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# KENDRIYA VIDYALAYA SANGTHAN, RANCHI REGION

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Support Material



**Computer Science (083)**

**TERM II (2021-22)**



**Sh. D. P Patel**  
**Deputy Commissioner**  
**Kendriya Vidyalaya Sangathan Ranchi Region**  
**Chief Patron**



**Sh. D. V. Ramakrsihna**  
**Assistant Commissioner**  
**Kendriya Vidyalaya Sangathan Ranchi Region**  
**Patron**

**Ravi Prakash**  
**Post Graduate Teacher**  
**Kendriya Vidyalaya Namkum**  
**Subject Convenor**

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## Syllabus

### Unit I: Computational Thinking and Programming – 2

- Data Structure: Stack, operations on stack (push & pop), implementation of stack using list.

### Unit II: Computer Networks

- Evolution of networking: introduction to computer networks, evolution of networking (ARPANET, NSFNET, INTERNET)
- Data communication terminologies: concept of communication, components of data communication (sender, receiver, message, communication media, protocols), measuring capacity of communication media (bandwidth, data transfer rate), IP address, switching techniques (Circuit switching, Packet switching)
- Transmission media: Wired communication media (Twisted pair cable, Co-axial cable, Fiber-optic cable), Wireless media (Radio waves, Micro waves, Infrared waves)
- Network devices (Modem, Ethernet card, RJ45, Repeater, Hub, Switch, Router, Gateway, WIFI card)
- Network topologies and Network types: types of networks (PAN, LAN, MAN, WAN), networking topologies (Bus, Star, Tree)
- Network protocol: HTTP, FTP, PPP, SMTP, TCP/IP, POP3, HTTPS, TELNET, VoIP
- Introduction to web services: WWW, Hyper Text Markup Language (HTML), Extensible Markup

### Unit III: Database Management

- Database concepts: introduction to database concepts and its need
- Relational data model: relation, attribute, tuple, domain, degree, cardinality, keys (candidate key, primary key, alternate key, foreign key)
- Structured Query Language: introduction, Data Definition Language and Data Manipulation Language, data type (char(n), varchar(n), int, float, date), constraints (not null, unique, primary key), create database, use database, show databases, drop database, show tables, create table, describe table, alter table (add and remove an attribute, add and remove primary key), drop table, insert, delete, select, operators (mathematical, relational and logical), aliasing, distinct clause, where clause, in, between, order by, meaning of null, is null, is not null, like, update command, delete command
- Aggregate functions (max, min, avg, sum, count), group by, having clause, joins : Cartesian product on two tables, equi-join and natural join
- Interface of python with an SQL database: connecting SQL with Python, performing insert, update, delete queries using cursor, display data by using fetchone(), fetchall(), rowcount, creating database connectivity applications

## Suggested List of Practical

### Python Programming

- Write a Python program to implement a stack using list.

### Database Management

- Create a student table and insert data. Implement the following SQL commands on the student table:
  - ❖ ALTER table to add new attributes / modify data type / drop attribute
  - ❖ UPDATE table to modify data
  - ❖ ORDER By to display data in ascending / descending order
  - ❖ DELETE to remove tuple(s)
  - ❖ GROUP BY and find the min, max, sum, count and average
  - ❖ Joining of two tables.
  - ❖ Similar exercise may be framed for other cases.
  - ❖ Integrate SQL with Python by importing suitable module.

### Marks Distribution

➤ **Theory (35 Marks)**

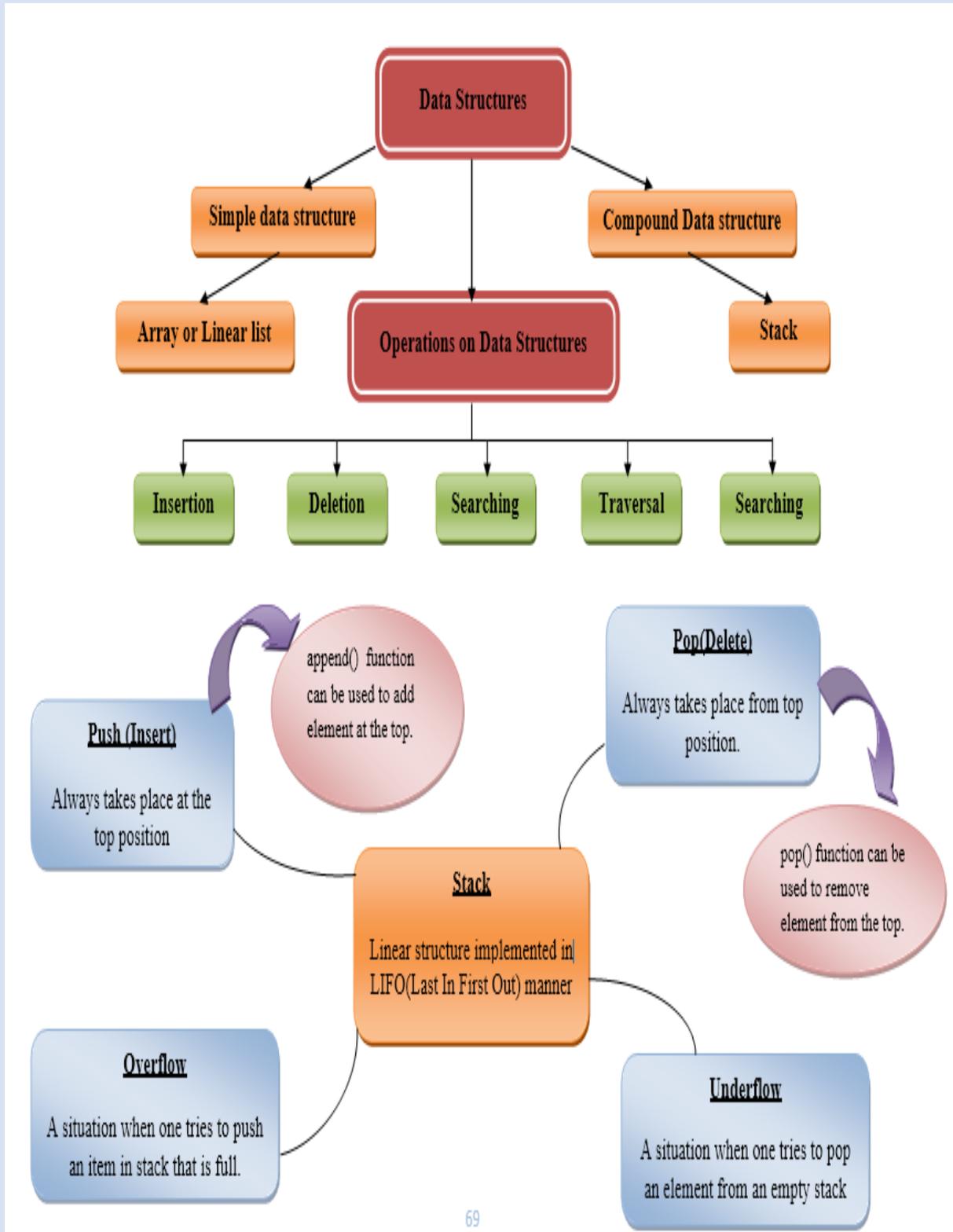
Unit No	Unit Name	Marks Allotted
I	Computational Thinking and Programming – 2	5
II	Computer Networks	10
III	Database Management	20
	Total	35

➤ **Practical (15 Marks)**

SL		Marks
01	<b>Lab Test :</b> Python Program 3 SQL Queries based on one/two table(s), 2 output questions based on SQL queries	2 4
02	<b>Report file:</b> Minimum 3 Python programs based on Term-2 Syllabus SQL Queries – Minimum 5 sets using one table / two tables. Minimum 2 programs based on Python – SQL connectivity.	3
03	Project (using concepts learnt in Classes 11 and 12) Final coding + Viva voce (Student will be allowed to modify their Term 1 document and submit the final executable code.)  Note: Synopsis of the Project is already submitted in Term 1	5
04	Viva voce	1

# Data Structure

## Mind Map



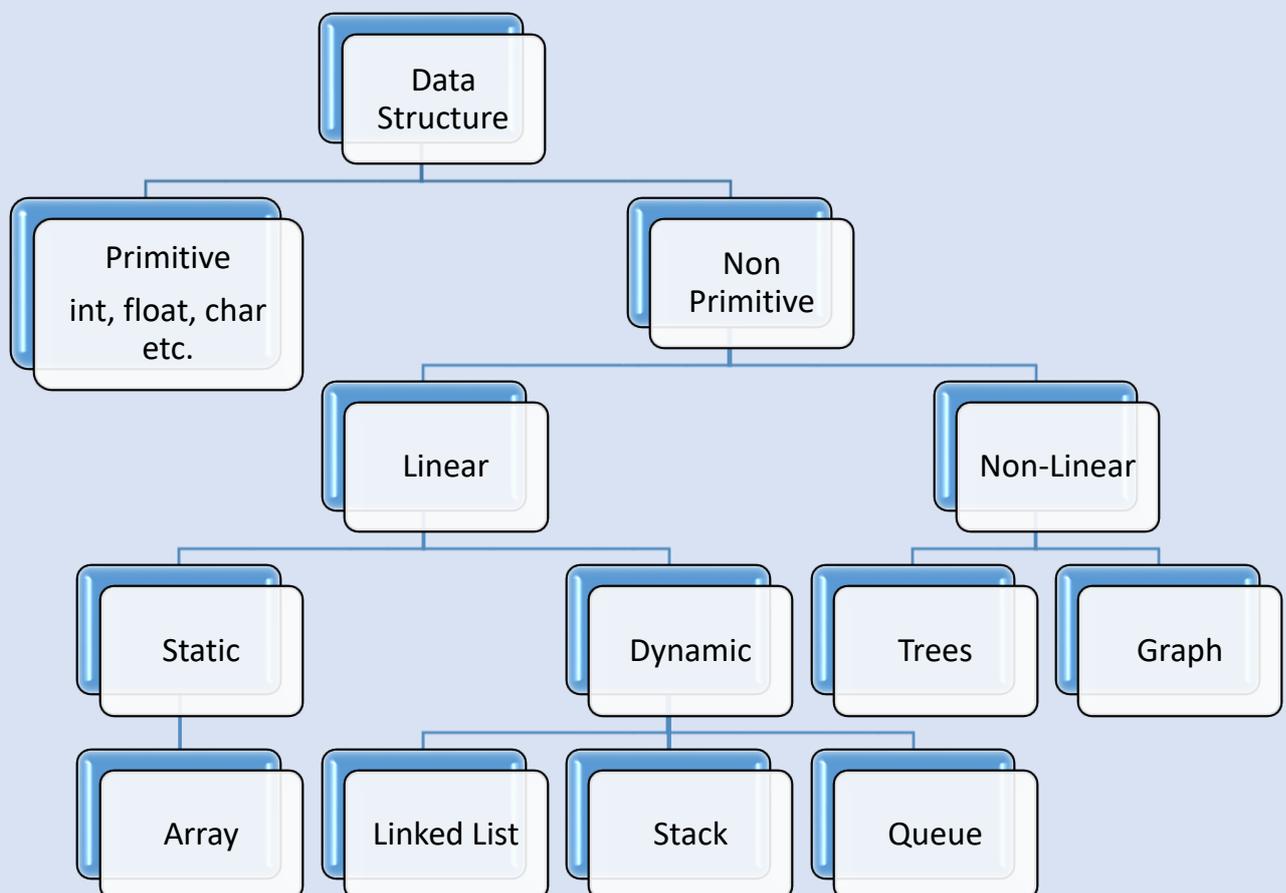
## Introduction

Data structures are a specific way of organizing data in a specialized format on a computer so that the information can be organized, processed, stored, and retrieved quickly and effectively. Different kinds of data structures are suited to different kinds of applications, and some are highly specialized to specific tasks. More precisely, a data structure is a collection of data values, the relationships among them, and the functions or operations that can be applied to the data.

### Classification of Data Structure:

**Linear** - Linear data structures have all their elements arranged in a linear or sequential fashion such as Array, linked list, Stack and Queue

**Nonlinear** - In non-linear data structures, data is not arranged sequentially, instead, it is arranged in a non-linear fashion. Elements are connected to each other in a non-linear arrangement

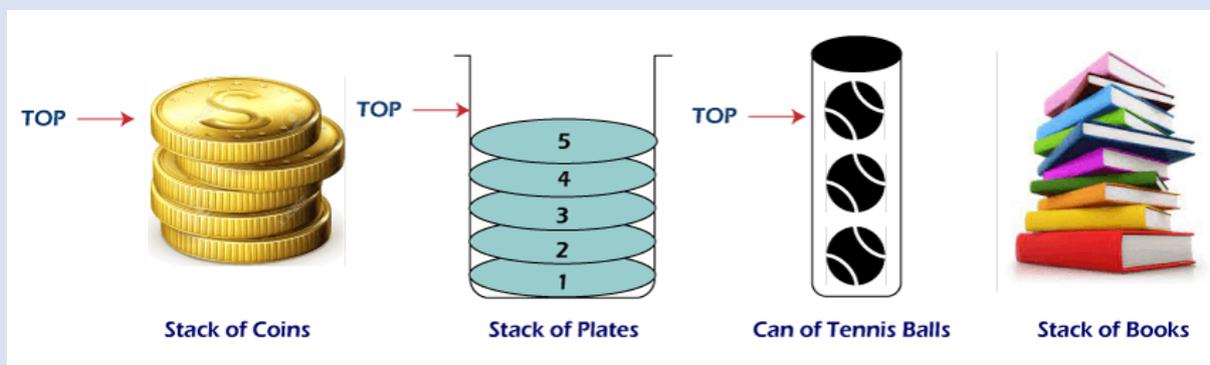


## Operation on Data Structure are:

- Creating : defining an data structure of required size
- Insertion: addition of a new element
- Deletion: removal of existing element
- Searching: searching for the specified element
- Traversing: processing/accessing all the elements
- Sorting : arranging elements in ascending/descending order
- Merging : combining elements of two similar types similar object

## Stack

Stack is a linear data structure in which the elements can be added or removed only from one end known as “Top” of the stack. The discipline of Stack is LIFO (Last In First Out) i.e. element inserted last will be removed first.



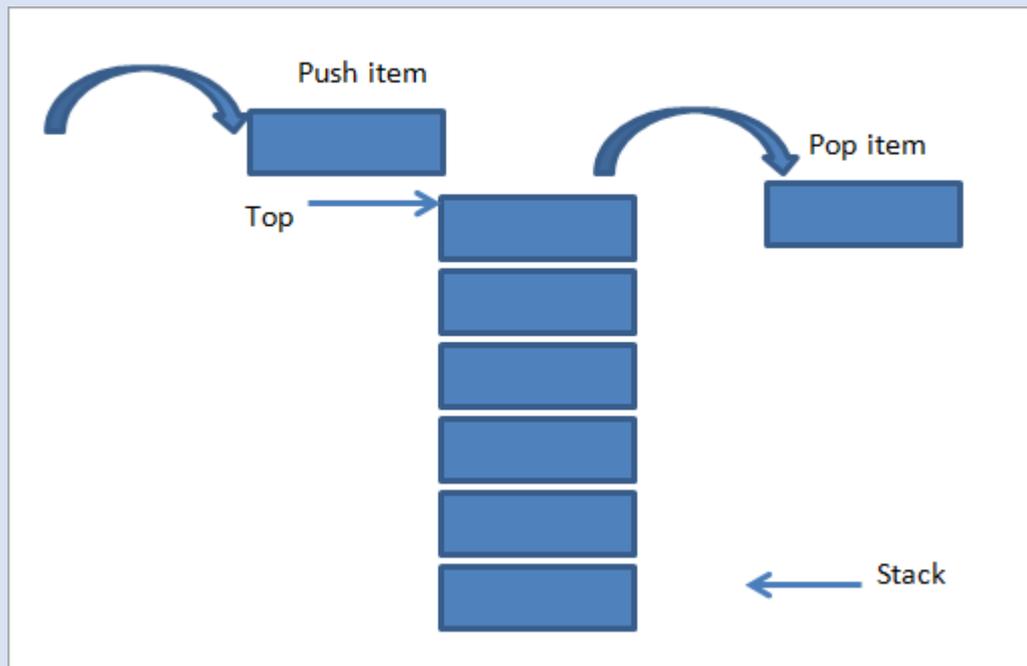
There are various real life example of stack, stack of plate in the kitchen, a pile of books etc. It is also used to implement functions, parsers, expression evaluation, and backtracking algorithms.

## Application of Stack:

- Balancing the Symbols
- Infix to postfix conversion
- Evaluation of postfix expression
- Implementation of function call including recursion
- Reversing word
- "undo" mechanism in text editors;
- Space for parameters and local variables is created internally using a stack.
- Compiler's syntax check for matching braces is implemented by using stack.

Operation of Stack: The two basic operation on stack is defined as

- Push- addition of new element on the top of stack.
- Pop – deletion of element from the top.
- isEmpty() - indicates whether any elements are stored in the stack or not (underflow)



Implementation of Stack Using List:

- i. Creation of empty list  
`Stack=[]`  
 Or  
`Stack=list()`
- ii. Push- Adding element at top of the list  
`def Push(stk, e):`  
`stk.append(e)`
- iii. Pop- Deletion Element from the stack  
`def pop(stk):`  
`a=stk.pop()`  
`return a`
- iv. Checking for underflow  
`def isEmpty(stk):`  
`if len(stk)==0:`  
`return True`  
`else:`  
`return False`

Complete Program :

```
def push(stk, e):
    stk.append(e)

def pop(stk):
    a=stk.pop()
    return a
def isEmpty(stk):
```

```

    if len(stk)==0:
        return True
    else:
        return False
def display(stk):
    print("The stack is : ")
    l=len(stk)
    for i in range(-1,-(l+1),-1):
        print(stk[i]),

#Main Program
stack =[]
top= None
choice=None
while True:
    print("***** Program implement Stack*****")
    print("1 Push")
    print("2 Pop")
    print("3 Display")
    print("4 Exit")
    choice=input("Enter your choice : ")
    if choice=='1':
        e=input("Enter element to insert")
        push(stack,e)
    elif choice=='2':
        if isEmpty(stack):
            print("Underflow! nothing to delete")
        else:
            a=pop(stack)
            print("The delete item is ",a)

    elif choice=='3':
        display(stack)
    elif choice=='4':
        break

    input("Enter any key to continue....")

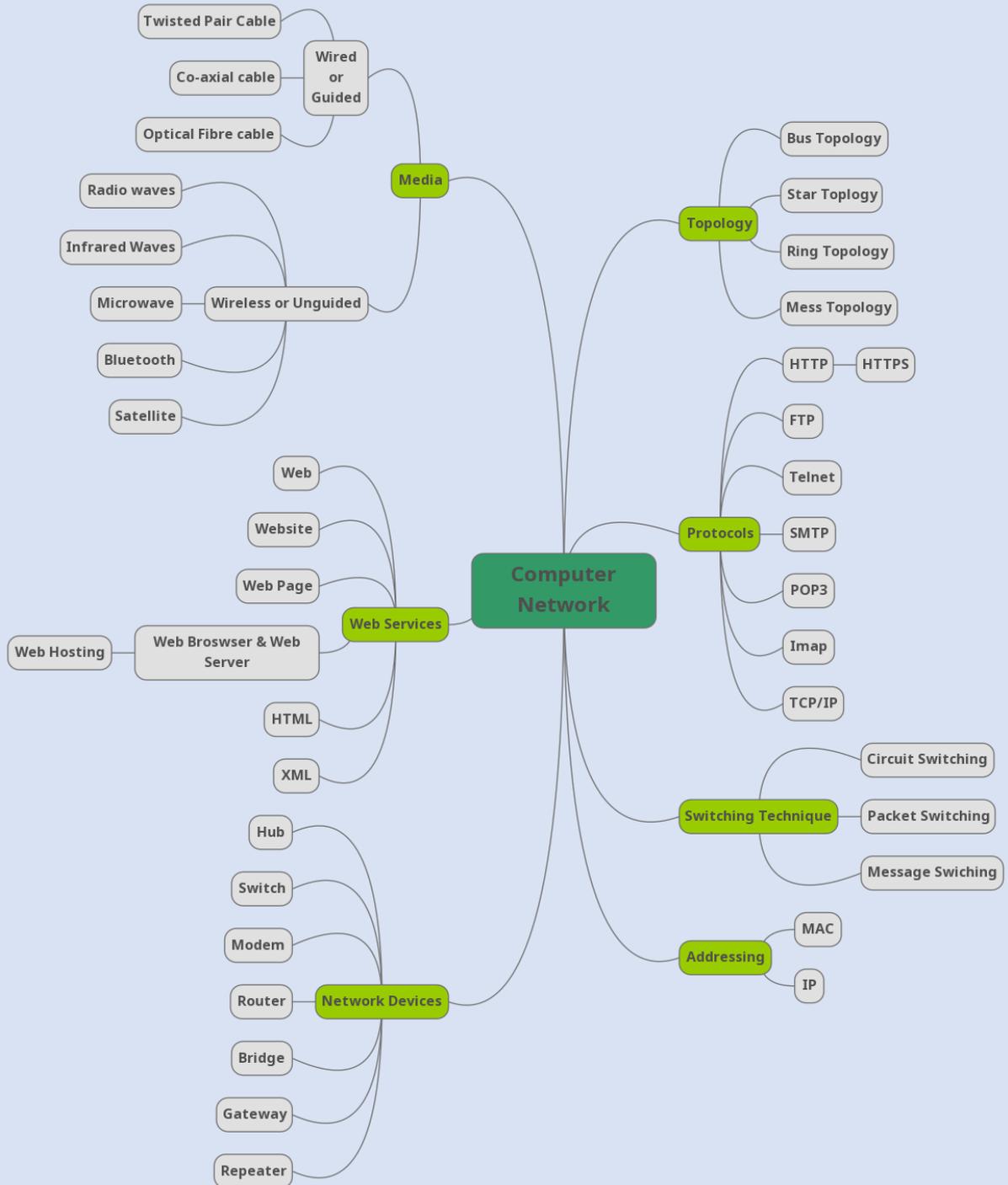
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#### Important Questions:

1. What is stack? Why it is called LIFO data structure?
2. Write the various applications of Stack.
3. Write an algorithm to pop element from the stack.
4. What is the situation called when an insertion is attempted in a full stack.
5. What is difference between array and stack.
6. Write a add(book) and delete(book) method in Python add book and remove book considering books are stored in a stack.



# Computer Network Mind Map



### **Introduction:**

Computer Network is a collection of autonomous computers interconnected by a single technology.

Two computers are said to be interconnected if they are able to exchange information. A computer network is a system that connects independent computers in order to share information and resources

### **Brief History of Network**

- In 1967, ARPA (Advance **R**esearch **P**roject Agency by Department of Defence) proposed the idea of ARPANET – a small network of computers.
- By 1969, ARPANET became reality that connect four nodes at University of California at Los Angeles (UCLA), University of California at Santa Barbara (UCSB), Stanford Research Institute (SRI) and University of Utah via IMPs ( **I**nterface **M**essage **P**rocessor – a specialized computer).
- In 1973, Vint Cerf and Bob Kahn presented paper outlined the protocol( **T**ransmission **C**ontrol **P**rotocol) to achieve end-to-end delivery of packets.

### **Advantage of Computer Network:**

- Central Storage of Data
- Sharing of Information
- Sharing of Resources(Hardware & Software)
- Reliability
- Communication
- Reduced Cost

### **Disadvantage of Computer Network:**

- Computer networks require a specific setup
- Lack of Security
- Cost of network hardware and software

### **Components of Data Communication:**

- Message – it information to be communicated
- Sender – The device which send the message
- Receiver – The device which receive the message
- Transmission media – It is physical path by which message travel from sender to receiver
- Protocol – It is set of rules that governs data communication. Actually it is agreement between the sender and receiver regarding various communication parameter.

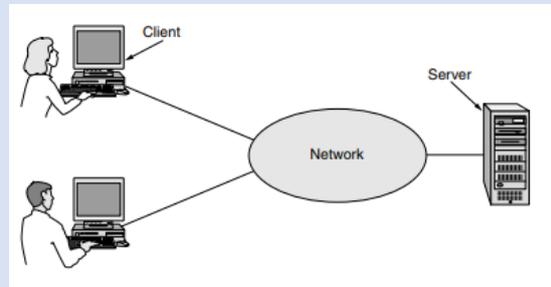
### **Data Flow**

- Simplex – In this mode of communication, data is transmitted in one direction only. e.g. Keyboard, monitor. It uses entire capacity of channel to send the data.
- Half Duplex – Communication is bi-directional but not same time. i.e. Walkie-Talkie. It uses entire capacity of channel is utilized for each direction.
- Full Duplex – Communications is bi-directional simultaneously i.e. both sender and receiver can be send data at same time.

### **Network Terminology**

- Node- The device connected to a network.

- Client – The device that request for a service
- Server – The Device that render the services
- Client-Server - In this model, the data are stored on powerful computers called **Server** that can be accessed by a much simpler computer called **Client** that are connected by a network.



- Network Interface Card or Unit (Network Adapter or LAN card) - It is hardware that allows a computer (or device) to connect to network.
- MAC (Media Access Control) address – Each NIC is assigned a unique 12 digit hexadecimal number, known a MAC address, is used as network address in communication. The format for the MAC address is

MM : MM : MM : SS : SS : SS

Manufacturer ID      Card Id

- IP Address: Every device on network has unique identifier called IP address. It consists of 4 bytes (IPv4) decimal number (between 0 to 255) separated by ‘.’ (Period).
- Channel – It is communication path through which data is actually transmitted.
- Communication Media- It is allows data or signal to be communicated across the devices. It is means of communication.
- Data – Information stored within the computer system in form of ‘0’ and ‘1’
- Signal- It is electric or electromagnetic encoding of data to be transmitted. It can be categorized into :
  - Analog Signal – that has infinitely many level of intensity over a period of time.
  - Digital Signal – that can have only a limited number of defined values.
- Bit rate – It defines the amount of data transferred. It is defined as number of bits per second (bps). [Bps – Bytes per Second]
- Baud – The number of changes in signal per second.
- Bandwidth – It is difference between the highest and the lowest frequencies contained in the signal.

### IP Address vs MAC Address

IP Address	MAC Address
It is of 4 bytes	It is of 6 bytes
Represented by decimal number	Represented by hexadecimal number
It is logical address	It is physical address

It is variable address	It is fixed address
It is assigned only when a device is	It is assigned by manufacturer of the card
Command to know the IP address is	Command to know the IP address is

### Mode of Transmission

#### ➤ Analog or Broadband Transmission

- It uses analog signals to transmit the information
- The data can be sent simultaneously using various frequencies.
- It is a unidirectional method of data transmission.
- Multiple signals can be transmitted using multiple frequencies using only one channel
- Signal range is long.
- Example- Used to transmit cable TV to premises

#### ➤ Digital or baseband Transmission

- It uses digital signal (square wave) to transmit the information.
- It is bi-directional transmission.
- Entire bandwidth is for single signal transmission.
- Short distance signal travelling
- Ethernet is using Basebands for LAN

#### ➤ Parallel Communication

#### ➤ Series Communication

#### ➤ Synchronous Transmission

#### ➤ Asynchronous Transmission

### Switching Technique

- A switched network consists of a series of interlinked nodes called switches capable of creating temporary connections between two or more liked devices.
- There are three basic switching technique
  - **Circuit Switching:** In circuit switching a dedicated path is established before sending data from sender to receiver and entire communication is carried out the same path.
  - **Packet Switching** – In packet switching in a message is broken into a number of parts called packet which are sent independently from sender to receiver and reassembled at the destination.

### Circuit Switching vs Packet Switching

Circuit Switching	Packet Switching
A dedicated path is established	No dedicated path is established
Entire message follow same path	Each packet travels independently to each other

### Network Devices

#### ➤ Modem

- It stands for modulator and demodulator

- It is a computer hardware device that converts data from a digital format into a format suitable for an analog.
- A modem transmits data by modulating one or more carrier wave signals to encode digital information, while the receiver demodulates the signal to recreate the original digital information.



#### ➤ Repeater

- Repeaters are network devices that amplify or regenerate an incoming signal before retransmitting it.
- It operates at the physical layer of the OSI model.
- The **repeater** allows to transfer the data through large area distance

#### ➤ Hub

- It is a multiport device that allows multiple computers to communicate with each other over a network.
- It is a non-intelligent network device that sends message to all ports( i.e. Broadcast)

#### • Types of Hub

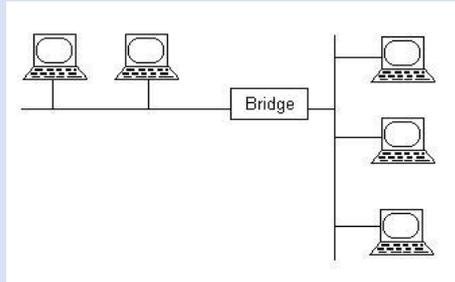
- **Active Hub** –
  - It strengthens the signal may boost noise too.
  - It needs electricity.
- **Passive Hub** –
  - It repeats/copy signals.
  - It does not need electricity

#### ➤ Switch

- Network Switch or switch is also a network multiport device that allows multiple computers to connect together.
- Network switch inspects the packet, determines source and destination address and routes the packet accordingly.
- It operates at the Data Link Layer (layer 2) of the OSI model.

#### ➤ Bridge

- It connects multiple network segments having the same protocol
- It works at the Data Link Layer (Layer 2).
- Bridge does not simply broadcast traffic from one network.
- Bridges use bridge tables to send frames across network segments.
- It also improves the overall network performance.



➤ **Router**

- A router is a device that connects two or more packet-switched networks or sub networks.
- It serves two primary functions:
  - Managing traffic between these networks by forwarding data packets to their intended IP addresses, and
  - Allowing multiple devices to use the same Internet connection.
- It connects LANs (local area networks) and WANs (wide area networks).
- It operates on layer 3 or 4 in OSI model

➤ **Gateway**

- ❖ It is simply a device or hardware that acts as a "gate" between the networks.
- ❖ It connects two networks with different transmission protocols together.
- ❖ It converts information, data or other communications from one protocol or format to another.
- ❖ It operates on layer 5 of OSI model

➤ **RJ45**

- ❖ It stands for Registered Jack.
- ❖ It is common interface to connect Twisted Pair Cable.
- ❖ It is used for Ethernet and Token Ring Network.



➤ **Ethernet Card**

- ❖ It also known as NIC card.
- ❖ It enables a computer to access an Ethernet network (LAN)
- ❖ It has MAC id which gives it unique identity in the network.



➤ **Wi-Fi card**

- ❖ It is also known wireless network adaptor.
- ❖ It is a wireless network technology that allows devices to communicate over wireless signals.
- ❖ It uses radio waves for the communication



➤ **Difference between Router and Switch**

- ❖ A network switch forwards data packets between groups of devices in the same network, whereas a router forwards data between different networks.

➤ **Difference between a Router and a Modem**

- ❖ A router forms networks and manages the flow of data within and between those networks, while a modem connects those networks to the Internet.

➤ **Difference between a Router and Gateway**

- ❖ A gateway is a concept while a router is a device that implements a gateway.

Router	Gateway
It ensure that data packets are switched to the right address with the best route.	To connect two networks of different protocols as a translator
It routes the data packets via similar networks	It connects two dissimilar networks
It supports dynamic Routing.	It does support dynamic Routing.

**Type of Network**

➤ **PAN**

- It stands for Personal Area Network.
- It is a computer network formed around a person.
- It generally consists of a computer, mobile, or personal digital assistant.
- Appliances use for PAN: cordless mice, keyboards, and Bluetooth systems.
- PAN includes mobile devices, tablet, and laptop.

➤ **LAN**

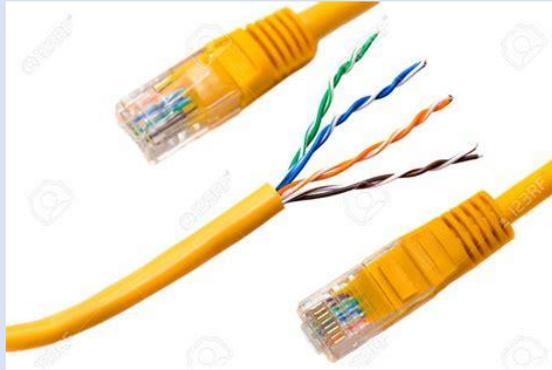
- ❖ It is a group of computer and peripheral devices which are connected in a limited area such as room, building & campus.
  - ❖ Higher Data Speed.
  - ❖ Lower Error Rate.
  - ❖ LANs are in a narrower geographic scope (upto 1 Km).
  - ❖ It is a private network.
- **MAN**
- ❖ A **Metropolitan Area Network** or MAN is consisting of a computer network that span across a city.
  - ❖ It mostly covers towns and cities in a maximum 50 km range.
  - ❖ The dual bus in MAN network provides support to transmit data in both directions concurrently.
  - ❖ Moderate Data Rate.
  - ❖ Moderate Error Rate.
- **WAN**
- ❖ It connect device across globe.
  - ❖ It uses public network
  - ❖ Internet
  - ❖ BSNL
  - ❖ VSNL

### Network Media

- **Guided or Wired**
- ❖ **Telephone (T1) cable**
  - ❖ **Twisted pair cable**
    - **STP (Shielded Twisted Pair)**
    - **UTP (Unshielded Twisted Pair)**
  - ❖ **Co-axial cable**
  - ❖ **Optical Fiber/Fibre**
- **Unguided or Wireless**
- ❖ **Infrared**
  - ❖ **Radio Wave**
  - ❖ **Microwave**
  - ❖ **Bluetooth**
  - ❖ **Satellite**

### Twisted Pair Cable

- A twisted pair cable comprises of two separate insulated copper wires, which are twisted together and run in parallel.
- ❖ A STP (Shielded Twisted Pair) cable has a fine wire mesh surrounding the wires to protect the transmission
  - ❖ UTP (Unshielded Twisted Pair) cable does not has a fine wire mess.
- It is also known as Cat# cable where # denote number. e.g. Cat6
- Connector : RJ 45



### Twisted Pair Cable – Advantages

- It is the least expensive medium of transmission for short distances.
- It is relatively easy to implement and terminate.
- It is flexible and lightweight.
- It is easy to set up and install.
- Less susceptible to electrical interference caused by nearby equipment or uses of wires.

### Twisted Pair Cable – Disadvantages

- Attenuation is very high.
- It offers poor noise immunity as the result signal distortion is too much more.
- STP called shielded twisted pair cable is more difficult to connect to a terminating block.
- Susceptible to noise and interference.

### Co-axial Cable

- Coaxial cabling has a single copper conductor at its center, and a plastic layer that provides insulation between the center conductor and a braided metal shield.
- Connector: BNC (Bayonet Neill-Concelman)



- Highly resistant to physical damage.
- Highly resistant to EMI.
- Great channel capacity.
- The transmission rate is high.
- It is less susceptible to noise interference compare to twisted pair.
- It is easy to wire and easy to expand to flexibility.
- It support high bandwidth signal transmission compare to twisted pair.
- It requires fewer repeater than twisted pair.

### Co-axial Cable – Disadvantage:

- It is expensive to install.
- Cost maintenance is also high.
- Inflexible construction.
- Unsupported by newer networking standards.
- It is bulky.
- It has a more security problem.
- It does not support high-speed transmission.
- It must be grounded to prevent interference.
- In case of failure in one cable, the entire network will be down by using this wire.

### **Optical Fibre**

- An optical fiber is a flexible, transparent fiber made by drawing glass or plastic to a diameter slightly thicker than that of a human hair.
- It uses light for data transmission using total internal reflection.

### **Optical Fibre- Advantages**

- Higher bandwidth
- Less signal attenuation
- Immune to cross-talk
- Optical fiber have long life more than 100 or above years
- Grater immune to tapping
- Resistance to corrosive material
- Long distance transmission is possible
- Immunity to electromagnetic interference

### **Optical Fibre-Disadvantage**

- Unidirectional propagation
- High initial cost
- Optical fiber more tensile stress than copper cables
- Installation and maintenance
- Fiber joining process is very costly and require skilled manpower
- Difficult to splice (join)
- Difficult to find error

### **Unguided Media or Wireless Media**

- No Physical media is used
- Less Secure
- Relatively low speed
- Can be used for longer distance
- Best suited for difficult terrain
- There is no need to acquire land rights

### **Radio Wave**

- Frequency – 3KHz – 1GHz
- Omni-Directional

- Penetrate obstacle
- Antenna of sender and receiver should not be aligned

### Infrared

- 300GHz to 400THz
- Line of sight- antenna of sender and receiver must be aligned
- Short distance communication
- It cannot penetrate obstacle – best suited for indoor
- Secure
- Support high data rate
- TV Remote

### Microwave

- 1GHz to 300 GHz
- Line of sight- antenna of sender and receiver must be aligned
- Cannot penetrate obstacles
- Rain or other disturbance cause issue with Microwave
- Types of microwave propagation
  - ❖ Terrestrial Microwave propagation
  - ❖ Satellite Microwave propagation

### Bluetooth

- It also uses radio waves
- 2.4 GHz
- Range 10mtr
- Short distance

### Topology

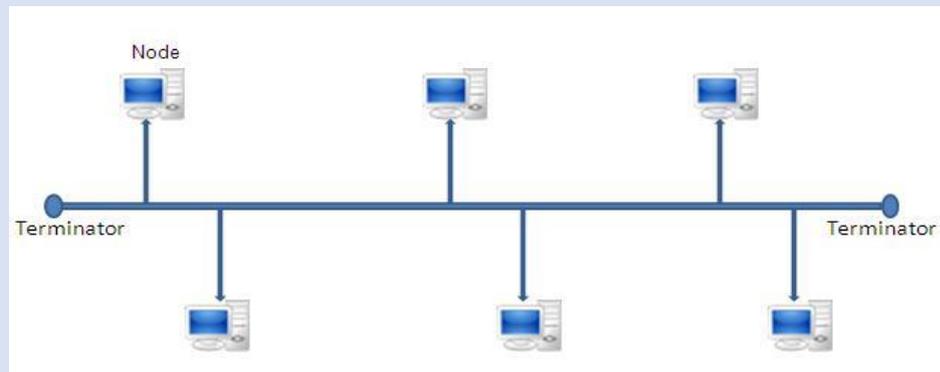
- Physical and Logical arrangement of nodes in the network is called Network Topology.
- The Key Elements to be considered to choose correct topology for your network
  - ❖ **Length of the Cable Needed** – longer the cable, more work is required for setup
  - ❖ **Cable Type**- Depending on requirement of bandwidth
  - ❖ **Cost**- Installation Cost and Complexity
  - ❖ **Scalability** – Ease of expansion
  - ❖ **Robustness** – Ability to recover from error

### Types of Topology

- Bus
- Ring
- Star
- Tree
- Mess
- Hybrid

### Bus Topology

- In Bus Topology all the nodes are connected to single cable or backbone
- Both the end have terminators.



### **Advantage – Bus Topology**

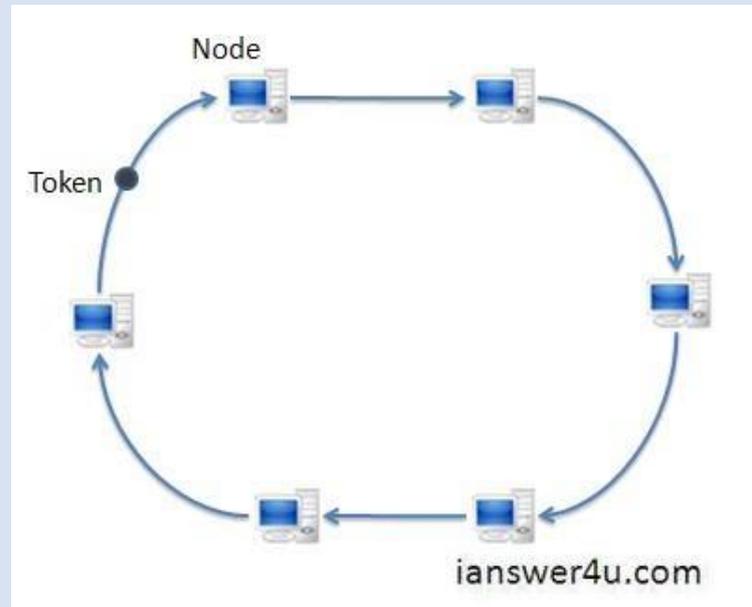
- It is easy to connect a device to the network.
- It require less cable length.
- Low setup cost
- There is no need of Hub/Switch.
- It can be extended easily.

### **Disadvantage – Bus Topology**

- Failure of one node can shutdown entire network
- There is a limit on central cable length and number of nodes that can be connected.
- Difficult to find and correct errors
- Terminator is required.
- Maintenance costs can get higher with time.
- Not suitable for Big network.
- Low Security due to broadcasting of data.

## Ring Topology

- In Ring Topology all the nodes are connected to each-other to form a loop.
- Each workstation is connected to two other components on either side
- It communicates with these two adjacent neighbors.
- Data is sent and received using Token.



### Advantage – Ring Topology

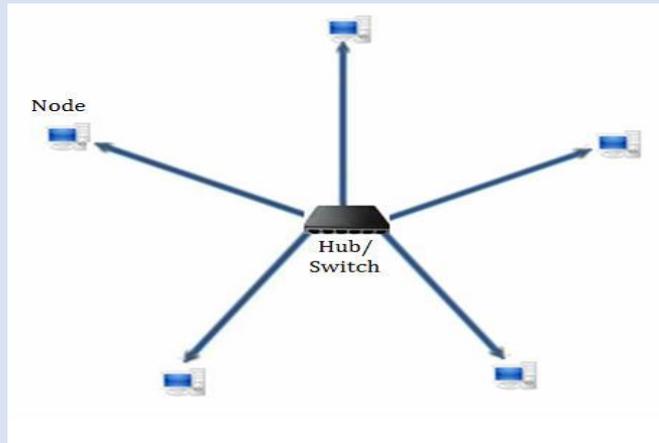
- It is easy to connect a device to the network.
- It require less cable length.
- Low setup cost
- There is no need of Hub/Switch
- Minimum collision
- Suitable for Optical Fibre Network

### Disadvantage – Ring Topology

- Failure of one node can shutdown entire network
- There is a limit on central cable length and number of nodes that can be connected.
- Difficult to find and correct errors.
- Maintenance costs can get higher with time.
- Not suitable for Big network.
- Low Security due to broadcasting of data.
- Unidirectional

### Star Topology

- In Star Topology all the nodes are connected to a central device called Hub/Switch.
- All communication is controlled by the central Device( Hub/Switch)



### Advantages –Star Topology

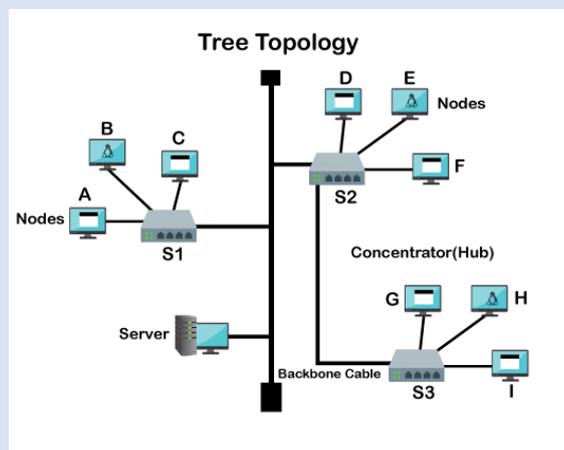
- Reliable
- Robust
- Failure of node does not affect the working of the network.
- Fault detection and isolation is easy.
- Maintenance of the network is easy.
- It doesn't create bottlenecks where data collisions occur.

### Disadvantages – Star Topology

- Require more cable length
- Central Device dependency
- More costly
- Performance depend on Hub/Switch

### Tree Topology

- In Tree Topology, the devices are arranged in a tree fashion similar to the branches of a tree.
- It multilayer architecture.



### **Advantages- Tree Topology**

- It is a combination of bus and star topology
- It provides high scalability, as leaf nodes can add more nodes in the hierarchical chain.
- Other nodes in a network are not affected, if one of their nodes get damaged
- It provides easy maintenance and fault identification.
- Point-to-point wiring for individual segments.

### **Disadvantages -Tree Topology**

- Large cabling is required as compared to star and bus topology.
- On the failure of a hub, the entire network fails.
- Tree network is very difficult to configure than other network topologies.

### **Protocol**

- It is set of rules or standard that governs communication.

### **Types of Protocol**

- **TCP/IP**
- **FTP**
- **HTTP/HTTPS**
- **IMAP**
- **POP3**
- **SMTP**
- **PPP**
- **TELNET**
- **VoIP**

### **TCP/IP – Transmission Control Protocol/ Internet Protocol**

- It is a protocol suite consist of two protocols **Transmission Control Protocol and Internet Protocol.**
- TCP ensures reliable transmission or delivery of packets on the network.
- TCP is state full protocol.
- IP is responsible for addressing of node on the network

### **HTTP (Hyper Text Transfer Protocol)**

- It is is an application-layer protocol for transmitting hypermedia documents, such as HTML.
- It is designed for communication between Client (Web Browser) and Web Server.
- It uses port number 80.
- It is stateless protocol.

### **HTTPS (Secure Hyper Text Transfer Protocol)**

- It is is an extension of HTTP protocol for transmitting hypermedia documents, such as HTML securely over a network.

- It encrypts data to be sent using TLS (Transport Layer Security)/SSL (Secure Sockets Layer).
- The default port is 443.

### **FTP (File Transmission Protocol)**

- It is used for the transfer of computer files among hosts over TCP/IP (internet).
- It allows access to directories or folders on remote computers.
- It uses client-server architecture.
- It is statefull protocol
- The default port is 21

### **Telnet (TERminal NETWORK)**

- It is an application **protocol** that allows a user to communicate with a remote device.
- It uses port no 23

### **SMTP (Simple Main Transfer Protocol)**

- It is used to send mail from mail client to mail server over internet.
- It can send a single message to one or more recipients.
- Sending message can include text, voice, video or graphics.
- It is connection Oriented Protocol.

### **POP3 (Post Office Protocol)**

- It provides mechanism for retrieving emails from a remote server for a mail recipient.
- POP3 downloads the email from a server to a single computer, then deletes the email from the server.
- Default port for POP3 110 and secure port 995

### **IMAP (Internet Message Access Protocol)**

- It is also used to retrieve mail from mail server to client over internet (TCP/IP).
- It allows access to mail from different device.
- E-mail client establishes a connection with the server every time you log in and maintained for the whole session.
- Email will not automatically gets deleted.
- Default Port is – 143 and Secure port is 993.

### **VoIP (Voice over IP)**

- It is also known as Internet Telephony or Internet calling.
- It allows to make voice calls using a broadband Internet connection instead of a regular (or analog) phone line.

### **Advantage of VoIP**

- Save a lot of money
- More than two people can communicate or speak
- Supports great audio transfer
- Provide conferencing facility

- More than voice (can transfer text, image, video along with voice).

### **Disadvantages of VoIP**

- Reliable Internet connection required
- No location tracking for emergency calls

### **Introduction to web services**

#### **WWW:**

- The World Wide Web, commonly known as the Web, is an information system where documents and other web resources are identified by Uniform Resource Locators, which may be interlinked by hyperlinks, and are accessible over the Internet.
- The Web is not the same as the Internet: the Web is one of many applications built on top of the Internet.
- Tim Berners-Lee proposed the architecture World Wide Web in 1989.

#### **Application of Internet Web 2.0 :**

- The term web 2.0 is used to refer to a new generation of websites that are supposed to let people to publish and share information online.
- It aims to encourage the sharing of information and views, creativity that can be consumed by the other users. E.g: Youtube

#### **The Main characteristics of web 2.0:**

- Makes web more interactive through online social media web- based forums, communities, social networking sites.
- It is a website design and development world which aim to encourage sharing of information and views, creativity and user interactivity between the users.
- Video sharing possible in the websites

#### **Web 3.0**

- It refers to the 3rd Generation of web where user will interact by using artificial intelligence and with 3-D portals.
- Web 3.0 supports semantic web which improves web technologies to create, connect and share content through the intelligent search and the analysis based on the meaning of the words, instead of on the keywords and numbers.

#### **Hyper Text Markup Language (HTML):**

- HTML stands for Hyper Text Markup Language
- HTML is the standard markup language for creating Web pages
- HTML describes the structure of a Web page
- HTML consists of a series of elements
- HTML elements tell the browser how to display the content
- HTML elements label pieces of content such as "this is a heading", "this is a paragraph", "this is a link", etc.

- Various Tags are
  - **<html>** represents the root of an HTML document
  - **<head>** element is a container for metadata (data about data) and is placed between the **<html>** tag and the **<body>** tag.
  - **<title>** tag defines the title of the document
  - **<body>** defines the document's body.
  - **</br>** Line Break Tags
  - **<h1> <h2> .....</h6>** - Heading Tags - tags are used to define HTML headings.
  - **<font>** - defines font face, font size, and color of text etc.

### Extensible Markup Language (XML)

- XML stands for eXtensible Markup Language.
- XML was designed to store and transport data.
- XML was designed to be both human- and machine-readable.
- XML is a markup language much like HTML
- XML was designed to be self-descriptive
- XML is a W3C Recommendation
- It simplifies data sharing
- It simplifies data transport
- It simplifies platform changes
- It simplifies data availability
- It is a little hard to understand, but XML does not DO anything.

### The Difference between XML and HTML

HTML	XML
It designed to display the data	It is designed to carry data
Its tags are predefined	Its tags user defined
It is not case sensitive	It is case sensitive
It is static	It is dynamic
It is Markup Language	It is framework to define Markup language
Closing tags are not necessary in HTML	Closing tags are necessary in XML

### Domain names

- A domain name is a website's address on the Internet.
- Domain names are used in URLs to identify to which server belong a specific webpage.
- The domain name consists of a hierarchical sequence of names (labels) separated by periods (dots) and ending with an extension.

### URL

- Uniform Resource Locator (URL) is a text string that specifies where a resource (such as a web page, image, or video) can be found on the Internet.
-

### **Website**

- Website is a group of web pages, containing text, images and all types of multi-media files.

### **Web browser-**

- A web browser, or simply "browser," is an application used to access and view websites. Common web browsers include Microsoft Internet Explorer, Google Chrome, Mozilla Firefox, and Apple Safari.

### **Web servers:**

- A web server is a computer that stores web server software and a website's component files (e.g. HTML documents, images, CSS style sheets, and JavaScript files).

### **Web hosting:**

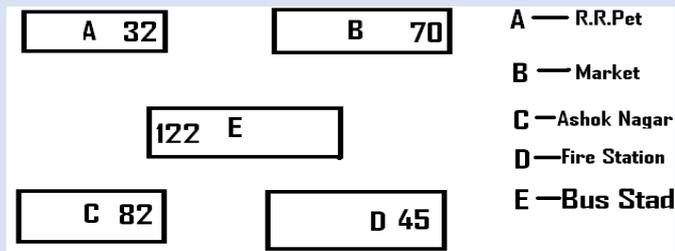
- Web hosting is an online service that enables you to publish your website or web application on the internet. When you sign up for a hosting service, you basically rent some space on a server on which you can store all the files and data necessary for your website to work properly.
- **Types of Web Hosting**
  - Shared Hosting - Web server shared among customers
  - Reseller Hosting – Become yourself as web host to sell others
  - Virtual Private Server – One server as multiple server for multiple websites
  - Dedicated Server- Entire web server is dedicated to same website

### **Exercise:**

1. Which protocol is used to exchange files on Internet
2. What is the purpose of using a MODEM?
3. What type of address is the following?  
20:B9:F1:63:2F:FB
4. Identify the topologies from the followings:
  - (i) In it the nodes form a circular path for data to travel and each node is connected to two other nodes.
  - (ii) In it devices are connected through hub/switch, hub/switch is responsible for receiving and transmitting data from each node to destination.
5. A School would like to go in for network of all the computers. Which topology would you recommend and why?
6. What is communication channel? What choices do you have while choosing a communication channel for a network?
7. What do you mean by network topology? Name most popular topologies.
8. Akhil is transferring songs from his mobile to his friend's mobile via Bluetooth connection. Name the network used by Akhil.
- 9.

### **Case Based**

10. In Hyderabad, 5 ABC Bank branches are available. One is at RR Pet, other at Market, other at Ashok Nagar, other at Fire Station and the last one at Bus Stand. Higher official want to keep a network between these 5 branches. The branch names(A to E) and the number of computers in each branch(given inside the rectangle) is given below.

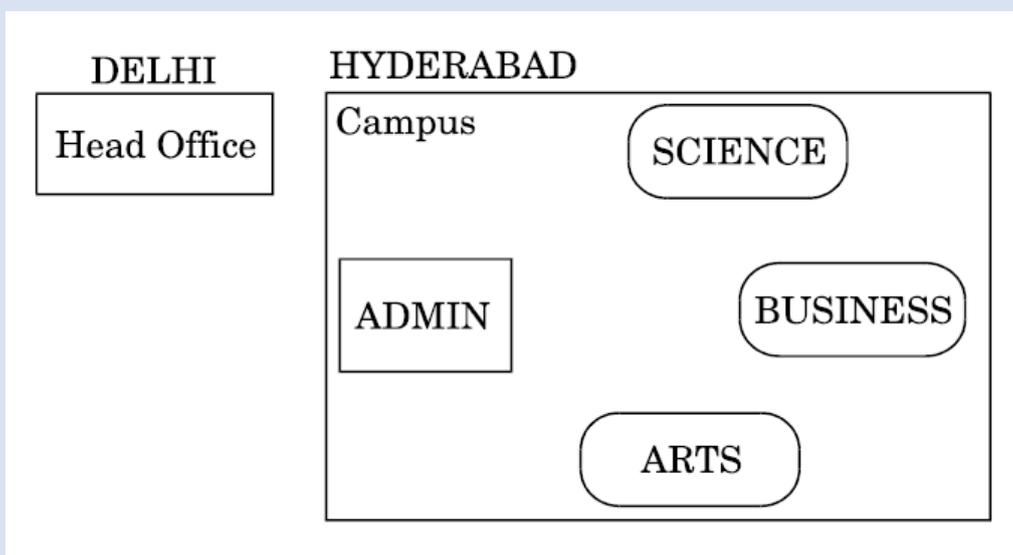


Distance between various buildings	
A to B	50 Mts
B to C	30 Mts
C to D	30 Mts
D to E	35 Mts
E to C	40 Mts
D to A	120 Mts
D to B	45 Mts
E to B	65 Mts

- (i) Suggest a possible cable layout for connecting the buildings.
- (ii) Suggest the most suitable place to install the server of this organization with a suitable reason
- (iii) Suggest the placement of the following devices with justification.
  - (a) Hub/Switch (b) Modem
- (iv) The Bank wants to link its head Office in 'A' building to its main office at Mumbai.
  - (a) Which type of transmission medium is appropriate for such a link?
  - (b) What type of network this connection result into?

11. Xcelencia Edu Services Ltd. is an educational organization. It is planning to set up its India campus at Hyderabad with its head office at Delhi. The Hyderabad campus has 4 main buildings - ADMIN, SCIENCE, BUSINESS and ARTS. You as a network expert have to suggest the best network related solutions for their problems raised in (i) to (iv), keeping in mind the distances between the buildings and other given parameters.

[CBSE 2015 Main]



Shortest distances between various buildings :

ADMIN to SCIENCE	65 m
ADMIN to BUSINESS	100 m
ADMIN to ARTS	60 m
SCIENCE to BUSINESS	75 m
SCIENCE to ARTS	60 m
BUSINESS to ARTS	50 m
DELHI Head Office to HYDERABAD Campus	1600 Km

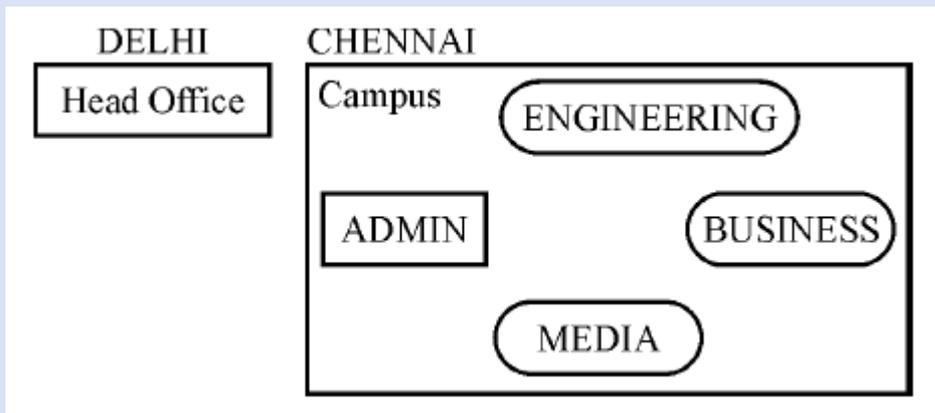
Number of computers installed at various buildings are as follows :

ADMIN	100
SCIENCE	85
BUSINESS	40
ARTS	12
DELHI Head Office	20

- (i) Suggest the most appropriate location of the server inside the HYDERABAD campus (out of the 4 buildings), to get the best connectivity for maximum number of computers. Justify your answer.
- (ii) Suggest and draw the cable layout to efficiently connect various buildings within the HYDERABAD campus for connecting the computers.
- (iii) Which hardware device will you suggest to be procured by the company to be installed to protect and control the internet uses within the campus?
- (iv) Which of the following will you suggest to establish the online face-to-face communication between the people in the Admin Office of HYDERABAD campus and DELHI Head Office?
  - a. Email
  - b. Text Chat
  - c. Video Conferencing
  - d. Cable TV

1. Perfect Edu Services Ltd. is an educational organization. It is planning to setup its India campus at Chennai with its head office at Delhi. The Chennai campus has 4 main buildings – ADMIN, ENGINEERING, BUSINESS and MEDIA. You as a network expert have to suggest the best network related solutions for their problems raised in (i) to (iv), keeping in mind the distances between the buildings and other given parameters.

[CBSE COMP 2015]



Shortest distances between various buildings:

ADMIN to ENGINEERING	55 m
ADMIN to BUSINESS	90 m
ADMIN to MEDIA	50 m
ENGINEERING to BUSINESS	55 m
ENGINEERING to MEDIA	50 m
BUSINESS to MEDIA	45 m
DELHI Head Office to CHENNAI Campus	2175 km

Number of Computers installed at various buildings are as follows :

ADMIN 110	110
ENGINEERING 75	75
BUSINESS 40	40
MEDIA 12	12
DELHI Head Office 20	20

- (i) Suggest the most appropriate location of the server inside the CHENNAI campus (out of the 4 buildings), to get the best connectivity for maximum no. of computers. Justify your answer.
- (ii) Suggest and draw the cable layout to efficiently connect various buildings within the CHENNAI campus for connecting the computers.
- (iii) Which hardware device will you suggest to be procured by the company to be installed to protect and control the internet uses within the campus ?
- (iv) Which of the following will you suggest to establish the online face-to-face communication between the people in the Admin Office of CHENNAI campus and DELHI Head Office ?
  - a. Email

- b. Text Chat
  - c. Video Conferencing
  - d. Cable TV
11. Expand the following:
    - a) ARPANET
    - b) MAC
    - c) ISP
    - d) URI
  12. What do you understand by the term network?
  13. Mention any two main advantages of using a network of computing devices.
  14. Differentiate between LAN and WAN.
  15. Write down the names of few commonly used networking devices.
  16. Two universities in different States want to transfer information. Which type of network they need to use for this?
  17. Define the term topology. What are the popular network topologies?
  18. How is tree topology different from bus topology?
  19. Identify the type of topology from the following:
    - a) Each node is connected with the help of a single cable.
    - b) Each node is connected with central switching through independent cables.
  20. What do you mean by a modem? Why is it used?
  21. Explain the following devices:
    - a) Switch
    - b) Repeater
    - c) Router
    - d) Gateway
    - e) NIC
  22. Draw a network layout of star topology and bus topology connecting five computers.
  23. What is the significance of MAC address?
  24. How is IP address different from MAC address? Discuss briefly.
  25. 15. What is DNS? What is a DNS server?
  26. Sahil, a class X student, has just started understanding the basics of Internet and web technologies. He is a bit confused in between the terms “World Wide Web” and “Internet”. Help him in understanding both the terms with the help of suitable examples of each.

## Database Management System

### **DATABASE:**

- May be defined as a collection of interrelated data stored together to serve multiple application
- It is computer based record keeping system.
- It not only allows to store but also allows us modification of data as per requirements

### **DBMS:**

- A DBMS refers to Database Management System
- It is a software that is responsible for storing, manipulating, maintaining and utilizing database.
- A database along with a DBMS is referred to as a database system.
- There are various DBMS software available in the market like :- Oracle, MS SQL Server, MySQL, Sybase, PostgreSQL, SQLite

### **Purpose of DBMS:**

- Reduced Data redundancy –
- Control Data Inconsistency
- Sharing of data
- Ensure data integrity
- Enforce standard

### **Relational Database Model:**

- In relational database model data is organized into table (i.e. rows and columns).
- These tables are also known as relations.
- A row in a table represent relationship among a set of values.
- A column represent the field/attributes related to relation under which information will be stored.
- For example if we want to store details of students then : Roll, Name, Class, Section, etc. will be the column/attributes and the collection of all the column information will become a Row/Record

### **Sample Tables:**

EMPLOYEE:

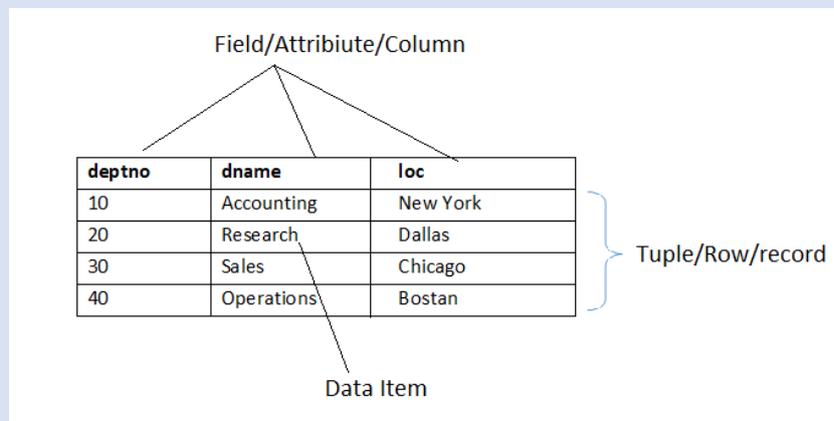
EMPNO	ENAME	GENDER	DEPTNO	SALARY	COMM
1	ANKITA	F	10	20000	1200
2	SUJEET	M	20	24000	
3	VIJAYA	F	10	28000	2000
4	NITIN	M	30	18000	3000
5	VIKRAM	M	30	22000	1700

Dept:

Deptno	dname	Loc
10	Accounting	New York
20	Research	Dallas
30	Sales	Chicago
40	Operations	Boston

### Component of a table:

- Byte: group of 8 bits and is used to store a character.
- Data Item: smallest unit of named data. It represent one type of information and often referred to as a field or column information
- Record : collection of data items which represent a complete unit of information
- Table: collection of all Rows and Columns.



### Common RDBMS:

- Oracle, MS SQL Server, MySQL, IBM DB2, IBM Informix, SAP Sybase, Adaptive Server Enterprise, SAP Sybase IQ, Teradata, PostgreSQL, SQLite, etc.
- Out of these MySQL, PostgreSQL and SQLite are Open source implementation.

### MySQL

- Runs on virtually all platforms including Linux, Unix and Windows. Popular for web based application and online publishing. It is a part of LAMP (Linux, Apache, MySQL, PHP) stack

### SQLite

- Relational DBMS but it is not client-server database engine rather, it is embedded into end program. Arguably the most widely deployed database engine as it is used by several browsers, OS and embedded systems (Mobiles).

### PostgreSQL

- General purpose object-relational DBMS.
- It is the most advanced open source database system. It is free and open source i.e. source code is available under PostgreSQL license, a liberal open source license.

### Common DBMS Tools for Mobile Devices:

- SQL Anywhere, DB2 Everywhere, IBM Mobile Database, SQL Server Compact, SQL Server Express, Oracle DatabaseLite, SQLite, SQLBase etc.
- Out of these SQLite is public domain open source implementation.

### Relational Data Model:-

Data is organized in two-dimensional tables called **relations**. The tables or relations are related to each other.

### Characteristics of relational database are:-

- Data is arranged into rows and columns,
- Each relation is represented as a table.
- Every row in a table represents a single entity.
- At any given row or column position, there is one and only one value.

### Advantages of a relational model are as follows:

- Changes made in the table structure do not affect the data access or other application programs.
- Tabular view also provides easier database design, use, implementation and management.
- Built-in query support .
- Mathematical operations can be successfully carried out using RDBMS.

### The **limitations** of relational model are:

- RDBMS incurs hardware and system software overheads.
- The size of database becomes very large.

**Various Terms Used in Relational Model:** - A **relational database** is a type of database that stores and provides access to data points that are related to one another.

### Basic Terminologies related to a Relational Database:-

- **Entity:** An entity is something that exists and an object which can be distinctly identified. *For example*, student entity, employee entity,
- **Attribute:** The term attribute is also used to represent a column.
- **Tuple:** Each row in a table is known as tuple.
- **Cardinality of Relation:** It is the number of records or tuples in the relation.
- **Degree of Relation:** Number of columns or attributes is known as degree of a relation.
- **Domain of Relation:** It defines the kind of data represented by the attribute.
- **Body of the Relation:** It consists of an unordered set of 0 or more tuples.

### Concept of Keys

- In relation each record must be unique i.e. no two identical records are allowed in the Database.
- A key attribute identifies the record and must have unique values. There are various types of Keys:

### Primary key:

- A set of one or more attribute that can identify a record uniquely in the relation is called Primary Key.
- There can be only 1 primary key in a table
- Allows only distinct (no duplicate) values and also forces mandatory entry (NOT NULL) i.e. we cannot left it blank.

### Candidate Key

- In a table there can be more than one attribute which contains unique values. These columns are known as candidate key as they are the candidate for primary key.
- Among these database analyst select one as a primary key based on requirement like must contain unique value, compulsory entry and where maximum searching is done etc.

### Alternate Key

- In case of multiple candidate keys, one of them will be selected as Primary Key and rest of the column will serve as Alternate Key
- A Candidate Key which is not a primary key is an Alternate Key.

### Foreign key

- Used to create relationship between two tables.
- It is a non-key attribute whose value is derived from the Primary key of another table.
- Foreign key column will for the value in Primary key of another table, if present then entry will be allowed otherwise data will be rejected.
- Primary Key column table from where values will be derived is known as Primary Table or Master Table or Parent Table and Foreign key column table will be Foreign Table or Detail Table or Child table.

### Example:

EMPLOYEE					
EMPNO	ENAME	GENDER	DEPTNO	SALARY	COMM
1	ANKITA	F	10	20000	1200
2	SUJEET	M	20	24000	
3	VIJAYA	F	10	28000	2000
4	NITIN	M	30	18000	3000
5	VIKRAM	M	30	22000	1700

DEPARTMENT		
DEPTNO	DNAME	LOCATION
10	HR	NEW YORK
20	ACCOUNTS	BRAZIL
30	SALES	CANADA
40	IT	INDIA

Child Table

Parent Table

From the Above table definition we can observe that the DEPTNO column of EMPLOYEE table is deriving its value from DEPTNO of table DEPARTMENT. So we can say that the DEPTNO of

EMPLOYEE table is a foreign key whose value is dependent upon the Primary key column DEPTNO of table DEPARTMENT.

**REFERENTIAL INTEGRITY:**

- Used to ensure relationship between records in related tables are valid and user don't accidentally delete or change the related data.
- Referential integrity can be applied when:
- The master table's column is a Primary Key or has a unique index
- The related fields have the same data type
- Both tables must belong to same database.
- When referential integrity is enforced using Foreign Key you must observe the following rules:
- You cannot enter a value in Child Table which is not available in Master Table's Primary key column. However you can enter NULL values in foreign key
- You cannot delete a record from Master Table if matching record exists in related table.
- You cannot modify or change the Primary Key value in Master table if its matching record is present in related table.

## Structured Query Language

- It is a language that enables you to create and operate on relational databases
- It is the standard language used by almost all the database s/w vendors.
- Pronounced as SEQUEL
- It is portable i.e. it is compatible with most of the database.
- It is not a case sensitive language.
- It is very easy to learn.

### SQL – features

- Allows creating/modifying a database's structure
- Changing security settings for system
- Permitting users for working on databases or tables
- Querying database
- Inserting/modifying/deleting the database contents

### Classification of SQL

- DDL (Data Definition Language)
- DML (Data Manipulation Language)
- DCL (Data Control Language)
- TCL (Transaction Control Language)

### Data Definition Language:

- It allows to create database objects like creating a table, view or any other database objects.
- The information about created objects are stored in special file called DATA DICTIONARY
- DATA DICTIONARY contains metadata i.e. data about data.
- The commands of DDL are –
  - CREATE – To create a new database object
  - ALTER – To modify existing database object
  - DROP – To permanently remove existing database object.

### Data Manipulation Language:

- It allows to perform following operation on data in the table
- Retrieval of information stored in table
- Insertion of new data in table
- Modification of existing data in table
- Deletion of existing data from table
- DML is of 2 type
- Procedural DML (in this we specify what data is needed and how to get it)
- Non-Procedural DML (in this we specify what data is needed without specifying how to get it)
- The commands of DML are
  - SELECT – To retrieve data from the table
  - INSERT – To insert new tuple/row in the table

- UPDATE – To update existing tuple/row from the table
- DELETE – To delete existing tuple/row from the table

**Exercise:**

1. What is Database? What are the advantages of Database System?
2. What is DDL and DML? Give examples of command belonging to each category
3. What is the difference between Primary key and Candidate key
4. What is Primary Key? What are the restriction imposed by Primary Key? How many primary key can be applied on a Table?
5. What is Degree and Cardinality of table?
6. Explain the purpose of DDL and DML commands used in SQL. Also give two examples of each

## Introduction of MYSQL

### Brief history of MySQL:

- MySQL is freely available open source RDBMS
- It can be downloaded from [www.mysql.org](http://www.mysql.org)
- In MySQL information is stored in Tables.
- Provides features that support secure environment for storing, maintaining and accessing data.
- It is fast, reliable, scalable alternative to many of the commercial RDBMS today.
- It is developed and supported by MySQL AB, a company based in Sweden.
- This company is now subsidiary of Sun Microsystems. On April 2009 Oracle Corp. acquires Sun Microsystems.
- The chief inventor of MySQL was **Michael Widenius(a.k.a Monty)**. MySQL has been named after Monty's daughter My. The logo of MySQL is dolphin and name of that dolphin is 'Sakila'.

### MYSQL DATABASE SYSTEM:

- MySQL database system refers to the combination of a MySQL server instance and MySQL database.
- It operates using Client/Server architecture in which the server runs on the machine containing the database and client connects to server over a network
- MySQL is a multiuser database system, meaning several users can access the database simultaneously.

### The Server

- Listens for client requests coming in over the network and access the database as per the requirements and provide the requested information to the Client.

### The Client

- Are the programs that connect to MySQL server and sends requests to the server and receives the response of Server. Client may be the MySQL prompt or it may be Front-end programming which connect to server programmatically like connecting to MySQL using Python Language or Java or any other language.

### FEATURES OF MYSQL:

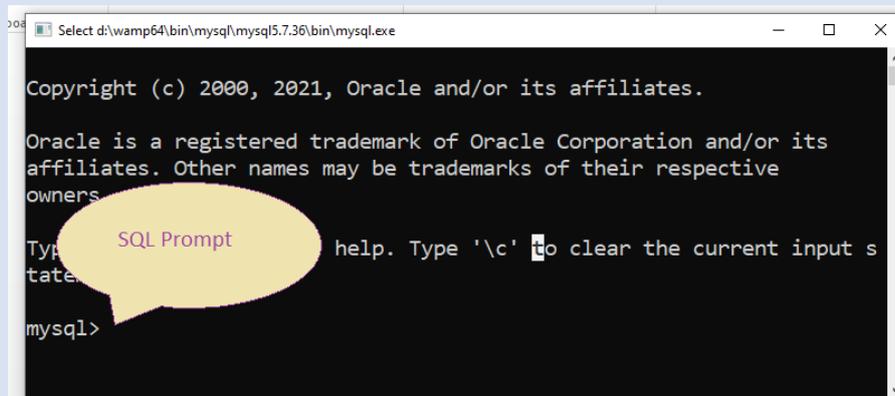
- Speed - MySQL runs very fast.
- Ease of Use -Can be managed from command line or GUI
- Cost Is available free of cost. It is Open Source
- Query language Support -Supports SQL
- Portability – Can be run on any platform and supported by various compilers
- Data Types - supports various data types like Numbers, Char etc.
- Security -Offers privileges and password systems that is very flexible and secure.

- Scalability and Limits -Can handle large databases. Some of real life MySQL databases contains millions of records.
- Connectivity-Clients can connect to MySQL using drivers
- Localization -The server can provide error message to client in many language
- Client and Tools -Provides several client and utility programs. Like mysqldump and mysqladmin. GUI tools like MySQL Administration and Query Browser.

### STARTING MYSQL:



Click on Start → All Programs → MySQL → MySQL Server → MySQL → Command Line Client



To exit from MySQL type **exit** or **quit** in front of MySQL prompt.

### SQL and MYSQL:

- SQL stands for Structured Query Language.
- It is a language that enables you to create and operate on relational databases.
- MySQL uses SQL in order to access databases.
- It is the standard language used by almost all the database s/w vendors.

### MYSQL Elements

- Literals
- Data types
- Nulls
- Comments

## Literals

- It means the fixed value or constant value. It may be of character, numeric or date time type.
- Character and date/time literals are always in single quotation marks whereas numeric literals must be without single quotation marks
- For example – ‘Virat’, 12, 12.56, ‘04-20-2018’
- Date and time values are always in the format YYYY-MM-DD HH:MI:SS
- Special character like quotes are always written by preceding it back-slash(\). For example if we want to store value as Tom’s Cat then it should be written as Tom\'s Cat

## Data Type

- Means the type of value and type of operation we can perform on data. For example on numeric value we can store numbers and perform all arithmetic operations and so on.
- MySQL support three categories of data types:
  - Numeric
  - Date and time
  - String types
- Numeric Data Types

Data type	Description
INT	Numbers without decimal. Store up to 11 digits. -2147483648 to 2147483647
TINYINT	Small integer value between 0 – 255 (4 digits)
SMALLINT	More than TINYINT between -32768 to 32767 (5 digit)
MEDIUMINT	Integer values up to 9 digits
BIGINT	Very large integer value up to 11 digits
FLOAT(M,D)	Real numbers i.e. number with decimal. M specify length of numeric value including decimal place D and decimal symbol. For example if it is given as FLOAT(8,2) then 5 integer value 1 decimal symbol and 2 digit after decimal TOTAL – 8. it can work on 24 digits after decimal.
DOUBLE(M, D)	Real numbers with more precision up to 53 place after decimal.
DECIMAL	It is used to store exact numeric value that preserve exact precision for e.g. money data in accounting system. <b>DECIMAL(P,D) means P no. of significant digits (1-65), D represent no. of digit after decimal(0-30), for e.g DECIMAL(6,2) means 4 digit before decimal and 2 digit after decimal. Max will be 9999.99</b>

## Date and Time Types

- **DATE**-A date in YYYY-MM-DD format between 1000-01-01 to 9999-12-31.
- **DATETIME**-Combination of date and time. For example to store 4th December 2018 and time is afternoon 3:30 then it should be written as – 2018-12-04 15:30:00
- **TIMESTAMP** - Similar to DATETIME but it is written without hyphen for example the above date time is stored as 20181204153000
- **TIME**-To store time in the format HH:MM:SS
- **YEAR(M)** -To store only year part of data where M may be 2 or 4 i.e. year in 2 digit like 18 or 4 digit like 2018.

## String Types

- **CHAR(M)**
  - Fixed length string between 1 and 255.
  - It always occupy M size, irrespective of actual number of characters entered.
  - Mostly use in the case where the data to be insert is of fixed size like Grade (A,B,C,..) or Employee code as E001, E002, etc
- **VARCHAR(M)**
  - Variable length string between 1 and 65535 (from MySQL 5.0.3) , earlier it was 255
  - It takes size as per the data entered for example with VARCHAR(20) if the data entered is MOBILE then it will take only 6 byte.
  - It is useful for the data like name, address where the number of character to be enter is not fixed.
- Difference between CHAR & VARCHAR

Char	varchar
Fixed length string	Variable length string
Fast, no memory allocation every time	Slow, as it take size according to data so every time memory allocation is done
It takes more memory	It takes less space

## Simple Queries in SQL

- **Show Databases**- This command is used to list all databases on MySQL Server
- **Use <dbname>**- This command is used to change/select/open given database e.g. To open a database named 'test'  
>>> **use test**
- **Show tables** – This command will list all the tables from current database. If no database is selected it will generate error.
- **Select database ()** – This command will display the name of current database.
- **Desc <tablename> or Describe <tablename>** - This command will be used to display the structure of the table.

```
mysql> desc emp;
+-----+-----+-----+-----+-----+-----+
| Field | Type          | Null | Key | Default | Extra |
+-----+-----+-----+-----+-----+-----+
| empno | decimal(4,0)  | NO   |     | NULL    |       |
| ename | varchar(10)   | YES  |     | NULL    |       |
| job   | varchar(9)    | YES  |     | NULL    |       |
| mgr   | decimal(4,0)  | YES  |     | NULL    |       |
| hiredate | date         | YES  |     | NULL    |       |
| sal   | decimal(7,2)  | YES  |     | NULL    |       |
| comm  | decimal(7,2)  | YES  |     | NULL    |       |
| deptno | decimal(2,0)  | YES  |     | NULL    |       |
+-----+-----+-----+-----+-----+-----+
8 rows in set (0.00 sec)
```

The above figure display the use of **describe** command

- **Create database <dbname>** - This command is use to create a new database. For example – **create database mydb** will new database **mydb** Above command will generate error, if database already exist. To supress the error following command can be used

**create database if not exist mydb**

- **Drop database <dbname>** - This command is used to remove existing database. For example – **drop database mydb** will permanently delete **mydb** database. Above command will generate error, if database already exist. To supress the error following command can be used

**drop database if exist mydb**

- **Create table <tablename>** - This command / statement is used to create a new table in a database. The syntax the is

```
CREATE TABLE table_name (  
    column1 datatype[(size)] [constraint] ,  
    column2 datatype[(Size)] [constraint],  
    column3 datatypeI[(size)] [constraints] ,  
    ....  
);
```

Here size and constraints are optional.

e. g.

```
CREATE TABLE pet (  
    name VARCHAR(20),  
    owner VARCHAR(20),  
    species VARCHAR(20),  
    sex CHAR(1),  
    birth DATE, death DATE);
```

- **Drop table <tablename>** - This command is used to permanently delete the table from database.  
For example, **drop table pet;** will delete **pet** table from database
- **Alter table <tablename>** - This command is used to modify the structure of existing table such as adding new column, removing existing column, rename or changing data type, size and constraints.

- **Adding new column to exiting table**

**Syntax :**

```
Alter table <tablename>  
Add [column] column_name datatype [(size)];
```

- **Removing new existing column from the table**

**Syntax:**

```
Alter table <tablename>  
drop column <column_name>;
```

- **Changing datatype/size of the column**

**Syntax:**

```
alter table <tablename>  
modify column <colname> datatype(size);
```

- **Renaming column name**

Alter table tablename

Change old\_columnname new\_column\_name datatype (size)

- **Update <tablename>** - This command is used to update data from the table  
**Syntax:**

```
UPDATE table_name SET column_name=new_value, column2_name=new_value  
WHERE condition;
```

e.g. UPDATE emp set sal=sal+100 where ename ='Scot'

The above query will update salary of Scot by 100.

If where clause is not given, it will update/modify the value of column from each row.

- Inserting into table\_name – This command is used to add new row to the table

Syntax :

```
INSERT INTO table_name VALUES (list of values)
```

- **Select data from Table using Select statement**

Syntax:

Select clause	select */column_list
from clause	from table(s)
where clause	where condition
group by clause	group by column_name
having clause	having condition
order by clause	order by column_name asc/desc
limit clause;	limit m,n;

- **Selecting/displaying entire data from the table**

Syntax:

```
SELECT * From tablename;
```

- **Selecting/displaying data from specific column**

Syntax:

```
SELECT column1, column2, column3, .... FROM tablename;
```

- **Giving describing name for column using column alias**

Syntax:

```
SELECT */col_name as 'alias1' FROM tablename;
```

- **Removing duplicate value from the column using distinct clause**

Syntax:

```
SELECT DISTINCT column_name FROM tablename;
```

- Display all data from column using all clause

Syntax:

```
SELECT ALL column_name FROM tablename;
```

- Inserting text in the query

Syntax:

```
SELECT 'text' FROM tablename;
```

```
mysql> select ename, ' is working as' job from emp;
+-----+-----+
| ename | job          |
+-----+-----+
| SMITH | is working as |
| ALLEN | is working as |
| WARD  | is working as |
| JONES | is working as |
| MARTIN | is working as |
+-----+-----+
```

Number of row in result depend on total number of rows in the table

- Performing simple calculation in the query

Syntax:

Select 2+4;

All operation can be perform such as addition (+), subtraction (-), multiplication (\*), division (/) and remainder (%)

```
mysql> select 3+5;
+-----+
| 3+5 |
+-----+
| 8 |
+-----+
1 row in set (0.00 sec)
```

Number of row in result depend on total number of rows in the table

- Performing calculation on column

Syntax:

SELECT column1 operator value, column2.... FROM Tablename

```
mysql> select ename, sal, sal*12 'Annual Salary' from emp;
+-----+-----+-----+
| ename | sal      | Annual Salary |
+-----+-----+-----+
| SMITH | 800.00  | 9600.00      |
| ALLEN | 1600.00 | 19200.00     |
| WARD  | 1250.00 | 15000.00     |
| JONES | 2975.00 | 35700.00     |
| MARTIN | 1250.00 | 15000.00     |
| BLAKE | 2850.00 | 34200.00     |
+-----+-----+-----+
```

- Working with null value

Any operation on NULL will result into NULL, MySql provide ifnull() function to work with null value. If column contain null value it is replace value given value, otherwise display original value.

Syntax:

ifnull(column, value\_to\_replace')

```
mysql> select ename, sal, comm, ifnull(comm,'N/A') from emp;
+-----+-----+-----+-----+
| ename | sal   | comm  | ifnull(comm,'N/A') |
+-----+-----+-----+-----+
| SMITH | 800.00 | NULL  | N/A                 |
| ALLEN | 1600.00 | 300.00 | 300.00             |
| WARD  | 1250.00 | 500.00 | 500.00             |
| JONES | 2975.00 | NULL  | N/A                 |
| MARTIN | 1250.00 | 1400.00 | 1400.00            |
| BLAKE | 2850.00 | NULL  | N/A                 |
| CLARK | 2450.00 | NULL  | N/A                 |
| SCOTT | 3000.00 | NULL  | N/A                 |
| KING  | 5000.00 | NULL  | N/A                 |
| TURNER | 1500.00 | 0.00 | 0.00                |
| ADAMS | 1100.00 | NULL  | N/A                 |
| JAMES | 950.00 | NULL  | N/A                 |
| FORD  | 3000.00 | NULL  | N/A                 |
| MILLER | 1300.00 | NULL  | N/A                 |
+-----+-----+-----+-----+
14 rows in set (0.00 sec)
```

Here, comm column contains null value which is replaced by 'N/A'.

➤ **Restricting rows using where clause**

Where clause in the query will restrict number of rows in the output based on condition.

Syntax:

SELECT \*/column list

FROM Tablename

where condition ;

**Condition (column\_name operator expression)**

**Relational Operator**

- > greater than
- < less than
- >= greater than equal to
- <= less than equal to
- = equal
- != or <> not equal to

**Logical Operator**

And – evaluated true if all the logical expression is true otherwise false.

Or - evaluated true if any the logical expression is true otherwise false.

Logical operator is used to combine two or more logical expression,

**Membership Operator**

in –

Not in

The IN operator allows you to specify multiple values in a WHERE clause.

The IN operator is a shorthand for multiple OR conditions.

**Comparing NULL**

is null –  
is not null

NULL (Absence of value) value cannot be compared using Relational operator. The above statement is used to check whether column contains NULL or not.

### **Range Operator**

Between

### **Pattern Matching**

Like

Not Like

Like clause is used to match pattern using two wild card characters

\_ (underscore) – single unknown character

% (modulo) - Zero or more unknown characters

e.g.

words starting with 't'	't%'
words ending with 't'	'%t'
words containing 't' -	'%t%'
word with 't' as second letter -	'_t%'
words with 't' as third last character –	'%t__'
words containing four letter and 't' as second letter –	'__t__'

### ➤ Ordering data using ORDER BY clause

- ORDER BY clause is used to arrange data in ascending/descending order
- Ordering can be done on more than one column, in this case data is arranged according first column and then second column and onwards.
- By default data is arranged in ascending order, in no ordering information (asc/desc) is given.

### **Syntax:**

```
SELECT */col_list  
FROM tablename  
ORDER BY col1 asc/desc, col2 asc/desc;
```

## Aggregate Functions

- An aggregate function performs a calculation on multiple values and returns a single value.
- These function work on multiple rows collectively return single value.
- List of Aggregate functions are
  - max() : return maximum value in set of value

```
mysql> select max(sal) from emp;
+-----+
| max(sal) |
+-----+
| 5000.00 |
+-----+
1 row in set (0.01 sec)
```

- min() – return minimum value from the set of values

```
mysql> select min(sal) from emp;
+-----+
| min(sal) |
+-----+
| 800.00 |
+-----+
1 row in set (0.00 sec)
```

- avg() –return average value in set of non-null values

```
mysql> select min(sal) from emp;
+-----+
| min(sal) |
+-----+
| 800.00 |
+-----+
1 row in set (0.00 sec)
```

- sum() - Return the summation of all non-NULL values of the set of values.

```
mysql> select sum(sal) from emp;
+-----+
| sum(sal) |
+-----+
| 29025.00 |
+-----+
1 row in set (0.01 sec)
```

- count() - Return the number of rows in a group
  - Count(\*) – return number of rows, including rows with NULL

```
mysql> select count(*) from emp;
+-----+
| count(*) |
+-----+
|         14 |
+-----+
1 row in set (0.00 sec)
```

- Count(column\_name) - return number of rows, excluding rows with NULL for the given column

```
mysql> select count(comm) from emp;
+-----+
| count(comm) |
+-----+
|             4 |
+-----+
1 row in set (0.00 sec)
```

- Count (distinct column\_name) – return number of rows with duplicate removed

```
mysql> select count(distinct job) from emp;
+-----+
| count(distinct job) |
+-----+
|             5 |
+-----+
1 row in set (0.01 sec)
```

In above example there are 14 row in the EMP table, but distinct clause only consider unique value.

#### ➤ Group By Clause

- It is used in a SELECT statement to collect data across multiple records and group the results by one or more columns.

Syntax:

```
SELECT column_name, aggregate_function
FROM table_name
GROUP BY column_name
```

```
mysql> select job, max(Sal) from emp group by job;
```

job	max(Sal)
ANALYST	3000.00
CLERK	1300.00
MANAGER	2975.00
PRESIDENT	5000.00
SALESMAN	1600.00

In above example salary is grouped on job and maximum salary from each job is displayed.

- Select clause involving group by clause can contain column present in group by clause, aggregate function or no column. Otherwise it will return random data from other column as given below.

```
mysql> select ename, job, max(sal) from emp group by job;
```

ename	job	max(sal)
SCOTT	ANALYST	3000.00
SMITH	CLERK	1300.00
JONES	MANAGER	2975.00
KING	PRESIDENT	5000.00
ALLEN	SALESMAN	1600.00

#### ➤ Having clause –

- Having clause is used to place condition on aggregate function in conjunction with group by clause.
- Having clause is placed after where clause in select statement.

#### **Syntax:**

SELECT column\_name, aggregate\_function(column\_name)

FROM table

WHERE condition

GROUP BY column\_name

HAVING aggregate\_function(column\_name) operator expression;

```
mysql> select deptno, max(sal), count(*) from emp group by deptno;
```

deptno	max(sal)	count(*)
10	5000.00	3
20	3000.00	5
30	2850.00	6

3 rows in set (0.00 sec)

The above query will display deptno, maximum salary and number of employees from each department.

The query given below display deptno, maximum salary and number of employees from those department which have maximum salary greater than equal to 3000.

```
mysql> select deptno, max(sal), count(*) from emp
-> group by deptno having max(sal)>=3000;
```

deptno	max(sal)	count(*)
10	5000.00	3
20	3000.00	5

As condition is on aggregate function max(), where clause can't be used in this case.

### Exercise Questions:

1. What is MySQL used for? Abhay wants to start learning MySQL. From where can he obtain the MySQL software ?
2. In the table "Student", Priya wanted to increase the Marks(Column Name:Marks) of those students by 5 who have got Marks below 33. She has entered the following statement:
3. `SELECT Marks+5 FROM Student WHERE Marks<33;`  
Identify errors(if any) in the above statement. Rewrite the correct SQL statement.
4. Write SQL statement to add a column "COUNTRY" with data type and size as VARCHAR(70) to the existing table named "PLAYER". Is it a DDL or DML or TCL command ?
5. Table Student has the columns RNO and SCORE. It has 3 rows in it. Following two SQL statements were entered that produced the output (AVG(SCORE) as 45 and COUNT(SCORE) as 2) :  
(i) AVG(SCORE)  
(ii) Count(score)
6. 'Employee' table has a column named 'CITY' that stores city in which each employee resides. Write SQL query to display details of all rows except those rows that have CITY as 'DELHI' or 'MUMBAI' or 'CHANDIGARH'.
7. How is a database related to a table ?
8. Mr. Sen has to create a table named 'Employee' with Columns to store EmpID, Name, Designation, Age and Salary. EmpID is the Primary key and Name cannot be NULL. Some of the rows that will be inserted are shown below.

101	Smita Kumar	Secretary	28	39500.00
102	Mani Scott	Programmer	32	45300.00
103	Firdaus Ali	Programmer II	45	67500.00

- Write SQL query to create the above table with appropriate data types and sizes of columns.
9. Ms. Rajshri is the Class Teacher of Class XII. She wants to create a table named 'Student' to store marks in different subjects of her class. Identify any 4 columns for the table along with their suitable data types.
  10. "XYZ" Company conducts workshops for employees of organizations. The company requires data of workshops that are organized. Write SQL query to create a table 'Workshop' with the following structure:

Field	Type	Constraint
WorkshopId	integer	Primary Key
Title	Varchar(50)	
DateWorkshop	Date	
NumSpeakers	Integer	

11. Ariya wants to add another column 'Gender' in the already existing table 'CUSTOMERS'. She has written the following statement. However, it errors. Rewrite the correct statement.

**MODIFY TABLE CUSTOMERS GENDER char(1);**

12. Explain the following statement with the help of example:

13. "In a transaction either all the SQL statements be committed or all rolled back."

14. How is HAVING clause similar to WHERE clause? How is HAVING clause different from WHERE clause? Explain with the help of examples of each.

15. Consider the following table 'Transporter' that stores the order details about items to be transported. Write SQL commands for the statements (i) to (viii).

**Table : TRANSPORTER**

ORDERNO	DRIVERNAME	DRIVERGRADE	ITEM	TRAVELDATE	DESTINATION
10012	RAM YADAV	A	TELEVISION	2019-04-19	MUMBAI
10014	SOMNATH		FURNITURE	2019-01-12	PUNE
10016	MOHAN VERMA	B	WASHING MACHINE	2019-06-06	LUCKNOW
10018	RISHI SINGH	A	REFRIGERATOR	2019-04-07	MUMBAI
10019	RADHE MOHAN		TELEVISION	2019-05-30	UDAIPUR
10020	BISHEN PRATAP	B	REFRIGERATOR	2019-05-02	MUMBAI
10021	RAM		TELEVISION	2019-05-03	PUNE

- (i) To display names of drivers and destination city where TELEVISION is being transported.
- (ii) To display driver names and destinations where destination is not MUMBAI.
- (iii) To display the names of destination cities where items are being transported. There should be no duplicate values.
- (iv) To display details of rows that have some value in DRIVERGRADE column.
- (v) To display names of drivers, names of items and travel dates for those items that are being transported on or before 1st April 2019.
- (vi) To display the number of drivers who have 'MOHAN' anywhere in their names.
- (vii) To display the names of drivers, item names and travel dates in alphabetic (ascending) order of driver names.
- (viii) To display names of drivers whose names are three characters long.

17. In CHAR(10) and VARCHAR(10), what does the number 10 indicate ?

18. 'Employee' table has a column named 'CITY' that stores city in which each employee resides. Write SQL query to display details of all rows except those rows that have CITY as 'DELHI' or 'MUMBAI' or 'CHANDIGARH'.

19. Consider the table given below. Write SQL queries for (i) to (vii).

**Table : Gym**

REGID	NAME	PREWEIGHT	CURRWEIGHT	DOJ	GENDER	BRANCH
1001	SHEELA SIA	115	98	2017-09-02	F	ADARSH VIHAR
1002	FAWAD KHAN	92	80	2018-10-11	M	MODEL TOWN
1003	PAWAN SINGH	85	80	2018-02-03	M	NIRMAN NAGAR
1004	SUPRIYA ARORA	113	100	2018-01-16	F	MODEL TOWN
1005	AJOY BASU	67	75	2017-12-09	M	NIRMAN NAGAR
1006	TANMAY JACOB	100	71	2017-11-18	M	ADARSH VIHAR
1007	LAKSHMI VENKAT	98	95	2018-06-09	F	MODEL TOWN

Columns REGID stores Registration Id, PREWEIGHT stores weight of the person before joining Gym, CURRWEIGHT stores current weight, DOJ stores Date of Joining, BRANCH stores the branch of Gym where the person has enrolled.

- (i) To display names of members along with their previous and current weights who are in Model Town branch.
- (ii) To display all names of members, previous weight, current weight, Change in weight (i.e. how much increase from previous weight or decrease from previous weight, Decrease will be displayed with negative sign)
- (iii) To display BRANCH wise count of members in the Gym. (i.e. display the BRANCH and number of members in each BRANCH)
- (iv) To display names and date of joining of all the members who joined in the year 2018.
- (v) To display Names and Current weight of all the members in descending order of Current Weight.
- (vi) To display the names and date of joining of male members who have joined after 27th September 2018.
- (vii) To display names and date of joining of members who have their names starting with 'S' and ending with 'a'.

20. Consider the table Flight given below, write command in SQL for (i) to (iv) and output for (v) to (viii)

**Table : FLIGHT**

Flight_No	Origin	Destination	Seats	FlightDate	Rate
1005	Varanasi	Nepal	275	12-Dec-07	3000
2785	Delhi	Kerala	290	17-Jan-08	5500
6587	Mumbai	Varanasi	435	19-Feb-08	5000
1265	Varanasi	Nepal	200	02-Jan-08	5400

4457	Delhi	Lucknow	150	22-Feb-08	4500
6856	Varanasi	Mumbai	180	03-Mar-08	6000

- i) To display Flight flying between Varanasi and Nepal.
- ii) To display the different Origin of Flights.
- iii) To display list of flights in descending order of Rate.
- iv) To display flight details of the flight whose flightdate is after Jan 2008.
- v) `SELECT Flight_No, Destination FROM Flight WHERE Destination LIKE '_u%';`
- vi) `SELECT Origin, COUNT(*) FROM Flight GROUP BY Origin;`
- vii) `SELECT Origin, Destination FROM Flight WHERE seats>400;`
- viii) `SELECT SUM(Rate),MAX( Seats) FROM Flight;`

## Joins

- A relational database consists of multiple related tables linking together using common columns, which are known as foreign key columns.
- **It is used retrieve data from multiple tables.**
- Consider the tables below EMP, DEPT & SALGRADE that stored related information, all the examples on join will be explained with help of these following three tables

EMP Table

empno	ename	job	mgr	hiredate	sal	comm	deptno
7369	SMITH	CLERK	7902	1993-06-13	800.00	0.00	20
7499	ALLEN	SALESMAN	7698	1998-08-15	1600.00	300.00	30
7521	WARD	SALESMAN	7698	1996-03-26	1250.00	500.00	30
7566	JONES	MANAGER	7839	1995-10-31	2975.00		20
7698	BLAKE	MANAGER	7839	1992-06-11	2850.00		30
7782	CLARK	MANAGER	7839	1993-05-14	2450.00		10
7788	SCOTT	ANALYST	7566	1996-03-05	3000.00		20
7839	KING	PRESIDENT		1990-06-09	5000.00	0.00	10
7844	TURNER	SALESMAN	7698	1995-06-04	1500.00	0.00	30
7876	ADAMS	CLERK	7788	1999-06-04	1100.00		20
7900	JAMES	CLERK	7698	2000-06-23	950.00		30
7934	MILLER	CLERK	7782	2000-01-21	1300.00		10
7902	FORD	ANALYST	7566	1997-12-05	3000.00		20
7654	MARTIN	SALESMAN	7698	1998-12-05	1250.00	1400.00	30

DEPT Table

deptno	dname	location
10	Accounting	New York
20	Research	Dallas
30	Sales	Chicago
40	Operations	Boston

SALGRADE Table

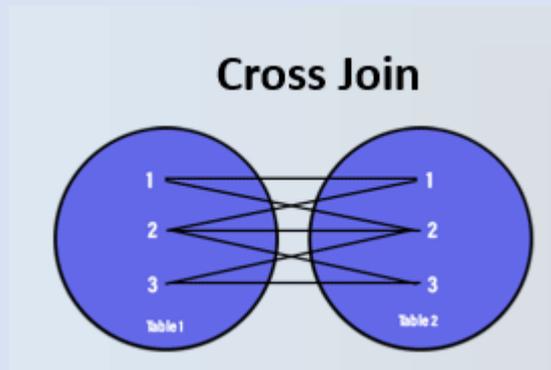
grade	losal	hisal
1	700.00	1200.00
2	1201.00	1400.00
4	2001.00	3000.00
5	3001.00	99999.00
3	1401.00	2000.00

➤ Types of Join

- ❖ Cartesian Product or Cross join
- ❖ Equi Join
- ❖ Natural Join
- ❖ Non-Equi Join
- ❖ Self Join
- ❖ Left Outer Join
- ❖ Right Outer Join

➤ Cartesian Product or Cross join

- ❖ The cross join makes a Cartesian product of rows from the joined tables.
- ❖ The cross join combines each row from the first table with every row from the right table to make the result set.
- ❖ If Table1 has degree d1 and cardinality c1 and table2 has degree d2 and cardinality c2, their Cartesian Product has degree  $d=d1+d2$  and cardinality  $c=c1*c2$ ;



Ven Diagram

Syntax:

```
SELECT * FROM table1, table2;
```

Or

```
SELECT * FROM table1 CROSS JOIN table2;
```

Or

```
SELECT * FROM table1 JOIN table2;
```

e.g. 

```
SELECT * FROM emp, dept;
```

```
SELECT * FROM emp CROSS JOIN dept;
```

```
SELECT * FROM emp JOIN DEPT;
```

Output:

empno	ename	job	mgr	hiredate	sal	comm	deptno	deptno	dname	loc

7369   SMITH   CLERK   7902   1980-12-17   800.00   NULL   20   10   ACCOUNTING   NEW YORK
7369   SMITH   CLERK   7902   1980-12-17   800.00   NULL   20   20   RESEARCH   DALLAS
7369   SMITH   CLERK   7902   1980-12-17   800.00   NULL   20   30   SALES   CHICAGO
7369   SMITH   CLERK   7902   1980-12-17   800.00   NULL   20   40   OPERATIONS   BOSTON
7499   ALLEN   SALESMAN   7698   1981-02-20   1600.00   300.00   30   10   ACCOUNTING   NEW YORK
7499   ALLEN   SALESMAN   7698   1981-02-20   1600.00   300.00   30   20   RESEARCH   DALLAS
7499   ALLEN   SALESMAN   7698   1981-02-20   1600.00   300.00   30   30   SALES   CHICAGO
7499   ALLEN   SALESMAN   7698   1981-02-20   1600.00   300.00   30   40   OPERATIONS   BOSTON
7521   WARD   SALESMAN   7698   1981-02-22   1250.00   500.00   30   10   ACCOUNTING   NEW YORK
7521   WARD   SALESMAN   7698   1981-02-22   1250.00   500.00   30   20   RESEARCH   DALLAS
7521   WARD   SALESMAN   7698   1981-02-22   1250.00   500.00   30   30   SALES   CHICAGO
7521   WARD   SALESMAN   7698   1981-02-22   1250.00   500.00   30   40   OPERATIONS   BOSTON
7566   JONES   MANAGER   7839   1981-04-02   2975.00   NULL   20   10   ACCOUNTING   NEW YORK
7566   JONES   MANAGER   7839   1981-04-02   2975.00   NULL   20   20   RESEARCH   DALLAS
7566   JONES   MANAGER   7839   1981-04-02   2975.00   NULL   20   30   SALES   CHICAGO
7566   JONES   MANAGER   7839   1981-04-02   2975.00   NULL   20   40   OPERATIONS   BOSTON
7654   MARTIN   SALESMAN   7698   1981-09-28   1250.00   1400.00   30   10   ACCOUNTING   NEW YORK
7654   MARTIN   SALESMAN   7698   1981-09-28   1250.00   1400.00   30   20   RESEARCH   DALLAS
7654   MARTIN   SALESMAN   7698   1981-09-28   1250.00   1400.00   30   30   SALES   CHICAGO
7654   MARTIN   SALESMAN   7698   1981-09-28   1250.00   1400.00   30   40   OPERATIONS   BOSTON
7698   BLAKE   MANAGER   7839   1981-05-01   2850.00   NULL   30   10   ACCOUNTING   NEW YORK
7698   BLAKE   MANAGER   7839   1981-05-01   2850.00   NULL   30   20   RESEARCH   DALLAS
7698   BLAKE   MANAGER   7839   1981-05-01   2850.00   NULL   30   30   SALES   CHICAGO
7698   BLAKE   MANAGER   7839   1981-05-01   2850.00   NULL   30   40   OPERATIONS   BOSTON
7782   CLARK   MANAGER   7839   1981-06-09   2450.00   NULL   10   10   ACCOUNTING   NEW YORK
7782   CLARK   MANAGER   7839   1981-06-09   2450.00   NULL   10   20   RESEARCH   DALLAS
7782   CLARK   MANAGER   7839   1981-06-09   2450.00   NULL   10   30   SALES   CHICAGO
7782   CLARK   MANAGER   7839   1981-06-09   2450.00   NULL   10   40   OPERATIONS   BOSTON
7788   SCOTT   ANALYST   7566   1982-12-09   3000.00   NULL   20   10   ACCOUNTING   NEW YORK
7788   SCOTT   ANALYST   7566   1982-12-09   3000.00   NULL   20   20   RESEARCH   DALLAS
7788   SCOTT   ANALYST   7566   1982-12-09   3000.00   NULL   20   30   SALES   CHICAGO
7788   SCOTT   ANALYST   7566   1982-12-09   3000.00   NULL   20   40   OPERATIONS   BOSTON
7839   KING   PRESIDENT   NULL   1981-11-17   5000.00   NULL   10   10   ACCOUNTING   NEW YORK
7839   KING   PRESIDENT   NULL   1981-11-17   5000.00   NULL   10   20   RESEARCH   DALLAS
7839   KING   PRESIDENT   NULL   1981-11-17   5000.00   NULL   10   30   SALES   CHICAGO
7839   KING   PRESIDENT   NULL   1981-11-17   5000.00   NULL   10   40   OPERATIONS   BOSTON

```

| 7844 | TURNER | SALESMAN | 7698 | 1981-09-08 | 1500.00 | 0.00 | 30 | 10 | ACCOUNTING | NEW YORK |
| 7844 | TURNER | SALESMAN | 7698 | 1981-09-08 | 1500.00 | 0.00 | 30 | 20 | RESEARCH | DALLAS |
| 7844 | TURNER | SALESMAN | 7698 | 1981-09-08 | 1500.00 | 0.00 | 30 | 30 | SALES | CHICAGO |
| 7844 | TURNER | SALESMAN | 7698 | 1981-09-08 | 1500.00 | 0.00 | 30 | 40 | OPERATIONS | BOSTON |
| 7876 | ADAMS | CLERK | 7788 | 1983-01-12 | 1100.00 | NULL | 20 | 10 | ACCOUNTING | NEW YORK |
| 7876 | ADAMS | CLERK | 7788 | 1983-01-12 | 1100.00 | NULL | 20 | 20 | RESEARCH | DALLAS |
| 7876 | ADAMS | CLERK | 7788 | 1983-01-12 | 1100.00 | NULL | 20 | 30 | SALES | CHICAGO |
| 7876 | ADAMS | CLERK | 7788 | 1983-01-12 | 1100.00 | NULL | 20 | 40 | OPERATIONS | BOSTON |
| 7900 | JAMES | CLERK | 7698 | 1981-12-03 | 950.00 | NULL | 30 | 10 | ACCOUNTING | NEW YORK |
| 7900 | JAMES | CLERK | 7698 | 1981-12-03 | 950.00 | NULL | 30 | 20 | RESEARCH | DALLAS |
| 7900 | JAMES | CLERK | 7698 | 1981-12-03 | 950.00 | NULL | 30 | 30 | SALES | CHICAGO |
| 7900 | JAMES | CLERK | 7698 | 1981-12-03 | 950.00 | NULL | 30 | 40 | OPERATIONS | BOSTON |
| 7902 | FORD | ANALYST | 7566 | 1981-12-03 | 3000.00 | NULL | 20 | 10 | ACCOUNTING | NEW YORK |
| 7902 | FORD | ANALYST | 7566 | 1981-12-03 | 3000.00 | NULL | 20 | 20 | RESEARCH | DALLAS |
| 7902 | FORD | ANALYST | 7566 | 1981-12-03 | 3000.00 | NULL | 20 | 30 | SALES | CHICAGO |
| 7902 | FORD | ANALYST | 7566 | 1981-12-03 | 3000.00 | NULL | 20 | 40 | OPERATIONS | BOSTON |
| 7934 | MILLER | CLERK | 7782 | 1982-01-23 | 1300.00 | NULL | 10 | 10 | ACCOUNTING | NEW YORK |
| 7934 | MILLER | CLERK | 7782 | 1982-01-23 | 1300.00 | NULL | 10 | 20 | RESEARCH | DALLAS |
| 7934 | MILLER | CLERK | 7782 | 1982-01-23 | 1300.00 | NULL | 10 | 30 | SALES | CHICAGO |
| 7934 | MILLER | CLERK | 7782 | 1982-01-23 | 1300.00 | NULL | 10 | 40 | OPERATIONS | BOSTON |

```

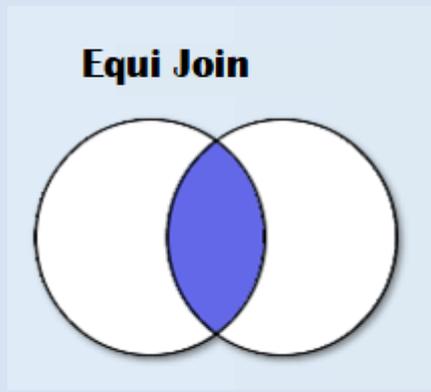
+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+

56 rows in set (0.02 sec)

Note: Above output has 56 row (14\*4) and 11 columns (8+3)

➤ Equi Join-

- ❖ It performs a JOIN against equality or matching column(s) values of the associated tables.



Ven Diagram

## Syntax

```
SELECT * /Column_list  
FROM Table1, Table 2  
WHERE table1.column=Table2.column;
```

Or

```
SELECT * /Column_list  
FROM Table1 join Table2 on Table1.Column=Table2.Column;
```

Example: `SELECT * FROM emp JOIN dept ON emp.deptno=dept.deptno;`

Or

```
SELECT * FROM emp, dept WHERE emp.deptno=dept.deptno;
```

## Output:

```
+-----+-----+-----+-----+-----+-----+-----+-----+-----+  
| empno | ename | job   | mgr | hiredate | sal   | comm | deptno | deptno | dname   | loc   |  
+-----+-----+-----+-----+-----+-----+-----+-----+-----+  
| 7369 | SMITH | CLERK |     | 1980-12-17 | 800.00 | NULL | 20 | 20 | RESEARCH | DALLAS |  
| 7499 | ALLEN | SALESMAN | 7698 | 1981-02-20 | 1600.00 | 300.00 | 30 | 30 | SALES | CHICAGO |  
| 7521 | WARD | SALESMAN | 7698 | 1981-02-22 | 1250.00 | 500.00 | 30 | 30 | SALES | CHICAGO |  
| 7566 | JONES | MANAGER | 7839 | 1981-04-02 | 2975.00 | NULL | 20 | 20 | RESEARCH | DALLAS |  
| 7654 | MARTIN | SALESMAN | 7698 | 1981-09-28 | 1250.00 | 1400.00 | 30 | 30 | SALES | CHICAGO |  
| 7698 | BLAKE | MANAGER | 7839 | 1981-05-01 | 2850.00 | NULL | 30 | 30 | SALES | CHICAGO |  
| 7782 | CLARK | MANAGER | 7839 | 1981-06-09 | 2450.00 | NULL | 10 | 10 | ACCOUNTING | NEW YORK |  
| 7788 | SCOTT | ANALYST | 7566 | 1982-12-09 | 3000.00 | NULL | 20 | 20 | RESEARCH | DALLAS |  
| 7839 | KING | PRESIDENT | NULL | 1981-11-17 | 5000.00 | NULL | 10 | 10 | ACCOUNTING | NEW YORK |  
| 7844 | TURNER | SALESMAN | 7698 | 1981-09-08 | 1500.00 | 0.00 | 30 | 30 | SALES | CHICAGO |  
| 7876 | ADAMS | CLERK | 7788 | 1983-01-12 | 1100.00 | NULL | 20 | 20 | RESEARCH | DALLAS |  
| 7900 | JAMES | CLERK | 7698 | 1981-12-03 | 950.00 | NULL | 30 | 30 | SALES | CHICAGO |  
| 7902 | FORD | ANALYST | 7566 | 1981-12-03 | 3000.00 | NULL | 20 | 20 | RESEARCH | DALLAS |  
| 7934 | MILLER | CLERK | 7782 | 1982-01-23 | 1300.00 | NULL | 10 | 10 | ACCOUNTING | NEW YORK |  
+-----+-----+-----+-----+-----+-----+-----+-----+-----+
```

Example 1: Display the employee name, sal and name of department name

Ans: In the above query ename and sal belong to emp table whereas dname belongs to DEPT table. So, to retrieve data in this we will use join

```
SELECT emp.ename, emp.sal, dept.dname  
FROM emp, dept WHERE emp.deptno=dept.deptno;
```

Output:

```
+-----+-----+-----+
| ename | sal   | dname   |
+-----+-----+-----+
| SMITH | 800.00 | RESEARCH |
| ALLEN | 1600.00 | SALES   |
| WARD  | 1250.00 | SALES   |
| JONES | 2975.00 | RESEARCH |
| MARTIN | 1250.00 | SALES   |
| BLAKE | 2850.00 | SALES   |
| CLARK | 2450.00 | ACCOUNTING |
| SCOTT | 3000.00 | RESEARCH |
| KING  | 5000.00 | ACCOUNTING |
| TURNER | 1500.00 | SALES   |
| ADAMS | 1100.00 | RESEARCH |
| JAMES | 950.00 | SALES   |
| FORD  | 3000.00 | RESEARCH |
| MILLER | 1300.00 | ACCOUNTING |
+-----+-----+-----+
```

Note:

- ❖ In case of join **full qualified (table\_name.column\_name)** name is used to avoid ambiguity as both table contains common columns as PRIMARY KEY and FOREIGN KEY.
- ❖ Table Alias – Like column alias table alias can be used in case of join as given below.

```
SELECT e.ename, e.sal FROM emp e, dept d WHERE emp.deptno=dept.deptno;
```

- ❖ Here 'e' & 'd' are table alias for EMP & DEPT table respectively.

#### ➤ Non- Equi Join

- ❖ It uses comparison operator instead of the equal sign like >, <, >=, <= along with join condition.

Syntax:

```
SELECT * /Column_list
FROM table1, table2,..
WHERE table1.column relational_operator table2.column;
```

Note: Where relational operator are other than equality operator and between.

Example: Display the employee name, salary and grade of each employee.

Ans: In the above query the involved table are EMP and SALGRADE.

```
SELECT e.ename, e.sal, s.grade
FROM emp e, salgrade s
WHERE e.sal BETWEEN s.losal AND s.hisal;
```

Output:

```
+-----+-----+-----+
| ename | sal   | grade |
+-----+-----+-----+
| SMITH | 800.00 | 1 |
| ALLEN | 1600.00 | 3 |
| WARD  | 1250.00 | 2 |
| JONES | 2975.00 | 4 |
| MARTIN | 1250.00 | 2 |
| BLAKE | 2850.00 | 4 |
| CLARK | 2450.00 | 4 |
| SCOTT | 3000.00 | 4 |
| KING  | 5000.00 | 5 |
| TURNER | 1500.00 | 3 |
| ADAMS | 1100.00 | 1 |
| JAMES | 950.00 | 1 |
| FORD  | 3000.00 | 4 |
| MILLER | 1300.00 | 2 |
+-----+-----+-----+
```

➤ Natural Join

- ❖ A natural join is a type of join operation that creates an implicit join by combining tables based on columns with the same name and data type.
- ❖ It makes the SELECT query simpler with minimal use of conditions.
- ❖ There is no need to specify the name of common column in the SELECT statement.

- ❖ Common column is present only once in the output.

Syntax:

```
SELECT */column_list
FROM Table1 NATURAL JOIN TABLE2;
```

Or

```
SELECT */column_list
FROM TABLE1 join on common_column_name;
```

Example :

```
SELECT * FROM emp JOIN dept USING(deptno);
```

Or

```
SELECT * FROM emp NATURAL JOIN DEPT;
```

Output:

```
-----+-----+-----+-----+-----+-----+-----+-----+-----+
|deptno|empno|ename|job|mgr|hiredate|sal|comm|dname|loc|
|-----+-----+-----+-----+-----+-----+-----+-----+-----+
| 20|7369|SMITH|CLERK|7902|1980-12-17|800.00|NULL|RESEARCH|DALLAS|
| 30|7499|ALLEN|SALESMAN|7698|1981-02-20|1600.00|300.00|SALES|CHICAGO|
| 30|7521|WARD|SALESMAN|7698|1981-02-22|1250.00|500.00|SALES|CHICAGO|
| 20|7566|JONES|MANAGER|7839|1981-04-02|2975.00|NULL|RESEARCH|DALLAS|
| 30|7654|MARTIN|SALESMAN|7698|1981-09-28|1250.00|1400.00|SALES|CHICAGO|
| 30|7698|BLAKE|MANAGER|7839|1981-05-01|2850.00|NULL|SALES|CHICAGO|
| 10|7782|CLARK|MANAGER|7839|1981-06-09|2450.00|NULL|ACCOUNTING|NEW YORK|
| 20|7788|SCOTT|ANALYST|7566|1982-12-09|3000.00|NULL|RESEARCH|DALLAS|
| 10|7839|KING|PRESIDENT|NULL|1981-11-17|5000.00|NULL|ACCOUNTING|NEW YORK|
| 30|7844|TURNER|SALESMAN|7698|1981-09-08|1500.00|0.00|SALES|CHICAGO|
| 20|7876|ADAMS|CLERK|7788|1983-01-12|1100.00|NULL|RESEARCH|DALLAS|
| 30|7900|JAMES|CLERK|7698|1981-12-03|950.00|NULL|SALES|CHICAGO|
| 20|7902|FORD|ANALYST|7566|1981-12-03|3000.00|NULL|RESEARCH|DALLAS|
| 10|7934|MILLER|CLERK|7782|1982-01-23|1300.00|NULL|ACCOUNTING|NEW YORK|
-----+-----+-----+-----+-----+-----+-----+-----+-----+
```

➤ Difference between Equi-Join vs Natural Join

Equi-Join	Natural Join
Join performed on equality of value of the columns	Join is performed on column haing common name.
Where clause is used to specify the condition	There is no need to use where clause
Both columns from tables are displayed in the result.	Common column is displayed only once

### Solved Exercise on Join:

Consider the following two table Customer and Saleman  
Customer Table:

salesman_id	name	city	commission
5001	James Hoog	New York	0.15
5002	Nail Knite	Paris	0.13
5005	Pit Alex	London	0.11
5006	Mc Lyon	Paris	0.14
5007	Paul Adam	Rome	0.13

Customer Table:

customer_id	cust_name	city	grade	salesman_id
3002	Nick Rimando	New York	100	5001
3007	Brad Davis	New York	200	5001
3005	Graham Zusi	California	200	5002
3008	Julian Green	London	300	5002
3004	Fabian Johnson	Paris	300	5006
3009	Geoff Cameron	Berlin	100	5003
3003	Jozy Altidor	Moscow	200	5007

Q1. Write a SQL query to display Salesman, cust\_name and city from above table where the salesperson and customer belongs to same city.

Ans:

```
SELECT s.name AS "Salesman",
```

```
c.cust_name, c.city
```

```
FROM salesman s, customer c
```

```
WHERE s.city=c.city;
```

Or

```
SELECT salesman.name AS "Salesman",
```

```
customer.cust_name, customer.city
```

```
FROM salesman, customer
```

```
WHERE salesman.city=customer.city;
```

Q2. write a SQL query to display ord\_no, purch\_amt, cust\_name, city of those orders where order amount exists between 500 and 2000.

Ans:

```
SELECT o.ord_no, o.purch_amt,
```

```
c.cust_name,c.city  
FROM orders o,customer c  
WHERE o.customer_id=c.customer_id  
AND o.purch_amt BETWEEN 500 AND 2000;
```

Q3. Write a SQL query to display Customer Name, city, Salesman, commission the all salesperson(s) and their respective the customer(s).

Ans:

```
SELECT c.cust_name AS "Customer Name",  
c.city, s.name AS "Salesman", s.commission  
FROM customer c, salesman s  
WHERE c.salesman_id=s.salesman_id;
```

Q4. What are Joins in SQL?

Ans. Joins in SQL are the statements or clauses using which we can combine two or more tables, based on some common fields present among the tables.

Q5.Explain the different types of Joins in SQL?

Ans: Some of the major joins in SQL are-

- ❖ Equi Join – Inner join is used to return the records which are having matching values in both the tables.
- ❖ Left Join – Left join is used to concatenate all the rows of the left table and the matching rows in the right table.
- ❖ Right Join-Right join is used to concatenate all the rows of the right table and the matching rows in the left table.
- ❖ Full Join-Full join is used to return all the records of both the tables as long as there is a matching record in either table.
- ❖ Self Join-Self join is a join that is used to join a table to itself. In a self-join, a table is considered as if it were two tables.
- ❖ Cartesian Join-Cartesian join is used to return the number of rows in the first table multiplied by the number of rows in the second table. It is also referred to as cross join.

Q6. What is Natural Join?

Ans: Natural join is used to create an implicit join clause based on the value of common attributes in the two tables. Common attributes are the attributes that have the same name in both tables. Natural join does not need any comparison operator as in the case of equi join.

Q7. What is an Equi Join?

Ans: An Equi Join is a type of join that combines tables based on matching values in the specified columns.

- ❖ The column names do not need to be the same.
- ❖ The resultant table can contain repeated columns.
- ❖ It is possible to perform an equi join on more than two tables.

Q 8. What is the difference between cross join and natural join?

Ans: A cross join produces a cross product or cartesian product of two tables whereas the natural join is based on all the columns having the same name and data types in both the tables.

Unsolved Exercise:

1. Consider the following tables PARTICIPANT and ACTIVITY and answer the questions that follow :

<b>Table : PARTICIPANT</b>			
<b>ADMNO</b>	<b>NAME</b>	<b>HOUSE</b>	<b>ACTIVITYCODE</b>
6473	Kapil Shah	Gandhi	A105
7134	Joy Mathew	Bose	A101
8786	Saba Arora	Gandhi	A102
6477	Kapil Shah	Bose	A101
7658	Faizal Ahmed	Bhagat	A104

<b>Table : ACTIVITY</b>		
<b>ACTIVITYCODE</b>	<b>ACTIVITYNAME</b>	<b>POINTS</b>
A101	Running	200
A102	Hopping bag	300
A103	Skipping	200
A104	Bean bag	250
A105	Obstacle	350

- (i) When the table "PARTICIPANT" was first created, the column 'NAME' was planned as the Primary key by the Programmer. Later a field ADMNO had to be set up as Primary key. Explain the reason.

OR

Identify data type and size to be used for column ACTIVITYCODE in table ACTIVITY.

- (ii) To display Names of Participants, Activity Code, Activity Name in alphabetic ascending order of names of participants.
- (iii) To display Names of Participants along with Activity Codes and Activity Names for only those participants who are taking part in Activities that have 'bag' in their Activity Names and Points of activity are above 250.

2. In a database there are two tables 'LOAN' and 'BORROWER' as shown below:

Table: LOAN

<b>Loan_no</b>	<b>Branch_name</b>	<b>Amount</b>
K-70	Downtown	5000
K-230	Redwood	6000
K-260	Perryridge	3700

Table : BORROWER

Customer_Name	Loan_no
Jones	K-170
Smith	K-230
Hayes	K-155

- (i) Identify the foreign key column in the table BORROWER.
- (ii) How many rows and columns will be there in the cross join of these two tables?
- (iii) Write sql query to display customer smith's loan record with their Name, Loan \_no, Branch \_name and Loan amount
- (iv) Write sql query to list names of all customers with their Amount in ascending order?

## Interface of Python with an SQL database

- The real world application need to store data persistently
- The front end (User Interface) is designed in Python or any other programming language and Data stored in database (Backend).
- Therefore, there is need to connect Python application and Database.
- The connectivity is achieved through API called MySQL-Connector.
- It needs to be installed using **pip command** on Command Prompt
  - ❖ Press Window +R to open Run Window
  - ❖ Type CMD press enter
  - ❖ It will open Command Prompt
  - ❖ Move to Script Folder of Python, if Python Path is not set  
**CD C:\Users\Your\_User\_Name\AppData\Local\Programs\Python\Python310\Scripts\**
  - ❖ Run Following command  
**pip install mysql-connector**

```
C:\Users\MICROSOFT>pip install mysql-connector
Collecting mysql-connector
  Downloading mysql-connector-2.2.9.tar.gz (11.9 MB)
    |████████████████████████████████████████| 11.9 MB 1.1 MB/s
Using legacy 'setup.py install' for mysql-connector, since package 'wheel' is not installed.
Installing collected packages: mysql-connector
  Running setup.py install for mysql-connector ... done
Successfully installed mysql-connector-2.2.9
```

- ❖ To check whether it is installed or not, use **pip list** command.
- **Step to Connect Python to MySQL**
  - ❖ Import MySQL Connector to your program  
**import mysql.connector**
  - ❖ Establish connection using mysql.connector connect() method. This method will generated ER\_ACCESS\_DENIED\_ERROR is password is wrong.  
**mycon=mysql.connector.connect((host="localhost",user="root",password="", database='test'))**  
host : - server name on which MySQL is running, default is localhost (127.0.0.1) for local machine  
user : user\_name of MySQL, default is 'root'  
password : - Password for user 'root', default is no password i. e. ""  
database: - Name of MySQL database to connect
  - ❖ Create Cursor using method of connection object's (mycon) cursor() method  
**mycursor=mycon.cursor()**
  - ❖ Execute the query using cursor method execute(SQL\_Command),

```
result_set=mycursor.execute("SELECT * FROM EMP;")
```

- ❖ Result\_set object holds all the record (rows) returned by execute() method
- ❖ Perform required operations using various cursor method
- ❖ Close Cursor using close() method of Cursor object

```
mycursor.close()
```

- ❖ Close Database connection using close() method connection object

```
Mycon.close()
```

- ❖ Other method

- is\_connected()- It is a connection method and return true is connection is established otherwise false.

```
myconn.is_connected()
```

- commit() – it is a method of connection object and save the same made by transaction.

```
myconn.commit()
```

- rollback() – it is a method of connection object that undo all the changes made.

```
Myconn.rollback()
```

- fetchone() – It is method of cursor object that fetches next one row of a query result set.

- Fetchall() – it is another method of cursor object that fetches all the rows in the result set.

- rowcount()- it is a method of cursor object that returns the number of rows affected by execute() method.

➤ Creating Database from Python

Listing database in MySQL before the execution of the code

```
mysql> show databases;
+-----+
| Database |
+-----+
| information_schema |
| mydb |
| mysql |
| newdb |
| performance_schema |
| sys |
| test |
| xiicomm |
+-----+
8 rows in set (0.00 sec)
```

Code:

```
In [3]: 1 import mysql.connector
        2 con=mysql.connector.connect(host='localhost',user='root',password='',database='test')
        3 cur=con.cursor()
        4 cur.execute("create database School")
        5
```

Result of Show databases command after the code.

```
mysql> show databases;
+-----+
| Database |
+-----+
| information_schema |
| mydb |
| mysql |
| newdb |
| performance_schema |
| school |
| sys |
| test |
| xiicomm |
+-----+
```

➤ Listing database from Python

```
1 import mysql.connector
2 con=mysql.connector.connect(host='localhost',user='root',password='',database='test')
3 cur=con.cursor()
4 cur.execute("show databases")
5 result_set=cur.fetchall() #read all record in result_set
6
7 for r in result_set:
8     print(r)
```

Output:

```
('information_schema',)
('mydb',)
('mysql',)
('newdb',)
('performance_schema',)
('school',)
('sys',)
('test',)
('xiicomm',)
```

➤ Reading table data

```

1 import mysql.connector
2 con=mysql.connector.connect(host='localhost',user='root',password='',database='test')
3 cur=con.cursor()
4 cur.execute("select * from emp")
5 result_set=cur.fetchall() #read all record in result_set
6
7 for r in result_set:
8     print(r)

```

### ➤ Updating Records

Details of Persons table before updating

```
mysql> select * from Persons;
```

PersonID	LastName	FirstName	Address	City
1	Rohit	prakash	1 Enclave	Ranchi
2	Mohit	Kumar	1 Enclave	Patna
3	Danush	K	2 Enclave	Ranchi
4	Dev	Singh	2 Enclave	Ranchi

Code:

```

1 #Program to update
2 import mysql.connector
3 con=mysql.connector.connect(host='localhost',user='root',password='',database='test')
4 cur=con.cursor()
5 name=input("Enter name of the person to update Address")
6 add=input("Enter New Address")
7 sql='update persons set address=' + "'" + add + "'" + 'where lastname=' + "'" + name + "'"
8 cur.execute(sql)
9 con.commit() # save the changes made
10 print(cur.rowcount,"records updated")
11 cur.close()
12 con.close()

```

Output:

```

Enter name of the person to update Address Rohit
Enter New Address Patna
1 records updated

```

Details of Persons table after updating

```
mysql> select * from Persons;
```

PersonID	LastName	FirstName	Address	City
1	Rohit	prakash	Patna	Ranchi
2	Mohit	Kumar	1 Enclave	Patna
3	Danush	K	2 Enclave	Ranchi
4	Dev	Singh	2 Enclave	Ranchi

➤ Deleting Record

Details of Persons table before deleting the row

```
mysql> select * from Persons;
```

PersonID	LastName	FirstName	Address	City
1	Rohit	prakash	1 Enclave	Ranchi
2	Mohit	Kumar	1 Enclave	Patna
3	Danush	K	2 Enclave	Ranchi
4	Dev	Singh	2 Enclave	Ranchi

Code:

```
1 #Program to delete row
2 import mysql.connector
3 con=mysql.connector.connect(host='localhost',user='root',password='',database='test')
4 cur=con.cursor()
5 pid=input("Enter name of the person person to delete record : ")
6 sql='delete from persons where personid= {}'.format(pid)
7 try:
8     cur.execute(sql)
9     con.commit() # save the changes made
10    print(cur.rowcount,"records updated")
11 except:
12     con.rollback() #undo the changes
13
14 cur.close() #closing the cursor
15 con.close() #closing the connection
```

```
Enter name of the person person to delete record : 1
1 records updated
```

Details of Persons table after deleting record with Personid= 1

```
mysql> select * from Persons;
```

PersonID	LastName	FirstName	Address	City
2	Mohit	Kumar	1 Enclave	Patna
3	Danush	K	2 Enclave	Ranchi
4	Dev	Singh	2 Enclave	Ranchi

Exercise:

1. What is the role of execute() method?
2. What is the significance of using connect()?
3. Explain the following method of cursor object
  - a. fetchone()
  - b. rowcount
  - c. fetchall()
4. What is Python's database interface known as?

Programming Based Question

5. Write a Python program to increase the salary by 1000 of all employees of deptno 10.
6. Write a Python program to create database called Shop.

**Sample Question Paper**  
**COMPUTER SCIENCE (Code: 083)**

Maximum Marks: 35

Time: 2 hours

**General Instructions**

- The question paper is divided into 3 sections – A, B and C
- Section A, consists of 7 questions (1-7). Each question carries 2 marks.
- Section B, consists of 3 questions (8-10). Each question carries 3 marks.
- Section C, consists of 3 questions (11-13). Each question carries 4 marks.
- Internal choices have been given for question numbers 7, 8 and 12.

<b>Section -A</b>			
<b>Each question carries 2 marks</b>			
<b>Q. No</b>	<b>Part No.</b>	<b>Question</b>	<b>Marks</b>
1.		Give any two characteristics of stacks.	(2)
2.	(i)	Expand the following: <b>SMTP , XML</b>	(1)
	(ii)	Out of the following, which is the fastest wired and wireless medium of transmission?  <b>Infrared, coaxial cable, optical fibre, microwave, Ethernet cable</b>	(1)
3.		Differentiate between char(n) and varchar(n) data types with respect to databases.	(2)
4.		A resultset is extracted from the database using the cursor object (that has been already created) by giving the following statement.  <b>Mydata=cursor.fetchone ()</b>  (a) How many records will be returned by fetchone() method?  (b) What will be the datatype of Mydata object after the given command is executed?	(2)

5.		<p>Write the output of the queries (a) to (d) based on the table, Furniture given below:</p> <p><b>Table: FURNITURE</b></p> <table border="1" data-bbox="366 298 1198 848"> <thead> <tr> <th>FID</th> <th>NAME</th> <th>DATEOFPURCHASE</th> <th>COST</th> <th>DISCOUNT</th> </tr> </thead> <tbody> <tr> <td>B001</td> <td>Double Bed</td> <td>03-Jan-2018</td> <td>45000</td> <td>10</td> </tr> <tr> <td>T010</td> <td>Dining Table</td> <td>10-Mar-2020</td> <td>51000</td> <td>5</td> </tr> <tr> <td>B004</td> <td>Single Bed</td> <td>19-Jul-2021</td> <td>22000</td> <td>0</td> </tr> <tr> <td>C003</td> <td>Long Back Chair</td> <td>30-Dec-2016</td> <td>12000</td> <td>3</td> </tr> <tr> <td>T006</td> <td>Console Table</td> <td>17-Nov-2019</td> <td>15000</td> <td>12</td> </tr> <tr> <td>B006</td> <td>Bunk Bed</td> <td>01-Jan-2021</td> <td>28000</td> <td>14</td> </tr> </tbody> </table> <p>(a) <code>SELECT SUM(DISCOUNT) FROM FURNITURE WHERE COST&gt;15000;</code></p> <p>(b) <code>SELECT MAX (DATEOFPURCHASE) FROM FURNITURE ;</code></p> <p>(c) <code>SELECT * FROM FURNITURE WHERE DISCOUNT&gt;5 AND FID LIKE "T%";</code></p> <p>(d) <code>SELECT DATEOFPURCHASE FROM FURNITURE WHERE NAME IN ("Dining Table", "Console Table");</code></p>	FID	NAME	DATEOFPURCHASE	COST	DISCOUNT	B001	Double Bed	03-Jan-2018	45000	10	T010	Dining Table	10-Mar-2020	51000	5	B004	Single Bed	19-Jul-2021	22000	0	C003	Long Back Chair	30-Dec-2016	12000	3	T006	Console Table	17-Nov-2019	15000	12	B006	Bunk Bed	01-Jan-2021	28000	14	(2)
FID	NAME	DATEOFPURCHASE	COST	DISCOUNT																																		
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B006	Bunk Bed	01-Jan-2021	28000	14																																		
6.	(i)	Which command is used to view the list of tables in a database?	(1)																																			
	(ii)	Give one point of difference between an equi-join and a natural join.	(1)																																			
7.		<p>Consider the table, <b>MOVIEDETAILS</b> given below:</p> <p><b>Table: MOVIEDETAILS</b></p> <table border="1" data-bbox="366 1709 1248 1818"> <thead> <tr> <th>MOVIEID</th> <th>TITLE</th> <th>LANGUAGE</th> <th>RATING</th> <th>PLATFORM</th> </tr> </thead> <tbody> <tr> <td>M001</td> <td>Minari</td> <td>Korean</td> <td>5</td> <td>Netflix</td> </tr> <tr> <td>M004</td> <td>MGR Magan</td> <td>Tamil</td> <td>4</td> <td>Hotstar</td> </tr> </tbody> </table>	MOVIEID	TITLE	LANGUAGE	RATING	PLATFORM	M001	Minari	Korean	5	Netflix	M004	MGR Magan	Tamil	4	Hotstar	(2)																				
MOVIEID	TITLE	LANGUAGE	RATING	PLATFORM																																		
M001	Minari	Korean	5	Netflix																																		
M004	MGR Magan	Tamil	4	Hotstar																																		

M010	Kaagaz	Hindi	3	Zee5
M011	Harry Potter and the Chamber of Secrets	English	4	Prime Video
M015	Uri	Hindi	5	Zee5
M020	Avengers: Endgame	English	4	Hotstar

- (a) Identify the degree and cardinality of the table.  
 (b) Which field should be made the primary key? Justify your answer.

**OR**

- (a) Identify the candidate key(s) from the table **MOVIEDETAILS**.  
 (b) Consider the table **SCHEDULE** given below:

Table: SCHEDULE

SLOTID	MOVIEID	TIMESLOT
S001	M010	10 AM to 12 PM
S002	M020	2 PM to 5 PM
S003	M010	6 PM to 8 PM
S004	M011	9 PM to 11 PM

Which field will be considered as the foreign key if the tables **MOVIEDETAILS** and **SCHEDULE** are related in a database?

**SECTION – B**  
**Each question carries 3 marks**

8. Julie has created a dictionary containing names and marks as key value pairs of 6 students. Write a program, with separate user defined functions to perform the following operations:
- Push the keys (name of the student) of the dictionary into a stack, where the corresponding value (marks) is greater than 75.
  - Pop and display the content of the stack.
- For example:  
 If the sample content of the dictionary is as follows:

		<p>R={"OM":76, "JAI":45, "BOB":89, "ALI":65, "ANU":90, "TOM":82}</p> <p>The output from the program should be: TOM ANU BOB OM</p> <p style="text-align: center;"><b>OR</b></p> <p>Alam has a list containing 10 integers. You need to help him create a program with separate user defined functions to perform the following operations based on this list.</p> <ul style="list-style-type: none"> <li>• Traverse the content of the list and push the even numbers into a stack.</li> <li>• Pop and display the content of the stack.</li> </ul> <p>For Example: If the sample Content of the list is as follows: N=[12, 13, 34, 56, 21, 79, 98, 22, 35, 38]</p> <p>Sample Output of the code should be: 38 22 98 56 34 12</p>													
9.	(i)	<p>A table, <b>ITEM</b> has been created in a database with the following fields: <b>ITEMCODE, ITEMNAME, QTY, PRICE</b></p> <p>Give the SQL command to add a new field, <b>DISCOUNT</b> (of type Integer) to the <b>ITEM</b> table.</p>	(1)												
	(ii)	<p>Categorize following commands into DDL and DML commands?</p> <p><b>INSERT INTO, DROP TABLE, ALTER TABLE, UPDATE...SET</b></p>	(2)												
10.		<p>Charu has to create a database named <b>MYEARTH</b> in MYSQL. She now needs to create a table named <b>CITY</b> in the database to store the records of various cities across the globe. The table <b>CITY</b> has the following structure:</p> <p>Table: CITY</p> <table border="1"> <thead> <tr> <th>FIELD NAME</th> <th>DATA TYPE</th> <th>REMARKS</th> </tr> </thead> <tbody> <tr> <td>CITYCODE</td> <td>CHAR(5)</td> <td>Primary Key</td> </tr> <tr> <td>CITYNAME</td> <td>CHAR(30)</td> <td></td> </tr> <tr> <td>SIZE</td> <td>INTEGER</td> <td></td> </tr> </tbody> </table>	FIELD NAME	DATA TYPE	REMARKS	CITYCODE	CHAR(5)	Primary Key	CITYNAME	CHAR(30)		SIZE	INTEGER		(3)
FIELD NAME	DATA TYPE	REMARKS													
CITYCODE	CHAR(5)	Primary Key													
CITYNAME	CHAR(30)														
SIZE	INTEGER														

AVGTEMP	INTEGER	
POLLUTIONRATE	INTEGER	
POPULATION	INTEGER	

Help her to complete the task by suggesting appropriate SQL commands.

**Section C**  
**Each question carries 4 marks**

11.

Write queries (a) to (d) based on the tables **EMPLOYEE** and **DEPARTMENT** given below:

(4)

**Table: EMPLOYEE**

EMPID	NAME	DOB	DEPTID	DESIG	SALARY
120	Alisha	23- Jan- 1978	D001	Manager	75000
123	Nitin	10- Oct- 1977	D002	AO	59000
129	Navjot	12- Jul- 1971	D003	Supervisor	40000
130	Jimmy	30- Dec- 1980	D004	Sales Rep	
131	Faiz	06- Apr- 1984	D001	Dep Manager	65000

**Table: DEPARTMENT**

DEPTID	DEPTNAME	FLOORNO
D001	Personal	4
D002	Admin	10
D003	Production	1
D004	Sales	3

(a) To display the average salary of all employees, department wise.

(b) To display name and respective department name of each employee whose salary is more than 50000.

		<p>(c) To display the names of employees whose salary is not known, in alphabetical order.</p> <p>(d) To display DEPTID from the table <b>EMPLOYEE</b> without repetition.</p>													
12.	(i)	<p>Give two advantages and two disadvantages of star topology</p> <p style="text-align: center;"><b>OR</b></p> <p>Define the following terms: <b>www, web hosting</b></p>	(2)												
	(ii)	How is packet switching different from circuit switching?	(2)												
13.		<p>BeHappy Corporation has set up its new centre at Noida, Uttar Pradesh for its office and web-based activities. It has 4 blocks of buildings.</p> <div style="border: 1px solid black; padding: 10px; margin: 10px auto; width: fit-content;"> <p style="text-align: center;"><b>BeHappy Corporation</b></p> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="border: 1px solid black; padding: 5px; margin: 5px;">Block A</div> <div style="border: 1px solid black; padding: 5px; margin: 5px;">Block B</div> </div> <div style="display: flex; justify-content: space-around; align-items: center; margin-top: 20px;"> <div style="border: 1px solid black; padding: 5px; margin: 5px;">Block C</div> <div style="border: 1px solid black; padding: 5px; margin: 5px;">Block D</div> </div> </div> <p>Distance between the various blocks is as follows:</p> <table style="margin-left: 40px;"> <tr><td>A to B</td><td>40 m</td></tr> <tr><td>B to C</td><td>120m</td></tr> <tr><td>C to D</td><td>100m</td></tr> <tr><td>A to D</td><td>170m</td></tr> <tr><td>B to D</td><td>150m</td></tr> <tr><td>A to C</td><td>70m</td></tr> </table> <p>Numbers of computers in each block Block A - 25</p>	A to B	40 m	B to C	120m	C to D	100m	A to D	170m	B to D	150m	A to C	70m	(4)
A to B	40 m														
B to C	120m														
C to D	100m														
A to D	170m														
B to D	150m														
A to C	70m														

Block B - 50

Block C - 125

Block D - 10

- (a) Suggest and draw the cable layout to efficiently connect various blocks of buildings within the Noida centre for connecting the digital devices.
- (b) Suggest the placement of the following device with justification
- i. Repeater
  - ii. Hub/Switch
- (c) Which kind of network (PAN/LAN/WAN) will be formed if the Noida office is connected to its head office in Mumbai?
- (d) Which fast and very effective wireless transmission medium should preferably be used to connect the head office at Mumbai with the centre at Noida?

**KENDRIYA VIDYALAYA SANAGTHA RANCHI REGION**

**CLASS 12 TERM 2 SAMPLE QUESTION PAPER COMPUTER**

**SCIENCE (Code: 083)**

Maximum Marks: 35

Time: 2 hours

**General Instructions**

- The question paper is divided into 3 sections – A, B and C
- Section A, consists of 7 questions (1-7). Each question carries 2 marks.
- Section B, consists of 3 questions (8-10). Each question carries 3 marks.
- Section C, consists of 3 questions (11-13). Each question carries 4 marks.
- Internal choices have been given for question numbers 7, 8 and 12.

<b>Section -A</b>			
<b>Each question carries 2 marks</b>			
<b>Q. No</b>	<b>Part No.</b>	<b>Question</b>	<b>Marks</b>
1.		What is a data structure? Give two examples.	(2)
2.	(i)	Expand the following: <b>HTTP, URL</b>	(1)
	(ii)	Which type of network (out of LAN, PAN and MAN) is formed, when you connect two mobiles using Bluetooth to transfer a video?	(1)
3.		Differentiate between DDL and DML commands	(2)
4.	(i)	Which function is used to check whether Python MySQL connectivity is successful or not	(1)
	(ii)	Name any two functions used to extract data from cursor.	(1)

5.	Table: CLUB							(2)
	COACH – ID	COACH NAME	Age	SPORTS	DATOFAPP	PAY	SEX	
	1	KRKREJA	35	KARATE	27/03/1996	1000	M	
	2	RAVINA	34	KARATE	20/01/1998	1200	F	
	3	KARAN	34	SQUASH	19/02/1998	2000	M	
	4	TARUN	33	BASKETBALL	01/01/1998	1500	M	
	5	ZUBIN	36	SWIMMING	12/01/1998	750	M	
	6	KETAKI	36	SWIMMING	24/02/1998	800	F	
	7	ANKITA	39	SQUASH	20/02/1998	2200	F	
	8	ZAREEN	37	KARATE	22/02/1998	1100	F	
	9	KUSH	41	SWIMMING	13/01/1998	900	M	
10	SHAILYA	39	BASKETBALL	19/02/1998	1700	M		
Write the output of the queries (a) to (d) based on the table, CLUB given above:								
(i) SELECT COUNT (DISTINCT SPORTS) FROM CLUB;								
(ii) SELECT MIN(AGE) FROM CLUB WHERE SEX = 'F';								
(iii) SELECT AVG(PAY) FROM CLUB WHERE SPORTS = 'KARATE';								
(iv) SELECT SUM(PAY) FROM CLUB WHERE DATEOFAPP > '31/01/1998';								
6.	(i)	Which clause is used to remove duplicate rows of the table					(1)	
	(ii)	Give one point of difference between primary key and foreign key					(1)	
7.	Consider the table, <b>STUDENT</b> given below:						(2)	
Table: STUDENT								
No	Name	Stipend	Stream	AvgMark	Grade	Class		
1	Karan	400.00	Medical	78.5	B	12B		
2	Divakar	450.00	Comme rce	89.2	A	11C		
3	Divya	300.00	Comme rce	68.6	C	12C		
4	Arun	350.00	Humani ties	73.1	B	12C		

5	Sabina	500.00	Nonmedical	90.6	A	11A
6	John	400.00	Medical	75.4	B	12B

- (a) Write the degree and cardinality of the table STUDENT.  
 (b) Identify the attribute best suitable to be declared as primary key.

OR

ItemNo	ItemName	Scode	Quantity
2005	Notebook Classic	23	60
2003	Ball Pen 0.25	24	50
2002	Get Pen Premium	21	150
2006	Get Pen Classic	25	60
2001	Eraser Small	26	220

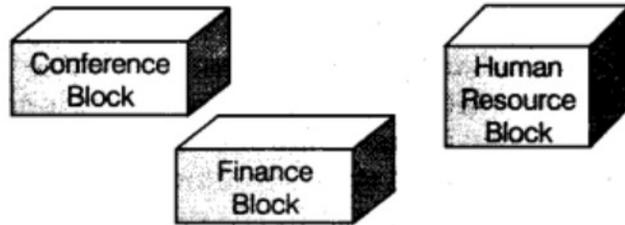
- a) Identify the candidate key(s) from the table INVENTORY.  
 b) Which command can be used to remove the table INVENTORY from the database HyStore.

**SECTION – B**  
**Each question carries 3 marks**

8. Nandu has created a dictionary containing countries and continent as key value pairs of 6 countries. Write a program, with separate user defined functions to perform the following operations: (3)
- Push the keys (name of the country) of the dictionary into a stack, where country belongs to continent "ASIA".
  - Pop and display the content of the stack.
- For example:  
 If the sample content of the dictionary is as follows:  
**R={"UK":"EUROPE", "INDIA":"ASIA", "CHINA":"ASIA", "EGYPT":"AFRICA", "CUBA":"AMERICA", "JAPAN":"ASIA"}**
- The output from the program should be:  
**JAPAN CHINA INDIA**
- OR
- Vaishnav has a list containing names of 10 cities. You need to help him create a program with separate user defined functions to perform the following operations based on this list.
- Traverse the content of the list and push those names which

		<p>are having more than 5 characters in it.</p> <ul style="list-style-type: none"> <li>Pop and display the content of the stack.</li> </ul> <p>For Example: If the sample Content of the list is as follows: <b>N=["Paris", "England", "Mumbai", "Delhi", "London"]</b></p> <p>Sample Output of the code should be: <b>London Mumbai England</b></p>																															
9	(i)	<p>A table, <b>medicalstore</b> has been created in a database with the following fields: <b>MedicineNo,MedicineName,MedCode,Quantity</b> Give the SQL command to add a new field, <b>PRICE</b>(of typeInteger) to the <b>medicalstore</b> table.</p>	(1)																														
	(ii)	<p>Define the following terms (a) Self Join (b) Natural Join</p>	(2)																														
10.		<p>An educational institution EducationPoint is considering to maintain their inventory using SQL to store the data. As a database administer, Ajay has decided that :</p> <ul style="list-style-type: none"> <li>Name of the database - EDUPOINT</li> <li>Name of the table - STUDENT</li> </ul> <p>The attributes of student are as follows:</p> <ul style="list-style-type: none"> <li>STUDENTID – numeric, primary key</li> <li>STUDNAME – character of size 30</li> <li>SCODE – character of size 10</li> <li>MARKS – numeric</li> </ul> <p>Help him to complete the task by suggesting appropriate SQL commands.</p>	(3)																														
<p><b>Section C</b> <b>Each question carries 4 marks</b></p>																																	
11		<p>Write SQL commands for the following queries (i) to (iv) based on the relations <b>Product</b> and <b>Client</b> given below:</p> <p>Product:</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>P_ID</th> <th>ProductName</th> <th>Manufacturer</th> <th>Price</th> <th>Discount</th> </tr> </thead> <tbody> <tr> <td>TP01</td> <td>Talcum Powder</td> <td>LAK</td> <td>40</td> <td></td> </tr> <tr> <td>FW05</td> <td>Face Wash</td> <td>ABC</td> <td>45</td> <td>5</td> </tr> <tr> <td>BS01</td> <td>Bath Soap</td> <td>ABC</td> <td>55</td> <td></td> </tr> <tr> <td>SH06</td> <td>Shampoo</td> <td>XYZ</td> <td>120</td> <td>10</td> </tr> <tr> <td>FW12</td> <td>Face Wash</td> <td>XYZ</td> <td>95</td> <td></td> </tr> </tbody> </table>	P_ID	ProductName	Manufacturer	Price	Discount	TP01	Talcum Powder	LAK	40		FW05	Face Wash	ABC	45	5	BS01	Bath Soap	ABC	55		SH06	Shampoo	XYZ	120	10	FW12	Face Wash	XYZ	95		(4)
P_ID	ProductName	Manufacturer	Price	Discount																													
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		Client :																									
		<table border="1"> <thead> <tr> <th>C_ID</th> <th>ClientName</th> <th>City</th> <th>P_ID</th> </tr> </thead> <tbody> <tr> <td>01</td> <td>Cosmetic Shop</td> <td>Delhi</td> <td>TP01</td> </tr> <tr> <td>02</td> <td>Total Health</td> <td>Mumbai</td> <td>FW05</td> </tr> <tr> <td>03</td> <td>Live Life</td> <td>Delhi</td> <td>BS01</td> </tr> <tr> <td>04</td> <td>Pretty Woman</td> <td>Delhi</td> <td>SH06</td> </tr> <tr> <td>05</td> <td>Dreams</td> <td>Delhi</td> <td>TP01</td> </tr> </tbody> </table>	C_ID	ClientName	City	P_ID	01	Cosmetic Shop	Delhi	TP01	02	Total Health	Mumbai	FW05	03	Live Life	Delhi	BS01	04	Pretty Woman	Delhi	SH06	05	Dreams	Delhi	TP01	
C_ID	ClientName	City	P_ID																								
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05	Dreams	Delhi	TP01																								
		<p>(i) Write SQL query to display ProductName and Price for all products whose Price is in the range of 50 to 150.</p> <p>(ii) Write SQL query to display details of product whose manufacturer is either XYZ or ABC</p> <p>(iii) Write SQL query to display ProductName, Manufacturer and Price for all products that are not given any discount.</p> <p>(iv) Write SQL query to display ClientName, City, and P_ID for all clients whose city is Delhi.</p>																									
12.	(i)	Give two advantages and two disadvantages of bus topology	(2)																								
		<b>OR</b>																									
		Define the following terms: <b>Protocols, Cookies</b>																									
	(ii)	Your friend wishes to install a wireless network in his office. Explain him the differences between guided and unguided media.	(2)																								
13		Tech Up Corporation (TUC) is a professional consultancy company. The company is planning to set-up their new offices in India with its hub at Hyderabad. As a network adviser, you have to understand their requirement and suggest to them the best available solutions	(4)																								



**Block to block distances (in m.)**

Block (From)	Block (To)	Distance
Human Resource	Conference	60
Human Resource	Finance	120
Conference	Finance	80

**Expected number of computers to be installed in each block**

Block	Computers
Human Resource	125
Finance	25
Conference	60

- a) What will the most appropriate block, where TUC should plan to install their server?
- b) Draw a block-to-block cable layout to connect all the buildings in the most appropriate manner for efficient communication.
- c) What will be the best possible connectivity out of the following, you will suggest to connect the new set-up of offices in Bangalore with its London based office?
- Infrared
  - Satellite Link
  - Ethernet Cable
- d) Which device will you suggest to connect each computer in each of the buildings?