CS Major Course

DBMS-11   DLD- 18   DS & ALG – 22   OOP WITH C++ - 27   C- 30

2^{10}=1024, 1 bit= 8 byte, 4byte=1 nibble

Data Communication & Networking

Data Communication: depends on four fundamental characteristic

1. Delivary
2. Accuracy
3. Timeliness
4. Jilter

Five Component
1. Message
2. Sender
3. Receiver
4. Transmission protocols
5. Protocols

Data Representation

1. Text
2. Number
3. Image
4. Audio
5. Video

Simplex (keyboard, Monitor), Half Duplex(Walkies-talkies, radios), Full Duplex (telephone)

Topology (Mesh, Star, Bus, Ring) mesh $\frac{n(n-1)}{2}$ (n-1) input/output port , star hub to control all , bus backbone to connected the devices,

Topology different

LAN: Local Area Network

WAN: Wide Area Network

Switch: a switch is a connected link together.

Data bus- bidirectional- processor to others component

Control bus- bidirectional- signal clock pulse

Address bus- unidirectional- carries memory address

Difference between Internet, Intranet and Extranet :

Point of difference	Internet	Intranet	Extranet
Accessibility of network	Public	Private	Private
Availability	Global system.	Specific to an organization.	To share information with suppliers and vendors it makes the use of public network.
Coverage	All over the world.	Restricted area upto an organization.	Restricted area upto an organization and some of its stakeholders or so.
Accessibility of content	It is accessible to everyone connected.	It is accessible only to the members of organization.	Accessible only to the members of organization and external members with logins.
Owner	No one.	Single organization.	Single/ Multiple organization.
Users	General public.	Employees of the organization.	Employees of the organization which are connected.
Example	What we are normally using is internet.	WIPRO using internal network for its business operations.	DELL and Intel using network for its business operations.

TCP/IP: Transmission control protocols /Internet Protocols

 TCP Layer:

Original: Application -> Transport->Internet ->Network Interface->Hardware devices

Book: Application ->Transport->Network-> Data Link-> Physical

OSI Model: Application -> Presentation->Session ->Transport->Network->Data link->Physical

https://www.plixer.com/blog/network-layers-explained/

Different work with different layer

File transfer	Application Layer
Dynamic Routing	Network
Error Detection	Data Link Layer
TCP Congestion Control	Transport
Bit Transfer	Physical Layer

Difference Between Analog And Digital Signal	
Analog Signals	**Digital Signals**
Continuous signals	Discrete signals
Represented by sine waves	Represented by square waves
Human voice, natural sound, analog electronic devices are a few examples	Computers, optical drives, and other electronic devices
Continuous range of values	Discontinuous values
Records sound waves as they are	Converts into a binary waveform.
Only used in analog devices.	Suited for digital electronics like computers, mobiles and more.

Bit rate , bit rate for HDTV 1920*1080*30*24=1.5Gbps

Bit Length= propagation speed* bit durations

Db= 10 log $\frac{p2}{p1}$

Bit rate = 2*bandwidth*log(L) l= number of signal level used to represented data .

Singal To noise ratio(SNR)=Average Signal power/Average noise power

Transmission modes

- Parallel
- Serial
    - Asynchronous
    - Synchronous
    - Isochronous

differences between Synchronous and Asynchronous Sequential Circuits −

Sr. No.	Key	Synchronous Sequential Circuits	Asynchronous Sequential Circuits
1	Definition	Synchronous sequential circuits are digital sequential circuits in which the feedback to the input for next output generation is governed by clock signals.	On other hand Asynchronous sequential circuits are digital sequential circuits in which the feedback to the input for next output generation is not governed by clock signals.
2	Memory Unit	In Synchronous sequential circuits, the memory unit which is being get used for governance is clocked flip flop.	On other hand unclocked flip flop or time delay is used as memory element in case of Asynchronous sequential circuits.
3	State	The states of Synchronous sequential circuits are always predictable and thus reliable.	On other hand there are chances for the Asynchronous circuits to enter into a wrong state because of the time difference between the arrivals of inputs. This is called as race condition.

Sr. No.	Key	Synchronous Sequential Circuits	Asynchronous Sequential Circuits
4	Complexity	It is easy to design Synchronous sequential circuits	However on other hand the presence of feedback among logic gates causes instability issues making the design of Asynchronous sequential circuits difficult.
5	Performance	Due to the propagation delay of clock signal in reaching all elements of the circuit the Synchronous sequential circuits are slower in its operation speed	Since there is no clock signal delay, these are fast compared to the Synchronous Sequential Circuits
6	Example	Synchronous circuits are used in counters, shift registers, memory units.	On other hand Asynchronous circuits are used in low power and high speed operations such as simple microprocessors, digital signal processing units and in communication systems for email applications, internet access and networking

difference between data and signal with respect to various parameters.

Parameters	Data	Signal
• What is it ?	Data is the information we want to transmit.	Signal is the waveform format used to send data over channel.
• Function	Acts as payload of carrier	Acts as carrier which carries data or payload.
• Measurement quantity	Bit rate in bps or Kbps or Mbps or Gbps	Signal rate or baud rate in Baud, KBaud or Mbaud

• Affecting data communication parameter	Speed, Higher the bit rate higher is the speed	Bandwidth, lower the signal rate, lower is the bandwidth
• Format	Analog (Continuous) or digital form (Binary or discrete)	Analog (Electric, EM or Optical) or digital form (i.e. pulse such as NRZ or RZ)

Data Link layer

Signal bit error

Burst error

Hamming Distance: two word of number differents between corresponding bit where the bit change. d(min)=s+1

10101

11110

3 bit error

Division of CRE encoder

Slotted ALOHA S=a*e^{-a}

High level data link control

ALOHA S=a*e^{-2a}

Smax=1/2e when a=1/2

Checksum: A checksum is **a value that represents the number of bits in a transmission message and is used by IT professionals to detect high-level errors within data transmissions**. Prior to transmission, every piece of data or file can be assigned a checksum value after running a cryptographic hash function.

Error Detecting: https://www.geeksforgeeks.org/error-detection-in-computer-networks/

IP to MAC addess coming protocols called- ARP(Address Resulation Protocols)

MAC-Media Access Control(MAC)

Multiple Access Protocols

1. Random access protocols
   ➢ ALOHA
   ➢ CSMA (carrier sense multiple access)
   ➢ CSMA/CD(carrier sense multiple access/collision detection)
   ➢ CDMA/CA(carrier sense multiple access/collision avaidance)
2. CONTROLLED access protocols
   ➢ Reservation
   ➢ Polling
   ➢ Token passing

3. Channelization protocols
   - ➢ FDMA (frequency division multiple access)
   - ➢ TDMA (time division multiple access)
   - ➢ CDMA (code division multiple access)

ATM-Asynchronous Transfer mode

A cell network uses the basis unit of data exchange, a cell is defined as a small fixed size block of information.

ATM Layer-

1. Application adaption layer
2. Segmentation and reassembly sublayer
3. Convergence sublayer
4. Simple and efficient adaption layer

Router: a router is a three layer devices (physical, data link, network)

Transmission Medium

Source to destination -free space, metallic cable, fiber optical cable

Guided(wired)

Unguided(wireless)

Unguided(wireless)

Radiowave , microwave, Intrared

Twisted-pair cable

Coaxial cable

Fiber optical cable

Coaxical cable: Plastic cover –>Insulator- >Outer Conductor->Insulator-> inner Conductor

Fiber Construction: Outer Jacket->

Switching:

- ➢ Circuit switching
- ➢ Message switching
- ➢ Packet switching

- Virtual circuit approach
- Datagram approach

Circuit Packet Message

Classful addressing

If IPv4 address was designed with fixed-length prefix n=8,16,24

Five class A=8, B=16, C24, D= not ,E=not applicable

The network address 8 bit but singce the first bit was 0.

So we have to bit 2^7=128 the A class address.

Multicast address reserve for future used.

A=8 bit   0-127

B=16 bit   128-191

C=24 bit   192-223

D=Not Applicable   224-239

E=Not Applicable   240-255

Number of block N=2^{32-n}

Address Musk N=2^{32-n}-1 , n=32-log2

Dynamic hosting configuration protocols (DHCP): Dynamic Host Configuration Protocol (DHCP) is **a client/server protocol that automatically provides an Internet Protocol (IP) host with its IP address and other related configuration information such as the subnet mask and default gateway**. DHCP operations fall into four phases: **server discovery, IP lease offer, IP lease request, and IP lease acknowledgement**.

Network address translation (NAT) : NAT stands for network address translation. It's **a way to map multiple local private addresses to a public one before transferring the information**. Organizations that want multiple devices to employ a single IP address use NAT, as do most home routers. Use LAN Network for secondary for external & internal IP address. Now days

NAT are two different variant NAPT(Network Address Port Translation) & PAT (Port Address Translation).

Router+NAT

| Host 10.0.0.1 | Private Network | 15 | Internet | Server 200.100.10.1 |
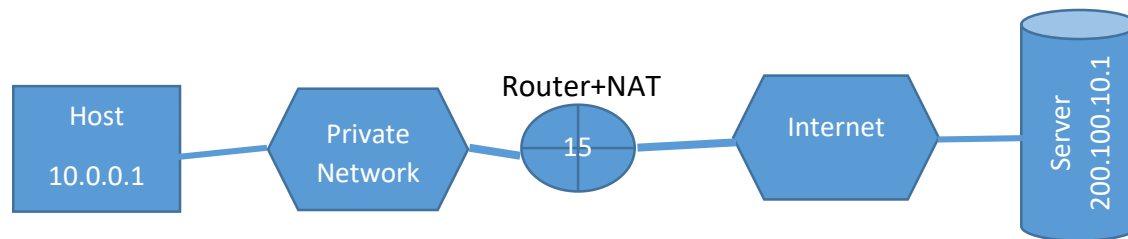
MOBILE IP: Mobile IP (or MIP) is **an Internet Engineering Task Force (IETF) standard communications protocol that is designed to allow mobile device users to move from one network to another while maintaining a permanent IP address**. Mobile IP for IPv4 is described in IETF RFC 5944, and extensions are defined in IETF RFC 4721.

Datagram protocols

User datagram protocols (UDP)

Three category of satellites:

1. Geostationary Earth orbit (GEO)
2. Low Earth orbit(LEO)-
3. Medium Earth Orbit(MEO)-GPS

Q-Write down different computer port and their functions?

A port:

- is a physical docking point using which an external device can be connected to the computer.
- can also be programmatic docking point through which information flows from a program to computer or over the internet.

Port	Protocol	Description
0	TCP, UDP	Reserved (technically illegal to use)
18	TCP, UDP	Message Send Protocol
22	TCP, UDP	SSH Remote Login Protocol
23	TCP, UDP	Telnet
24	TCP, UDP	Private e-mail system
25	TCP, UDP	Simple Mail Transfer Protocol (SMTP)
53	TCP, UDP	Domain Name Server (DNS)
80	TCP, UDP	HTTP
92	TCP, UDP	Network Printing Protocol

107	TCP, UDP	Remote Telnet Service	161	TCP, UDP	Simple Net Management Protocol (SNM
108	TCP, UDP	SNA Gateway Access Server	179	TCP, UDP	Border Gateway Protocol (BGP)
109	TCP, UDP	POP2 (Post Office Protocol version 2)	190	TCP, UDP	Gateway Access Control Protocol
110	TCP, UDP	POP3 (Post Office Protocol version 3)	220	TCP, UDP	Interactive Mail Access Protocol (IMAF
115	TCP, UDP	Simple File Transfer Protocol (SFTP)	264	TCP, UDP	Border Gateway Multicast Protocol (BG
118	TCP, UDP	SQL Services	366	TCP, UDP	On-Demand Mail Relay (ODMR)
119	TCP, UDP	Network News Transfer Protocol (NNTP)	406	TCP, UDP	Interactive Mail Support Protocol (IMSI
123	UDP	Network Time Protocol (NTP)	413	TCP, UDP	Storage Management Services Protocol
143	TCP, UDP	Internet Message Access Protocol (IMAP)	443	TCP, UDP	Hypertext Transfer Protocol over TL/SS
152	TCP, UDP	Background File Transfer Program (BFTP)	444	TCP, UDP	Simple Network Paging Protocol (SNPF
153	TCP, UDP	Simple Gateway Monitoring Protocol (SGMP)	465	TCP, UDP	SMTP protocol over TLS/SSL
156	TCP, UDP	SQL Service	1433	TCP, UDP	Microsoft SQL Server
			3306	TCP, UDP	MySQL database server

Transmission control protocol-TCP	User datagram protocol-UDP
Connection oriented protocol	Connectionless protocols
Header size-20 byte	8 byte
Heavy weight	Light weight
http, https, FTP,SMTP,	DNS,DHCP,SNMP,RIP

Database

A relational database consist of collection of table each of which is assigned a unique name.
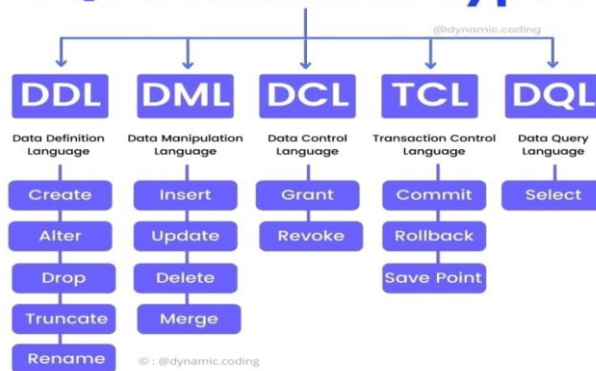
Tuple: tuple is simply a sequence of value.

A super key is a set of one or more attributes that taken collectively allow us to identify uniquely a tuple in the relation.

Minimal super key is called candidate keys.

Relational algebra

1. Selection
2. Projection (Remove Duplicate Data)
3. Natural join (Matches row)
4. Cartesian product
5. Union

SQL Command Types

DDL	DML	DCL	TCL	DQL
Data Definition Language	Data Manipulation Language	Data Control Language	Transaction Control Language	Data Query Language
Create	Insert	Grant	Commit	Select
Alter	Update	Revoke	Rollback	
Drop	Delete		Save Point	
Truncate	Merge			
Rename				

© : @dynamic.coding

DDL-relations schemas, deleting and modify (create, alter, drop, truncate, rename)

DML-insert tuple, delete tuple, modify tuple (insert, update, delete, merge)

DCL-Grant, Revoke (Data Control Language)

TCL- COMMINT, ROLLBACK, SAVE POINT (Transaction Control Language)

DQL- SELECT (Data Query Language)

Integraty - view definition, transaction, embedded, authorization

What are the differences between DROP, TRUNCATE and DELETE commands?

DROP	TRUNCATE	DELETE
Used to delete a database, table or a view	Used to delete all rows from a table	Used to delete a row in the table
Data cannot be rollbacked	Data cannot be rollbacked	Data can be rollbacked
A DDL command	A DDL command	A DML command.
Slower than TRUNCATE	Faster than DROP and DELETE	Slower than TRUNCATE
Deletes the full structure of the table	Preserves the structure of the table	Deletes the structure of the row from a table

What are the different types of keys in the database?

There are mainly 7 types of Keys, that can be considered in a database. I am going to consider the below tables to explain to you the various keys.
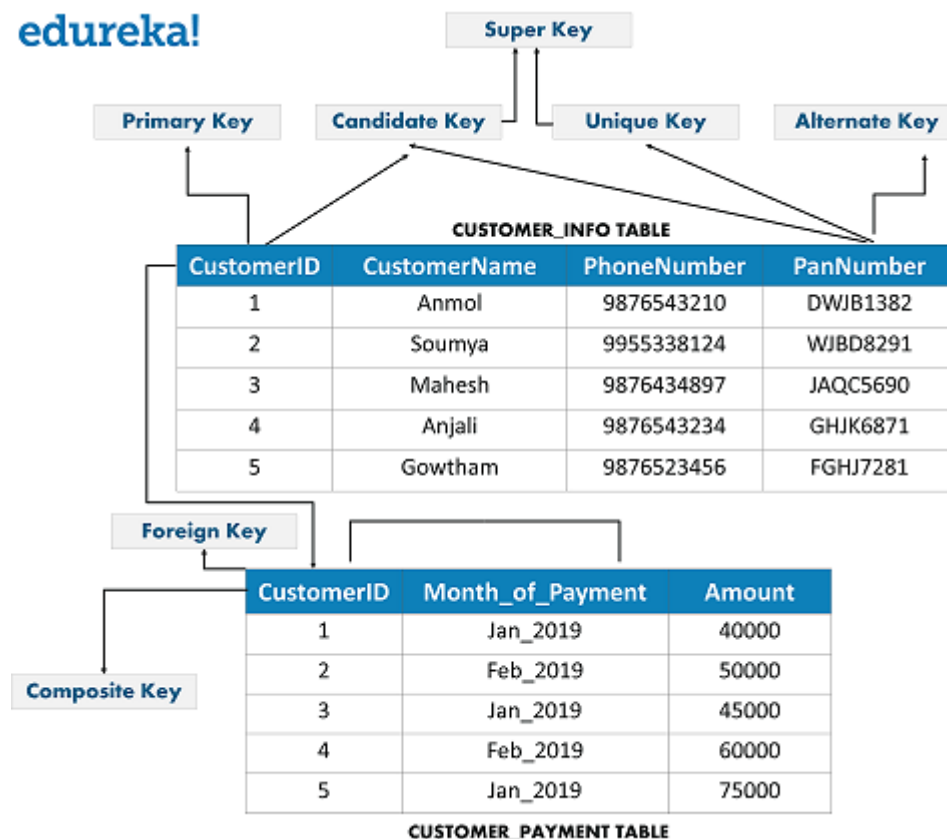
Fig 1: Different Types of Keys in Database – DBMS Interview Questions

- **Candidate Key –** This is a set of attributes which can uniquely identify a table. Each table can have more than a candidate key. Apart from this, out of all the candidate keys, one key can be chosen as the Primary key. In the above example, since CustomerID and PanNumber can uniquely identify every tuple, they would be considered as a Candidate Key.
- **Super Key –** This is a set of attributes which can uniquely identify a tuple. So, a candidate key, primary key, and a unique key is a superkey, but vice-versa isn't true.
- **Primary Key –** This is a set of attributes which are used to uniquely identify every tuple. In the above example, since CustomerID and PanNumber are candidate keys, any one of them can be chosen as a Primary Key. Here CustomerID is chosen as the primary key. **NULL values are not allowed & One table only one primary key.** Entity entegrity
- **Unique Key –** The unique key is similar to the primary key, but allows NULL values in the column. Here the PanNumber can be considered as a unique key. **only one NULL value for column**
- **Alternate Key –** Alternate Keys are the candidate keys, which are not chosen as a Primary key. From the above example, the alternate key is PanNumber
- **Foreign Key –** An attribute that can only take the values present as the values of some other attribute, is the foreign key to the attribute to which it refers. in the

above example, the CustomerID from the Customers Table is referred to the CustomerID from the Customer_Payment Table. Referential entegrity

- **Composite Key –** A composite key is a combination of two or more columns that identify each tuple uniquely. Here, the CustomerID and Date_of_Payment can be grouped together to uniquely identify every tuple in the table.

https://www.guru99.com/database-normalization.html

SQL basic/SQL

1. Create Database: CREARE DATABASE DATABASENAME;
2. DROP DATABASE : DROP DATABASE DATABASENAME;
3. CREATE TABLE: CREATE TABLE TABLENAME(COLUMNNAME1 DATATYPE(SIZE), COLUMNNAME2 DATATYPE(SIZE), COLUMNNAME3 DATATYPE(SIZE),……………………………………………………………… ,PRIMARY KEY(COLUMN NAME));
4. RENAME TABLE: RENAME TABLE OLDTABLENAME TO NEWTABLENAME;
5. DROP TABLE: DROP TABLE TABLENAME;
6. INSERT DATA INTI TABLE: INSERT INTO TABLENAME VALUES(VALUE1,VALUE2,VALUE3,…….), VALUES(VALUE1,VALUE2,VALUE3,…….);
7. VEIW SPECIFIC COLUMN FROM TABLE: SELECT COLUMNLIST FROM TABLENAME ;
8. VIEW UNIQUE DATA FOR SPECIFIC COLUMN: SELECT DISTINCT COLOUNMLIST FROM TABLENAME;
9. SORTING DATA IN ACCOUNDING TO COLUMN NAME: SELECT COLUMNLIST FROM TABLENAME ORDER BY COLUMNNAME ASC/DESC;
10. SHOW SPECIFIC MEMBER DETAILS FROM TABLE: SELECT* FROM TABLENAME WHERE CONDITION;
11. UPDATE DETAILS FOR SPECIFIC MEMBERS: UPDATE TABLENAME SET COLUMNNAME1=VALUE1, COLUMNNAME2=VALUE2……………………………………………………………………….WHERE CONDITION;
12. DATELE SPECIFIC ROW/RECORD: DELETE FROM TABLENAME WHERE CONDITION;
13. DELETEA SPECIFIC COLUMN: ALTER TABLE TABLENAME DROP COLUMN COLUMNNAME;
14. ADD A NEW COLUMN INO TABLE: ALTER TABLE TABLENAME ADD COLUMN COLUMNNAME DATATYPE(SIZE);
15. ADD COLUMN IN SPECIFIC LOCATION:
    ALTER TABLE TABLENAME
    ALTER TABLE vendors ADD COLUMN phone VARCHAR(15) AFTER name;

    ALTER TABLE planes
    ADD COLUMN num int(6) AUTO_INCREMENT AFTER tail_number;

16. COPY A TABLE FROM AN OLDER TABLE: CREATE TABLE NEWTABLENAME AS SELECT* FROM OLDTABLENAME;
17. COLUMN NAME CHANGE: ALTER TABLE TABLENAME CHANGE OLDTABLENAME NEWTABLENAME DATATYPE(SIZE);

18. DUBLICATE VALUE : SINGLE COLUMN- SELECT COLUMN,COUNT(COLUMN) FROM TABLENAME GROUP BY COLUMN HAVING COUNT (COLUMN)>1; MULTIPLE COLUMN- SELECT COLUMN,COUNT(COLUMN),COLUMN,(COUNT(COLUMN), COLUMN, COUNT(COLUMN) FROM TABLENAME GROUP BY COLUMN1,COLUMN2,COLUMN3 HAVING COUNT(COLUMN1)>1 AND COUNT (COLUMN2)>1 AND COUNT (COLUMN3)>1;

SQL query to find second highest salary of employee?

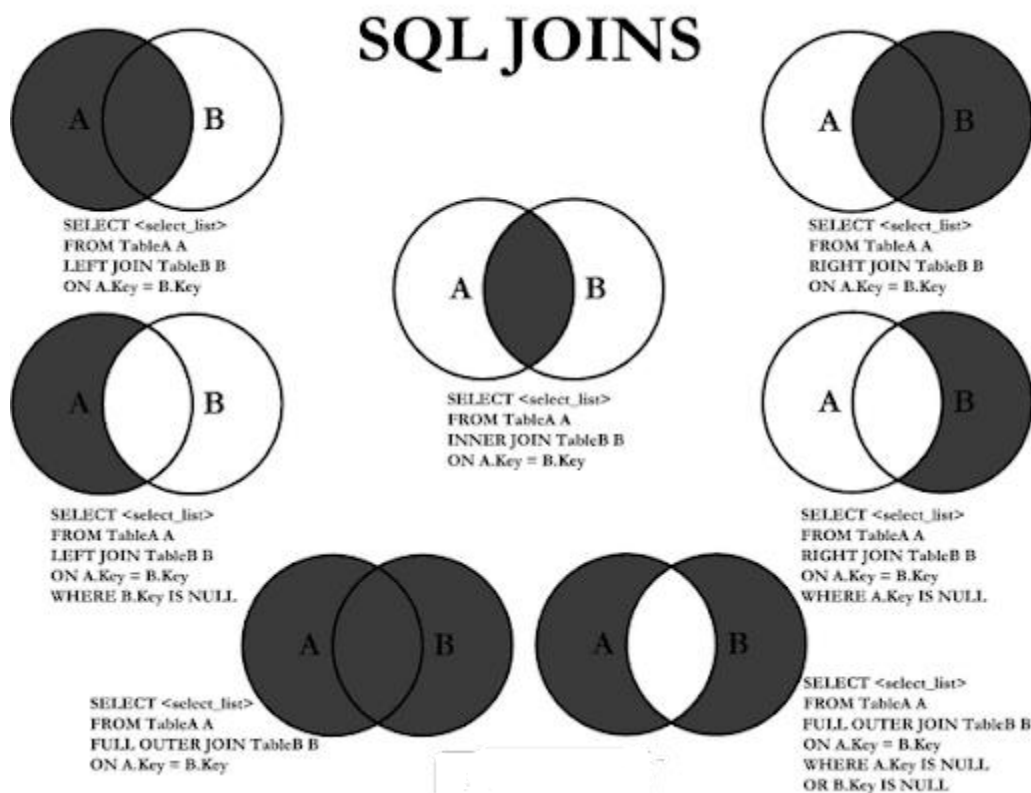Select MAX(Salary) from Employee WHERE Salary NOT IN (Select MAX(Salary) from Employee);

SQL JOINS

SELECT <select_list>
FROM TableA A
LEFT JOIN TableB B
ON A.Key = B.Key

SELECT <select_list>
FROM TableA A
RIGHT JOIN TableB B
ON A.Key = B.Key

SELECT <select_list>
FROM TableA A
INNER JOIN TableB B
ON A.Key = B.Key

SELECT <select_list>
FROM TableA A
LEFT JOIN TableB B
ON A.Key = B.Key
WHERE B.Key IS NULL

SELECT <select_list>
FROM TableA A
RIGHT JOIN TableB B
ON A.Key = B.Key
WHERE A.Key IS NULL.

SELECT <select_list>
FROM TableA A
FULL OUTER JOIN TableB B
ON A.Key = B.Key

SELECT <select_list>
FROM TableA A
FULL OUTER JOIN TableB B
ON A.Key = B.Key
WHERE A.Key IS NULL
OR B.Key IS NULL

Table Join

1. Left Join: SELECT users.id,transaction.name FROM users INNER JOIN transaction ON users.id=transaction.id;
2. Inner Join: SELECT posts.title,posts.body,users.name FROM posts,users WHERE users.id=posts.id;
3. Left Join: SELECT users.id,posts.title FROM users INNER JOIN posts ON users.id=posts.id;

4. Left Join: SELECT users.id,posts.title,posts.body,users.name FROM users INNER JOIN posts ON users.id=posts.id;
5. Left Join: SELECT users.id,posts.title,posts.body,users.name FROM users LEFT JOIN posts ON users.id=posts.id;
6. Right Join: SELECT users.id,posts.title,posts.body,users.name FROM users RIGHT JOIN posts ON users.id=posts.id;
7. Join: SELECT posts.title,posts.body,users.name FROM posts,users;

https://www.javatpoint.com/mysql-tutorial

Primary key attributes are required tobe non null and unique .

"---" matches any string of at length three characters

"--%" matches any string of at length three characters

"%" The % characters matches any substring

(-) The _ character matches any string

"intri%" matches any string beginning with " intro"

"%comp%" matches any string containing comp

Agregate function: avg, min, max, sum, count

Transaction-commit work, rollback work,

Design- alternatives- redundancy-incompleteness

An entity has a set of properties and the values of some set properties may uniquely identify and entity.

Storage devices hierarchy:

Cache-main memory-flash memory- magnetic disk- optical disk-magnetic tape.

RAID(redundant array of independent disk) improve performance and reliability

Index and hashing ,B+ tree

Transaction management

ACID(atomicity consistency isolation durability)

- **Atomicity:** Atomicity refers to those transactions which are completely successful or failed. Here each transaction refers to a single logical operation of a data. So, even if one part of any transaction fails, the entire transaction fails and the database state is left unchanged.

- **Consistency:** Consistency ensures that the data must meet all the validation rules. In simple words, you can say that your transaction never leaves the database without completing its state.
- **Isolation:** The main goal of isolation is concurrency control.
- **Durability:** Durability means that if a transaction has been committed, it will occur whatever may be the scenario.

https://database.guide/what-is-acid-in-databases/

Answer: Different types of Normalization are:
- **First Normal Form (1NF- Inconsistency):** A relation is said to be in 1NF only when all the entities of the table contain unique or atomic values.
  - ➢ Eliminate repeating groups in individual table
  - ➢ Create separate table for each set of related data
  - ➢ Related data with a primary key
- **Second Normal Form (2NF- Partial Dependency):** A relation is said to be in 2NF only if it is in 1NF and all the non-key attribute of the table is fully dependent on the primary key.
  - ➢ Create separate table for set of values that apply multiple records
  - ➢ Related table with a foreign key.
- **Third Normal Form (3NF- Transitive):** A relation is said to be in 3NF only if it is in 2NF and every non-key attribute of the table is not transitively dependent on the primary key.
  - ➢ Eliminate fields that do not depend on the key.

Index- Quickly retrieve record from a database file

Define Cursor and its types.
Answer: Cursor is a temporary work area that stores the data, as well as the result set, occurred after manipulation of data retrieved. A cursor can hold only one row at a time.
The 2 types of Cursor are:
- **Implicit cursors** are declared automatically when DML statements like INSERT, UPDATE, DELETE is executed.
- **Explicit cursors** have to be declared when SELECT statements that are returning more than one row are executed.

https://www.javatpoint.com/dbms-interview-questions

https://www.edureka.co/blog/interview-questions/dbms-interview-questions

Digital Logic and Computer Design

Block Diagram of digital computer

Number base conversion

1. Decimal Number System.

2. Binary Number System.

3. Octal Number System.

4. Hexadecimal Number System.

What is a Logic gate?

The basic gates that make up the digital system are called a logic gate. The circuit that can operate on many binary inputs to perform a particular logic function is called an electronic circuit.

Basic logic operation – AND OR NOT

Universal logic gate- NOR NAND

$(x.y)'=x'+y'$ $(x+y)'=x'.y'$
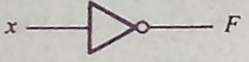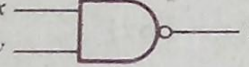
Name	Graphic symbol	Algebraic function	Truth table

AND

x ⎯⎯⎯⎯ F $F = xy$

x	y	F
0	0	0
0	1	0
1	0	0
1	1	1

OR

x ⎯⎯⎯⎯ F $F = x + y$

x	y	F
0	0	0
0	1	1
1	0	1
1	1	1

NOT Inverter

x ⎯⎯⎯⎯ F $F = x'$

x	F
0	1
1	0

Buffer

x ⎯⎯⎯⎯ F $F = x$

x	F
0	0
1	1

NAND

x ⎯⎯⎯⎯ F $F = (xy)'$

x	y	F
0	0	1
0	1	1
1	0	1
1	1	0

NOR

x ⎯⎯⎯⎯ F $F = (x + y)'$

x	y	F
0	0	1
0	1	0
1	0	0
1	1	0

Exclusive-OR (XOR)

x ⎯⎯⎯⎯ F $F = xy' + x'y$
$= x \oplus y$

same input 0

x	y	F
0	0	0
0	1	1
1	0	1
1	1	0

Exclusive-NOR or equivalence

x ⎯⎯⎯⎯ F $F = xy + x'y'$
$= x \odot y$

x	y	F
0	0	1
0	1	0
1	0	0
1	1	1

Figure 2-5 Digital logic gates

Combinational circuits	Sequential circuits
No memory state required	Memory required for save this feedback state
Easier to design ,use & handle	Not
Clock signal is not required & not depend on time	Clock signal required depend on time
These faster logic circuit	Slower than Combinational Circuit
Block are only logic gate	Block are fip-flops

Combinational logic design procedure

Decoder: a decoder is a combinational circuit that converts binary information from n input line to maximum of 2^n unique output line.

Demultiplexer

Encoder: an encoder is a digital function that produce a reverse operation from that of a decoder. An encoder has 2^n input lines and n output lines.

Multiplexers: 2^n input line and n selection line whose bit combinations determines inpout is selected.

Sequential login- synchronous, asynchronous

Basic flip flop- latch

Boolean Algebra rules

K-map

M_0	M_1
M_2	M_3

M_0	M_1	M_3	M_2
M_4	M_5	M_7	M_6

M_0	M_1	M_3	M_2
M_4	M_5	M_7	M_6
M_{12}	M_{13}	M_{15}	M_{14}
M_8	M_9	M_{11}	M_{10}

0	1	3	2
4	5	7	6
12	13	15	14
8	9	11	10

What is the difference between Latch And Flip-flop?

The difference between latches and Flip-flop is that the **latches** are level **triggered** and flip-flops are **edge triggered**. In latches level triggered means that the output of the latches changes as we change the input and edge triggered means that control signal only changes its state when goes from low to high or high to low.

Latches are fast whereas flip-flop is slow.

Register: register is a group a binary storage cell suitable for holding binary information .

Parallel to series circuit convertor -multiplexer

Counter- memory unit

Simple computer consist of memory unit & 7 register : MAR (Memory Address Register), MBR (Memory Buffer Register), A register,

 R Register, PC (Program Counter), IR(Instruction Register), timing Counter.

Block diagram a simple computer

https://www.javatpoint.com/digital-electronics-interview-questions

Data Structure & Algorithm

Data: data are the simply value or set of values. when data is meaningful is is called information .

Data structure: the logical & mathematical model of particular organization of a data is called data structure.

Basic data structure operation : traversal , search, insertion, deletion

Special data structure operation : sorting, merging

Linked list is or one way list ,is a linear collection of data structure.

Linked list- data, pointer of the node

Overflow & underflow

Header linked list have special node that is called the header node.

Two way linked list

Stack push, pop

Polish (postfix) notation

Queue is a linear list of elememt

Deques is also called double-ended queue

Priority queues

Non linear data structure is called tree. A tree is define as finite set of elements , called nodes .

Tree have n nodes then will be n-1 edges

Complete binary tree

Binary tree operation

- Preorder-root-left-right
- Inorder- left-root right
- Postorder-left –right-root

Binary search tree

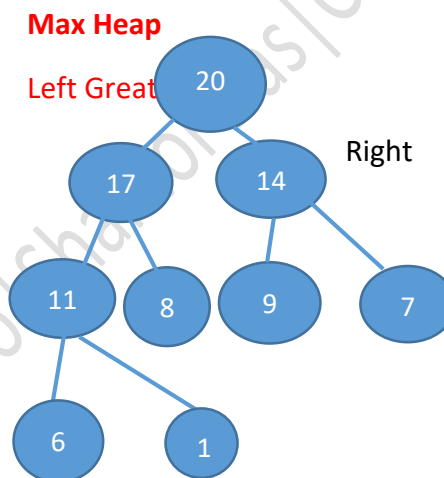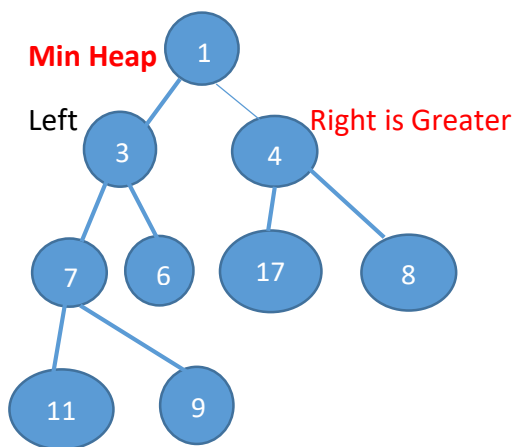Graph G=(V,E) as the collection of adjacency lists or as an adjacency matrix

A complete graph with n nodes will have n(n-1)/2 edges

Breadth first search(BFS)-FIFO-Queqe O(V+E)

Depth First Search(DFS)-LIFO-Stack O(V+E)

DFS is faster than BFS

$\dfrac{complexity \Rrightarrow}{Algorithm \Downarrow}$	Worst case	Best case	Average case
Quick sort	$O(n^2)$	O(nlogn)	O(nlogn)
Merge sort	O(nlogn)	O(nlogn)	O(nlogn)
Heap sort	O(nlogn)	O(nlogn)	O(nlogn)

Min Heap

Left   Right is Greater

Max Heap

Left Great   Right

Topology sort

Strongly connected graph –every pair are connected.

Acyclic graph

Minimum spanning tree

Kruskal-find minimum weight, no loop

Prim's- starting point to compare minimum path , no loop and queue

Single-source shortest path

Disallowing route that contain cycles

Bellman-ford –source to minimum weight-queue

Dijkstra's- source to mininum weight, queue

Divide & Conquer Method	Dynamic Programminng
Recursive	Non Recursive
Top down approach	Bottom-up approach
Sub problem are independent of each other	Sub problem are interdependent
Merge sort , Binary Search	Matrix Multiplication

Greedy	Backtracking	Dynamic Programming
Kruskal's, prim's(MST), Dijkstra's (shortest path), Huffman Coding	N Queen, Suduku,Work Break problem, The Knight Tour	Fibonacci Series, Tower of hanai, project schuduling

All pairs:

 Floyed-warshall   best way to representation to **Linked List.**

A hash table is an effective DS for implementing Dictionaries. Average time search HT O(1).

More suitable representation

 Floyd warshall (graph Alg) – Adjacency Matrix

Dynamic programming

The time complexity of Quicksort is O(n log n) in the best case, O(n log n) in the average case, and O(n^2) in the worst case. But **because it has the best performance in the average case for most inputs**, Quicksort is generally considered the "fastest" sorting algorithm
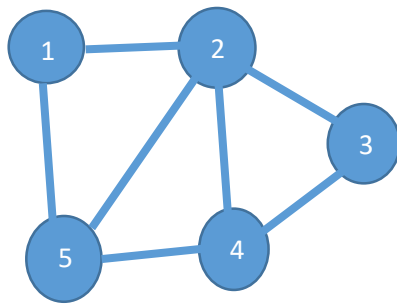
An Undirect Graph

The Adjacency Matric Representaton

	1	2	3	4	5
1	0	1	0	0	1
2	1	0	1	1	1
3	0	1	0	1	0
4	0	1	1	0	1
5	1	1	0	1	0

List the types of trees?

- The General Tree

A tree is referred to as a generic tree if its hierarchy is not constrained. In the General Tree, each node can have an endless number of offspring, and all other trees are subsets of the tree.

- The Binary Tree

The binary tree is a type of tree in which each parent has at least two offspring. The children are referred to as the left and right youngsters. This tree is more popular than most others. When specific limitations and features are given to a Binary tree, various trees such as AVL tree, BST (Binary Search Tree), RBT tree, and so on are also utilized.

- Tree of Binary Search

Binary Search Tree (BST) is a binary tree extension that includes numerous optional constraints. In BST, a node's left child value should be less than or equal to the parent value, while the correct child value should always be higher than or equal to the parent's value.

- The AVL Tree

The AVL tree is a self-balancing binary search tree. The term AVL is given in honor of the inventors Adelson-Velshi and Landis. This was the first tree to achieve dynamic equilibrium. Each node in the AVL tree is assigned a balancing factor based on whether the tree is balanced or not. The node kids have a maximum height of one AVL vine.

- Red and Black Tree

Red-black trees are another type of auto-balancing tree. The red-black term is derived from the qualities of the red-black tree, which has either red or black painted on each node. It helps to keep the forest in balance. Even though this tree is not perfectly balanced, the searching process takes just O (log n) time.

- The N-ary Tree

In this sort of tree with a node, N is the maximum number of children. A binary tree is a two-year tree since each binary tree node has no more than two offspring. A full N-ary tree is one in which the children of each node are either 0 or N.

What are Binary trees?

A binary tree is a tree data structure made up of nodes, each of which has two offspring, known as the left and right nodes. The tree begins with a single node called the root.

Each node in the tree carries the following information:

Data

A pointing device indicates the left kid.

An arrow pointing to the correct child

What are the differences between the B tree and the B+ tree?

The B tree is a self-balancing m-way tree, with m defining the tree's order. Depending on the number of m, Btree is an extension of the Binary Search tree in which a node can have more than one key and more than two children. The data is provided in the B tree in a sorted manner, with lower values on the left subtree and higher values on the right subtree.

The B+ tree is an advanced self-balanced tree since every path from the tree's root to its leaf is the same length. The fact that all leaf nodes are the same length indicates that they all occur at the same level. Specific leaf nodes can't appear at the third level, while others appear at the second level.

https://www.interviewbit.com/data-structure-interview-questions/

OOP WITH C++

Basic concept of OOP:

- Objects
- Classes
- Data abstraction and Encapsulation
- Inheritance
- Polymorphism
- Dynamic binding
- Message passing

Hide internal implementation - Encapsulation

Application of OOP

- Real time system
- Simulation & modeling
- Object oriented database
- Hyper text, hypermedia & experttext
- AI & expert system
- Neural network & parallel programming

Structure of c++/oop program

- ➢ Include file
- ➢ Class declaration
- ➢ Member function definations
- ➢ Main function program

Token

- ➢ Keywords
- ➢ Identifiers
- ➢ Constants
- ➢ Strings operators

Basic data type

- ❖ User define
  - ➢ Structure
  - ➢ Union
  - ➢ Class
  - ➢ Enumeration
- ❖ Derived
  - ➢ Array
  - ➢ Function
  - ➢ Pointer
  - ➢ Reference

- ❖ Built-in
  - ➢ Intergral
    - ▪ Int
    - ▪ Char
  - ➢ Void
  - ➢ Floating
    - ▪ float
    - ▪ double

primitive data type- int , char, float, bool

Scope resolution operation

Call by value & call by reference

Inline function, function overloading, friend function , virual function

Static data member, static class member, static member function

Array of objects

Constructor

- special characteristics

(parameterized multiple, overloaded) constructor, copy, dynamic constructor

Destructor: destroy the object that have been created by a constructor.


Operator overloading

- class member access operator
- scope resolution operator (::)
- size operator (sizeof)
- conditional operator(?:)

private, protected, public

Inheritance

Inheritance: the mechanism of deriving a new class from an old one is called inheritance . the **old class** is referred to as the **base class** and the new one is called the **derived class or subclass** . A derive class with one base class, is called single inheritance and one with several base classes is called multiple inheritance.

- ➢ Single inheritance
- ➢ Multiple inheritance
- ➢ Hierarchical inheritance
- ➢ Multilevel inheritance
- ➢ Hybrid inheritance

Fig. 8.1 Forms of inheritance
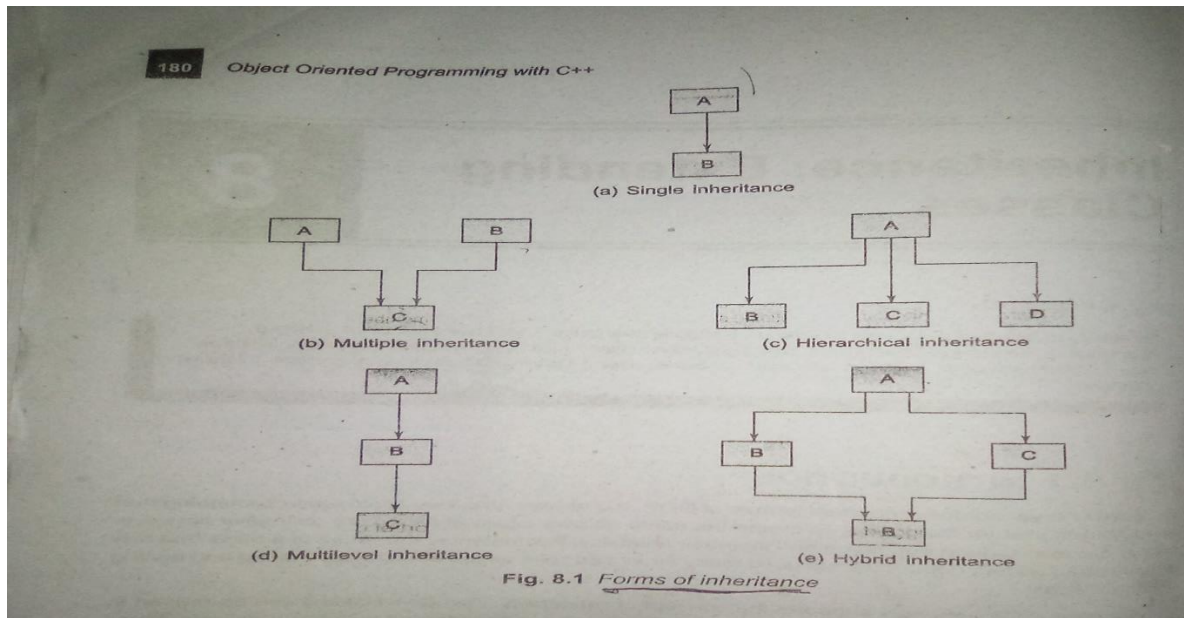
Abstract class ,virtual base class

Pure virtual function

Java is not support multiple inheritance

Managing console input /output operation

Working with file

Template

Exception handing

- Try
- Catch
- Throw

Throw replace return.

Standard template library

'

C

The main function of C

- Main()
- Int main()
- Void main()
- Main(void)
- Voin main(void)
- Int main(void)

Basic structure of c

- Link section(header file include)
- Definition section
- Global declaration section
- Main() function section

Operator and expressions

1. Arithmetic operators (+, -, *,/, %)
2. Relational operators (<,<=,>,>=,==,!=)
3. Logical operators (&&,||,!) highest (!,> >= < <=, == != , &&, ||) lowest
4. Assignment operators
5. Increment and decrement operators (++ ,--)
6. Conditional operator (?)
7. Bitwise operators (& ,|,^,<<,>>)
8. Special operator (for ,while)

Decision making and Branching

1. If
2. Switch (break, continue, default)
3. Conditional operator statement
4. Goto

Array

An array is fixed-size sequenced collection of elements of the same data type.

1D, 2D int array[2][3]={1,2,3},{3,4,5}}; , multi-dimensional arrays, Dynamic array(malloc,calloc,realloc) in the header file<stdlib.h>

I

Strings: a strings is a sequence of characters that is treated as a single data item .

Char name[10];

Scanf("% ws", name); width of the string

Reading a line of text scanf("%[^\n]", name]; gets(name) /getchar()

Printf("%s",name);

The scope visibility and life time of variable

- Automatic variable (auto)
- External variable (global variable ,extern)
- Static variable (static)
- Register variable (register)

Structure And union

Pointers

- Pointer constants
- Pointer values
- Pointer variables

Pointe and array

Array of pointer

File management in c

Dynamic memory allocation and linked lists

Malloc

Calloc

Free

Realloc

Bangla English Math Photocopy Note

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