

Ranges: The port numbers are divided into three ranges:

Well-Known Port Numbers:

Well-known ports (0-1023) are used for the major internet applications, such as web and e-mail. They have range 0-1023.

Registered Port Numbers:

Registered ports are assigned to applications that are mostly vendor specific, such as Skype and BitTorrent. They have range 1024-49151.

Dynamic Port Numbers:

The dynamic and/or private ports are those in the range 49152-65535. These ports are not used by any defined application.

3. TCP/IP Applications:

TCP/IP application protocols were designed to access and transfer data between dissimilar systems. These protocols include HTTP, FTP, and Telnet. TCP/IP provides a robust, scalable, cross-platform client/server framework.

Uses of TCP/IP: The TCP/IP is used by the following applications:

1. Web browsers (Internet Explorer, Firefox, Safari, Opera etc.)
2. Web servers

3. File servers
4. Terminal servers
5. Online games
6. File transfer applications (WS-FTP etc.)
7. Microsoft Windows update
8. Anti-Virus applications

Q14: What are three common TCP/IP protocols?

Answer: Three Most Common TCP/IP Protocols are:

1. **HTTP:** HTTP stands for Hypertext Transfer Protocol. It is used between a web server, for non-secure data transmissions. A web client (i.e., internet browser on a computer) sends a request to a web server to view a web page. The web server receives that request and sends the web page information back to the web client.

2. **HTTPS:** HTTPS stands for Hypertext Transfer Protocol Secure. It is used between a web client and a web server, for secure data transmissions. Often used for sending credit card transaction data or private data from a web client (i.e., Internet browser on a computer) to a web server.

3. **FTP:** FTP stands for File Transfer Protocol. It is used between two or more computers. One computer sends data to or receives data from another computer directly.

Q15: Explain various classes of IP addresses.

Answer: IP Address:

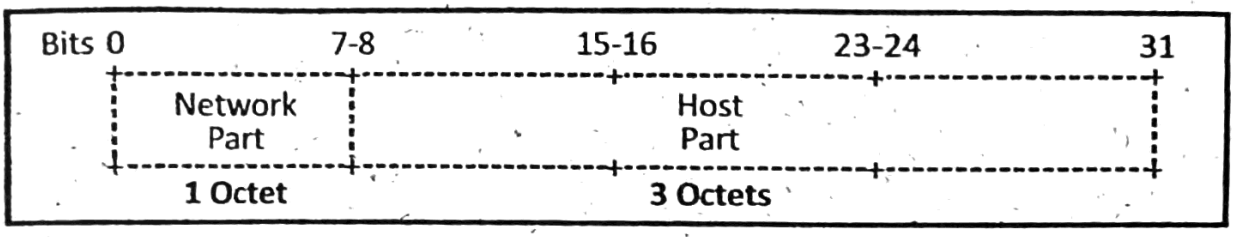
An internet protocol address (IP address) is a number that is used to identify on the network. Each device on a network must have a unique IP address to communicate with other network devices. A host (usually a computer) is a device that sends or receives information on the network. These devices include hubs, switches and routers.

Classes of IP Addresses:

There are five different classes of an IP address from A to E.

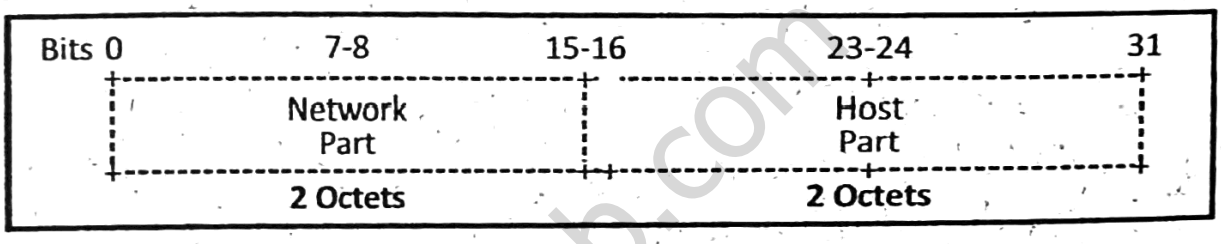
Class A Address:

Class A networks use a default subnet mask of 255.0.0.0 and have 0-126 as their first octet. The address **10.52.36.11** is a class A address. Its first octet is 10, which is between 1 and 126, inclusive.



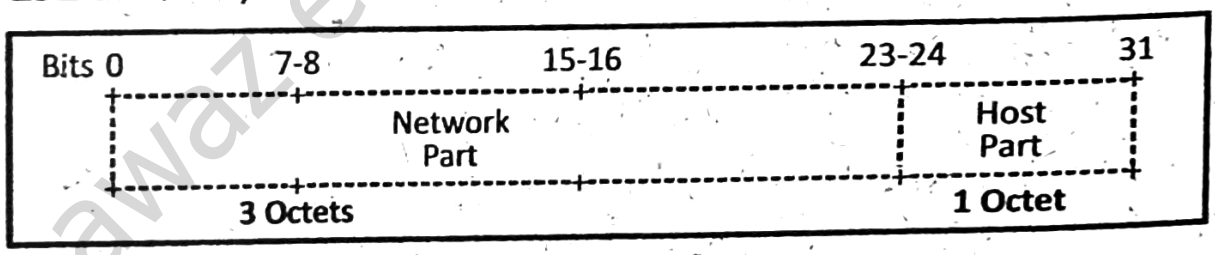
Class B Address:

Class B networks use a default subnet mask of 255.255.0.0 and have 128-191 as their first octet. The address **172.16.52.63** is a class B address. Its first octet is 172, which is between 1285 and 191, inclusive.



Class C Address:

Class C networks use a default subnet mask of 255.255.255.0 and have 192-223 as their first octet. The address **192.168.123.132** is a class C address. Its first octet is 192, which is between 192 and 223, inclusive.



Class D Address:

Class D is for special use for multicasting. The binary addresses for the class D starts with 1110 and the IP address ranges from 224 to 239. An example of the class D IP address is **230.150.110. 11.**

Class E Address:

Class E is under experimental research. The binary address can

start with 1111 and the decimal can be in range from 240 to 255. An example of the class E IP address is **245.101.110.110**.

Q16: Explain briefly subnet masks.

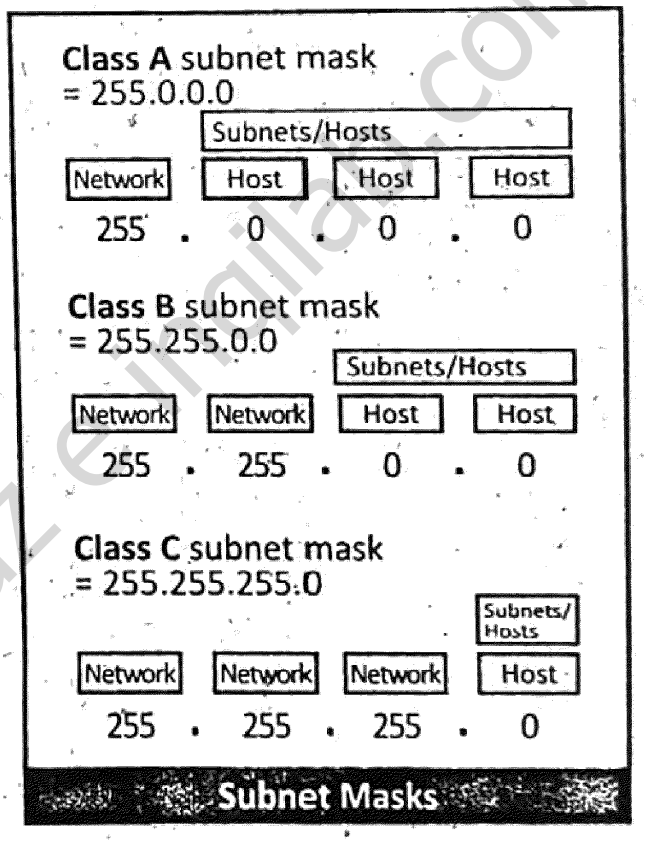
Answer: Subnet Mask:

Subnet mask indicates the network portion of an IP address.

Explanation: Like the IP address, the subnet mask is a dotted-decimal number. Usually all hosts within a LAN use the same subnet mask. Subnet mask is a 32-bit combination used to describe which portion of an address refers to the subnet and which part refers to the host.

Default Subnet Masks:

Figure shows default subnet masks for usable IP addresses that are mapped to the first three classes of IP addresses such as Class A subnet mask, Class B subnet mask and Class C subnet mask.



EXERCISE MCQS

Q#1 Select the best choice for the following MCQs.

1. A collection of two or more connected computers to share the resources and data is called a_____
   a. Route b. Network
   c. Path d. Medium
2. In which communication mode data can be sent and received in both directions but not at the same time?
   a. Simplex b. Full-duplex
   c. Half-duplex d. Duplex
3. _____is the data or information that is to be communicated over the network.
   a. Message b. Sender
   c. Medium d. Receiver
4. _____is a set of rules that governs data communications.
   a. Message b. Sender
   c. Medium d. Protocol
5. In _____mode, both stations can send and receive the data simultaneously.
   a. Simplex b. Full-duplex
   c. Half-duplex d. Duplex
6. In which type of transmission data is transmitted one byte at a "time".
   a. Simplex b. Synchronous
   c. Asynchronous d. Duplex
7. _____cable is formed of two insulated copper wires twisted together.
   a. Coaxial b. Fiber Optic
   c. CAT5 d. Twisted Pair
8. Which of the following network devices is used to forward data packets across different networks?
   a. Switch b. Router

c. Gateway d. Modem

9. In _____networking there are no dedicated servers or hierarchy among the computers.
   a. Peer-to-Peer b. Server
   c. LAN d. WAN

10. _____works by using the shared public infrastructure while maintaining privacy through security procedures.
   a. LAN b. WAN
   c. VPN d. MAN

11. Which of the following topology is most expensive to implement?
   a. Star Topology b. Bus Topology
   c. Ring Topology d. Mesh Topology

12. How many layers does the OSI model consist of?
   a. 4 b. 5
   c. 8 d. 7

13. Which layer of OSI model decides which physical path-way the data should take to reach to the destination?
   a. Data Link Layer b. Transport Layer
   c. Network Layer d. Session Layer

14. Which layer performs security, name recognition, logging and similar functions?
   a. Transport Layer b. Presentation Layer
   c. Network Layer d. Session Layer

15. In _____topology, each node (computer, server, peripheral etc.) attaches to a common cable.
   a. Star b. Tree
   c. Ring d. Mesh

Answers:

1	2	3	4	5	6	7	8
b	c	a	d	b	c	d	b
9	**10**	**11**	**12**	**13**	**14**	**15**	
a	c	d	d	c	d	b	

Short Questions

Q2: Give short answers to the following questions.

Q:i. Show all the modes of data communication with the help of a diagram.

Answer:

Modes of Data Communication:

The way in which data or information is transmitted from one place to another is called data communication mode. (OR) Modes of data transmission refer to the methods or ways information is transmitted from one place to another.

1. Simplex:

A Simplex Communication channel only sends information in one direction, so it is also called one-way transmission or unidirectional mode.

Examples:

i. Communication from a central computer to a dumb terminal.
ii. Data send to an electronic notice board in train stations and airports.

2. Half Duplex:

In Half Duplex mode, each station can both transmit and receive data, but not at the same time. Each end of the communications link acts as sender and receiver.

Examples:

i. Walkie-Talkies is a typical example of half-duplex made of communication.
ii. Communication between a computer and credit card machine.

3. Full duplex:

In full duplex mode, both stations can send and receive the data simultaneously. It is the fastest bi-directional mode of

communication.

Examples:

Communication through telephone or mobile, both person can talk at same time.

4. Synchronous Transmission:

In synchronous transmission, large volumes of information can be transmitted at a time. in this type of transmission, data is transmitted block-by-block or word-by-word simultaneously. Each block may contain several bytes of data. Synchronous transmission requires that both the sending and receiving devices be synchronized before data is transmitted.

Examples:

i. Face-to-face interactions
ii. Telephonic conversations
iii. Video conferencing and chatrooms

5. Asynchronous Transmission:

In asynchronous transmission, data is transmitted one byte at a time. The data is transmitted character-by-character and does not occur at regular intervals. A sending device can transmit bytes at any time, and the receiving device must be ready to accept them as they arrive. The timing of the signal is not important in this type of transmission. Therefore, this type of transmission is relatively slow.

Q:ii. Differentiate between synchronous and asynchronous transmission.

Answer:

Synchronous	Asynchronous
1. Data is transmitted at regular time period.	**1.** Data is transmitted at irregular time period.
2. Multiple characters are transmitted at a time.	**2.** Single character is transmitted at a time.
3. No error checking is involved.	**3.** Error checking is involved .

4. Suitable for long-range transmission.	5. Not suitable for long-range transmission.
5. No use of start and stop bits.	5. Use of start and stop bits.
6. Data transmission speed is faster.	6. Data transmission speed is slower.

Q:iii. Differentiate between synchronous and asynchronous

Answer:

Guided Media	Unguided Media
1. Wire is the medium for data transmission.	1. Air is the medium for data transmission.
2. Everyone can't receive data without wire connection.	2. Everyone can receive data without wire connection.
3. Less expensive way of data transmission.	3. More expensive way of data transmission.
4. Suitable for short range data transmission.	4. Suitable for long range data transmission.
5. Data transmitted in the form of current.	5. Data transmitted in the form of waves.
6. **Examples are:** Twisted Pair Cable, Coaxial Cable and Fiber Optic Cable .	6. **Examples are:** Radio Waves, Micro Waves and Infrared Waves

Q:iv. Differentiate between LAN and WAN.

Answer:

LAN (Local Area Network)	WAN (Wide Area Network)
1. LAN is a computer network that covers small area like a home, office or colleges etc..	1. WAN is a computer network that covers a broad area.
2. Data transfer speed is very fast in LAN (up to 1000 Mbps).	2. Data transfer speed is slow in WAN (up to 150 Mbps).
3. LAN is used to share files and hardware like printers.	3. Used to share only data and information i.e. e-mail and files
4. LAN is less expensive.	4. WAN is more expensive.
5. LAN faces less data	5. WAN faces more data

transmission errors.	transmission errors
6. The best examples for a LAN is the network in organization.	**6.** The best examples for a WAN is the internet

Q:v. What is OSI model?

Answer: OSI Model:

Introduction: The international standards organization (ISO) based in Geneva, developed standards for international and national data communications. In the early 1970s, ISO developed a standard model of a data communication system and called it the Open Systems Interconnection (OSI) model.

Explanation:

The OSI model consists of seven layers. Each layer performs a specific task during data communication.

In OSI model, control is passed from one layer to the next, starting at the application layer in one station and proceeding to the bottom layer (the physical layer), over the physical link to the next station and back up to the application layer.

Seven Layers of OSI Model:

The seven layers of OSI model are below:

1. Layer 7 – Application layer
2. Layer 6 – Presentation layer
3. Layer 5 – Session layer
4. Layer 4 – Transport layer
5. Layer 3 – Network layer
6. Layer 2 – Data link layer
7. Layer 1 – Physical layer

Q:vi. Compare TCP/IP model with OSI model.

Answer:

OSI (Open System Interconnection)	TCP/IP (Transmission Control Protocol/Internet Protocol)
1. OSI is a generic, protocol	**1.** TCP/IP model is based on

independent standard, acting as a communication gateway between the network and end user.	standard protocols around which the Internet has develoed. It is a communication protocol, which allows connection of hosts over a network.
2. In OSI model the transport layer guarantees the delivery of packets.	**2.** Transport layer does not guarantee delivery of packets. Still the TCP/IP model is more reliable.
3. OSI model has a separate Presentation layer and Session layer.	**3.** TCP/IP does not have a separate Presentation layer or Session layer.
4. OSI is a reference model used as a guidance tool.	**4.** TCP/IP model is an implementation of the OSI model.
5. Network layer of OSI model provides both connection oriented and connectionless service.	**5.** The Network layer in TCP/IP model provides connectionless service.
6. OSI model is layer based model.	**6.** The TCP/IP suit is based on protocols.
7. OSI is a theoretical model which is used for computing system.	**7.** TCP/IP is client server model used for transmission of data over the internet.
8. OSI model defines services, interfaces and protocols very clearly and makes clear distinction between them. It is protocol independent.	**8.** In TCP/IP, services, interfaces and protocols are not clearly separated. It is also protocol dependent.
9. It has 7 layers.	**9.** It has 4 layers.
10. It was developed by ISO (International Standard Organization)	**10.** It was developed by US department of Defense (DoD).

Q:vii. Differentiate between circuit switching and packet switching networks.

Answer:

Circuit Switching Networks	Packet Switching Networks
1. It is connection oriented and may also be connection less service.	**1.** It is commonly connection less service.
2. It is costly.	**2.** It is less expensive.
3. This type of switching is fast and facing no errors.	**3.** This type of switching faces errors as a result connection is slow.
4. It is best used for transmission of audio signals only.	**4.** It is best used for sending data and audio and video signals in the form of packets.
5. It has fixed bandwidth allocation.	**5.** It has dynamic bandwidth allocation.
6. In this type of network, a physical connection must established through the network.	**6.** In this type of network no physical connection is established between two subscribers.
7. This concept is mainly used in telephony system.	**7.** This can be used for telephony DSL services and other data transmission services.
8. Example is Telephone system, PBX.	**8.** Example is Internet.

Q:viii. Briefly described IP addressing.

Answer:

Answer: IP Addressing:

Definition-1: An internet protocol address (IP address) is a number that is used to identify a device, for example a computer, a printer, etc. on the network.

Definition-2: An IP address is a 32-bit number that uniquely identifies a host (computer or other device, such as a printer or

router) on a TCP/IP network.

Explanation:

An internet protocol address (IP address) is a number that is used to identify on the network. Each device on a network must have a unique IP address to communicate with other network devices. A host (usually a computer) is a device that sends or receives information on the network. These devices include hubs, switches and routers.

Part of IP Address: IP addresses have two parts. The first part identifies the network to which the computers are connected and the second part identifies the computers or hosts on the given network.

Network Number	Computer/Host Number

All the computers on a given network share the same network number but must have a unique computer/host number. Similarly, any two computers on different networks must have different network number but may have the same computer/ host number.

Number of Bits in IP Address: An IP address is made up of 32 bits. The 32 bits are broken down into four octets. One octet is 8 bits. Each octet is converted to decimal and separated by a dot. Therefore, an IP address is expressed in dotted-decimal format.

Example:

The following IP address is an example which shows an IP address represented in both binary and decimal formats.

00001010.00000001.00010111.00010011 (Binary)
10. 1. 23. 19 (Decimal)

These octets can be broken down to provide an addressing scheme that can support/accommodate large and small networks.

Detailed Questions

Q3: Give detailed answers to the following questions.

i. Explain various modes of data communication.

Answer: See Question # **2**, Page # **132**

ii. What is guided media? Explain different types of guided media.

Answer: See Question # **3**, Page # **136**

iii. Explain radio wave and microwave communications.

Answer: See Question # **4**, Page # **139**

iv. Write notes on switch, router and gateway.

Answer: See Question # **7**, Page # **143**

v. Explain in detail Client/Server and Peer-to-Peer networks.

Answer: See Question # **8**, Page # **144**

vi. Define network topology and explain its types.

Answer: See Question # **10**, Page # **150**

vii. Describe the seven layers of OSI Model.

Answer: See Question # **11**, Page # **156**

viii. What is TCP/IP? Explain TCP/IP protocol suite.

Answer: See Question # **13**, Page # **162**

Additional MCQs

Q: Select the best answer for the following MCQs.

1. _____of the following is the smallest computer.
   a. Mainframe b. Minicomputer
   c. Microcomputer d. Supercomputer
2. How many instructions per second a minicomputer can execute?
   a. Thousands of instructions
   b. Millions of instructions
   c. Billions of instructions
   d. Above trillion instructions
3. What type of software MS Word is?
   a. System software **b. Application software**
   c. Utility software d. Language software
4. _____device is most suitable for playing games.
   a. Mouse b. Keyboard
   c. Joystick d. Light pen
5. Which of the following is an impact printer?
   a. Dot matrix printer b. Laser printer
   c. Ink-jet printer d. Plotter
6. _____software controls the operation of a hardware device.
   a. Utility software b. Language processor
   c. Application software **d. Device driver**
7. Which of the following devices is used to print large size hard copy?
   a. Plotter b. Ink-jet printer
   c. Laser printer d. Chain printer
8. Which of the following devices converts spoken words into electrical form?
   a. Touch pad **b. Microphone**
   c. Scanner d. Digital camera
9. _____software converts computer programs to

machine language.

a. Utility program b. Device driver
c. Language processor d. Application software

10. Which of the following is productivity software?
a. Spreadsheet software b. Utility software
c. Windows 7 d. Compiler

11. Which of the following transmission directions listed is not a legitimate channel?
a. Simplex b. Half duplex
c. Full duplex **d. Double duplex**

12. What kind of transmission medium is most appropriate to carry data in a computer network that is exposed to electrical interferences?
a. Unshielded twisted pair
b. Optical fiber
c. Coaxial cable
d. Microwave

13. The location of a resource on the internet is given by its:
a. Protocol **b. URL**
c. E-mail address d. ICQ

14. The term HTTP stands for:
a. Hyper terminal tracing program
b. Hypertext tracing protocol
c. Hypertext transfer protocol
d. Hypertext transfer program

15. Which software prevents the external access to a system?
a. Firewall b. Gateway
c. Router d. Virus checker

+ + + + +

UNIT : 6
WIRELESS COMMUNICATION

Q1: What are advantages and disadvantages of wireless networks?

Answer:

Wireless Networks:

Definition: Wireless communication is a term used to describe communications between two or more devices without any physical connection. This network uses radio signal frequency to communicate among computers and other network devices.

Types of Wireless Network:

There are four main types of wireless networks:

1. WLAN (Wireless Local Area Network)
2. WMAN (Wireless Metropolitan Area Network)
3. WWAN (Wireless Wide Area Network)
4. WPAN (Wireless Personal Area Network)

Advantages of Wireless Network:

1. **Manageability:** Users can be easily connected to wireless network without changing physical connection.

2. **Mobility:** Users can easily connect their laptops or mobile devices to wireless network from different locations within the range.

3. **Fast Setup:** Wireless network can be easily located by wireless adapter of a computer. In some case, user can connect automatically within the wireless range.

4. **Cost:** Wireless network setup is more cost effective than installing cables.

5. **Expandability:** Wireless network can be easily expanded (پھیلنا/بڑھنا) by adding new computers or mobile devices with existing equipment's (سازوسامان).

6. **VOIP Facility:** Voice Over Internet Protocol facility is available with wireless network users can do VOIP calls to any place if they have an internet connection.

7. **Efficiency in Business:** Wireless networks help to increase business between partners and customers.

8. **Productivity:** Wireless access to the internet and to company's key applications and resources, helps staff to get the job done and encourages (تعاون کی حوصلہ افزائی کرتا ہے) collaboration.

9. **Last Mile Data Delivery:** Wireless connections are easily installed and managed in areas where wired connections cannot be installed and managed.

10. **Access and Availability:** Because wireless technology allows the users to communicate while on the move, they are rarely (بہت کم) out of touch they don't need extra cables or adaptors to access office networks.

Disadvantages of Wireless Networks:

1. **Security:** A common disadvantage of the wireless network is security. Hackers can tap into a wireless network relatively easier than a wired network.

2. **Signals Problem:** Users of networks may face problems of range of signals. Another disadvantage is about its coverage that somewhere users might face problems of range of signals also some routers allow limited access.

3. **Slow Speed:** Sometimes their speed can be slower than wired networks because of their signals droppage problem.

4. **Electromagnetic Interference:** Wireless networks are susceptible (حساس) to interference from magnetic or electronic effects of different devices/machines.

5. **Interference of Fluorescent Light:** Wireless networks users are susceptible to interference (مداخلت) from fluorescent lights and other electronic devices.

6. Less Stability: Wireless connections are not as stable as compared to a dedicated cable because of interference of electrical devices and the items when block the path of transmission.

7. Reliability: Due to the limitation of data transfer rates, wireless LAN technologies are not reliable for network backbones.

8. Expensive: Large wireless networks are expensive to install than wired network.

Q2: Write a short note on the following wireless communication terminologies.

Answer:

Wireless Communication Terminologies:

The following are some important wireless communication terminologies:

a) Radio Signals
b) Radio Transceiver
c) Wireless Access Point
d) Line-of-Sight Communication

a) Radio Signals:

Radio signals are electromagnetic waves which are used as a medium in wireless communication.

Frequency Range: The frequency range of radio signal is between 3KHz to 1GHz. Radio waves can be generated naturally as well as artificially.

b) Radio Transceiver:

Radio transceiver is a wireless communication device which is used to send as well as receive data through radio signals.

Radio Transceiver

Explanation: Radio transceiver is a full duplex device that can perform both the functions of sending and receiving data simultaneously. The transceiver is connected to the station by means of a transceiver cable that provides separate paths for sending

and receiving the data.

In case of radio, the transmitter and the receiver are separated. The radio broadcasting station is basically a transmitter and the radio is a receiver.

c) Wireless Access Point (WAP):

An access point is a device that both transmits and receives data. It is also called transceiver. It has a built-in network adapter, antenna, and radio transmitter.

Explanation: The access point connects users to other users within the wireless local area network (WLAN) and can also serve as the point of interconnection between the point of interconnection between the WLAN and a wired network. A single access point can serve multiple users within a defined network area. When people move beyond (دور یا دوسری طرف) the range of one access point, they are automatically handed over to the next one.

Number of Clients to Communicate in WAP:

Wireless access point can typically (عام طور پر) communicate with 30 client systems located within a radius of 100 meter. The older and base model of access points allow a maximum of only 10 or 20 clients but many newer access points support up to 255 clients.

Uses: Wireless access points (WAP) are used to provide network connectivity in office environments, public places like airports, train stations, big shopping malls etc.

d) Line-of-Sight Communication:

Line-of-sight communication means that transmitter and receiver communicate in straight line using high frequency radio beam.

Explanation: A line-of-sight communication uses highly directional transmitter and receiver antennas to communicate through radio beam in straight line with very high frequency. The transmission path of line-of-sight microwave link can be

established (قائم) between two land-based antennas, between a land-based antenna and a satellite-based antenna, or between two satellite antennas. Long-distance data communication is more effective (مؤثر) through wireless networks.

Examples:

i) **For Long Distance:** High frequency microwaves, FM radio, microwave and satellite transmission.

ii) **For Short Distance:** TV remote is an example of line-of-sight communication using infrared radiations.

Q3: Explain different types of short distance communications technologies.

Answer: **Short Distance Communication Technologies:**

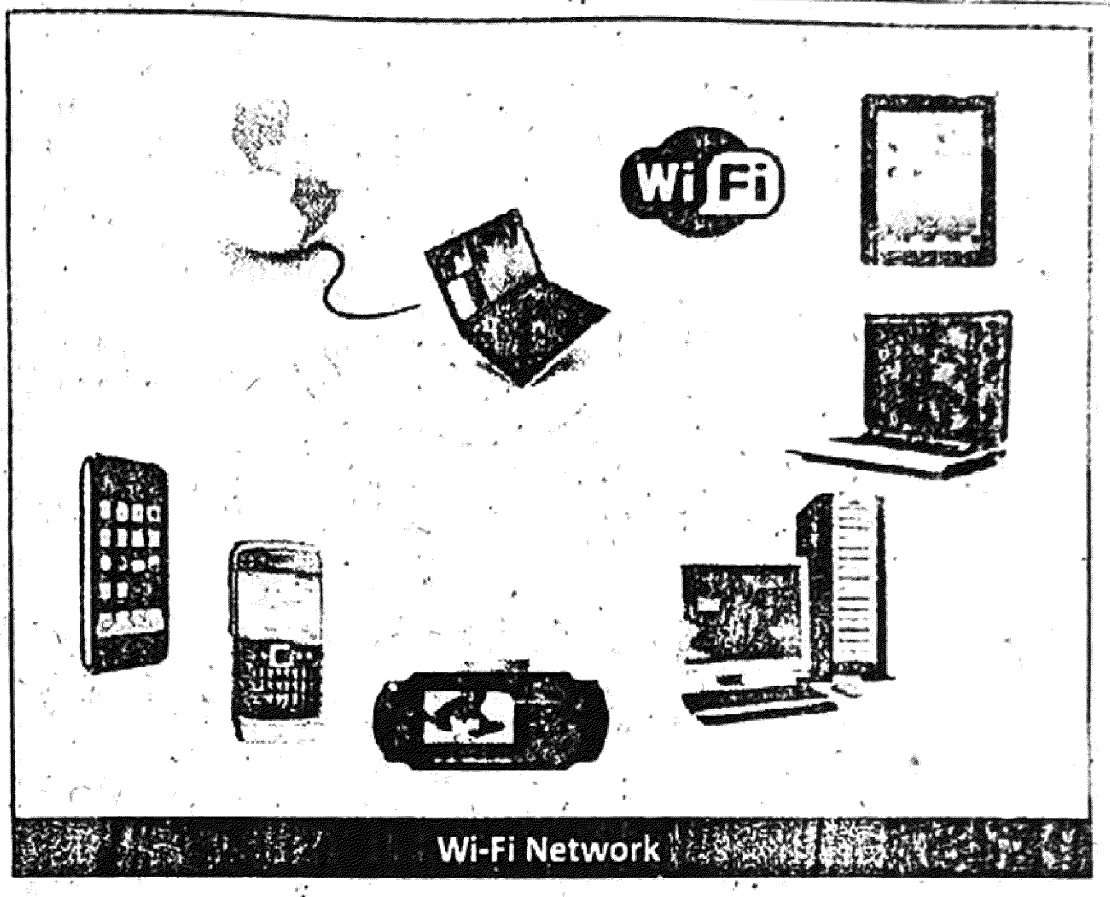
1. **Wi-Fi:**

Introduction: Wi-Fi (Wireless Fidelity) is a wireless communication system very commonly used at home and office. It uses the 802.11 standard, developed by the Institute of Electrical and Electronics Engineers (IEEE). It is also called WLAN (Wireless LAN). It is a popular wireless networking technology which uses radio waves to provide wireless high-speed internet and network connections.

Wi-Fi Router: A Wi-Fi router or similar device creates a "hotspot" or access point to which other devices can be connected to network (or internet). Wi-Fi router translate data into a radio signal and transmits it using an antenna. It then sends the information to the internet using a physical, wired ethernet connection. The process also works in reverse, with the router receiving information from the internet, translate it into a radio signal and sends it to the computer's wireless adapter.

Wi-Fi Supported Devices:

i) Video game consoles ii) PDAs
iii) Mobile phones iv) Laptops
v) IPads and tablets etc.



Wi-Fi Network

2. Bluetooth:

Introduction: Bluetooth is a short-range and high-speed wireless communication technology and consumes low power.

Explanation: Bluetooth provides a way to connect and exchange information between devices such as mobile phones, laptop computers, PCs, printers, fax machines, digital cameras, and video game controllers. Bluetooth can be used to replace cables between the PC and the linking devices such as printers, keyboards, mouse etc. It does not require line-of-sight communication of connected devices. Bluetooth networks have called a piconet or PAN. Piconets contain a minimum of two and a maximum of eight Bluetooth peer devices.

Data Speed: Bluetooth signals can work up to 10 meters and its data transfer rate is 1 Mbps – 2 Mbps.

Features:

- Bluetooth technology uses radio waves to communicate between devices. Most of these radio waves have a range of 15-50 feet.

- According to the official Bluetooth website, Bluetooth uses a low-power signal with a maximum range of 50 feet with sufficient (کافی) speed to enable transmission of data.
- The pairing process identifies and connects any two devices to each other. It also prevents interference (مداخلت) from other non-paired Bluetooth devices in the area.
- It uses maximum power only when it is required, thus preserving (تحفظ) battery life.

3. Wi-Max:

Introduction: Wi-Max stands for "Worldwide Interoperability for Microwave Access". The Wi-Max technology is a standard based wireless technology which is used to provide internet access and multimedia services at very high speed to the end users.

Explanation: Wi-Max creates a metropolitan area network (MAN) and provides a wireless alternative to cable TV and DSL internet connection. It uses 802.16 standard for communication. It provides broadband wireless access up to 30 miles (50 km) for fixed stations, and 3-10 miles (5-15 km) for mobile stations.

Wi-Max Components:

The Wi-Max system has two components, the Wi-Max receiver and the Wi-Max tower.

i) **Wi-Max Receiver:** The receiver is a small box or card that would be built into a device such as a laptop or installed at a home for personal use.

Wi-Max Tower: A Wi-Max tower would be similar to telephone towers.

Data Speed: The Wi-Max technology offers around 72 mega bits per second without any need for the cable infrastructure. However, this technology is obsolete (ناکارہ/جو استعمال میں نہ ہو) now.

5. Infrared Communication:

Introduction: Infrared wireless communication communicates information in a device or systems through IR radiation. IR are

electromagnetic radiations having wavelength longer than that of red light.

Explanation: In infrared communication the transmitter and receiver must be in line of sight to communicate with each other. Also data rate in this type of communication is very low as compared to other methods of data communication.

Data Speed: It supports data rate from 100 Kbps to 4Mbps.

Applications of Infrared Communication:

1. Car locking systems are infrared technology for automatic locking and unlocking the doors of cars.
2. Modern computers have infrared enabled mouse, keyboards, and printers.
3. Home security systems have infrared enabled burglar alarm.
4. Remote control system in TVs, Toys, etc. uses infrared technology.

Q4: Describe long distance communications technology in detail.

Answer: Cellular Communication:

Introduction: Cellular communication refers to wireless communication systems that divide a geographical region into sections called cells. Each cell has a base station (BS) at the center that contains a transmitter, receiver and control unit that provides radio communication to mobile phones.

Explanation: In cellular communication, each mobile phone uses a separate temporary radio frequency (channel) to talk to the base station (BS). The BS talks to many mobile users at the same time. Channels use a pair of frequencies for communication. One frequency, the uplink is used for the mobile phone to communicates with the BS and another frequency for the down link for BS to communicate with the mobile phone. In cellular communication, adjacent cells are assigned (سونپنا یا مختص کرنا) different

frequencies to avoid interference or crosstalk (فون کی گفتگو میں مداخلت ہونا). However they use the same frequency band.

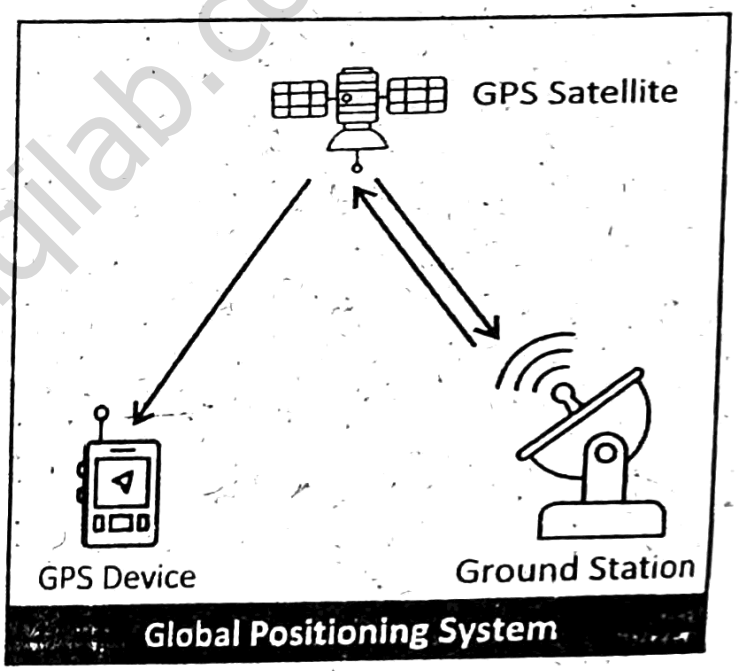
Characteristics of Cellular Communication:

1. Consist of several thousand radio cells, each with a coverage area of between 500m to 35km radius.
2. Comprised of several access networks and a single core network.
3. Usually cover an entire country and serve millions of subscribers.
4. Initially designed for speech telephony, but increasingly used for data transmission.
5. Support of terminal and personal mobility.
6. **Examples:** GSM and CDMA

Global Positioning System (GPS):

Introduction: Global positioning system (GPS) is a radio navigation system that allows people on land, in sea or in the air to determine their exact position, 24 hours a day anywhere in the world in all weather conditions (موسم کی حالت).

Explanation:



The GPS system consists of 24 satellites, constructed and operated by the U.S. Department of Defense. It is used for land, sea and air navigation (سمت شناسی) to provide time and locations for vehicles and ships. GPS works in any weather conditions, anywhere in the world, 24 hours a day. There are no subscription fees or setup charges to use GPS. The 24 satellites are moving around the earth about 12,000 miles above the earth surface.

They are constantly moving, making two complete orbits in less than 24 hours.

Uses:

1. GPS can be used for cartography (نقشہ نگاری), forestry, mineral exploration, surveying (سروے), disaster (آفت) management, weather forecasting (موسم کی پیشگوئی), wildlife habitation management, monitoring the movement of people and things, bringing precise timing to the world.
2. GPS is also used to study the movement of tectonic plates to understand earthquake and astronomical observations, telecommunication (فلکیاتی مشاہدات).

Global Segments:

GPS has three segments or components.

1. Space Segment:

The space segment consists of a nominal constellation (تاروں کا فرضی جھرمٹ) of 24 operating satellites that transmit one-way signals that give the current GPS satellite position and time.

2. Control Segment:

GPS control segment consists of a global network of ground facilities that track the GPS satellites, monitor their transmission, perform analysis, and send commands and data to the constellation.

3. User Segment:

The user segment consists of the GPS receiver equipment, which receives the signals from the GPS satellites and uses the transmitted information to calculate the user's three-dimensional position and time.

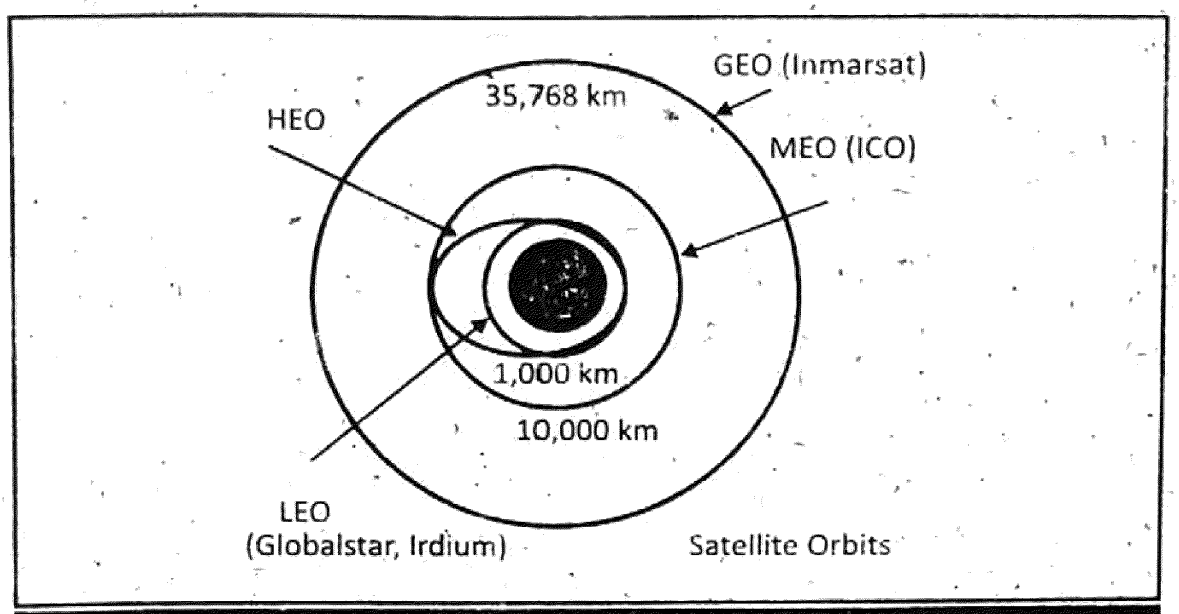
Q5: Explain different classifications of satellite systems.

Answer: Classification of Satellite System:

Satellites are launched into space to do a specific job. Based upon their orbits, satellite system can be classified into three types:

1. Geostationary Earth Orbit (GEO)
2. Medium Earth Orbit (MEO)

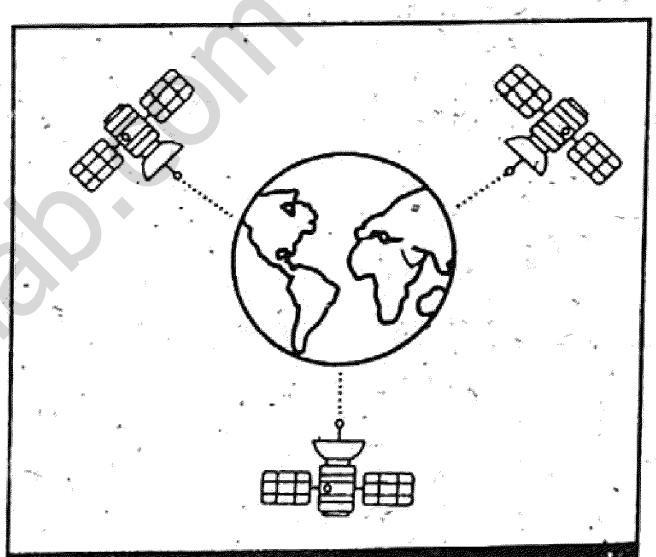
3. Low Earth Orbit (LEO)



Satellite Systems

1. Geostationary Earth Orbit (GEO):

Introduction: A geostationary Earth Orbit (GEO) or geostationary orbit is an orbit directly above the earth's equator (at 0° latitude), with a period equal to the earth's rotational period.



Satellite in Geostationary Orbit

Explanation: Geostationary satellites have the special property of remaining permanently fixed in exactly the same position in the sky, it means that ground-based antennas do not need to track them but can remain fixed in one direction. Such satellites are called geostationary.

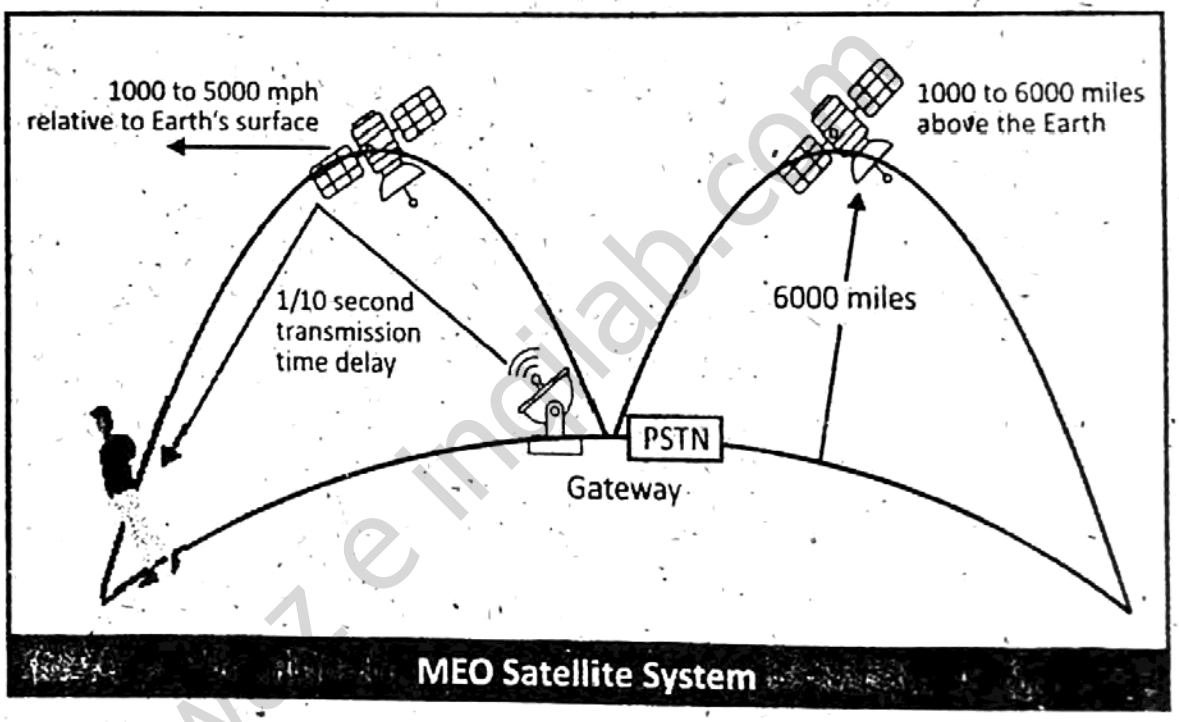
Only one orbit can be geostationary because of orbital speed. But one geostationary satellite cannot cover the whole earth. Three satellites equidistant from each other in geostationary earth orbit (GEO) to provide full global transmission. These three satellites are 120° from each other in geosynchronous orbit and around the equator.

2. Medium Earth Orbit (MEO):

Introduction: Medium or Middle Earth Orbit (MEO) is a satellite system used in telecommunications. MEO satellites orbit the earth between 1,000 and 22,300 miles above the earth's surface. MEO are higher than LEO satellites, but lower than GEO satellites.

Uses: MEOs are mainly used in Geographical Positioning Systems (GPS) and are not stationary in relation to the rotation of the earth.

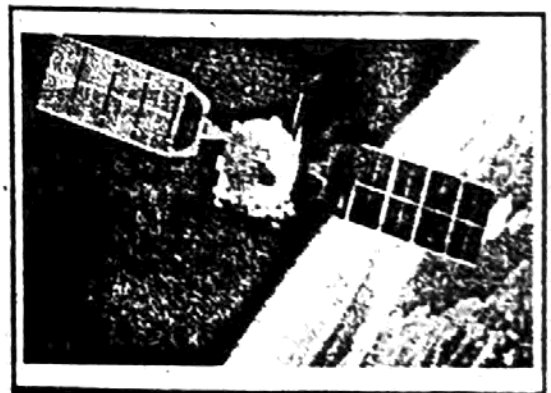
For Example: GLONASS (a Russian satellite-based navigation system) is at an altitude of 19,100 km and GALILEO (a European Union (EU) satellite-based navigation system) is at an altitude of 23,222 km from the earth. **Telstar** is the one of the first and most famous experimental satellites, orbited in MEO.



MEO Satellite System

3. Low Earth Orbit (LEO):

Introduction: In satellite communications systems, a low earth orbit (LEO) satellite operates at heights of between 500 and 2,000 km above the earth's surface. LEO satellites can be



LEO Satellite Sytem

divided into "Big LEOs" and Little LEOs".

Uses:

1. They provide pager, cellular telephones and location services. They carry voice and data broadband services.
2. LEOs are mostly used for data communication such as e-mail, paging and videoconferencing.
3. They can be also used for satellite communication and surveillance.

❖ Most of the satellites, the international space station, the space shuttle, and the Hubble space telescope are all in low earth orbit.

Q6: What are the requirements of mobile communication system?

Answer: Requirements of Mobile Communication System:

Mobile communication system consists of the following major components that work together to provide mobile service to subscribers:

1. Public switched telephone network (PSTN)
2. Mobile telephone switched office (MTSO)
3. Cell site with antenna system
4. Mobile subscriber unit (MSU)
5. Mobile station

1. Public Switched Telephone Network (PSTN):

The PSTN is made up of local area and the exchange area networks that interconnect telephone and communication devices by means of telephone lines, fiber optic cables, microwave transmission links and communication satellites.

2. Mobile Telephone Switched Office (MTSO):

The MTSO is the main office for mobile switching. It automatically keeps track of cell phones users signal. MTSO consists of Mobile Switching Center (MSC), field monitoring and relay stations. The MSC controls calls, tracks billing information and locates cell users.

3. Cell Site with Antenna System:

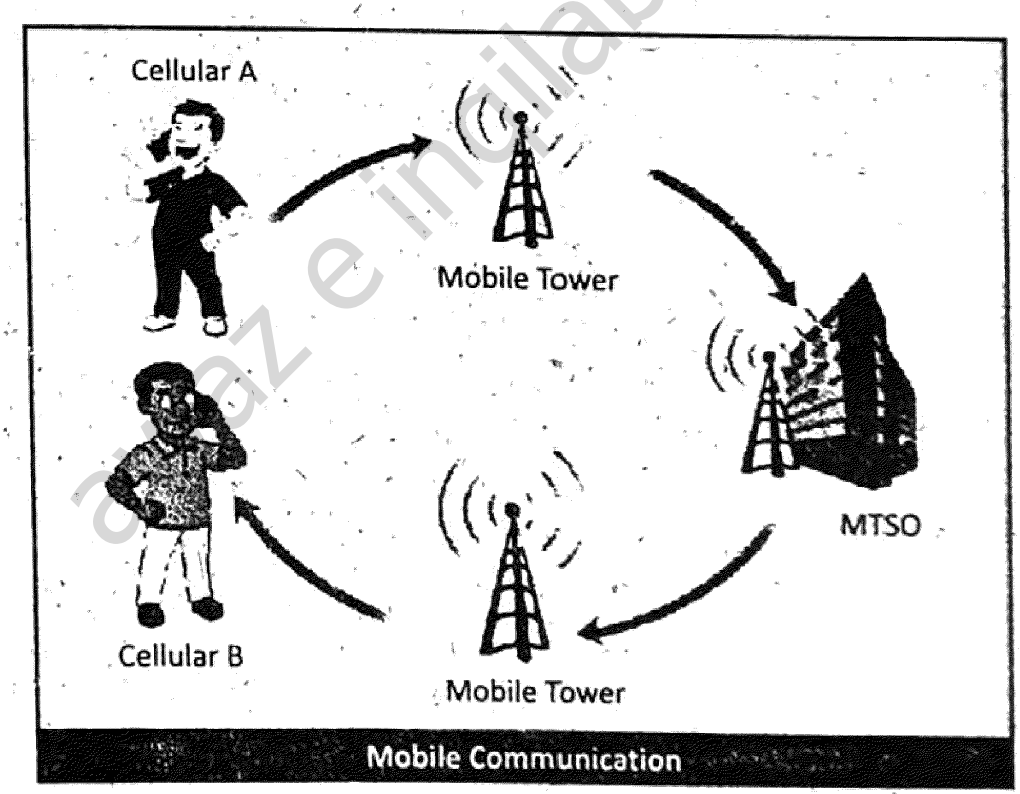
The term cell site is used to refer to the physical location of radio equipment that provides coverage within a cell. A list of hardware located at a cell site includes power sources, interface equipment, radio frequency transmitters and receivers, and antenna systems.

4. Mobile Subscriber Units (MSUs):

The mobile subscriber unit consists of a control unit and a transceiver that transmits and receives radio transmissions to and from a cell site.

5. Mobile Station (MS):

The MS includes mobile equipment and a subscriber identity module (SIM). The SIM is a subscriber module which stores all the subscriber-related information. When the SIM is inserted into the mobile equipment, the relevant information is checked and a call is then delivered to the mobile station. The mobile equipment is not associated with a caller number and any mobile equipment can be used by a subscriber by inserting the SIM.



Q7: Give important features and limitations of mobile communication system.

Answer:

A. Features of Mobile Communication System:

The mobile communication system has variety of the following features:

1. User Mobilities and Device Portability:

The mobile communication system provides user mobility and device portability.

a. **User Mobility:** With mobile communication, user communicates anytime, anywhere and anytime.

b. **Device Portability:** With mobile communication, multiple devices can be connected anytime, anywhere to any network.

2. Large Coverage:

Mobile System provides large coverage area than a single terrestrial transmitter because multiple cell towers can be added.

3. Fast Communication:

It is the fastest mean of communication by providing various transmission services all around the word.

4. Less Power Consumption:

Mobile towers use less power with single transmitter than satellite because the cell towers are closer.

5. Service Charges:

It has the facility of text messaging, voice and video calling with low cast.

6. Communication Services:

In smart phones, the service of MMS, GPRS, Wi-Fi and WAP can be used for better communication.

7. GSM Technology:

The mobile communication system uses GSM (Global System

for Mobile Communication) technology for international roaming, improved efficiency, high quality voice and other services offered by cellular company.

8. 3G and 4G Service:
With the introduction of 3G and 4G communication, the data rate, and bandwidth have significantly improved (نمایاں طور پر بہتر ہوا).

B. Limitation of Mobile Communication System:
Mobile communication system has certain limitations, which are discussed one by one.

1. Transmission Interference: The physical characteristics of a location can affect (اثر) the performance of a mobile communication as signal strength can sometimes be reduced by thick walls and steel constructions. Reception in tunnels, some building and rural areas is often poor.

2. Health Hazards: More car accidents are related to drivers who were talking through a mobile device. There are allegations (الزامات) that cell phone signals may cause health problems.

3. Validity & Accuracy of Information:
Mobile devices readily access information from the world wide web. The validity (درستگی) and accuracy of information cannot be guaranteed.

4. Violation of Rights:
Mobile internet users copy and paste information from websites without the permission of publisher and this is violations of property rights.

5. Security Issues: Security is major issue with mobile system. Anyone can back the user's data through networks interconnected through the line.

EXERCISE MCQS

Q#1: Select the best choice for the following MCQs.

1. The frequency range of radio signal is between 3 KHz to _____3 GHz.
   a. 1 b. 2
   c. 3 d. 4
2. Which of the following is a wireless communication device used to send as well as receive data through radio signals?
   a. Sender b. Transceiver
   c. Receiver d. Infrared
3. What does WAP stand for?
   a. Wireless Access Place
   b. Wired Application Protocol
   c. Wireless Access Protocol
   d. Wireless Access Portion
4. _____uses 802.11 standards, developed by the institute of Electrical and Electronics Engineers (IEEE).
   a. Wi-Fi b. Bluetooth
   c. Infra-red d. Wi-Max
5. Which of the following is used to provide Internet access and multimedia services at very high speed to the end users?
   a. Wi-Fi b. Bluetooth
   c. Infra-red d. Wi-Max
6. _____signals can be used for short-range communication in a closed area using line-of-sight propagation.
   a. Wi-Fi b. Bluetooth
   c. Wi-Max d. Infra-red
7. The GPS system consists of _____satellites.
   a. 20 b. 22
   c. 24 d. 25
8. GPS _____segment facilitates that track the GPS satellites, monitor their transmissions, perform analysis and

send commands and data to the constellation.

a. User b. Control

c. Space d. Air

9. Which of the following orbits is at the distance of 22,000 miles from the surface of the earth.?

a. Geostationary Earth Orbit

b. Low Earth Orbit

c. Medium Earth Orbit

d. High Earth Orbit

10. _____ is the first markup language standard for wireless devices.

a. HTML b. WAP

c. HTTP d. WML

Answers:

1	2	3	4	5	6	7	8	9	10
a	b	c	a	d	d	c	b	a	d

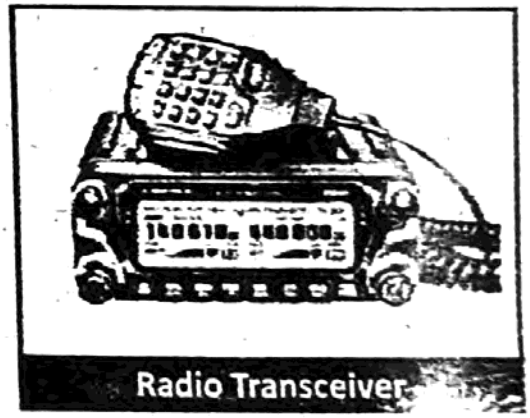
Short Questions

Q2: Give short answers to the following questions.

Q:i: What is radio transceiver?

Answer: Radio Transceiver (Transmitter and Receiver):

Radio transceiver is a wireless communication device which is used to send as well as receive data through radio signals.



Radio Transceiver

Explanation: Radio transceiver is a full duplex device that can perform both the functions of sending and receiving data simultaneously. The transceiver is connected to the station by means of a transceiver cable that provides separate paths for sending and receiving the data.

In case of radio, the transmitter and the receiver are separated. The radio broadcasting station is basically a transmitter and the radio is a receiver. A radio transceiver is shown in the given figure

Q:ii. What is "Hotspot"?

Answer: Hotspot: A hotpot is a physical location where people can access the internet using Wi-fi through a wireless local area network (WLAN) with router connected to an internet.

Explanation: A Hotspot is any location where Wi-Fi internet access is made publicly available over a wireless local area network (WLAN) through the use of a router. Hotspots may be found in airports, hotels, schools, colleges and office shops.

Q:iii. What does IEEE stands for?

Answer: IEEE: IEE stands for the "Institute of Electrical and Electronic Engineers".

Explanation: IEE is an organization dedicated to advancing innovation and technological excellence for the benefit of humanity. It is the world's largest technical professional society. It is designed to serve professionals involved in all aspects of the electrical, electronic and computing fields and related areas of science and technology.

Q:iv. What is meant by line of sight communication?

Answer: Line-of-Sight Communication:

Line-of-sight communication means that transmitter and receiver communicate in straight line using high frequency radio beam.

Explanation: A line-of-sight communication uses highly directional transmitter and receiver antennas to communicate through radio beam in straight line with very high frequency. The transmission path of line-of-sight microwave link can be established between two land-based antennas, between a land-based antenna and a satellite-based antenna, or between two satellite antennas. Long-distance data communication is more effective through wireless networks.

Examples:

i) For Long Distance:

High frequency microwaves, FM radio, microwave and satellite transmission.

ii) For Short Distance:

TV remote is an example of line-of-sight communication using infrared radiations.

Q:v. Differentiate between short distance and long distance wireless communication.

Answer: Short Distance Wireless Communication:

In Short Distance Communication, signals travel from one point to another point in a few centimeters to several Kilometers.

Examples: Examples of short distance wireless communications are Wi-Fi, Wi-Max, Bluetooth and Infrared.

Long Distance Wireless Communication:

In Long Distance Wireless Communication, signals can travel from several Kilometers to several thousand Kilometers.

Examples:

Examples of long distance wireless communications are cellular communication and satellite communication such as Global Positioning System (GPS), Geostationary Earth Orbit (GEO), Medium Earth Orbit (MEO) and Low Earth Orbit (LEO).

Q:vi. What is global positioning system (GPS)?

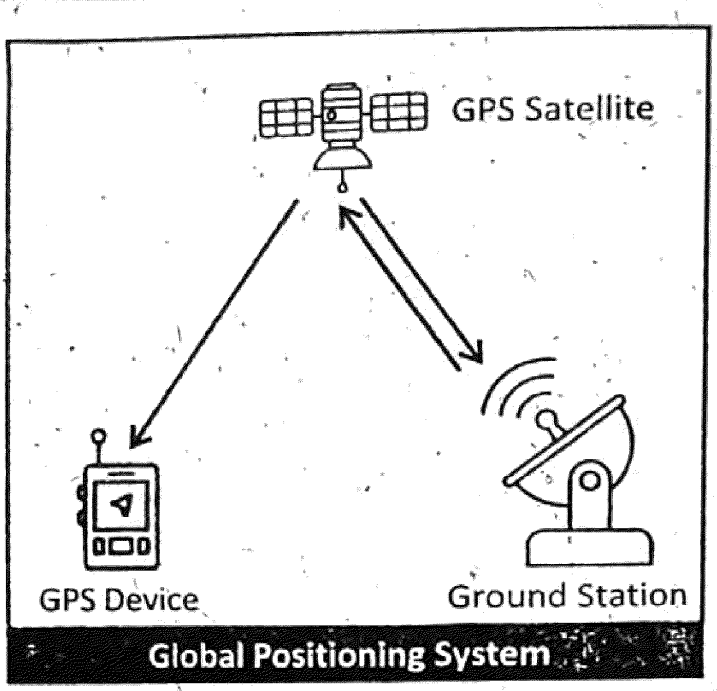
Answer: Global Positioning System (GPS):

Introduction: Global positioning system (GPS) is a radio navigation system that allows people on land, in sea or in the air to determine their exact position, 24 hours a day anywhere in the world in all weather conditions.

Explanation:

The GPS system consists of 24 satellites, constructed and operated by the U.S. Department of Defense. It is used for land, sea and air navigation to provide time and locations for vehicles

and ships. GPS works in any weather conditions, anywhere in the world, 24 hours a day. There are no subscription fees or setup charges to use GPS. The 24 satellites are moving around the earth about 12,000 miles above the earth surface. They are constantly moving, making two complete orbits in less than 24 hours.



Global Positioning System

Uses:

1. GPS can be used for cartography, forestry, mineral exploration, surveying, disaster management, weather forecasting, wildlife habitation management, monitoring the movement of people and things.
2. GPS is also used to study the movement of tectonic plates to understand earthquake and astronomical observations, telecommunication.

GPS Segments/GPS Components:

GPS has three segments or components.

1. Space Segment
2. Control Segment
3. User Segment

Q:vii. What is wireless markup language?

Answer:

Wireless Markup Language (WML):

Wireless markup language is a markup language created for devices that implement the wireless application protocol (WAP), such as mobile phones.

First Markup Language: WML (wireless markup language) is the first markup language standard for wireless devices. It is

supported by all the major mobile phone manufacturers.

Uses: WML provides navigational support, data input, hyperlinks, text and image presentation, and forms, much like HTML (hypertext markup language).

Q:viii. What is wireless application protocol?

Answer:

Wireless Application Protocol (WAP):

The wireless application protocol (WAP) is an open standard protocol which provides internet access to mobile users of wireless phones and other wireless devices such as pagers and personal digital assistants (PDAs).

WAP Forum: In 1998 WAP Forum is formed by Nokia, Ericsson, Motorola and Unwired Planet. The basic objectives of this WAP forum are to bring diverse internet content and other data services to mobile phones and other wireless terminals (e.g. PDAs, laptops).

WAP Supported Network: Most wireless networks are supported by WAP, including CDMA, TDMA, and GSM. Also, WAP is supported by all operating systems.

Q:ix. Write short note on web protocol stack.

Answer:

Web Protocol Stack:

A Web Service Protocol Stack is a set of protocol that is used to define, locate, implement and make Web services.

Protocol of Web Protocol Stack: A web service protocol stack consists of four protocols:

1. Transport Protocol:

It is responsible for transporting messages between network applications and includes protocols such as HTTP (Hypertext Transfer Protocol), SMTP (Simple Mail Transfer Protocol), FTP (File Transfer Protocol), as well as the more recent Blocks Extensible Exchange Protocol (BEEP).

2. Messaging Protocol:

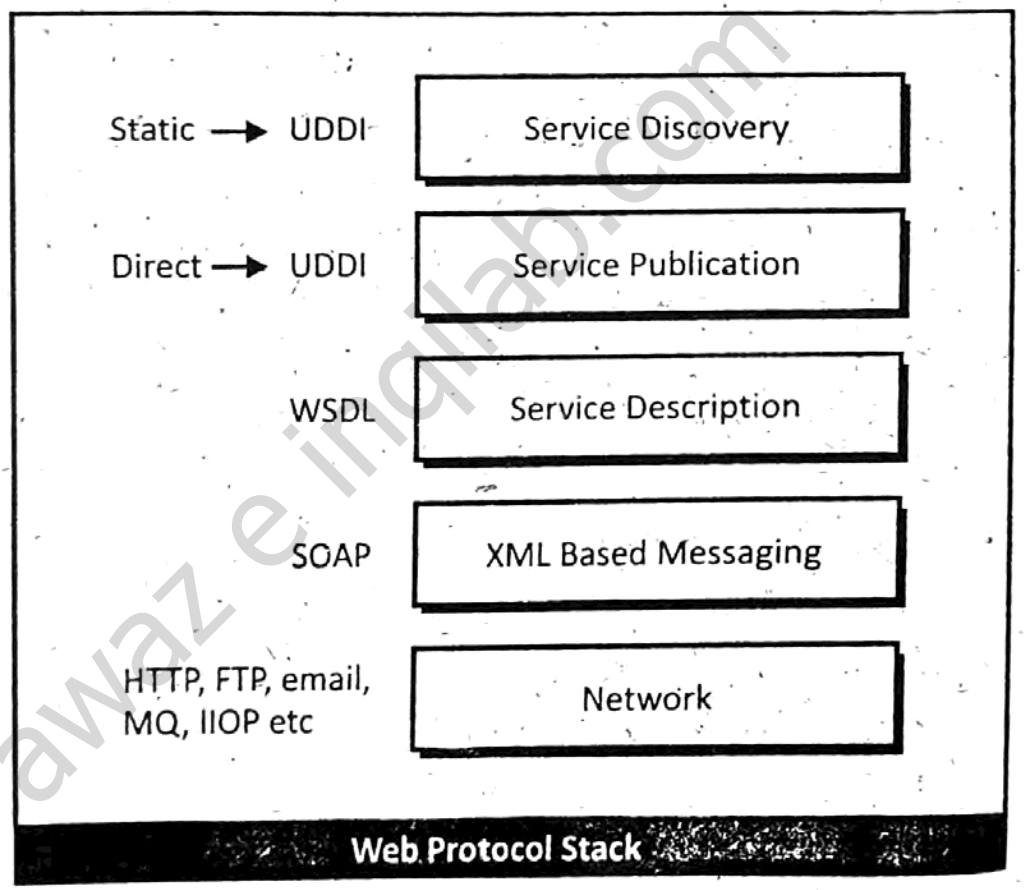
It is responsible for encoding messages in a common XML (Extensible Markup Language) format so that they can be understood at either end of a network connection. Currently, this area includes such protocols as XML (extensible markup language) and SOAP (Simple Object Access Protocol).

3. Description Protocol:

It is used for describing the public interface to a specific Web service. Currently, this includes WSDL (Web Service Description Language).

4. Discovery Protocol:

It is used for centralizing services into a common registry. It can publish their location and details and makes it easy to find what services are available on the network. Currently, this includes UDDI (Universal Description, Discovery and Integration).



Web Protocol Stack

Detailed Questions

Q3: Give detailed answers to the following questions.

i. What are the advantages and disadvantages of wireless networks?

Answer: See Question # **1**, Page # **180**

ii. Explain different types of short distance communication technologies.

Answer: See Question # **3**, Page # **184**

iii. Describe long distance communication technologies in detail.

Answer: See Question # **4**, Page # **187**

iv. Explain different classifications of satellite systems.

Answer: See Question # **5**, Page # **189**

v. What are the requirements of mobile communication system?

Answer: See Question # **6**, Page # **192**

vi. Give important features and limitations of mobile communication system.

Answer: See Question # **7**, Page # **194**

Additional MCQs

Q: Select the best answer for the following MCQs.

1. Which of the following has a range of 40 to 50 km?
   a. Wi-Fi **b. Wi-Max**
   c. Bluetooth d. Infrared

2. Which of these uses extremely high frequency waves for short range communications?
   a. Wi-Fi b. Wi-Max
   c. Bluetooth **d. Infrared**

3. Which of these is used for communication between mobile phones, laptop computers and digital cameras?
   a. Wi-Fi b. Wi-Max
   c. Bluetooth d. Radio signal

4. Which of these is positioned from 160 to 2,000 km above the earth surface?
   a. Geostationary earth orbit b. Medium earth orbit
   c. Low earth orbit d. GALILEO

5. Which orbit is located directly above the earth's equator?
   a. Geostationary earth orbit b. Medium earth orbit
   c. Low earth orbit d. GALILEO

6. What is a fixed station in a cellular wireless network called that provides local coverage for mobile communication?
   a. Base station b. Satellite
   c. Mobile terminal d. Global positioning system

7. What is used to create web pages?
   a. HTML b. HTTP
   c. WAP d. TCP

8. What is HTTP?
   a. Markup language
   b. Protocol for mobile phones

c. Application layer protocol
d. Transport layer protocol

9. Which of these provides wireless alternative to cable TV and DSL?
a. Bluetooth b. Infrared
c. Wi-Max d. Wireless access point

10. In which earth orbit satellite is placed for navigation?
a. Geostationary earth orbit
b. Medium earth orbit
c. Low earth orbit
d. High earth orbit

11. Data can be in the forms of.....
a. Audio b. Video
c. Graphics **d. All of these**

12. The wireless mediums include like:
a. Microwave b. Infrared
c. Satellite **d. All of these**

13. A sender may be a.....
a. Computer b. Workstation
c. Telephone handset **d. All of these**

14. In which media the communication takes place through air or space?
a. Guided **b. Unguided**
c. Transmission d. None of these

15. Transmitting signal from satellite to earth is called.....
a. Up-linking **b. Down-linking**
c. Both a & b d. None

+ + + + +

UNIT : 7
DATABASE FUNDAMENTALS

Q1: What is data and information. Give examples.

Answer: Data:

Definition: Data is a set of raw facts and figures that need to be processed.

Word "Data": The word "Data" is the plural form of Latin word "Datum" which means "to give" or "something given". Data may consists of numbers, characters, symbols or pictures.

Examples of the Data: Some examples of the data are:

1. Students' names in a class are data.
2. A student's subject marks are data.
3. A day's temperature, humidity, wind speed recorded are data.

Information:

Definition: When facts, figures or number (data) are processed and converted into meaningful (بامعنی) form that can be used for decision making (فیصلہ سازی) or other useful activity, it is called information.

Examples of Information: Examples information are:

1. Names of students' in alphabetic order is an information.
2. Student percentage of marks, grade and position of student are information.
3. Weather prediction (پیشگوئی) as cold or warm in information.

Q2: Differentiate between data and information.

Answer:

Differences between Data and Information:

Data	Information
1. Data is a set of raw facts and figures that need to be	1. When facts, figures or number (data) are processed

processed.	and converted into meaningful form that can be used for decision making or other useful activity, it is called information.
2. Data is used as input in the computer.	**2.** Information is the output of computer.
3. Data alone is meaningless (بے معنی) and valueless (بے قدر).	**3.** Information is useful, meaningful and valuable.
4. Data is difficult or even impossible to reproduce if lost. For examples in an exam result all the subject marks award lists are lost or damaged, it would be very difficult to reproduce them.	**4.** Information is easier to reproduce if lost. For example, if the obtained marks of the students' are lost, these can easily be recalculated from the award lists.
5. Data is an independent entity.	**5.** Information depends on data.
6. Data is asset (اثاثہ) of organization and is not available for sale.	**6.** Information is normally available to people for sale.
7. Examples: i) Students' names in a class ii) A student's subject marks	**7. Examples:** i) Names of students' in alphabetic order ii) Student percentage of marks, grade and position

Q3: What is file management system? Write down its limitations.

Answer: File Management System:

Definition: File management system also known as conventional file system or simply file system is a method of storing and organizing collection of data in the form of files on the secondary storage devices.

Limitations of File Management System:

i) Data Redundancy: Redundancy means duplication (نقل) of data which is recorded and stored in several files. Independent data files contain a lot of duplicated data. This data redundancy (اضافی یا زائد) causes problems during data updating.

ii) Inconsistency: In this system, all the files containing some data needs properly updating. If all the files are not updated properly there may be high risk of inconsistency (عدم مطابقت).

iii) Intensive Coding: The processing tasks like searching, editing, deletion and updating should have separate programs. It means there are no built-in functions available and needs coding every time to perform these operations.

iv) Data Isolation: Data is scattered (بکھرے ہوئے) in various files and the files may be in different format. The users have to write new application program to retrieve (دوبارہ حاصل کرنا) data from these files. This is difficult, time-consuming, and costly process.

v) Concurrent Access: Accessing the same data from the same file is called concurrent (بیک وقت) access. In the file system, concurrent access leads to incorrect data.
For example, a student want to borrow a book from the library and there is a single copy available of that book. At the same time another student also borrow this single copy of book. Then the system must be update to zero-copy in the file as the first student borrow the book.

vi) Integrity Problems: Integrity means reliability (ڈیٹا کی درستی) and accuracy of data. Data values need some integrity constrains.
For example, the balance field value of a bank account must be greater than 5000.

vii) Atomicity Problem: If there is any failure to insert, update, or delete in the file system, there is no mechanism to switch back to the previous state. Atomicity refers to the completion

of the whole transaction. Partial completion of any transaction leads to incorrect data in the system. The file system does not guarantee atomicity.

viii) Poor Data Security: The security of data is low in file-based system because, the data is maintained in the flat file(s) is easily accessible.

For example: consider the banking system. The customer transaction file has details about the total available balance for all customers. In a file system it is difficult to give the customer access to only his data in the file.

Q4: Write three disadvantages of file management system.

Answer: Disadvantages of File Management System:

1. Data Redundancy:

Redundancy means duplications of data. Since same data is stored in multiple files which are needed by different application programs which causes data redundancy.

2. Data Isolation:

Isolation means separation of data i.e., related data is scattered in in multiple files. It is difficult and time consuming to write new programs to retrieve the proper data from multiple files at once.

3. Poor Data Security:

File management system does not provide proper security on data. The data can be easily accessed and changed by unauthorized (غیر قانونی) user. Applying security techniques such as password protection and locking of files is very difficult.

4. Difficulty in Accessing Data:

It is not easy to retrieve information using a file management system. The simplest data retrieval task from the requires extensive programming. Also this is a time consuming and a high skill activity.

5. Intensive Coding:

The processing tasks like searching, editing, deletion and

updating should have separate programs. It means there are no built-in functions available and needs coding every time to perform these operations.

6. Integrity Problems:

Integrity means reliability and accuracy of data. Data values may need to satisfy some integrity constraints.

Q5: Give advantages of database system.

Answer: Advantages of Database System:

1. Sharing of Data:

In DBMS, Data can be shared between authorized users of database. All the users have their own right to access the database up to a level. Database Administration has complete access of database. He can assign users to access the database. Others users are also authorized to access database and also they can share data between them. Many users have same authority to access the database.

2. Enforcing Data Integrity Constraints:

Integrity means unification (یکجا کرنا) of file into one file. Centralized control of the data helps in allowing the authority (اختیار) to define integrity constraints to the information in the database.

3. Support Concurrent Access:

A DBMS support concurrent (بیک وقت) access to the data to multiple users.

4. Standards can be Enforced:

Data management system ensures standards in the representation of data such as the format of data items, the convention on data names, documentation standards etc.

5. Flexibility:

DBMS allows changes to the structure of the database without affecting the stored data and currently existing application programs.

6. Backup & Recovery:

DBMS provides facilities of backup and recovery from failures including disk crash, power failure, software errors, which may bring the database from the inconsistent (متضاد) state to a state prior (پہلے) to the failure.

7. Data Security:

Data Security means protecting user's precious (قیمتی) data from unauthorized access. There is a username set for all the users who access the database with password so that no other guy can access this information. DBMS always keep database tamperproof, secure and theft free (چوری سے پاک).

8. Data Privacy:

Data privacy is related to data security. Data privacy characterizes to the right of persons and associations to determine for themselves when, how and to what extent data is to be exchanged with others.

9. Reduced Application Development Time:

DBMS supports many essential functions that are common to many applications accessing data stored in the DBMS. This feature allows rapid development of new application for emerging needs.

10. Data Administration:

A DBMS facilitates maintenance (دیکھ بھال) and data administration tasks. A good DBA can effectively provide the fine-tuning, the data description, periodic backups etc.

Q6: What is the role of DBA?

Answer: DBA (Database Administrator):

Introduction: A Database Administrator (DBA) is responsible for the development and design of data base and improving database performance, capacity and planning for future expansion requirements. (OR)

A database administrator is a person or a group of persons who

are resi onsible for managing all the activities related to data-base system.

Role of Database Administrator:

1. Installing and upgrading (بہتر بنانا/فروغ دینا) the database server.
2. Implementation (نفاذ) of data models, database design and performance issues
3. Allocating system storage.
4. Enrolling users and maintaining system security.
5. Controlling and monitoring user access to the database.
6. Backing up and restoring databases.
7. Allocating passwords to users.
8. Providing training to new employee about using the database.
9. Monitoring jobs running on the database and performance.

Q7: Explain different types of database models.

Answer: Database Model:

Introduction: A database model is a set of rules or specifications which state that how data can be stored, organized and manipulated in a database system.

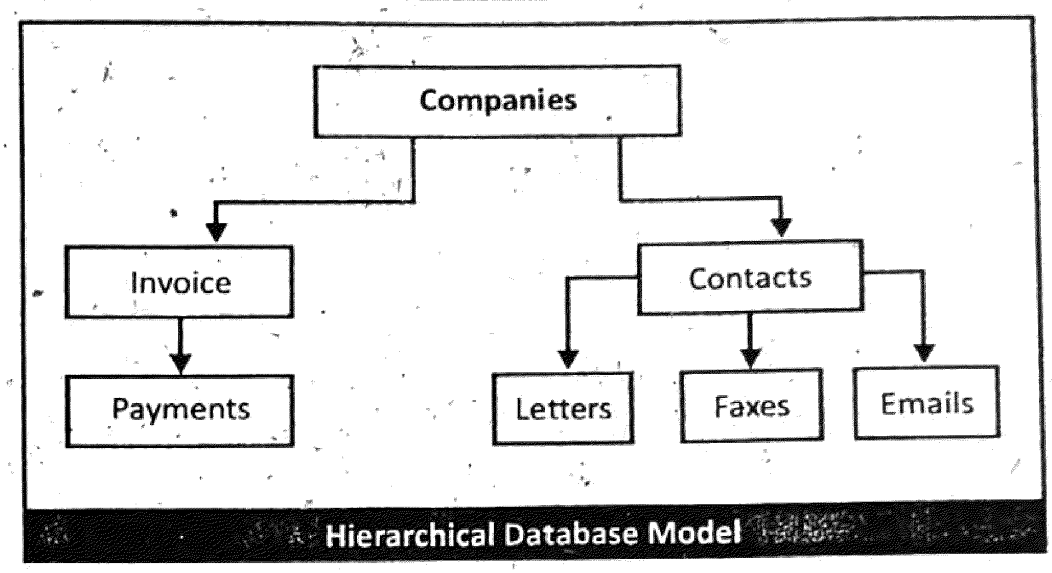
Types of Database Models:

1. Hierarchical Database Model:

In this type of model, data is organized into a tree-like structure. There is a hierarchy of parent and child segments. This structure implies (مطلب بتانا) that a record can have repeating information, usually in the child data segment. Each parent can have many children but each child has only one parent. The following figure shows a hierarchical database model.

Examples:

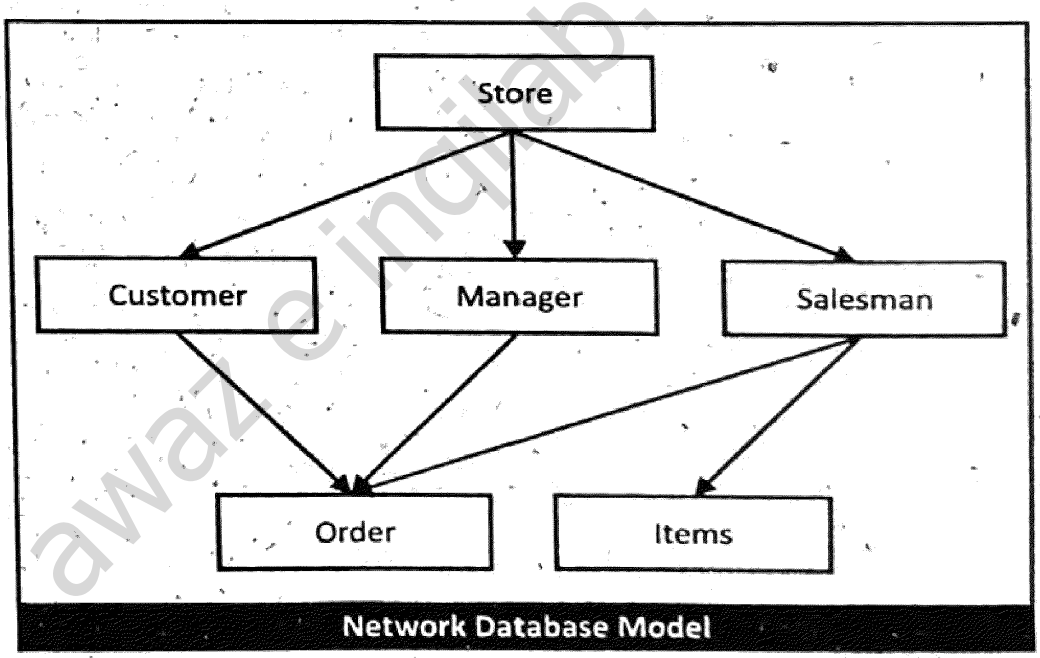
Some examples of hierarchical model are table of contents, departments of an organization and types of memories.



Hierarchical Database Model

2. Network Database Model:

A network database is similar to a hierarchical database model except that each child can have more than one parent record. A child record is referred to as a "member" and a parent record is referred to as an "owner". The advantage of the network database is its ability to establish (قائم کرنا) relationships between different branches of data records and thus offer increased access capability for the manager. The following figure shows a network database model.

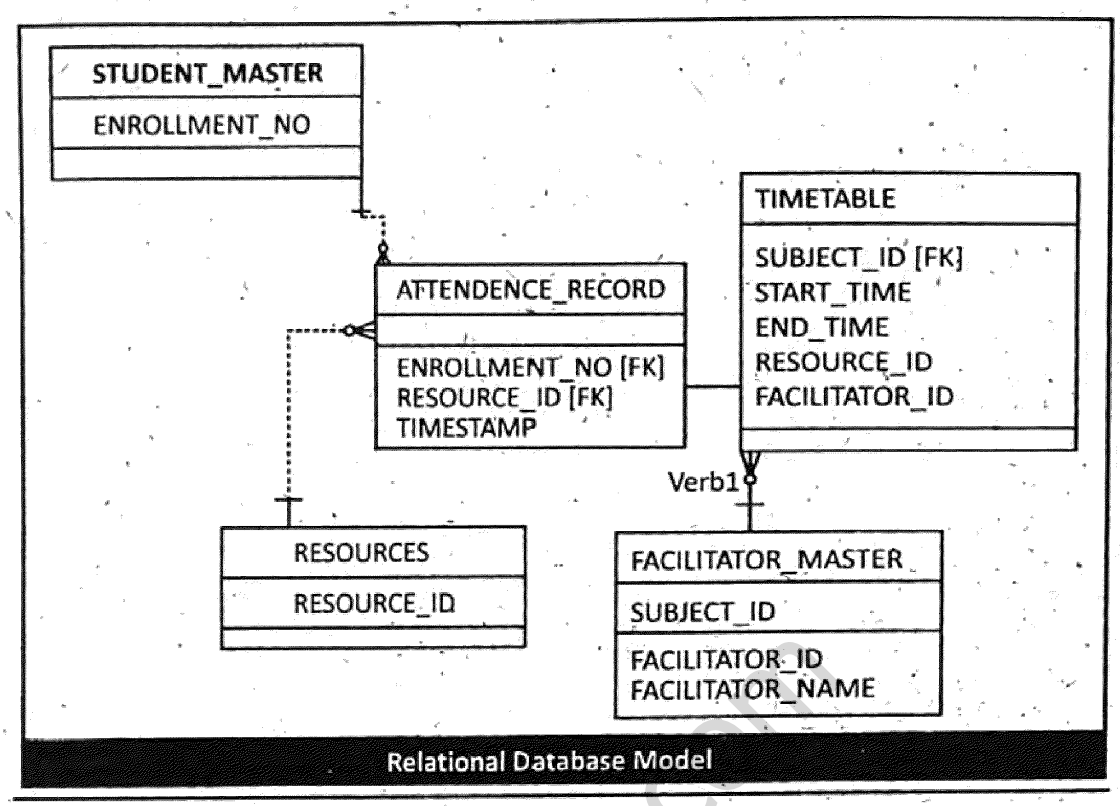


Network Database Model

3. Relational Database Model:

A relation is a table with columns and rows. The relational model uses a collection of tables/relations to represent both data and

the relationship among those data. Each table has multiple columns and each column has a unique name. information about particular entity is represented in rows (also called tuples) and columns. The following figure shows relational database model. This model is used in business applications.



4. Object-Oriented Database Model:

Object-oriented database model is a database model in which information is represented in the form of objects as used in object-oriented programming. When database capabilities (صلاحیتیں) are combined with object-oriented programming language capabilities, the result is an object-oriented database model.

5. Object Relational Database Model (ORDB):

Object relational database model adds new object storage capabilities to the relational database systems at the core of modern information systems. This model is designed to provide a relational database management that allows developers to combine databases with their data types and methods.

Function: The basic function of this new object relational model is more power, greatly flexibility, better performance, and

greater data integrity than other database models.

Q8: What is SQL? Explain its types.

Answer: SQL (Structured Query Language):

SQL (Structured Query Language) is a language for manipulating databases developed in the 70s by IBM. All data management systems use SQL to access data or to communicate with a data server.

Types of SQL:

1. DDL (Data Definition Language)
2. DML (Data Manipulation Language)
3. DCL (Data Control Language)

1. Data Definition Language (DDL):

Data Definition Language, DDL, is the part of SQL that allows a database user to create and restructure database objects, such as the creation or the deletion of a table.

DDL Commands:

Some of the most fundamental DDL commands are:

i)	CREATE TABLE	ii)	ALTER TABLE
iii)	DROP TABLE	iv)	CREATE INDEX
v)	ALTER INDEX	vi)	DROP INDEX
vii)	CREATE VIEW	viii)	DROP VIEW

2. Data Manipulation Language:

Data Manipulation Language, DML, is the part of SQL used to manipulate data within objects of a relational database.

DML Commands:

Some of the most important DML commands are:

a)	INSERT	b)	SELECT
c)	UPDATE	d)	MERGE
e)	DELETE	f)	LOCK TABLE

3. Data Control Language:

Data Control Commands in SQL allow users to control access to data within the database.

DCL Commands:

Some of the most important DCL commands are:

a) ALTER PASSWORD b) GRANT

c) REVOKE d) CREATE SYNONYM

Q9: Describe basic database terminologies.

Answer: Basic Database Terminologies:

The following are some basic database terminologies:

a) Field/Attribute/Column:

An attribute is a property or characteristic of an entity that is of interest to the organization. Following are some attributes:

- STUDENT: student no, name, address, phone no
- EMPLOYEE: employee no, name, address, skill

❖ In relational database model, an attribute is represented by column or field name.

b) Record/Tuple/Row:

A collection of related fields treated as a single unit is called a record.

For Example: A student's record includes a set of fields that contains Roll No, Name, Class, Data of Birth and Address.

❖ In relational database, a row or a record or tuple represents a single occurrence of an entity.

c) Table/Relation:

A table is set of values that are organized using vertical named columns and horizontal rows. A table has a specified number of columns but have any number of rows. In relational database, a table can be considered as relation.

For Example: A table contain duplicate rows, but a relation cannot contain duplicate rows.

d) View:

A view is a dynamic and virtual table that may not exist in the database but is derived from one or more base tables.

e) Data Type:

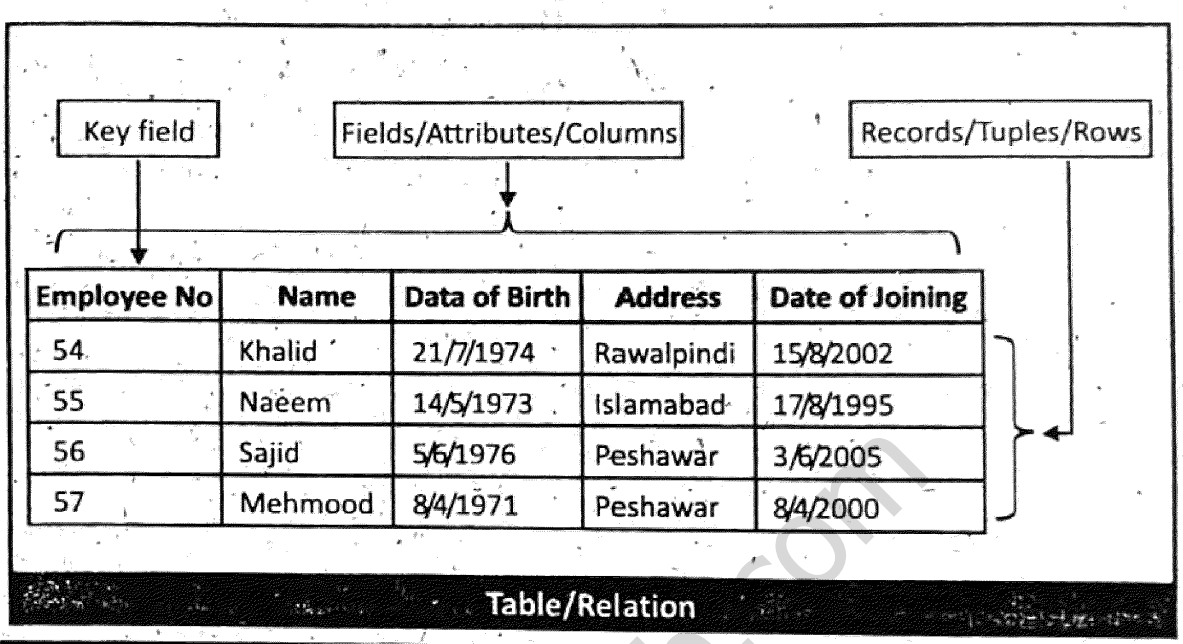
Data type is the classification of a particular type of

information. Flowing-point and character (text) are the common data types.

f) Key:

In order to track and analyze data effectively, each record in a table requires an identifier that identifies it, is called a key.

For Example: Student's roll number, employee number, and customer number, etc. are key fields.



Employee No	Name	Data of Birth	Address	Date of Joining
54	Khalid	21/7/1974	Rawalpindi	15/8/2002
55	Naeem	14/5/1973	Islamabad	17/8/1995
56	Sajid	5/6/1976	Peshawar	3/6/2005
57	Mehmood	8/4/1971	Peshawar	8/4/2000

Table/Relation

Q10: Explain various steps of planning a database.

Answer:

Planning a Database:

Introduction: Database planning is a systematic approach (منظم نقطہ نظر) to the development of database that moves from concept to design and development to implementation. A well-designed database promotes consistent data entry and retrieval.

Steps for Planning a Database:

There are five steps of planning a database, these are:

1. Problem Identification or Problem Definition
2. Feasibility Study (ممکنہ مطالعہ)
3. Requirements Analysis
4. Identifying Entities and Attributes
5. Assigning Names to Tables and Columns

1. Problem Identification or Problem Definition:

This is the first and most important steps in database designing process. The whole system depends upon this step because actual problem due to which database design is started is identified in this step. If the problem is identified correctly then all of the future work will be correct otherwise all future efforts, time and money used for database design will be wasted.

2. Feasibility Study:

It is a study conducted to find whether the new database system should be developed or not. Feasibility study depends on different factors required for database development including cost, time, staff, hardware and software, training, maintenance etc.

3. Requirement Analysis:

It is the process of understanding the customer needs and expectations (توقعات) from the proposed system. The database analyst has to work with people directly facing the problem and finds out how it can be solved. The current system is completely studied to collect all the available information about it. Requirements of users are important to know that how new system should behave.

4. Identifying Entities and Attributes:

Once the requirements have been defined, the next step is to identify the entities, it attributes and the relationships between entities. An entity is a person, place, thing about which actual data is to be stored in database.

Any attribute is the property of an entity. For example, if student is an entity then the student's name, age, address etc. are the attributes. A relationship is an association or connection between the entities.

5. Assigning Names to Tables and Columns:

After conversion of entities to tables and attributes to columns

of the tables, each and every table and columns should give name. Although there is no standard defined for naming tables and columns but all names should be meaningful and consistent (ثابت) throughout the database. For example, "Customer" for customer table. In case of attributes, meaningful names should also be used.

Q11: What is entity and attribute?

Answer: a) Entity:

Definition: An entity is a person, place, object, event or concept in user environment about which the organization wishes to maintain data.

Examples: Examples of entities are as under:

PERSON: employee, student, patient

PLACE: city, state, country

OBJECT: machine, building, automobile

EVENT: sale, admission, exams

CONCEPT: account, course, work center

Entity Instance:

Definition: A single occurrence of an entity is called entity instance. For example, the instances of entity STUDENT are as under:

Roll No: 454	Roll No: 343
Name: Ahmad Ali	Name: Nauman
Address: Peshawar	Address: Mardan
Phone No: 0454450454	Phone No: 0445666454

b) Attribute:

An attribute is a property or characteristic of an entity that is of interest to the organization. Following are some attribute:

STUDENT: student no, name, address, phone no

EMPLOYEE: employee no, name, address, skill

Q12: What is relation? Explain the degree of relationship with examples.

Answer: Relation:

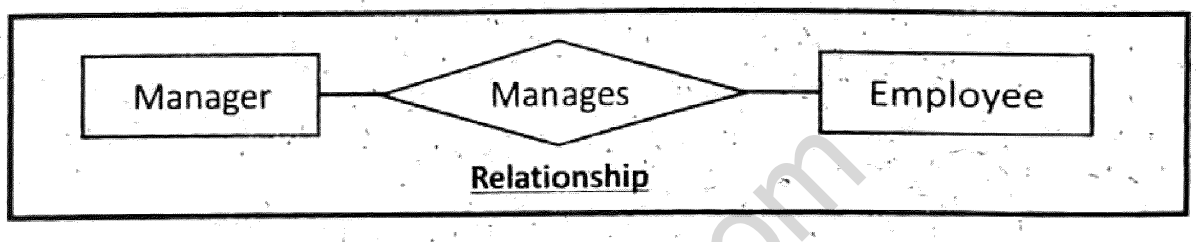
It is the combination of columns and rows and represents the

fundamental object of database. The basic application of relation is to store data. A relation has specified number of columns and may have many numbers of rows. There are no duplicate rows in relation. In relation, columns are called Fields, while Rows are called Tuples.

Relationship:

A meaningful association among entities is called a relationship. A relationship describes how the data is shared between entities. Relationships are represented by a diamond symbol connected to the related entities.

In the original Chen notation, the relationship is placed inside a diamond, e.g., manager manages employee as shown in figure:



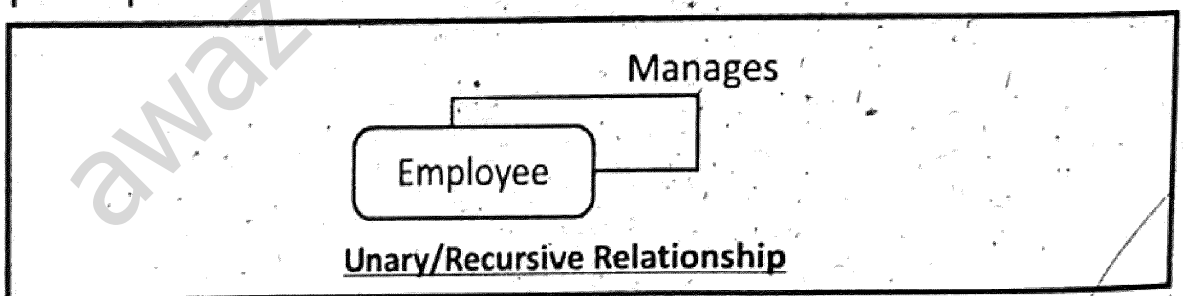
Relationship

Degree of a Relationship:

The number of participating entities in a relationship is known as the degree of the relationship. It has three types:

i) Unary Relationship:

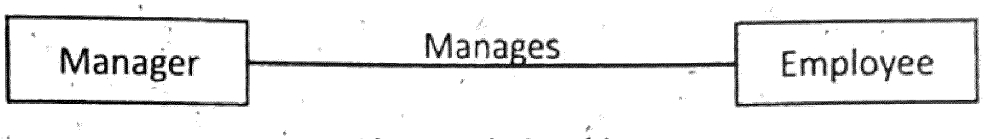
A unary relationship exists when an association is maintained within a single entity. Unary relationships are also known as a recursive relationship. It is a relationship where the same entity participates more than once in different roles.



Unary/Recursive Relationship

ii) Binary Relationship:

A binary relationship exists when two entities are associated with each other through a relationship. Or if there are two entity types involved, it is a binary relationship type.



Binary Relationship

One-to-One: One instance of an entity (A) is associated with only one instance of another entity (B). it is marked as 1:1.

For example, in a database one instance of entity type country (A) is associated with only one instance of entity type president (B).

One-to-One

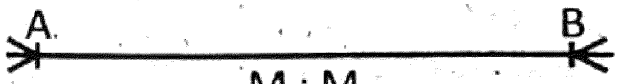
One-to-Many: One instance of an entity (A) is associated with zero, one or many instances of another entity (B), but for one instance of entity B there is only one instance of entity A. It is marked as 1 : M.

For example, for a company with all employees working in one building, the building name (A) is associated with many different employees (B).

One-to-Many

Many-to-Many: One instance of an entity (A) is associated with one, zero or many instances of another entity (B), and one instance of entity B is associated with one, zero or many instances of entity A. It is marked as M : M.

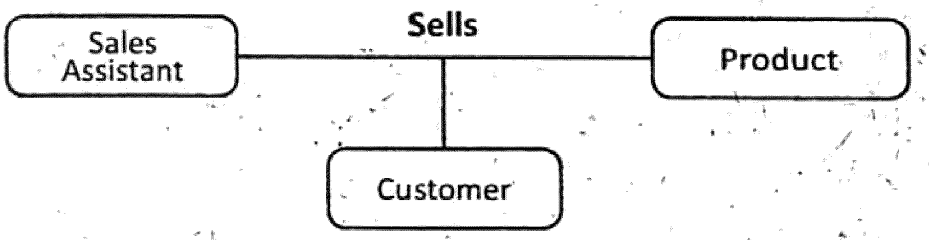
For example, for a company in which all of its employees work on multiple projects, each instance of an employee (A) is associated with many instances of a project (B), and at the same time, each instance of a project (B) has multiple employees (A) associated with it.



Many-to-Many

iii) Ternary Relationship:

A ternary relationship exists when three entities are associated. Or if there are three entity types involved, it is a ternary relationship type.



Ternary Relationship

Q.13: What is key? Explain different types of keys.

Answer: Key:

Introduction: A key is a way of specifying uniqueness. A key is an important part of relational database and a vital part of the structure of a table. A key ensures each record within a table can be uniquely identified by one field or a combination of fields within the table.

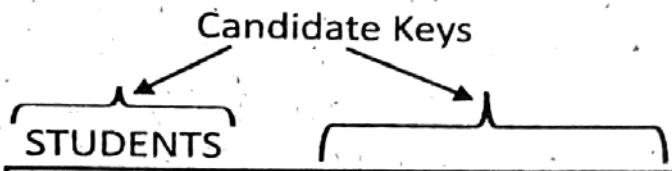
Types of Keys: There are different types of keys:

i) CANDIDATE KEY:

A candidate key is any set of one or more columns whom combined values are unique among all occurrences. In other words, a candidate key can be used to uniquely identify each record in the table.

For Example:

Student_id can be a candidate key in a student table. But at the same time, the combination of student's first name and last name also form a candidate key. These both can be candidate keys for student table.



StudentId	firstName	lastName	courseId
P001234	Hassan	Khan	C001
P002345	Junaid	Asad	A003
P003456	Yahya	Jan	B002
P002134	Ali	Sher	P004
P003245	Nasir	Hussain	Z005
P004135	Usman	Ejaz	E002

Candidate Keys

ii) PRIMARY KEY:

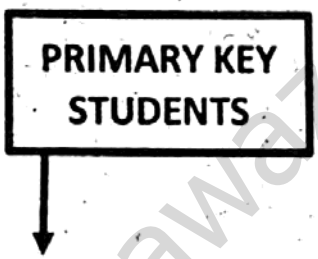
Each entity in a database must have a unique key field known as primary key to identify a record. It is used to identify particular rows in a relation.

For Example:

Roll number of a student can be used as primary key in a student database since it is unique key field.

Characteristics of Primary Key:

- The value of primary key must not be duplicated throughout the database.
- The value of Primary key must not be null anywhere in the database.



StudentId	firstName	lastName	courseId
P001234	Hassan	Khan	C001
P002345	Junaid	Asad	A003
P003456	Yahya	Jan	B002
P002134	Ali	Sher	P004

Primary Key

iii) FOREIGN KEY:

A foreign key is generally a primary key from one table that appears as a field in another table where the first table has relationship to the second.

For Example:

If we have a table A with a primary key X that is linked to a table B where X is a field in B, then X would be a foreign key in B.

STUDENTS

StudentId	firstName	lastName	courseId
P001234	Hassan	Khan	C001
P002345	Junaid	Asad	A003
P003456	Yahya	Jan	B002
P002134	Ali	Sher	P004

Foreign Key

Relationships

COURSES

Primary Key →

courseId	courseName
C001	Computer Sci
A003	Accounts
B002	Biology
P004	Physics

Foreign Key

iv) COMPOSITE PRIMARY KEY:

When a primary key contains two or more of columns or fields, it is called as composite primary key.

v) SUPER KEY:

A super key is a set of one or more attributes that are taken collectively and can identify all other attributes uniquely.

For example, student roll no combined with CNIC is an example of super key.

vi) SECONDARY KEY:

A secondary key is an attribute or combination of attributes

that is not a primary key and can have duplicate data. In a STUDENT table if roll number is a primary key, then name of the student, address of the student, phone number of the student and the fee paid by the student are secondary keys. Secondary keys are used to speed up searching process in databases.

vii) ALTERNATE KEY:

A candidate key which is not selected as the primary key is called alternate key.

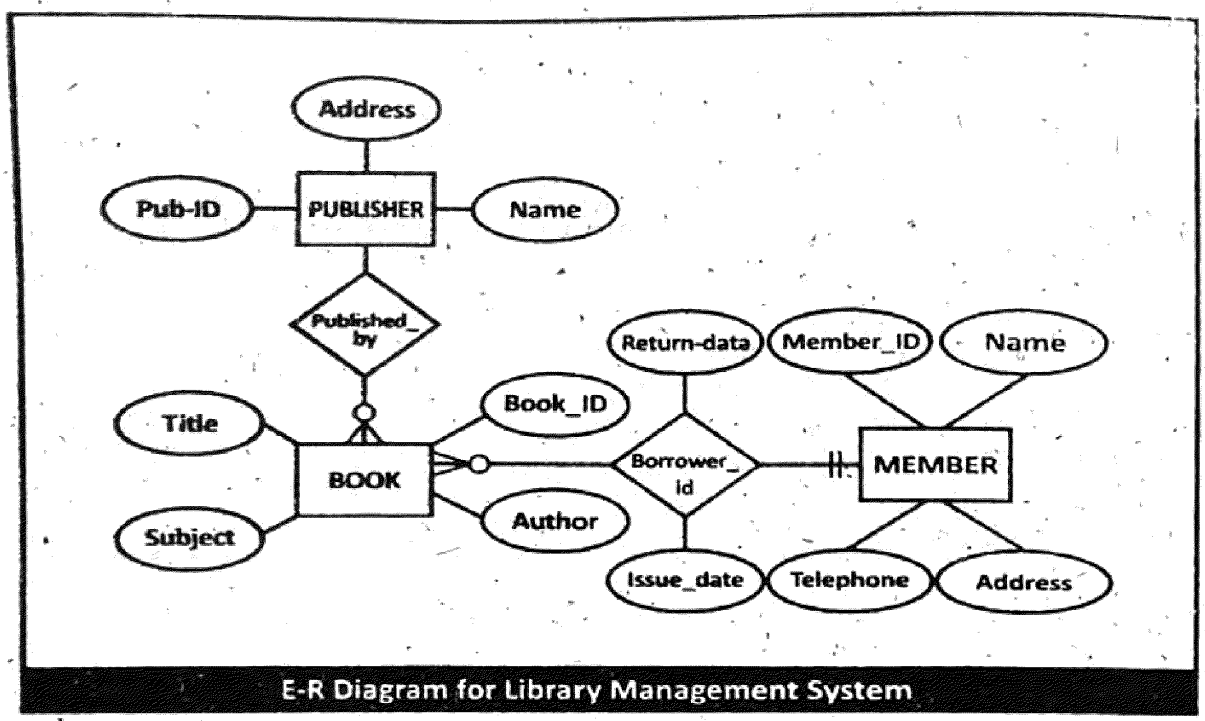
For example, if roll no. and registration no. fields are the candidate keys and if roll no. is selected as the primary key then registration no. will work as the alternate key.

Q14: Draw ERD for:
- **i) Library Management System**
- **ii) Student Management System**

Answer: i) E-R Diagram for Library Management System:

In the library management system shown in figure, the following entities and attributes can be identified:

1. **Book:** The set of all the books in the library. Each book has a book-id, title, author and subject as its attributes.
2. **Member:** The set of all the library members. The member is described by the attributes memb_id, name, address and telephone.
3. **Publisher:** The set of all the publishers of the books. Attributes of this entity are Pub_ID, address and name.
4. **Relationship between Publisher and Book:** The relationship between publisher and book is one-to-many because a publisher publishes many books.
5. **Relationship between Member and Book:** The relationship between member and book is also one-to-many because a member can borrow one or more books.



E-R Diagram for Library Management System

ii) E-R Diagram for Student Management System:

In the student management system shown in figure, the following entities and attributes can be identified.

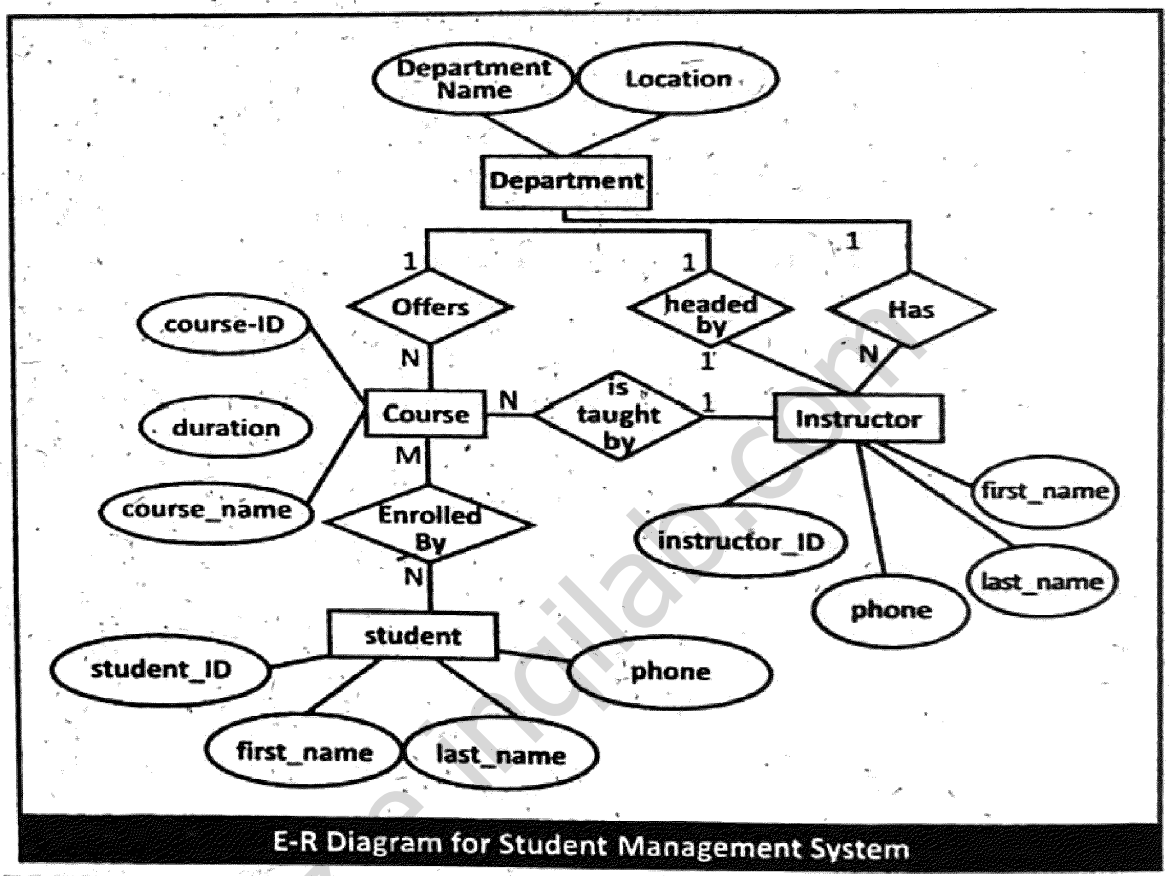
1. **Department:**
   The set of all the departments in an organization. Each department has a department name and location as its attributes.

2. **Instructor:**
   The set all the instructors in a department. The instructor is described by the attributes instructor_ID, first_name, last_name and phone.

3. **Course:**
   The set of all the courses offered by a department. The course is described by the attributes course_ID, duration and course_name.

4. **Student:**
   The set of all the students of the institution. Attributes of this entity are student_ID first_name, last_ name and phone.

5. **Relationship between Department and Course:** The relationship between department and course is one to many because a department offers many courses for study.
6. **Relationship between Department and Instructor:** The relationship between department and instructor is one to many because a department can hire many instructors to teach different courses in the institution.
7. **Relationship between Instructor and Course:** The relationship between instructor and course is one to many because an instructor teaches one or many courses.



E-R Diagram for Student Management System

Q15: Describe E-R diagram of ticket booking system.

Answer: E-R Diagram for Ticket Booking System:

In the ticket booking system shown in figure, the following entities and attributes can be identified:

i) Airline: The entity airline is set of all the airlines and its attributes are Airline_Code and Airline_Name.

ii) Passenger: The set of all the passengers who want to travel by an airplane. Each passenger has a Ticket_No, Name, Address

and Phone_No as its attributes.

iii) Seat: The set of all the seats available for reservation to passengers. The seat is described by the attributes Seat_No, Class and Name.

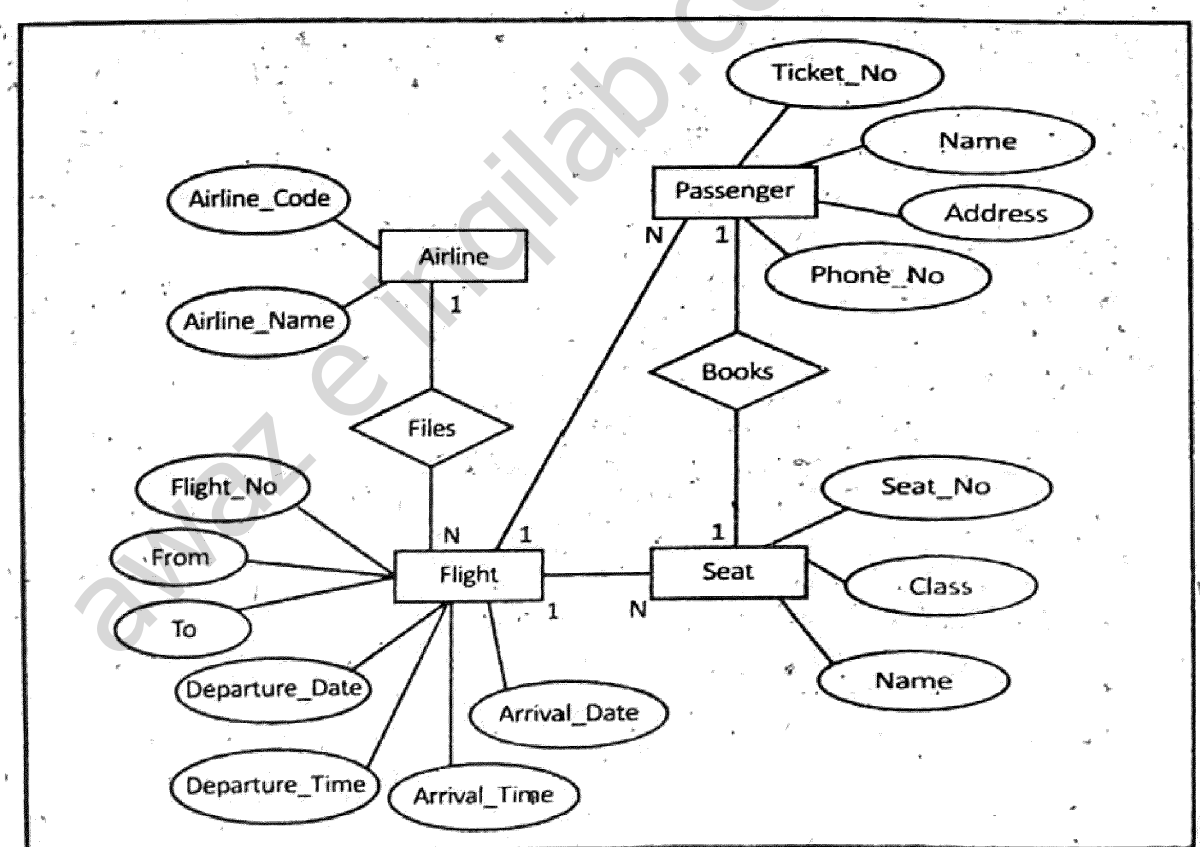
iv) Flight: The set of all flights offered by an airline. The flight is described by the attributes Flight_No, Departure_Date, Departure_Time, Arrival_Date, Time, From and To.

v) Relationship between Airline and Flight: The type of relationship between airline and flight is one-to-many because one airline has many flights.

vi) Relationship between Passenger and Seat: The type of relationship between passenger and seat is one-to-one because each passenger occupies a single seat for travelling in a flight.

vii) Relationship between Flight and Passenger: The type of relationship between flight and passenger is one-to-many because each flight has many passengers.

viii) Relationship between Flight and Seat: The relationship between flight and seat is one-to-many because there may be one or many seats available for reservation in each flight.



E-R Diagram for Ticket Booking System

Q16: Describe different steps of transformation of E-R model into relational schema.

Answer: A Relational Schema for a database is an outline of how data is organized. It can be a graphical illustration or another kind of chart used by programmers to understand how each table is laid out (ترتیب دینا), including the columns and the types of data they hold and how tables connect.

Steps of Transformation of E-R Model into Rational Schema:

There are three steps of transforming E-R model into relational schema. The steps are:

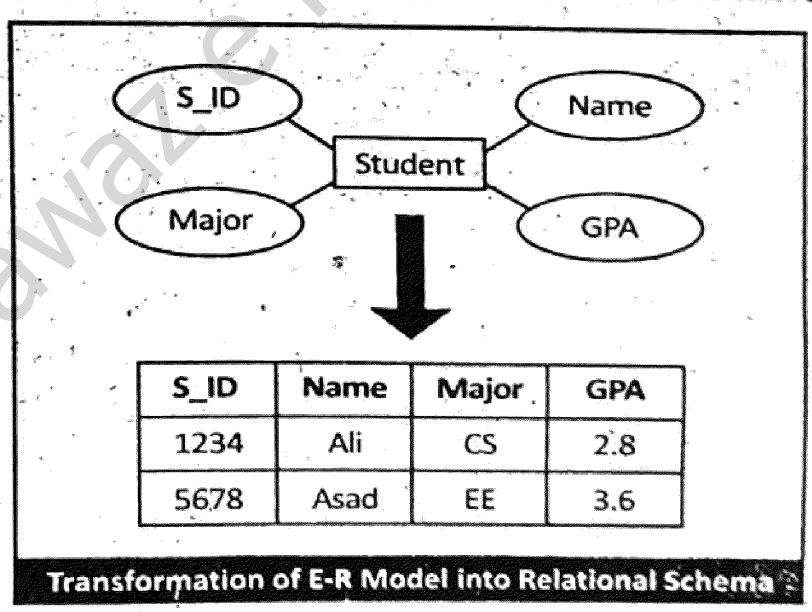
1. Transforming Entities to Relational Schema
2. Transforming Attributes to Relational Schema
3. Transforming Relationships to Relational Schema

1. Transforming Entities to Relational Schema:

In this step, each entity set is replaced by a table or relation. Each table has a name. The name used is the entity name. each table has a number of rows and columns each row corresponds (مطابقت رکھنا) to an entity instance. Each columns corresponds to an attribute.

2. Transforming Attributes to Relational Schema:

In this step, each attribute of the entity type is replaced by a column (Field) in the table. Suppose we have an entity type "Student" that has attributes, S_ID, Name and marks. All the attributes of Student entity will become columns in the Student table.



S_ID	Name	Major	GPA
1234	Ali	CS	2.8
5678	Asad	EE	3.6

Transformation of E-R Model into Relational Schema

3. Transforming Relationships to Relational Schema:

Each Relationship in an E-R diagram must also be represented in relational schema. The representation depends upon the nature of relationship. In some cases, a relationship is represented by making the primary key of one relation, a foreign key of another relation. In some cases, a separate relation is created to represent a relationship.

Q17: What is normalization? Explain the following normal forms 1NF, 2NF, 3NF.

Answer: Normalization:

Introduction: Normalization is the process of organizing data in relational database in order to minimize duplication (نقل کو کم کرنا) of information (data) and to safeguard (حفاظت) the database against certain anomalies (بے ترتیبی).

Purpose of Normalization: The basic purpose of normalization is to divide large table into smaller and well-formed tables/relations and remove the inconsistencies or anomalies.

Normal Form:

The degree of normalization is termed as Normal Form. For example, First Normal Form (1NF)), Second Normal Form (2NF), Third Normal Form (3NF) etc.

First Normal Form (1NF): The relation is considered to be in First Normal Form (1NF), if the intersection of each row and column contains only one value. In 1NF we remove the repeating groups. Consider the following example:

Employee Table

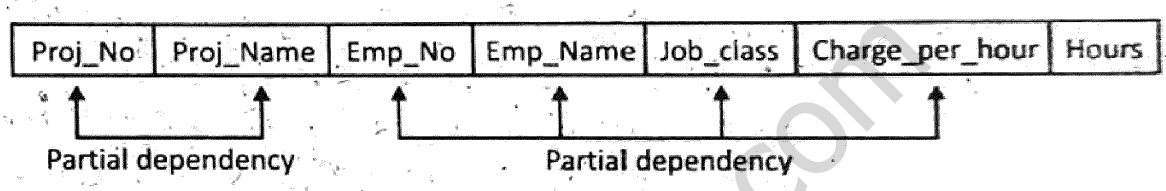
Proj No	ProjName	EmpNo	EmpName	JobClass	Charge-PerHour	Hours
15	Evergreen	103	Jameel Khan	Elect. Engineer	1000	23
		101	Faisal Naeem	DB Designer	900	19
		105	Bilal Ahmad	DB Designer	900	35
18	MIS	114	Zubair Ahmad	Programmer	750	12.6
		118	M. Waseem	System Analyst	800	45.3
		104	Shaukat Ali	App Designer	600	32.4

Unnormalized Table

The employee table contains repeating group. To normalize the above table, all repeating groups must be eliminated. We re-arrange the relation (table) as below, to convert it to First Normal Form.

Proj No	ProjName	EmpNo	EmpName	JobClass	Charge-PerHour	Hours
15	Evergreen	103	Jameel Khan	Elect. Engineer	1000	23
15	Evergreen	101	Faisal Naeem	DB Designer	900	19
15	Evergreen	105	Bilal Ahmad	DB Designer	900	35
18	MIS	114	Zubair Ahmad	Programmer	750	12.6
18	MIS	118	M. Waseem	System Analyst	800	45.3
18	MIS	104	Shaukat Ali	App Designer	600	32.4

Second Normal Form: A relation will be in 2NF, if it is in the first normal form and all non key attributes must be fully functional dependent on the whole primary key (No partial dependencies). Consider the following table:



Tables with Partial Dependencies

Attribute Proj_Name is dependent on **Proj_No**, while Emp_Name, Job_Class and Charge_per_hour are dependent on **Emp_No**. Dependencies based on only part of a composite primary key are called partial dependencies.

Project Table:

ProjNo	ProjName

Normalized Table

Employee Table:

EmpNo	EmpName	JobClass	ChargePerHour

Table in 2NF

Hours Table:

ProjNo	EmpNo	Hours

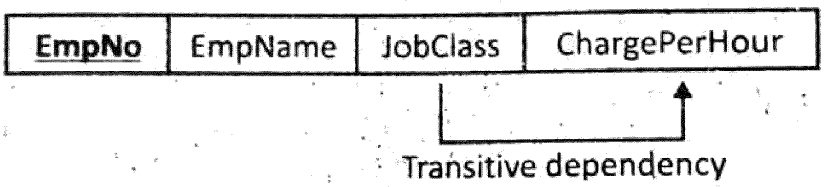
Normalized Table

Because the number of hours spent on each project by each

employee is dependent on both Proj_No and Emp_No, we place these hours in the Hours table hours as in figure.

Third Normal Form: The relation should be in the 1st and 2nd normal forms and all transitive dependencies must be removed. A transitive dependency is a dependency of one non-key attribute on another non-key attribute. Consider the following table:

Employee Table:



Tables with Transitive Dependencies

Both Job_class and Charge_per_hour are non-key attributes and the later one is dependent on the former. So by removing transitive dependency the following new tables will be created:

Employee Table:

EmpNo	EmpName	JobClass

Table in 3NF

Job Table:

JobClass	ChargePerHour

Table in 3NF

Q18: What is ERD? Draw an ERD for the following systems.

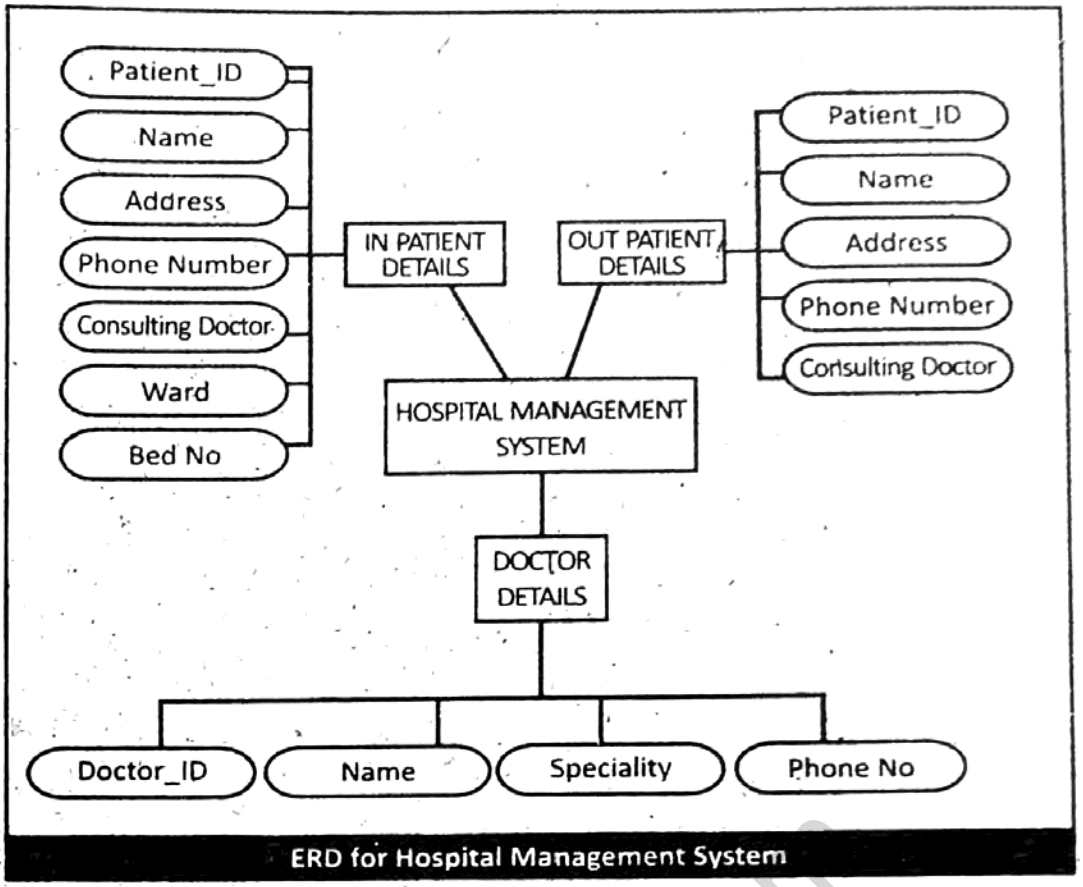
Answer: ERD: An Entity Relationship (ER) diagram is a specialized graphic that shows the relationships between entities in a database. **(OR)**

An Entity-Relationship diagram is a graphical representation of entities and their relationship to each other.

ER Diagrams often use symbols to represent three different types of information. Boxes are commonly used to represent entities. Diamonds are normally used to represent relationships and ovals are used to represent attributes.

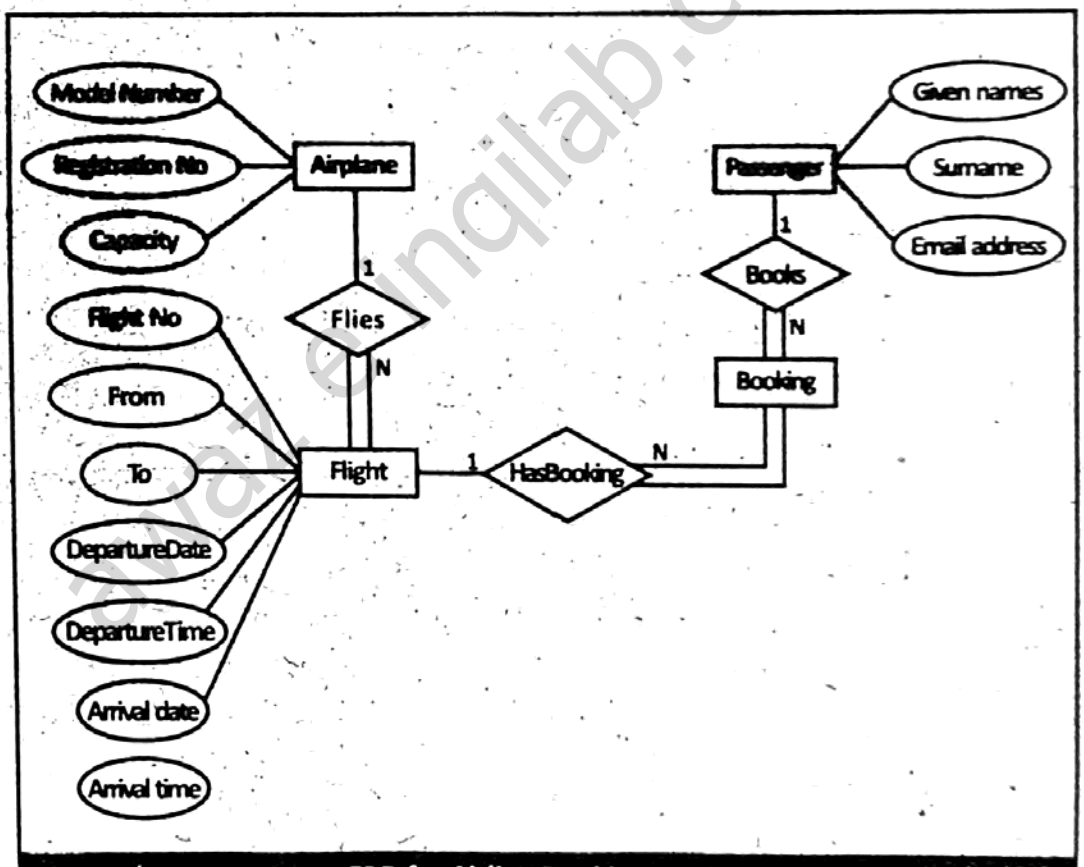
1. Hospital Management System
2. Airline Booking System

1. ERD for Hospital Management System:



ERD for Hospital Management System

2. ERD for Airline Booking System:



ERD for Airline Booking System

EXERCISE MCQS

Q#1: Select the best choice for the following MCQs.

1. Hierarchical DBMS organizes data elements into_____
   a. Segments b. Data Compartments
   c. Data Units d. Objects
2. _____is a database model in which information is represented in the form of objects.
   a. Network Database Model
   b. Relational Database Model
   c. Object-Oriented Database Model
   d. Hierarchical Database Model
3. Who is the person who has central control over data and programs in a database system?
   a. DBA b. Designer
   c. System Analyst d. Programmer
4. In relational terminology, an attribute is also called _____.
   a. A record b. An entity
   c. A field d. A table
5. A row in a table is also known as_____.
   a. Column b. Relation
   c. Tuple d. Field
6. _____is a set of rules or specifications which state that how data can be stored, organized and manipulated in a database system.
   a. Database Model b. Database Design
   c. Database Architecture d. Database Structure
7. Which of the following database models uses a collection of tables to represent both data and the relationship among those data?
   a. Network Database Model
   b. Relational Database Model
   c. Object-Oriented Database Model

d. Hierarchal Database Model

8. _____ is a database language that defines the structure in which data are stored.
   a. DNL b. DCL
   c. DDL d. DML

9. A field or a combination of fields used to identify particular row in a relation is called_____.
   a. Secondary Key b. Foreign Key
   c. Primary Key d. Alternate Key

10. A combination of two or more columns used to identify particular row in a relation is a_____.
   a. Secondary Key b. Composite Key
   c. Foreign Key d. Primary Key

Answers:

1	2	3	4	5	6	7	8	9	10
a	c	a	c	c	a	b	c	c	b

Short Questions

Q2: Give short answers to the following questions.

Q:i. Define the terms database and DBMS.

Answer: 1. Database:

Introduction: A database is a collection of information that is organized so that it can be easily accessed, managed and updated.

Explanation:

Consider the names, telephone numbers and addresses of the people you know. You may have recorded this data in an indexed address book or you stored it on your computer's hard disk using software such as Microsoft Access or Excel. This collection of data is said to be database.

A database can be of any size and complexity.

Small Database: For example, a database containing names and telephone numbers of your friends may have only a few

records.

Large Database: For example, a database containing information about all the citizens of a country for National Identity Card (NIC) contain millions of record.

A computerized database is created and maintained by a database management system, for example library management system, stock control system, examination control system, etc.

2. DBMS:

Definition: A database management system (DBMS) is the software system that allows users to define, create and maintain a database and provides controlled access to the data. **(OR)**

A database management system (DBMS) is a set of programs that allow users to create, maintain and manipulate database, and store or retrieve data from those database files.

Manipulation of Data: Manipulation of data includes the following:

1. Adding new data, for example adding details of new student.
2. Deleting unwanted data, for example deleting the details of students who have completed course.
3. Changing existing data, for example modifying the fee paid by the student.

The DBMS makes it possible to share the data in the database among multiple applications and users.

Examples of the Database System:

Some examples of the database systems managed by DBMS are:

1. Customer information system
2. Inventory information
3. Library management
4. Accounting and bookkeeping

Examples of DBMS:

- Microsoft SQL Server
- Oracle
- Sybase
- MongoDB
- Microsoft Access
- MySQL from Sun Microsystems (Oracle)
- Db2 from IBM

Q:ii. Give three examples of data and information.

Answer: Data:

Data is a set of raw facts and figures that need to be processed.

Word "Data": The word "Data" is the plural form of Latin word "Datum" which means "to give" or "something given". Data may consists of numbers, characters, symbols or pictures.

Examples of the Data:

Some examples of the data are:

1. Students' names in a class are data.
2. A student's subject marks are data.
3. A day's temperature, humidity, wind speed recorded are data.

Information:

When facts, figures or number (data) are processed and converted into meaningful form that can be used for decision making or other useful activity, it is called information.

Examples of Information: Examples information are:

1. Names of students' in alphabetic order is an information.
2. Student percentage of marks, grade and position are information.
3. Weather prediction as cold or warm in information.

Q:iii. Write three disadvantages of file management system.

Answer: Disadvantages of File Management System:

1. Data Redundancy:

Redundancy means duplications of data. Since same data is

stored in multiple files which are needed by different application programs which causes data redundancy.

2. Data Isolation:

Isolation means separation of data i.e., related data is scattered in in multiple files. It is difficult and time consuming to write new programs to retrieve the proper data from multiple files at once.

3. Poor Data Security:

File management system does not provide proper security on data. The data can be easily accessed and changed by unauthorized user. applying security techniques such as password protection and locking of files is very difficult.

4. Intensive Coding:

The processing tasks like searching, editing, deletion and updating should have separate programs. It means there are no built-in functions available and needs coding every time to perform these operations.

Q:iv. Give any four advantages of database system.

Answer: Advantages of Database System:

1. Sharing of Data:

In DBMS, Data can be shared between authorized users of database. All the users have their own right to access the database up to a level. Database Administration has complete access of database. He can assign users to access the database. Others users are also authorized to access database and also they can share data between them. Many users have same authority to access the database.

2. Data Consistency:

DBMS controls data redundancy which in turn controls data consistency. Data consistency means if users want to update data in any files then all the files should not be updated again. As in DBMS, data is stored in a single database so data becomes more consistent in comparison to file processing system. Also

updated values are available to all the users immediately.

3. Controlled Data Redundancy:

In the conventional file management system, every user maintains its own files for handling data. The database approach combines redundant data into a single, logical structure. Every primary fact is stored at only one place in the database.

4. Backup & Recovery:

DBMS provides facilities of backup and recovery from failures including disk crash, power failure, software errors, which may bring the database from the inconsistent state to a state prior to the failure.

Q:v. Differentiate between DDL and DML.

Answer:

DDL	DML
1. DDL stands for data definition language.	**1.** DML stands for data manipulation language.
2. It is a database language that defines the structure in which data are stored.	**2.** It is a language that enables users to access or manipulate data.
3. Examples of DDL statements are: ➢ **CREATE:** To create objects in the database ➢ **ALTER:** Alters the structure of the database ➢ **DROP:** Delete objects from the database ➢ **TRUNCATE:** Remove all records from a table, including all spaces allocated for the records are removed ➢ **COMMENT:** Add	**4.** Examples of DML statements are: ➢ **SELECT:** Retrieve data from a database ➢ **INSERT:** Insert data into a table ➢ **UPDATE:** Updates existing data within a table ➢ **DELETE:** Deletes all records from a table, the space for the records remain ➢ **MERGE:** UPSERT operation (insert or update)

comments to the data dictionary ➢ **RENAME:** Rename an object	➢ **CALL:** Call a PL/SQL or Java subprogram ➢ **EXPLAIN PLAN:** Explain access path to data ➢ **LOCK TABLE:** Control concurrency

Q:vi. What is data model?

Answer: Data Model:

A database model is a set of rules or specifications which state that how data can be stored, organized, and manipulated in a database system. It provides tools for describing data, data relationships, data semantics and consistency constraints. In short words database define a way of structuring data.

Types of Data Model:

There are five types of database models:

1. Hierarchical database model
2. Network database model
3. Relational database model
4. Object oriented database model
5. Object relational database model

Q:vii. Differentiate between cardinality and modality.

Answer:

Cardinality	Modality
1. Cardinality refers to the maximum number of times an instance is one entity can be associated with instance in the related entity.	1. Modality refers to the minimum number of times an instance in one entity can be associated with an instance in the related entity.
2. Cardinality can be 1 or many and the symbol is placed on the outside ends of the relationship line, closest to the entity.	**2.** Modality can be 1 or 0 and the symbol is placed on the inside, next to thee cardinality symbol.

3. For a cardinality of 1 a straight line is drawn.	3. For a modality of 1 a straight line is drawn.
4. For a cardinality of many a foot with three toes is drawn.	4. For a modality of 0 a circle is drawn.

Q:viii. What is primary key and foreign key?

Answer: Key:

A key is a way of specifying uniqueness. A key is an important part of relational database and a vital part of the structure of a table.

i) PRIMARY KEY:

Each entity in a database must have a unique key field known as primary key to identify a record. It is used to identify particular rows in a relation.

For Example:

Roll number of a student can be used as primary key in a student database since it is unique key field.

Characteristics of Primary Key:

- The value of primary key must not be duplicated throughout the database.
- The value of Primary key must not be null anywhere in the database.

PRIMARY KEY
STUDENTS

StudentId	firstName	lastName	coursed
P001234	Hassan	Khan	C001
P002345	Junaid	Asad	A003
P003456	Yahya	Jan	B002
P002134	Ali	Sher	P004

Primary Key

ii) FOREIGN KEY:

A foreign key is generally a primary key from one table that appears as a field in another table where the first table has relationship to the second.

For Example:

If we have a table A with a primary key X that is linked to a table B where X is a field in B, then X would be a foreign key in B.

STUDENTS

StudentId	firstName	lastName	courseId
P001234	Hassan	Khan	C001
P002345	Junaid	Asad	A003
P003456	Yahya	Jan	B002
P002134	Ali	Sher	P004

Foreign Key

Relationships

COURSES

Primary Key →

courseId	courseName
C001	Computer Sci
A003	Accounts
B002	Biology
P004	Physics

Foreign Key

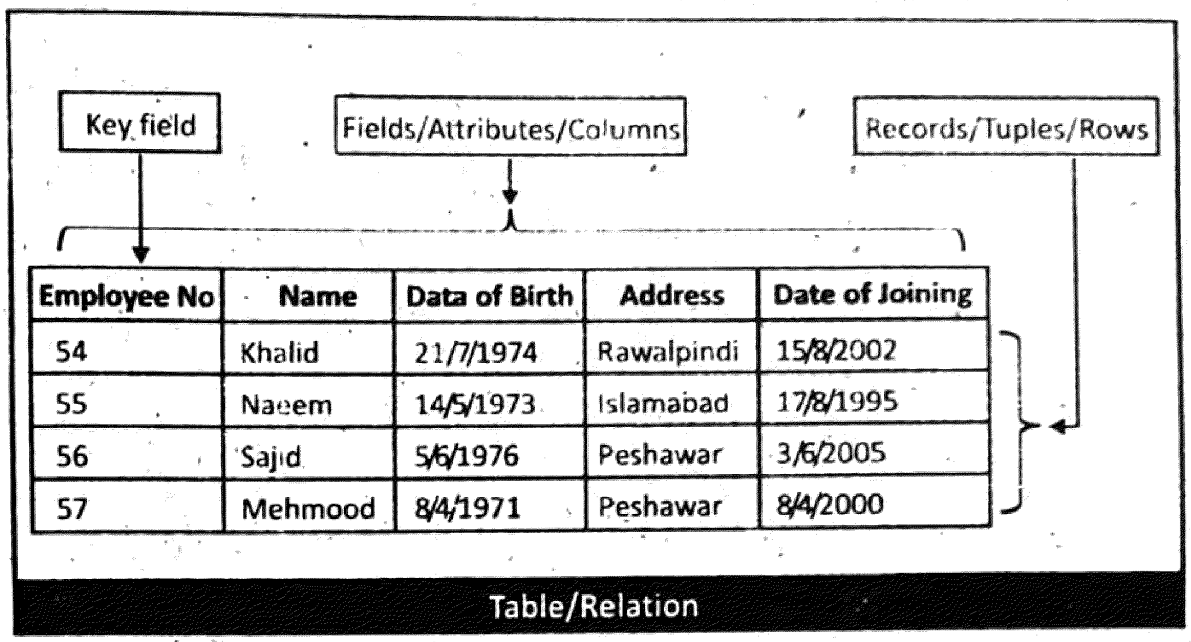
Q:ix. What is relation?

Answer: Relation:

Relation is the combination of columns and rows and represents the fundamental object of database. The basic application of relation is to store data. A relation has specified number of columns and may have many numbers of rows. There are no duplicate rows in relation.

For Example:

A table contain duplicate rows, but a relation cannot contain duplicate rows.



Employee No	Name	Data of Birth	Address	Date of Joining
54	Khalid	21/7/1974	Rawalpindi	15/8/2002
55	Naeem	14/5/1973	Islamabad	17/8/1995
56	Sajid	5/6/1976	Peshawar	3/6/2005
57	Mehmood	8/4/1971	Peshawar	8/4/2000

Q:x. What is the role of DBA?

Answer: DBA (Database Administrator):

A Database Administrator (DBA) is responsible for the development and design of data base and improving database performance, capacity and planning for future expansion requirements. (OR)

A database administrator is a person or a group of persons who are responsible for managing all the activities related to database system.

Role of Database Administrator:

10. Installing and upgrading the database server.
11. Implementation of data models, database design and performance issues
12. Allocating system storage.
13. Enrolling users and maintaining system security.
14. Controlling and monitoring user access to the database.
15. Backing up and restoring databases.
16. Allocating passwords to users.
17. Providing training to new employee about using the database.
18. Monitoring jobs running on the database and performance.

Detailed Questions

Q3: Give detailed answers to the following questions.

i. Explain different types of database models.

Answer: See Question # 7, Page # 212

ii. What is SQL? Explain its types.

Answer: See Question # 8, Page # 215

iii. Explain various steps of planning a database.

Answer: See Question # 10, Page # 217

iv. What is a relation? Explain the degree of relationships with examples.

Answer: See Question # 12, Page # 219

v. What is ERD? Draw an ERD for the following systems:
(a) Hospital management system
(b) Airline booking system

Answer: See Question # 18, Page # 232

vi. Describe different steps of transformation of E-R model into relational schema.

Answer: See Question # 16, Page # 229

vii. What is normalization? Explain the following normal forms 1NF, 2NF, 3NF.

Answer: See Question # 17, Page # 230

Additional MCQs

Q. Select the best answer for the following MCQs.

1. Duplication of data in different files is called_____.
   a. Data inconsistency **b. Data redundancy**
   c. Data overflow d. Invalid data

2. If data is not updated in a file in file based data management systems, what types of problem will it cause?
   a. Data inconsistency b. Data redundancy
   c. Data overflow d. Invalid data

3. A record is also called_____.
   a. Attribute b. Entity
   c. Property **d. Tuple**

4. An attribute is also called:
   a. Record b. Entity
   c. Field d. Relation

5. What is a thing of interest to an organization called about which data is to be held?
   a. Field b. Relation
   c. Entity d. Attribute

6. In which type of database data is held in tables and tables are linked by common field?
   a. Hierarchical database b. Network database
   c. Relational database d. Object-oriented database

7. In Which database model data is organized in tree-like structure?
   a. Hierarchical database b. Network database
   c. Relational database d. Object-oriented database

8. What refers to the maximum number of times an instance in one entity can be associated with instances in the

related entity?

a. Relation b. Cardinality
c. Modality d. E-R diagram

9. What refers to the minimum number of times an instance in one entity can be associated with an instance in the related entity?

a. Relation b. Cardinality
c. Modality d. E-R diagram

10. What is a key field called that is used in relationship between tables whose value matches a primary key in the other table?

a. Candidate key b. Secondary key
c. Alternate key **d. Foreign key**

11. Which of the following is not an example of DBMS?

a. MySQL b. Microsoft Access
c. IBM DB2 **d. Google**

12. In which of the following formats data is stored in the database management system?

a. Image b. Text
c. Table d. Graph

13. Which type of data can be stored in the database?

a. Image oriented data
b. Text, files, containing data
c. Data in the form of audio or video
d. All of the above

14. What is the full form of DBMS?

a. Data of Binary Management System
b. Database Management System
c. Database Management Service
d. Data Backup Management System

UNIT 8
DATABASE DEVELOPMENT

Q1 Explain types of relational database management system.

Answer: Relational Database Management System:

In a relational database model, the database is logically organized as group of inter related tables. Each table can have multiple rows and columns. A table is a collection of records and represents a database entity.

Types of Relational Database Management System:

There are three common types of relational database management system (RDBMS):

a) Microsoft Access b) SQL Server c) Open Office Base

a) Microsoft Access:

Microsoft access, also known as access, is a relational database management system. MS access is bundled as part of the Microsoft office suite. An access database is a collection of database objects i.e., tables, queries, forms, reports, macros, and modules. Microsoft access saves database with a .accdb file extension. Older access databases used an .mdb extension or sometimes a .mde extension. However 2007, Microsoft access use .accdb extension.

b) SQL Server:

Microsoft SQL server is a relational database management system developed by Microsoft. Its main function is to store and retrieve data as requested by other software applications. SQL server offers a variety of tools for database development, maintenance and administration. It is also used to create and manage web-based databases.

c) Open Office Base:

Open Office Base is the database module of open office suite. It has wizards to help new users to create database design, that is, to create tables, queries, forms and reports. It allows users

to create interactive databases to manage data related to payroll, inventory, assets, budgets, customers, sales orders and invoices etc.

Q2: What is MS Access 2016?

Answer: MS Access 2016:

Microsoft access is relational database management system (RDBMS), designed mainly for home or small business use. Microsoft access 2016 is the common and best suited DBMS for developing and managing databases. Microsoft access 2016 provides a powerful set of tools that help users to quickly start tracking, reporting and sharing information. By using access 2016, it is easy to adapt database applications and reports for changing business needs.

Q3: How to open MS Access 2016?

Answer: Opening Access:

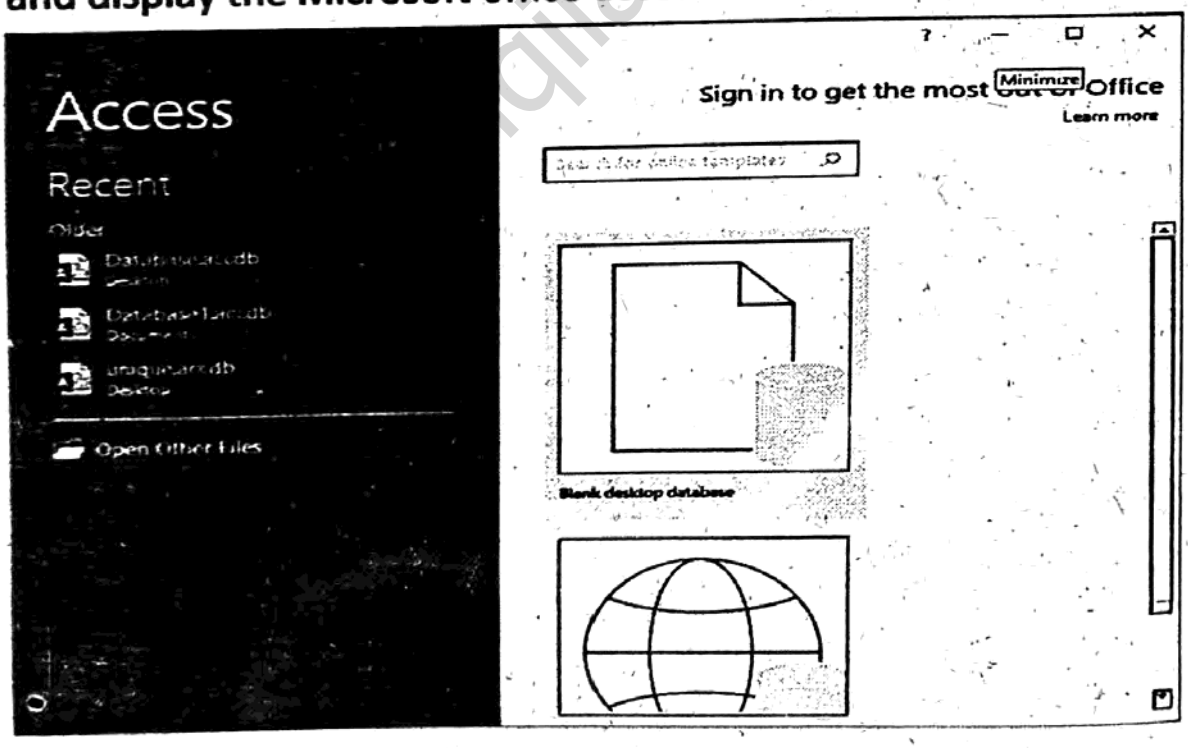
The following steps are used to open access:

Step-1: Click the **Start** button.

Step-2: Click **Program** on the start menu.

Step-3: Click **Microsoft Office** on the programs submenu.

Step-4: Click **Microsoft Office Access 2016** to open access 2016 and display the Microsoft office access screen.

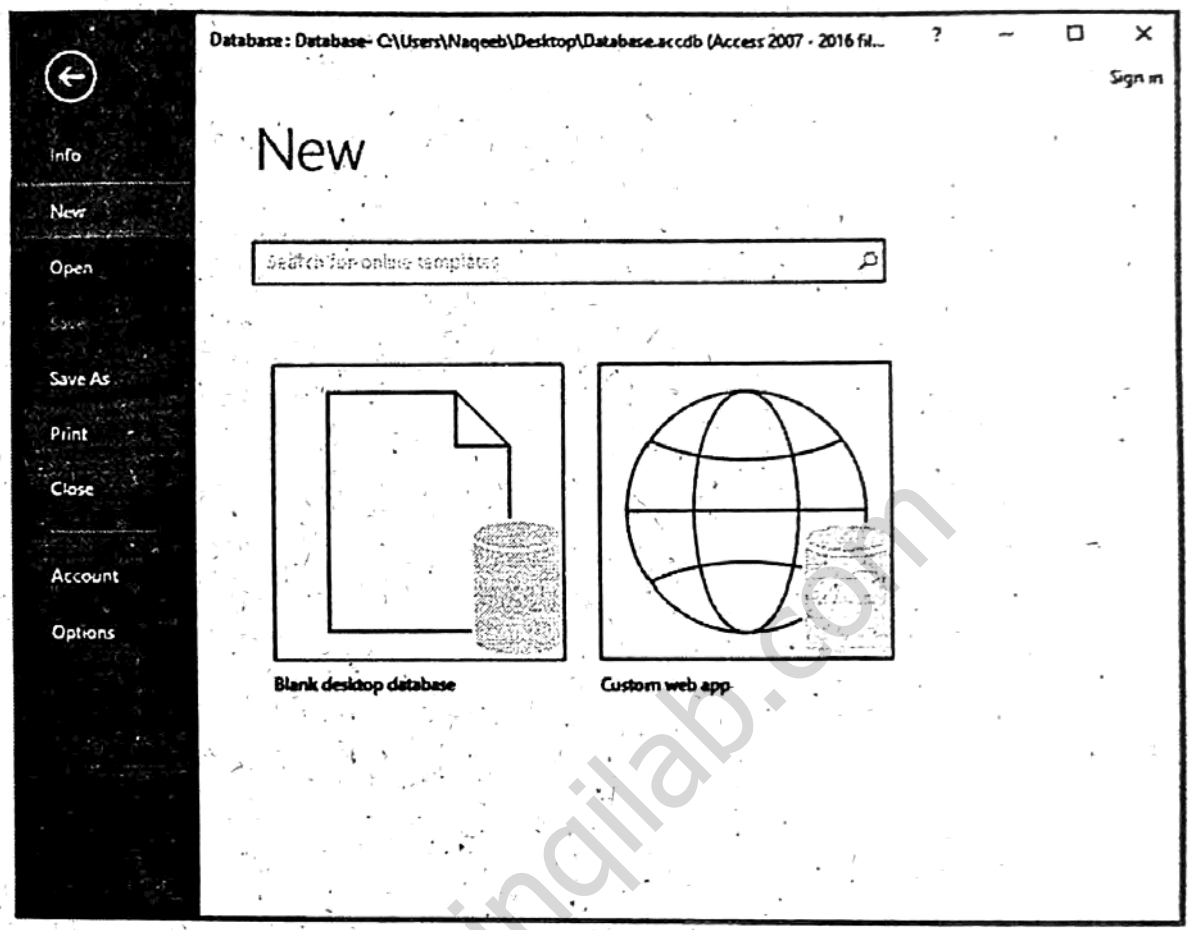


Microsoft office Access Welcome Screen

2nd Way to Open MS Access 2016:

If you already have another access database open, click on the file menu at the top-left corner of access, then click New to bring up the same options.

Click blank desktop database to create a new database as shown in figure.



Creating Blank Desktop Database from New Command

Q4: What are the important components of access 2016 window?

Answer: Important Components of Access 2016 Window:

1. Ribbon:

In MS Access 2016, ribbon contains different tabs such as file, home, create, external data. Database tools, tables tools. Each tabs contains several groups/commands.

2. Status Bar:

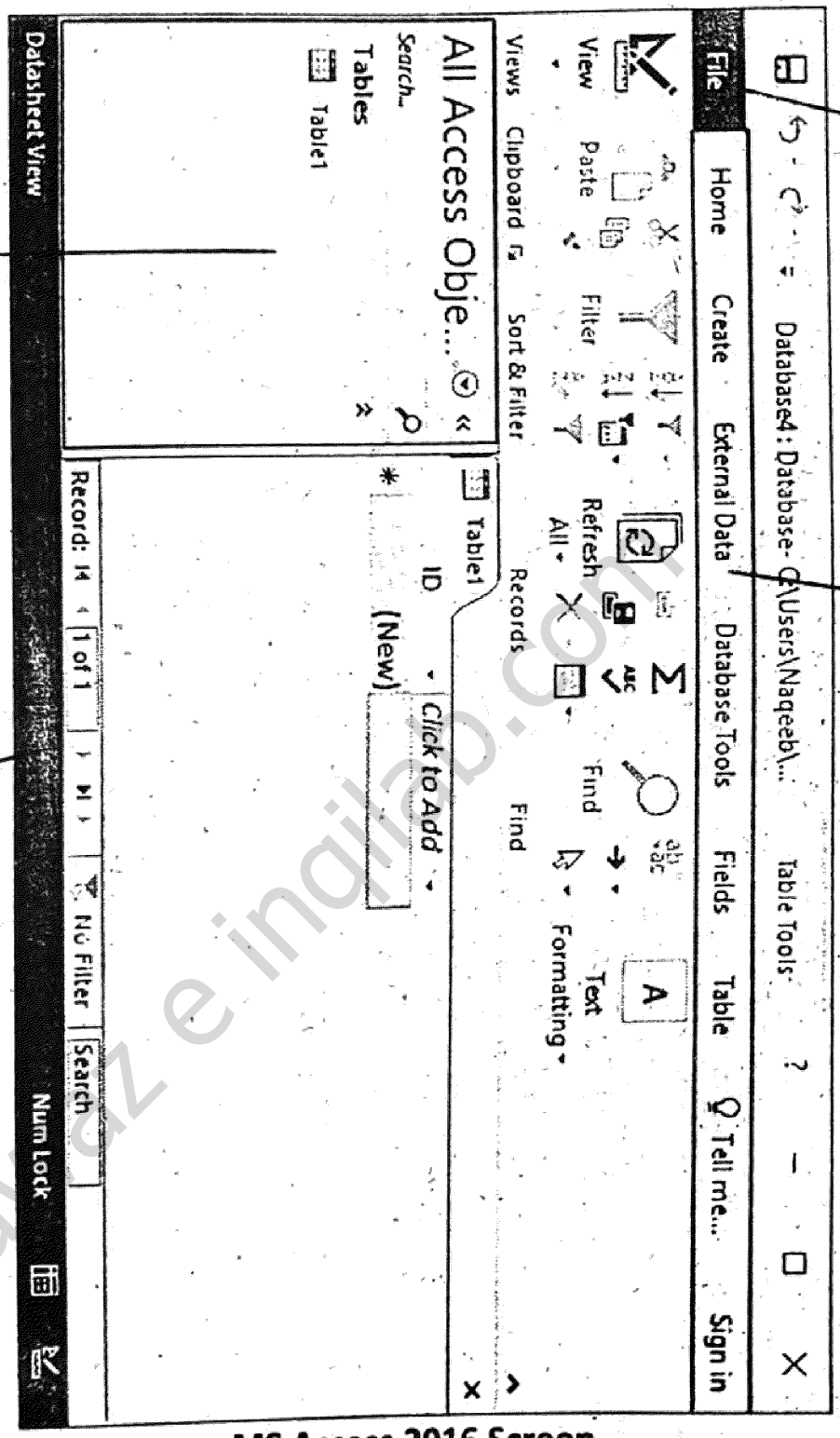
It is located at the bottom of the access window. It display information about current object.

3. Navigation Pane:

It displays objects such as tables, queries, forms and reports.

4. File Menu:

File menu contains command like Info, New, Open, Save, Save As, Print.



MS Access 2016 Screen

Q.3 Write down the steps for creating and saving access database.

Answer: **Creating and Saving Access Database:**

The following steps are used to create and save new database:

Step-1: First step in creating an access database is to create a blank database file.

Step-2: Click **Blank desktop database** icon to create a new database as shown in figure (a).

Step-3: Enter a file name for database file in **File Name** bar.

Step-4: Name the database (for example, student as shown in figure (b).

Step-5: Click the **folder** icon and browse for selecting a location for saving the database.

Step-6: Click the **Create** button to create and save the database.

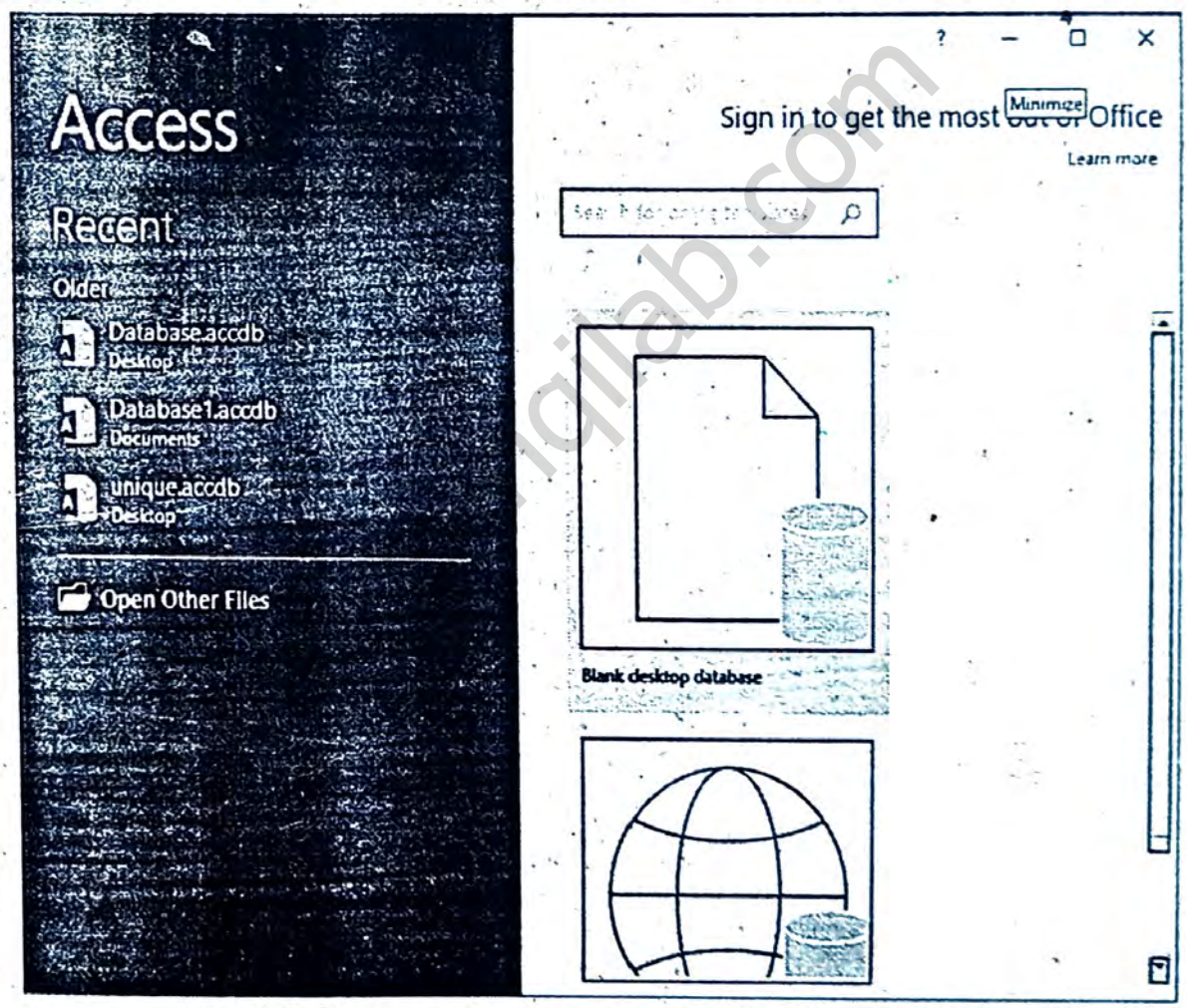


Fig (a): Microsoft office Access Welcome Screen

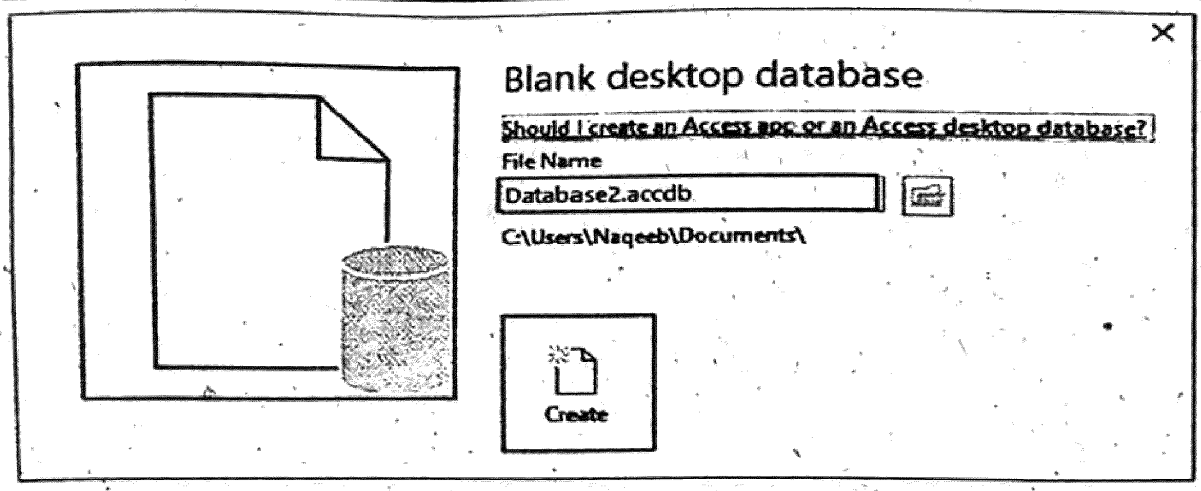


Fig (b): Name the Database

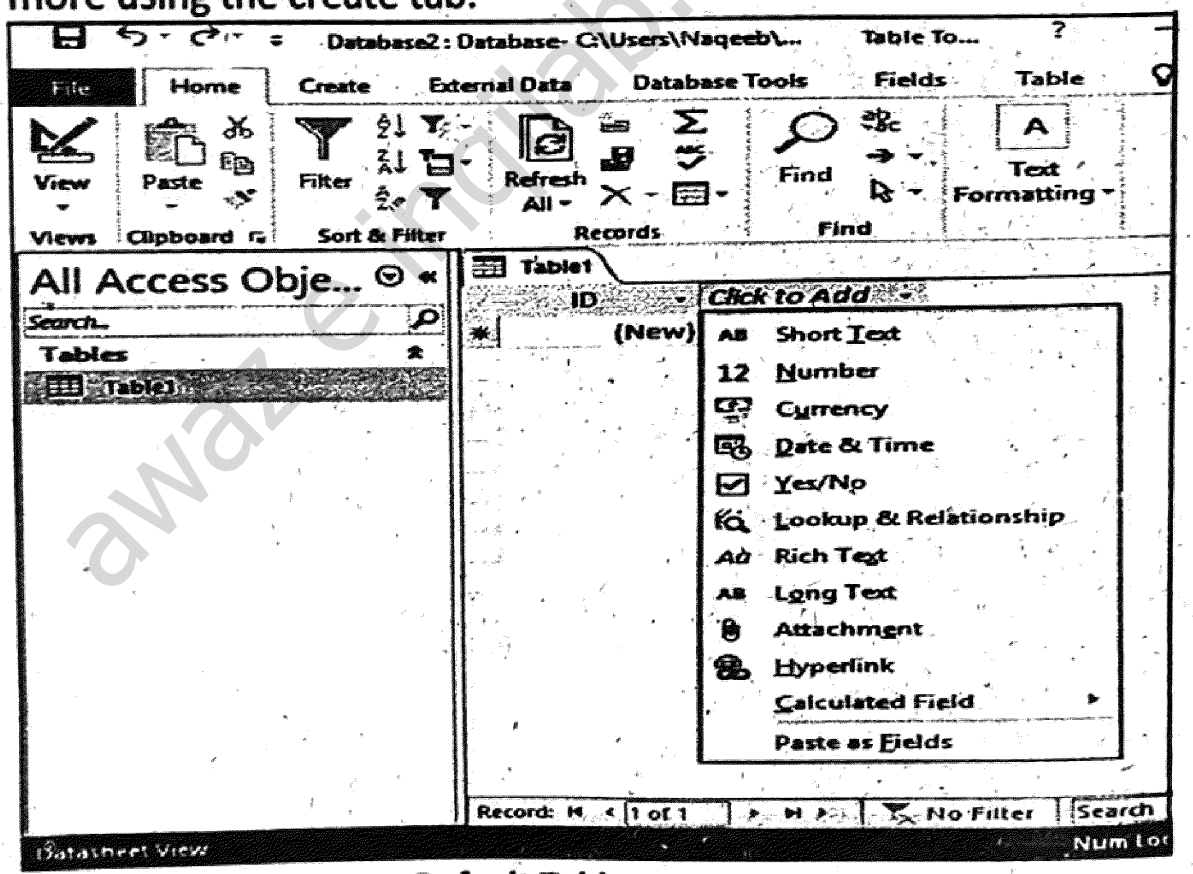
Q6: Explain the following database objects:
(a) Tables (b) Forms (c) Queries (d) Reports

Answer: a) TABLES:

A table is an access database object that is used to store information that relates to one entity. In RDBMS, it is called a relation and consists of rows and columns.

Creating a Table in MS Access 2016:

MS access 2016 creates a table automatically when you create a blank database. You can also customize this table, then create more using the create tab.



Default Table Name

Customize the Blank Table:

First add a field to existing table and then rename it. The following steps are used to give the table a unique name.

- Select a data type for the new field as shown in figure (a).
- Click, **Click to Add** and select **Short Text** from the combo box.
- This combo box lists the data types you can assign to a field. Access requires that each field is assigned a data type.
- In this case, we're telling access to only allow short text in this field.
- If a user enter different data type, then error will occur.

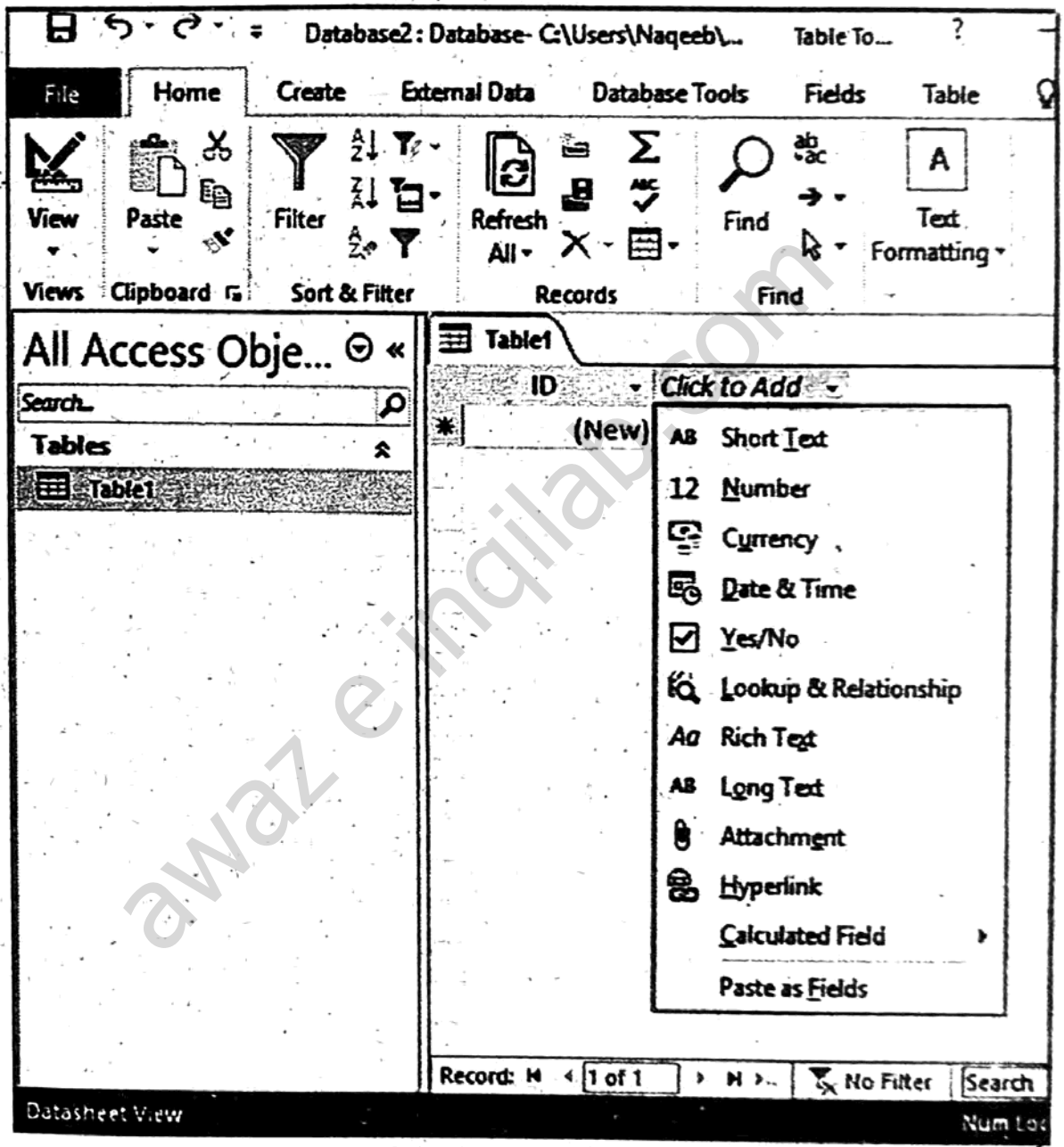


Fig (a): Customizing Table

Name the Field:

- Once you've selected a data type, the field header will be highlighted with the text field1, so that you can provide a name for the field.
- Enter Artist Name as the name of the field as shown in figure (b).

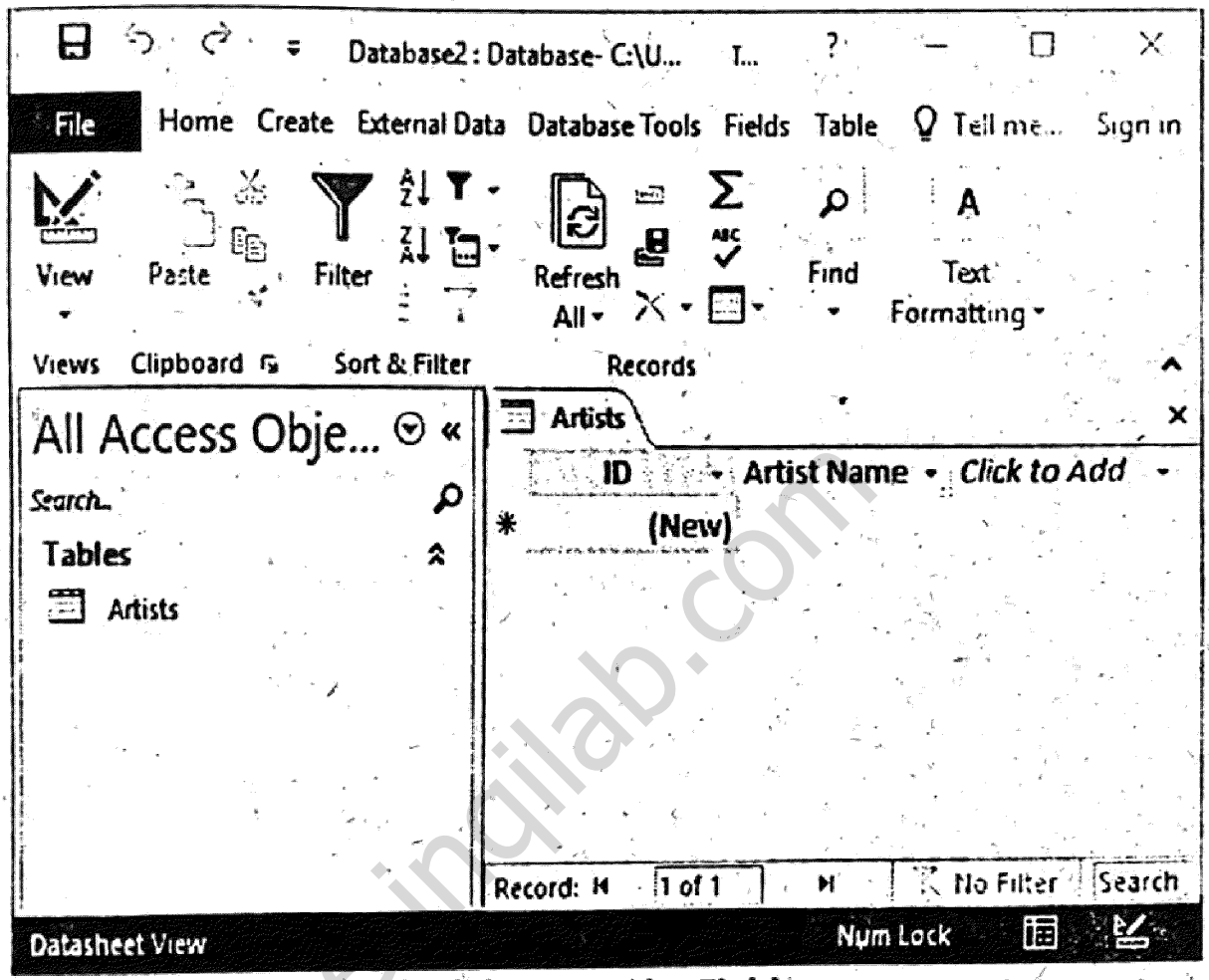


Fig (b): Name the Fields

i) Rename the First Fields:

- The first field in our table is currently called ID. We'll rename it.
- Right-click on the ID field header and select **Rename Field**. The field will be highlighted for you to rename it as shown in figure (c).
- Enter artistId.

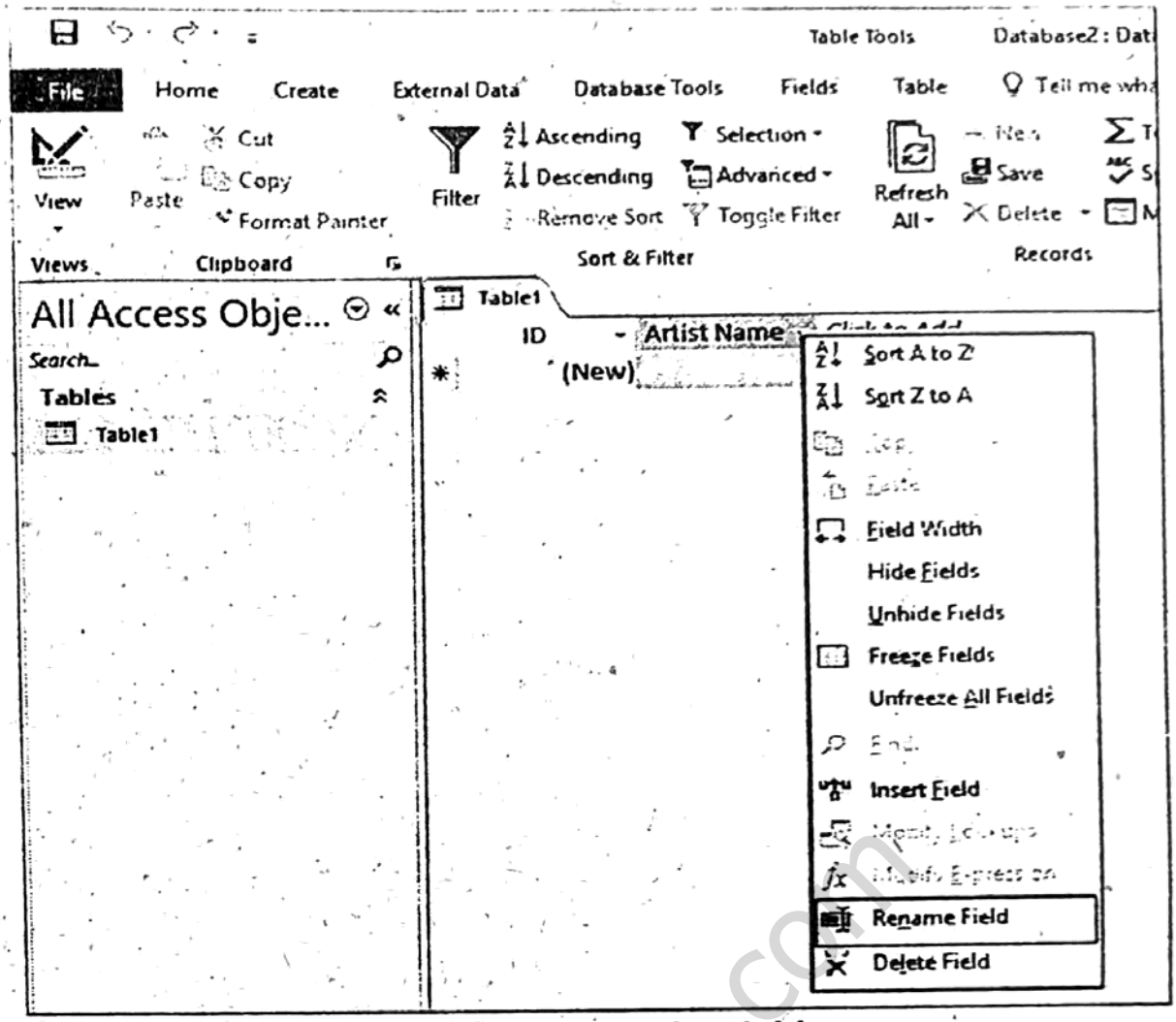


Fig (c): Rename the Field

ii) Save the Table:

- Right-click on table1 to save the table.

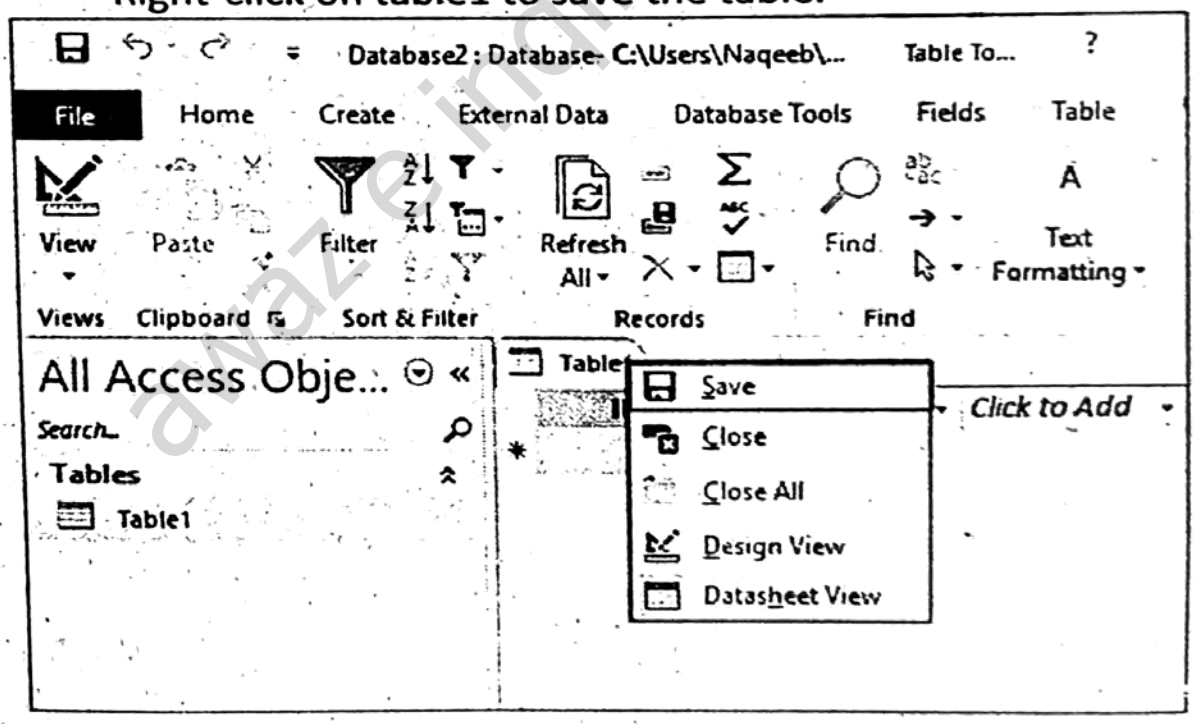
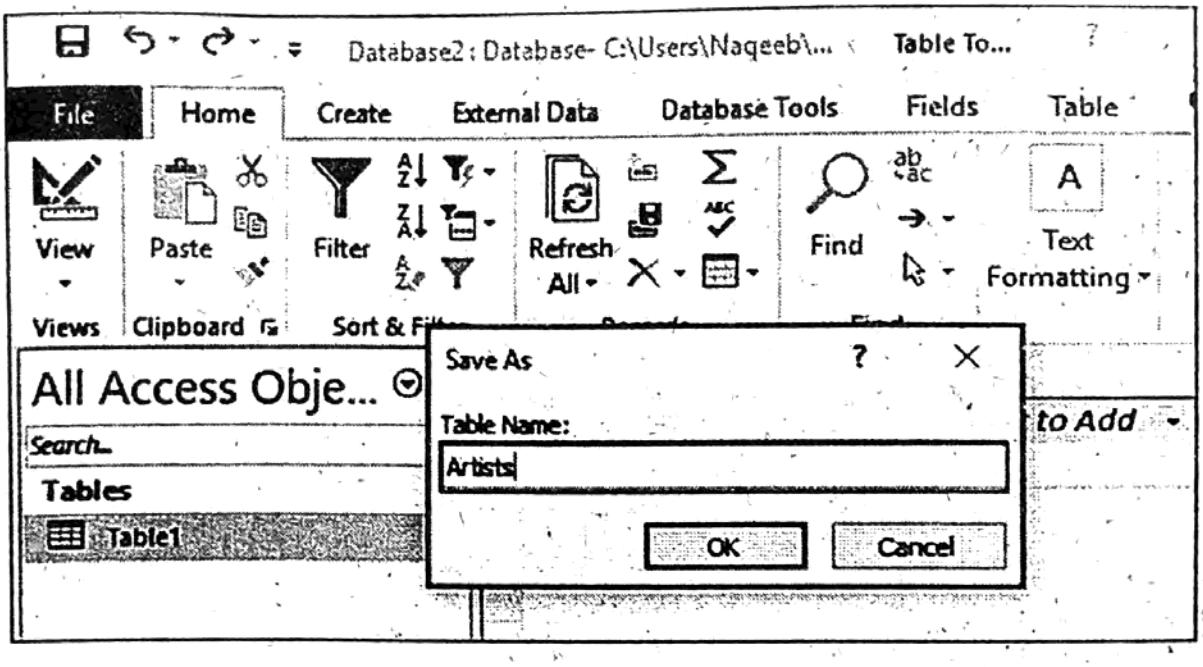


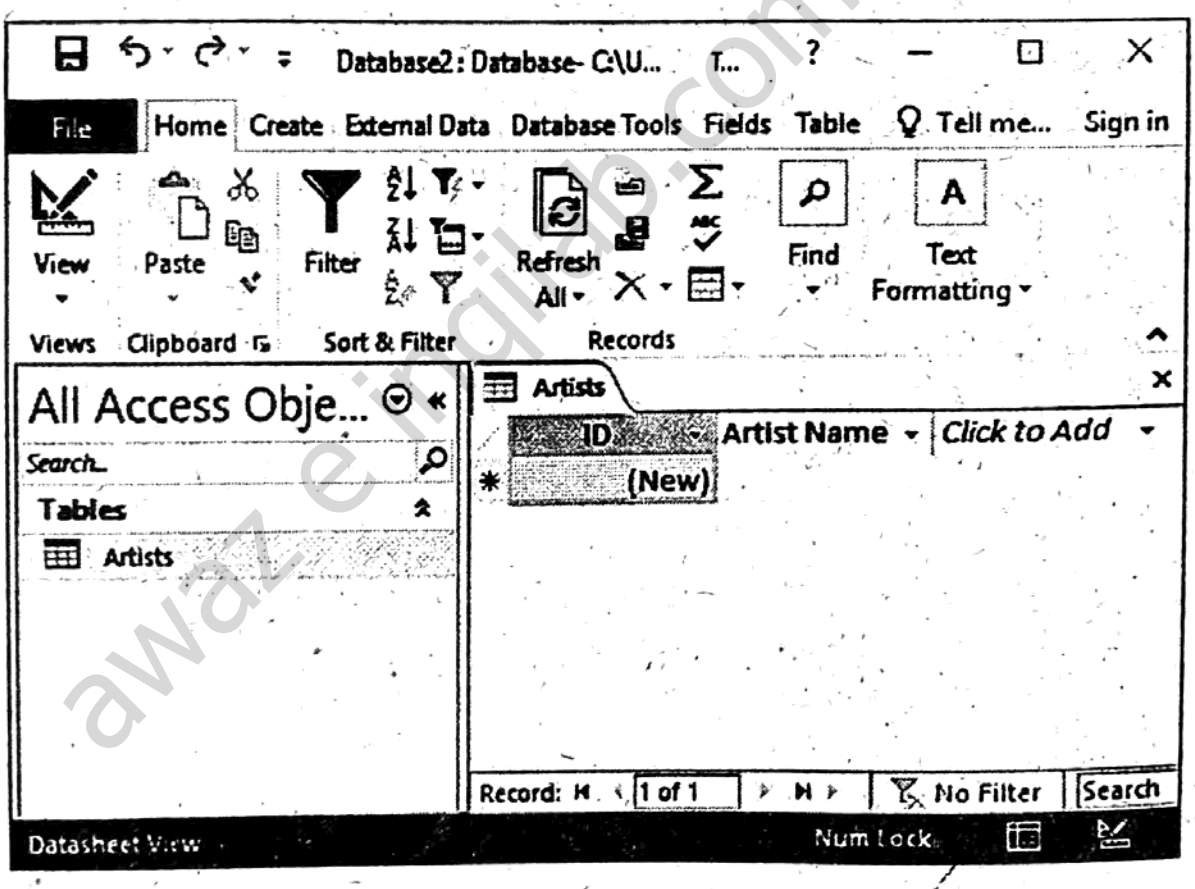
Fig (d): Save the Table

- Enter artists at the prompt (figure e).



iii) Your Finished Table:

- Your database table now contains two fields (artistId and artistName) as shown in figure (f).



b) FORMS:

Form is a window that displays data for viewing, entering and editing information.

Access 2016 provides many options that make it easy to create forms.

Purposes of Form:

Form is generally used for the following purposes:

- It allows users to perform data entry. Data can be inserted, updated, or deleted from a table using a form object.
- It allows users to enter custom information, and based on that information a task is performed. For example, a system may want to ask for parameters before running a report.
- It allows users a method of navigation through the system. For example, one may create a form where a user can select a report to run.

User can also add certain control components to a form, like buttons, combo box, list box, drop down menus and sub-forms.

Creating MS Access Form:

The following steps are used to create a form:

- Highlight the table to use as a source table.
- Select the **Form** command from the **Forms** command group in the **Create** tab on the **Ribbon**.
- The new form is created and opens in the object pane. Figure (a) shows a form created.

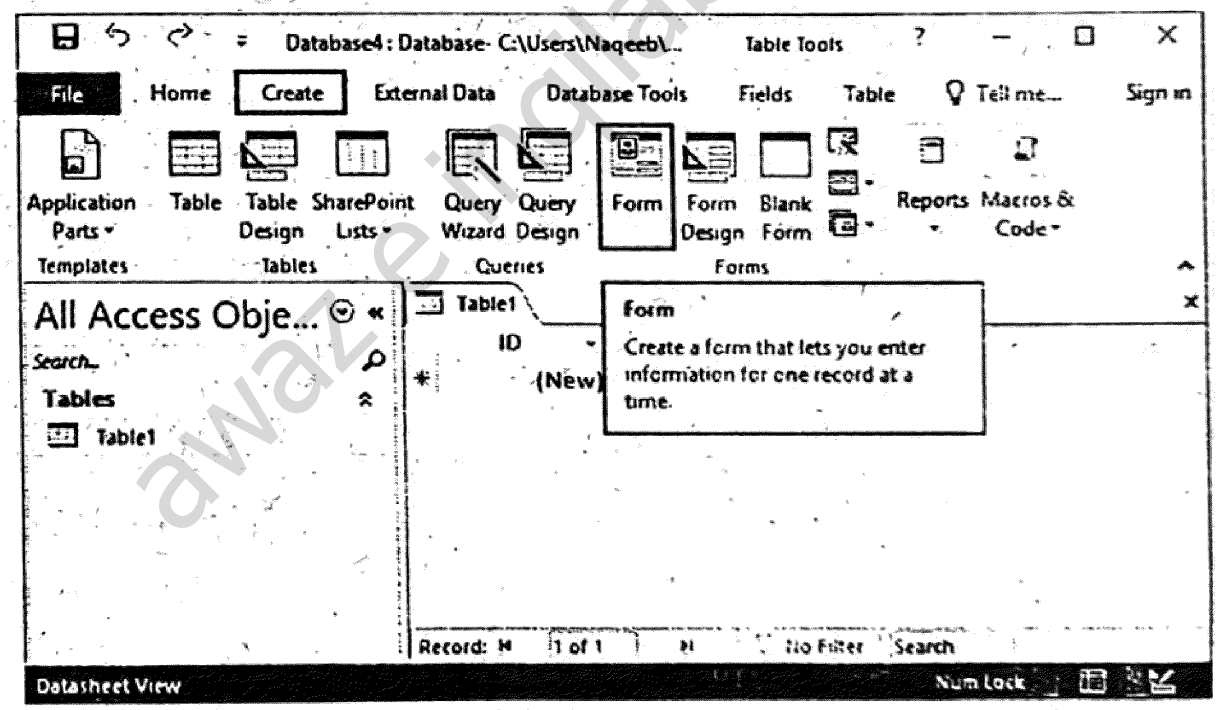


Fig (a): Creating Form

The form displays all fields as label/field pairs.

- The label allows users to see the fields.
- The field is presented in an editable form element such as a text box, combo box etc.

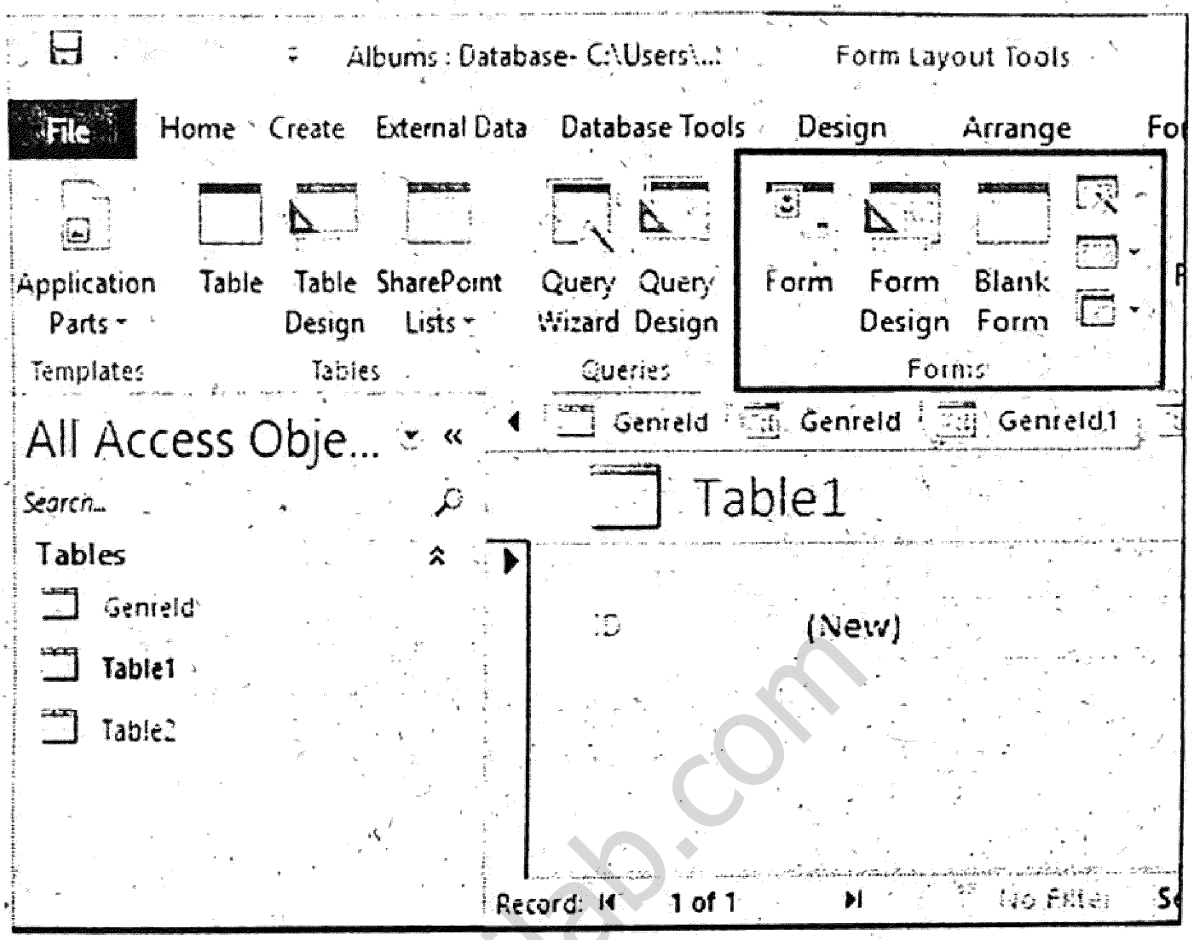


Fig (b): Form

c) QUERIES:

Queries are a way of searching for a compiling data from one or more tables. Running a query is like asking a detailed question of the database. When users build a query in access, they are defining specific search conditions to find exactly the data they want.

A well-designed query can give information that users might not be able to find out just by examining the data in tables. Access has a query wizard that allows you to choose the type of query you want to run, then walks you through the creation of the query.

Types of Queries in MS Access:

The following are some common types of queries in MS Access 2016:

i) Select Query
ii) Update Query
iii) Delete Query

i) Select Query:

A select query is a type of database object that shows information in datasheet view. A query can get its data from one or more tables, from existing queries, or from a combination of the two. The tables or queries from which a query gets its data are referred to as its record-source.

Basic Steps to Create a Select Query:

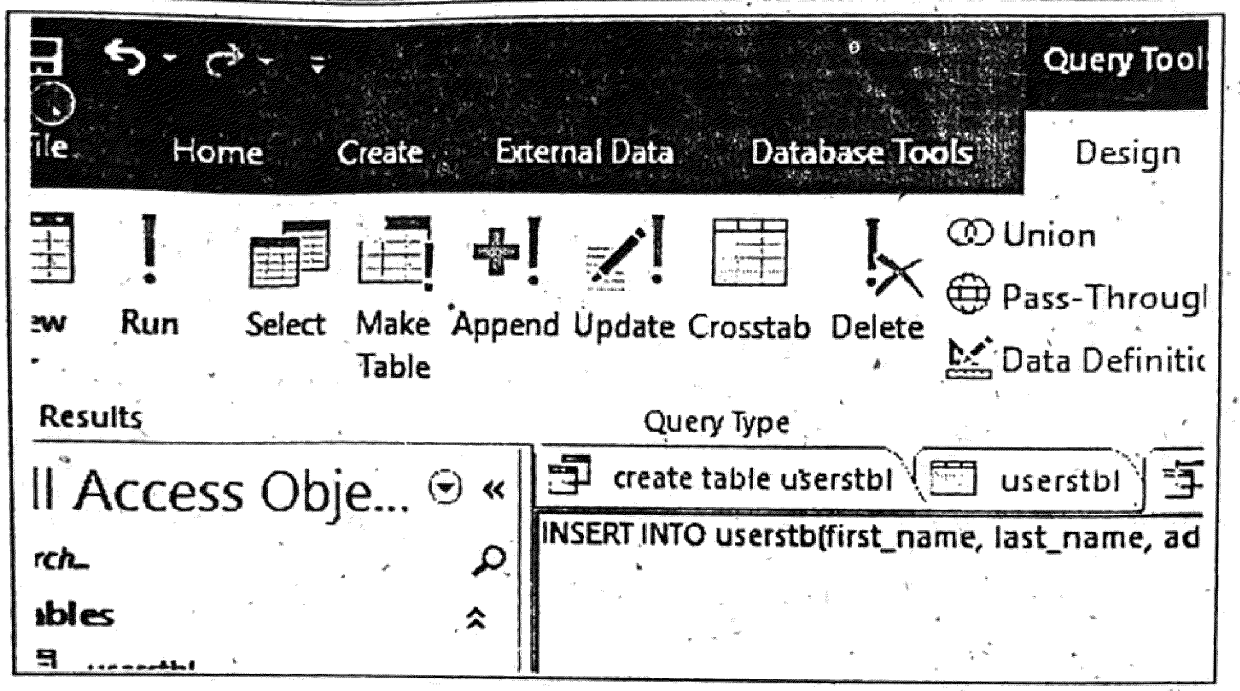
User can create a select query by using the **Query Wizard** or by working in **Design view**.

The following steps are used to create a select query:

- Choose the tables or queries that to use as sources of data.
- Specify the fields that user wants to include from the data sources.
- Optionally, specify criteria to limit the records that the query returns.
- After user has created a select query, it can be run to see the results.

ii) Update Query:

An update query is an action query (SQL statement) that changes a set of records according to criteria (search conditions) user specifies. It is a very powerful feature and a fundamental part of relational databases since the user can modify a huge number of records at a time. Queries improves the performance of applications and makes them easier to maintain.



iii) Delete Query:

Delete query is used to delete records from a single database table or multiple tables. Delete query removes records from tables permanently. The delete query works with a group of records that meet specified criteria that user applies. Remember that the query will permanently delete records from the specified table(s).

d) REPORTS:

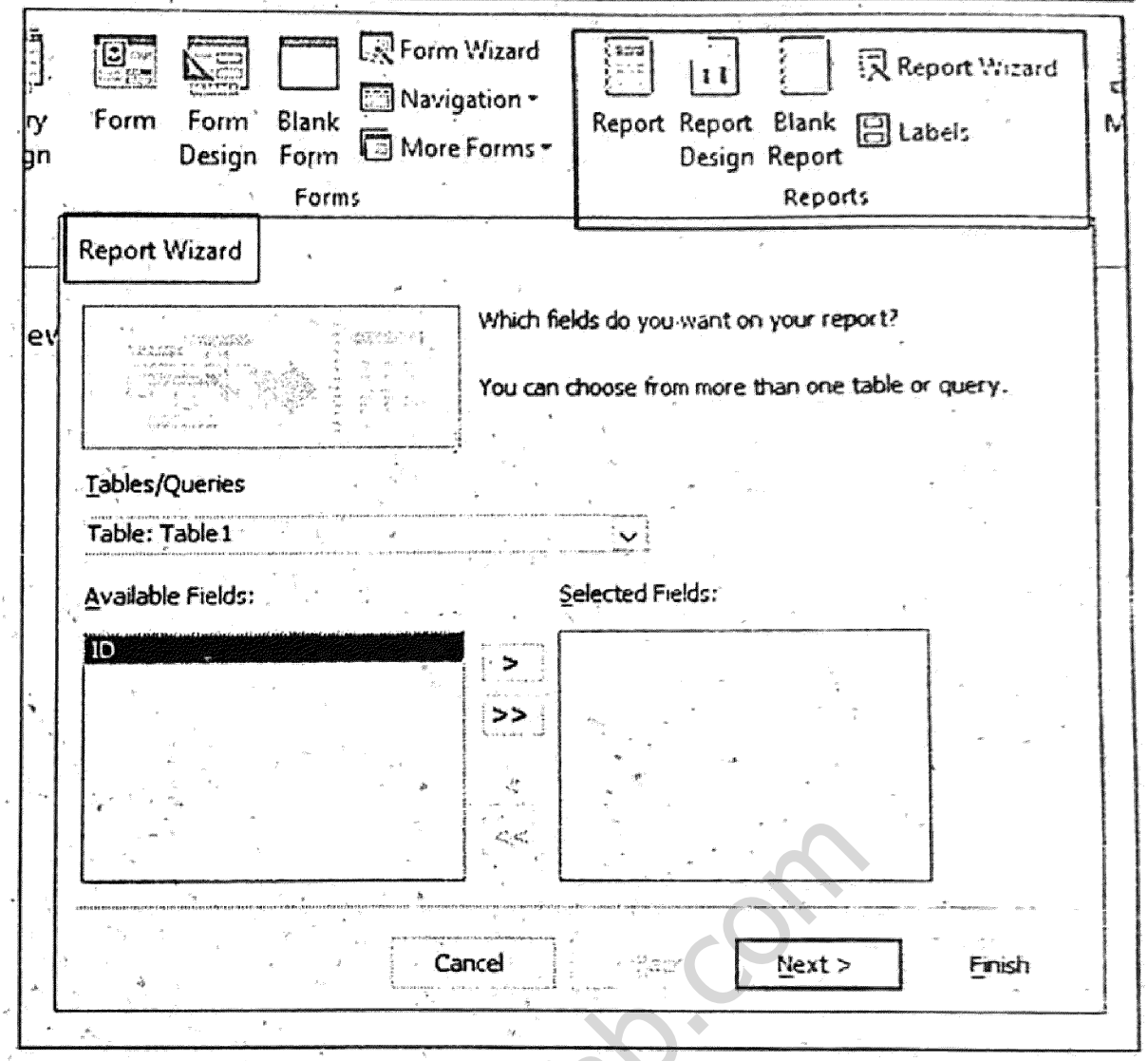
A report is an access object. It is used to display data in an organized manner so that users can print it. A report is an effective way to present data using an attractive layout.

Microsoft access report visualize data for presentations, printable, formats, management reports, or simple summaries of what the tables represent from the database. Using the report wizard, you can quickly create a basic report.

Using the Report Wizard to Generate a Report:

The following steps are used to generate a report using report wizard:

- Open the database and go to the **Create** tab.
- In the reports group, select report wizard.
- The report wizard will open.



- In the **Tables/Queries** list, choose the table or query on which you want to base the report.
- In the available fields list, double-click a field name to add it to the report or select the field and click the single right arrow to move it to the selected fields list.
- Select **Next** when you finish adding fields.
- Choose the fields by which you want to sort the records and select **Next**.
- In the **Layout** section, select the layout in which you want the report to appear. Options include **Columnar, Tabular** and **Justified**. You can choose **Portrait** or **Landscape** orientation as well.
- Select **Next** to continue.
- Enter a title for the report.

- Choose **Preview** the report to see the completed report in **Report View** when finished or select.
- Modify the report's design to open the report in Design View and select **Finish**.

Q7: Explain different data types used in access.

Answer: Data Types in MS Access 2016:

Following data types are used in MS Access 2016:

1. Short Text: It is used for alpha numeric data. i.e. combination of text and numbers.
Size: The maximum size of the text field is 255 characters.

2. Long Text: It is used for large amount of alpha numeric data (sentences and paragraphs).
Size: This data type allows as many as 64000 characters to fields.

3. Number: Number data type is assigned to numeric fields.
Size: The maximum size of this field is 16 bytes.

4. Large Number: The large number data type stores a non-monetary, numeric value.
Size: The maximum size of this filed is 8 bytes.

5. Auto Number: An auto number field is a numeric (long integer) value that access automatically fills in for each new record that a user enters to a table.
Size: The maximum size of this field is 4 bytes.

6. Yes/No: It is used for true/false data.
Size: The maximum size of this field is 1 byte.

7. Currency: Currency is a special fixed format number with 4 decimal places designed to store currency value.
Size: The maximum size of this field is 8 bytes.

8. Date/Time: Date and time are stored in a special fixed format.
Size: The maximum size of this field is 8 bytes.

9. Date/Time Extended: The date/time extended data type stores the date and time information and is similar to the date/

time data type, but is provides a larger date range, a higher fractional precision.

Size: The maximum size of this field is encoded string of 42 bytes.

10. OLE Object: It is used for OLE (Object Linking and Embedding) objects (such as Microsoft Word documents, Microsoft Excel spreadsheets, pictures, sounds, or other binary data) that were created in other programs using the OLE protocol.

Size: The maximum size of this filed is up to 2 GB.

11. Hyperlink: It is used for hyperlinks which contain link to other files or web pages.

Size: The maximum size of this field is up to 8, 192 characters.

Q8: Explain the process of creating forms in access.

Answer: Forms:

Form is a window that displays data for viewing, entering and editing information.

Creating MS Access Form:

The following steps are used to create a form:

- Highlight the table to use as a source table.
- Select the **Form** command from the **Forms** command group in the **Create** tab on the **Ribbon**.
- The new form is created and opens in the object pane. Figure (a) shows a form created.

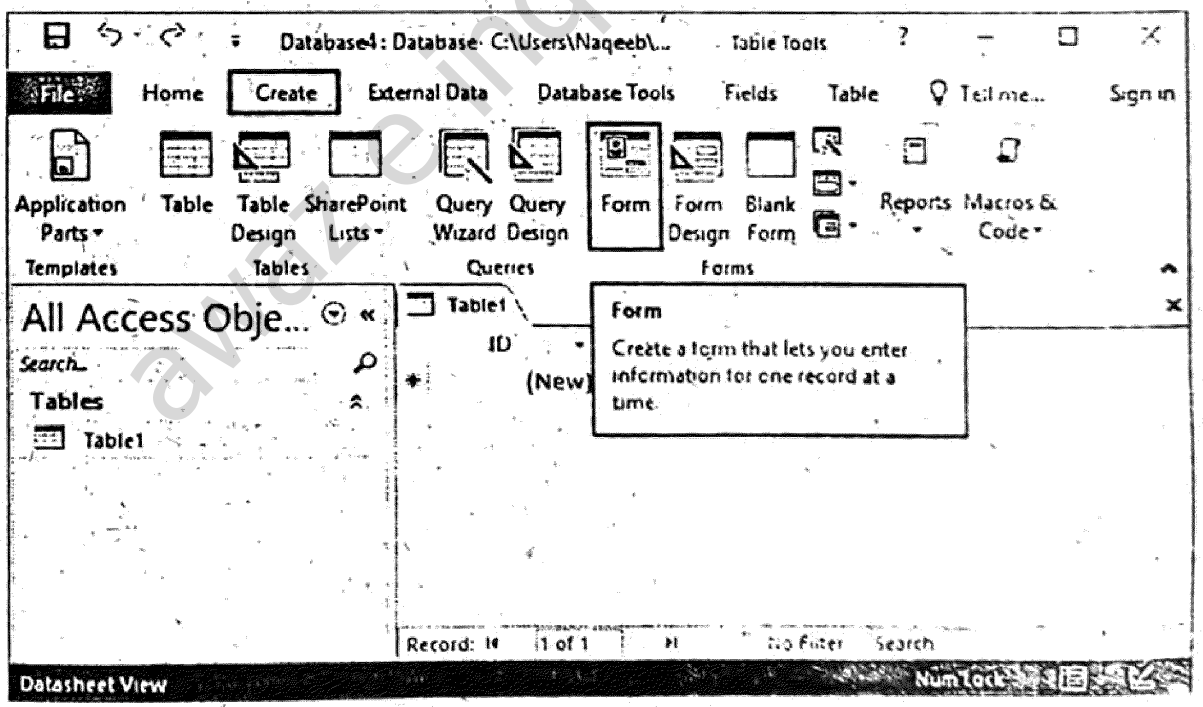


Fig (a): Creating Form

The form displays all fields as label/field pairs.

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- The field is presented in an editable form element such as a text box, combo box etc.

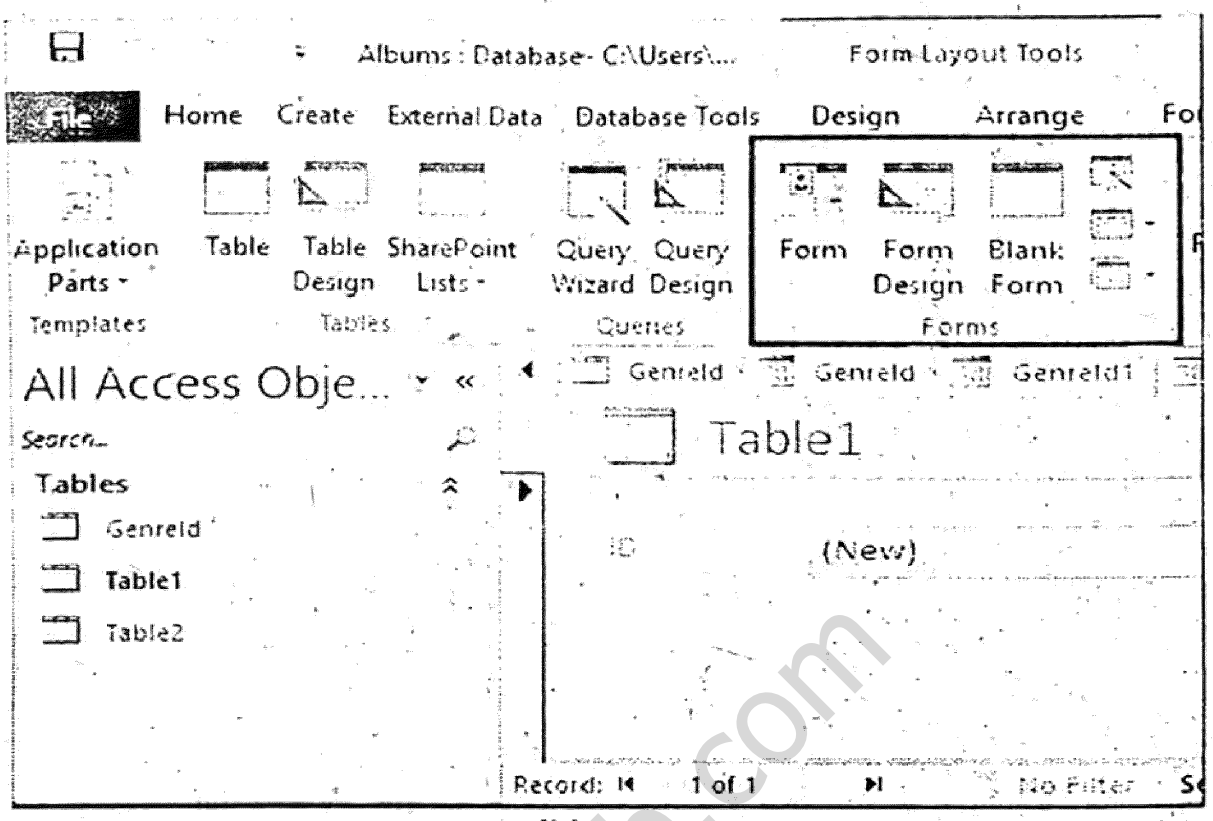


Fig (b): Form

Q9: Write the steps for creating relationships between tables.

Answer: Relationships: Relationships are links that associate a field in one table with a field in another.

Creating Relationships between Tables:

The following steps are used for creating relationship between tables:

Step-1: Open the **Relationship** dialogue.

Step-2: Click **Relationship** from the **Database Tools** tab on the ribbon.

Step-3: The Show **Tables** dialog box appears. If it doesn't appear, click **Show Tables.**

Step-4: Select the tables as shown in figure (a).

Step-5: Select both the artists and albums tables from the list and click **Add.**

Step-6: Click the **Close** button to close the dialog box.

Step-7: Create the relationship as shown in figure (b).

Step-8: Click and drag the albums, artistId field over the artists. Artistid field and release.

Step-9: The **Edit Relationships** dialog box appears.

Step-10: Check the **Enforce Referential Integrity, Cascade Update Related Fields** and **Cascade Delete Related Records** check boxes.

Step-11: Click the **Create** button to create the relationship (One-to-Many) between tables.

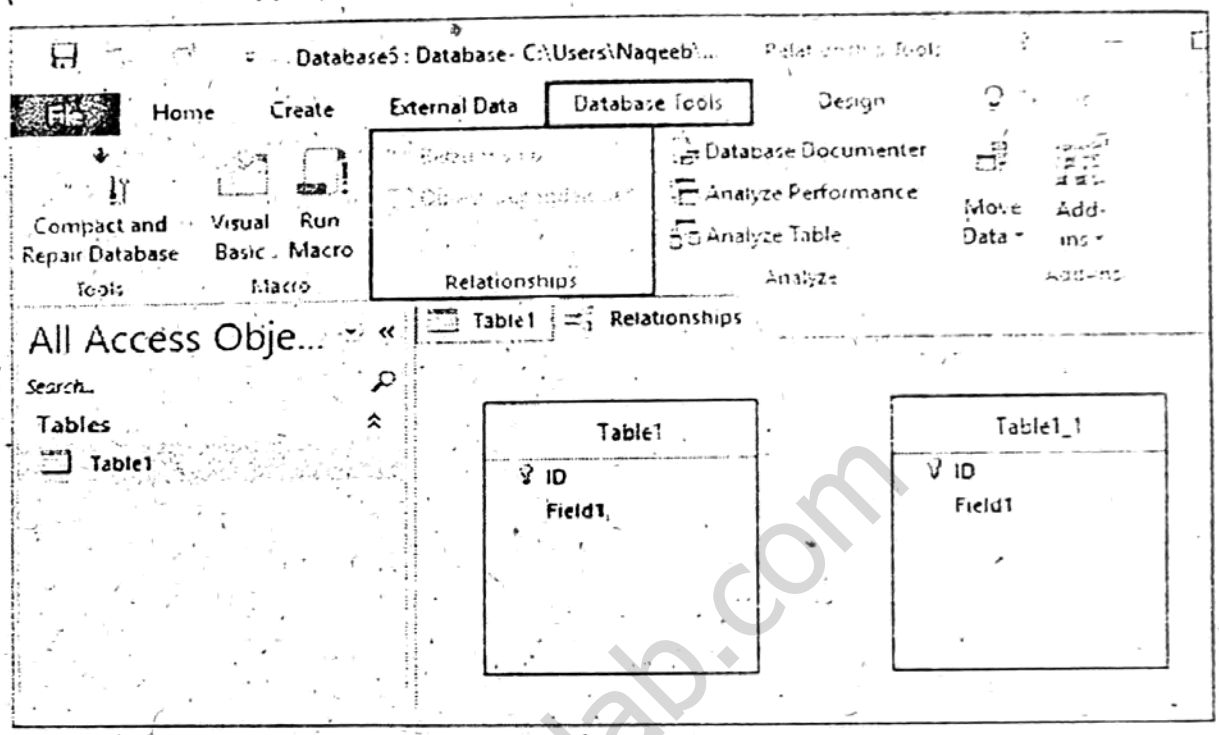


Fig (a): Adding Tables for Creating Relationships

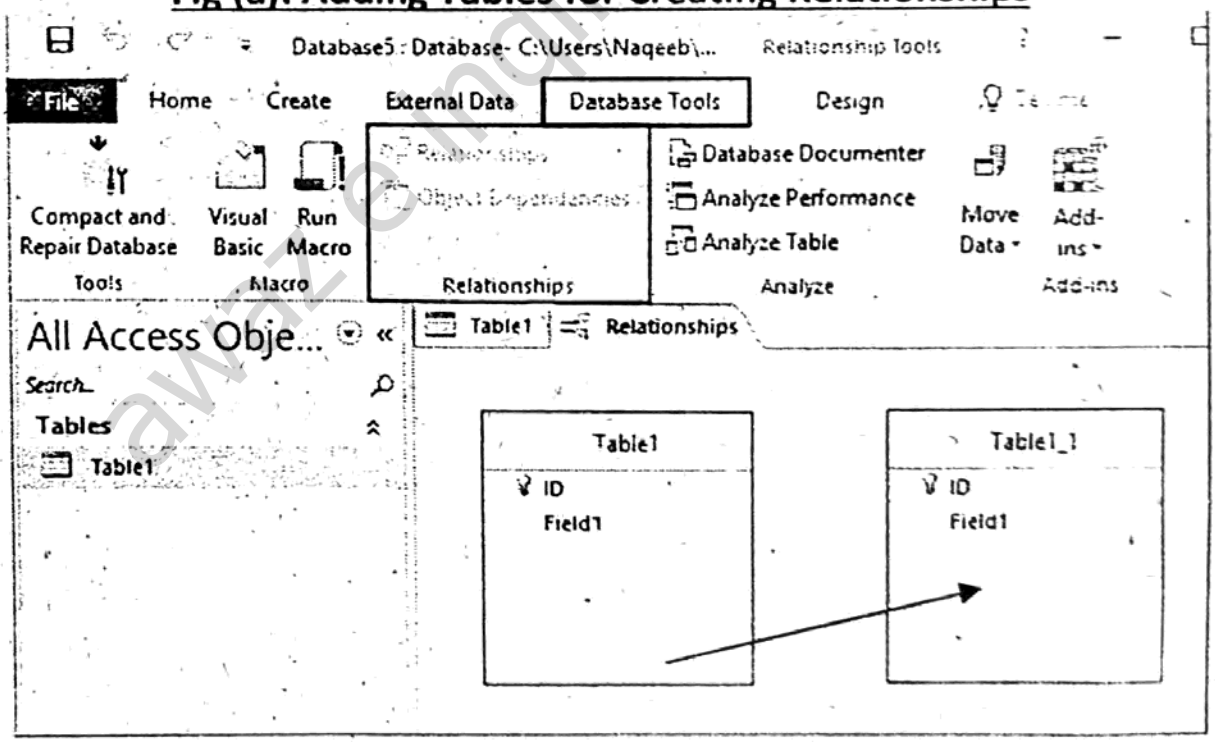


Fig (b): Edit Relationship Dialog Box for Creating Relationship

Q10: Explain different types of queries used in access.

Answer: Queries:

Queries are a way of searching for and compiling data from one or more tables. When users build a query in access, they are defining specific search conditions to find exactly the data they want.

Types of Queries in MS Access:

The following are some common types of queries in MS Access 2016:

i) Select Query ii) Update Query
iii) Delete Query

i) Select Query:

A select query is a type of database object that shows information in datasheet view.

Basic Steps to Create a Select Query:

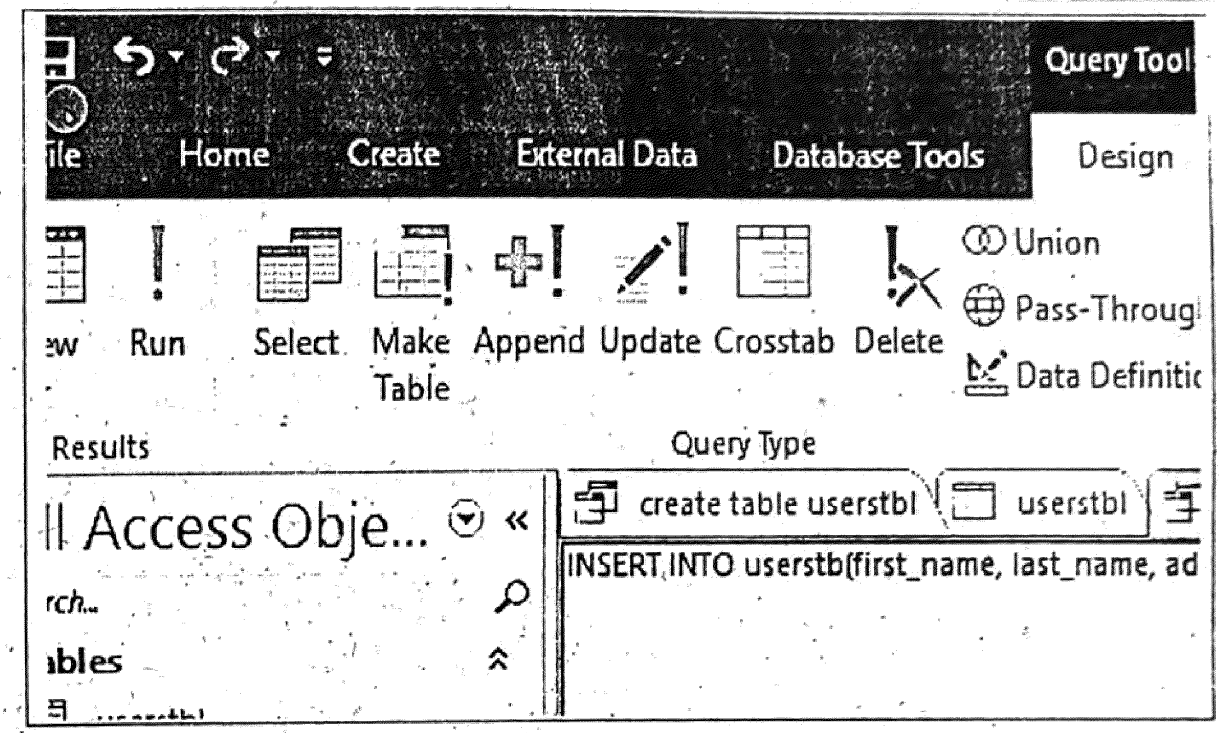
User can create a select query by using the **Query Wizard** or by working in **Design view**.

The following steps are used to create a select query:

Step-1: Choose the tables or queries that to use as sources of data.
Step-2: Specify the fields that user wants to include from the data sources.
Step-3: Optionally, specify criteria to limit the records that the query returns.
Step-4: After user has created a select query, it can be run to see the results.

ii) Update Query:

An update query is an action query (SQL statement) that changes a set of records according to criteria (search conditions) user specifies. It is a very powerful feature and a fundamental part of relational databases since the user can modify a huge number of records at a time. Queries improves the performance of applications and makes them easier to maintain.



iii) Delete Query:

Delete query is used to delete records from a single database table or multiple tables. Delete query removes records from tables permanently. The delete query works with a group of records that meet specified criteria that user applies. Remember that the query will permanently delete records from the specified table(s).

Q11: How can One-to-Many relationship can be created between two tables? Give example.

Answer: Creating One-to-Many Relationships between Two Tables: The following steps are used for creating relationship between tables:

Step-1:

Open the **Relationship** dialogue.

Step-2:

Click **Relationship** from the **Database Tools** tab on the ribbon.

Step-3:

The Show **Tables** dialog box appears. If it doesn't appear, click **Show Tables.**

Step-4:

Select the tables as shown in figure (a).

Step-5:

Select both the artists and albums tables from the list and click **Add**.

Step-6:

Click the **Close** button to close the dialog box.

Step-7:

Create the relationship as shown in figure (b).

Step-8:

Click and drag the albums, artistId field over the artists. Artistid field and release.

Step-9:

The **Edit Relationships** dialog box appears.

Step-10:

Check the **Enforce Referential Integrity, Cascade Update Related Fields** and **Cascade Delete Related Records** check boxes.

Step-11:

Click the **Create** button to create the relationship (One-to-Many) between tables as shown in figure (c).

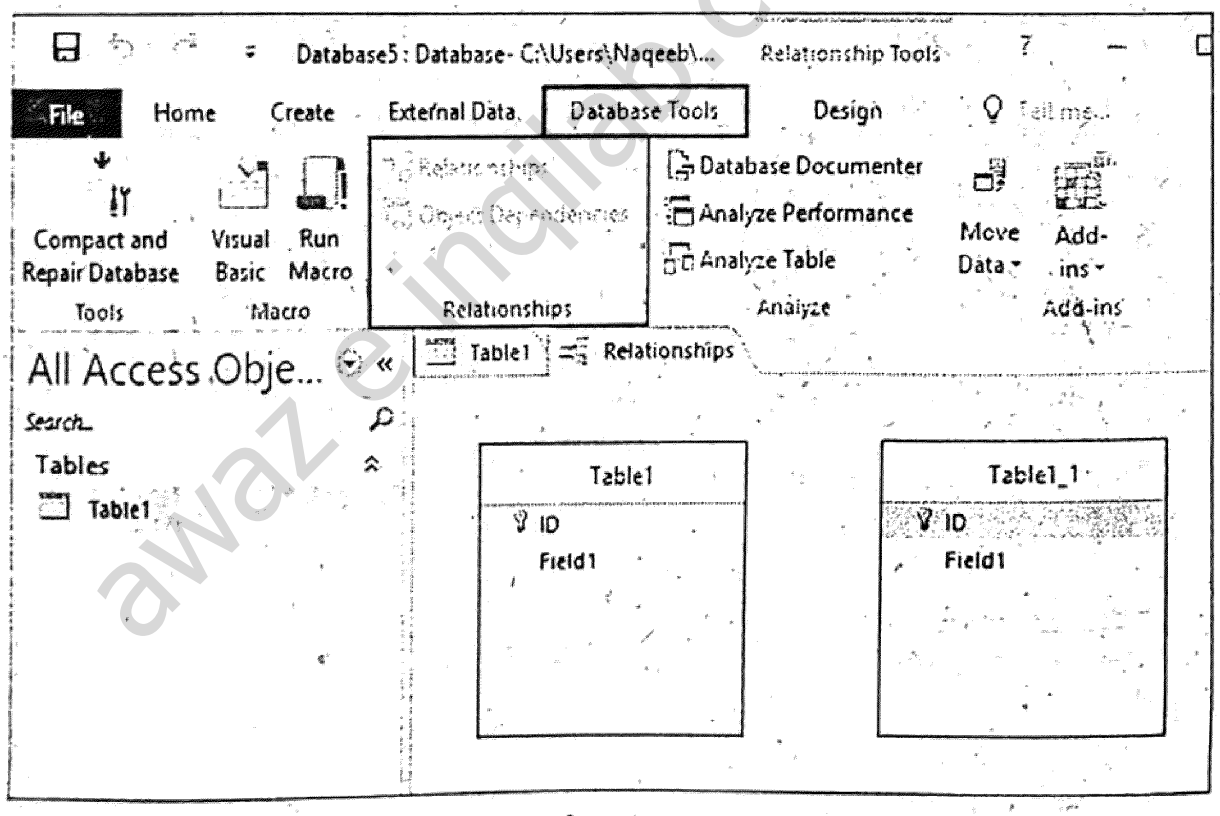


Fig (a): Adding Tables for Creating Relationships

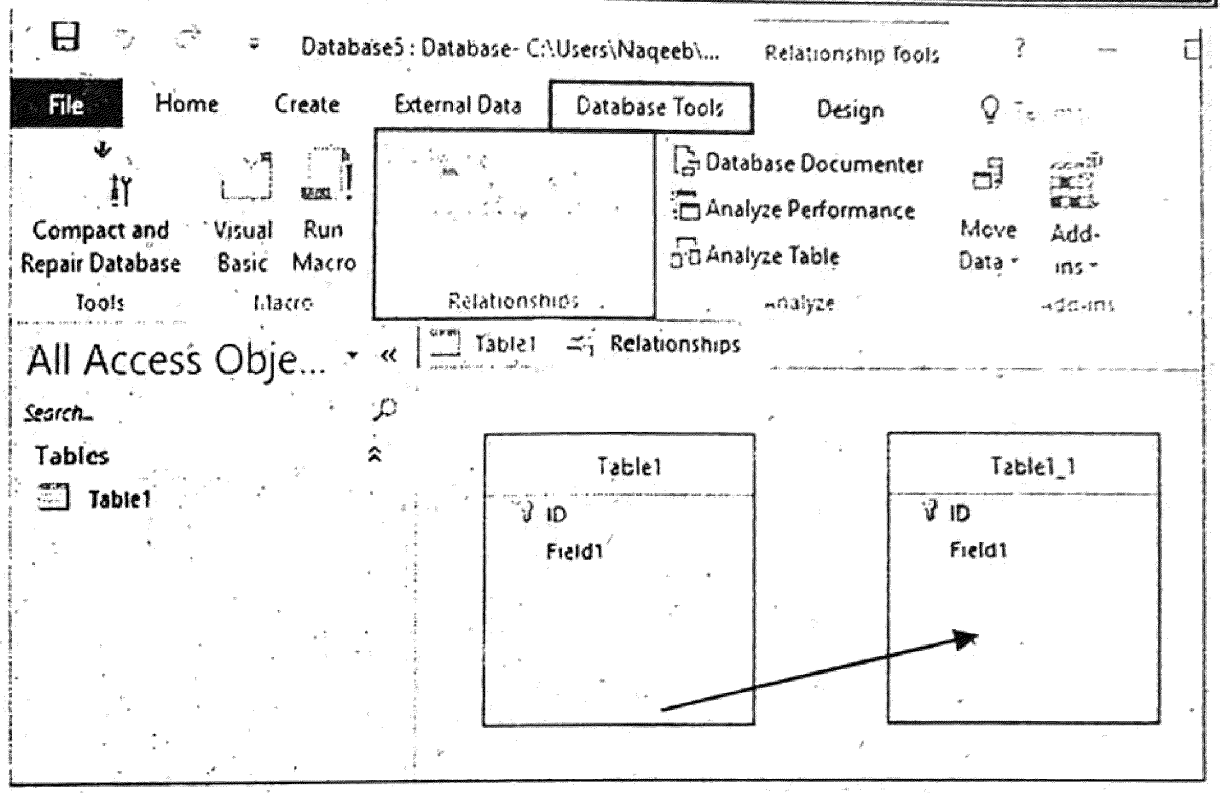


Fig (b): Edit Relationship Dialog Box for Creating Relationship

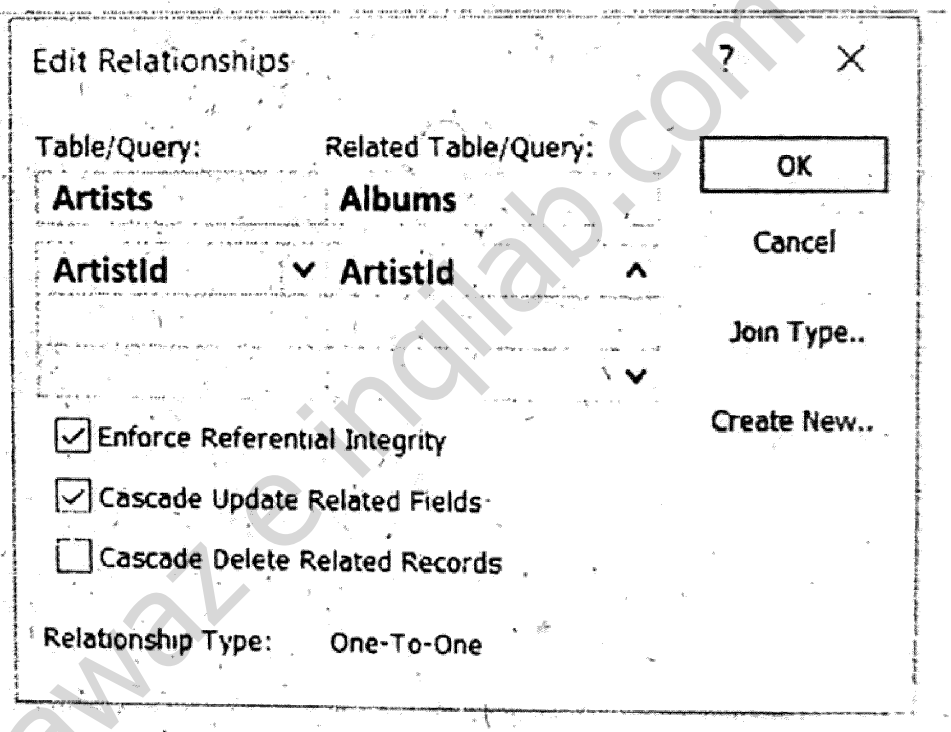


Fig (c): One-to-Many Relationship

Q12: What is report? How report is created using wizard option in access 2016?

Answer: Report:

A report is an access object. It is used to display data in an organized manner so that users can print it. A report is an

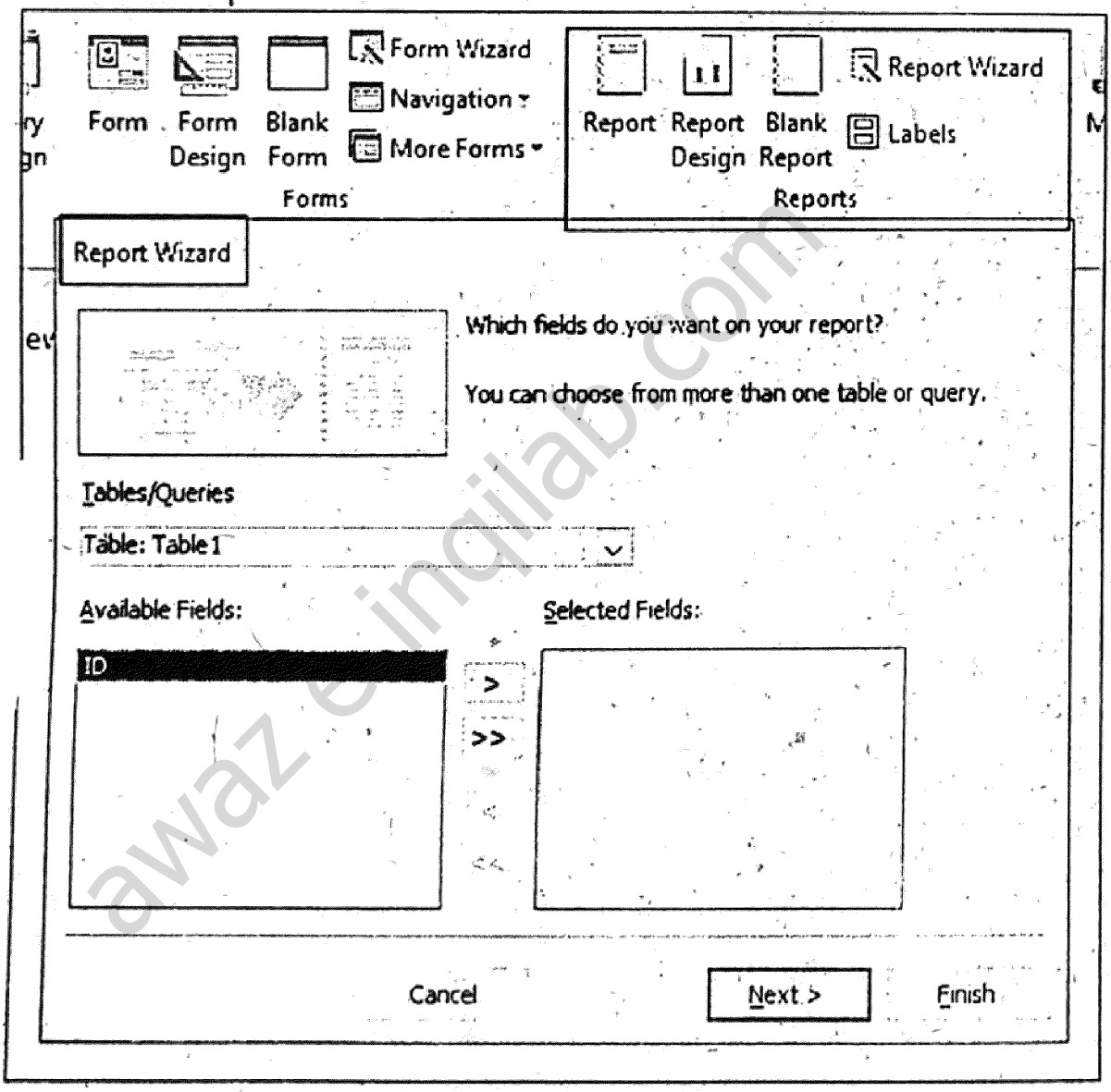
effective way to present data using an attractive layout.

Using the Report Wizard to Create a Report:

The following steps are used to generate a report using report wizard:

Step-1: Open the database and go to the **Create** tab.
Step-2: In the reports group, select report wizard.
Step-3: The report wizard will open as shown in figure.
Step-4: In the **Tables/Queries** list, choose the table or query on which you want to base the report.

- In the available fields list, double-click a field name to add it to the report.



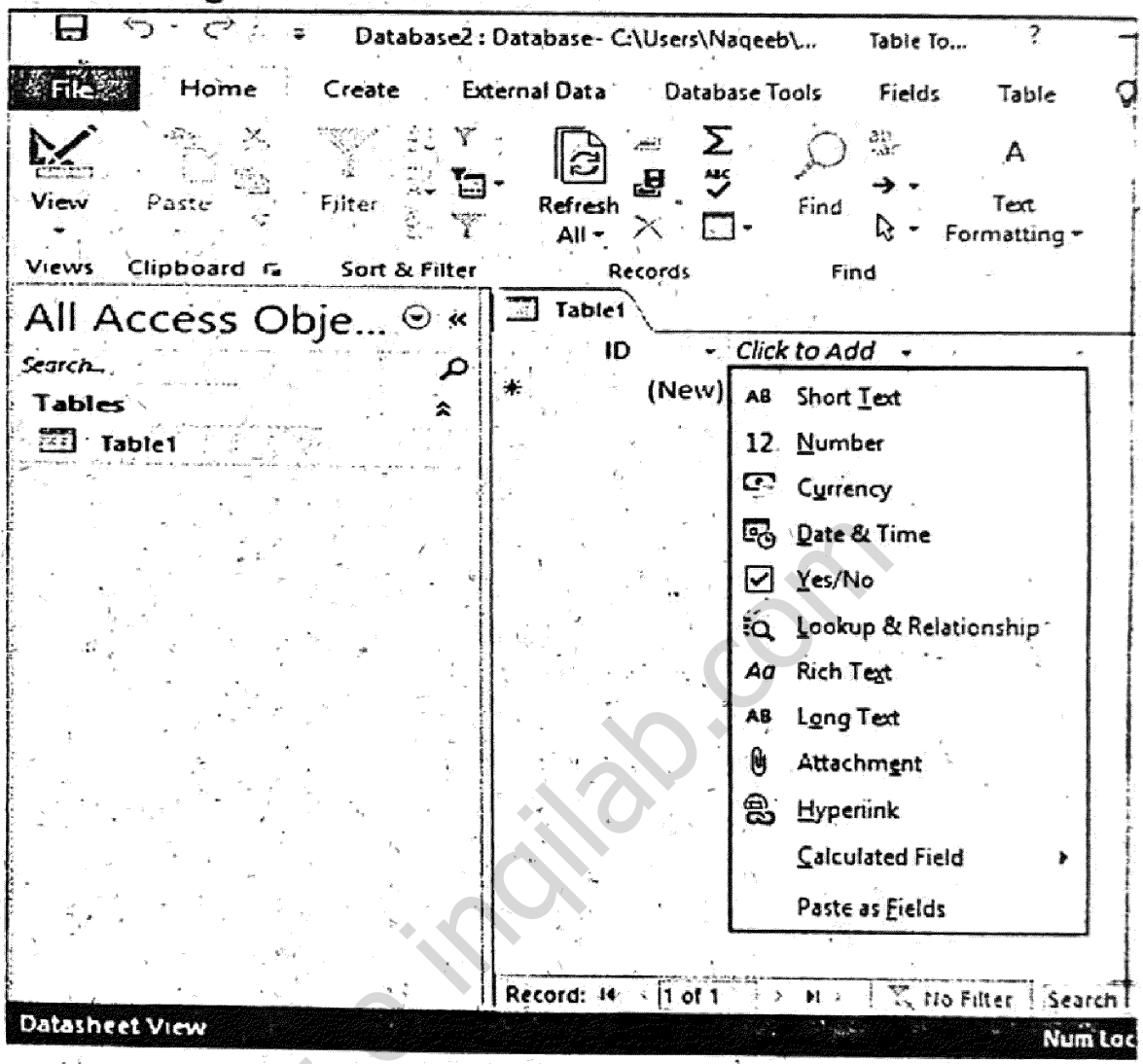
Q13: Describe two methods of creating a table in access.

Answer: TABLES: A table is an access database object that is

used to store information that relates to one entity. In RDBMS, it is called a relation and consists of rows and columns.

Creating a Table in MS Access 2016:

MS access 2016 creates a table automatically when you create a blank database. You can also customize this table, then create more using the create tab.



Default Table Name

Create a New Table an Existing Database:

Step-1: Open MS Access 2016.

Step-2: Click to create on **blank desktop database.**

Step-3: Then click on **Create** icon.

Step-4: MS Access 2016 creates table automatically which is named as Table 1. This table can be customized.

Step-5: Click on create table, then in the tables group, click table.

Step-6: A new table is inserted in the database and the table opens in datasheet view.

EXERCISE MCQS

Q#1: Select the best choice for the following MCQs.

1. Which of the following is used to store data in a database?
   a. Table b. Form
   c. Query d. Report
2. _____is a window that displays data for viewing, entering and editing information.
   a. Table b. Form
   c. Query d. Report
3. Which of the following is logical data type?
   a. Text b. Memo
   c. Auto-number d. Yes/No
4. _____is an open source application program.
   a. MS Access b. OpenOffice Base
   c. SQL Server d. MS Word
5. What is the maximum size of text field data type?
   a. 253 b. 254
   c. 255 d. 256
6. _____key is a unique key field in a table.
   a. Secondary b. Foreign
   c. Composite d. Primary
7. Which key is used to create one-to-many relationship between tables?
   a. Secondary b. Foreign
   c. Composite d. Primary
8. _____is used to display data in an organized manner so that users can print it.
   a. Table b. Form
   c. Query d. Report

Answers:

1	2	3	4	5	6	7	8
a	b	d	b	c	d	b	d

Short Questions

Q2: Give short answers to the following questions.

Q:i. Name different types of database management systems.

Answer: Database Management System:

Definition: A database management system (DBMS) is software designed to store, retrieve, define, and manage data in a database. (OR)

Database management systems (DBMS) are software systems used to store, retrieve, and run queries on data. A DBMS serves as an interface between an end user and a database, allowing users to create, read, update and delete data in the database.

Types of Database Management System:

1. Rational Database
2. Network Database
3. Object Oriented Database
4. Hierarchical Database
5. No SQL Database
6. Cloud Database
7. Distributed Database

Q:ii. What is Open Office Base?

Answer: Open Office Base:

Open Office Base is the database of Open Office Suite. It is a fully featured database management system.

Features of Open Office Base:

Open Office Base has wizards to help new users to create database design, that is, to create tables, queries, forms, and reports. It allows users to create interactive database to manage data related payroll, inventory, assets, budgets, customers, sales orders and invoices etc.

Q:iii. How forms are useful in database?

Answer: Purposes of Form:

Form is generally used for the following purposes:

1. It allows users to perform data entry. Data can be inserted, updated, or deleted from a table using a form object.
2. It allows users to enter custom information and based on that information a task is performed. For example, a system may want to ask for parameters before running a report.
3. It allows users a method of navigation through the system. For example, one may create a form where a user can select a report to run.
4. User can also add certain control components to a form, like buttons, combo box, list box, drop down menus and sub-forms.

Q:iv. Name common access database objects.

Answer: Database Objects:

The following are the common database objects:

i) Tables ii) Queries iii) Forms iv) Reports

i) Tables: A table is a set of columns and rows, with each column referred to as a field and each row of table is referred to as a record. In Access 2016, data is stored in tables.

ii) Queries: Queries are used to retrieve specific data from database and to answer questions about the data. For example, a user can use a query to find the names of the employees in the database who are in BPS 18.

iii) Forms: Forms give the ability to choose the format and arrangement of fields to enter and view data. User can use a form to enter, edit, display, modify and define data from the database.

iv) Reports: Reports organize or summarize the data so that the user can print it or view it on the screen. Users often use reports when they want to analyze the data or present it in different styles.

Q:v. How primary key is assigned in a table?

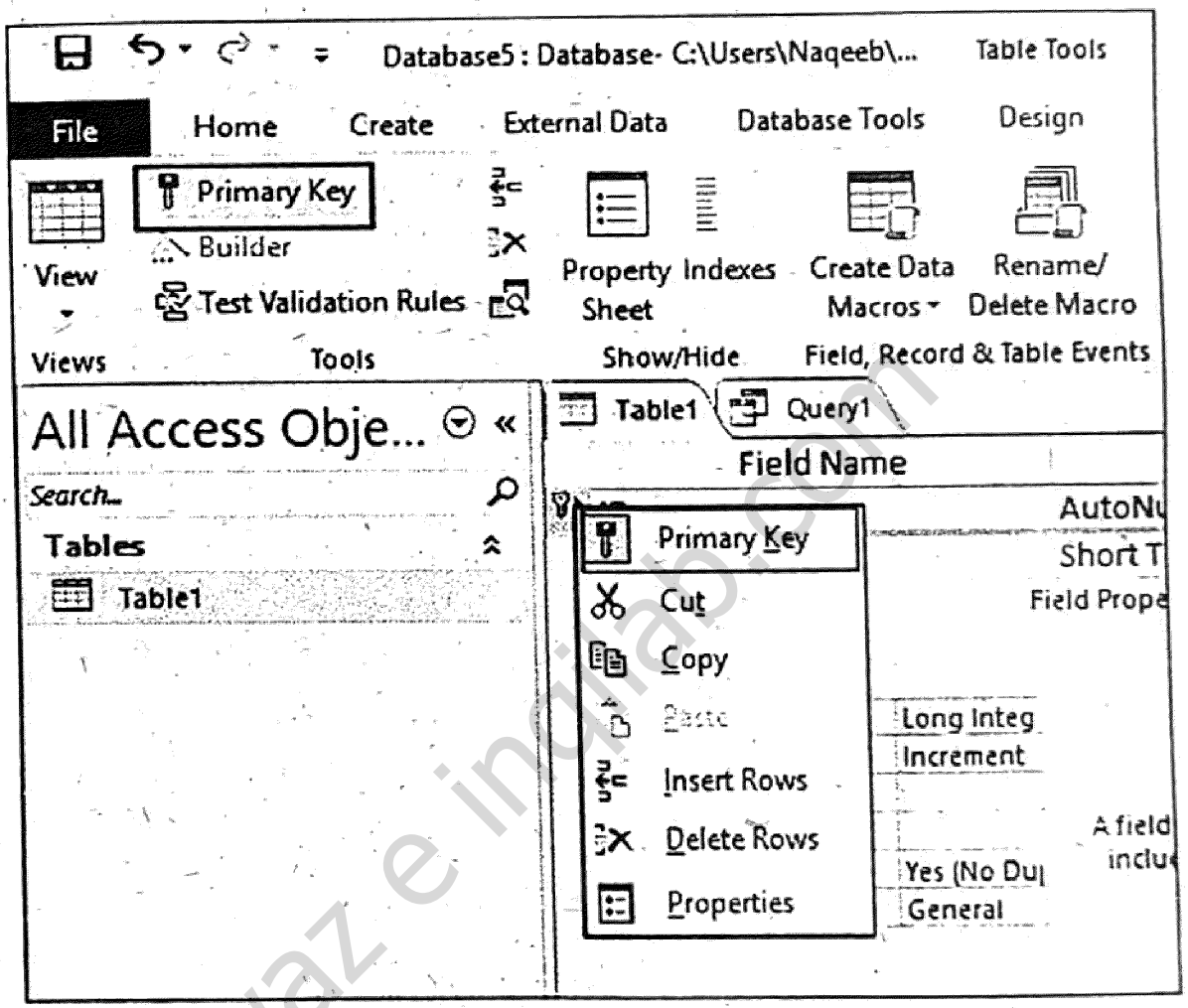
Answer: Primary Key:

Primary key is a unique field in a table. After defending all the

field names and their data types in design view, create a primary key for the table as shown in figure.

Steps to Assign Primary Key in a Table:

- Right-click on the genreId field (for example)
- Select primary key from the drop down list.
- This makes the field a primary key field.
- Once you've done this, you'll see a little key icon to the left of genreId.



Creating Primary Key

Q:vi. What is a report?

Answer: Report: A report is an access object.

Purpose of Report: Report is used to display data in an organized manner so that users can print it. A report is an effective way to present data using an attractive layout.

Microsoft access report visualize data for presentations, printable, formats, management reports, or simple summaries of

what the tables represent from the database. Using the report wizard, you can quickly create a basic report.

Q:vii. How relationship can be edited in Access?

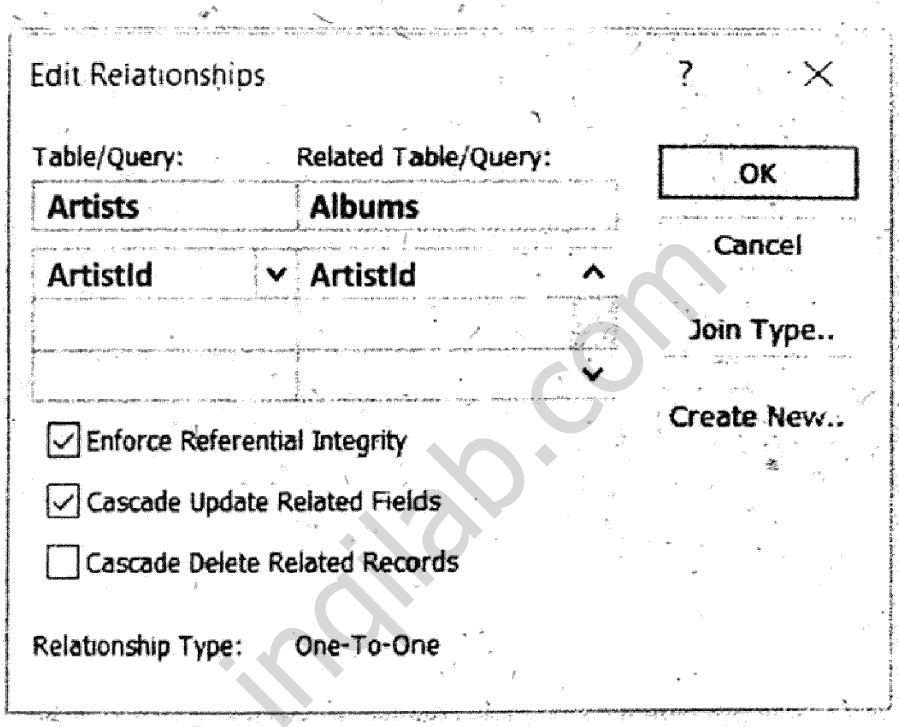
Answer: Editing Relationship:

The following steps are used to edit relationship between tables:

Step-1: Click relationship in the database tools tab.

Step-2: Click the join line that connects the fields.

Step-3: Right-click on the line and select edit relationship option as shown in the figure.



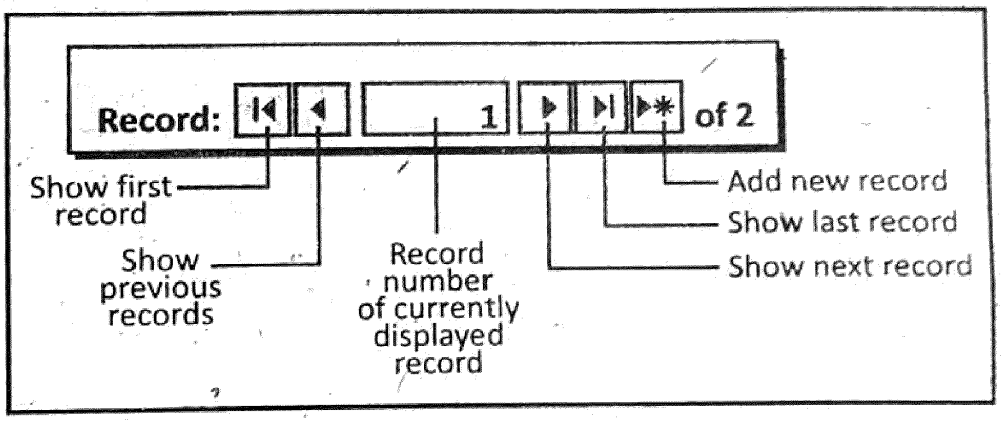
Q:viii. Name different navigation buttons in a form.

Answer:

Different Navigation Buttons:

There are various navigation buttons in a form. These

1. First Record Button
2. Previous Record Button
3. Next Record Button
4. Last Record Button
5. New Record Button



Detailed Questions

Q3: Give detailed answers to the following questions.

i. Explain the following database objects:
(a) Tables (b) Forms (c) Queries (d) Reports

Answer: See Question # 6, Page # 252

ii. Explain different data types used in Access.

Answer: See Question # 7, Page # 262

iii. Describe two methods of creating a table in Access.

Answer: See Question # 13, Page # 270

iv. Explain the process of creating forms in Access.

Answer: See Question # 8, Page # 263

v. Write the steps for creating relationships between tables.

Answer: See Question # 9, Page # 264

vi. Explain different types of queries used in Access.

Answer: See Question # 10, Page # 266

vii. How can One-to-Many relationship can be created between two tables? Give example.

Answer: See Question # 11, Page # 267

viii. What is a report? How report is created using wizard option in Access 2016?

Answer: See Question # 12, Page # 269

Additional MCQs

Q: Select the best answer for the following MCQs.

1. Which of the following is used to gather information based on one or more criteria?
   a. Table b. Form **c. Query** d. Report
2. Which data field type is used to provide descriptive comments?
   a. Text **b. Memo** c. Autonumber d. Yes/No
3. Selecting records in a table which match a given criteria is known as:
   a. Sorting data b. Searching data
   c. Updating data **d. Filtering data**
4. The maximum number of records in a table that can use the autonumber field is slightly more than:
   a. 1 million b. 1 billion **c. 2 billion** d. 3 billion
5. Which database object stores all the information of a database?
   a. Table b. Form c. Query d. Report
6. What is the default value of number of characters for text data type in access?
   a. 30 b. 40 **c. 50** d. 60
7. Which query is used to add records from a table to another table?
   a. Select query b. Update query
   c. Append query d. Make table query
8. Which query is used to change data in existing records?
   a. Select query **b. Update query**
   c. Append query d. Make table query
9. In which tab of access ribbon relationships icon is located?
   a. Home b. Create
   c. External data **d. Database tools**
10. In which tab of access ribbon query design icon is located?
    a. Home **b. Create**
    c. External data d. Database tools

MODEL PAPER

PR XI (01) 16

COMPUTER SCIENCE

Inter part – I (New)

Time Allowed: 3 Hours **Marks: 75**

Note: There are Three sections in this paper i.e. Section-A, B and C. Attempt Section – A on the same paper and return it to the Superintendent within the given time.

No marks will be awarded for Cutting, Erasing or Overwriting. Marks of Identification will lead to UFM case, Mobile Phone etc. are not allowed in the examination hall.

Time: 20 Minutes **SECTION – A** **Marks: 15**

Q.I. Write the correct option i.e. A, B, C or D in the empty box provided opposite to each part.

(i) The distance between the pixels on the monitor is called_____
(a) Size (b) Resolution (c) Dot pitch (d) Refresh rate

(ii) _____is not a portable computer.
(a) Laptop (b) PDA (c) Notebook (d) Mainframe

(iii) _____is the fastest memory.
(a) RAM (b) ROM (c) Cache (d) PROM

(iv) _____is volatile memory.
(a) RAM (b) ROM (c) PROM (d) EEPROM

(v) System bus connects the Central Processing Unit to_____on the motherboard.
(a) Register (b) Main memory
(c) ALU (d) Memory

(vi) _____is small memory device available in the CPU to store data temporarily.
(a) CU (b) Register (c) ALU (d) Memory

(vii) An example of output device is_____
(a) Printer (b) Scanner (c) Mouse (d) ROM

(viii) _____is a new technology cable for connecting storage devices to computer.
(a) IDE (b) PCI (c) FD (d) SATA

(ix) OSI model has_____layers.
(a) 7 (b) 5 (c) 6 (d) 3

(x) A collection of two or more connected computers to share the resources and data is called_____
(a) Router (b) Network (c) Path (d) Medium

(xi) The frequency range of radio signal is between 3KHz to _____

GHz.
(a) 1 (b) 2 (c) 3 (d) 4

(xii) The GPS system consists of_____satellites.
(a) 20 (b) 22 (c) 24 (d) 25

(xiii) A row in a table is also known as_____
(a) Column (b) Relation (c) Tuple (d) Field

(xiv) PROM stands for_____
(a) Previous read only memory
(b) Practical read only memory
(c) Programmable read only memory
(d) None of these

(xv) Which one is the shortcut key of Redo in MS Word?
(a) Ctrl + Y (b) Ctrl + Z
(c) F12 (d) None of these

Note: Time allowed for Section – B and Section – C is 2 Hours and 40 minutes.

SECTION – B

Marks: 40

Q.II. Answer any TEN parts. Each part carries FOUR marks.

1. What is processing operation?
2. Differentiate between shareware and freeware.
3. What is the importance of cache memory in a computer?
4. Give few characteristics of secondary storage devices.
5. What is the function of ALU in the computer?
6. Differentiate between CISC and RISC processor architecture.
7. List different parts of motherboard.
8. Why cooling system is important for a computer?
9. Compare TCP/IP model with OSI model.
10. Differentiate between short distance and long distance wireless communication.
11. What is hotspot?
12. Define the term database and DBMS with the help of example.
13. Give any four advantages of database system.

SECTION – C

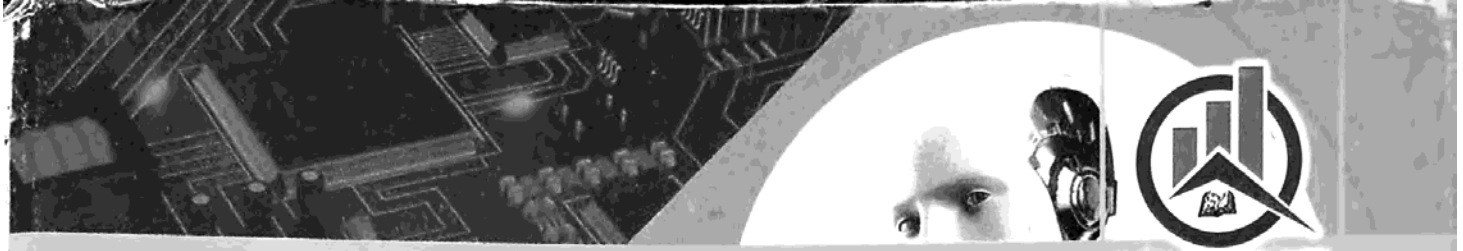
Marks: 20

Note: Attempt any TWO questions. All questions carry equal marks.

Q.III. What are impact and non-impact printers? Explain any two types of printers in each category.

Q.IV. Explain RAM and ROM along with their types in detail.

Q.V. What is instruction cycle? Explain different phases of CPU instruction cycle.



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