



केंद्रीय विद्यालय संगठन, एर्नाकुलम क्षेत्र

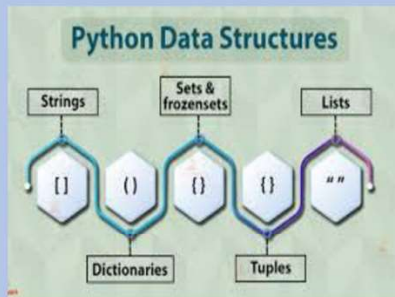
KENDRIYA VIDYALAYA SANGATHAN ERNAKULAM REGION

## STUDENT SUPPORT MATERIAL (TERM II)

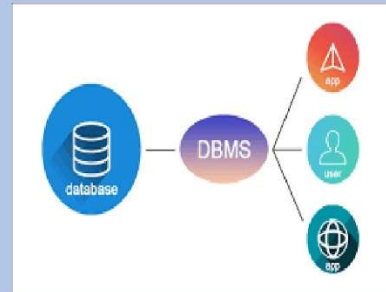
COMPUTER SCIENCE (083)

ACADEMIC YEAR 2021-22

DATA STRUCTURE & STACK



DBMS & SQL



COMPUTER NETWORKS





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KVSRO Ernakulam

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**F.31/Acad/KVS(EKM)**

**Dated: 01.11.2021**

**Message**

*I feel immense pleasure to publish the study material for class XII Computer Science (083). This support material is prepared incorporating all the recent changes in curriculum and assessment process made by CBSE. I am sure it will definitely be of great help to class XII students of all Kendriya Vidyalayas.*

*Getting acquainted with the latest changes will help students to prepare well for the board examination and enable students to face case based and Multiple-Choice Questions with confidence. This support material has been prepared by a team of dedicated and veteran teachers with expertise in their respective subjects.*

*The Support material contains all the important aspects required by the students- the design of question paper, term wise split up syllabus, summary of all the chapters, important formulas, Sample question papers, problem solving and Case study questions.*

*I hope that this Support Material will be used by students and teachers as well and will prove to be a good tool for quick revision.*

*I would like to express my sincere gratitude to the In-charge principal and all the teachers who have relentlessly worked for the preparation of this study material. Their enormous contribution in making this project successful is praiseworthy.*

*Meticulous planning blended with hard work, effective time management and sincerity will help the students to reach the pinnacle of success.*

*Wish you all the best*

  
( R. Senthil Kumar )

Sh. Jyothimohan N V  
Principal  
Kendriya Vidyalaya  
SAP Peroorkada



**KENDRIYA VIDYALAYA SANGATHAN**  
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# Computer Science

CLASS-XII  
Code No. 083  
2021-22

## 1. Prerequisites

Computer Science- Class XI

## 2. Learning Outcomes

Student should be able to

- use basic data structure: Stacks.
- explain basics of computer networks.
- use Database concepts, SQL along with connectivity between Python and SQL.

## 3. Distribution of Marks:

Unit No.	Unit Name	Marks	Periods	
			Theory	Practical
I	Computational Thinking and Programming - 2	40	50	25
II	Computer Networks	10	10	---
III	Database Management	20	20	15
	Total	70	80	40

Unit No	Unit Name	Term-1	Term-2
I	Computational Thinking and Programming - 2	35	5
II	Computer Networks	---	10
III	Database Management	---	20
	Total	35	35

## **Unit wise Syllabus: TERM 2:**

### **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 Language (XML), domain names, URL, website, web browser, web servers, web hosting

### **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

## 5. Practical

S.No		Marks (Total 30)	Term-2 (15 Marks)
1	<b>Lab Test:</b>  1. Python program	<b>8</b>	<b>2</b>
	2. 3 SQL Queries based on one/two table(s), 2 output questions based on SQL queries	<b>4</b>	<b>4</b>
2	Report file: Term – 1 : Minimum 15 Python programs based on Term - 1 Syllabus Term – 2 : <ul style="list-style-type: none"> <li>• Minimum 3 Python programs based on Term-2 Syllabus</li> <li>• SQL Queries – Minimum 5 sets using one table / two tables.</li> <li>• Minimum 2 programs based on Python - SQL connectivity.</li> </ul>	<b>7</b>	<b>3</b>
3	Project (using concepts learnt in Classes 11 and 12) Term – 1 : Synopsis of the project to be submitted by the students (documentation only, may not submit the code during Term - 1)  Term - 2 : Final coding + Viva voce (Student will be allowed to modify their Term 1 document and submit the final executable code.)	<b>8</b>	<b>5</b>
4	Viva voce	<b>3</b>	<b>1</b>



## 6. Suggested Practical List:

### Term-2 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.

### 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
- Similar exercise may be framed for other cases.
- Integrate SQL with Python by importing suitable module.

# DATA STRUCTURE

## INTRODUCTION

We know that computers store and process data with an extra ordinary speed and accuracy. So, it is highly essential that the data is stored efficiently and can be accessed fast. Also, the processing of data should happen in the smallest possible time but without losing the accuracy.

Data structures deal with how the data is organized and held in the memory when a program processes it.

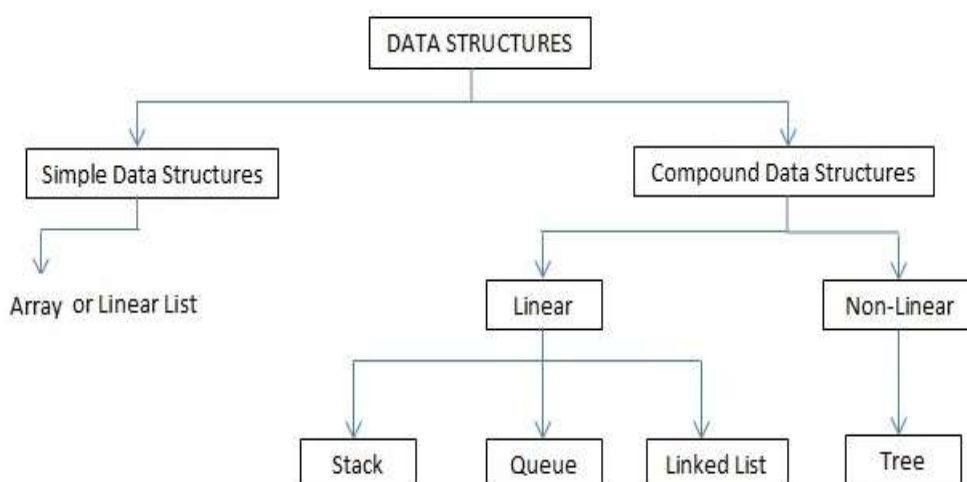
- Data structures are fundamental concepts of computer science which helps in writing efficient programs in any language.
- A data structure is a named group of data of different data types which is stored in a specific way and can be processed as a single unit.
- A data structure has well-defined operations, behavior and properties.

### Data type vs Data structure

- A data type defines a set of values along with well-defined operations stating its input-output behavior.
- A data structure is a physical implementation that clearly defines a way of storing, accessing, manipulating data stored in a data structure.

For example, List as a data type which can store heterogeneous data type of elements, but when implemented as data structure its behavior is clearly prescribed (searching, sorting etc.)

### Different Data Structures



## List

- Lists in Python are used to store collection of heterogeneous items.
- These are mutable, which means that you can change their content without changing their identity.
- You can recognize lists by their square brackets [ and ] that hold elements separated by a comma.
- Lists are built into Python: you do not need to invoke them separately.

## Stack

A stack is a container of objects that are inserted and removed according to the Last-In-First-Out (LIFO) concept.

- Think of a scenario where at a dinner party where there is a stack of plates, plates are always added or removed from the top of the pile.
- In computer science, this concept is used for evaluating expressions and syntax parsing, scheduling algorithms/routines, etc.



## Linear List

- A linear data structure is that those elements form a sequence.
- When elements of linear structure are homogeneous and are represented in memory by means of sequential memory locations, these linear structures are called arrays.
- Linear List size:  $\text{Length} = \text{UB} - \text{LB} + 1$

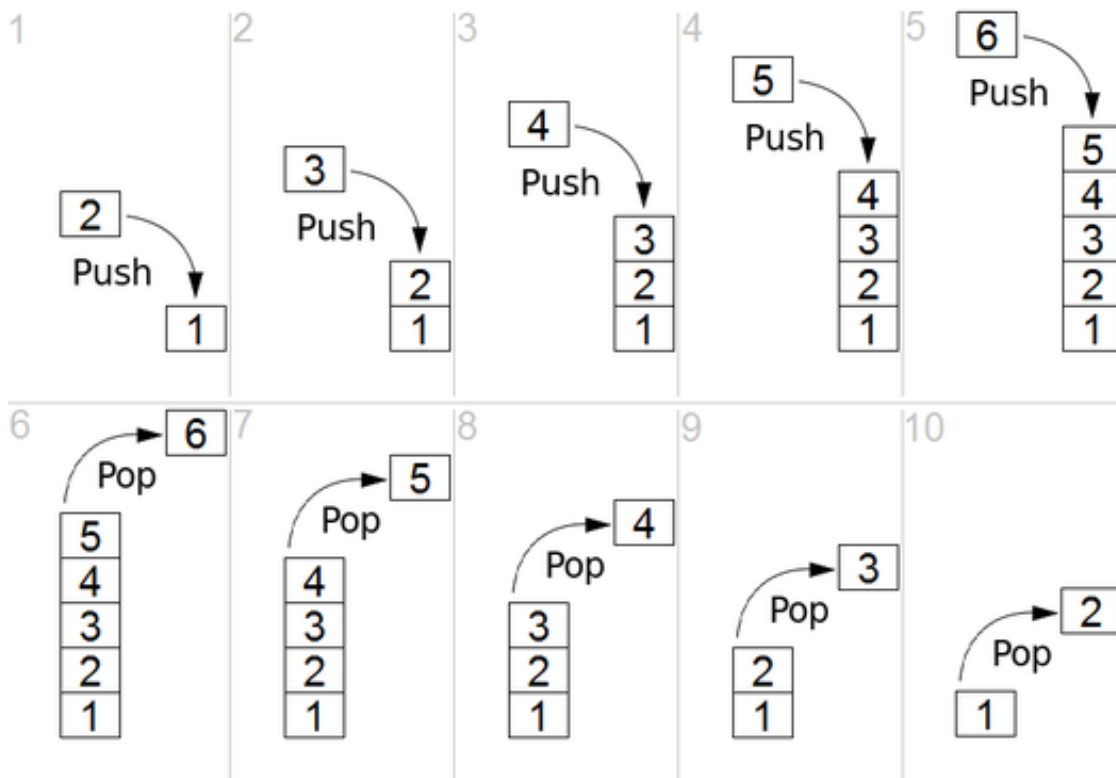
### Linear Search:

```
def Lsearch(ar,item):
    i=0
    while i<len(ar) and ar[i]!=item:
        i=i+1
    if i<len(ar):
        return i
    else:
        return Flase
N=int(input("Enter total numbers of the list"))
print("\nEnter elements for the list\n")
ar=[0]*N #initialize list of size N with zero
for i in range(N):
    ar[i]=int(input("Element"+str(i)+":"))
item=int(input("Enter element to be searched"))
index=Lsearch(ar,item)
if index:
    print("Element found at index", index+1)
else:
    print("Element not found")
```

## Stack

Stack is a linear/sequence structure in which insertion and deletion can take place only at one end, i.e., stack's top. Because of this, stack is called LIFO (Last in First out) data structure. For example, a pile of books, a stack of coins where you can remove only the top book or the coin placed at the top.

Working of Stack:



## Implementation of stack using list

- The implementation of stack using list in Python is the easiest of all programming language.
- Basic operations performed on stack are:

1. Creating a stack
2. Push/Adding elements to the stack
3. Checking for empty stack
4. Pop/Deleting elements from a stack
5. Traversal/Displaying a stack

## List methods used and Important things to remember

- 1) `list.append(element)` – It is used to implement push operations(used to append or add elements at the end of the list)
- 2) `list.pop()` –It is used to implement pop operations(removing elements at the end)

3)list[::-1]-List slicing is used to print the elements in the reverse order from top position to list[0]

4)top=len(list)-1 (length of list -1)

5)stack LIFO(Last In First Out)

6)Push and Pop through one end(Top)

### Implementation of List as Stack

```
s=[]
c="y"
while(c=="y"):
    print("1. PUSH")
    print("2. POP")
    print("3. DISPLAY")
    choice=int(input("Enter your choice"))
    if(choice==1):
        a=input("Enter any number: ")
        s.append(a)
    elif (choice==2):
        if(s==[]):
            print("Stack Empty")
        else:
            print("Element Deleted is :",s.pop())
    elif(choice==3):
        l=len(s)
        for i in range(l-1,-1,-1):
            print(s[i])
    else:
        print("Wrong Input")
    c=input("Do you want to continue?(y/n)")
```

### Applications of Stack

1. Reversing a word/line: This can be accomplished by pushing each character on to a stack as it is read. When the line is finished, characters are popped off the stack and they will come off in the reverse order.

2. The compilers use stacks to store the previous state of a program when a function is called during recursion.

3. Backtracking is a form of recursion. But it involves choosing only one option out of possibilities. Used in solving Puzzle Sudoku.

#### 4. Undo mechanism in Text editors by keeping all the text changes in a stack.

Menu based programme for stack:

```
S=[]
from os import system
def menu():#menu display
    ch=0
    while(ch<1 or ch>4):
        anyvar=system('cls')#print ("\n"*100)
        print ("\n\n\n\n\n\n")
        print ("\t\t\t1: PUSH")
        print ("\t\t\t2: POP")
        print ("\t\t\t3: DISPLAY")
        print ("\t\t\t4: EXIT")
        ch=int(input("\n\t\t\tEnter a choice (1-4):"))
    return ch
def push():#code to push an item
    item=int(input("\t\t\tEnter an item to push: "))
    S.append(item)
    print ("\t\t\tITEM " , item , " PUSHESD IN THE STACK")
def pop():#code to pop from stack
    if (S==[]):
        print ("\t\t\tNO ITEM TO POP")
    else:
        item=S.pop()
        print ("\t\t\tITEM " , item , " POPPED FROM THE STACK")
def display():#code to display stack
    if (S==[]):
        print ("\t\t\tEMPTY STACK")
    else:
        print ("\t\t\t")
        for i in S:
            print(i,',',end="")

#code to call all functions
import sys
ch=0
while(ch!=4):
    ch=menu()
    if(ch==1):
        push()
    elif(ch==2):
        pop()
    elif(ch==3):
        display()
    elif(ch==4):
        break
```

```
elif(ch==3):  
    display()  
elif(ch==4):  
    print ("\t\t\tABORTING PROGRAM.....")  
    sys.exit()
```

## SAMPLE QUESTIONS:

### I. MCQ/Very Short Answer Type Questions(1-mark)

1. Choose the correct output for the following stack operation(\* top position)

Push(5)  
Push(8)  
Pop()  
Push(2)  
Push(5)  
Pop()  
Push(1)

- (a) 8 5 2 5 1\*
- (b) 8 5 5 2 1\*
- (c) 2 5 5 1\*
- (d) 5 2 1\*

2. Which list method can be used to perform Push operation in a stack implemented by list?

- (a) append()
- (b) extend()
- (c) push()
- (d) insert()

3. Which list method can be used to perform Pop operation in a stack implemented by list?

- (a) pop()
- (b) pop(1)
- (c) remove()
- (d) pop(0)

4. Consider the following operation performed on a stack of size 3, What will be the output?  
(\* top position)

Push(10)  
Push(20)  
Push(30)  
Pop()  
Push(40)  
Push(50)

- (a) overflow
- (b) underflow
- (c) 10 20 30 40 50\*
- (d) 10 20 40 50\*



5. Based on the below given code, Write answer to the following questions i to v

```
#function definition
def push(colour,n):
    -----# statement1

#function calling
colour=[]
c=['red','blue','violet','white','black']
for i in range(0,len(c),2):
    .....# statement2
print(colour[::-1])
#function definition
def pop(colour):
    if .....#statement 3
        return "underflow"
    else:
        return .....#statement 4
#function calling
for i in range(len(colour)+1):
    print(.....)#statement 5
```

(i) Identify the suitable code for statement 1?

- a) colour.insert(len(colour),n)
- b) colour.append(len(colour),n)
- c) colour.append()
- d) colour.extend()

(ii) Identify the suitable code for statement 2?

- a) push(colour,c[i])
- b) push(colour)
- c) push(c[i])
- d) push(colour,i)

(iii) Identify the suitable code for statement 3?

- a) colour==[]:
- b) colour.isEmpty():
- c) len(colour)=0:
- d) None of the above

(iv) Fill in the statement to delete an element from the stack?

- a) colour.pop(1)
- b) colour.pop()
- c) del colour[1]
- d) colour.delete(1)

(v) Fill the statement 5, to call pop function

- a) pop(c)
- b) pop(colour)
- c) call pop(colour)
- d) def pop(colour)

6. What do you mean by Data Structure?
7. LIFO data structure is?
8. Can we have nested list?
9. Name one linear data structure.
10. Name one non-linear data structure.
11. Name the operation for insertion in a stack.
12. Name the operation for deletion from a stack.
13. Name the function to find length of a list.
14. Indexing in list starts from?

## II. Short Answer Type Questions(2-marks)

1. How is Data Structure different from Data Type?
2. Define Stack and Queue
3. Name some operations commonly performed on data structures?
4. What is a list?
5. What is traversing? Write python code to traverse a list.
6. Name the methods used for inserting and deleting elements from a list.
7. Write some applications of stack.

## III. Application based Short Answer Type Questions(2-marks)

1. Predict the output with respect to the list L=[40,20,30,10,50]
  - (a) print(L)
  - (b) print(len(L))
  - (c) L.pop() ;  
print(L)
  - (d) L.append(70);  
print(L)
  - (e) L.sort();  
print(L)
2. Find the output:
  - (a) secondlist=[1,2,3,[4,5,[6,7,8],9],10,11]  
print(len(secondlist))  
L=[1, 2, 3, [4, 5, [ 6, 7, 8 ], 9 ],10,11]
  - (b) L[1]
  - (c) L[3]
  - (d) L[3][1]
  - (e) L[3][2][0]
  - (f) L[3][2]
  - (g) L[3][2][1]
  - (h) L[3][3]

3. Predict the output:
- (a) `b=[[9,6],[4,5],[7,7]]`  
`X=b[:2]`  
`X.append(10)`  
`print(X)`
- (b) `b=[[9,6],[4,5],[7,7]]`  
`X=b[:2]`
- `X[1].append(10)`  
`print(X)`
4. Consider `STACK=['a','b','c','d']`. Write the `STACK` content after each operations:
- `STACK.pop()`
  - `STACK.append('e')`
  - `STACK.append('f')`
  - `STACK.pop()`
5. Write a program to implement a stack for the students(studentno, name). Just implement Push.
6. Write a program to implement a stack for the students(studentno, name). Just implement Pop and display.
7. If `L=["Python", "is", "a", ["modern", "programming"], "language", "that", "we", "use"]`, then find the output:
- `L[0][0]`
  - `L[3][0][2]`
  - `L[3:4][0]`
  - `L[3:4][0][1]`
  - `L[3:4][0][1][3]`
  - `L[0:9][0]`
  - `L[0:9][0][3]`
  - `L[3:4][1]`
8. What is the difference between `pop()` and `pop(0)`?

#### IV Long Answer Type Questions (3-marks)

- Write a program for linear search in a list.
- Write a program for bubble sort.
- Write `PushOn(Book)` and `Pop(Book)` methods/functions in Python to add a new Book and delete a Book from a list of Book titles, considering them to act as push and pop operations of the Stack data structure.

- Write functions in python for performing stack operations implemented by using list and also write a function for the menu driven operations to implement all the stack operations? (Hint: Use global variables)
- Write a function in python to perform Push Operation in a stack implemented by using list. Maximum size of the stack can be input by the user along with original stack and also display the top position and stack elements after push operation.

```
>>> li=[3,4,5]
>>> push(li,5)
enter the element:20
Top position after Push operation: 3
stack after Push operation: [20, 5, 4, 3]
```

- Write a function in python to perform Pop Operation in a stack implemented by using list. Print the element deleted, top position and also display the stack elements before and after the pop operation?

```
>>> li=[20,5,4,3]
>>> pop(li)
Original stack [3, 4, 5, 20]
Top position: 3
Deleted element 3
stack after Pop Operation: [4, 5, 20]
```

- Write a function in python to display elements of a stack implemented by using list. Use both traditional and python methods. Print stack empty message, if elements are not there.

```
>>> li=[20,5,4,3]
>>> display(li)
Stack elements: [3, 4, 5, 20]
>>> displaytraditional(li)
Stack elements:
3 4 5 20
>>> l2=[]
>>> display(l2)
Stack empty
```

- Write a function in Python PUSH(Arr), where Arr is a list of numbers, from this list push all even numbers into a stack implemented by using a list. Display the stack if it has at least one element, otherwise display "stack empty" message.

```
>>> li=[1,6,89,100,25,29]
>>> push(li)
The item 1 can't be inserted because it is not an even number
The item 89 can't be inserted because it is not an even number
The item 25 can't be inserted because it is not an even number
The item 29 can't be inserted because it is not an even number
```

Stack elements after push operation : [100, 6]

9. Write a function in Python PUSH(mydict,maxsize=5),where mydict is a dictionary of phone book(name and mobile numbers), from this dictionary push all phone numbers to a stack implemented by using list and also the display the numbers that Display the stack if it has at least one element, otherwise display “stack empty” message

```
>>>mydict={1234567890:"Shyam",94567892:"Ram",8657456789012:
"Karun",9674123789:"Tharun"}
>>> push(mydict)
```

Stack elements after push operation :

```
[[1234567890, 94567892, 8657456789012, 9674123789]]
```

10. Write a function in Python PUSH(mydict),where mydict is a dictionary of phone book(name and mobile numbers), from this dictionary push only phone numbers having last digit is greater than 5 to a stack implemented by using list and also display the stack if it has at least one element, otherwise display “stack empty” message.

```
>>> mydict={9446789123:"Ram",8889912345:"Sam",7789012367:"Sree"}
>>> push(mydict)
```

Phone number: 9446789123 last digit is less than five which can't be pushed  
Stack elements after push operation : [7789012367, 8889912345]

11. Write a function in Python PUSH(mydict),where mydict is a dictionary of phone book(name and mobile numbers), from this dictionary push only phone numbers having 10 digits into a stack implemented by using list . Display the stack if it has at least one element, otherwise display “stack empty” message.

```
>>>mydict={1234567890:"Shyam",94567892:"Ram",8657456789012:"Karun",
9674123789:"Tharun"}
```

```
>>> push(mydict)
```

Digit of phone number 8

Phone number: 94567892 doesn't have 10 digits,which can't be pushed

Digit of phone number 13

Phone number: 8657456789012 doesn't have 10 digits,which can't be pushed

Stack elements after push operation : [9674123789, 1234567890]

12. Write a function in Python PUSH(Arr),where Arr is a list of numbers, From this list push all numbers divisible by 5 in to a stack implemented by using a list. Display the stack if it has at least one element, otherwise display appropriate error message.

```
>>> li=[10,2,5,6,15,30]
```

```
>>> push(li)
```

The item 2 can't be inserted because it is not divisible by 5

The item 6 can't be inserted because it is not divisible by 5

Stack elements: [30, 15, 5, 10]

13. Write a function in Python POP(Arr),where Arr is a stack implemented by a list of numbers. The function returns the value deleted from the stack and stack status after pop operation.

```
>>> li=[10,20,30,40,50]
```

```
>>> dele,st=pop(li)
Original stack [50, 40, 30, 20, 10]
>>> print("Element deleted=",dele,"Stack after deletion",st[::-1])
Element deleted= 50 Stack after deletion [40, 30, 20, 10]
    Or
>>> pop(li)
Original stack [40, 30, 20, 10]
(40, [10, 20, 30])
```

## ANSWER KEY

### I. MCQ/Very Short Answer Type Questions(1-mark)

1.(d) 5 2 1\*

2. (a) append()

3. (a) pop()

4. (a) overflow

5.

(i). a colour.insert(len(colour),n)

(ii). a push(colour,c[i])

(iii).a colour==[]

(iv). b colour.pop()

(v). b pop(colour)

6. Data Structure means organization of data. A data structure has well defined operations or behavior.

7.STACK

8.Yes

9. Lists

10.Graphs

11 PUSH

12.POP

13.len()

14.0

### II. Short Answer Type Questions(2-marks)

1. Data Structure provides information regarding organization of data whereas Data Type provides information regarding the domain of values and operations that can be performed on data.

2. Stack – A stack is a linear list also known as LIFO list with the special property that items can be added or removed from only one end called the top.

Queue – A queue is a linear list also known as FIFO list with the special property that items can be added at one end and removed from the other.

3. Traversal, Insertion, Deletion, Searching, Sorting, Merging etc.

4. A list is a mutable sequence of data elements indexed by their position. A list is represented using []. e.g L=[10,20,30]

5.Traversing means accessing or visiting or processing each element of any data structure.

L=[10,20,30,40,50]

for x in L :

    print(x)

6. Various methods for inserting elements in a list are - insert(), append(), extend() and methods used for deleting items from a list are - pop() , remove(), clear()

7. Reversing a string, compilers use stack to store previous state of program, undo mechanism in text editors and backtracking.

### III. Application based Short Answer Type Questions(2-marks)

1. (a) Ans: [40, 20, 30, 10, 50]

(b) Ans: 5

(c) Ans:50

[40, 20, 30, 10]

(d) Ans: [40, 20, 30, 10, 70]

(e) Ans: [10, 20, 30, 40, 70]

2. (a) Ans:6

(b) Ans: 2

(c) Ans:[4, 5, [6, 7, 8], 9]

(d) Ans:5

(e) Ans:6

(f) Ans: [6, 7, 8]

(g) Ans:7

(h) Ans:9

3. (a) Ans: [[9, 6], [4, 5], 10]

(b) Ans: [[9, 6], [4, 5, 10]]

4. Ans: ['a', 'b', 'c']

Ans: ['a', 'b', 'c', 'e']

Ans: ['a', 'b', 'c', 'e', 'f']

Ans: ['a', 'b', 'c', 'e']

5. Ans: Program for push operation in a stack

```
stk=[]
```

```
top=-1
```

```
def PUSH(stk,student):
```

```
    stk.append(student)
```

```
    top=len(stk)-1
```

```
sno=int(input("Enter student No:"))
```

```
sn=input("Enter student Name:")
```

```
data=[sno,sn]
```

```
PUSH(stk,data)
```

6. Ans: Program for pop and display operation in a stack

```
stk=[1,2,3,4]
```

```
top=len(stk)-1
```



```

def POP():
    global top
    if(top==--1):
        print("NO STUDENT DATA, Stack Empty")
    else:
        print("Element popped:", stk.pop())
        top=len(stk)-1
def display():
    global top
    if(top==--1):
        print("NO STUDENT DATA")
    else:
        print("Elements in stack")
        for i in range(top,-1,-1):
            print(stk[i])
POP()
display()

```

7. (a) Ans: 'P'  
 (b) Ans: 'd'  
 (c) Ans: ['modern', 'programming']  
 (d) Ans: 'programming'  
 (e) Ans: 'g'  
 (f) Ans: 'Python'  
 (g) Ans: 'h'  
 (h) Ans: IndexError: list index out of range
8. Ans: pop() will delete the last element of a list whereas pop(0) will delete element at index zero of a list

#### IV Long Answer Type Questions (3-marks)

- 1.
- ```

L=eval(input("Enter the elements: "))
n=len(L)
item=eval(input("Enter the element that you want to search : "))
for i in range(n):
    if L[i]==item:
        print("Element found at the position :", i+1)
        break
else:
    print("Element not Found")

```

2.

```
L=eval(input("Enter the elements:"))
n=len(L)
for p in range(0,n-1):
    for i in range(0,n-p-1):
        if L[i]>L[i+1]:
            t=L[i]
            L[i]=L[i+1]
            L[i+1]=t
print("The sorted list is : ", L)
```

3.

```
def PushOn(Book):
    a=input('enter book title :')
    Book.append(a)
def Pop(Book):
    if (Book ==[]):
        print("Stack empty")
    else:
        print("Deleted element :")
        print(Book.pop())
```

4# declaration of global variables

```
stack=list()
maxsize=5
# 1.Push operation
def push(ele):
    top=len(stack)-1
    if(top==maxsize-1):
        print("Overflow")
    else:
        stack.append(ele)
```

# 2.Pop operation

```
def pop():
    top=len(stack)-1
    if(top== -1):
        print("Underflow")
    else:
        print("Deleted element",stack.pop())
```

# 3.Display operation

```
def display():
    if(stack==[]):
        print("Stack empty")
    else:
        print("Stack elements",stack[::-1])
```

# 4.Menu operations @ \_\_main\_\_

```
def mainfun():
    option=True
    while(option==True):
        print("Menu-Stack Operations")
```

```

print("1: Push")
print("2: Pop")
print("3: Display")
choice=int(input("Enter your choice"))
if choice ==1:
    ele=int(input("Enter the element"))
    push(ele)
elif(choice==2):
    pop()
elif(choice==3):
    display()
else:
    print("Wrong Choice")
option=input("Press any key to continue/Press No to exit")
if(option.upper()=="NO"):
    option=False
else:
    option=True

```

```

# 5.function calling statement
mainfun()

```

#### 5. #Stack operation-Push

```

def push(stack,maxsize=5):
    ele=int(input("enter the element:"))
    top=len(stack)-1
    if(top==maxsize-1):
        print("Overflow")
    else:
        stack.append(ele)
        top=top+1
    print("Top position after Push operation:",top)
    print("stack after Push operation:",stack[::-1])

```

#### 6. #stack operation-Pop

```

def pop(stack):
    top=len(stack)-1
    print("Original stack",stack[::-1])
    if(top== -1):
        print("Underflow")
    else:
        print("Top position:",top)
        print("Deleted element",stack.pop())
        print("stack after Pop Operation:",stack[::-1])

```

#### 7. #Display operation-Python style

```

def display(stack):
    if(stack==[]):

```

```

    print("Stack empty")
else:
    print("Stack elements:",stack[::-1])

#Display operation-Traditional style
def displaytraditional(stack):
    top=len(stack)-1
    if(top== -1):
        print("Stack empty")
    else:
        print("Stack elements:")
        for i in range(top,-1,-1):
            print(stack[i],end=" ")

```

8.

```

def push(Arr):
    stack=list()
    maxsize=5
    for ele in Arr:
        top=len(stack)-1
        if(top==maxsize-1):
            print("Overflow")
        elif(ele%2==0):
            stack.append(ele)
        else:
            print("The item",ele," can't be inserted because it is not an even number")

    if(stack==[]):
        print("Stack empty")
    else:
        print("Stack elements after push operation :",stack[::-1])

```

9.

```

def push(mydict,maxsize=5):
    stack=list()
    phonebook=list(mydict)
    top=len(stack)-1
    if(top==maxsize-1):
        print("Overflow")
    else:
        stack.append(phonebook)

    if(stack==[]):
        print("Stack empty")
    else:
        print("Stack elements after push operation :",stack[::-1])

```

10.

```

def push(mydict):
    stack=list()
    maxsize=5

```

```

phonebook=list(mydict.keys())
for mob in phonebook:
    lastdig=mob%10
    top=len(stack)-1
    if(top==maxsize-1):
        print("Overflow")
    elif(lastdig>=5):
        stack.append(mob)
    else:
        print("Phone number:",mob,"last digit is less than five which can't be pushed")

if(stack==[]):
    print("Stack empty")
else:
    print("Stack elements after push operation :",stack[::-1])

```

11.

```

def push(mydict):
    stack=list()
    maxsize=5
    phonebook=list(mydict.keys())
    for mob in phonebook:
        l=len(str(mob))
        top=len(stack)-1
        if(top==maxsize-1):
            print("Overflow")
        elif(l==10):
            stack.append(mob)
        else:
            print("Digit of phone number",l)
            print("Phone number:",mob,"doesn't have 10 digits,which can't be pushed")

if(stack==[]):
    print("Stack empty")
else:
    print("Stack elements after push operation :",stack[::-1])

```

12.

```

def push(Arr):
    stack=list()
    maxsize=5
    for ele in Arr:
        top=len(stack)-1
        if(top==maxsize-1):
            print("Overflow")
        elif(ele%5==0):
            stack.append(ele)
        else:
            print("The item",ele," can't be inserted because it is not divisible by 5")

if(stack==[]):

```

```
    print("Stack empty")
else:
    print("Stack elements:",stack[::-1])
```

### 13. #stack Operation-Pop

#Function returns the element deleted and the stack status after pop operation

```
def pop(stack):
    print("Original stack",stack[::-1])
    if(stack==[]):
        print("Underflow")
    else:
        return stack.pop(),stack[::-1])
```

# COMPUTER NETWORKS AND DATA COMMUNICATION

## INTRODUCTION

We are living in a connected world. Information is being produced, exchanged, and traced across the globe in real time. It's possible as almost everyone and everything in the digital world is interconnected through one way or the other.

A group of two or more similar things or people interconnected with each other is called network. Some of the examples of network in our everyday life includes:

- Social network
- Mobile network
- Network of computers
- Airlines, railway, banks, hospitals networks

What is Computer Network?

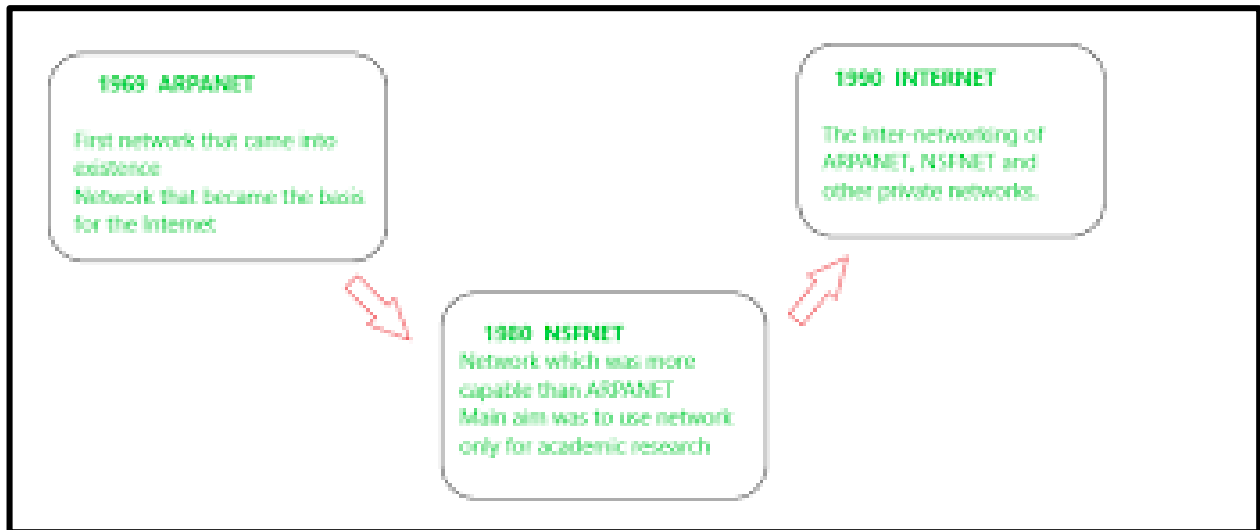
A Computer network is an interconnection among two or more computers or computing devices. Such interconnection allows computers to share data and resources among each other. Resources such as files, applications, printers and software are common information shared in a networking.



The advantage of networking is

- Resource Sharing
- Collaborative Interaction
- Cost Saving
- Increased storage
- Time Saving

Evolution of Network:



### (I) ARPANET (Advanced Research Project Agency Network)

- It came into existence in 1960s
- A project for interconnecting, US department of defense with academic and research organization across different places for scientific collaboration.

### (II) NSFNET (National Science Foundation Networks)

- It came into existence in 1986
- It was the first large-scale implementation of Internet technologies in a complex environment of many independently operated networks

### (III) INTRA NET

- It is a local or restricted communication system
- It is managed by a person or organization.
- Intranet users can avail services from internet but Internet user cannot access intranet directly

### (III) INTER NET

- It came into existence in 1960s
- It is known as Network of Networks
- A global computer network providing variety of information and communication facilities consisting of interconnected networks using standardized communication protocols.

## DATA COMMUNICATION TERMINOLOGIES

### DATA

Data means information in digital form which is stored processed and exchanged between digital devices like computer, mobile phones or laptop.

Data can be text, image, audio, video or multimedia files.



Computers stores raw data and process these data into meaningful information. Hence, we can define Information as processed data.



## COMMUNICATION

The exchange of information between two or more networked or interconnected devices is called communication. These devices must be capable of sending /receiving data over a communication medium.

## COMPONENTS OF DATA COMMUNICATION

The five main components of data communication are as follows:

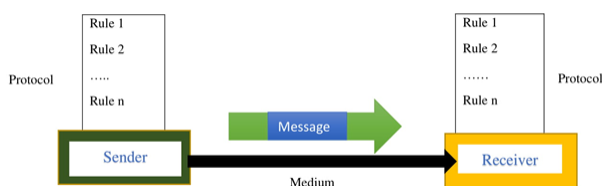
**SENDER:** Sender is a device which is capable of sending data over a communication network. In data communication Sender is also called Source.

**RECEIVER:** Receiver is a device which is capable of receiving data over a communication network. In data communication Receiver is also called Destination.

**MESSAGE:** message is the information being exchanged between a sender and a receiver over a communication network.

**COMMUNICATION MEDIUM:** Communication medium is the path or channel through which the information is moved from the sender to the receiver. A communication medium can be either wired/guided or wireless/unguided.

**PROTOCOLS:** The set of standard rules which are followed in data communication are known as Data Communication Protocols. All the communicating devices like sender receiver and other connected devices in the network should follow these protocols.



### Why Protocols are needed?

The communicating devices may be in different geographical areas. The speed of these devices may be different. Also, the data transfer rates of different networks may be different. These complexities make it necessary to have a common set of rules to ensure the secure communication of data.

Examples of some commonly used Protocols in data communication are given below:

- Transmission Control Protocol (TCP)
- Internet Protocol (IP)

- File Transfer Protocol (FTP)
- Simple Mail Transport Protocol (SMTP)
- Hyper Text Transfer Protocol (HTTP)

## MEASURING CAPACITY OF COMMUNICATION MEDIA

Capacity of a communication channel means the maximum quantity of signals that a communication channel can carry. The capacity of a communication medium is measured by its bandwidth and data transfer rate.

### BANDWIDTH

Bandwidth is the difference between the highest and lowest frequencies a transmission media can carry.

The unit of bandwidth is Hertz.

### DATA TRANSFER RATES

Data transfer rate is the number of bits transmitted through a channel per unit of time. Data transfer rate is measured in bits per second (bps). It is also measured in Kilobits per second (Kbps), Megabits per second (Mbps) or Gigabits per second (Gbps).

### IP ADDRESS

IP address or Internet Protocol address is a unique numeric address assigned to every device connected to a network. It uniquely identifies every node connected to a local network or internet.

An IP address allows computers to send and receive data over the internet. They can also be used to track down a user's physical location.

There are two versions for IP address IPV4 and IPV6. IP addresses are binary numbers but are typically expressed in decimal form (IPv4) or hexadecimal form (IPv6) to make reading and using them easily.

The commonly used IP address is IPV4. An IPv4 address consists of four numbers, each of which contains one to three digits, with a single dot (.) separating each set of digits. Each of the four numbers can range from 0 to 255.

Example IP address:

24.171.248.170

### SWITCHING TECHNIQUES

In large networks, there may be more than one paths for transmitting data from sender to receiver. The process of selecting a path of data out of the available paths is called switching. There are two popular switching techniques – circuit switching and packet switching.

## 1. Circuit Switching

In circuit switching, whenever a source end node wants to send a message to the destination end node a physical link is first established between the source and the destination. Then only the data transmission takes place. After the complete transmission of data this physical link is terminated.

Simple example of a circuit switching is telephone network in which a person calls another person. When the call receiving person receives the call, then only the connection is established. Then the message is conveyed and finally the connection is terminated.

Advantages:

1. Since a dedicated communication channel is set up before communicating the message, the data transmission is reliable and is suitable for long and continuous communication.
2. Circuit switching uses fixed bandwidth as well as data rates.
3. As the data is communicated continuously, no need of sequencing or re ordering it at the receiving end.

Disadvantages:

1. time required to setup a physical connection between the sender and the receiver makes delay in communication
2. Since a communication channel is dedicated for a particular transmission, it cannot be utilized for other communication, even if the channel is free.
3. More expensive since connection has to be established every time before communication.

## 2. Packet Switching

In the packet switching technique, the whole message is split into small packets. Now, these packets are transmitted one by one from sender to the receiver through the intermediary switches in the network. The packets will take shortest path as possible.

Every packet will have a sequence number in order to identify their order at the receiving end. The packets will also contain information like source address, intermediate node address, destination address etc.

Advantages:

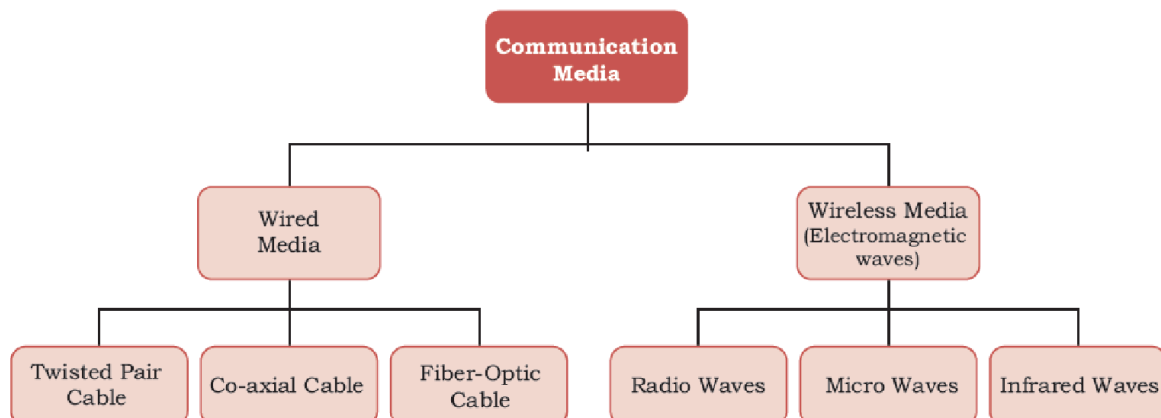
1. Packet switching is effective type of data transmission technique as it effectively utilizes the communication channel. Multiple users can share the channel simultaneously utilizing the bandwidth effectively.
2. It is cost effective and easy to implement compared to circuit switching.
3. As the messages are sent as small sized packets, the data transmission is quick and easy.

### Disadvantages:

1. In packet switching the movement of packets may not be in correct order. Hence it is not suitable for voice communication.
2. Unorganized movement of packets makes it necessary to implement proper sequencing and reordering techniques.
3. As the packets flow through multiple paths from the source to the destination, complex security protocols are required to ensure reliable communication.

## TRANSMISSION MEDIA

- A transmission medium can be anything that can carry signals or data between the source (transmitter) and destination (receiver).
- In data communication, transmission media are the links that carry messages between two or more communicating devices.
- Transmission can be classified as guided or unguided.
- In guided transmission, there is a physical link made of wire/cable through which data in terms of signals are propagated between the nodes. These are usually metallic cable, fiber-optic cable, etc. They are also known as wired media.
- In unguided transmission, data travels in air in terms of electromagnetic waves using an antenna. They are also known as wireless media.



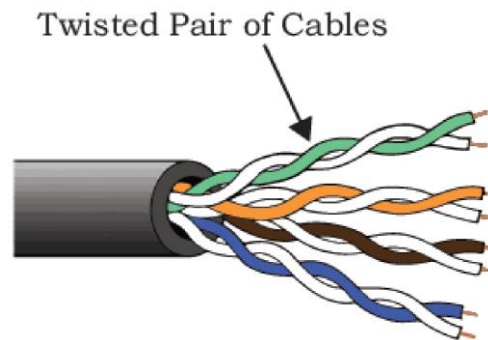
### Wired Transmission Media

- Any physical link that can carry data in the form of signals belongs to the category of wired transmission media.
- Three commonly used guided/wired media for data transmission are, twisted pair, coaxial cable, and fiber optic cable.

- Twisted-pair and coaxial cable carry the electric signals whereas the optical fiber cable carries the light signals.

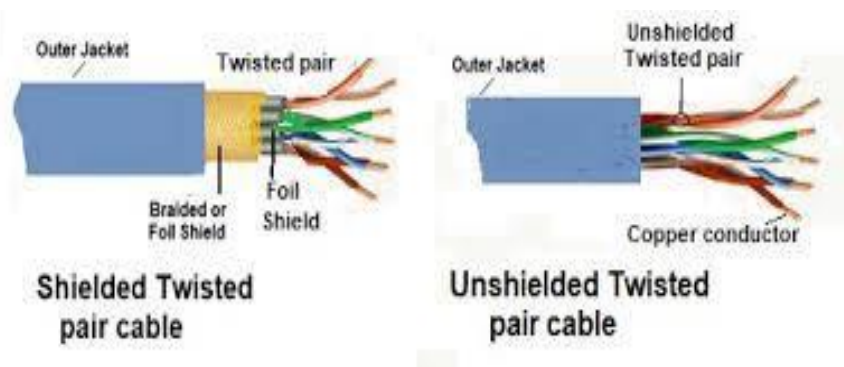
### (A) Twisted Pair Cable

- A twisted-pair consists of two copper wires twisted like a DNA helical structure.
- Both the copper wires are insulated with plastic covers.
- Usually, a number of such pairs are combined together and covered with a protective outer wrapping.



- The use of twisted configuration minimises the effect of electrical interference from similar pairs close by.

These cables are of two types: Unshielded twisted-pair (UTP) and Shielded twisted-pair (STP).



#### ✓ *Advantages:*

- ✓ It is low-cost, low-weight and flexible cables.
- ✓ It is easy to install and maintain and requires RJ-45 Connector.

#### ✓ *Disadvantages:*

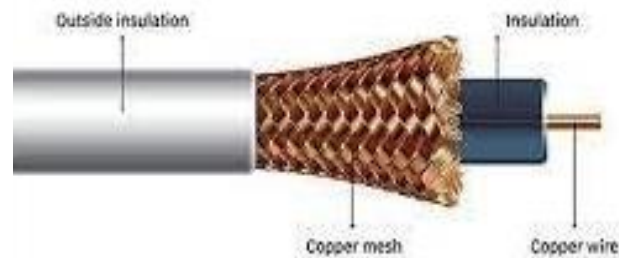
- ✓ Suitable for short distance (up to 100 mt.). For long distance Repeater is required.
- ✓ It supports low bandwidth and offers up to 100 Mbps speed.

### (B) Coaxial cable

- Coaxial cable has a copper wire at the core of the cable which is surrounded with insulating material. The insulator is further surrounded with an outer conductor (usually a copper mesh). This outer conductor is wrapped in a plastic cover.

- The shielded design allows the cable's copper core to transmit data quickly, without interference of environmental factors.
- These types of cables are used to carry signals of higher frequencies to a longer distance.
- It is better shielded and has more bandwidth than a twisted pair.

### Coaxial cable



#### ✓ *Advantages:*

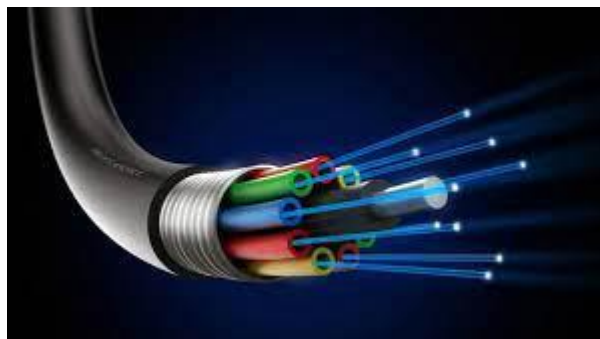
- ✓ It offers high bandwidth and carry data for a long distance (185-500 m)
- ✓ Suitable for Broadband transmission (cable TV) and can be used in shared cable network.

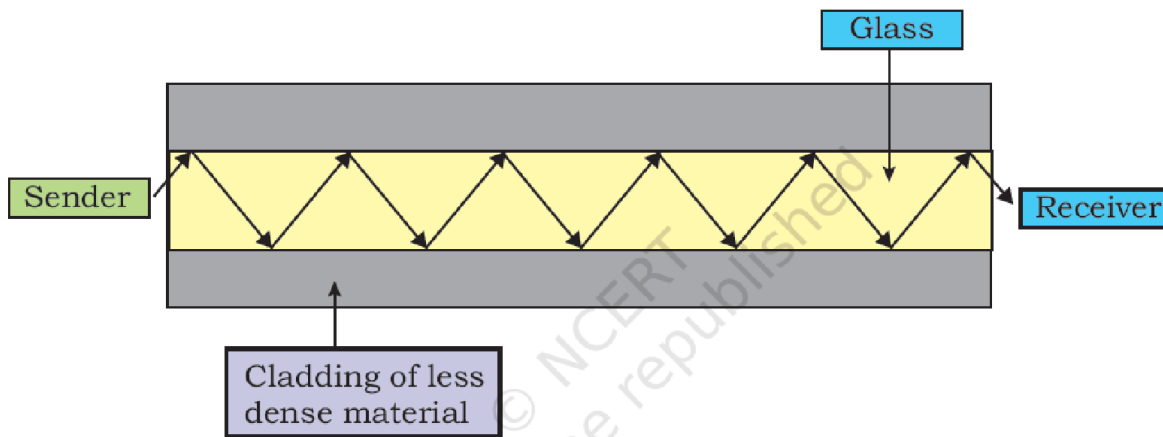
#### ✓ *Disadvantages:*

- ✓ It is less flexible and expensive compared to Twisted Pair cable.
- ✓ Not compatible with modern cables like Twisted pair cable.

### *(C) Optical Fibre*

- The optical fiber cable carries data as light, which travels inside a thin fiber of glass.
- Optic fiber uses refraction to direct the light through the media.
- A thin transparent strand of glass at the centre is covered with a layer of less dense glass called cladding. This whole arrangement is covered with an outer jacket made of PVC or Teflon.
- These cables are of light weight and have higher bandwidth which means higher data transfer rate.





✓ **Advantages:**

- ✓ It is free from Electro-Magnetic Interference (EMI), since no Electrical signal are carried.
- ✓ Offers secure and high speed transmission up to a long distance.

✓ **Disadvantages:**

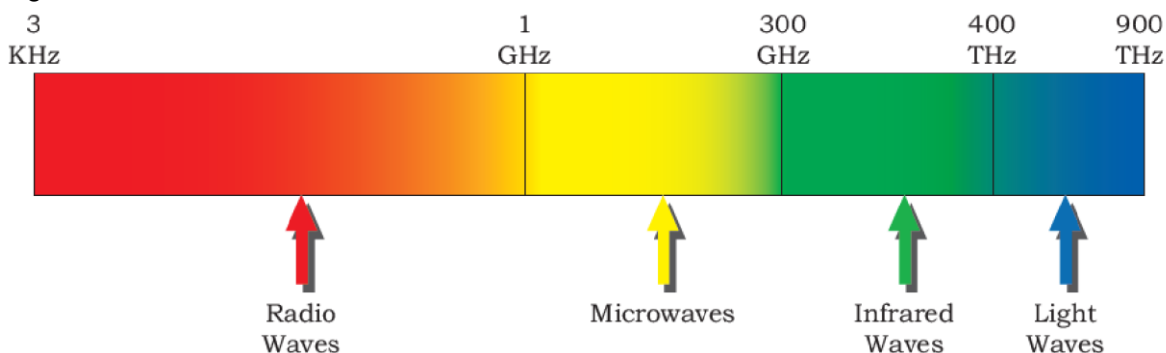
- ✓ Expensive and quite fragile (breakable).
- ✓ They are unidirectional
- ✓ Complicated Installation procedure and difficult to join two broken fiber.
- ✓ Not suitable for domestic purposes due to high maintenance cost.

### Wireless Transmission Media

- In wireless communication technology, information travels in the form of electromagnetic signals through air.
- Electromagnetic spectrum of frequency ranging from 3 KHz to 900 THz is available for wireless communication.
- Wireless technologies allow communication between two or more devices in short to long distance without requiring any physical media.

There are many types of wireless communication technologies such as Bluetooth, WiFi, WiMax etc.

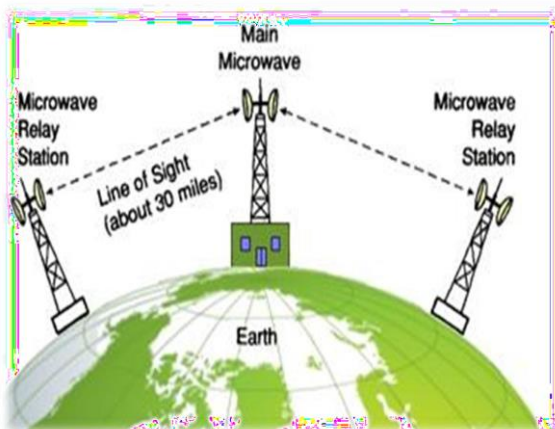
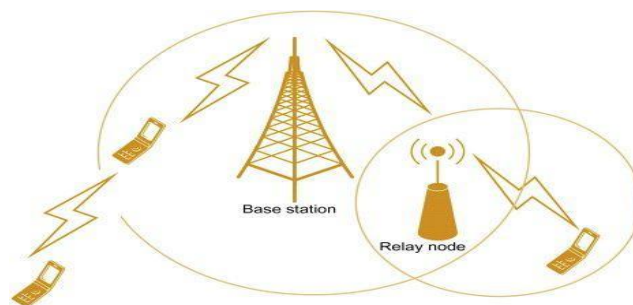
The electromagnetic spectrum range (3KHz to 900THz) can be divided into 4 categories ( Radio waves, Microwaves, Infrared waves and Visible or Light waves) according to their frequency ranges.



## Classification of transmission waves and their properties

| Transmission Waves | Properties                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Radio Waves        | <ol style="list-style-type: none"> <li>1. Waves of frequency range 3 KHz - 1 GHz</li> <li>2. Omni-directional, these waves can move in all directions</li> <li>3. Radio waves of frequency 300KHz-30MHz can travel long distance</li> <li>4. Susceptible to interference</li> <li>5. Radio waves of frequency 3-300KHz can penetrate walls</li> <li>6. These waves are used in AM and FM radio, television, cordless phones.</li> </ol>                                                                                                         |
| Microwaves         | <ol style="list-style-type: none"> <li>1. Electromagnetic waves of frequency range 1GHz - 300GHz.</li> <li>2. Unidirectional, can move in only one direction.</li> <li>3. Cannot penetrate solid objects such as walls, hills or mountains.</li> <li>4. Needs line-of-sight propagation i.e. both communicating antenna must be in the direction of each other.</li> <li>5. Used in point-to-point communication or unicast communication such as radar and satellite.</li> <li>6. Provide very large information-carrying capacity.</li> </ol> |
| Infrared waves     | <ol style="list-style-type: none"> <li>1. Electromagnetic waves of frequency range 300GHz - 400THz.</li> <li>2. Very high frequency waves.</li> <li>3. Cannot penetrate solid objects such as walls.</li> <li>4. Used for short-distance point-to-point communication such as mobile-to-mobile, mobile-to-printer, remote-control-to-TV, and Bluetooth-enabled devices to other devices like mouse, keyboards etc.</li> </ol>                                                                                                                   |

### Radio wave transmission



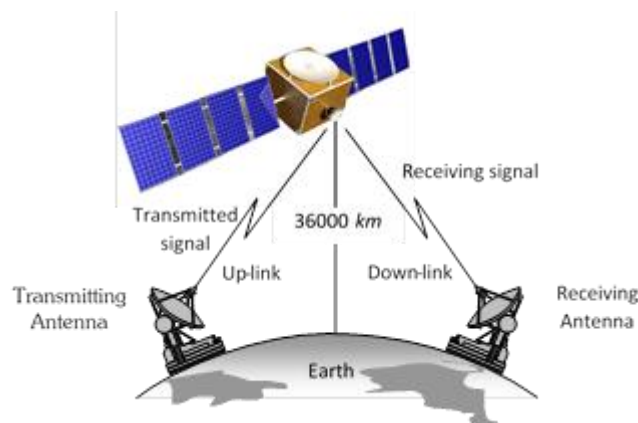


## Bluetooth



- Bluetooth is used to establish a small network across handheld devices like a cell phone and Bluetooth enabled Computer.
- It uses 2. Bluetooth is a wireless technology for creating personal networks operating within a range of 10 meters.
- 4 GHz unlicensed band.
- Bluetooth is a communications protocol standard primarily designed for low power consumption, with a short range.

## Satellite link



The satellite transmission is also a kind of line of sight transmission that is used to transmit signals throughout the world.

### ✓ Advantages:

- ✓ Area covered is quite large.
- ✓ No line of sight restrictions such as natural mountains, tall building, towers etc.
- ✓ Earth station which receives the signals can be fixed position or relatively mobile.

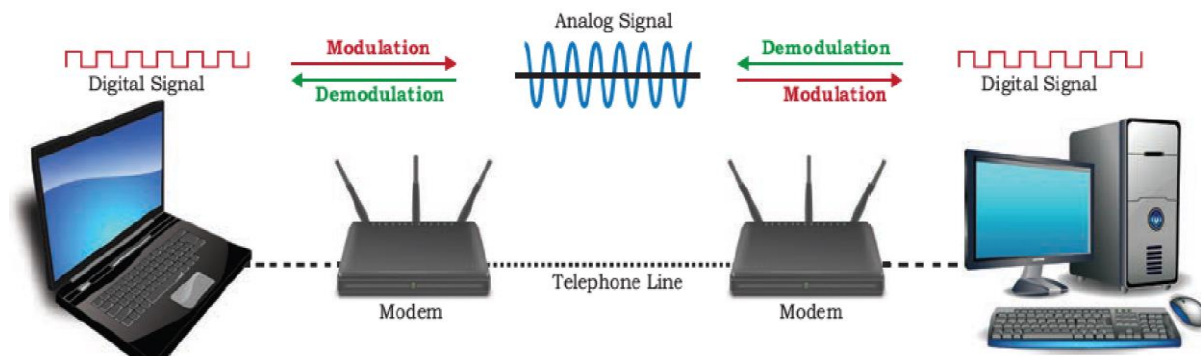
### ✓ Disadvantages:-

- ✓ Very expensive as compared to other transmission mediums.
- ✓ Installation is extremely complex.
- ✓ Signals sent to the stations can be tampered by external interference.

## Network Devices

To communicate data through different transmission media and to configure networks with different functionality, we require different devices like Modem, Hub, Switch, Repeater, Router, Gateway, etc.

### Modem



- Modem stands for 'MOdulator DEModulator'.
- It refers to a device used for conversion between analog signals and digital bits.
- It is used to transmit data from a sender to a receiver, or while browsing the internet, digital data are converted to an analog signal and the medium (be it free-space or a physical media) carries the signal to the receiver.
- There are modems connected to both the source and destination nodes.
- The modem at the sender's end acts as a modulator that converts the digital data into analog signals.
- The modem at the receiver's end acts as a demodulator that converts the analog signals into digital data for the destination node to understand.

### Ethernet Card



- Ethernet card, also known as Network Interface Card (NIC) is a network adapter used to set up a wired network.
- It acts as an interface between computer and the network.
- It is a circuit board mounted on the motherboard of a computer
- The Ethernet cable connects the computer to the network through NIC.
- Ethernet cards can support data transfer between 10 Mbps and 1 Gbps (1000 Mbps).

- Each NIC has a MAC address, which helps in uniquely identifying the computer on the network.

## RJ45



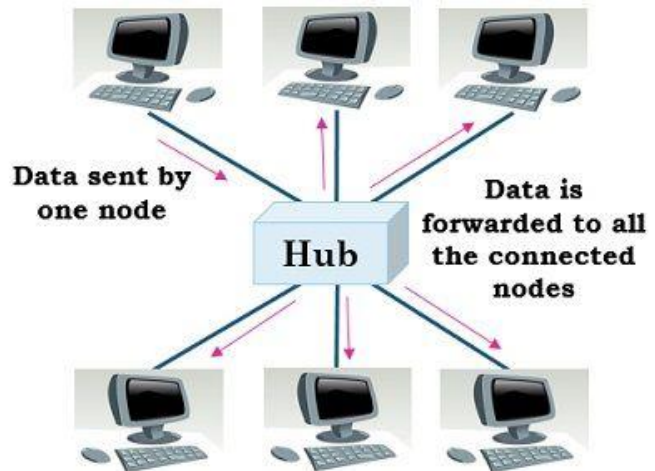
- RJ 45 or Registered Jack-45 is an eight-pin connector
- It is used exclusively with Ethernet cables for networking.
- It is a standard networking interface that can be seen at the end of all network cables.
- It is a small plastic plug that fits into RJ-45 jacks of the Ethernet cards present in various computing devices.

## Repeater



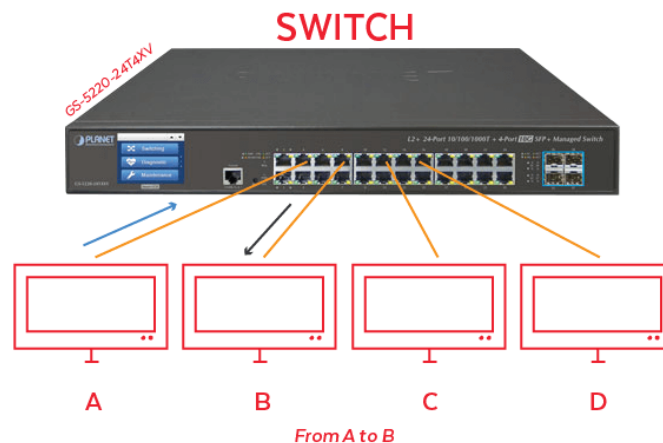
- A repeater is a device that amplifies a signal being transmitted on the network.
- Data are carried in the form of signals over the cable.
- These signals can travel a specified distance (usually about 100 m).
- Signals lose their strength beyond this limit and become weak.
- In such conditions, the weakened signal appearing on the cable is regenerated and put back on the cable by a repeater.

## Hub



- An Ethernet hub is a network device used to connect different devices through wires.
- Data arriving on any of the lines are sent out on all the others.
- The limitation of Hub is that if data from two devices come at the same time, they will collide.

## Switch



- Like a hub, a network switch is used to connect multiple computers or communicating devices.
- When data arrives, the switch extracts the destination address from the data packet and looks it up in a table to see where to send the packet.
- It sends signals to only selected devices instead of sending to all.
- It can forward multiple packets at the same time.
- A switch does not forward the signals which are noisy or corrupted. It drops such signals and asks the sender to resend it.
- Ethernet switches are common in homes/offices to connect multiple devices thus creating LANs or to access the Internet.

## Router

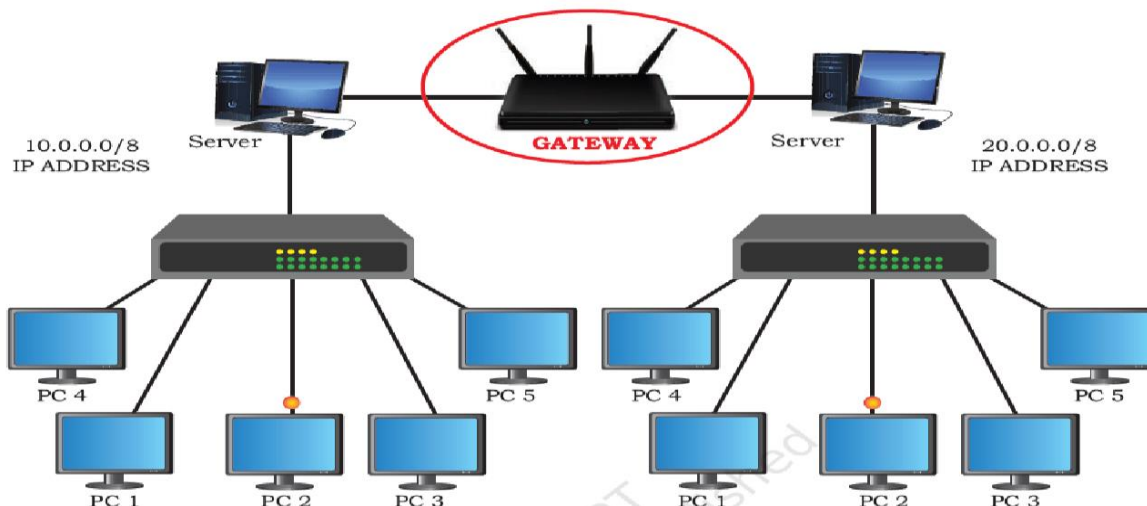
- A router is a network device that can receive the data, analyse it, decide/alter how it is packaged and transmit it to other networks.
- A router connects a local area network to the internet.
- For example, data has been divided into packets of a certain size. Suppose these packets are to be carried over a different type of network which cannot handle bigger packets. In such a case, the data is to be repackaged as smaller packets and then sent over the network by a router.



- A router can be wired or wireless.
- A wireless router can provide Wi-Fi access to smartphones and other devices.
- Nowadays, home Wi-Fi routers perform the dual task of a router and a modem/ switch.

## Gateway

- “Gateway” is a key access point that acts as a “gate” between an organisation's network and the outside world of the Internet.
- Gateway serves as the entry and exit point of a network, as all data coming in or going out of a network must first pass through the gateway in order to use routing paths.
- If a node from one network wants to communicate with a node of a foreign network, it will pass the data packet to the gateway, which then routes it to the destination using the best possible route.



- For simple Internet connectivity at homes, the gateway is usually the Internet Service Provider that provides access to the entire Internet.
- Generally, a router is configured to work as a gateway device in computer networks.
- A gateway can be implemented completely in software, hardware, or a combination of both.
- Since a network gateway is placed at the edge of a network, the firewall is usually integrated with it.

## WiFi card

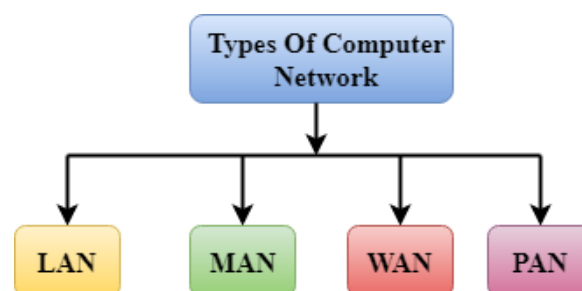


- A Wi-Fi card connects to your laptop either in your USB port or a wider card slot.
- The Wi-Fi card acts as both a receiver and transmitter.
- It receives the wireless signal and communicates with the wireless network, enabling you to access the Web with your laptop.

## Computer Network Types

A computer network is a group of computers linked to each other that enables the computer to communicate with another computer and share their resources, data, and applications.

A computer network can be categorized by their size, complexity and geographical spread. A computer network is mainly of four types:



- LAN (Local Area Network)
- PAN (Personal Area Network)
- MAN (Metropolitan Area Network)
- WAN (Wide Area Network)

## PAN (Personal Area Network)

- Personal Area Network is a network of information technology devices (laptop, mobile phones, media player and play stations) arranged within the range of an individual person, typically within a range of 10 meters / covers an area of 30 feet.
- Thomas Zimmerman was the first research scientist to bring the idea of the Personal Area Network.



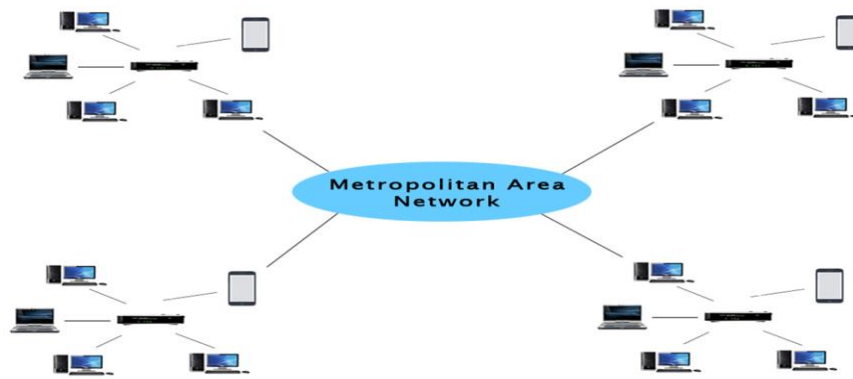
## LAN (Local Area Network)

- Local Area Network is a group of computers connected to each other in a small area such as a building, office through a communication medium such as twisted pair, coaxial cable, etc to share resources. Shared resources can be data, information, programs, printers, hard-disks, modem etc. The data is transferred at an extremely faster rate, and provides higher security
- It is less costly as it is built with inexpensive hardware such as hubs, network adapters, and Ethernet cables.



## MAN (Metropolitan Area Network)

- A metropolitan area network is a network that covers a larger geographic area that is spread over an area as big as a city by interconnecting different LAN to form a larger network through a telephone exchange line.
- Government agencies use MAN to connect to the citizens and private industries.
- The most widely used protocols in MAN are RS-232, Frame Relay, ATM, ISDN, OC-3, ADSL, etc.

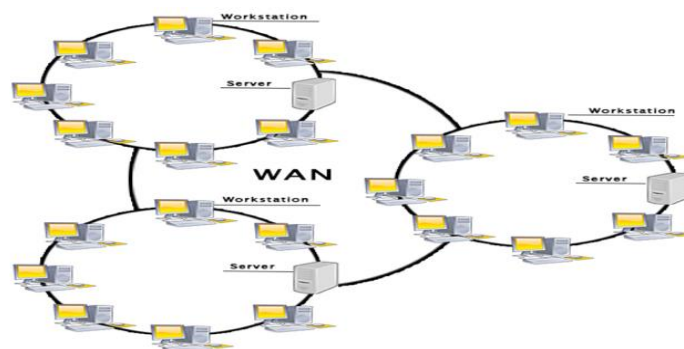


### Uses Of Metropolitan Area Network:

- MAN is used in communication between the banks in a city.
- It can be used in an Airline Reservation.
- It can be used in a college within a city.
- It can also be used for communication in the military.

### WAN (Wide Area Network)

- A Wide Area Network is a network that extends over a large geographical area such as states or countries through a telephone line, fiber optic cable or satellite links.
- The internet is one of the biggest WAN in the world.
- A Wide Area Network is widely used in the field of Business, government, and education.



### Advantages Of Wide Area Network:

Following are the advantages of the Wide Area Network:

- Geographical area: A Wide Area Network provides a large geographical area. Suppose if the branch of our office is in a different city then we can connect with them through WAN. The internet provides a leased line through which we can connect with another branch.
- Centralized data: In case of WAN network, data is centralized. Therefore, we do not need to buy the emails, files or back up servers.



- Get updated files: Software companies work on the live server. Therefore, the programmers get the updated files within seconds.
- Exchange messages: In a WAN network, messages are transmitted fast. The web application like Facebook, WhatsApp, Skype allows you to communicate with friends.
- Sharing of software and resources: In WAN network, we can share the software and other resources like a hard drive, RAM.
- Global business: We can do the business over the internet globally.
- High bandwidth: If we use the leased lines for our company then this gives the high bandwidth. The high bandwidth increases the data transfer rate which in turn increases the productivity of our company.

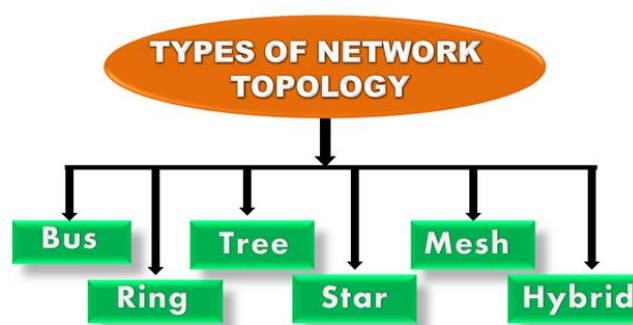
### Disadvantages of Wide Area Network:

- Security issue: A WAN network has more security issues as compared to LAN and MAN network as all the technologies are combined together that creates the security problem.
- Needs Firewall & antivirus software: The data is transferred on the internet which can be changed or hacked by the hackers, so the firewall needs to be used. Some people can inject the virus in our system so antivirus is needed to protect from such a virus.
- High Setup cost: An installation cost of the WAN network is high as it involves the purchasing of routers, switches.
- Troubleshooting problems: It covers a large area so fixing the problem is difficult.

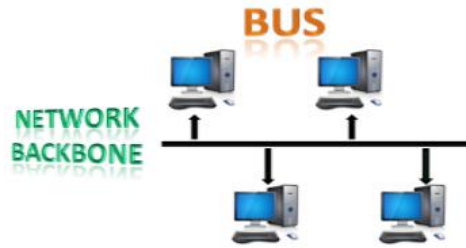
### Network Topology:

Topology defines the structure of the network of how all the components are interconnected to each other. In other words, it is the pattern of interconnection of nodes in a network. There are two types of topology: physical and logical topology.

Physical topology is the geometric representation of all the nodes in a network.



### Bus Topology



- The bus topology is designed in such a way that all the stations are connected through a single cable known as a backbone cable. Each node is either connected to the backbone cable by drop cable or directly connected to the backbone cable.
- When a node wants to send a message over the network, it puts a message over the network. All the stations available in the network will receive the message whether it has been addressed or not.
- The bus topology is mainly used in 802.3 (ethernet) and 802.4 standard networks.
- The configuration of a bus topology is quite simpler as compared to other topologies.

#### Advantages of Bus topology:

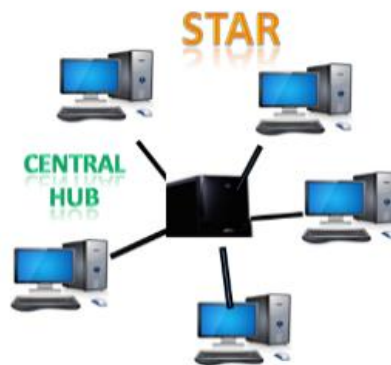
- Low-cost cable: In bus topology, nodes are directly connected to the cable without passing through a hub. Therefore, the initial cost of installation is low.
- Short Cable Length and Simple wiring Layout : As there is a single common data path connecting all nodes, the linear topology allows a very short cable length to be used.
- Easy to extend : Additional nodes can be connected to an existing bus network at any point along its length. Repeaters can be used , if required.
- Moderate data speeds: Coaxial or twisted pair cables are mainly used in bus-based networks that support up to 10 Mbps.
- Familiar technology: Bus topology is a familiar technology as the installation and troubleshooting techniques are well known, and hardware components are easily available.
- Limited failure: A failure in one node will not have any effect on other nodes.

#### Disadvantages of Bus topology:

- Difficult troubleshooting: It requires specialized test equipment to determine the cable faults. If any fault occurs in the cable, then it would disrupt the communication for all the nodes.
- Fault isolation is difficult : If a node is faulty on the bus, it must be rectified at the point where the node is connected to the network.
- Nodes must be intelligent : Each node on the network is directly connected to the central bus. This means, some way of deciding, who can use the network at any given time must be performed in each node.

- Signal interference: If two nodes send the messages simultaneously, then the signals of both the nodes collide with each other.
- Reconfiguration difficult: Adding new devices to the network would slow down the network. When Bus type network has its backbone extended using repeaters, reconfiguration may be necessary.
- Attenuation: Attenuation is a loss of signal leads to communication issues. Repeaters are used to regenerate the signal.

## Star Topology



- Star topology is an arrangement of the network in which every node is connected to the central hub, switch or a central computer by a single path.
- The central computer is known as a server, and the peripheral devices attached to the server are known as clients.
- Coaxial cable or RJ-45 cables are used to connect the computers.
- Hubs or Switches are mainly used as connection devices in a physical star topology.
- Star topology is the most popular topology in network implementation.

## Advantages of Star topology

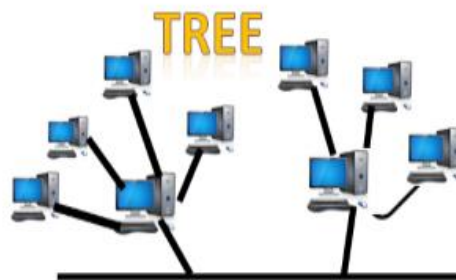
- Easily expandable: It is easily expandable as new stations can be added to the open ports on the hub.
- Limited failure: As each station is connected to the central hub with its own cable, therefore failure in one cable will not affect the entire network.
- Efficient troubleshooting: Troubleshooting is quite efficient in a star topology as compared to bus topology. In a bus topology, the manager has to inspect the kilometers of cable. In a star topology, all the stations are connected to the centralized network. Therefore, the network administrator has to go to the single station to troubleshoot the problem.
- Network control: Complex network control features can be easily implemented in the star topology. Any changes made in the star topology are automatically accommodated.
- Familiar technology: Star topology is a familiar technology as its tools are cost-effective.
- Cost effective: Star topology networks are cost-effective as it uses inexpensive coaxial cable.

- High data speeds: It supports a bandwidth of approx. 100Mbps. Ethernet 100BaseT is one of the most popular Star topology networks.

### Disadvantages of Star topology

- A Central point of failure: If the central hub or switch goes down, then all the connected nodes will not be able to communicate with each other.
- Long Cable length : As each node is directly connected to the center, it increases the cable length, if new node is far away from central node. Sometimes cable routing becomes difficult when a significant amount of routing is required.

### Tree topology



- Tree topology combines the characteristics of bus topology and star topology.
- A tree topology is a type of structure in which all the computers are connected with each other in hierarchical fashion.
- The top-most node in tree topology is known as a root node, and all other nodes are the descendants of the root node.
- There is only one path exists between two nodes for the data transmission. Thus, it forms a parent-child hierarchy.

### Advantages of Tree topology

- Support for broadband transmission: Tree topology is mainly used to provide broadband transmission, i.e., signals are sent over long distances without being attenuated.
- Easily expandable: We can add the new device to the existing network. Therefore, we can say that tree topology is easily expandable.
- Easily manageable: In tree topology, the whole network is divided into segments known as star networks which can be easily managed and maintained.
- Error detection: Error detection and error correction are very easy in a tree topology.
- Limited failure: The breakdown in one station does not affect the entire network.
- Point-to-point wiring: It has point-to-point wiring for individual segments.

### Disadvantages of Tree topology

- Difficult troubleshooting: If any fault occurs in the node, then it becomes difficult to troubleshoot the problem.
- High cost: Devices required for broadband transmission are very costly.
- Failure: A tree topology mainly relies on main bus cable and failure in main bus cable will damage the overall network.
- Reconfiguration difficult: If new devices are added, then it becomes difficult to reconfigure.

## NETWORK PROTOCOL :

A protocol means the rules that are applicable for a network. Protocols defines standardized formats for data packets, techniques for detecting and correcting errors etc.

### TCP/IP

- TCP/IP stands for Transmission Control Protocol/ Internet Protocol.
- It is a set of standardized rules that uses a client-server model of communication in which a user or machine (a client) requests a service by a server in the network.
- The IP protocol ensures that each computer or node connected to the Internet is assigned an IP address, which is used to identify each node independently.
- TCP ensures that the message or data is broken into smaller chunks, called IP packets. Each of these packets are routed (transmitted) through the Internet, along a path from one router to the next, until it reaches the specified destination. TCP guarantees the delivery of packets on the designated IP address. It is also responsible for ordering the packets so that they are delivered in sequence.

### FTP

- FTP stands for File transfer protocol. It is a standard internet protocol provided by TCP/IP used for transmitting the files from one host to another. It is mainly used for transferring the web page files from their creator to the computer that acts as a server for other computers on the internet. It is also used for downloading the files to computer from other servers.

### Objectives of FTP

- It provides the sharing of files.
- It is used to encourage the use of remote computers.
- It transfers the data more reliably and efficiently.

### SMTP

- SMTP stands for Simple Mail Transfer Protocol.
- SMTP is a set of communication guidelines that allow software to transmit an electronic mail over the internet is called Simple Mail Transfer Protocol.
- It is a program used for sending messages to other computer users based on e-mail addresses.
- It provides a mail exchange between users on the same or different computers, and it also supports:
  - It can send a single message to one or more recipients.
  - Sending message can include text, voice, video or graphics.
  - It can also send the messages on networks outside the internet.
- The main purpose of SMTP is used to set up communication rules between servers. They also have a way of handling the errors such as incorrect email address. For example, if the recipient address is wrong, then receiving server reply with an error message of some kind.

### PPP :

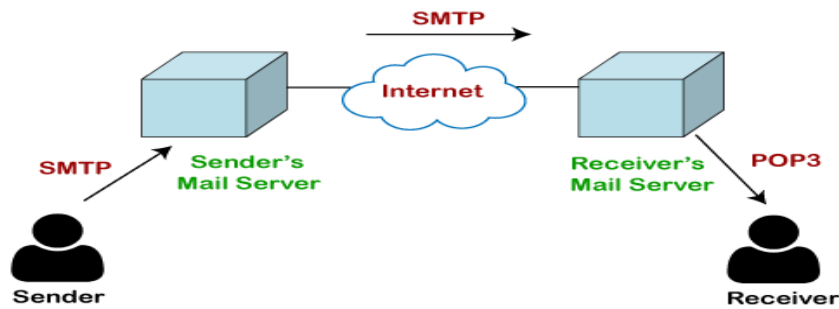
Point-to-Point Protocol (PPP) is protocol that is used to connect one computer system to another. Computers use PPP to communicate over the telephone network or the Internet.

A PPP connection exists when two systems physically connect through a telephone line. You can use PPP to connect one system to another. For example, an established PPP connection between a branch office and a central office allows either office to transfer data to the other through the network.

### POP3 Protocol

Post Office Protocol version 3 (POP3) is a standard mail protocol used to receive emails from a remote server to a local email client. POP3 allows you to download email messages on your local computer and read them even when you are offline.

### How is mail transmitted?



## Telnet

- The main task of the internet is to provide services to users. For example, users want to run different application programs at the remote site and transfers a result to the local site. This requires a client-server program such as FTP, SMTP. But this would not allow us to create a specific program for each demand.
- The better solution is to provide a general client-server program that lets the user access any application program on a remote computer. Therefore, a program that allows a user to log on to a remote computer. A popular client-server program Telnet is used to meet such demands. Telnet is an abbreviation for Terminal Network.
- Telnet provides a connection to the remote computer in such a way that a local terminal appears to be at the remote side.

There are two types of login:

### Local Login

- When a user logs into a local computer, then it is known as local login.

### Remote login

- When the user wants to access an application program on a remote computer, then the user must perform remote login.

## VoIP:

VoIP stands for Voice over Internet Protocol. It is also referred to as IP telephony, internet telephony, or internet calling. It's an alternative to a public switched telephone network (PSTN).

## Introduction to Web Services

Everyone is using internet irrespective of their background & interest. The types of services available on internet are as diverse as the interest of the people. Web Services means the services provided by World Wide Web. The World Wide Web provides services like chatting, emailing, video conferencing, e-learning, e-shopping, e-reservation, e-groups and social networking. These services may mean different things to different people but in simple words, they are the ways to communicate and here the communication takes place between two electronic devices.

### World Wide Web (WWW)

The World Wide Web commonly referred to as WWW, W3, or the Web is an interconnected system of public webpages accessible through the Internet.

The Web is not the same as the Internet: the Web is one of many applications built on top of the Internet.

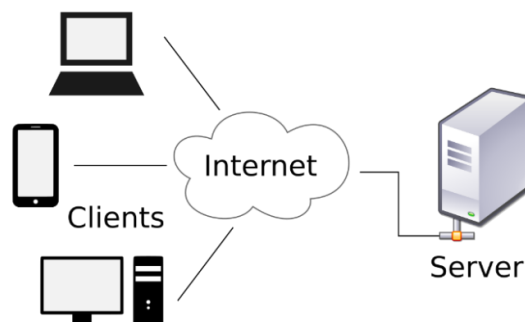
It's invented by Tim Berners-Lee in 1989. Since that time, the Web has changed the world. It has perhaps become the most powerful communication medium the world has ever known.

Major components of WWW are,

1. Web Server – It is a computer that stores website resources (web pages, images, videos, etc.).
2. Web Browser (Client) – A software application used to access the web resources.
3. Webpage – Hypertext documents formatted in Hypertext Mark-up Language (HTML) and displayed in a web browser.
4. Website – A website is a collection of inter-linked web pages that is identified by a common domain name (website name) and stored on a web server.
5. HTTP Protocol – It governs data (web page) transfer between a server and a client.
6. HTML – A mark-up language used to specify the structure of a webpage.
7. URL – Address used to identify documents and other web resources on the internet.

### Web Architecture

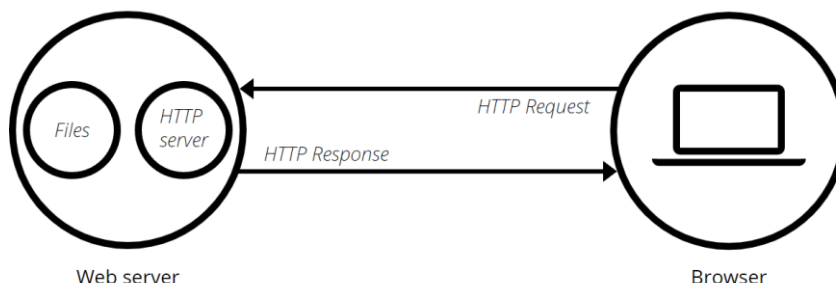
Web is working based on a client-server architecture.





**Client:** It is a computer capable of requesting, receiving & displaying information in the form of web pages or using a particular service from the service providers (Servers). It's also called as web browsers.

**Servers:** It is a remote computer which provides/transfers information to the client (in the form of web pages) or access to particular services.



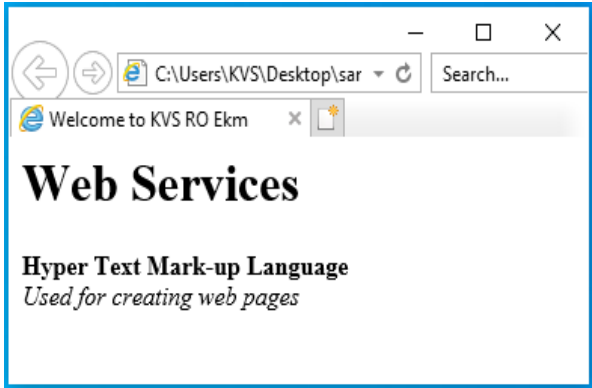
So, it's basically the Client requesting web pages and the Server serving it as long as the requested content is available in the server. i.e. a request-response model.

#### Difference between Internet and WWW

| Internet                                                                                  | World Wide Web(WWW)                                                                     |
|-------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|
| Internet stands for Interconnected Networks                                               | WWW stands for World wide Web                                                           |
| Internet is a means of connecting a computer to any other computer anywhere in the world. | World Wide Web which is a collection of information which is accessed via the Internet. |
| Internet is infrastructure.                                                               | WWW is service on top of that infrastructure.                                           |
| Internet is primarily hardware-based.                                                     | WWW is more software-oriented as compared to the Internet.                              |
| Internet uses TCP/IP protocol.                                                            | WWW uses HTTP Protocol.                                                                 |

#### HTML (Hypertext Mark-up Language)

- It is not a programming language. It is a mark-up language that tells web browsers how to structure the web pages you visit.
- HTML is language the helps in creating and designing web content.
- It has a variety of tags and attributes for defining the layout and structure of the web document.
- It is designed to display the data in formatted manner.
- A HTML document has the extension .htm or .html.
- Hypertext is a text which is linked to another document.

| HTML Code                                                                                                                                                                                                                                                                                 | As Rendered in the Browser                                                         |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|
| <pre>&lt;html&gt; &lt;head&gt; &lt;title&gt; Welcome to KVS RO Ekm &lt;/title&gt; &lt;/head&gt; &lt;body&gt; &lt;h1&gt;Web Services&lt;/h1&gt; &lt;b&gt;Hyper Text Mark-up Language&lt;/b&gt; &lt;br&gt; &lt;i&gt;Used for creating web pages&lt;/i&gt; &lt;/body&gt; &lt;/html&gt;</pre> |  |

## XML (eXtensible Mark-up Language)

- XML is a mark-up language like HTML.
- It is designed to transport or store data.
- In contrast to HTML, it's used to transport the data and not for displaying the data.
- Unlike HTML, it does not have predefined tags.
- It is possible to define new tags in XML.
- It allows the programmer to use customized tags.
- XML is case sensitive.
- A XML document has the extension .xml.

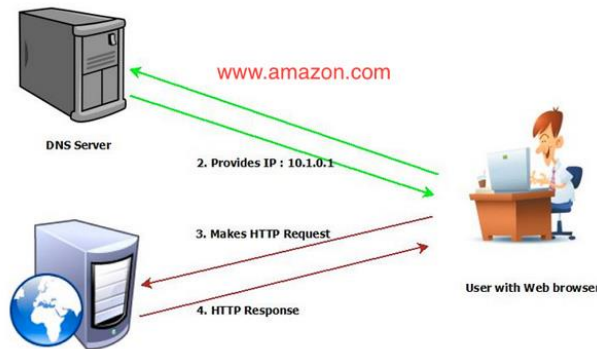
## HTML v/s XML

| HTML                                       | XML                                        |
|--------------------------------------------|--------------------------------------------|
| HTML stands for HyperText Mark-up Language | XML stands for eXtensible Mark-up Language |
| HTML is a case insensitive.                | XML is case sensitive.                     |
| Predefined tags (commands).                | User defined tags (commands).              |
| It is used for presentation of the Data.   | It is used for transportation of the Data. |
| Small errors can be ignored.               | Errors not allowed.                        |
| Closing tags are optional.                 | Compulsory to use closing tags.            |

## HTTP - Hyper Text Transfer Protocol

- HTTP stands for hypertext transfer protocol and is used to transfer data across the web.
- HTTP specifies how to transfer hypertext (linked web documents) between two computers.
- It allow users of the World Wide Web to exchange information found on web pages.

- When accessing any web page entering http:// in front of the address tells the browser to communicate over HTTP.
- A Protocol is a set of rules for communication between two computers. HTTP is a textual, stateless protocol.



- Clients (web browsers) send requests through request object of http to web servers for web pages, resources etc.
- Web server respond accordingly through response object of http.
- After this cycle (request – response), the connection between client and server across the Internet is disconnected.
- A new connection must be made for each request (means for each web page).
- Hypertext Transfer Protocol Secure (HTTPS) is an extension of the HTTP.
- It is used for secure communication over a computer network.
- In HTTPS, the communication protocol is encrypted using Transport Layer Security (TLS).
- HTTPS provides,
  - 1) Encryption: Encrypting the exchanged data to keep it secure from eavesdroppers.
  - 2) Data integrity: Data cannot be modified or corrupted during transfer.
  - 3) Authentication: Proves that your users communicate with the intended website.

## Domain Names

- The Internet is a vast ocean where information is available in the form of millions of websites.
- Each website is stored on a server which is connected to the Internet, which means each server has an IP address. Every device connected to the Internet has an IP address.
- To access a website, we need to enter its IP address on our web browser.
- But it is very difficult to remember the IP addresses of different websites as they are in terms of numbers or strings.
- However, it is easier to remember names, and therefore, each computer server hosting a website or web resource is given a name against its IP address. These names are called the Domain names or hostnames corresponding to unique IP addresses assigned to each server.
- For easy understanding, it can be considered as the phonebook where instead of remembering each person’s phone number, we assign names to their numbers.

For example, IP addresses and domain names of some websites are as follows:

| Domain Name  | IP Address     |
|--------------|----------------|
| ncert.nic.in | 164.100.60.233 |

} DNS look-up table

|                    |                |
|--------------------|----------------|
| cbse.nic.in        | 164.100.107.32 |
| kvsangathan.nic.in | 164.100.166.91 |
| wikipedia.org      | 198.35.26.96   |

- The process of converting a hostname (such as www.google.com) into the corresponding IP address (such as 172.217.14.196) is called domain name resolution.
- Specialized DNS servers are used for domain name resolution (DNS resolution), so whenever you type some web address (domain name) on the address bar of a web browser, it will be translated into an equivalent IP address with the help of one or more DNS servers including local DNS cache.

### URL-Uniform Resource Locator

- URL stands for Uniform Resource Locator.
- Every web page that is displayed on the Internet has a specific address associated with it, this address is known as the URL.
- Like postal address is required to reach a letter to a person staying anywhere on earth.

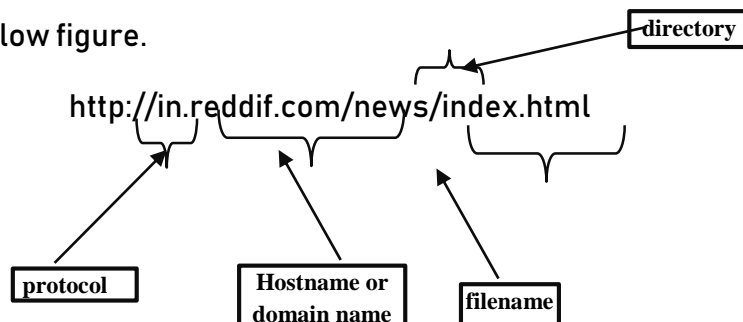
The URL consists of four basic parts, namely, server type, hostname, folder name and the filename. Each one of these has a specific function.

- 1) The “server type” indicates the type of Internet server (Protocol) being accessed. The server type is always followed by “://” and the host name.
- 2) The host name/domain name is the Internet address of a remote computer on which the files reside.
- 3) The folder name indicates the name of the directory in which the files are located.
- 4) The filename specifies the name of the specific document to be displayed in the browser. The filename itself consists of two pieces of information, the name of the file to be displayed and the file extension, which specifies the file type (.htm for HTML file, .txt for a text file, .bmp for a bitmap image, etc.)

The structure of a URL can be represented as follows:

server type://hostname/directory/sub-directory/.../filename

A URL is illustrated in below figure.



## Websites

- A website is a collection of linked web pages (plus their associated resources) that share a unique domain name.
- Thus, a Web site is a collection of related Web pages.
- Each web page of a given website provides explicit links, most of the time in the form of clickable portion of text, that allow the user to move from one page of the website to another.
- Each Web site is owned and updated by an individual, company, or an organization.
- Web is a dynamically moving and changing entity, today web sites generally change on a daily or even hourly basis.
- To access a website, type its domain name in your browser address bar, and the browser will display the website's main web page, or homepage (casually referred as "the home"):

## Web page

- Web page is an electronic document designed using HTML.
- It displays information in textual or graphical form.
- It may also contain downloadable data files, audio files or video files.
- Traversal from one webpage to another web page is possible through hyperlinks.

### Difference between Webpage and Website

A web page is one single page of information, while a website is made up of a number of related web pages inter-connected by links known as hyperlinks.

## Web Browser

- Web browser is software program to navigate the web pages on the internet.
- A browser interprets the coding language of the web page and displays it in graphic form.
- A web browser allows anyone to access the web without even knowing commands used in software languages to design a web page.
- Internet works on client -server model.
- A web browser is a client which requests the information from the web server.
- The web server sends the information back to the client.
- The web address of the webpage written on the address bar tells the web browser which page to access.
- The most popular web browsers are: Google Chrome, Mozilla Firefox, Internet Explorer, Safari, Opera, Netscape and UC Browser.

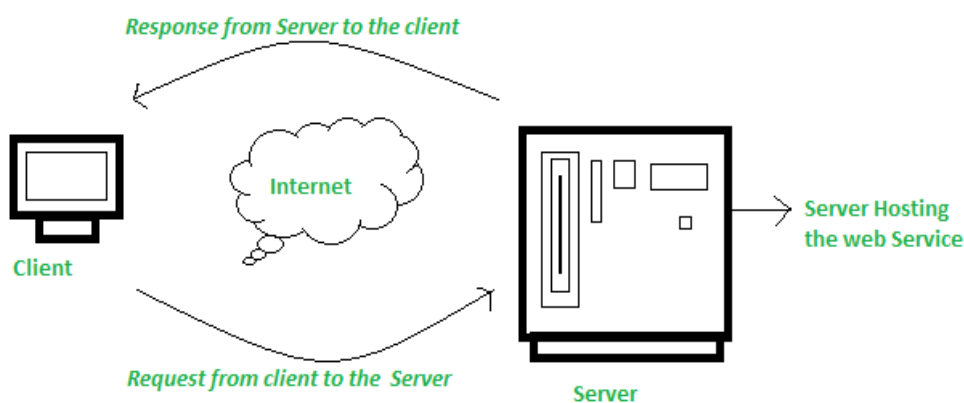
## What is a cookie?

- A cookie is information stored on your computer by a website you visit.
- Cookies often store your settings for a website, such as your preferred language or location.
- When you return to the site, browser sends back the cookies that belong to the site.
- This allows the site to present you with information customized to fit your needs.
- Cookies can store a wide range of information, including personally identifiable information (such as your name, home address, email address, or telephone number).

- However, this information can only be stored if you provide it - websites cannot gain access to information you didn't provide to them, and they can't access other files on your computer.

## Web Server

- A *web server* is a computer or a group of computers hosting one or more *websites*.
- "Hosting" means that all the *web pages* and their supporting files are available on that computer.
- The *web server* will send any *web page* from the *website* it is hosting to any user's browser, per user request.
- More importantly, since a web server can host multiple websites, the term *web server* is never used to designate a website, as it could cause great confusion.
- It works on client/server model.
- It delivers the requested web page to web browser.
- Web servers use special programs such as Apache or IIS to deliver web pages over the http



protocol

## Web Hosting

- Web hosting is the process of uploading/saving the web content on a web server to make it available on WWW.
- In case an individual or a company wants to make its website available on the internet, it should be hosted on a web server.
- A good way to think about this is if the domain name is the address of our house, then web hosting is the actual house that address points to. All websites on the internet, need web hosting.
- Domain names and web hosting are two different services. However, they work together to make websites possible. It is possible with the system known as DNS.

## Model Questions

### I. Multiple Choice Questions

1. Which one of the following devices will you suggest for connecting all the computers within each block of a building?

- a. Switch/Hub
- b. Modem
- c. Telephone
- d. Repeater

2. XYZ company is planning to link its head office situated in New Delhi with the offices in hilly areas. Suggest a way to connect it economically:

- a. Micro waves
- b. Coaxial cable
- c. Fibre optic
- d. Radio waves

3. Which of the following is/are not communication media?

- a. Microwaves
- b. Optical Fiber cable
- c. Node
- d. Radio waves

4. The \_\_\_\_\_ is over which the messages are sent.

- a. Signal
- b. Channel
- c. Protocol
- d. Sender

5. Which of the following is not a unit of data transfer rate?

- a. Abps
- b. Bps
- c. Kbps
- d. Gbps

6. The number of bits transmitted per second is called \_\_\_\_\_.

- a. Bit rate
- b. Baud rate
- c. Data rate
- d. Transfer rate

7. The messages sent over a network is divided into small pieces called \_\_\_\_\_.

- a. Units
- b. Chunks
- c. Packets
- d. Bits

8. A \_\_\_\_\_ is established in circuit switching before actual communication.

- a. Switch
- b. Link
- c. Protocol
- d. Hub

9. The \_\_\_\_\_ is the difference between upper and lower frequencies of a communication medium.

- a. Bandwidth
- b. Data rate
- c. Latency
- d. communication speed

10. The unit of Bandwidth is?

- a. Khz
- b. Hz
- c. Watt
- d. KW

11. For every device connected to a network, there will be a unique \_\_\_\_\_.

- a. Name
- b. ID
- c. IP Address
- d. IC

12. Raw data is processed to get \_\_\_\_\_.

- a. File
- b. Information
- c. Communication
- d. Message

13. Which of the following is/are true regarding packet switching?

1. *The packets of data are sent simultaneously through different paths.*
2. *The free communication channel is utilized properly.*
3. *Protocols are used for the reliable receipt of data at the receiver end.*
4. *Sequence numbers are assigned to the data packets.*

a. Only 1    b. Both 1 & 4    c. Both 2 & 4    d. All of the above.

14. \_\_\_\_\_ is applicable in the case of long voice data communication.

a. Protocols                      b. Circuit Switching    c. Packet Switching    d. None of these.

15. Which of the following is/are true in the case of IP address?

1. *IP address can be used to trace the actual physical location of a device in the network.*
2. *A printer connected to a network will also have an IP Address.*
3. *Two devices can have same IP Address.*
4. *The IP Address can be formed of any number.*

a. Only 1 is true    b. Only 1 & 2 are true    c. Options 1, 2 and 4 are true.                      d. All the options are true.

16. Selecting a communication path among multiple available paths is termed as:

a. Transmission    b. Reception    c. Switching    d. multiplexing

17. The other name for communication medium is:

a. Channel                      b. Source                      c. Hub                      d. Switch

18.



The above procedure occurs in the case of \_\_\_\_\_.

a. Packet Switching                      b. Circuit Switching    c. Both a and b                      d. None of these.

19. What are the three common types of computer networks?

- a. ROM, MAN, LAN                      b. RAM, WAN, LAN
- c. MAN, LAN, WAN                      d. None of the above

20. What is the acronym for LAN?



- a. Local Area Network
- b. Local Access Network
- c. Line And Networking
- d. Line-less Networking

21. Define what a LAN is?

- a. Connected devices share the resources of a single processor or server within a small geographic area
- b. Normally find within a business and school
- c. These are computers that share resources over a large area
- d. None of the above

22. Mr. John is a small businessman who runs Hardware. He has been experiencing problems with his small accounting department, which he depends on to provide sales reports. Mr. John wants to share information between his 7 computer stations and have one central printing area. What type of network would you recommend to Mr. John?

- a. MAN
- b. LAN
- c. WAN
- d. SAN

23. WAN covers a larger geographical area than MAN?

- a. True
- b. False

24. A network that consists of both LANs and MANs is called a Wide area network?

- a. True
- b. False

25. Arrange the Following Types of Networks according to their size, from largest to smallest?

- a. LAN, WAN, MAN
- b. WAN, LAN, MAN
- c. MAN, LAN, WAN
- d. WAN, MAN, LAN

26. You are a member of a club that deals with computer networks. The club has to take a project to build a MAN. Where would this project likely take place?

- a. A small building/organization
- b. University or college
- c. Home
- d. None of the above

27. What is the acronym MAN stand for?

- a. Magnetic Access Network
- b. Metropolitan Area Network
- c. Multi-Area Network
- d.. Multi-Access net

28. In your school there is a library, and you can use the internet to do research, this library will most likely be a WAN network?

- a. True                      b. False

29. Types of Networks are Categories by their Geographical Area cover?

- a. True                      b. False

30. Metropolitan Area Network Normally Require an Internet connection?

- a. True                      b. False

## II. Short Answer Type Questions(1-mark)

1. Give examples for Wired media and Wireless media.

2. Name the device which connects multiple nodes to form a network. It redirects the received information only to the intended node(s).

3. Identify odd one out of the following:

Optical Fiber/Coaxial Cable/ Bluetooth/Twisted Pair Cable. Give reason for your answer.

4. Differentiate between communication using Optical Fiber and Ethernet Cable in context of wired medium of communication technologies.

5. Ms. Emily is planning to connect 20 computers in her computer lab to form a local area network. Suggest an intelligent network device to connect all the computers.

6. Which communication channel is/are suitable in each of the following situations?

- (i) Transfer of data from one mobile to another.
- (ii) Communication in a hilly area.

7. Tagore Consultancy is planning to link its head office at Kolkata with the offices at Ernakulam. Suggest an economic way to set up a connection between these offices. The company is ready to compromise on the speed of the connectivity.

8. Mr. Roy, General Manager of Infopark Solutions discovered that the communication between his company's main office and HR office is extremely slow and signals drop quite frequently. These offices are 150 meters away from each other and connected by an Ethernet cable. Suggest him a device which can be installed between the offices for smooth communication.

9. Name The transmission media best suitable for connecting to hilly areas.

10. How many pair of wires are there in twisted pair cable (Ethernet)?

11. Name a device that forwards data packets along networks.

12. Your friend wishes to install a wireless network in his office. Explain him the difference between guided and unguided media

13. What are Protocols? Name the protocol used to transfer a file from one device to the other.

14. Define communication channel.

15. What do you mean by an IP Address? Give an example for IP Address.
16. Differentiate between Circuit Switching and Packet Switching.
17. Define the following:     a. Bandwidth   b. Data rate
18. Explain the components of data communication.
19. What are the advantages of Packet switching over Circuit switching.
20. Explain why Circuit Switching is not cost effective compared to Packet Switching?
21. Explain how an IP Address become helpful in investigating cyber-crimes.
22. Why Protocols are needed in the case of Data Communication?
23. What is the full form of WWW?
24. What is the full form of Internet?
25. What is the difference between World Wide Web & Internet?
26. Who invented the WWW in 1989?
27. Special software's that is used to view webpages are \_\_\_\_\_
28. \_\_\_\_\_ are used to store webpages, so whenever a request, it will serve the request.
29. What's a web browser?
- a) A kind of spider
  - b) A computer that store www files
  - c) A person who likes to look at websites
  - d) A software program that allows you to access sites on the World Wide Web
30. A \_\_\_\_ is a document commonly written and is accessible through the internet or other network using a browser?
- a) Accounts                      b) Data
  - c) Web page                      d) Search engine
31. Which of the following is used to read HTML code and to render Webpage?
- a) Web Server                    b) Web Browser
  - c) Web Matrix                   d) Weboni
32. Which of these tech company owns Firefox web browser?
- a) Lenovo                         b) IBM
  - c) Apple                          d) Mozilla
33. Which of the following browsers were/are available for the Macintosh?
- a) Opera                          b) Safari
  - c) Netscape                      d) All of these

34. What is the name of the browser developed and released by Google?

- a) Chrome
- b) Googly
- c) Heetson
- d) Titanium

35. Which of the following is a Web Browser?

- a) MS-office
- b) Notepad
- c) Firefox
- d) Word 2007

36. Which of the following is not a web browser?

- a) Chrome
- b) Microsoft Edge
- c) Safari
- d) Ubuntu

37. \_\_\_\_\_ are programs /computers used to store information's in the form of webpages.

38. Web pages that are linked to each other via \_\_\_\_\_

39. \_\_\_\_\_ protocol is used to transfer web pages over internet.

40. Full form of HTTP?

41. \_\_\_\_\_ is a massive collection of digital pages to access information over the Internet

42. URL stands for

- (i) Uniform Research Limited
- (ii) Uniform Resource Locator
- (iii) Uniform Resource Labs
- (iv) Uniform Research Locator

43. LinkedIn is an example for \_\_\_\_\_ website.

- (i) E-learning
- (ii) E-commerce
- (iii) Video conferencing
- (iv) Social networking

44. Which of the following is not a web service?

- (i) Distance Learning
- (ii) E-mailing
- (iii) Video conferencing
- (iv) Social networking

45. Web browsers are also called as \_\_\_\_\_

- (i) Web Servers
- (ii) Web Clients
- (iii) Web Hosting
- (iv) Web Designing

46. Working of WWW based on \_\_\_\_\_ architecture.

- (i) Peer-To-Peer architecture
- (ii) Client-Client architecture
- (iii) Client-Server architecture
- (iv) Server-Server architecture

47. \_\_\_\_\_ is a computer software capable of requesting, receiving & displaying information in the form of webpages.

- (i) Web Servers                      (ii) Web Browsers  
(iii) Web Designers    (iv) Web Camera

48.A \_\_\_\_\_ is a program or automated script which browses the World Wide Web in a methodical, automated manner.

- (i) Web Servers                      (ii) Web Browsers  
(iii) Web Designers    (iv) Web Crawler

49 \_\_\_\_\_ is a mark-up language that helps in developing web pages.

- (i) HTTP                                  (ii) HTML  
(iii) XML                                (iv) C++

50 \_\_\_\_\_ is a language used to transport data over internet.

- (i) HTTP                                  (ii) HTML  
(iii) XML                                (iv) C++

51 Write any 2 differences between HTML & XML?

52. \_\_\_\_\_ is a set of rules for communication between two computers over a network.

- (i) Modem                                (iii) Protocol  
(ii) Switch                                (iv) IP address

53. \_\_\_\_\_ is a real-time communication between two or more users via computer.

54. \_\_\_\_\_ helps us to learn anywhere using Internet.

55. \_\_\_\_\_ allows customers to conduct financial transactions on a secure Website.

56 Internet can be used to get reservation of trains and air planes through \_\_\_\_\_ service.

57 \_\_\_\_\_ helps to create and maintain social relationship over web.

58 Expand the following abbreviations:

- a. HTTP  
b. XML  
c. HTTPS  
d. HTML

59. What is a protocol, give some examples?

60. What out of the following, you will use to have an audio visual chat with an expert sitting in a faraway place to fix-up technical issues?

- (i) E-mail                                (ii) VoIP                                (iii) FTP

61. What is the difference between E-mail and chat?

62. What are cookies?

63. Expand the following abbreviations:

(i) HTTP

(ii) VoIP

64. What is the difference between domain name and IP address?

65. Give one suitable example of each URL and domain name?

66. Differentiate between XML and HTML.

67. Name any two common web browsers.

68. Distinguish between website and web browser.

69. Differentiate between the terms Domain Name and URL in context of web services. Also write one example of each to illustrate the difference.

70. In web services, the communication takes place between

(i) Two electronic devices    (ii) Two human beings

(iii) Two spiders                (iv) None of the above

71. Web services means services provided by \_\_\_\_\_

(i) Microsoft                      (ii) Google

(iii) BSNL                          (iv) World Wide Web

72. Full form of Email is \_\_\_\_\_

73. Match the following

| Web Services |                    | Description |                                                                                                                                          |
|--------------|--------------------|-------------|------------------------------------------------------------------------------------------------------------------------------------------|
| A            | Video conferencing | P           | Without ever having to go booking office                                                                                                 |
| B            | E-Shopping         | Q           | Self-paced learning modules allow students to work at their own speed                                                                    |
| C            | E-mail             | R           | Each of the end user has a camera as well as microphone to capture video and audio in real time and it will be transmitted over internet |
| D            | E-reservation      | S           | Purchasing products through computers/mobile devices                                                                                     |
| E            | E-learning         | T           | Messages normally reaches a recipients account within seconds                                                                            |

74. Match the following

| Web Services |                    | Applications |            |
|--------------|--------------------|--------------|------------|
| A            | Video conferencing | P            | IRCTC      |
| B            | E-Shopping         | Q            | Diksha App |
| C            | E-mail             | R            | GEM        |
| D            | E-reservation      | S            | Gmail      |
| E            | E-learning         | T            | Instagram  |
| F            | Social Networking  | U            | VConSol    |

### III. Previous CBSE Board Questions

- 1) Ravi was trying to log-in to his internet-banking account. He noticed that the URL of the net banking starts with 'https'. The 's' in 'https' stands for \_\_\_\_\_
  - (i) Simple
  - (ii) Smart
  - (iii) Secure
  - (iv) Strength
- 2) What is mean by the homepage of a website?
- 3) What is the significance of the URL?
- 4) Which of the following is not a network protocol?
  - (i) HTML
  - (ii) HTTP
  - (iii) SMTP
  - (iv) FTP
- 5) Which of the following internet protocols provides secure data transmission between server and browser with the help of encryption.
 

a) HTTP            b) HTTPS            c) TELNET            d) ARPANET
- 6) Devanand, a student of Class XII, is not able to understand the difference between web client and web-server. Help him in understanding the same by explaining their role and giving suitable example of each.
- 7) Write the full form of Cc and Bcc (used in email communication). Explain the difference between them.
- 8) Define Internet and write its two uses in our daily life. How is it different from the World Wide Web (WWW).
- 9) Web \_\_\_\_\_ is a software used to view web pages.
- 10) In a network, \_\_\_\_\_ is a computer that provides data and resources to other computers.
- 11) How is a website and a webpage related?

- 12) Microsoft Edge, Apple Safari are examples for \_\_\_\_\_
- 13) What is the use of a server in a computer network?
- 14) Among service available on the World Wide Web are?
- i) Email      ii) HTML      iii) XML      iv) Video conferencing
- (a) (i) and (ii)      (b) (i) and (iv)  
(c) (ii) and (iii)      (d) None of the above
- 15) HTML and XML are \_\_\_\_\_
- (a) Programming Languages      (b) Scripting Languages  
(c) Mark-up Languages      (d) None of the above
- 16) XML uses \_\_\_\_\_
- (a) User defined tags      (b) Predefined Tags  
(c) Both user defined and predefined tags (d) None of the above
- 17) XML was not designed to \_\_\_\_\_
- (a) store the data      (b) present the data  
(c) carry the data      (d) both a & c
- 18) Which of the following will you suggest to establish the online face to face communication between the people in the Regional Office Ernakulum and Delhi Headquarter?
- (a) Cable TV      (b) Email  
(c) Text chat      (d) Video Conferencing
- 19) What kind of data gets stored in cookies and how is it useful?
- 20) What do the following top level domains signify?
- (a) .com  
(b) .org
- 21) "With XML you invent your own tags", Explain this statement with the help of example.
- 22) Define Domain Name Resolution?
- 23) \_\_\_\_\_ tags are case sensitive and \_\_\_\_\_ tags are not case sensitive.
- (a) HTML, XML      (b) HTTP, XML  
(c) XML, HTTP      (d) XML,HTML
- 24) Which of the following is not a web browser ?
- (a) Google Chrome   (b) Internet Explorer   (c) Mozilla Firefox   (d) Photoshop
- 25) Which protocol helps us to browse through web pages using internet browsers?
- 26) Name any one internet browser.
- 27) XML stands for



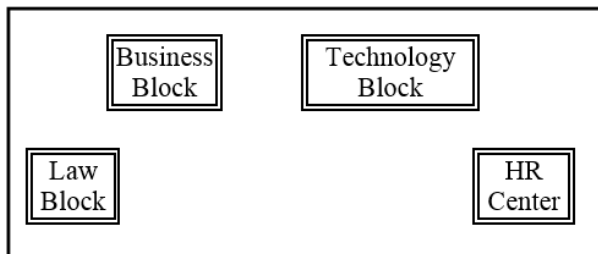
- (A) Xtra Markup Language
- (B) Extensible Markup Language
- (C) Extensible Marking Language
- (D) Extensive Marked Language

28) We can upload a file to a web server using a protocol called \_\_\_\_\_.

- (A) FPT
- (B) IP
- (C) TCP
- (D) FTP

29) \_\_\_\_\_ delivers the requested web page to web browser.

30). MyPace University is setting up its academic blocks at Naya Raipur and is planning to set up a network. The University has 3 academic blocks and one Human Resource Center as shown in the diagram below: Study the following structure and answer questions (a) to (e)



Center to Center distances between various blocks/center is as follows:

|                                    |      |
|------------------------------------|------|
| Law Block to business Block        | 40m  |
| Law block to Technology Block      | 80m  |
| Law Block to HR center             | 105m |
| Business Block to technology Block | 30m  |
| Business Block to HR Center        | 35m  |
| Technology block to HR center      | 15m  |

Number of computers in each of the blocks/Center is as follows:

|                  |     |
|------------------|-----|
| Law Block        | 15  |
| Technology Block | 40  |
| HR center        | 115 |
| Business Block   | 25  |

- a) Suggest the most suitable place (i.e., Block/Center) to install the server of this University with a suitable reason.
- b) Suggest an ideal layout for connecting these blocks/centers for a wired connectivity.
- c) Which device will you suggest to be placed/installed in each of these blocks/centers to efficiently connect all the computers within these blocks/centers.
- d) Suggest the placement of a Repeater in the network with justification.

e) The university is planning to connect its admission office in Delhi, which is more than 1250km from university. Which type of network out of LAN, MAN, or WAN will be formed? Justify your answer.

## ANSWER KEY

### I. Multiple Choice Questions(MCQ)

|       |     |       |       |       |       |
|-------|-----|-------|-------|-------|-------|
| 1. a  | 2.  | 3. d  | 4. c  | 5. b  | 6. a  |
| 7. a  | 8.  | 9. c  | 10. b | 11. a | 12. b |
| 13. c | 14. | 15. b | 16. d | 17. b | 18. c |
| 19. c | 20. | 21. a | 22. b | 23. c | 24. a |
| 25. a | 26. | 27. b | 28. a | 29. a | 30. d |
| 31. d | 32. | 33. b | 34. a | 35. a | 36. a |

### II. Very Short Answer Type Questions(1-mark)

1. Wired media: Optical Fiber cable  
Wireless media: Microwaves, Radio waves
2. Switch
3. Odd one: Bluetooth(Reason: Bluetooth is a wireless/unguided communication media while others are wired/guided communication media)
4. Optical Fibre - Very Fast - Expensive - Immune to electromagnetic interference  
Ethernet Cable - - Slower as compared to Optical Fiber - Less Expensive as compared to Optical Fiber - prone to electromagnetic interference
5. Switch
6. (i) Bluetooth           (ii). Radio waves
7. Satellite
8. Repeater
9. Microwave / Radio wave
10. Two insulated copper wires
11. Router
12. Guided media uses cables to connect computers, whereas unguided media uses waves.
13. Protocols are set of rules that are followed while transmitting data through a computer network. Protocols determines how to data can be moved securely from a source device to a destination device. The protocol used for transferring a file from one device to another is the File Transfer Protocol (FTP).
14. A communication channel is the medium through which data is moved from the source to destination. The communication channel can be either wired or wireless. Wired communication channel is also called guided medium while wireless communication channel is also called unguided medium.

15. An IP Address is a numerical address that uniquely identifies every device connected to a network or internet. The user's physical location can be tracked by using an IP Address. IP V4 (IP Version 4) is a popular version of IP Address. IP Address (in IP V4) consists of four set of numbers separated by a dot. These numbers can range from 0 to 255.

An example IP Address format is given below:

192.158.12.38

16. In Circuit Switching a physical connection between the sender and the receiver is set up first. Then, through that physical link, the complete message is communicated continuously. After completion of the transmission, the physical connection is terminated. In Packet Switching, the message is split into small units called packets. Then these packets are passed from source to destination simultaneously through different routes in the network. As the flow of packets are asynchronous, sequence numbers are assigned to each packet to facilitate re-ordering of packets at the destination.
17. Bandwidth: It is the range of frequencies that can be carried through a communication channel. The bandwidth of a channel determines its capacity. It is the difference between the highest and lowest frequencies that can be carried through the channel. The unit of Bandwidth is Hertz (Hz).  
Data transfer rate: It is the amount of data moved through a communication channel per unit time. The units of Data transfer rate are Bits per second (Bps), Kilobits per second (Kbps), Megabits per second (Mbps) or Gigabits per second (Gbps).
18. The components of data communication are: Sender, Receiver, Message, Communication Medium and Protocols.

**Sender:** The device which sends data through a network is called sender or source.

**Receiver:** The device which receives data through a network is called receiver or destination.

**Message:** The data that is communicated between the source and the destination is called message.

**Communication channel:** The medium through which the data is carried from the source to destination is called a communication medium.

**Protocols:** The set of rules followed while communicating data over a network are called Protocols.

19. In Packet Switching the communication channel is utilized completely whenever it is free. Where as in Circuit Switching, once the connection is assigned for a particular communication, the entire channel cannot be used for other data transmissions even if the channel is free.

Data packets moves simultaneously through different paths in a Packet Switched network, making the transmission quick and easy. But in the case of Circuit Switched network, there is a delay in setting up a physical connection between the source and destination before communicating the actual message.

Packet Switching is cost effective compared to Circuit Switching as there is no need to set up a connection between the communicating parties every time before the actual communication.

20. The Circuit Switching is not cost effective like Packet Switching because, in Circuit Switching, every time there is a need to set up a connection between the sender and the receiver before communicating the message.
21. IP address can be used to trace the physical location of a user connected to a network. By this many cybercrime can be investigated and traced out efficiently tracking the exact location from where the cybercrime is carried out.
22. The communicating devices may be in different geographical areas. The speed of these devices may be different. Also, the data transfer rates of different networks may be different. These complexities make it necessary to have a common set of rules i.e., Protocols to ensure the secure communication of data
23. World Wide Web
24. Interconnected Networks
25. Internet means interconnected networks that spread all over the world (i.e. the physical infrastructure), while WWW means the information's (available in the form of webpages) that can be accessed through internet.
26. Tim Berners-Lee
27. Web browsers
28. Web servers
29. d) A software program that allows you to access sites on the world wide web
30. c) Web page
31. b) Web Browser
32. Mozilla
33. Safari
34. Chrome
35. Firefox
36. Ubuntu
37. Web servers
38. hyperlinks
39. HTTP- HyperText Transfer Protocol
40. HyperText Transfer Protocol
41. World Wide Web(WWW) or Web
42. (ii) Uniform Resource Locator
43. Social networking
44. Distance Learning
45. (ii) Web Clients
46. (iii) Client/Server architecture
47. (ii) Web Browsers
48. web crawler (also known as a web spider or web bot)
49. (ii) HTML

50. (iii) XML
51. Refer comparison table
52. (iii) Protocol
53. Chat
54. E-learning
55. Internet banking
56. E-reservation
57. Social networking websites
- 58.
- a. HTTP - HyperText Transfer Protocol
  - b. XML - eXtensible Mark-up Language
  - c. HTTPS - HyperText Transfer Protocol Secure
  - d. HTML - HyperText Mark-up Language
59. Protocol is a set of rules that two or more computers must follow to communicate on network.  
Examples:  
HTTP (HyperText Transfer Protocol) is used to transfer web pages over internet.  
FTP (File Transfer Protocol) is used to copy a file from/to a remotely located server.
60. (ii) VoIP
61. In order to chat, you need to have an account on the same service as the person you are chatting with. e.g. on the other hand, in case of E-mail, it is not necessary, i.e. you can have an account from any provider and you can establish your own.
62. Cookies are files stored temporarily on www browser's computer, which allow the www server to store persistent information associated with browsing user on user's system.
- 63.
- (i) HTTP - HyperText Transfer Protocol
  - (ii) VoIP - Voice over Internet Protocol
64. IP addresses look like this: 192.168.12.134.  
Domain names look like this: "www.google.com"  
Domain names are easier for us to remember and use, while computers are quite handy with numbers. Thus, we use DNS (Domain Naming System) to translate domain names into the IP addresses.  
IP address is a unique identifier for a computer or device on internet. A domain name (website name) is a name that identifies one or more IP addresses (when hosted at different servers for load balancing).
65. URL: <https://kvsangathan.nic.in/hq-gyan-kosh>  
Domain name: kvsangathan.nic.in
66. XML was designed to describe data and to focus on what data is.  
HTML was designed to display data and to focus on how data looks.  
HTML is about displaying information while XML is about describing information.
67. Google Chrome, Mozilla Firefox
68. Website:- It is a collection of inter-linked web pages stored in a server.

**Web Browser:-** It is a software application for retrieving, presenting and traversing through information resources in the form of web pages available on the World Wide Web.

69.

| Domain Name                                                                    | URL                                                                                                      |
|--------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------|
| A domain name or website name is a human-friendly text form of the IP address. | URL is a string that represents the complete web address of any web page. It's used to locate a webpage. |
| It is the part of the URL that is more human friendly.                         | It is the string that represents a complete web address that contains the domain name.                   |
| Example: kvsangathan.nic.in                                                    | Example: https://kvsangathan.nic.in/contact-us                                                           |

70. (i) Two electronic devices

71. (iv) World Wide Web

72. Electronic mail

73.

|   |                    |   |                                                                                                                                          |
|---|--------------------|---|------------------------------------------------------------------------------------------------------------------------------------------|
| A | Video conferencing | P | Each of the end user has a camera as well as microphone to capture video and audio in real time and it will be transmitted over internet |
| B | E-Shopping         | Q | Purchasing products through computers/mobile devices                                                                                     |
| C | E-mail             | R | Messages normally reaches a recipients account within seconds                                                                            |
| D | E-reservation      | S | Without ever having to go booking office                                                                                                 |
| E | E-learning         | T | Self-paced learning modules allow students to work at their own speed                                                                    |

74.

| Web Services |                    | Applications |            |
|--------------|--------------------|--------------|------------|
| A            | Video conferencing | P            | VConSol    |
| B            | E-Shopping         | Q            | GEM        |
| C            | E-mail             | R            | Gmail      |
| D            | E-reservation      | S            | IRCTC      |
| E            | E-learning         | T            | Diksha App |
| F            | Social Networking  | U            | Instagram  |

### III. Previous CBSE Board Questions - Answers

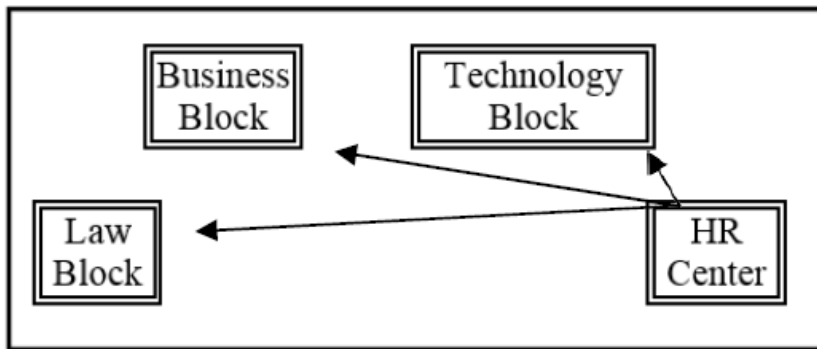
1. (iii) Secure
2. The default (first) page of a website is called a Homepage.
3. URL specifies unique address of each document on the internet.
4. (i) HTML  
Internet Protocols for communication over the Internet, the communicating devices must follow certain rules. These rules are called Internet protocols.  
For email communication, we use SMTP and POP.  
For communication between browser and server HTTP and HTTPS protocols are used.  
We can use TELNET to access services available on a remote computer.
5. b) HTTPS
6. Web-Client: An application that requests for services from a webserver. Example: Web Browsers, Chatting Applications  
Web-Server: Web-server is a software (or any dedicated computer running this software) that serves the request made by web-clients. Example: Apache Server.
7. Cc : Carbon Copy: every recipient can check who else has received the mail.  
Bcc : Blind Carbon Copy: no recipient can check who else has received the mail.
8. The Internet is a worldwide network that links many smaller computer-networks. Uses of the Internet 1. E-learning 2. E-commerce  
The difference between the internet and www:  
Internet means interconnected networks that spread all over the world (i.e. the physical infrastructure), while WWW means the information's (available in the form of webpages) that can be accessed through internet.
9. Web Browser
10. Server
11. A website is a collection of interlinked webpages.
12. Web Browsers
13. Role of server is to serve various clients (sharing data or resources among multiple clients)
14. (b) (i) and (iv)
15. (c) Mark-up Languages
16. (a) User defined tags
17. (b) present the data
18. (d) Video Conferencing
19. Cookies can store a wide range of information, including personally identifiable information (such as your name, home address, email address, or telephone number).  
Cookies often store your settings for a website, such as your preferred language or location. When you return to the site, browser sends back the cookies that belong to the site. This allows the site to present you with information customized to fit your needs.
20. (a) .com - commercial  
(b) .org - organization
21. XML tags are created by the user as there are no standard tags.  
Ex : <name>Nayana</name>



- 22. The process of converting domain names (website names) into corresponding IP address with the help of DNS servers is called domain name resolution.
- 23. (d) XML,HTML
- 24. (d) Photoshop
- 25. HTTP - Hyper Text Transfer Protocol
- 26. Google Chrome or any other valid browser name
- 27. (B) Extensible Markup Language
- 28. (D) FTP
- 29. Web Server

30 a. Most suitable place to install the server is HR center, as this center has maximum number of computers.

b.



c. Switch

d. Repeater may be placed when the distance between 2 buildings is more than 70 meter.

e. WAN, as the given distance is more than the range of LAN and MAN.

## DBMS-DATABASE MANAGEMENT SYSTEM(DBMS)

---

DBMS: A database management system (DBMS) is a collection of interrelated data and a set of programs to access those data. The collection of data, usually referred to as the database, contains information relevant to an enterprise. The DBMS provides a way to store and retrieve database information that is both convenient and efficient.

Keeping organizational information in a file- processing system has a number of major disadvantages like:

- a) Data redundancy and inconsistency
- b) Difficulty in accessing data
- c) Data isolation
- d) Integrity problems
- e) Atomicity problems
- f) Concurrent access anomalies
- g) Security problems

These difficulties among others, prompted the development of database systems.

- Database systems are designed to manage large bodies of information.
- Management of data involves both defining structures for storage of information and providing mechanisms for the manipulation of information.
- The database system also must ensure the safety of the information stored, despite system crashes or attempts at unauthorized access. If data are to be shared among several users, the system must avoid possible anomalous results.
- DBMS lets users to create a database, store, manage, update/modify and retrieve data from that database by users or application programs.

Some examples of open source and commercial DBMS include MySQL, Oracle, PostgreSQL, SQL Server, Microsoft Access, MongoDB.

Database systems are widely used. Some representative applications are :

- a) Banking
- b) Airlines
- c) Universities
- d) Telecommunications
- e) Sales
- f) Finance, etc.

A data model describes the structure of the database, including how data are defined and represented, relationships among data, and the constraints.

Key concepts in database:

**Database schema:** Database Schema is the design of a database. It is the skeleton of the database that represents the structure (table names and their fields/columns), the type of data each column can hold, constraints on the data to be stored (if any), and the relationships among the tables.

Database schema is also called the visual or logical architecture as it tells us how the data are organized in a database.

**Data constraint:** Restrictions or limitations are put on the type of data that can be inserted in one or more columns of a table to ensure accuracy and reliability of data in the database.

**Meta – Data or Dictionary:** A database catalog or dictionary that has data about data.

**Database instance:** The state of database at any time, after loading of data. A database schema can have different instances at different times.

**Query:** A query is a request to a database for obtaining information in a desired way.

**Data Manipulation:** Modification of database consists of three operations viz. Insertion, Deletion or Update.

**Database engine:** Database engine is the underlying component or set of programs used by a DBMS to create database and handle various queries for data retrieval and manipulation.

**Relational model:** The relational model uses a collection of tables to represent both data and the relationships among those data. Each table has multiple columns, and each column has a unique name. The relational model is an example of a record – based model. Record- based models are so named because the database is structured in fixed- format records of several types. Each table contains records of particular type. Each record type defines a fixed number of fields/attributes. The columns of the table correspond to the attributes of the record type. A row in a table represents a relationship among a set of values. The relational data model is the *most widely used data model*. Other types of data models include object-oriented data model, entity-relationship data model, document model and hierarchical data model.

| SNO | NAME  | CLASS | CITY  |
|-----|-------|-------|-------|
| 1   | SUMIT | 12    | DELHI |
| 2   | ANU   | 11    | NOIDA |
| 3   | MEENU | 12    | AGRA  |

**Relation:** A Relation is logically related data organized in the form of tables.

**Attribute/Field:** Column of a table is called Attribute or Field.

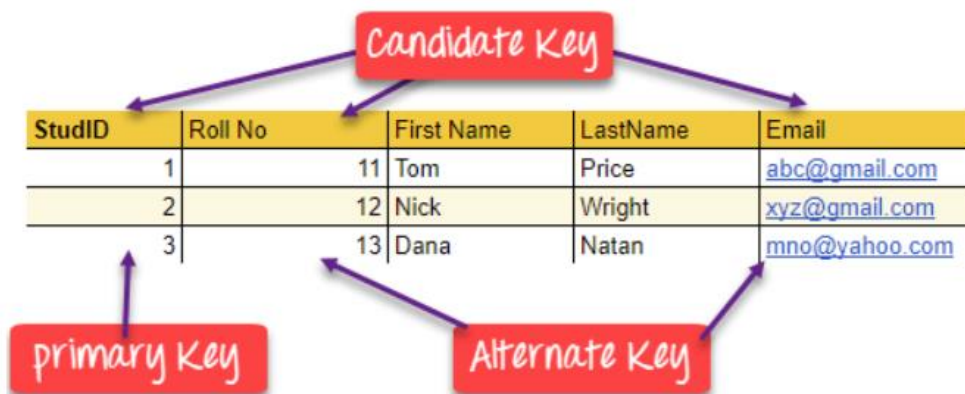
**Tuple/Entity/Record:** Rows of a table is called Tuple or Record.

**Domain:** It is collection of values from which the value is derived for a column.

Degree - Number of columns (attributes) in a table.

Cardinality - Number of rows (Records) in a table.

Keys:



**Primary Key** - A primary is a column or set of columns in a table that uniquely identifies tuples (rows) in that table.

**Candidate Key** -It is an attribute or a set of attributes or keys participating for Primary Key, to uniquely identify each record in that table.

**Alternate Key** - Out of all candidate keys, only one gets selected as primary key, remaining keys are known as alternate or secondary keys.

**Foreign Key** - Foreign keys are the columns of a table that points to the primary key of another table.

## Model Questions

### I. Multiple choice Questions(MCQ):

1. DBMS stands for\_\_\_\_\_
  - a) Data Base Management Software
  - b) Data Base Maintenance System
  - c) Data Basic Management System
  - d) Data Base management system
2. In RDBMS, R stands for\_\_\_\_\_
  - a) Relational
  - b) Rotational
  - c) Rational
  - d) None of the above
3. A Database contains one or more\_\_\_\_\_
  - a) Data
  - b) Tables
  - c) Files
  - d) Links
4. What is not true in respect of DBMS?
  - a) Database enforces standards
  - b) Database increases redundancy
  - c) Database facilitates sharing of data
  - d) Database helps to maintain integrity
5. Cardinality is total \_\_\_\_\_
  - a) number of rows in a table
  - b) number of columns in a table
  - c) number of data items in a table
  - d) none of the above
6. Degree refers to total\_\_\_\_\_
  - a) number of rows in a table
  - b) number of columns in a table
  - c) number of data items in a table
  - d) none of the above
7. Referential Integrity is a rule that ensures \_\_\_\_\_ between records in related tables are valid.

- a) links
- b) difference
- c) relationship
- d) similarity

8. Data about data is \_\_\_\_\_

- a) Data redundancy
- b) Meta Data
- c) Database schema
- d) None of the above

9. Repetition of data is called .....

- a) Data redundancy
- b) Data Description
- c) Data inconsistency
- d) None of the above

10. Mismatched redundant copies of data is known as data .....

- a) Dependence
- b) Inconsistency
- c) Isolation
- d) Redundancy

11. A ..... is an organized collection of structured data.

- a) Database
- b) File
- c) DBMS
- d) Information

12. A data ..... is a set of rules that define valid data.

- a) Query
- b) Constraint
- c) Dictionary
- d) All of the above

13. A relational database consists of a collection of .....

- a) Fields
- b) Records
- c) Keys
- d) Tables

14. A row in a database.

- a) Field
- b) Record
- c) Key
- d) Table

15. The term \_\_\_\_\_ is used to refer to a field in a table.
- Attribute
  - Row
  - Tuple
  - Instance
16. Which of the following statements is not true about relational database?
- Relational data model is the most widely used data model.
  - The data is arranged as a collection of tables in relational database.
  - Relational database increases data redundancy and inconsistency.
  - None of the above.
17. Which of the following is a disadvantage of file processing system?
- Data redundancy
  - Data isolation
  - Data inconsistency
  - All of the above
18. A \_\_\_\_\_ is a property of the entire relation, rather than of the individual tuples in which each tuple is unique.
- Rows
  - Key
  - Attribute
  - Fields
19. Which one of the following attribute can be taken as a primary key?
- Name
  - Street
  - Id
  - Department
20. A \_\_\_\_\_ integrity constraint requires that the values appearing in specified attributes of any tuple in the referencing relation also appear in specified attributes of at least one tuple in the referenced relation.
- Referencing
  - Referential
  - Primary
  - Specific

21. Table: Employee

| EMPID | ENAME  | SALARY | DEPTNO | Email                                                          |
|-------|--------|--------|--------|----------------------------------------------------------------|
| 1001  | George | 30000  | 10     | <a href="mailto:George23@yahoo.co.in">George23@yahoo.co.in</a> |
| 1002  | Mary   | 32000  | 12     | <a href="mailto:Mary_123@yahoo.co.in">Mary_123@yahoo.co.in</a> |
| 1003  | Alwin  | 25000  | 12     | <a href="mailto:Al_win@gmail.com">Al_win@gmail.com</a>         |

|      |       |       |    |                                                                  |
|------|-------|-------|----|------------------------------------------------------------------|
| 1004 | Sumit | 20000 | 11 | <a href="mailto:Sumit_222@yahoo.co.in">Sumit_222@yahoo.co.in</a> |
|------|-------|-------|----|------------------------------------------------------------------|

Answer the questions based on the table Employee.

- a) The cardinality of the table Employee is .....
- 5
  - 4
  - 3
  - 6
- b) The degree of the table Employee is .....
- 3
  - 4
  - 5
  - 6
- c) Which column can be made as the primary key in the table Employee?
- EMPID
  - EMAIL
  - Both i and ii
  - None of the above
- d) If two columns are added to the table Employee, then the cardinality and degree of the table is ..... and ..... respectively.
- 4, 7
  - 7, 4
  - 6, 5
  - 5, 6
- e) State True/False:  
Both EMPID and EMAIL can be defined as primary key in the table Employee.
- True
  - False

22. An attribute in a relation is a foreign key if it is the \_\_\_\_\_ key in any other relation.

- Candidate
- Primary
- Super
- Sub
- 

23. A(n) \_\_\_\_\_ in a table represents a logical relationship among a set of values.

- Column



- b) Key
- c) Row
- d) Attribute

24. Which of the following attributes can be considered as a choice for the primary key?

- a) Name
- b) Street
- c) RollNo
- d) Subject

II. Very Short Answer Questions:

- 1) What is meant by a database?
- 2) What is primary key?
- 3) What do you mean by candidate key?
- 4) What is meant by degree and cardinality of a table?
- 5) What is meant by DBMS?
- 6) What is meant by database schema?
- 7) What is meant by data constraint?
- 8) What is meant by relation?
- 9) 

Table: Product

| Pno | Name     | Qtr | Purchase Date |
|-----|----------|-----|---------------|
| 101 | Pen      | 102 | 12-12-2011    |
| 102 | Pencil   | 201 | 21-02-2013    |
| 103 | Eraser   | 90  | 09-08-2010    |
| 109 | Sharpner | 90  | 31-08-2011    |
| 113 | Clips    | 900 | 12-12-2011    |

- (i) Write the names of the most appropriate columns, which can be considered as candidate keys.
- (ii) What is the degree and cardinality of the above table.

III. Fill in the blanks:

- 1) \_\_\_\_\_ helps in efficient retrieval, inserting and deleting of data.
- 2) \_\_\_\_\_ is a software for creating and managing databases.
- 3) \_\_\_\_\_ means that data is accurate and consistent in the database.

- 4) \_\_\_\_\_ - ensure that the database properly changes states upon a successfully committed transaction.
- 5) RDBMS stands for \_\_\_\_\_.
- 6) In RDBMS a database is considered as a collection of \_\_\_\_\_
- 7) Collection of rows and columns are called as \_\_\_\_\_
- 8) Record is also called as a \_\_\_\_\_
- 9) The group of one or more columns used to uniquely identify each row of a relation is called \_\_\_\_\_
- 10) \_\_\_\_\_ is data about data.
- 11) A \_\_\_\_\_ is a request to a database for obtaining information in a desired way.
- 12) \_\_\_\_\_ is collection of values from which the value is derived for a column.
- 13) \_\_\_\_\_ are the columns of a table that points to the primary key of another table.

#### IV. True/False Questions:

- 1 Data is raw facts.
2. Information is processed data.
3. Database is a software for creating and managing databases.
4. DBMS increases application development and maintenance time.
5. A column or a combination of columns which can be used to identify one or more rows (tuples) in a table is called a key of the table.
6. The group of one or more columns used to uniquely identify each row of a relation is called its Primary Key.

## ANSWERS:

### I. Multiple Choice Questions (MCQ)

|      |      |      |       |      |       |      |      |
|------|------|------|-------|------|-------|------|------|
| 1    | D    | 2    | A     | 3    | B     | 4    | B    |
| 5    | A    | 6    | B     | 7    | C     | 8    | B    |
| 9    | A    | 10   | B     | 11   | A     | 12   | B    |
| 13   | D    | 14   | B     | 15   | A     | 16   | C    |
| 17   | D    | 18   | B     | 19   | C     | 20   | B    |
| 21a) | (ii) | 21b) | (iii) | 21c) | (iii) | 21d) | (ii) |
| 21e) | (ii) | 22   | B     | 23   | C     | 24   | C    |

### II. Very Short Answer Answers:

|   |                                                                                                                                                                                                                                                                                                                        |
|---|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 | A database is an organized collection of structured information, or inter-related data, typically stored in a computer system.                                                                                                                                                                                         |
| 2 | A primary key is a column or set of columns that contain values that uniquely identify each row in a table.                                                                                                                                                                                                            |
| 3 | It is an attribute or a set of attributes or keys participating for Primary Key, to uniquely identify each record in that table.                                                                                                                                                                                       |
| 4 | Degree refers to the number of attributes/columns in a relation.<br>Cardinality refers to the number of tuples/rows in a relation.                                                                                                                                                                                     |
| 5 | RDBMS (relational database management system) is the software used to store, manage, query, and retrieve data stored in a relational database. The RDBMS provides an interface between users and applications and the database, as well as administrative functions for managing data storage, access and performance. |
| 6 | Database schema is also called the visual or logical architecture as it tells us how the data are organized in a database.                                                                                                                                                                                             |
| 7 | Restrictions or limitations are put on the type of data that can be inserted in one or more columns of a table to ensure accuracy and reliability of data in the database.                                                                                                                                             |
| 8 | A relation is a named, two dimensional table storing logically related data.                                                                                                                                                                                                                                           |
| 9 | (i) Pno,Name<br>(ii) Degree:4<br>Cardinality :5                                                                                                                                                                                                                                                                        |

**III. Fill in the blanks:**

|    |             |    |                                       |    |                   |
|----|-------------|----|---------------------------------------|----|-------------------|
| 1  | Database    | 2  | DBMS                                  | 3  | Data integrity    |
| 4  | Consistency | 5  | Relational Database Management System | 6  | Interrelated data |
| 7  | Table       | 8  | Tuple                                 | 9  | Primary key       |
| 10 | Meta - data | 11 | Query                                 | 12 | Domain            |
| 13 | Foreign key |    |                                       |    |                   |

**IV. True/False:**

- 1) True
- 2) True
- 3) False
- 4) False
- 5) True
- 6) True

# STRUCTURED QUERY LANGUAGE(SQL)

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.

## 1.1 What is SQL?

SQL (Structured Query Language) is a language that is used to manage data that is held in a relational database management system. It uses tables to manipulate and retrieve information from databases for analysis.

By using SQL commands, one can search for any data in the database and perform other functions like creating tables, adding records, modifying data, removing rows, dropping tables etc.

## 1.2 What Can SQL do?

SQL can execute queries against a database

SQL can retrieve data from a database

SQL can insert records in a database

SQL can update records in a database

SQL can delete records from a database

SQL can create new databases

SQL can create new tables in a database

SQL can create stored procedures in a database

SQL can create views in a database

SQL can set permissions on tables, procedures, and views

## 1.3 ADVANTAGES OF SQL

There are the following advantages of SQL:

- High speed

Using the SQL queries, the user can quickly and efficiently retrieve a large amount of records from a database.

- No coding needed

In the standard SQL, it is very easy to manage the database system. It doesn't require a substantial amount of code to manage the database system.

- Well defined standards

Long established are used by the SQL databases that are being used by ISO and ANSI.

- Portability

SQL can be used in laptop, PCs, server and even some mobile phones.

- Interactive language

SQL is a domain language used to communicate with the database. It is also used to receive answers to the complex questions in seconds.

- Multiple data view

Using the SQL language, the users can make different views of the database structure.

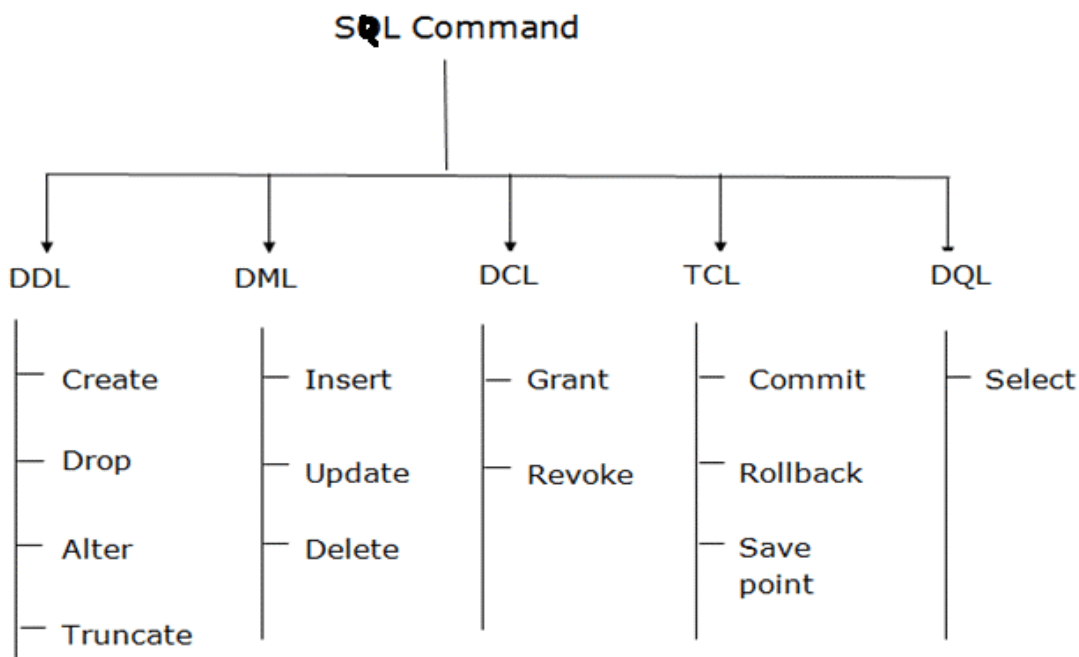
### 1.4 SQL Commands

SQL commands are instructions. It is used to communicate with the database. It is also used to perform specific tasks, functions, and queries of data.

SQL can perform various tasks like create a table, add data to tables, drop the table, modify the table, set permission for users.

### 1.5 Types of SQL Commands

There are five types of SQL commands: DDL, DML, DCL, TCL, and DQL.



#### 1.5.1 DDL or Data Definition Language

DDL or Data Definition Language actually consists of the SQL commands that can be used to define the database schema. It simply deals with descriptions of the database schema and is used to create and modify the structure of database objects in the database. DDL is a set of SQL commands used to create, modify, and delete database structures but not data.

#### List of DDL commands:

**CREATE:** This command is used to create the database or its objects (like table, index, function, views, store procedure, and triggers).

**DROP:** This command is used to delete objects from the database.

**ALTER:** This is used to alter the structure of the database.

**TRUNCATE:** This is used to remove all records from a table, including all spaces allocated for the records are removed.

**COMMENT:** This is used to add comments to the data dictionary.

**RENAME:** This is used to rename an object existing in the database.

### 1.5.2 DML (Data Manipulation Language):

The SQL commands that deals with the manipulation of data present in the database belong to DML or Data Manipulation Language and this includes most of the SQL statements. It is the component of the SQL statement that controls access to data and to the database. Basically, DCL statements are grouped with DML statements.

#### List of DML commands:

**INSERT :** It is used to insert data into a table.

**UPDATE:** It is used to update existing data within a table.

**DELETE :** It is used to delete records from a database table.

#### Difference between DDL and DML:

| <u>DDL</u>                                                                               | <u>DML</u>                                                             |
|------------------------------------------------------------------------------------------|------------------------------------------------------------------------|
| It stands for Data Definition Language.                                                  | It stands for Data Manipulation Language.                              |
| It is used to create database schema and can be used to define some constraints as well. | It is used to add, retrieve or update the data.                        |
| It basically defines the column (Attributes) of the table.                               | It add or update the row of the table. These rows are called as tuple. |
| It doesn't have any further classification.                                              | It is further classified into Procedural and Non-Procedural DML.       |
| Basic command present in DDL are CREATE, DROP, RENAME, ALTER etc.                        | BASIC command present in DML are UPDATE, INSERT, MERGE etc.            |
| DDL does not use WHERE clause in its statement.                                          | While DML uses WHERE clause in its statement.                          |

## 1.6 DATATYPES

### ➤ Text Data types

Char(size) – fixed length of *size* bytes

Varchar(size)-variable length of *size* bytes

Varchar2(size)-variable length of *size* bytes

### ➤ Number Data types

Integer(size)or Int- It represents a number without decimal point

Float(Size)-It represents a floating point number

Real-Same as float but no size argument is used

### ➤ Date data type

Date

Time Data type

Time

## 1.7 CONSTRAINT

A Constraint is a condition or check applicable on a field or set of fields

There are 2 types of constraints

- Column Level constraints – Applied on a single column
- Table level constraints- Applied on multiple columns

### 1.7.1 Types of Constraints:

- Unique Constraint :-This ensures that no rows have the same value in the specified column(s)

Syntax:

Create table EMP (ecode integer unique, ename char(20),sex char(1),grade char(2));

Unique constraint applied on ecode of EMP table ensures that no rows have the same ecode value

- Primary key Constraint:- This declares a column as the primary key of the table This is similar to unique constraint except that one column (or one group of columns)can be applied in this constraint .The primary key cannot allow NULL values but Unique key allows for the first time (allows only once)

The following SQL creates a PRIMARY KEY on the "ID" column when the "Persons" table is created:



MySQL:

```
CREATE TABLE Persons (  
  ID int NOT NULL,  
  LastName varchar(255) NOT NULL,  
  FirstName varchar(255),  
  Age int,  
  PRIMARY KEY (ID)  
);
```

- Not null:-This constraint ensures column should not be NULL

Syntax:

```
Create table EMP(ecode integer Not null unique, ename char(20),sex char(1),grade char(2));
```

Multiple constraints can be given by putting space in between them comma should be given at the end of the constraint

## 1.8 DATABASE COMMANDS IN MYSQL

- CREATE DATABASE

CREATE DATABASE is the SQL command used for creating a database in MySQL.

Imagine you need to create a database with name “movies”. You can create a database in MySQL by executing following SQL command

Syntax:

```
mysql>CREATE DATABASE movies;
```

- SHOW DATABASES

You can see list of existing databases by running following SQL command.

Syntax:

```
mysql>SHOW DATABASES;
```

- USE

You can use SQL command USE to select a particular database.

Syntax:

```
mysql>USE database_name;
```

- DROP DATABASE

The DROP DATABASE statement is used to drop an existing SQL database.

Syntax

```
mysql>DROP DATABASE database_name;
```

### ➤ CREATE TABLE

The CREATE TABLE statement is used to create a new table in a database.

Syntax

```
CREATE TABLE table_name (  
    column1 datatype,  
    column2 datatype,  
    column3 datatype,  
    ....  
);
```

Example

The following example creates a table called "Persons" that contains five columns:

PersonID, LastName, FirstName, Address, and City:

```
CREATE TABLE Persons (  
    PersonID int,  
    LastName varchar(255),  
    FirstName varchar(255),  
    Address varchar(255),  
    City varchar(255)  
);
```

### ➤ SHOW TABLES:

We can get the number of table information of a database using the following statement:

```
mysql> SHOW TABLES;
```

### ➤ DESCRIBE TABLE

Use the DESCRIBE command to show the structure of the table, such as column names, constraints on column names, etc. The DESC command is a short form of the DESCRIBE command. Both DESCRIBE and DESC commands are equivalent.

Syntax

The following are the syntax to display the table structure:

```
mysql> DESCRIBE | DESC table_name;
```

### SQL ALTER TABLE Statement

The ALTER TABLE statement is used to add, delete, or modify columns in an existing table.

The ALTER TABLE statement is also used to add and drop various constraints on an existing table.

## ALTER TABLE - ADD Column/Attribute

To add a column in a table, use the following syntax:

```
ALTER TABLE table_name
```

```
ADD column_name datatype;
```

Example

```
ALTER TABLE Customers
```

```
ADD Email varchar(255);
```

## ALTER TABLE - DROP COLUMN

To delete a column in a table, use the following syntax

```
ALTER TABLE table_name
```

```
DROP COLUMN column_name;
```

Example

```
ALTER TABLE Customers
```

```
DROP COLUMN Email;
```

## SQL PRIMARY KEY on ALTER TABLE

To create a PRIMARY KEY constraint on the "ID" column when the table is already created, use the following SQL:

```
ALTER TABLE table_name
```

```
ADD PRIMARY KEY (Column_name);
```

Example

```
ALTER TABLE Persons
```

```
ADD PRIMARY KEY (ID);
```

## DROP a PRIMARY KEY Constraint

To drop a PRIMARY KEY constraint, use the following SQL:

```
ALTER TABLE table_name
```

```
DROP PRIMARY KEY;
```

## Example

```
ALTER TABLE Persons
```

```
DROP PRIMARY KEY;
```

## The SQL DROP TABLE Statement

The DROP TABLE statement is used to drop an existing table in a database.

## Syntax

```
DROP TABLE table_name;
```

## SQL DROP TABLE Example

The following SQL statement drops the existing table "Shippers":

```
DROP TABLE Shippers;
```

## The SQL INSERT INTO Statement

The INSERT INTO statement is used to insert new records in a table.

## INSERT INTO Syntax

It is possible to write the INSERT INTO statement in two ways:

1. Specify both the column names and the values to be inserted:

```
INSERT INTO table_name (column1, column2, column3, ...)
```

```
VALUES (value1, value2, value3, ...);
```

2. If you are adding values for all the columns of the table, you do not need to specify the column names in the SQL query. However, make sure the order of the values is in the same order as the columns in the table. Here, the INSERT INTO syntax would be as follows:

```
INSERT INTO table_name
```

```
VALUES (value1, value2, value3, ...);
```

## The SQL DELETE Statement

The DELETE statement is used to delete existing records in a table.

## DELETE Syntax

```
DELETE FROM table_name WHERE condition;
```

Note: Be careful when deleting records in a table! Notice the WHERE clause in the DELETE statement. The WHERE clause specifies which record(s) should be deleted. If you omit the WHERE clause, all records in the table will be deleted!

The following SQL statement deletes all rows in the "Customers" table, without deleting the table:

```
DELETE FROM Customers;
```

### The SQL SELECT Statement

The SELECT statement is used to select data from a database.

The data returned is stored in a result table, called the result-set.

### SELECT Syntax

```
SELECT column1, column2, ...
```

```
FROM table_name;
```

Here, *column1, column2, ...* are the field names of the table you want to select data from. If you want to select all the fields available in the table, use the following syntax:

```
SELECT * FROM table_name;
```

### SELECT Column Example

The following SQL statement selects the "CustomerName" and "City" columns from the "Customers" table:

#### Example

```
SELECT CustomerName, City FROM Customers;
```

### The SQL WHERE Clause

The WHERE clause is used to filter records.

It is used to extract only those records that fulfill a specified condition.

### WHERE Syntax

```
SELECT column1, column2, ...
```

```
FROM table_name
```

WHERE *condition*;

## Operators in The WHERE Clause

The following operators can be used in the WHERE clause:

| Operator | Description                                                                 |
|----------|-----------------------------------------------------------------------------|
| =        | Equal                                                                       |
| >        | Greater than                                                                |
| <        | Less than                                                                   |
| >=       | Greater than or equal                                                       |
| <=       | Less than or equal                                                          |
| <>       | Not equal. Note: In some versions of SQL this operator may be written as != |
| BETWEEN  | Between a certain range                                                     |
| LIKE     | Search for a pattern                                                        |
| IN       | To specify multiple possible values for a column                            |

## The SQL AND, OR and NOT Operators

The WHERE clause can be combined with AND, OR, and NOT operators.

The AND and OR operators are used to filter records based on more than one condition:

- The AND operator displays a record if all the conditions separated by AND are TRUE.
- The OR operator displays a record if any of the conditions separated by OR is TRUE.

The NOT operator displays a record if the condition(s) is NOT TRUE.

### AND Syntax

```
SELECT column1, column2, ...
```

```
FROM table_name
```

```
WHERE condition1 AND condition2 AND condition3...;
```

## OR Syntax

```
SELECT column1, column2, ...  
FROM table_name  
WHERE condition1OR condition2OR condition3...;
```

## NOT Syntax

```
SELECT column1, column2, ...  
FROM table_name  
WHERE NOT condition;
```

## The SQL IN Operator

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

The IN operator is a shorthand for multiple OR conditions.

## IN Syntax

```
SELECT column_name(s)  
FROM table_name  
WHERE column_name IN (value1, value2, ...);
```

or:

```
SELECT column_name(s)  
FROM table_name  
WHERE column_name IN (SELECT STATEMENT);
```

## The SQL BETWEEN Operator

The BETWEEN operator selects values within a given range. The values can be numbers, text, or dates.

The BETWEEN operator is inclusive: begin and end values are included.

## BETWEEN Syntax

```
SELECT column_name(s)
```

FROM *table\_name*

WHERE *column\_name* BETWEEN *value1* AND *value2*;

### The SQL ORDER BY Keyword

The ORDER BY keyword is used to sort the result-set in ascending or descending order.

The ORDER BY keyword sorts the records in ascending order by default. To sort the records in descending order, use the DESC keyword.

### ORDER BY Syntax

```
SELECT column1, column2, ...
```

```
FROM table_name
```

```
ORDER BY column1, column2, ... ASC|DESC;
```

### Example

```
SELECT * FROM Customers
```

```
ORDER BY Country;
```

### ORDER BY DESC Example

The following SQL statement selects all customers from the "Customers" table, sorted DESCENDING by the "Country" column:

### Example

```
SELECT * FROM Customers
```

```
ORDER BY Country DESC;
```

### ORDER BY Several Columns Example

The following SQL statement selects all customers from the "Customers" table, sorted by the "Country" and the "CustomerName" column. This means that it orders by Country, but if some rows have the same Country, it orders them by CustomerName:

### Example

```
SELECT * FROM Customers
```

```
ORDER BY Country, CustomerName;
```



## SQL Aliases

SQL aliases are used to give a table, or a column in a table, a temporary name.

Aliases are often used to make column names more readable.

An alias only exists for the duration of that query.

An alias is created with the AS keyword.

### Alias Column Syntax

```
SELECT column_name AS alias_name
```

```
FROM table_name;
```

### Alias Table Syntax

```
SELECT column_name(s)
```

```
FROM table_name AS alias_name;
```

## The SQL UPDATE Statement

The UPDATE statement is used to modify the existing records in a table.

### UPDATE Syntax

```
UPDATE table_name
```

```
SET column1= value1, column2= value2, ...
```

```
WHERE condition;
```

### UPDATE Table

The following SQL statement updates the first customer (CustomerID = 1) with a new contact person *and* a new city.

#### Example

```
UPDATE Customers
```

```
SET ContactName = 'Alfred Schmidt', City= 'Frankfurt'
```

```
WHERE CustomerID = 1;
```

## The SQL SELECT DISTINCT Statement

The SELECT DISTINCT statement is used to return only distinct (different) values.

Inside a table, a column often contains many duplicate values; and sometimes you only want to list the different (distinct) values.

### SELECT DISTINCT Syntax

```
SELECT DISTINCT column1, column2, ...
```

```
FROM table_name;
```

### SELECT Example Without DISTINCT

The following SQL statement selects all (including the duplicates) values from the "Country" column in the "Customers" table:

#### Example

```
SELECT Country FROM Customers;
```

Now, let us use the SELECT DISTINCT statement and see the result.

### SELECT DISTINCT Examples

The following SQL statement selects only the DISTINCT values from the "Country" column in the "Customers" table:

#### Example

```
SELECT DISTINCT Country FROM Customers;
```

The following SQL statement lists the number of different (distinct) customer countries:

#### Example

```
SELECT COUNT(DISTINCT Country) FROM Customers;
```

## The SQL LIKE Operator

The LIKE operator is used in a WHERE clause to search for a specified pattern in a column.

There are two wildcards often used in conjunction with the LIKE operator:

- The percent sign (%) represents zero, one, or multiple characters
- The underscore sign (\_) represents one, single character

The percent sign and the underscore can also be used in combinations!

## LIKE Syntax

SELECT *column1, column2, ...*

FROM *table\_name*

WHERE *columnN* LIKE *pattern*;

| LIKE Operator                  | Description                                                                  |
|--------------------------------|------------------------------------------------------------------------------|
| WHERE CustomerName LIKE 'a%'   | Finds any values that start with "a"                                         |
| WHERE CustomerName LIKE '%a'   | Finds any values that end with "a"                                           |
| WHERE CustomerName LIKE '%or%' | Finds any values that have "or" in any position                              |
| WHERE CustomerName LIKE '_r%'  | Finds any values that have "r" in the second position                        |
| WHERE CustomerName LIKE 'a_%'  | Finds any values that start with "a" and are at least 2 characters in length |
| WHERE CustomerName LIKE 'a__%' | Finds any values that start with "a" and are at least 3 characters in length |
| WHERE ContactName LIKE 'a%o'   | Finds any values that start with "a" and ends with "o"                       |

## What is a NULL Value?

A field with a NULL value is a field with no value.

If a field in a table is optional, it is possible to insert a new record or update a record without adding a value to this field. Then, the field will be saved with a NULL value.

## How to Test for NULL Values?

It is not possible to test for NULL values with comparison operators, such as =, <, or <>.

We will have to use the IS NULL and IS NOT NULL operators instead.

## IS NULL Syntax

SELECT *column\_names*

FROM *table\_name*

WHERE *column\_name* IS NULL;

IS NOT NULL Syntax

SELECT *column\_names*

FROM *table\_name*

WHERE *column\_name* IS NOT NULL;

The IS NULL Operator

The IS NULL operator is used to test for empty values (NULL values).

The following SQL lists all customers with a NULL value in the "Address" field:

Example

```
SELECT CustomerName, ContactName, Address
```

```
FROM Customers
```

```
WHERE Address IS NULL;
```

The IS NOT NULL Operator

The IS NOT NULL operator is used to test for non-empty values (NOT NULL values).

The following SQL lists all customers with a value in the "Address" field:

Example

```
SELECT CustomerName, ContactName, Address
```

```
FROM Customers
```

```
WHERE Address IS NOT NULL;
```

### Aggregate (Group) function

- Aggregate functions are the functions that operate on a set of rows to give one result per group.
- These sets of rows on which group function is applied may be the whole table or the table split into groups.

## Types of Group Functions

| Function | Description                                       |
|----------|---------------------------------------------------|
| sum()    | Find the sum of numeric values                    |
| avg()    | Find the average of numeric values                |
| count()  | Counts the number of rows in a table              |
| max()    | Find the maximum among all the values in a column |
| min()    | Find the minimum among all the values in a column |

Remember the following points about group functions:

- All group functions, except count(\*) ignore NULL values
- Functions -sum(),avg() are used with NUMERIC data.
- Functions -min() and max() can be used with any data type

Example:

Consider the following table employee

```
mysql> select * from employee;
+----+-----+-----+-----+-----+-----+-----+
| No  | Name  | Salary | Zone  | Age  | Grade | Dept |
+----+-----+-----+-----+-----+-----+-----+
1	Mukul	30000	West	28	A	10
2	Kritika	35000	Centre	30	A	10
3	Naveen	32000	West	40	NULL	20
4	Uday	38000	North	38	C	30
5	Nupur	32000	East	26	NULL	20
6	Moksh	37000	South	28	B	10
7	Shelly	36000	North	26	A	30
+----+-----+-----+-----+-----+-----+-----+
7 rows in set (0.00 sec)
```

Q: Find the sum,average,minimum,maximum value of salaries of employees in the employee table

```
mysql> select sum(salary),min(salary),avg(salary),max(salary) from employee;
+-----+-----+-----+-----+
| sum(salary) | min(salary) | avg(salary) | max(salary) |
+-----+-----+-----+-----+
| 240000      | 30000       | 34285.7143  | 38000       |
+-----+-----+-----+-----+
1 row in set (0.00 sec)
```

## Count() function

Count () has got three formats:

### Count(\*)

- This function returns the number of rows in the table that satisfy the criteria of select statement.
- In its counting, it includes duplicate rows and rows with NULL values in any of the column

Example:

Q: Count the number of employees in the employee table.

```
mysql> select count(*) from employee;
+-----+
| count(*) |
+-----+
|         7 |
+-----+
1 row in set (0.00 sec)
```

### Count(<col name>)

- This function returns the number of not null values in the specified column, but includes duplicate values in counting

Example

Q; count the number of grades of employees in the employee table.

```
mysql> select count(grade) from employee;
+-----+
| count(grade) |
+-----+
|             5 |
+-----+
1 row in set (0.00 sec)
```

### Count(DISTINCT <col name>)

- This function returns the number of unique, not null values in the specified column.

Example

Q Count the number of different grades of the employee

```
mysql> select count(distinct grade) from employee;
+-----+
| count(distinct grade) |
+-----+
|                3 |
+-----+
1 row in set (0.00 sec)
```

## Grouping Records (Group by clause)

- To divide the rows in a table into smaller groups of information, group by clause is used.
- It combines all identical rows in a group of fields.
- A column name is used for grouping

Syntax:-

```
SELECT [DISTINCT] <COL LIST> FROM <TABLE NAME>
[WHERE <CONDITION>]
[GROUP BY < GROUP BY EXPR>]
[HAVING <CONDITION>]
[ORDER BY <COL NAME>/<EXPR> ASC/DESC];
```

NOTE-

- Group by expression specifies the columns whose values determine the basics for grouping rows
- WHERE clause is always before GROUP BY if required.

Example

Q. Display the no of employees in each zone

```
mysql> select zone,count(zone) from employee group by zone;
+-----+-----+
| zone | count(zone) |
+-----+-----+
Centre	1
East	1
North	2
South	1
West	2
+-----+-----+
5 rows in set (0.01 sec)
```

Q Display the no of employees in each zone whose salary is greater than 32000

```
mysql> select zone,count(zone) from employee where salary>32000 group by zone;
+-----+-----+
| zone | count(zone) |
+-----+-----+
Centre	1
North	2
South	1
+-----+-----+
3 rows in set (0.00 sec)
```

## Nested groups

- If there are groups within groups , these are called nested groups.
- Nesting can be applied to the fields to group records where first field determines the highest level of grouping
- The last field has lowest level of grouping
- To create a nested group, we have to specify multiple fields in group by expression.

Example-

Q. Display no of employees dept wise and zone wise.

```
mysql> select dept,zone, count(zone) from employee group by dept,zone;
+-----+-----+-----+
| dept | zone | count(zone) |
+-----+-----+-----+
10	Centre	1
10	South	1
10	West	1
20	East	1
20	West	1
30	North	2
+-----+-----+-----+
6 rows in set (0.00 sec)
```

## Having clause

- This clause is used to restrict rows resulting after grouping.
- Steps followed in execution of select with group by and having clause-
  1. Rows are grouped according to the columns in the group by clause.
  2. Then the group function is applied.
  3. Groups matching with Having clauses are displayed.

Example

Q. Display only those departments with sum of salaries whose total salary is greater than 70000



```
mysql> select dept,sum(salary) from employee group by dept having sum(salary)>70000;
+-----+-----+
| dept | sum(salary) |
+-----+-----+
| 10   | 102000      |
| 30   | 74000       |
+-----+-----+
2 rows in set (0.00 sec)
```

## Cartesian Product (Cross Join or unrestricted join)

- Returns all the rows in the two tables listed in the query.
- Each row of the first table is paired with all the rows in the second table.
- This happens when there is no relationship between two tables.
- It is rarely useful.

Example-

- Example- Consider the following tables

```
mysql> SELECT * FROM EMPLOYEE;
+----+-----+-----+-----+-----+-----+-----+
| No | Name   | Salary | Zone   | Age  | Grade | Dept |
+----+-----+-----+-----+-----+-----+-----+
1	Mukul	30000	West	28	A	10
2	Kritika	35000	Centre	30	A	10
3	Naveen	32000	West	40	NULL	20
4	Uday	38000	North	38	C	30
5	Nupur	32000	East	26	NULL	20
6	Moksh	37000	South	28	B	10
7	Shelly	36000	North	26	A	30
8	Mukul	40000	West	50	C	10
+----+-----+-----+-----+-----+-----+-----+
8 rows in set (0.00 sec)

mysql> SELECT * FROM DEPARTMENT;
+-----+-----+
| Dept | Dname          |
+-----+-----+
10	Mechanical
20	Electrical
30	Computer Sci
+-----+-----+
3 rows in set (0.00 sec)
```

Q: To display the name of the employees and their department name

```
mysql> select Name,Dname from employee,department;
+-----+-----+
| Name | Dname |
+-----+-----+
Mukul	Mechanical
Mukul	Electrical
Mukul	Computer Sci
Kritika	Mechanical
Kritika	Electrical
Kritika	Computer Sci
Naveen	Mechanical
Naveen	Electrical
Naveen	Computer Sci
Uday	Mechanical
Uday	Electrical
Uday	Computer Sci
Nupur	Mechanical
Nupur	Electrical
Nupur	Computer Sci
Moksh	Mechanical
Moksh	Electrical
Moksh	Computer Sci
Shelly	Mechanical
Shelly	Electrical
Shelly	Computer Sci
Mukul	Mechanical
Mukul	Electrical
Mukul	Computer Sci
+-----+-----+
24 rows in set (0.00 sec)
```

## Joins in MySQL

- A join is used when data from two or more tables is required.
- Rows in one table can be joined to the rows in another table based on the common values existing in corresponding columns of two tables.
- Joins are used to retrieve data from tables related to each other with primary- foreign key relationships.
- There are many types of join

## Equi join

- Specified columns from the joining tables are checked for equality.
- Values from joining tables are retrieved only if the condition in where clause is satisfied.

SYNTAX:-

```
SELECT <column_name (s)>
FROM <table_name1>, <table_name2>, ....., <table_nameN>
WHERE <table_name1>.<column_name> = <table_name2>.<column_name>;
```

Q: to display the name of the employee and their department

```
mysql> select name,dname from employee e,department d where e.dept = d.dept;
```

| name    | dname        |
|---------|--------------|
| Mukul   | Mechanical   |
| Kritika | Mechanical   |
| Naveen  | Electrical   |
| Uday    | Computer Sci |
| Nupur   | Electrical   |
| Moksh   | Mechanical   |
| Shelly  | Computer Sci |
| Mukul   | Mechanical   |

8 rows in set (0.00 sec)

alias Name of the table

#### Note-

- ❖ To join n tables together minimum of n-1 join conditions are to be satisfied.
- ❖ Results of Equi joins are the same as simple joins or inner joins. Inner join (simply join) uses on clause.
- ❖ You should always qualify the columns when joining tables having the same name as corresponding columns. To qualify the columns we use "." (dot) operator.

#### Natural Join

- This clause is based on all the columns in the two tables that have the same name.
- It selects the rows from two tables that have equal values in the matched columns.

#### SYNTAX:-

```
SELECT [column_names | *]
FROM table_name1
NATURAL JOIN table_name2;
```

- Example- consider the same tables employee and department.

Q : To display the name of employee and department of all employee

```
mysql> select Name, dept, Dname from employee natural join department;
```

| Name    | dept | Dname        |
|---------|------|--------------|
| Mukul   | 10   | Mechanical   |
| Kritika | 10   | Mechanical   |
| Naveen  | 20   | Electrical   |
| Uday    | 30   | Computer Sci |
| Nupur   | 20   | Electrical   |
| Moksh   | 10   | Mechanical   |
| Shelly  | 30   | Computer Sci |
| Mukul   | 10   | Mechanical   |

8 rows in set (0.00 sec)

Appears only once

Note-

- ❖ No need to specify the column names to join. Works with same column name in both the tables
- ❖ The Resulting table has unique columns.

## Interface Python with SQL database

Contents:

- Connecting SQL with Python
- Creating database connectivity applications
- Performing insert, delete, update, delete queries
- Display data by using fetchone(), fetchall(), fetchmany (), rowcount()

- Database connectivity

Database connectivity refers to connection and communication between an application and a database system.

The term “front-end” refers to the user interface, while “back-end” means the server, application and database that work behind the scenes to deliver information to the user.

- Mysql.connector- Library or package to connect from python to MySQL.

Before we connect the program with mysql , we need to install connectivity package named mysql-connector- python

- Command to install connectivity package:- `pip install mysql-connector-python`
- Command to import connector:- `import mysql.connector`
- Steps for python MySQL connectivity
  1. Install Python
  2. Install MySQL
  3. Open Command prompt
  4. Switch on internet connection
  5. Type `pip install mysql-connector-python` and execute
  6. Open python IDLE
  7. `import mysql.connector`

### Steps for creating database connectivity applications:

1. Start Python- start python editor to create our own python script.

2. Import `mysql.connector` package

Use the following statement for this.

```
import mysql.connector or
```

```
import mysql.connector as Con
```

3. Establishing a connection to Mysql DATABASE.

We need to establish a connection to a mysql database using `connect ()` function of `mysql.connector` package.

The `connect` statement creates a connection to the mysql server and returns a MySQL connection object.

Syntax:

```
<Connection object>=mysql.connector.connect(host=<hostname>,user=<username>,  
passwd:<password>, database=<dbname>)
```

For eg:

```
import mysql.connector
```

```
con=mysql.connector.connect(host="localhost",user="root", passwd="")
```

#### 4. Creating a cursor Object

It is a useful control structure of database connectivity. It will let us execute all the queries we need. Cursor stores all the data as a temporary container of returned data and allows traversal so that we can fetch data one row at a time from cursor. Cursors are created by the `connection.cursor()` method.

Syntax:

```
<cursor object>=<connectionobject>.cursor()
```

Eg:

```
Cursor=con.cursor()
```

#### 5. Execute SQL query:

We can execute SQL query using `execute()` function .

Syntax:

```
<cursor object>.execute(SQL QUERY)
```

Eg: `cursor.execute("select * from data")`

The above code will execute the sql query and store the retrieved records (resultset) in the cursor object(cursor).

Result set refers to a logical set of records that are fetched from the database by executing an sql query and made available in the program.

#### 6.Extract data from Result set:

The records retrieved from the database using SQL select query has to be extracted as record from the result set. We can extract data from the result set using the following `fetch ()` function.

`fetchall()`

`fetchone()`

`fetchmany()`

➤ Multiple ways to retrieve data:

- ❖ fetchall()- Fetches all (remaining) rows of a query result, returning them as a sequence of sequences (e.g. a list of tuples) .
- ❖ fetchone()-Fetches the next row of a query result set, returning a single sequence or None when no more data is available
- ❖ fetchmany (size)-Fetches the next set of rows of a query result, returning a sequence of sequences. It will return number of rows that matches to the size argument.

### Functions to execute SQL queries

#### # TO CREATE DATABASE SCHOOL USING PYTHON INTERFACE

```
import mysql.connector
mydb=mysql.connector.connect(host="localhost",user="root",passwd="system")
mycursor=mydb.cursor()
mycursor.execute("CREATE DATABASE SCHOOL")
```

#### # SHOW DATABASE

```
import mysql.connector
mydb=mysql.connector.connect(host="localhost",user="root",passwd="system")
mycursor=mydb.cursor()
mycursor.execute("SHOW DATABASES")
for x in mycursor:
    print (x)
```

#### # TO CREATE A TABLE IN MYSQL USING PYTHON INTERFACE

```
import mysql.connector
mydb=mysql.connector.connect(host="localhost",user="root",passwd="system",
database="student")
mycursor=mydb.cursor()
mycursor.execute("CREATE TABLE FEES (ROLLNO INT,NAME VARCHAR(20),AMOUNT
INT);")
```

#### # TO SHOW THE TABLES IN MYSQL USING PYTHON INTERFACE

```
import mysql.connector
mydb=mysql.connector.connect(host="localhost",user="root",passwd="system",data
```

```
base="student") mycursor=mydb.cursor()
mycursor.execute("SHOW TABLES")
for x in mycursor:
    print(x)
```

#### #TO DESCRIBE TABLE STRUCTURE USING PYTHON INTERFACE

```
mydb=mysql.connector.connect(host="localhost",user="root",passwd="system",database="student") mycursor=mydb.cursor()
mycursor.execute("DESC STUDENT")
for x in mycursor:
    print(x)
```

#### # TO EXECUTE SELECT QUERY USING A PYTHON INTERFACE

```
import mysql.connector
conn=mysql.connector.connect(host="localhost",user="root",passwd="12345",database="student") c=conn.cursor()
c.execute("select * from student")
r=c.fetchone()
while r is not None:
    print(r)
    r=c.fetchone()
```

#### # TO EXECUTE SELECT QUERY WITH WHERE CLAUSE USING A PYTHON INTERFACE

```
import mysql.connector
conn=mysql.connector.connect(host="localhost",user="root",passwd="12345",database="student")
if conn.is_connected()==False:
    print("Error connecting to MYSQL DATABASE")
c=conn.cursor()
c.execute("select * from student where marks>90")
r=c.fetchall()
count=c.rowcount
print("total no of rows:",count)
for row in r:
    print(row)
```

#### #TO INSERT A RECORD (ROLLNO,NAME,AND MARKS) IN MYSQL TABLE student USING #PYTHON INTERFACE

```
import mysql.connector
mydb=mysql.connector.connect(host="localhost",user="root",passwd="system",database="student") mycursor=mydb.cursor()
```



```
r=int(input("enter the rollno"))
n=input("enter name")
m=int(input("enter marks"))
mycursor.execute("INSERT INTO student(rollno,name,marks)
VALUES({},'{}'.{}).format(r,n,m))
mydb.commit()
print(mycursor.rowcount,"RECORD INSERTED")
```

#### # TO UPDATE A DATA IN A TABLE USING PYTHON INTERFACE

```
import mysql.connector
mydb=mysql.connector.connect(host="localhost",user="root",passwd="system",datab
ase="student") mycursor=mydb.cursor()
mycursor.execute("UPDATE STUDENT SET MARKS=100 WHERE MARKS=40")
mydb.commit()
print(mycursor.rowcount,"RECORD
UPDATED")
```

#### # TO DELETE A RECORD FROM THE TABLE USING PYTHON INTERFACE

```
import mysql.connector
mydb=mysql.connector.connect(host="localhost",user="root",passwd="system",datab
ase="student") mycursor=mydb.cursor()
mycursor.execute("DELETE FROM STUDENT WHERE
MARKS<50") mydb.commit()
print(mycursor.rowcount,"RECORD DELETED")
```

#### # TO DROP AN ENTIRE TABLE FROM MYSQL DATABASE USING PYTHON INTERFACE

```
import mysql.connector
mydb=mysql.connector.connect(host="localhost",user="root",passwd="system",datab
ase="student") mycursor=mydb.cursor()
mycursor.execute("DROP TABLE STUDENT")
```

#### # TO ADD A COLUMN IN THE EXISTING TABLE USING PYTHON INTERFACE

```
import mysql.connector
mydb=mysql.connector.connect(host="localhost",user="root",passwd="system",datab
ase="student") mycursor=mydb.cursor()
mycursor.execute("ALTER TABLE STUDENT ADD AGE INT")
mydb.commit()
```

#### #TO DROP A COLUMN FROM THE TABLE USING PYTHON INTERFACE

```
import mysql.connector
mydb=mysql.connector.connect(host="localhost",user="root",passwd="system",datab
ase="student") mycursor=mydb.cursor()
mycursor.execute("ALTER TABLE DROP AGE ")
mydb.commit()
```

## # TO ALTER THE DATATYPE OF A COLUMN IN A TABLE USING PYTHON INTERFACE

```
import mysql.connector
mydb=mysql.connector.connect(host="localhost",user="root",passwd="system",database="student")
mycursor=mydb.cursor()
mycursor.execute("ALTER TABLE STUDENT MODIFY GRADE CHAR(3)")
```

- ❖ `commit()`: After executing insert or update query we must commit our transaction using commit method of connection object.  
Eg: `mycon.commit()`
- ❖ `rollback()`: `mysqlConnection.rollback()` reverts the changes made by the current transaction.
- ❖ `rowcount`: This attribute returns the number of rows that were affected by an `execute()`

### Closing cursor and connection

Since the database can keep limited number of connections at a time , we must close the connection using

```
cursorobject.close()
Eg: mycursor.close()
con.close()
```

### MODEL QUESTIONS

|    |                                                                                                          |
|----|----------------------------------------------------------------------------------------------------------|
| 1  | Which command is used to add new column in existing table?                                               |
| 2  | Which clause is used to search for NULL values in any column?                                            |
| 3  | Which command is used to see information like name of columns, data type, size etc. ?                    |
| 4  | Which clause is used for pattern matching? What are the 2 main characters used for matching the pattern? |
| 5  | Which clause is used to see the output of query in ascending or descending order?                        |
| 6  | Which clause is used to eliminate the duplicate rows from output?                                        |
| 7  | Which command is used to remove the table from database?                                                 |
| 8  | Which command is used to add new record in table?                                                        |
| 9  | Which option of ORDER BY clause is used to arrange the output in descending order?                       |
| 10 | Which command is used to change the existing information of table?                                       |

| 11           | <p>Raj is a database programmer, He has to write the query from EMPLOYEE table to search for the employee who are not getting any commission, for this he has written the query as: <code>SELECT * FROM EMPLOYEE WHERE commission=null;</code><br/>But the query is not producing the correct output, help Raj and correct the query so that he gets the desired output.</p>                                                                                                                                                                                                                                                                                                                                                                                                                       |              |              |     |      |       |            |      |      |            |      |       |            |      |        |            |      |        |            |      |        |            |
|--------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|--------------|-----|------|-------|------------|------|------|------------|------|-------|------------|------|--------|------------|------|--------|------------|------|--------|------------|
| 12           | <p>Raj is a database programmer, has to write the query from EMPLOYEE table to search for the employee who are working in „Sales“ or „IT“ department, for this he has written the query as: <code>SELECT * FROM EMPLOYEE WHERE department=“Sales“ or „IT“;</code><br/>But the query is not producing the correct output, help Raj and correct the query so that he gets the desired output.</p>                                                                                                                                                                                                                                                                                                                                                                                                    |              |              |     |      |       |            |      |      |            |      |       |            |      |        |            |      |        |            |      |        |            |
| 13           | <p>Sonal needs to display name of teachers, who have “0” as the third character in their name. She wrote the following query.<br/><code>SELECT NAME FROM TEACHER WHERE NAME = “\$\$0?”;</code><br/>But the query is’nt producing the result. Identify the problem.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |              |              |     |      |       |            |      |      |            |      |       |            |      |        |            |      |        |            |      |        |            |
| 14           | <p>Deepika wants to remove all rows from the table BANK. But he needs to maintain the structure of the table. Which command is used to implement the same?</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |              |              |     |      |       |            |      |      |            |      |       |            |      |        |            |      |        |            |      |        |            |
| 15           | <p>While creating table ‘customer’, Rahul forgot to add column ‘price’. Which command is used to add new column in the table. Write the command to implement the same.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |              |              |     |      |       |            |      |      |            |      |       |            |      |        |            |      |        |            |      |        |            |
| 16           | <p>Observe the given Table TEACHER and give the output of question (i) and (ii)</p> <table border="1" data-bbox="240 1111 1278 1720"> <thead> <tr> <th>TEACHER_CODE</th> <th>TEACHER_NAME</th> <th>DOJ</th> </tr> </thead> <tbody> <tr> <td>T001</td> <td>ANAND</td> <td>2001-01-30</td> </tr> <tr> <td>T002</td> <td>AMIT</td> <td>2007-09-05</td> </tr> <tr> <td>T003</td> <td>ANKIT</td> <td>2007-09-20</td> </tr> <tr> <td>T004</td> <td>BALBIR</td> <td>2010-02-15</td> </tr> <tr> <td>T005</td> <td>JASBIR</td> <td>2011-01-20</td> </tr> <tr> <td>T006</td> <td>KULBIR</td> <td>2008-07-11</td> </tr> </tbody> </table> <p>(i) <code>SELECT TEACHER_NAME,DOJ FROM TEACHER WHERE TEACHER_NAME LIKE “%I%”;</code></p> <p>(ii) <code>SELECT * FROM TEACHER WHERE DOJ LIKE “%-09-%”;</code></p> | TEACHER_CODE | TEACHER_NAME | DOJ | T001 | ANAND | 2001-01-30 | T002 | AMIT | 2007-09-05 | T003 | ANKIT | 2007-09-20 | T004 | BALBIR | 2010-02-15 | T005 | JASBIR | 2011-01-20 | T006 | KULBIR | 2008-07-11 |
| TEACHER_CODE | TEACHER_NAME                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | DOJ          |              |     |      |       |            |      |      |            |      |       |            |      |        |            |      |        |            |      |        |            |
| T001         | ANAND                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 2001-01-30   |              |     |      |       |            |      |      |            |      |       |            |      |        |            |      |        |            |      |        |            |
| T002         | AMIT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 2007-09-05   |              |     |      |       |            |      |      |            |      |       |            |      |        |            |      |        |            |      |        |            |
| T003         | ANKIT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 2007-09-20   |              |     |      |       |            |      |      |            |      |       |            |      |        |            |      |        |            |      |        |            |
| T004         | BALBIR                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 2010-02-15   |              |     |      |       |            |      |      |            |      |       |            |      |        |            |      |        |            |      |        |            |
| T005         | JASBIR                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 2011-01-20   |              |     |      |       |            |      |      |            |      |       |            |      |        |            |      |        |            |      |        |            |
| T006         | KULBIR                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 2008-07-11   |              |     |      |       |            |      |      |            |      |       |            |      |        |            |      |        |            |      |        |            |

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Write SQL commands for the queries (i) to (iv) based on a table COMPANY and CUSTOMER

**COMPANY**

| CID | NAME       | CITY   | PRODUCTNAME |
|-----|------------|--------|-------------|
| 111 | SONY       | DELHI  | TV          |
| 222 | NOKIA      | MUMBAI | MOBILE      |
| 333 | ONIDA      | DELHI  | TV          |
| 444 | SONY       | MUMBAI | MOBILE      |
| 555 | BLACKBERRY | MADRAS | MOBILE      |
| 666 | DELL       | DELHI  | LAPTOP      |

**CUSTOMER**

| CUSTID | NAME           | PRICE  | QTY | CID |
|--------|----------------|--------|-----|-----|
| 101    | ROHAN SHARMA   | 70,000 | 20  | 222 |
| 102    | DEEPAK KUMAR   | 50,000 | 10  | 666 |
| 103    | MOHAN KUMAR    | 30,000 | 5   | 111 |
| 104    | SAHIL BANSAL   | 35,000 | 3   | 333 |
| 105    | NEHA SONI      | 25,000 | 7   | 444 |
| 106    | SONAL AGGARWAL | 20,000 | 5   | 333 |
| 107    | ARUN SINGH     | 50,000 | 15  | 666 |

1. To display those company name which are having prize less than 30000.
2. To display the name of the companies in reverse alphabetical order.
3. To increase the prize by 1000 for those customer whose name starts with 'S'?
4. To add one more column totalprice with decimal(10,2) to the table customer

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Table : TRAVEL

| CNO | CNAME        | TRAVELDATE | KM  | VCODE | NOP |
|-----|--------------|------------|-----|-------|-----|
| 101 | K. Niwal     | 2015-12-13 | 200 | V01   | 32  |
| 103 | Fredrick Sym | 2016-03-21 | 120 | V03   | 45  |
| 105 | Hitesh Jain  | 2016-04-23 | 450 | V02   | 42  |
| 102 | Ravi Anish   | 2016-01-13 | 80  | V02   | 40  |
| 107 | John Malina  | 2015-02-10 | 65  | V04   | 2   |
| 104 | Sahanubhuti  | 2016-01-28 | 90  | V05   | 4   |
| 106 | Ramesh Jaya  | 2016-04-06 | 100 | V01   | 25  |

1. To display CNO, CNAME, TRAVELDATE from the table TRAVEL in descending order of CNO.
2. To display the CNAME of all customers from the table TRAVEL who are travelling by vehicle with code V01 or V02

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TABLE: TRIP

| NO | NAME         | TDATE      | KM  | TCODE | NOP |
|----|--------------|------------|-----|-------|-----|
| 11 | Tanish Khan  | 2015-12-13 | 200 | 101   | 32  |
| 13 | Danish Sahai | 2016-06-21 | 100 | 103   | 45  |
| 15 | Ram Kumar    | 2016-02-23 | 350 | 102   | 42  |
| 12 | Fen Shen     | 2016-01-13 | 90  | 102   | 40  |
| 17 | Aan Kumar    | 2015-02-10 | 75  | 104   | 2   |
| 14 | Veena        | 2016-06-28 | 80  | 105   | 4   |
| 16 | Rajpal Kirti | 2016-06-06 | 200 | 101   | 25  |

- 1.To display NO, NAME, TDATE from the table TRIP in descending order of NO.
- 2.To display the NAME of the drivers from the table TRIP who are traveling by transport vehicle with code 101 or 103.
- 3.To display the NO and NAME of those drivers from the table TRIP who travelled between '2015-02-10' and '2015-04-01'.
- 4.To display all the details from table TRIP in which the distance travelled is more than 100 KM in ascending order of NOP

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Consider the following tables SCHOOL and answer this question :

Table : SCHOOL

| CODE | TEACHER NAME | SUBJECT   | DOJ        | PERIODS | EXPERIENCE |
|------|--------------|-----------|------------|---------|------------|
| 1001 | Ravi Shankar | English   | 12/3/2000  | 24      | 10         |
| 1009 | Priya Rai    | Physics   | 03/09/1998 | 26      | 12         |
| 1203 | Lisa Anand   | English   | 09/04/2000 | 27      | 5          |
| 1045 | Yashraj      | Maths     | 24/08/2000 | 24      | 15         |
| 1123 | Ganan        | Physics   | 16/07/1999 | 28      | 3          |
| 1167 | Harish B     | Chemistry | 19/10/1999 | 27      | 5          |
| 1215 | Umesh        | Physics   | 11/05/1998 | 22      | 16         |

Table:ADMIN

| CODE | DESIGNATION | PAY   | GENDER | PANNO      |
|------|-------------|-------|--------|------------|
| 1009 | PGT         | 54000 | MALE   | AGVOP7645G |
| 1167 | TGT         | 37000 | FEMALE | WERIO6534K |
| 1123 | PGT         | 78000 | MALE   | LKSP06523H |

Write SQL statements for the following:

- 1.To display TEACHERNAME, PERIODS of all teachers whose periods are more than 25.
2. To display all the information from the table SCHOOL in descending order of experience.
- 3.To display DESIGNATION without duplicate entries from the table ADMIN.
- 4.To display TEACHERNAME, CODE and corresponding DESIGNATION from tables SCHOOL and ADMIN of Male teachers.

## Worksheet -1

1. Consider the table TEACHER given below. Write commands in SQL for (I) and output for (II) to (IV)

| ID | Name             | Department    | Hiredate   | Category | Gender | Salary |
|----|------------------|---------------|------------|----------|--------|--------|
| 1  | Tanya Nanda      | SocialStudies | 1994-03-17 | TGT      | F      | 25000  |
| 2  | Saurabh Sharma   | Art           | 1990-02-12 | PRT      | M      | 20000  |
| 3  | Nandita Arora    | English       | 1980-05-16 | PGT      | F      | 30000  |
| 4  | James Jacob      | English       | 1989-10-16 | TGT      | M      | 25000  |
| 5  | Jaspreet Kaur    | Hindi         | 1990-08-01 | PRT      | F      | 22000  |
| 6  | Disha Sehgal     | Math          | 1980-03-17 | PRT      | F      | 21000  |
| 7  | Siddharth Kapoor | Science       | 1994-09-02 | TGT      | M      | 27000  |
| 8  | Sonali Mukherjee | Math          | 1980-11-17 | TGT      | F      | 24500  |

- To count the number of teachers in English department.
- SELECT MAX(Hiredate) FROM Teacher;
- SELECT COUNT(DISTINCT category) FROM teacher;
- SELECT COUNT(\*) FROM TEACHER WHERE Category = "PGT"
- SELECT Gender,AVG(Salary) FROM TEACHER group by Gender;

2. The Item\_No and Cost column of a table "ITEMS" are given below:

| ITEM_NO | COST |
|---------|------|
| 101     | 5000 |
| 102     | NULL |
| 103     | 4000 |
| 104     | 6000 |
| 105     | NULL |

Based on this information, find the output of the following queries:

- SELECT AVG(COST) FROM ITEMS;
  - SELECT COST +100 FROM ITEMS WHERE ITEM\_NO > 103;
3. Assume "PrincipalName" is a column in a table "Schools". The SOL queries (1) and (2) give the result 28 and 27 respectively.:-
- SELECT count(\*) FROM Schools; ----->(1)  
And
  - SELECT count( PrincipalName) FROM schools; ----->(2)

What may be the possible reason for this? How many records are present in the table-27 or 28?

4. Consider the table Projects given below. Write commands in SQL for I) and output for II) to III)

| PROJECTS |              |          |            |            |        |
|----------|--------------|----------|------------|------------|--------|
| ID       | ProjName     | ProjSize | StartDate  | EndDate    | Cost   |
| 1        | Payroll-MMS  | Medium   | 2006-03-17 | 2006-09-16 | 60000  |
| 2        | Payroll-ITC  | Large    | 2008-02-12 | 2008-01-11 | 500000 |
| 3        | IDMgmt-LITL  | Large    | 2008-06-13 | 2009-05-21 | 300000 |
| 4        | Recruit-LITL | Medium   | 2008-03-18 | 2008-06-01 | 50000  |
| 5        | IDMgmt-MTC   | Small    | 2007-01-15 | 2007-01-29 | 20000  |
| 6        | Recruit-ITC  | Medium   | 2007-03-01 | 2007-06-28 | 50000  |

- I. To count the number of projects of cost less than 100000.
- II. SELECT SUM(Cost) FROM projects;
- III. SELECT ProjSize, COUNT(\*) FROM Projects GROUP BY ProjSize;

5. Consider the following table named "GARMENT". Write output

| Table : GARMENT |               |      |        |         |
|-----------------|---------------|------|--------|---------|
| GCODE           | GNAME         | SIZE | COLOUR | PRICE   |
| 111             | TShirt        | XL   | Red    | 1400.00 |
| 112             | Jeans         | L    | Blue   | 1600.00 |
| 113             | Skirt         | M    | Black  | 1100.00 |
| 114             | Ladies Jacket | XL   | Blue   | 4000.00 |
| 115             | Trousers      | L    | Brown  | 1500.00 |
| 116             | Ladies Top    | L    | Pink   | 1200.00 |

- I. SELECT COUNT(DISTINCT (SIZE)) FROM GARMENT;
  - II. SELECT AVG (PRICE) FROM GARMENT;
6. Consider the table 'Hotel' given below :

Mr. Vinay wanted to display average salary of each Category. He entered the following SQL statement. Identify error(s) and Rewrite the correct SQL statement.

SELECT Category, Salary FROM Hotel GROUP BY Category;

| Table : Hotel |           |        |
|---------------|-----------|--------|
| EMPID         | Category  | Salary |
| E101          | MANAGER   | 60000  |
| E102          | EXECUTIVE | 65000  |
| E103          | CLERK     | 40000  |
| E104          | MANAGER   | 62000  |
| E105          | EXECUTIVE | 50000  |
| E106          | CLERK     | 35000  |



## Worksheet -2

1. There is a column HOBBY in a Table CONTACTS. The following two statements are giving different outputs. What may be the possible reason ?

- a. SELECT COUNT(\*) FROM CONTACTS;
- b. SELECT COUNT(HOBBY) FROM CONTACTS;

2. Given the following employee table:-

| Employee_ID | NAME            | Commission |
|-------------|-----------------|------------|
| 101         | Sabhyata Sharma | NULL       |
| 102         | Divya Arora     | 8900       |
| 103         | Faizal Zaidi    | NULL       |

- a. What values will the following statements return ?
- b. SELECT COUNT(\*) FROM Employee;
- c. SELECT COUNT(Commission) FROM Employee;

3. What will be the output of the following queries on the basis of Employee table:

```

+-----+-----+-----+
| EmpId | EName | Salary
+-----+-----+-----+
A001	Bob	5600
A002	John	NULL
A003	Tom	5000
+-----+-----+-----+
```

- a. Select avg(Salary) from Employee;
- b. Select Salary+100 from Employee where EmpId='A002';

4. Kunal has entered the following SQL command on Table 'STUDENT' that has TotalMarks as one of the columns.

```
SELECT COUNT (*) FROM STUDENT;
```

The output displayed is 20.

Then, Kunal enters the following command :

```
SELECT COUNT (*) FROM STUDENT WHERE TotalMarks <100;
```

The output displayed is 15.

Then, Kunal enters the following command :

```
SELECT COUNT (*) FROM STUDENT WHERE TotalMarks >= 100;
```

He predicts the output of the above query as 5. Do you agree with Kunal ? Give reason for your answer

5. Consider the table given below :

(Table : Salesperson)

| SID  | Name            | Phone       | DOB        | Salary   | Area  |
|------|-----------------|-------------|------------|----------|-------|
| S101 | Amit Kumar      | 98101789654 | 1967-01-23 | 67000.00 | North |
| S102 | Deepika Sharma  | 99104567834 | 1992-09-23 | 32000.00 | South |
| S103 | Vinay Srivastav | 98101546789 | 1991-06-27 | 35000.00 | North |
| S104 | Kumar Mehta     | 88675345789 | 1967-10-16 | 40000.00 | East  |
| S105 | Rashmi Kumar    | 98101567434 | 1972-09-20 | 50000.00 | South |

Write command for (i) and output for (ii)

i) To display Area along with number of Salespersons working in that area.

(ii) SELECT Area, COUNT (\*) FROM Salesperson GROUP BY Area HAVING COUNT (\*) > 1;

6. Consider the table 'PERSONS' given below. Write commands in SQL for (i) to (iv) and write output for (i) to (iii)

Table : PERSONS

| PId | Surname | Firstname | Gender | City                 | PinCode | BasicSalary |
|-----|---------|-----------|--------|----------------------|---------|-------------|
| 1   | Sharma  | Geeta     | F      | Udhamwara            | 182141  | 50000       |
| 2   | Singh   | Surinder  | M      | Kupwara<br>Nagar     | 193222  | 75000       |
| 3   | Jacob   | Peter     | M      | Bhawani              | 185155  | 45000       |
| 4   | Alvis   | Thomas    | M      | Ahmed<br>Nagar       | 380025  | 50000       |
| 5   | Mohan   | Garima    | M      | Nagar<br>Coolangatta | 390026  | 33000       |
| 6   | Azmi    | Simi      | F      | New Delhi            | 110021  | 40000       |
| 7   | Kaur    | Manpreet  | F      | Udhamwara            | 182141  | 42000       |

(i) SELECT SUM(BasicSalary) FROM Persons Where Gender='F';

(ii) SELECT Gender,MIN(BasicSalary) FROM Persons GROUP BY gender;

(iii) SELECT Gender,Count(\*) FROM Persons GROUP BY Gender;

## Worksheet -3

1. From the following table, write SQL queries :-

table: orders

| ord_no | purch_amt | ord_date   | customer_id | salesman_id |
|--------|-----------|------------|-------------|-------------|
| 70001  | 150.5     | 2012-10-05 | 3005        | 5002        |
| 70009  | 270.65    | 2012-09-10 | 3001        | 5005        |
| 70002  | 65.26     | 2012-10-05 | 3002        | 5001        |
| 70004  | 110.5     | 2012-08-17 | 3009        | 5003        |
| 70007  | 948.5     | 2012-09-10 | 3005        | 5002        |
| 70005  | 2400.6    | 2012-07-27 | 3007        | 5001        |
| 70008  | 5760      | 2012-09-10 | 3002        | 5001        |
| 70010  | 1983.43   | 2012-10-10 | 3004        | 5006        |
| 70003  | 2480.4    | 2012-10-10 | 3009        | 5003        |
| 70012  | 250.45    | 2012-06-27 | 3008        | 5002        |
| 70011  | 75.29     | 2012-08-17 | 3003        | 5007        |
| 70013  | 3045.6    | 2012-04-25 | 3002        | 5001        |

table: customer

| 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        |
| 3001        | Brad Guzan     | London     |       | 5005        |

- write a SQL query to calculate total purchase amount of all orders. Return total purchase amount.
- write a SQL query to calculate average purchase amount of all orders. Return average purchase amount.
- write a SQL query to count the number of unique salespeople. Return number of salespeople
- write a SQL query to find the number of customers who got at least a gradation for his/her activity.
- write a SQL query to find the highest grade of the customers for each of the city. Return city, maximum grade.
- write a SQL query to find the highest purchase amount ordered by each customer. Return customer ID, maximum purchase amount.

2. In a database there are two tables 'Customer' and 'Bill' as shown below:

| Customer   |                  |                      | Bill   |        |          |
|------------|------------------|----------------------|--------|--------|----------|
| CustomerID | CustomerName     | CustAddress          | BillNo | CustID | Bill_Amt |
| 1          | Akhilesh Narang  | C4,Janak Puri,Delhi  | 1      | 2      | 12000    |
| 2          | Purnima Williams | B1,Ashok Vihar,Delhi | 2      | 1      | 15000    |
| 3          | Sumedha Madaan   | 33, South Ext.,Delhi | 3      | 2      | 13000    |
|            |                  |                      | 4      | 3      | 13000    |
|            |                  |                      | 5      | 2      | 14000    |

(i) How many rows and how many columns will be there in the Cartesian product of these two tables?

(ii) Which column in the 'Bill' table is the foreign key?

3. Consider the tables HANDSETS and CUSTOMER given below:

| Handsets |            |             |           | Customer |       |             |
|----------|------------|-------------|-----------|----------|-------|-------------|
| SetCode  | SetName    | TouchScreen | PhoneCost | CustNo   | SetNo | CustAddress |
| N1       | Nokia 2G   | N           | 5000      | 1        | N2    | Delhi       |
| N2       | Nokia 3G   | Y           | 8000      | 2        | B1    | Mumbai      |
| B1       | BlackBerry | N           | 14000     | 3        | N2    | Mumbai      |
|          |            |             |           | 4        | N1    | Kolkata     |
|          |            |             |           | 5        | B1    | Delhi       |

With reference to these tables, Write commands in SQL for (i) and (ii) and output for (iii) below:

(i) Display the CustNo, CustAddress and corresponding SetName for each customer.

(ii) Display the Customer Details for each customer who uses a Nokia handset.

(iii) select SetNo, SetName from Handsets, customer where SetNo = SetCode and CustAddress = 'Delhi';

4. Consider the tables DOCTORS and PATIENTS given below:

| DocID | DocName     | Department | OPD_Days |
|-------|-------------|------------|----------|
| 101   | M. Panday   | ENT        | TTS      |
| 102   | G. P. Gupta | Paed       | MWF      |
| 201   | C.K. Sharma | Ortho      | MWF      |

| PatNo | PatName | Department | DocID |
|-------|---------|------------|-------|
| 1     | Neeraj  | ENT        | 101   |
| 2     | Mohit   | Ortho      | 201   |
| 3     | Ragini  | ENT        | 101   |
| 4     | Mohit   | Paed       | 102   |
| 5     | Nandini | Ortho      | 201   |

With reference to these tables, write commands in SQL for (i) and (ii) and output for (iii) below:

- (i) Display the PatNo, PatName and corresponding DocName for each patient
- (ii) Display the list of all patients whose OPD\_Days are MWF.
- (iii) select OPD\_Days, Count(\*) from Doctors, Patients where Patients.Department = Doctors.Department Group by OPD\_Days;

5. In a Database there are two tables study the table and answer the following questions:

Table MAGAZINE:

| Mag_Code | Mag_Title        | Number_of_Pages | Mag_Category |
|----------|------------------|-----------------|--------------|
| 1        | Good Deeds       | 60              | 12           |
| 2        | Health is Wealth | 45              | 15           |
| 3        | Indian Cooking   | 90              | 20           |
| 4        | Karma            | 50              | 12           |

MAGTYPE

| Mag_Category | Type      |
|--------------|-----------|
| 1            | Bollywood |
| 12           | Spiritual |
| 15           | Fitness   |
| 20           | Cookery   |

- (i) Which column can be set as the PRIMARY KEY in the MAGAZINE table?
- (ii) Which column in the 'MAGAZINE' table is the foreign key?
- (iii) How many rows and columns will be there in the Cartesian product of the above 2 tables.
- (iv) Write command in SQL to display the mag\_code, Mag\_Title and corresponding types for all the Magazines.
- (v) Write the output :

Select Mag\_Code, Mag\_Title, Number\_of\_Pages, Type From MAGAZINE, MAGTYPE Where Magazine.Mag\_Category=Magtype.Mag\_Category and Type='Spiritual';

## Worksheet 4 :

1. The following table represents information on sales representatives of ABC company with the following data.

Sales man name  
Code  
Address  
commission  
salary.

Write Python code to create the above table.

2. Write Python mysql connectivity program to retrieve all the data from a table student.

3. Write a python code to delete all the records from employee table whose age >60 and the table has

the following fields.

Empid, empname, deptid, age, payscale

4. Consider the information stored in the table : EMP

| EMPNO | ENAME | DEPT  | SALARY |
|-------|-------|-------|--------|
| 1     | ALEX  | MUSIC | 60000  |
| 2     | PETER | ART   | 67000  |
| 3     | JOHNY | WE    | 55000  |
| 4     | RAMBO | P&HE  | 48000  |

A python code is written to access the records of table: EMP, What will be the output of following code:

```
#Assume All basic setup related to connection and cursor creation is already  
done  
query="select * from emp"  
mycursor.execute(qu  
ery)  
results =  
mycursor.fetchone()  
results =  
mycursor.fetchone()  
results =  
mycursor.fetchone()  
d = int (results[3])
```

```
print (d*3)
```

5. Consider the following Python code is written to access the details of employee, whose employee number is passed to function:

Complete the missing statements:

```
def Search(eno):
```

```
    import mysql.connector
    mydb=mysql.connector.connect(host="localhost",user="root",passwd="system",d
    atabase="DB")
    mycursor=mydb.cursor()
    query="select *from emp where empno=
    _____".format(e
    no) mycursor.execute(query)
    results = mycursor._____
    print(results)
```

6. Consider the following python code for updating the records.

```
import mysql.connector
mydb=mysql.connector.connect(host="localhost",user="root",passwd="system"
,database="student")
mycursor=mydb.cursor()
mycursor.execute("UPDATE STUDENT SET MARKS=95 WHERE MARKS=50")
print(mycursor.rowcount,"RECORD UPDATED")
```

Code is running but the record in actual database is not updating, what could be the possible reason?

7. Which function of connection is used to check whether connection to mysql is successfully done or not?

```
import mysql.connector as msq
con=msq.connect(#ConnectionString)      #Assuming all parameter required
aspassed
if _____:
    print("Connected!")
else:
    print(" Error! Not Connected")
```

8. What is the difference in fetchall() and fetchone()?

9. Write a python connectivity program to retrieve data, one record at a time from EMP table for employees with id<10.

10. Write python connectivity program to delete the employee record whose name is read from the keyboard at execution time.

11. SD School is managing the student data in student table in school database. Write a python code that connects to database school and display the record of students and total number of students.

12. Which record will get inserted in the table by the following code:

```
import mysql.connector
mydb=mysql.connector.connect(host="localhost",user="root",passwd="system",
database="db") mycursor=mydb.cursor()
a=1011
b="Euphoria"
c=599.00
mycursor.execute("INSERT INTO BOOKS(bookid,bname,price) VALUES
({},'{}',{})" .format(a,b,c))
mydb.commit()
```

### WORKSHEET 5 -Fill in the blanks

1. A ----- is a special control structure that facilitates the row by row processing of ----- records in the resultset.
2. After importing mysqlconnector, first of all ----- is established by using connect()
3. ----- method executes a database query from within Python.
4. Running of sql query through database cursor returns the table records in the form of-----
5. A connectivity package----- must be imported before running db connection program.

### WORKSHEET 6-(Multiple Choice questions:)

1. Which of the following is not a legal method for fetching records from database.  
a) fetchone() b) fetchtwo() c) fetchall() d) fetchmany()
2. To fetch one record from resultset you may use <curor>..... method.  
a) fetch() b) fetchone() c) fetchtuple d) none of these.
3. To reflect the changes made in the database permanently you need to run.....  
a) done() b) reflect() c) commit() d) final
4. To run an sql query from within python you may use cursor. ----- method.  
a) query() b) execute() c) commit() d) final()
5. A database ..... controls the connection to an actual database, established in program.  
a) database object b) connection object c) fetch object d) query object



## ANSWER KEY (DATA BASE MANAGEMENT SYSTEM)

|    |                                                                                                                                               |
|----|-----------------------------------------------------------------------------------------------------------------------------------------------|
| 1  | ALTER TABLE                                                                                                                                   |
| 2  | IS NULL                                                                                                                                       |
| 3  | DESCRIBE OR DESC                                                                                                                              |
| 4  | LIKE<br>% (percent) and _ (underscore)                                                                                                        |
| 5  | ORDER BY                                                                                                                                      |
| 6  | DISTINCT                                                                                                                                      |
| 7  | DROP TABLE                                                                                                                                    |
| 8  | INSERT INTO                                                                                                                                   |
| 9  | DESC                                                                                                                                          |
| 10 | UPDATE                                                                                                                                        |
| 11 | SELECT * FROM EMPLOYEE WHERE commission IS null;                                                                                              |
| 12 | SELECT * FROM EMPLOYEE WHERE department="Sales" or department="IT";<br><i>OR</i><br>SELECT * FROM EMPLOYEE WHERE department IN ('Sales','IT') |
| 13 | The wildcards are incorrect. The corrected query is SELECT NAME FROM TEACHER WHERE NAME LIKE ' _ _0%'.                                        |
| 14 | DELETE FROM BANK.                                                                                                                             |
| 15 | ALTER TABLE CUSTOMER ADD PRICE NUMBER (10, 2).                                                                                                |

|              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |              |                                                                                                                                                           |       |                                                                                                                                                                                                |      |            |       |            |        |            |        |            |        |            |              |              |     |       |  |  |      |      |            |      |       |            |
|--------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|-------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|------------|-------|------------|--------|------------|--------|------------|--------|------------|--------------|--------------|-----|-------|--|--|------|------|------------|------|-------|------------|
| 16           | <p>(i)</p> <table border="0"> <tr> <td>TEACHER_NAME</td> <td>DOJ</td> </tr> <tr> <td colspan="2">-----</td> </tr> <tr> <td>AMIT</td> <td>2007-09-05</td> </tr> <tr> <td>ANKIT</td> <td>2007-09-20</td> </tr> <tr> <td>BALBIR</td> <td>2010-02-15</td> </tr> <tr> <td>JASBIR</td> <td>2011-01-20</td> </tr> <tr> <td>KULBIR</td> <td>2008-07-11</td> </tr> </table> <p>(ii)</p> <table border="0"> <tr> <td>TEACHER_CODE</td> <td>TEACHER_NAME</td> <td>DOJ</td> </tr> <tr> <td colspan="3">-----</td> </tr> <tr> <td>T002</td> <td>AMIT</td> <td>2007-09-05</td> </tr> <tr> <td>T003</td> <td>ANKIT</td> <td>2007-09-20</td> </tr> </table>                                             | TEACHER_NAME | DOJ                                                                                                                                                       | ----- |                                                                                                                                                                                                | AMIT | 2007-09-05 | ANKIT | 2007-09-20 | BALBIR | 2010-02-15 | JASBIR | 2011-01-20 | KULBIR | 2008-07-11 | TEACHER_CODE | TEACHER_NAME | DOJ | ----- |  |  | T002 | AMIT | 2007-09-05 | T003 | ANKIT | 2007-09-20 |
| TEACHER_NAME | DOJ                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |              |                                                                                                                                                           |       |                                                                                                                                                                                                |      |            |       |            |        |            |        |            |        |            |              |              |     |       |  |  |      |      |            |      |       |            |
| -----        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |              |                                                                                                                                                           |       |                                                                                                                                                                                                |      |            |       |            |        |            |        |            |        |            |              |              |     |       |  |  |      |      |            |      |       |            |
| AMIT         | 2007-09-05                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |              |                                                                                                                                                           |       |                                                                                                                                                                                                |      |            |       |            |        |            |        |            |        |            |              |              |     |       |  |  |      |      |            |      |       |            |
| ANKIT        | 2007-09-20                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |              |                                                                                                                                                           |       |                                                                                                                                                                                                |      |            |       |            |        |            |        |            |        |            |              |              |     |       |  |  |      |      |            |      |       |            |
| BALBIR       | 2010-02-15                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |              |                                                                                                                                                           |       |                                                                                                                                                                                                |      |            |       |            |        |            |        |            |        |            |              |              |     |       |  |  |      |      |            |      |       |            |
| JASBIR       | 2011-01-20                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |              |                                                                                                                                                           |       |                                                                                                                                                                                                |      |            |       |            |        |            |        |            |        |            |              |              |     |       |  |  |      |      |            |      |       |            |
| KULBIR       | 2008-07-11                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |              |                                                                                                                                                           |       |                                                                                                                                                                                                |      |            |       |            |        |            |        |            |        |            |              |              |     |       |  |  |      |      |            |      |       |            |
| TEACHER_CODE | TEACHER_NAME                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | DOJ          |                                                                                                                                                           |       |                                                                                                                                                                                                |      |            |       |            |        |            |        |            |        |            |              |              |     |       |  |  |      |      |            |      |       |            |
| -----        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |              |                                                                                                                                                           |       |                                                                                                                                                                                                |      |            |       |            |        |            |        |            |        |            |              |              |     |       |  |  |      |      |            |      |       |            |
| T002         | AMIT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 2007-09-05   |                                                                                                                                                           |       |                                                                                                                                                                                                |      |            |       |            |        |            |        |            |        |            |              |              |     |       |  |  |      |      |            |      |       |            |
| T003         | ANKIT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 2007-09-20   |                                                                                                                                                           |       |                                                                                                                                                                                                |      |            |       |            |        |            |        |            |        |            |              |              |     |       |  |  |      |      |            |      |       |            |
| 17           | <ol style="list-style-type: none"> <li>1. SELECT NAME FROM COMPANY WHERE COMPANY.CID=CUSTOMER. CID AND PRICE &lt; 30000;</li> <li>2. SELECT NAME FROM COMPANY ORDER BY NAME DESC;</li> <li>3. UPDATE CUSTOMER<br/>SET PRICE = PRICE + 1000<br/>WHERE NAME LIKE 'S%';</li> <li>4. ALTER TABLE CUSTOMER<br/>ADD TOTALPRICE DECIMAL(10,2);</li> </ol>                                                                                                                                                                                                                                                                                                                                      |              |                                                                                                                                                           |       |                                                                                                                                                                                                |      |            |       |            |        |            |        |            |        |            |              |              |     |       |  |  |      |      |            |      |       |            |
| 18           | <table border="1"> <tr> <td data-bbox="261 1066 357 1149">(i)</td> <td data-bbox="357 1066 1361 1149">           SELECT CNO, CNAME, TRAVELDATE FROM TRAVEL ORDER BY CNO DESC ;<br/>           (½ Mark for SELECT CNO, CNAME, TRAVELDATE FROM TRAVEL)<br/>           (½ Mark for ORDER BY CNO DESC)         </td> </tr> <tr> <td data-bbox="261 1149 357 1285">(ii)</td> <td data-bbox="357 1149 1361 1285">           SELECT CNAME FROM TRAVEL WHERE VCODE = 'V01' OR VCODE = 'V02';<br/> <b>OR</b><br/>           SELECT CNAME FROM TRAVEL VCODE IN ('V01', 'V02');<br/>           (½ Mark for correct SELECT)<br/>           (½ Mark for correct clause)         </td> </tr> </table> | (i)          | SELECT CNO, CNAME, TRAVELDATE FROM TRAVEL ORDER BY CNO DESC ;<br>(½ Mark for SELECT CNO, CNAME, TRAVELDATE FROM TRAVEL)<br>(½ Mark for ORDER BY CNO DESC) | (ii)  | SELECT CNAME FROM TRAVEL WHERE VCODE = 'V01' OR VCODE = 'V02';<br><b>OR</b><br>SELECT CNAME FROM TRAVEL VCODE IN ('V01', 'V02');<br>(½ Mark for correct SELECT)<br>(½ Mark for correct clause) |      |            |       |            |        |            |        |            |        |            |              |              |     |       |  |  |      |      |            |      |       |            |
| (i)          | SELECT CNO, CNAME, TRAVELDATE FROM TRAVEL ORDER BY CNO DESC ;<br>(½ Mark for SELECT CNO, CNAME, TRAVELDATE FROM TRAVEL)<br>(½ Mark for ORDER BY CNO DESC)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |              |                                                                                                                                                           |       |                                                                                                                                                                                                |      |            |       |            |        |            |        |            |        |            |              |              |     |       |  |  |      |      |            |      |       |            |
| (ii)         | SELECT CNAME FROM TRAVEL WHERE VCODE = 'V01' OR VCODE = 'V02';<br><b>OR</b><br>SELECT CNAME FROM TRAVEL VCODE IN ('V01', 'V02');<br>(½ Mark for correct SELECT)<br>(½ Mark for correct clause)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |              |                                                                                                                                                           |       |                                                                                                                                                                                                |      |            |       |            |        |            |        |            |        |            |              |              |     |       |  |  |      |      |            |      |       |            |
| 19           | <ol style="list-style-type: none"> <li>1. SELECT NO, NAME, TDATE FROM TRIP ORDER BY NO DESC;</li> <li>2. SELECT NAME FROM TRIP<br/>WHERE TCODE = 101 OR TCODE = 103;</li> <li>3. SELECT NO AND NAME FROM TRIP<br/>WHERE TDATE &lt; '2015-04-01' AND TDATE &gt; '2015-02-10';</li> <li>4. SELECT * FROM TRIP<br/>WHERE KM &gt; 100 ORDER BY NOP;</li> </ol>                                                                                                                                                                                                                                                                                                                              |              |                                                                                                                                                           |       |                                                                                                                                                                                                |      |            |       |            |        |            |        |            |        |            |              |              |     |       |  |  |      |      |            |      |       |            |

20

```
1.SELECT TEACHERNAME, PERIODS
FROM SCHOOL WHERE PERIODS>25:;

2.SELECT * FROM SCHOOL ORDER BY EXPERIECE DESC;

3.SELECT DISTINCT DESIGNATION FROM ADMIN;

4.SELECT TEACHERNAME.CODE
DESIGNATION FROM SCHOOL,ADMIN WHERE
SCHOOL.CODE = ADMIN.CODE AND GENDER = 'MALE';
```

### ANSWER KEY WORKSHEET 1

1. i) select count(\*) from teacher where department = "english";  
ii) 1994-09-02  
  
iii) 3  
  
iv) 1  
  
v) F    24500  
      M    24000
2. i) 5000  
   ii) 6100  
  
      NULL
3. No of records = 28 ; There may be NULL values in the column. Hence it will be ignored by count(<colName>) function.
4. i) select count(ProjName) from projects where cost<100000;  
   ii) 980000  
  
   iii) Medium    3  
          Large    2  
          Small    1
5. I) 3  
   II) 1800
6. Select category , Avg(Salary) from Hotel group by category;

## ANSWER KEY WORKSHEET 2

1. The column hobby may have NULL values, when we give count(colname) it ignores null values while count(\*) will count all duplicate and NULL values. therefore two statements may give different values.
2. 3  
1
3. I) 5300  
II) NULL
4. Yes , as no of records =20 , students scoring <100 = 15. ; hence the students scoring greater than equal to 100 will be 20-15 =5. As all the three statements mentioned use count(\*) as the count function.
5. i) select area,count(\*) from salespersons group by area;  
ii) North      2  
  
      South      2
6. I) 132000  
II) F            42000  
  
      M            33000  
  
III) F          3  
  
      M            4

## ANSWER KEY FOR WORKSHEET 3

1. a) SELECT SUM(purch\_amt) FROM orders;  
b) SELECT AVG (purch\_amt) FROM orders;  
  
c) SELECT COUNT (DISTINCT salesman\_id) FROM orders;  
  
d) SELECT COUNT (ALL grade) FROM customer;  
  
e) SELECT city,MAX(grade) FROM customer GROUP BY city;  
  
f) SELECT customer\_id,MAX(purch\_amt) FROM orders GROUP BY customer\_id;
2. i) 15 rows and 6 columns  
ii) custID
3. i) select Custno,CustAddress,setName from customer c,handset h where c.setNo=h.setNo;  
ii) select Custno,CustAddress,setName from customer c,handset h where c.setNo=h.setNo and h.setName like 'Nokia%';

iii) N2 Nokia 3G

B1 Blackberry

4. I) select patNo,PatName,DocName from Patient p,doctor d where p.docID=d.docID;  
II) select patNo,PatName,DocName from Patient p,doctor d where p.docID=d.docID and OPD\_Days="MWF";

III) TTS2

MWF        3

5. i)Mag\_code

ii)Mag\_category

iii) 16 rows and 6 columns

iv) select Mag\_code,Mag\_title,Type from Magazine m1, Magtype m2 where m1.  
Mag\_category =m2. Mag\_category;

v) 1            Good Deeds            60    Spiritual

4    Karma                    50    Spiritual

#### ANSWER KEY FOR WORKSHEET 4:

1.

```
import mysql.connector
mydb=mysql.connector.connect(host="localhost",user="root",passwd="system",datab
ase="sales") mycursor=mydb.cursor()
mycursor.execute("CREATE TABLE SALESMAN (NAME VARCHAR(20),CODE INT
,ADDRESS VARCHAR(20), COMMISSION DEC,SALARY FLOAT);")
```

2.

```
import mysql.connector
conn=mysql.connector.connect(host="localhost",user="root",passwd="system",data
base="DB") c=conn.cursor()
c.execute("select * from student")
r=c.fetchone()
while r is not None:
    print(r)
    r=c.fetchone()
conn.close()
```

3.

```
import mysql.connector
```

```

mydb=mysql.connector.connect(host="localhost",user="root",passwd="system",database="DB")
mycursor=mydb.cursor()
mycursor.execute("DELETE FROM EMP WHERE AGE>60 ")
mydb.commit()
print(mycursor.rowcount,"RECORD DELETED")
mydb.close()

```

4. 165000

5. .{} and fetchone()

6. con.commit() function is missing in the python code

7. con.is\_connected()

8. fetchall() function is used to fetch all the records from the cursor in the form of tuple. fetchone() is used to fetch one record at a time. Subsequent fetchone() will fetch next records. If no more records to fetch, it returns None.

9. import mysql.connector

```

conn=mysql.connector.connect(host="localhost",user="root",passwd="system",database="com")

```

```

c=conn.cursor()
c.execute("select * from emp where id>10")
r=c.fetchone()
while r is not None:
    print(r)
    r=c.fetchone()
conn.close()

```

10.

```

import mysql.connector
mydb=mysql.connector.connect(host="localhost",user="root",passwd="system",database="DB")
mycursor=mydb.cursor()
s= input("enter the name")
mycursor.execute("delete from emp where name = '{}'.format(s)")
mydb.commit()

```

11.

```

import mysql.connector
mydb=mysql.connector.connect(host="localhost",user="root",passwd="system",database="school")
mycursor=mydb.cursor()
sql="select * from student"

```

```
mycursor.execute(sql)
recs=mycursor.fetchall()
count=0
for r in recs:
    count+=1
    print(r)
print("total no of records",count)
```

12. 1011,"Euphoria" 599.00

**ANSWER KEY FOR WORKSHEET 5(Fill in the blanks)**

- 1.database cursor
- 2.database connection.
3. execute()
- 4.resultset
- 5.mysql.connector

**ANSWER KEY FOR WORKSHEET 6(MCQ)**

1. b)fetchtwo()
2. b)fetchone()
3. c)commit()
4. b)execute()
5. b)connection object