SRINIVAS UNIVERSITY

INSTITUTE OF COMPUTER & INFORMATION SCIENCE

CITY CAMPUS, PANDESHWAR,

MANGALORE - 575 001

Question Bank Answers with Bloom's Model

Database Management and MySQL

B.C.A - II SEMESTER

Compiled by
Mrs. Anusha S Rai

DATABASE MANAGEMENT AND MYSOL QUESTION BANK

Exam	II Semester	Paper code	22CAC-5
Subject	Database Management and MySQL	Class	I BCA
Maximum marks	50	Time	2 Hours

Weightage Table

Sl. No	Objectives	Marks	Percentage marks
1.	Knowledge (Remembering)	05	10
2.	Understanding	20	40
3.	Application	15	30
4.	Skill	10	20
Total		**50**	**100**

Blueprint with Unit wise Marks

Module	Remembering			Understand			Application			Skill			Total
	OT	SA	Module wise Marks	OT	SA	Module wise Marks	OT	SA	Module wise Marks	OT	SA	Module wise Marks	
1	1(1)	1(4)	5	1(1)	1(4)	5	-	-	-	-	-	-	10
2	-	-	-	1(1)	1(4)	5	-	-	-	1(1)	1(4)	5	10
3	-	-	-	1(1)	1(4)	5	1(1)	1(4)	5	-	-	-	10
4	-	-	-	1(1)	1(4)	5	1(1)	1(4)	5	-	-	-	10
5	-	-	-	-	-	-	1(1)	1(4)	5	1(1)	1(4)	5	10
	05			**20**			**15**			**10**			**50**

Blueprint

Module	Remembering		Understand		Application		Skill		Total
	OT	SA	OT	SA	OT	SA	OT	SA	
1	1(1)	1(4)	1(1)	1(4)	-	-	-	-	10
2	-	-	1(1)	1(4)	-	-	1(1)	1(4)	10
3	-	-	1(1)	1(4)	1(1)	1(4)	-	-	10
4	-	-	1(1)	1(4)	1(1)	1(4)	-	-	10
5	-	-	-	-	1(1)	1(4)	1(1)	1(4)	10
	05		**20**		**15**		**10**		**50**

1. What do you think when a same record or a file is to be used by multiple users simultaneously called?
   A. Dataintegrity
   B. Dataisolation
   C. Concurrent access
   D. Isolated access

2. Can you clarify, what is it called if the data isduplicated in two files?
   A. Data Redundancy
   B. Data integrity
   C. Data concurrency
   D. Data isolation

3. Can you clarify the concept called when the related data is stored in a centralized storage?
   A. Data Integration
   B. Data Sharing
   C. Data independence
   D. Data isolation

4. Who do you think is like a super user of DBMS?
   A. End user
   B. Application programmer
   C. DBA
   D. Database user

5. Can you clarify, in which of the following models, the records are physically linked through linked lists?
   A. Network model
   B. Hierarchical model
   C. Relational model
   D. File structure model

6. Who do you think are the users of DBMS?
   A. End users
   B. Application programmer
   C. DBA
   D. All the above

7. What do you think is centralized DBMS?
   A. The data is stored in a single computer
   B. A centralized DBMS supports multiple users
   C. It supports only single user
   D. Only A and B

8. What do you think is a set of programs that help to use or modify a collection of related data called?
    A. File system
    B. **Database Management system**
    C. Online system
    D. Decision support system

9. Can you clarify, which level in the DBMS architecture comprises of all the DBMS functions?
    A. **Conceptual level**
    B. Physical level
    C. Internal level
    D. External level

10. What do you think the DBMS architecture can be viewed as?
    A. 2-tier system
    B. 7-tier system
    C. **3-tier system**
    D. 4-tier system

11. Can you clarify. what is it called when isolating an upper level changes in the structure of a lower level is called
    A. Data isolation
    B. Data security
    C. **Data Independence**
    D. Data integration

12. What do you think is the description of the schema constructs and constraints called?
    A. Data mart
    B. **Metadata**
    C. Data schema
    D. Schema diagram

(Questions for Skills)

13. What is the collection of interrelated datacalled?
    A. File
    B. **Database**
    C. Record
    D. Attribute

14. Which of the level in the DBMS architecture, the data actually resides?
    A. Conceptual level
    B. Externallevel
    C. **Internal level**
    D. Data level

15. Which of the level in the DBMS architecture, the application programs actually reside?
    A. Conceptual level
    B. Physicallevel
    C. **Internal level**
    D. Externallevel

16. What do you think is the immunity of the applications to change the physical representation andaccess technique called?
    A. Data isolation
    B. <u>Data independence</u>
    C. Data integration
    D. Data inconsistency

17. Which of the following views a database as a set of pages?
    A. DBMS
    B. <u>File Manager</u>
    C. Disk Manager
    D. Data Manager

18. What do you think is the capacity to change the conceptual schema without having to change the external schemas called?
    A. Physical data independence
    B. <u>Logical data independence</u>
    C. Internal data independence
    D. External data independence

19. Which of the following is the acronym for SDL?
    A. schema definition language
    B. system definition language
    C. set definition language
    D. <u>storage definition language</u>

20. Which of the following is true about Hierarchical model?
    A. Records are inter-related through tree-like structure
    B. A parent record can have several children
    C. A child can have only one parent
    D. <u>All the above</u>

21. Which of the following is/are functions of DBMS?
    A. Data recover
    B. Data security
    C. Data Dictionary maintenance
    D. <u>All the above</u>

22. Which of the following statements are true?
    A. DBMS views the database as a collection of records
    B. File manager views the database as a set of pages
    C. Disk manager views the database as collection of physical locations on the disk
    D. <u>All the above</u>

23. Which of the following statements are true about DML?
    A. DML is data manipulation language
    B. The two types of DML are high-level DML and low-level DML
    C. High level DML is non-procedural and low-level DML is procedural

D. <u>All the above</u>

24. In which of the following models' records are inter-related through tree-like structures
    A. Network model
    B. <u>Hierarchical model</u>
    C. Relational model
    D. Data model

25. Which of the following is the acronym for DBA?
    A. <u>Database Administrator</u>
    B. Database Actor
    C. Database Application programmer
    D. Database Access

<div align="center">

Long Questions (4 Marks)

(Questions for Remembering)

</div>

1. Find the definition of DBA and what is its role in a database environment?

DBA stands for Data Base Administrator. Database admin is responsible for managing the entire DBMS system. Administering these resources is the responsibility of the DBA. The DBA is responsible for authorizing access to the database, coordinating and monitoring its use and acquiring the software and hardware resources as needed. DBA is also accountable for system security.

2. Find the definition of categories of data models with examples.

1. High-Level or conceptual data models- provide concepts that are close to the way how many users perceive data

2. Low-Level or physical data models – provide concepts that describe details of how the data is stored in computers.

3. Explain different types of database users?

The various classes of database users are:-

- DBA
- DB Designers
- End Users
- Software engineers

DBA - Data Base Administrator: DBA stands for Data Base Administrator. Database admin is responsible for managing the entire DBMS system. Administering these resources is the responsibility of the DBA. The DBA is responsible for authorizing access to the database, coordinating and monitoring its use and acquiring the software and hardware resources as needed. DBA is also accountable for system security.

DB Designers: These are people who are responsible for identifying data to be stored in the database and for choosing appropriate structures to represent and store data .

End Users: The end users are the people who interact with the database management system. End users are people whose jobs require access to the database for querying, updating and generating reports. These people make use of the existing database.

Software Engineers: This class of users can be classified as follows

- System analyst: People who determine the requirements of the end users.
- Application programmers: These people implement the above specification as programs, then test and debug and maintain the software for which the database was designed.

4. Write a note on classification of Database Management Systems?

There are several criteria on which DBMS can be classified. They are: -

1. Based on data models
2. Based on number of users
3. Based on number of sites
4. Based on types of applications

Data Models: Based on data models, DBMS can be classified as

a. Relational Data Model- data is organized as tables
b. Hierarchical Data model- data is stored and related through treelike structures.
c. Network Data Model- data records have a 1:N relation between them
d. Object – relational Data Model- data is treated as objects

Number of users: Depending on the number of users supported by the system, DBMS can be categorized into a. Single user systems- that support only one user at a time b. Multi-user system – that support multiple users concurrently

Number of sites: Based on the number of sites over which the database is distributed.

DBMS can be classified as:-

a. Centralized DBMS- Here the data is stored at a single computer site. It supports multiple users but the DBMS and database reside at a single computer site.
b. Distributed DBMS- The database and DBMS are distributed over many sites connected through network. This can again be divided as
   i. Homogeneous RDBMS: They use same DBMS software at multiple sites
   ii. Heterogeneous RDBMS: They use different DBMS software at different sites

Types of application: Based on the types of application DBMS can be classified as follows

a. General Purpose DBMS: DBMS that can be used for all types of application
b. Special Purpose DBMS: DBMS used for a specific application for which they are designed.

E.g. airline reservation – It cannot be used for other applications.

5. What are the characteristics of database approach?

1. Self-describing nature of database system
2. Insulation between data and programs and data abstraction
3. Support of multiple views of data
4. Sharing of data and multi-user transaction processing

Self-describing nature of database system
A fundamental characteristic of database approach is that the database system contains not only the database but also a complete definition or description of the database structure and constraints. The definition is stored in a DBMS catalog. The catalog contains information such as structure of each file, the type and storage format for each data item and various constraints on data. The information stored in the catalog is called the meta-data and it describes the structure of primary database.

Insulation between data and programs and data abstraction
The structure of data files is stored in DBMS catalog separately from access programs. This property is called program-data independence. The structure of the data file can be modified to reflect any changes in the data description. Program-operation independence is a term where users define operations on data as apart of database operation. An operation is specified in 2 parts- the interface of an operation includes the

name of the operation and data types of the parameters. The implementation of the operations is specified separately without affecting the interface. The characteristic that allows both program-data independence and program-operation independence is called data abstraction.

Support of multiple views of data
A database typically has many users, each of whom may require a different view or perspective of the database. A view may be a subset of the database or may contain virtual data that is derived from database files. A multi-user DBMS whose users have a variety of distinct applications must provide facility for defining multiple views.

Sharing of data and multi-user transaction processing
A multi user DBMS must allow multiple users to access the database at the same time. DBMS must include concurrency control software to ensure that several users trying to update the same data in a controlled manner. DBMS must support multiple users to make concurrent transactions. A transaction is an executing program or a process that includes one or more database accesses, such as reading or updating a database record.

6. What are the various types of DBMS interfaces?

a. **Menu based interfaces for web clients or browsers:** These help the users with a list of options called menus that lead the user through formulation of requests. The user need not remember any command or syntax of the query language. The query is composed step by step by picking options from the menu.

b. **Form based Interfaces**: It displays a form to each user. Users can fill data in the form to insert new data. The user can also fill specific entries in which case the DBMS retrieves data from the database.

c. **Graphical user interfaces**: A GUI displays a schema in a diagrammatic form to the user. The user specifies a query by manipulating the diagram. A pointing device such as mouse is used.

d. **Natural Language Interfaces**: These interfaces accept request written in English and attempts to understand them. It has its own schema and dictionary of important words. If the interpretation is successful, the interface generates a high-level query corresponding to the natural language request and submits it to the DBMS. Otherwise a dialog is started with the user for clarification of request.

e. **Interface for parametric users**: Parametric users such as bank tellers perform small set of operations on the database repeatedly. A small set of abbreviated commands are included to minimize the number of keystrokes for each request.

f. **Interface for DBA**: Privileged commands can be used only by the DBA. These include commands for creating user accounts, granting account authorization and reorganizing storage structure of data.

(Questions for Understanding)

7. Explain any four advantages of database approach?

- Potential for enforcing standards- Database approach permits DBA to define and enforce standards among database users in large organizations. These rules include format of data elements, display formats and report structures.
- Reduced Application Development time- Developing an application using DBMS requires very little time.
- Availability of up-to-date information- DBMS makes the database available to all the users. Once any change is made to the database, these changes can be viewed by all the users.
- Flexibility- DBMS facilitates changes in structure of database as the requirements change.
- Economies of scale: DBMS reduces the overall cost of operation and management.

The functions performed by DBMS are as follows:

- Defining a database involves specifying the data types, structures and constraints for the data to be stored in the database

- Constructing the database is the process of storing the data itself on some storage medium that is controlled by the DBMS.

8. Illustrate the functions of DBMS?

- Manipulating the database includes functions like querying the database to retrieve specific data, updating the database so as to reflect changes and generating reports from the data
- Sharing the database allows multiple users and programs to access the database concurrently
- DBMS protects the database. Protection includes both system protection against hardware or software malfunction and security malfunction against unauthorized access
- A large database may have a life cycle for many years. Hence the DBMS must be able to maintain the database system by allowing the system to evolve as requirements change over time.

9. Describe the three-schema architecture with the help of a diagram?

The schemas are defined at the following three levels:

The internal level has an internal schema which describes the physical storage structure of the database. The internal schema uses physical data model and describes the complete details of data storage and access paths for the database.

The conceptual level has a **conceptual schema** which describes the structure of the whole database for a community of users. It hides details of physical storage and concentrates on describing entities, data types, relationships, operations and constraints. The representational model is used to describe the conceptual schema.

The external or view level includes a number of external schemas or user views. Each external schema describes a part of the database that a particular user group is interested and hides the rest of the database from that user group. The process of transforming requests and results between levels is called mappings.
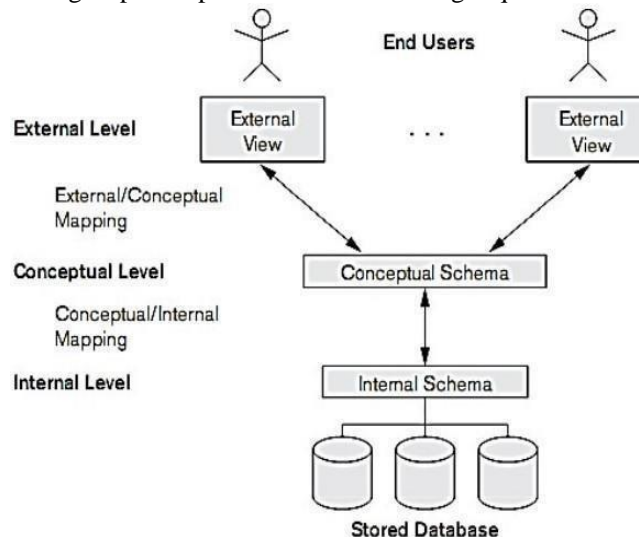
10. Write a brief outline on various DBMS languages?

DBMS Languages: Once the database design is over and DBMS is chosen to implement the database. The main task is to specify conceptual and internal schemas for the database and any mappings between the two. In most DBMS when no strict separation of levels is maintained, one language called the DDL (Data Definition Language) is used by the DBA

The DBMS will have a DDL compiler whose function is to process the DDL statements in order to identify the descriptions of the schema constructs and to store the schema description in the DBMS

catalog. the DDL is used to specify the conceptual schema only. Storage Definition Language is used to describe the internal schema.

Manipulations in the database include retrieval, insertion, deletions and modification on data. DBMS provides a language called DML (Data Manipulation Language) to perform manipulations on the data in the database. There are two main types of DML. They are:-

- High level or non-procedural DML: It can be used on its own to specify complex database operations in a concise manner. Many DBMSs allow high level DML statements to be entered interactively from a terminal. They specify only what to do rather than how to do i.e. the procedural details are not mentioned here.
  E.g., SQL. High level DML such as SQL can specify and retrieve many records in a single DML statement.
- Low level or procedural DML: They are embedded in a general-purpose programming language. This type of DML retrieves individual records or objects from the database and processes them separately. They are also called record-at-time DML.

11. Explain Database system environment with the help of a diagram?

DBMS Component Modules: The database and DBMS catalog is stored on disk. Access to disk is controlled primarily by the operating system which schedules disk I/O. The stored data manager module controls access to the DBMS information stored on the disk whether it is a part of catalog or database. Some DBMS use a buffer manager module that transfers the data from the disk to the main memory buffer so that it can be processed by other DBMS modules as well as application programs. The DDL compiler process the schema definition specified in DDL and stores the description of the schema in the catalog. The run-time database processor handles database access at run time. It receives retrieval and updates operation and carries them on the database. A query compiler handles high level queries that are entered interactively. The pre-compiler extracts the DML commands from an application program and sends these commands to DML compiler for compilation into object code. The DBMS runs on a computer which can be accessed by the end users. This is known as client program/ computer. The database resides on a computer called the database server.
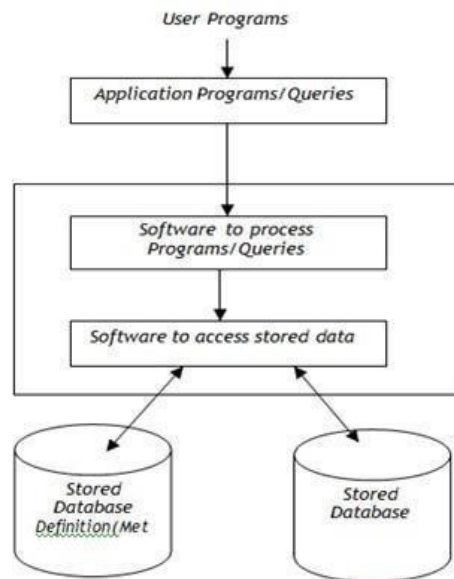
12. How would you explain the concept of data independence in DBMS?

Data Independence: Data independence can be defined as the capacity to change the schema at one level of the database system without having to change the schema at the next higher level. There are two types of data independence logical data independence and physical data independence.

Logical Data Independence: It is the capacity to change the conceptual schema without having to change external schemas or application programs. We may need to change the constraints or reduce the database. After the conceptual schema undergoes logical reorganization, application programs that reference the external schema constructs should work as before.

Physical Data Independence: It is the capacity to change the internal schema without having to change conceptual schemas. Changes to the internal schema may be needed because physical files had to be reorganized. The three-schema architecture makes it easier to achieve true data independence i.e. both physical and logical data independence.

13. Write a brief outline about the various models of DBMS with the aid of diagrams?

Datamodels can be categorized as
- a. Hierarchical model
- b. Network model
- c. Relational model

**Hierarchical Data Model**: Here different records are interrelated through a hierarchical or a tree-like structure. A parent record can have several children but a child can have only one parent. At the top of hierarchy there is only on entity which is called Root.

c **Hierarchical Model**
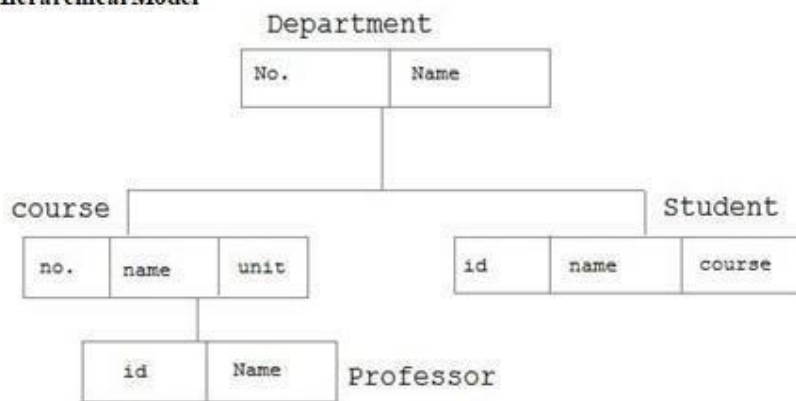
**Network Data Model**: Here, a parent record can have several children and a child record can also have many parent records.

i *Network Model*
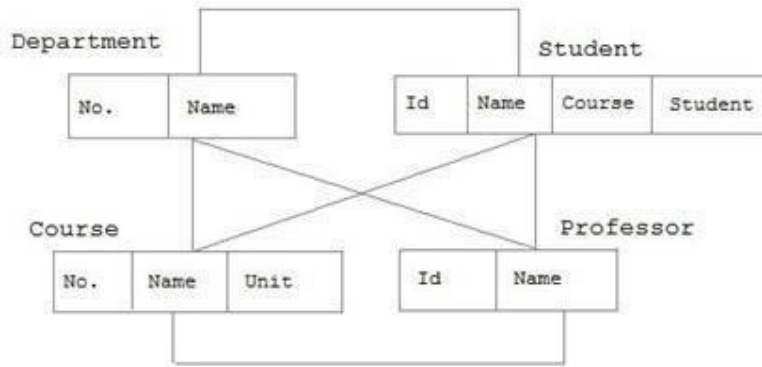
RelationalDataModel: Inthismodel,thereareno physicallinksbetweenrecords. Allthedataismaintainedintheformoftables,comprisingofrowsandcolumns. Dataintwotablesisrelatedthroughcommoncolumns.Queryingismucheasierin thismodel.Itisverymuchprogrammerfriendlyandisthemostwidelyusedmodel.
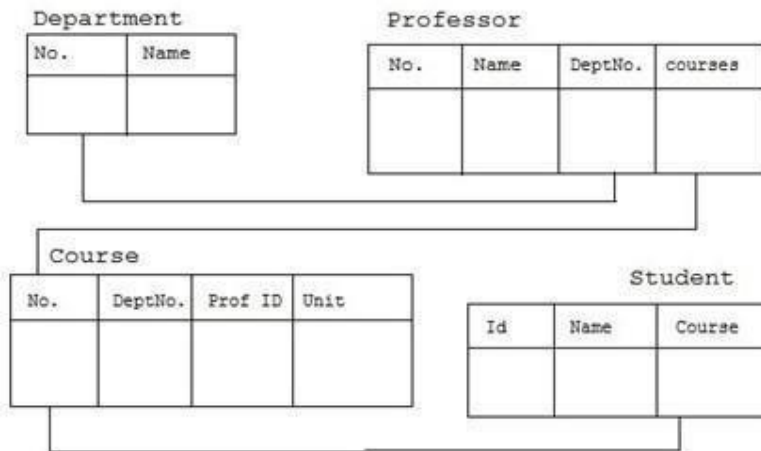
1. What do you think a row in a relation called?
   - **A. tuple**
   - B. Attribute
   - C. Domain
   - D. Cardinality

2. What do you think is the number of attributes in a relation called?
   - A. Cardinality
   - B.Domain
   - C.**Degree**
   - D. Number

3. What do you think an entity that does not have key attributes on their own called?
   - **A. weak entity**
   - B. strongentity
   - C. dependant entity
   - D. independent entity

4. Can you clarify, in relational data model what is a table of records called?
   - A. Tuple
   - B. Attribute
   - **C. Relation**
   - D. Cardinality

5. What do you think an attribute or a group of attributes that uniquely identify records in a table known as?
   - A. Foreign key
   - B. Primary key
   - C. Domain
   - **D. Degree**

6. What do you think is a set of entities of the same type that share the same properties or attributes called?
   - **A. Entity set**
   - B. Attribute set
   - C. Relation set
   - D. Entity model

7. Can you clarify, The attribute name could be structured as a attribute consisting of first name, middle initial, and last name. This type of attribute is called
   - A. Simple attribute
   - **B. Composite attribute**
   - C. Multivaluedattribute

D. Derived attribute

8. If attribute AGE is calculated from DATE_OF_BIRTH, then the attribute AGE is called?
    A. Single valued
    B. Multi valued
    C. Composite
    D. Derived

9. What do you think the values that are not applicable can be represented in relation entry?
    A. NA
    B. 0
    C. NULL
    D. Blank Space

10. Does any of the following value belong to a multivalued attribute?
    A. Phone number
    B. Name
    C. Date_of_birth
    D. Age

11. Does any of the following value belong to a single valued attribute?
    A. Register number
    B. Address
    C. SUBJECT_TAKEN
    D. Reference

12. What do you think is an entity?
    A. Object of relation
    B. Present working model
    C. Thing in real world
    D. Model of relation

13. Can you clarify, when primary key is null of new tuple then constraint violated is called?
    A. null integrity constraint
    B. primary integrity constraint
    C. secondary integrity constraint
    D. entity integrity constraint

14. Can you clarify; the key which specifies that two different tuples cannot have same value is classified as?
    A. super key
    B. simple key
    C. parallel key
    D. conceptual key

(Questions for Application)

15. Do you know which set of all values that can be taken by an attribute?
    A. Degree
    B. Domain

C. Tuple

D. Relation

16. Identify the properties of a relation?
    A. Tuples are ordered
    B. <u>Tuples are unordered</u>
    C. No duplicate tuples are allowed
    D. Only B and C

17. Analyze a relation.
    A. A relation is a two dimensional object having a vertical and horizontalcomponent
    B. B. Vertical component is a attribute
    C. Horizontal component is a tuple
    D. <u>All the above</u>

18. Can you tell in a relational data model what is a field or column in a table called?
    A. Tuple
    B. <u>Attribute</u>
    C. Cardinality
    D. Primary Key

19. Do you know what are number of tuples in a relation called?
    A. <u>Cardinality</u>
    B. Degree
    C. Domain
    D. Relation

20. Which rule states that the database must not contain any unmatched foreign key value?
    A. Non redundancy rule
    B. Security Rule
    C. Cascading Rule
    D. <u>Referential integrity rule</u>

21. Can you tell, an employee is assigned to one department and a department having many employees is an example of?
    A. one-to-one relationship
    B. many-to-one relationship
    C. <u>one-to-many relationship</u>
    D. many-to-many relationship

22. Identify the descriptive property possessed by each entity set
    A. Entity
    B. <u>Attribute</u>
    C. Relation
    D. Model

23. Can you tell the function that an entity plays in a relationship is called that entity's?
    A. Participation
    B. Position
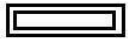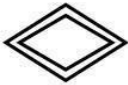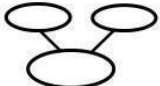
C. <u>Role</u>
D. Instance

24. Can you tell in relational model terminology what is a table considered as?
    A. range
    B. domain
    C. <u>relation</u>
    D. tuple

25. Can you tell, in a formal relational model what a set of indivisible values called is?
    A. range
    B. <u>domain</u>
    C. relation
    D. tuple

<u>**Questions carrying 4 marks**</u>

(Questions for Understanding)

1. Write a brief outline on various symbols used in ER diagrams?

Symbol	Meaning
▭	Represents Entity
⬭	Represents Attribute
◇	Represents Relationship
—	Links Attribute(s) to entity set(s) or Entity set(s) to Relationship set(s)
⬭ (double)	Represents Multivalued Attributes
⬭ (dotted)	Represents Derived Attributes
═	Represents Total Participation of Entity
▭ (double)	Represents Weak Entity
◇ (double)	Represents Weak Relationships
⬭⬭ connected	Represents Composite Attributes
⬭ (underlined)	Represents Key Attributes / Single Valued Attributes

2. What do you think is cardinality ratio in a relation? Explain its types.

The cardinality ratio for a binary relation specifies the maximum number of instances that an entity participates in. The following are the types of relationship sets [cardinality ratios];

☐ One-to-one relationship
☐ One-to-many relationship
☐ Many-to-one relationship
☐ Many-to-many relationship

- **One-to-One**
  Only one entity of the first set is related to only one entity of the second set. E.g.*A teacher teaches a student.* Only one teacher is teaching only one student. This can be expressed in the following diagram as:
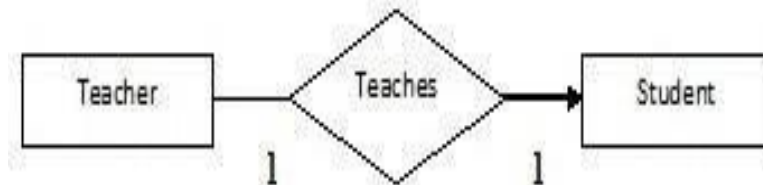
- **One-to-Many**
  Only one entity of the first set is related to multiple entities of the second set. E.g. *A teacher teaches students.* Only one teacher is teaching many students. This can be expressed in the following diagram as:
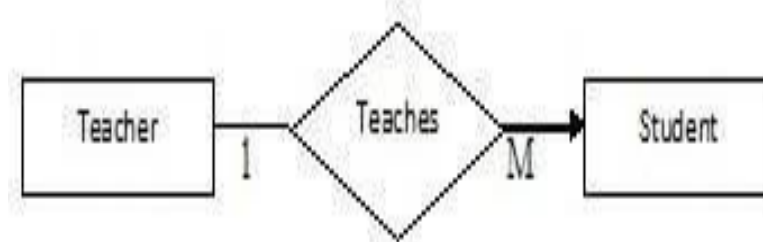
- **Many-to-One**
  Multiple entities of the first set are related to multiple entities of the second set. E.g.*Teachers teach a student.* Many teachers are teaching only one student. This can be expressed in the following diagram as:
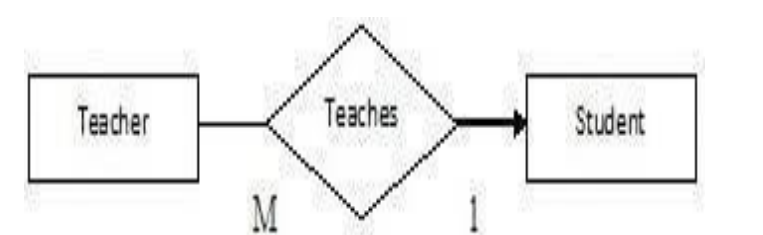
- **Many-to-Many**
  Multiple entities of the first set is related to multiple entities of the second set. E.g.*Teachers teach students.* In any school or college many teachers are teaching many students. This can be considered as a two way one-to-many relationship. This can be expressed in thefollowing diagram as:
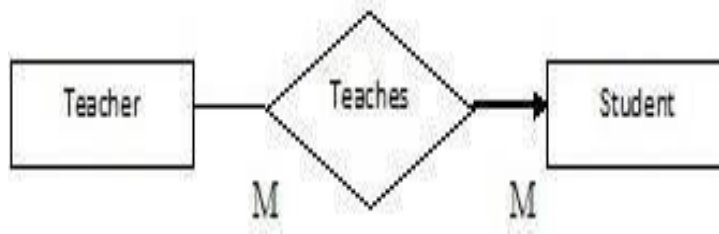
3. Explain weak entity types with an example?

A weak entity is an entity set that does not have sufficient attributes for Unique Identification of its records. Simply a weak entity is nothing but an entity which does not have a primary key attribute. It contains a partial key called as discriminator which helps in identifying a group of entities from the entity set.

- Will not have a primary key but it has partial discriminator key
- Which entity is dependent on the strong entity
- Represented by double rectangle relationship between a strong entity and the weak entity is represented by double Diamond
- It has always total participation

4. Explain strong entity types with an example?

A strong entity set is an entity that contains sufficient attributes to uniquely identify all its entities. Simply strong entity is nothing but an entity set having a primary key attribute or a table which consists of a primary key column.The primary key of the strong entity is represented by underlining it.

- Strong entity always has a primary key
- It is not dependent on any other entity
- Represented by a single rectangle
- Relationship between two strong entities is represented by a single diamond
- A strong entity has may or may not have total participation.

5. Illustrate the concept of recursive relationship with an example?

A relationship between two entities of similar entity type is called a **recursive** relationship. Here the same entity type participates more than once in a relationship type with a different role for each instance. However, it is possible for the same entity to participate in the relationship. This is termed a **recursive** relationship.

Example: Suppose we have an employee table. A manager supervises a subordinate. Every employee can have a supervisor except the CEO and there can be at most one boss for each employee. One employee may be the bossof more than one employee.

Let's suppose that REPORTS_TO is a recursive relationship on the Employee entity type where each Employee plays two roles

1. Supervisor
2. Subordinate

Supervisor and Subordinate are called "Role Names". Here the degree of the REPORTS_TO relationship is 1 i.e., a unary relationship.

- The minimum cardinality of Supervisor entity is ZERO since the lowest level employee may not be a manager for anyone.
- The maximum cardinality of Supervisor entity is N since an employee can manage many employees.
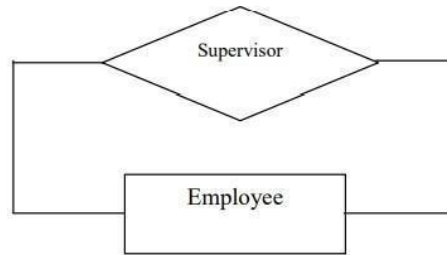
6. Illustrate the key constraints on a relation with an example?

A relation is a set of tuples, and each tuple's "identity" is given by the values of its attributes., no two tuples may have the same combination of values in their attributes. Usually, the miniworld dictates that there be (proper) subsets of attributes for which no two tuples may have the same combination of values. Such a set of attributes is called a super key of its relation.

Example,
Suppose that we stipulate that a faculty member is uniquely identified by Name and Address and also by Name and Department, but by no single one of the three attributes mentioned. Then {Name, Address, Department} is a (non-minimal) superkey and each of {Name, Address} and {Name, Department} is a key (i.e., minimal superkey).

7. Illustrate the participation constraints with example?

The participation constraint specifies whether the existence of an entity depends on its being related to another entity via a relation type. It specifies the minimum number of relation instance that each entity can participate in and is also called the minimum cardinality relation. The two types of participation constraints are:-

- ☐ Total participation
- ☐ Partial participation

Total Participation

- It specifies that each entity in the entity set must compulsorily participate in at least one relationship instance in that relationship set.
- That is why, it is also called as **mandatory participation.**
- Total participation is represented using a double line between the entity set and relationship set.
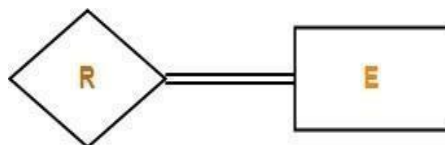
Total Participation

Partial participation
- It specifies that each entity in the entity set may or may not participate in the relationship instance in that relationship set.

- That is why, it is also called as **optional participation.**

Partial participation is represented using a single line between the entity set and relationship set
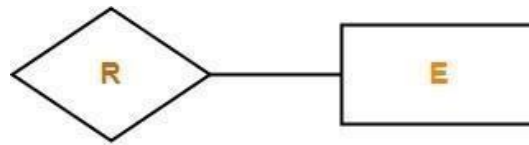
Partial Participation

8. Describe in your own words about the concept of Transaction?

A database application program running against a relational database typically executes one or more transactions. A transaction is an executing program that includes some database operations, such as reading from the database, or applying insertions, deletions, or updates to the database. At the end of the transaction, it must leave the database in a valid or consistent state that satisfies all the constraints specified on the database schema. These retrievals and updates will together form an atomic unit of work against the database. For example, a transaction to apply a bank withdrawal will typically read the user account record, check if there is a sufficient balance, and then update the record by the withdrawal amount.

(Questions for Applications)

9. Explain various types of attributes in a relation with examples?

a) Ordering of tuples in a relation: A relation is defined as a set of tuples. Mathematically, elements, of a set have no order among them; hence, tuples in a relation do not have any particular order. In other words, a relation is not a sensitive to the ordering of tuples. However, in a file, record is physically stored on the disk, so there always in an order among the records. This ordering indicates first, second, ith, last records in the file. Similarly, when we display a relation as a table, the rows are displayed in certain order.

b) Ordering of a tuple within a tuple: According to the preceding definition of a relation, an n-tuple is an ordered list of n-values, so the ordering of values in a tuple and hence of attributes in a relation in a relation schema is important. However, at a more abstract level, the order of attributes and their values is not the important as long as precedence between attributes and values is maintained.

c) Values and NULLs in the tuples: Each value in a tuple is an atomic value; that is not divisible into components within the framework of the basic relational model. Hence, composite and multivalued attributes are not allowed. This model is sometimes called the flat-relational model.

An important concept is that of NULL values, which are used to represent the values of attributes that may be unknown or may not apply to a tuple. A special value called NULL, is used in these cases:

For example:

Some STUDENT tuples have NULL for their office phones (i.e. office phone does not apply to the students).

10. Distinguish between strong and weak entity types?

Strong entity

- Strong entity always has a primary key
- It is not dependent on any other entity
- Represented by a single rectangle

- Relationship between two strong entities is represented by a single diamond
- A strong entity has may or may not have total participation

Weak entity

- Will not have a primary key but it has partial discriminator key
- Which entity is dependent on the strong entity
- Represented by double rectangle relationship between a strong entity and the weak entity is represented by double Diamond
- It has always total participation

11. What are Entity integrity constraints on a relation? Explain with an example.

Entity Integrity Constraint: It states that no primary key value can be null. This is because primary keys are used to identify the tuples in a relation. In a tuple, none of the values of the attributes forming the relation's primary key may have the (non-)valuenull.
For example, the orders table primary key is order_num. The order_num column holds a unique system generated order number for each row in the table.

12. What are referential integrity constraints on a relation? Explain with an example.

A foreign key of relation R is a set of its attributes intended to be used (by each tuple in R) for identifying/referring to a tuple in some relation S. For this to make sense, the set of attributes of R forming the foreign key should "correspond to" some superkey of S. Indeed, by definition we require this superkey to be the primary key of S. This constraint says that, for every tuple in R, the tuple in S to which it refers must actually be in S.

For Example,

EID	Name	DNO
01	Divine	12
02	Dino	22
04	Vivian	14

DNO	Place
12	Jaipur
13	Mumbai
14	Delhi

Explanation:
In the above, DNO of the first relation is the foreign key, and DNO in the second relation is the primary key. DNO = 22 in the foreign key of the first table is not allowed since DNO = 22 is not defined in the primary key of the second relation. Therefore, Referential integrity constraints is violated here.

13. What are some of the characteristics of relation?

a) Ordering of tuples in a relation: A relation is defined as a set of tuples. Mathematically, elements, of a set have no order among them; hence, tuples in a relation do not have any particular order. In other words, a relation is not a sensitive to the ordering of tuples. However, in a file, record is physically stored on the disk, so there always in an order among the records. This ordering indicates first, second and last records in the file.

b) Ordering of a tuples within a tuple: According to the preceding definition of a relation, an n-tuple is an ordered list of n-values, so the ordering of values in a tuple and hence of attributes in a relation in a relation schema is important .However ,at a more abstract level, the order of attributes and their values is not the important as long as precedence between attributes and values is maintained.

c) Values and NULLs in the tuples: Each value in a tuple is an atomic value; that is not divisible into components within the framework of the basic relational model. Hence, composite and multivalued attributes are not allowed. This model is sometimes called the flat-relational model. An important concept is that of NULL values, which are used to represent the values of attributes that may be unknown or may not apply toatuple. A special value called NULL, is used in these cases:

For example: Some STUDENT tuples have NULL for their office phones

d) Interpretation (Meaning) of relation: The relation schema can be interpreted as a declaration or as a type of assertion. For example, the schema of the STUDENT relation asserts that, in general, a student entity has a name, ssn, home-phone, address, gpa. Each tuple in the relation can then be interpreted as particular instance of relation.

14. Can you group by and explain the operations on relations?

Insert operation: It provides a list of attribute values for a new tuple that is to be inserted into R. Insert operation can violate the following constraints:

- Domain constraint can be violated if an attribute value does not match the specified domain.
- Key constraint can be violated if a key value in the new tuple t already exists in another tuple in the relation r(R).
- Entity integrity constraint can be violated if the primary key of the new tuple t is null
- Referential integrity constraint can be violated if the value of any foreign key in t refers to a tuple that does not exist in the referenced relation.

Delete Operation: This operation deletes a tuple from a relation. It can violate only referential integrity constraint. This occurs in case the tuple being deleted is referenced by foreign key from other tuples in the database.

Three options for dealing with it:

- Reject the deletion
- Attempt to cascade (or propagate) by deleting any referencing tuples (plus those that reference them, etc., etc.)
- Modify the foreign key attribute values in referencing tuples to null or to somevalid value referencing a different tuple

Update Operation: This operation is used to modify / change values of one or more attributes in tuple(s) in a relation R. It is necessary to specify a condition on attributes of a relation to select a tuple to be modified. Updating an attribute that is neither a primary key nor a foreign key creates no problem. Modifying a primary key is similar to deleting a tuple and inserting another in its place. When updating DBMS checks to confirm the new value is of correct data type and domain.

15. What do you see as the possible outcomes of violation of constraints in a relation?

Insert operation: It provides a list of attribute values for a new tuple that is to be inserted into R. Insert operation can violate the following constraints:

- Domain constraint can be violated if an attribute value does not match the specified domain.
- Key constraint can be violated if a key value in the new tuple t already exists in another tuple

in the relation r(R).

- Entity integrity constraint can be violated if the primary key of the new tuple t is null
- Referential integrity constraint can be violated if the value of any foreign key in t refers to a tuple that does not exist in the referenced relation.

Delete Operation: This operation deletes a tuple from a relation. It can violate only referential integrity constraint. This occurs in case the tuple being deleted is referenced by foreign key from other tuples in the database.

Three options for dealing with it:

- Reject the deletion
- Attempt to cascade (or propagate) by deleting any referencing tuples (plus those that reference them, etc., etc.)
- Modify the foreign key attribute values in referencing tuples to null or to some valid value referencing a different tuple

Update Operation: This operation is used to modify / change values of one or more attributes in tuple(s) in a relation R. It is necessary to specify a condition on attributes of a relation to select a tuple to be modified. Updating an attribute that is neither a primary key nor a foreign key creates no problem. Modifying a primary key is similar to deleting a tuple and inserting another in its place. When updating DBMS checks to confirm the new value is of correct data type and domain.

Multiple Choice Questions

(Questions for Remembering)

1. Can you name the relational algebra operator that is used to retrieve specific tuples in a relation
    A. project
    B. union
    C. intersect
    D. select

2. Can you name the relational algebra operator that is used to obtain all possible combinations of tuples from two relations
    A. project
    B. product
    C. Union
    D. Intersect

3. Can you name the relational algebra operator that is used to retrieve tuples that appear in both the relations specified
    A. project
    B. product
    C. join
    D. intersect

4. Can you name the relational algebra operator that is used to retrieve specific attributes from a relation
    A. select
    B. project
    C. join
    D. product

5. Can you name the relational algebra operator that is used to retrieve tuples appearing in either or both of the given two relations
    A. union
    B. product
    C. divide
    D. intersect

6. Can you name the relational algebra operator that is used to retrieve tuples appearing in the first relation but not in the second
    A. Join
    B. Divide
    C. Difference
    D. Project

7. Name a join condition contains an equality operator:
    A. Equijoin
    B. Cartesian

C. Natural

D. Left

8. What is the assignment operator in relational algebra is denoted by?

    A. ->

    B. <-

    C. =

    D. ==

9. A table is in the _____ if only candidate keys are the determinants.

    A. Functional dependency

    B. transitive dependency

    C. 4 NF

    D. BCNF

10. Define second normal form

    A. No functional dependencies exist.

    B. No multivalued dependencies exist.

    C. No partial functional dependencies exist

    D. No partial multivalued dependencies exist.

11. Name the normal form is considered adequate for normal relational database design?

    A. 2NF

    B. 5NF

    C. 4NF

    D. 3NF

12. Name the normal form where if every field contains only atomic values that is, no lists or sets.

    A. 1 NF

    B. 2 NF

    C. 3 NF

    D. BCNF

(Questions for Understanding)

13. What do you think is the relation that does not contain repeated groups is in?

    A. 1NF

    B. 2NF

    C. 3NF

    D. 4NF

14. Can you clarify, which of the following is true about join operator?

    A. It is used to retrieve combinations of tuples in two relations based on a common field

    B. Natural join is also called inner join

    C. Natural join is also called outer join

    D. Only A and B

15. Can you clarify, which of the following are the types of outer join?

    A. left outer join

B. full outer join
C. right outer join
D. all the above

16. Can you clarify, Relational Algebra is a_____query language
    A. Relational
    B. Structural
    C. Procedural
    D. Fundamental

19. What do you think is the operation that allows us to find tuples that are in one relation but are not in another?
    A. Union
    B. Set-difference
    C. Product
    D. Intersection

20. Can you clarify, which of the following is used to denote the projection operation in relational algebra?
    A. Pi (Greek)
    B. Sigma (Greek)
    C. Lambda (Greek)
    D. Omega (Greek)

21. Can you clarify, in which normal form, a composite attribute is converted to individual attributes
    A. First
    B. Second
    C. Third
    D. Fourth

22. Can you clarify, what specifies the actions needed to remove the drawbacks in the current design of database.
    A. 1 NF
    B. 2 NF
    C. 3 NF
    D. Normal form

23. What do you think is normal form that is not necessarily dependency preserving?
    A. 2NF
    B. 3NF
    C. BCNF
    D. 4NF

24. Can you clarify, dependency preservation is not guaranteed in?
    A. BCNF
    B. 3NF
    C. 4NF
    D. 2NF

25. Can you clarify what normal form is a relation when an attribute of a composite key is dependent on an attribute of other composite key.
   A. 2NF
   B. 3NF
   C. BCNF
   D. 1NF

<div align="center">

Long Questions (4 marks)

(Questions for Understanding)

</div>

1. How do you explain SELECT operation in relational algebra with an example?

The select operation is used to select a subset of tuples from a relation that satisfy a selection condition. It can be considered as a filter that keeps only those tuples that satisfy a qualifying condition.

Select operation is denoted by σ(select condition) (R)

For Example,To select employee tuples whose department is 4, it can be specified as follows: σ→σDNO=4(EMPLOYEE)

2. Illustrate PROJECT operation in relational algebra with an example?

Project operation selects certain columns from the table and discards other columns. It can be visualized as vertical partitioning of relation into two relations – one has the required attributes that containsthe result of the operation and the other contains discarded columns.

Project operations is denoted by Π (R) Here, is the desired list of attributes that are to be projected from the relation R

For example,If the name and salary of an employee is to be listed, it can be written as follows: ΠNAME,SAL (EMPLOYEE) The number of tuples in a relation resulting from project operation is always less than or equal to the total number of tuples in R.

3. Describe in your own words on functional dependency with an example?

Functional Dependency (FD) determines the relation of one attribute to another attribute in a database management system (DBMS) system. Functional dependency helps you to maintain the quality of data in the database. A functional dependency is denoted by an arrow →. The functional dependency of X on Y is represented by X → Y.

Example:-

Employee number	Employee Name	Salary	City
1	Dana	50000	San Fransico
2	Francis	38000	Londan
3	Andrew	25000	Tokyo

In this example, if we know the value of Employee number, we can obtain Employee Name, city, salary, etc. By this, we can say that the city, Employee Name, and salary are functionally depended on Employee number.

4. Explain First normal form with an example?

A relation R is said to be in 1NF if every attribute of R takes only single atomic values. In order to transform un-normalized table to 1NF we identify and remove repeating groups within a table.

Example: Suppose a company wants to store the names and contact details of its employees. It creates a table that looks like this:

emp_id	emp_name	emp_address	emp_mobile
101	Herschel	New Delhi	8912312390
102	Jon	Kanpur	8812121212 9900012222
103	Ron	Chennai	7778881212
104	Lester	Bangalore	9990000123 8123450987

Two employees (Jon & Lester) are having two mobile numbers so the company stored them in the same field as you can see in the table above.

This table is not in 1NF as the rule says "each attribute of a table must have atomic (single) values", the emp_mobile values for employees Jon & Lester violates that rule.

To make the table complies with 1NF we should have the data like this:

emp_id	emp_name	emp_address	emp_mobile
101	Herschel	New Delhi	8912312390
102	Jon	Kanpur	8812121212
102	Jon	Kanpur	9900012222
103	Ron	Chennai	7778881212
104	Lester	Bangalore	9990000123
104	Lester	Bangalore	8123450987

5. Explain Second normal form with an example?

A table is said to be in 2NF if both the following conditions hold:

• Table is in 1NF (First normal form)

• No non-prime attribute is dependent on the proper subset of any candidate key of table. An attribute that is not part of any candidate key is known as non-prime attribute.

Example: Suppose a school wants to store the data of teachers and the subjects they teach. They create a table that looks like this: Since a teacher can teach more than one subjects, the table can have multiple rows for a same teacher.

teacher_id	subject	teacher_age
111	Maths	38
111	Physics	38
222	Biology	38
333	Physics	40
333	Chemistry	40

Candidate Keys: {teacher_id, subject}

Non prime attribute: teacher_age

The table is in 1 NF because each attribute has atomic values. However, it is not in 2NF because non prime attribute teacher_age is dependent on teacher_id alone which is a proper subset of candidate key. This violates the rule for 2NF as the rule says "no non-prime attribute is dependent on the proper subset of any candidate key of the table".

To make the table complies with 2NF we can break it in two tables like this:

teacher_details table.

teacher_id	teacher_age
111	38
222	38
333	40

teacher_subject table:

teacher_id	Subject
111	Maths
111	Physics
222	Biology
333	Physics
333	Chemistry

6. Explain third normal form with an example?

A table design is said to be in 3NF if both the following conditions hold:

- Table must be in 2NF
- Transitive functional dependency of non-prime attribute on any super key should be removed.

An attribute that is not part of any candidate key is known as non-prime attribute. In other words, 3NF can be explained like this: A table is in 3NF if it is in 2NF and for each functional dependency X-> Y at least one of the following conditions hold:

- X is a super key of table
- Y is a prime attribute of table An attribute that is a part of one of the candidate keys is known as prime attribute.

Example: Suppose a company wants to store the complete address of each employee, they

create a table named employee_details that looks like this:

emp_id	emp_name	emp_zip	emp_state	emp_city	emp_district
1001	John	282005	UP	Agra	Dayal Bagh
1002	Ajeet	222008	TN	Chennai	M-City
1006	Lora	282007	TN	Chennai	Urrapakkam
1101	Lilly	292008	UK	Pauri	Bhagwan
1201	Steve	222999	MP	Gwalior	Ratan

Super keys: {emp_id}, {emp_id, emp_name}, {emp_id, emp_name, emp_zip}…so on

Candidate Keys: {emp_id}

Non-prime attributes: all attributes except emp_id are non-prime as they are not part of any candidate keys.

employee table:

emp_id	emp_name	emp_zip
1001	John	282005
1002	Ajeet	222008
1006	Lora	282007
1101	Lilly	292008
1201	Steve	222999

employee_zip table:

emp_zip	emp_state	emp_city	emp_district
282005	UP	Agra	Dayal Bagh
222008	TN	Chennai	M-City
282007	TN	Chennai	Urrapakkam
292008	UK	Pauri	Bhagwan
222999	MP	Gwalior	Ratan

7. Explain BCNF with an example?

It is an advance version of 3NF that's why it is also referred as 3.5NF. BCNF is stricter than 3NF. A table complies with BCNF if it is in 3NF and for every functional dependency X->Y, X should be the super key of the table.

Example: Suppose there is a company wherein employees work in more than one department. They store the data like this:

emp_id	emp_nationality	emp_dept	dept_type	dept_no_of_emp
1001	Austrian	Production and planning	D001	200
1001	Austrian	Stores	D001	250
1002	American	design and technical support	D134	100
1002	American	Purchasing department	D134	600

Functional dependencies in the table above:

emp_id ->emp_nationality

emp_dept -> {dept_type, dept_no_of_emp}

Candidate key: {emp_id, emp_dept} The table is not in BCNF as neither emp_id nor emp_dept alone are keys. To make the table comply with BCNF we can break the table in three tables like this:

emp_nationality table:

emp_id	emp_nationality
1001	Austrian
1002	American

emp_dept table:

emp_dept	dept_type	dept_no_of_emp
Production and planning	D001	200
Stores	D001	250
design and technical support	D134	100
Purchasing department	D134	600

emp_dept_mapping table:

emp_id	emp_dept
1001	Production and planning
1001	stores
1002	design and technical support
1002	Purchasing department

Functional dependencies:

emp_id ->emp_nationality

emp_dept -> {dept_type, dept_no_of_emp}

Candidate keys:

For first table: emp_id

For second table: emp_dept

For third table: {emp_id, emp_dept}

This is now in BCNF as in both the functional dependencies left side part is a key

(Questions for Application)

8. What are the set theory operations in relational algebra?

Standard mathematical operations on sets can also be applied to relational algebra. The three operations in this category are:

a) UNION b) INTERSECTION c) MINUS

UNION – The result of this operation is denoted by R∪S. The result is a relation that includes all tuples that are in R or in S or in both R and S. Duplicate tuples are eliminated.

Example: STUDENT ∪ INSTRUCTOR

FNAME	LNAME
Suresh	Rao
Ramesh	Krishna
Ravi	Reddy
Vipul	Kumar
Vinay	Kumar
Sachin	Kumar
Rohit	Sharma

INTERSECTION – The result of this operation is denoted by R∩S. It results in a relation that contains all tuples that are present in both R and S

Example: STUDENT ∩ INSTRUCTOR

FNAME	LNAME
Ravi	Reddy
Sachin	Kumar

SET DIFFERENCE – The result of this operation is denoted by R-S. It is a relation that includes all tuples that are in R but not in S.

a) STUDENT-INSTRUCTOR

FNAME	LNAME
Suresh	Rao
Ramesh	Krishna
Vipul	Kumar
Vinay	Kumar

b) INSTRUCTOR-STUDENT

FNAME	LNAME
Rohit	Sharma

9. What is union compatibility of two relations? Explain with an example.

These are binary operations and are applied on two relations. But, the relations must have same type of tuples. Two relations R(A1,A2,….,An) and S(B1,B2,…,Bn) are said to be union compatible if they have the same degree n and if dom(Ai)=dom(Bi) for 1≤i≤ n i.e. Two relations should have the same number of attributes and each corresponding pair of attributes should have the same domain. This condition is known as union compatibility.

Example: Two union Compatible relations

STUDENT

FNAME	LNAME
Suresh	Rao
Ramesh	Krishna
Ravi	Reddy
Vipul	Kumar
Vinay	Kumar
Sachin	Kumar

INSTRUCTOR

FNAME	LNAME
Sachin	Kumar
Rohit	Sharma
Ravi	Reddy

10. Can you group by the various types of inner join operations in relational algebra with examples?

The different types of inner join are:-

a) Equi Join b) Natural Join c) Theta Join

a) Equi-Join – When join conditions involve only equality comparisons on the attributes of 2 tables ,then, such joins are called equi-joins.

EMP

EMPNO	ENAME	DNO
E001	RAMA	D001
E002	GITA	D002
E003	RITA	D001

DEPT

DNUM	DNAME
D001	HR
D002	SALES

EMP⋈ DEPT

EMPNO	ENAME	DEPTNO	DNAME
E001	RAMA	D001	HR
E002	GITA	D002	SALES
E003	RITA	D001	HR

Natural Join- In order to eliminate identical values in every tuple, we use natural joins. The definition of natural join requires that the two join attributes have the same name in both the relations. It is denoted by. In case the two attributes do not have the same name, renaming is done.

EMP

EMPNO	ENAME	DNAME
E001	RAMA	HR
E002	GITA	SALES
E003	RITA	HR

DEPT

DNAME	DLOCATION
HR	CHENNAI
SALES	KANNUR

EMP⋈ DEPT

EMPNO	ENAME	DNAME
E001	RAMA	HR
E002	GITA	SALES
E003	RITA	HR

Theta Join – When the join conditions involve all comparison operators on the attributes i.e.{,<=,>=,!=} then, such a join is called theta join.

CAR

CarModel	CarPrice
CarA	20,000
CarB	30,000
CarC	50,000

BOAT

BoatModel	BoatPrice
Boat1	10,000

Boat2	40,000
Boat3	60,000

CAR⋈_{CARPRICE>=BOATPRICE} BOAT

CAR $\bowtie_{CARPRICE>=BOATPRICE}$ BOAT

CarModel	CarPrice	BoatModel	BoatPrice
CarA	20,000	Boat1	10,000
CarB	30,000	Boat1	10,000
CarC	50,000	Boat1	10,000
CarC	50,000	Boat2	40,000

11. Can you group by the various types of outer join operations in relational algebra with examples?

An outer join doesn't require each record in the two join tables to have a matching record. In this type of join, the table retains each record even if no other matching record exists. A set of operations called outer join. The different types of outer joins are:

a. Left Outer Join
b. Right Outer Join
c. Full Outer Join

LeftOuterJoin⋈:This operation keeps all the tuples in the first or left relation(RxS)i.e.R.If no match is found in S then the join result pads the attribute with null values.

Employee

Name	EmpId	DeptName
Hari	3415	Finance
Samit	2241	Sales
Geetha	3401	Finance
Haritha	2202	Sales
Tom	1123	Executive

Dept

DeptName	Manager
Sales	Haritha
Production	Charles

Employee ⋈ Dept

Name	EmpId	DeptName	Manager
Hari	3415	Finance	NULL
Samit	2241	Sales	Haritha
Geetha	3401	Finance	NULL
Haritha	2202	Sales	Haritha
Tom	1123	Executive	NULL

RightOuterJoin

(⋈):This operation keeps all the tuples in the second or right relation(RxS)i.e.S.If no match is found in R then the join result pads the attribute with null values.

Employee

Name	EmpId	DeptName
Hari	3415	Finance
Samit	2241	Sales

Geetha	3401	Finance
Haritha	2202	Sales
Tom	1123	Executive

Dept

DeptName	Manager
Sales	Haritha
Production	Charles

Employee ⋈ Dept

Name	EmpId	DeptName	Manager
Samit	2241	Sales	Haritha
Haritha	2202	Sales	Haritha
NULL	NULL	Production	Charles

FullOuterJoin(⋈). This operation keeps all the tuples in both the left and right relations. When no match is found in either relations, the corresponding attributes are padded with null values as needed.

Employee

Name	EmpId	DeptName
Hari	3415	Finance
Samit	2241	Sales
Geetha	3401	Finance
Haritha	2202	Sales
Tom	1123	Executive

Dept

DeptName	Manager
Sales	Haritha
Production	Charles

Employee ⋈ Dept

Name	EmpId	DeptName	Manager
Hari	3415	Finance	NULL
Samit	2241	Sales	Haritha
Geetha	3401	Finance	NULL
Haitha	2202	Sales	Haritha
Tom	1123	Executive	NULL
NULL	NULL	Production	Charles

12. Distinguish between SELECT and PROJECT operation in relational algebra?

The select operation is used to select a subset of tuples from a relation that satisfy a selection condition. It can be considered as a filter that keeps only those tuples that satisfy a qualifying condition

To select employee tuples whose department is 4, it can be specified as follows:
$\sigma \rightarrow \sigma DNO=4(EMPLOYEE)$

Project operation selects certain columns from the table and discards other columns. It can be visualized as vertical partitioning of relation into two relations – one has the required attributes that contains the result of the operation and the other contains discarded columns.

Π<attribute list>(R) Here, is the desired list of attributes that are to be projected from the relation R.

Multiple Choice Questions

(Questions for Understanding)

1. What do you think are the indexes that are built based on the same key by which data is ordered on the disk called?
   - **A. clustered index**
   - B. non-clustered index
   - C. index-id
   - D. page-number

2. Can you clarify, when two records hash to the same address, then it leads to
   - **A. collision**
   - B. clashing
   - C. indexing
   - D. searching

3. What do you think a unit of storage that can store one or more records in a hash file organization denoted as?
   - **A. Buckets**
   - B. Disk pages
   - C. Blocks
   - D. Nodes

4. What do you think stores information on a sector magnetically as reversals of the direction of magnetization of the magnetic material in a magnetic disk?
   - A. Read–write head
   - **B. Read-assemble head**
   - C. Head–disk assemblies
   - D. Disk arm

5. What do you think is the smallest unit of information that can be read from or written to the disk?
   - A. Track
   - B. Spindle
   - **C. Sector**
   - D. Platter

6. What do you think is the time for repositioning the arm is called and it increases with the distance that the arm must move?
   - A. Access time
   - B. Average seek time
   - **C. Seek time**
   - D. Rotational latency time

7. Can you clarify, what is that once the head has reached the desired track, the time spent waiting for the sector to be accessed to appear under the head called?
- A. Access time
- B. Average seek time
- C. Seek time
- **D. <u>Rotational latency time</u>**

8. What do you think is popular for applications such as storage of log files in a database system, since it offers the best write performance?
- **A. <u>RAID level 1</u>**
- B. RAID level 2
- C. RAID level 0
- D. RAID level 3

9. Which RAID type doesn't use parity for data protection?
- **A. <u>RAID level 1</u>**
- B. RAID level 4
- C. RAID level 6
- D. RAID level 5

10. What do you think is the file organization that provides very fast access to any arbitrary record of a file?
- A. Ordered files
- B. Unordered files
- **C. <u>Hash files</u>**
- D. B+ Trees

11. Can you clarify the process of saving information onto secondary storage devices is referred to as?
- A. Backing up
- B. Restoring
- **C. <u>Writing</u>**
- D. Reading

12. What do you think is collection of related fields that can be treated as a unit by some application program?
- A. field
- **B. <u>record</u>**
- C. file
- D. database

<p align="center">**(Questions for Skill)**</p>

13. What do you think are the clustered records that belong to the same file or table called?
- A. Inter-file clustering
- **B. <u>Intra file clustering</u>**
- C. External clustering
- D. Indexing

14. Which of the following methods is NOT used to detect collision
    - **A. Binary search**
    - B. Linear search
    - C. Collision chain
    - D. All the above

15. Which of the following statements are true about indexing?
    - A. Index can be created on multiple fields
    - B. Multiple indexes can be created on the same table
    - C. There is no limit on a maximum number of indexes that are created on the same table
    - **D. Only A and B**

16. Which level of RAID refers to disk mirroring with block striping?
    - **A. RAID level1**
    - B. RAID level 2
    - C. RAID level 0
    - D. RAID level 3

17. What do you think are the disk platters mounted on a spindle and the heads mounted on a disk arm are together known as?
    - A. Read-disk assemblies
    - **B. Head–disk assemblies**
    - C. Head-write assemblies
    - D. Read-read assemblies

18. Which of the following is the time from when a read or write request is issued to when data transfer begins?
    - **A. Access time**
    - B. Average seek time
    - C. Seek time
    - D. Rotational latency time

19. Which level of RAID refers to disk mirroring with block striping?
    - **A. RAID level 1**
    - B. RAID level 2
    - C. RAID level 0
    - D. RAID level 3

20. With multiple disks, we can improve the transfer rate as well by using
    - **A. Striping**
    - B. Dividing
    - C. Mirroring
    - D. Merging

21. Which one of the following is a Stripping technique?
    - A. Byte level stripping
    - **B. Raid level stripping**
    - C. Disk level stripping
    - D. Block level stripping

22. With multiple disks, we can improve the transfer rate as well by
   A. Mirroring
   B. Stripping
   C. Shadowing
   D. Dividing

23. Which of the following is/are disadvantages of traditional file systems?
   A. Data redundancy and inconsistency
   B. Data isolation
   C. Difficult to access data
   D. All the above

24. Which of the file organization, a fixed format is used for records where all records are of the same length, consisting of the same number of fixed length fields in a particular order?
   A. heap
   B. sequential
   C. indexed sequential
   D. indexed

25. Which of the following is the basic element of data where individual field contains a single value, such as an employees last name, a data or the value of the sensor reading?
   A. field
   B. record
   C. file
   D. database

<div align="center">

Long Questions (4 marks)

(Questions for Understanding)

</div>

1. Find the reasons for variable length records? What types of separator characters are needed for each?

- The file records are of same record type but one or more fields may be of varying size.
- The file records are of same record type but, one or more fields may have multiple value for the same field for individual records. Such fields are called repeating fields.
- A file may contain same record type but the fields may be optional.
- A file may contain records of different record types and hence of varying size.

(a)

(b)

(c)

Three record storage formats. (a) A fixed-length record with six fields and size of 71 bytes. (b) A record with two variable-length fields and three fixed-length fields. (c) A variable-field record with three types of separator characters.
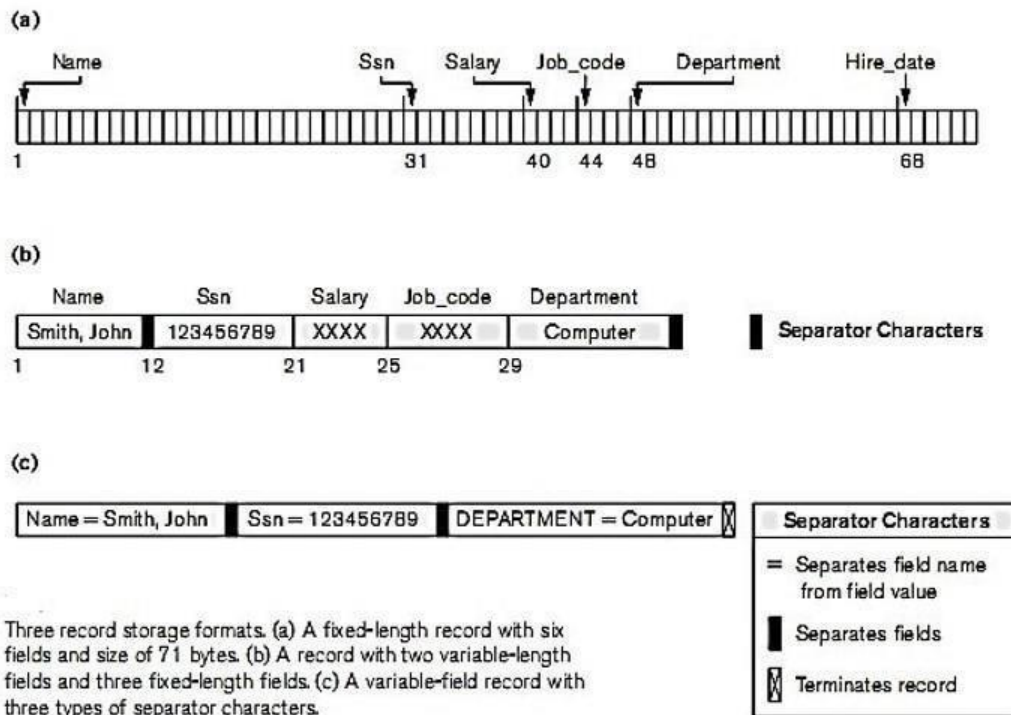
2. Debate on sorted files. Find the advantages of such a file over unordered files?

The records of a file can be physically ordered based on the values of one of their fields called the ordering fields. If the ordering field is also a key field, then it will have a unique value in each record. Such a field is called ordering key of the file. These files are known as ordered sequential file

Advantages over unordered files:-

1. Reading the records in the ordering of the key values becomes efficient because no sorting is required.
2. Finding a record in the ordering of the key field requires no additional block access.
3. A search condition based on the value of the ordering key results in faster access.

3. Find out any four different operations that can be performed on a file.

- Open – prepares the file for either reading or writing.
- Reset – sets the file pointer of an open file to the beginning of a file.
- Find/Locate – searches the first record that satisfies the search condition. Transfers the block containing that record into main memory buffer.
- Read/Get – copies the current record from buffer to program variable in the user program.
- FindNext – searches for the next record in the file that satisfies the search condition.
- Delete – deletes the current record and updates the file on the disk to reflect deletion.
- Modify – modifies the field values for current record and updates the file on the disk.
- Insert – inserts a new record in the file by locating the block where the record is to be inserted.
- Close – completes file access by releasing the buffers.

4. Debate on hash file organization with reference to disk files.

Hashing for disk files is called external hash files. To suit the characteristics of disk storage, the target address is made up of buckets, each of which holds multiple records. A bucket is either one disk block or a cluster of contiguous blocks. The hash function maps a key into a relative bucket number, rather than assign an absolute block address to a bucket. A table maintained in the file header converts the bucket number into the corresponding disk block address.
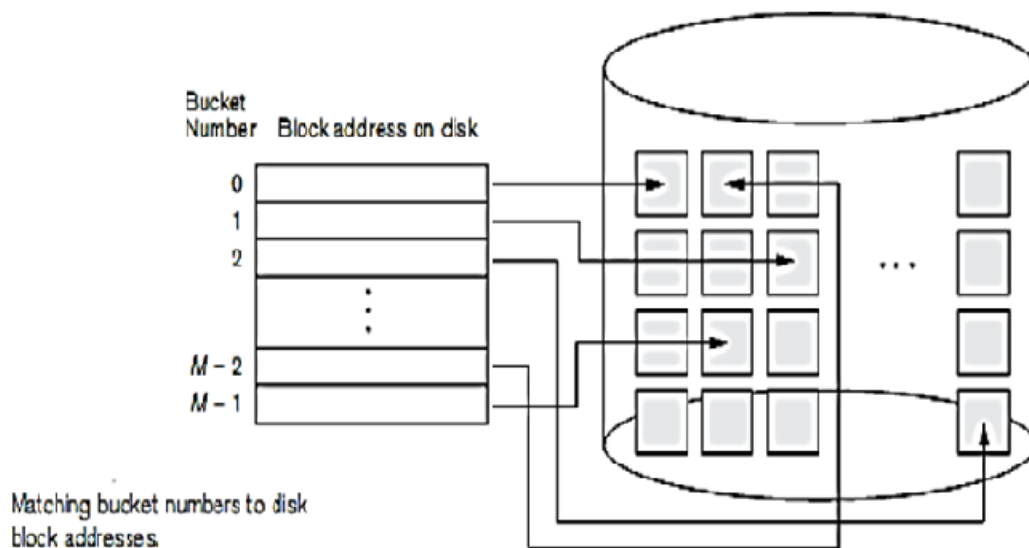
5. Debate on mirroring in RAID technology.

RAID stands for Redundant Array of Independent Disks. The main goal of RAID is to improve the performance of disks like disk access time and disk capacities. Here the large arrays of small disks act as a single higher performance disk. A concept called data stripping is used, which utilizes parallelism to improve disk performance. One technique for introducing redundancy is mirroring /shadowing. Data is written redundantly on two identical physical disks that are treated as one logical disk. When data is read, it can be retrieved from the disk with shorter seek time and rotational delay. If the disk fails another one is used until it is repaired. To incorporate redundancy, we must consider two problems.
1. Selecting a technique for computing redundant information.
2. Selecting methods of distributing redundant information across disk array.

The first problem can be solved by using error correcting codes involving parity bits or hamming codes. The second problem can be solved by storing redundant information on small number of disks or to distribute it uniformly across all disks.

Data stripping can be applied at finer levels of granularity by breaking a byte of data into bits and spreading the bits across disks. This concept is called bit-level data stripping that consists of splitting a byte of data and writing bit j to the jth disk. Even blocks of a file can be stripped across disks. This concept is called block-level stripping.

6. Debate on the concept of internal hashing.

Hashing is typically implemented as a hash table through the use of array of records. Suppose the array index range is from 0 to M-1. We then have M slots whose addresses correspond to array indexes. We choose a hash function that transforms the hash field value into an integer between 0 and M-1. One most commonly used hash function is h(K)=K mod M which returns a remainder of an integer hash field value K after division by M. This value is used for record address. One technique called folding involves applying an arithmetic function such as addition or a logical function such as exclusive OR to calculate hash address.

(a)

	Name	Ssn	Job	Salary
0				
1				
2				
3				
⋮				
M − 2				
M − 1				

Internal hashing data structures. (a) Array
of M positions for use in internal hashing.
(b) Collision resolution by chaining records.

	Data fields	Overflow pointer
(b) 0		−1
1		M
2		−1
3		−1
4		M + 2
⋮		
M − 2		M + 1
M − 1		−1
M		M + 5
M + 1		−1
M + 2		M + 4
⋮		
M + 0 − 2		
M + 0 − 1		

Address space

Overflow space

• null pointer = −1
• overflow pointer refers to position of next record in linked list

7. Debate on primary indexing with an example.

A primary index on an ordered file whose records are of fixed length with two fields. The first field is of the same data type as the ordering key field – called the primary key of the data file and the second field is the pointer to the disk block. There is one index entry in the index file for each block in the data file. Each index entry has the value of the primary key field for the first record in a block and a pointer to that block as its two fields. The total number of entries in the index is equal to the number of disk blocks in the ordered data file. The first record in each block of the data file is called the anchor record of the block or block anchor.

8. Debate on clustering indexing with an example.

If the records of a file are physically ordered on a non-key field – which do not have a distinct value for each record – that record is called the clustering field. We can create an index called clustering index, to speed up the retrieval of records that have the same value for clustering field. A clustering index is also an ordered file with two fields: the first is of the same type as the clustering field of the data file and the second field is a block pointer. There is one entry in the clustering index for each distinct value of the clustering field, containing the value and a pointer to the first block in the data file that has a record as a with that value as its clustering field. A clustering index is another example for a nondense index; because it has an entry for every distinct value of the indexing filed which is a non key by definition and hence duplicate values rather than for every record in the file.

Data file

(Clustering field)

Dept_number	Name	Ssn	Job	Birth_date	Salary
1					
1					
1					
2					

2					
3					
3					
3					

3					
3					
4					
4					

5					
5					
5					
5					

6					
6					
8					
8					

8					
8					
8					
8					

Index file
(<K(i), P(i)> entries)

Clustering field value	Block pointer
1	●
2	●
3	●
4	●
5	●
6	●
8	●

A clustering index on the Dept_number ordering nonkey field of an EMPLOYEE file.
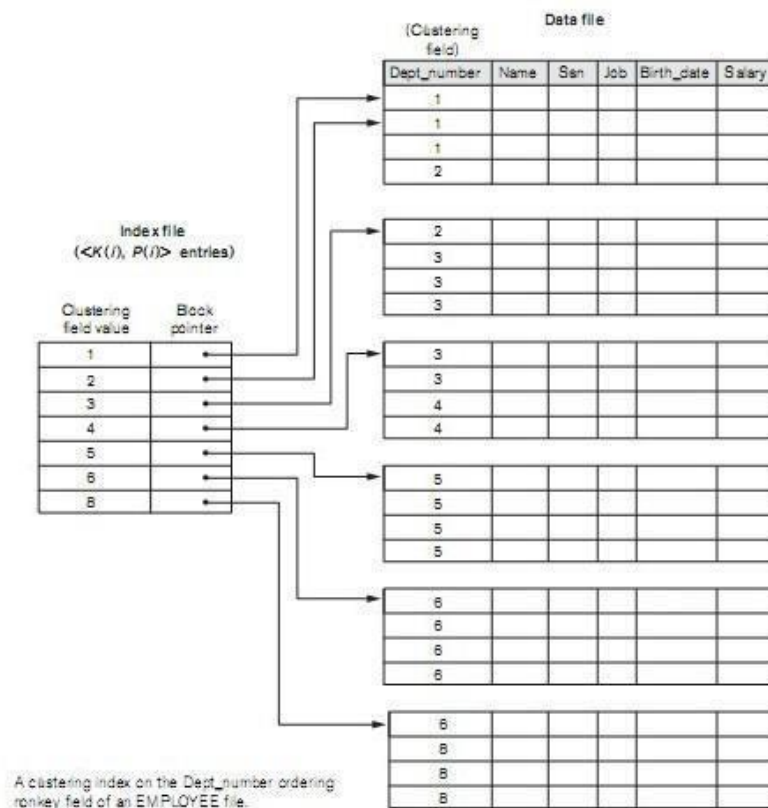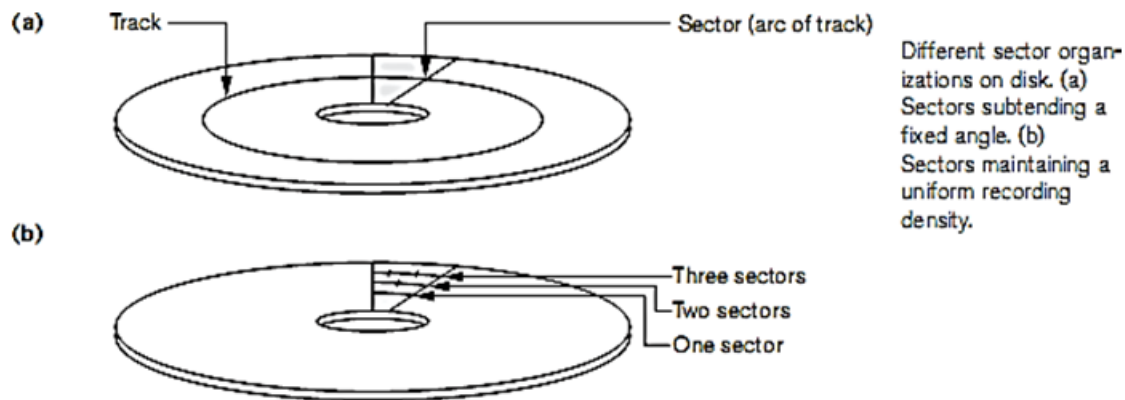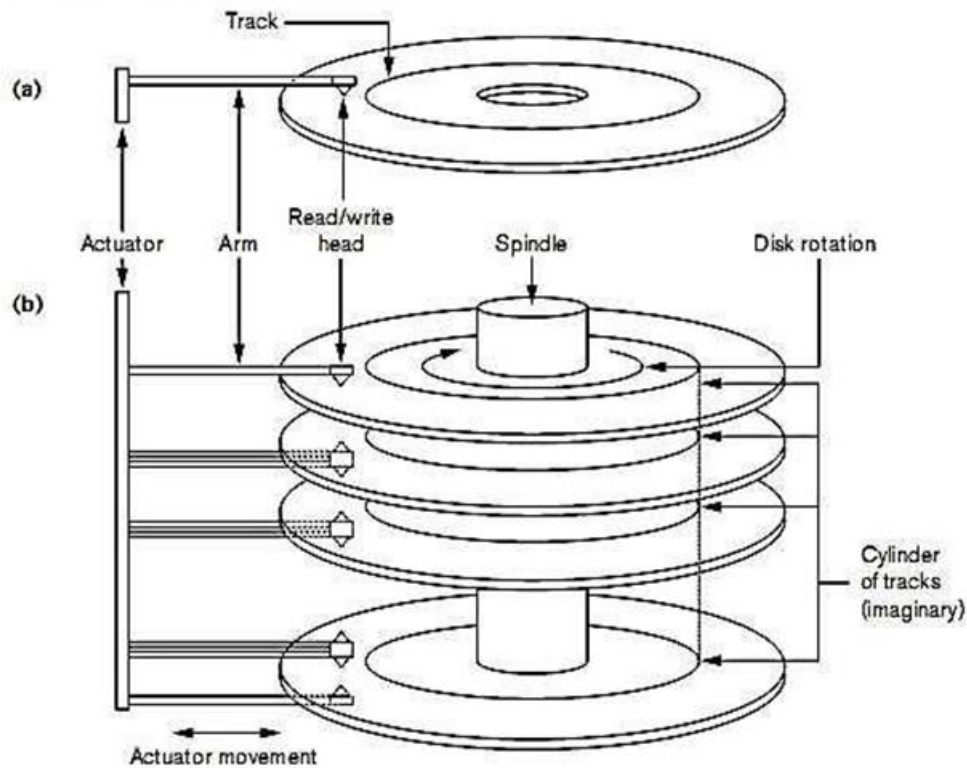
9. Write a brief outline on magnetic tape storage device?

Disks are random access storage devices because an arbitrary disk block may be accessed at random. Magnetic tapes are sequential access devices. i.e. to access the nth block on tape, we must first scan the preceding n-1 blocks. A tape drive is used to read data from or to write the data to a tape reel. A read/write head is used to read/write data onto tape. The main characteristic of tape is that data blocks can be accessed in sequential order. For this reason the access to data can be slow and hence are not used for online applications. Tapes are usually used for backing up the data base. One reason for backup is to keep the copies of disk files in case the data is lost because of disk crash.

10. What do you think is the function of disk controller in a magnetic disk?

Disks are all made up of magnetic material shaped as thin circular disks and protected by a plastic or acrylic cover. A disk is single sided if it can store information only on one surface and is double sided if information can be stored on both the surfaces. Information is stored on disk surfaces in concentric circles of small width, each having a distinct diameter. Each circle is called a track. For disk packs, the tracks with same diameter on various surfaces is called cylinder. Each track is divided into smaller blocks called sectors. The time required for the disk controller to mechanically position the read/write head on the correct track is called seek time. Rotational delay/rotational latency is the time required for the beginning of the desired block to rotate and position itself on the read/write head. Block transfer time is the time needed to transfer data to/from the buffer and the disk.

(a) A single-sided disk with read/write hardware.
(b) A disk pack with read/write hardware.

Track

(a)

Actuator   Arm   Read/write   Spindle   Disk rotation
                    head

(b)

Cylinder
of tracks
(imaginary)

Actuator movement

(a)   Track   Sector (arc of track)

Different sector organ-
izations on disk. (a)
Sectors subtending a
fixed angle. (b)
Sectors maintaining a
uniform recording
density.

(b)

Three sectors
Two sectors
One sector

11. How do you explain the concept of stripping in RAID technology?

RAID stands for Redundant Array of Independent Disks. The main goal of RAID is to improve the performance of disks like disk access time and disk capacities. Here the large arrays of small disks act as a single higher performance disk. A concept called data stripping is used, which utilizes parallelism to improve disk performance. Data stripping distributes data transparently over multiple disks to make them appear as a single large, fast disk. Stripping improves the overall I/O performance. It accomplishes load balancing among disks. Reliability can be improved by storing redundant information on disks. Data stripping distributes data transparently over multiple disks to make them appear as a single large, fast disk. Stripping improves the overall I/O performance. It accomplishes load balancing among disks. Reliability can be improved by storing redundant information on disks.

Data stripping can be applied at finer levels of granularity by breaking a byte of data into bits and spreading the bits across disks. This concept is called **bit-level data stripping** that consists of splitting a byte of data and writing bit j to the jth disk. Even blocks of a file can be stripped across disks. This concept is called **block-level stripping**.

Striping of data across multiple disks. (a) Bit-level striping across four disks. (b) Block-level striping across four disks.
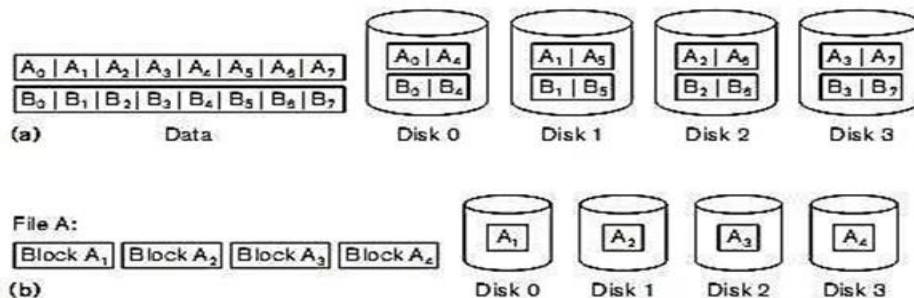
12. Illustrate the concept of double buffering? How does it improve data access?

The CPU can start processing a block once its transfer to the main memory is completed. At the same time disk I/O processor can be reading and transferring the next block into a different buffer. This technique can be used to write a continuous stream of blocks from memory to disk. It permits continuous reading/writing of blocks thus, eliminating seek time and rotational delay for all except for the first block transfer.

Use of two buffers, A and B, for reading from disk.
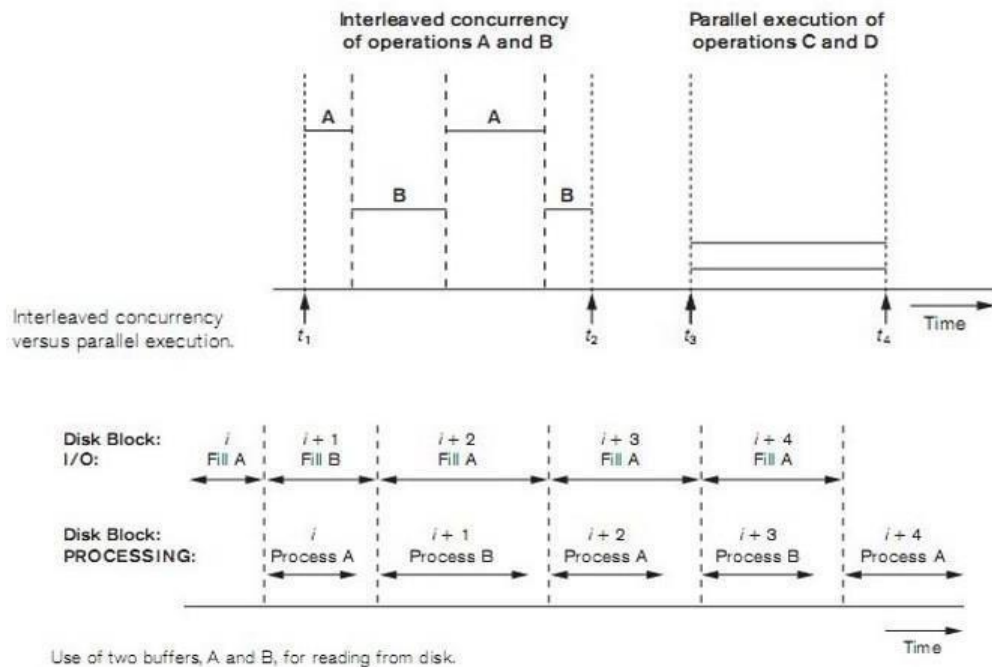
13. Write a brief outline on the concept of external hashing?

Hashing for disk files is called **external hash files**. To suit the characteristics of disk storage, the target address is made up of buckets, each of which holds multiple records. A bucket is either one disk block or a cluster of contiguous blocks. The hash function maps a key into a relative bucket number, rather than assign an absolute block address to a bucket. A table maintained in the file header converts the bucket number into the corresponding disk block address.

The collision problem is less severe in with buckets, because there are many records that can fit in a single bucket. But, in case a collision occurs, it is resolved using record pointers. The pointers in the linked list include both the block address and the relative record position within the block. When a fixed number of buckets are allocated, the hashing scheme is called **static hashing**.

Bucket
Number   Block address on disk

0
1
2
⋮
M − 2
M − 1

Matching bucket numbers to disk
block addresses.
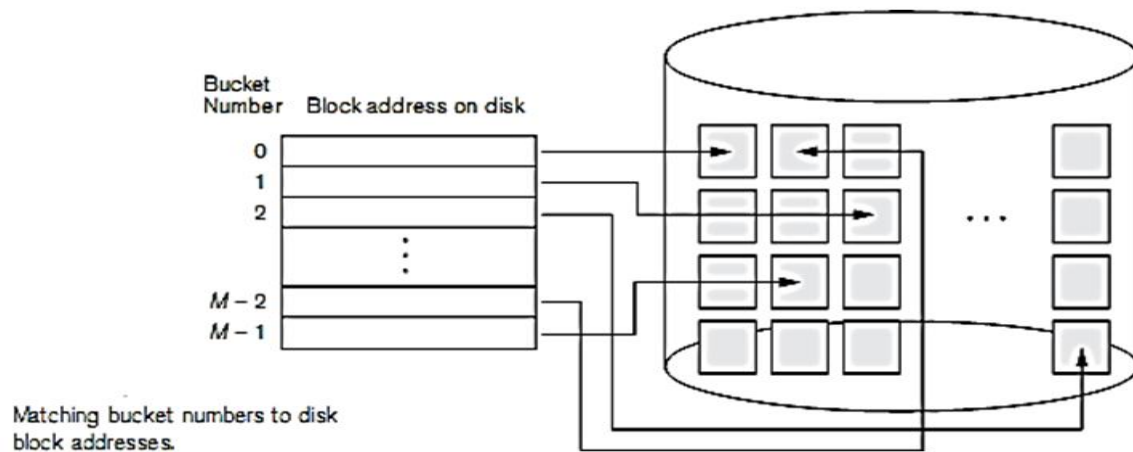
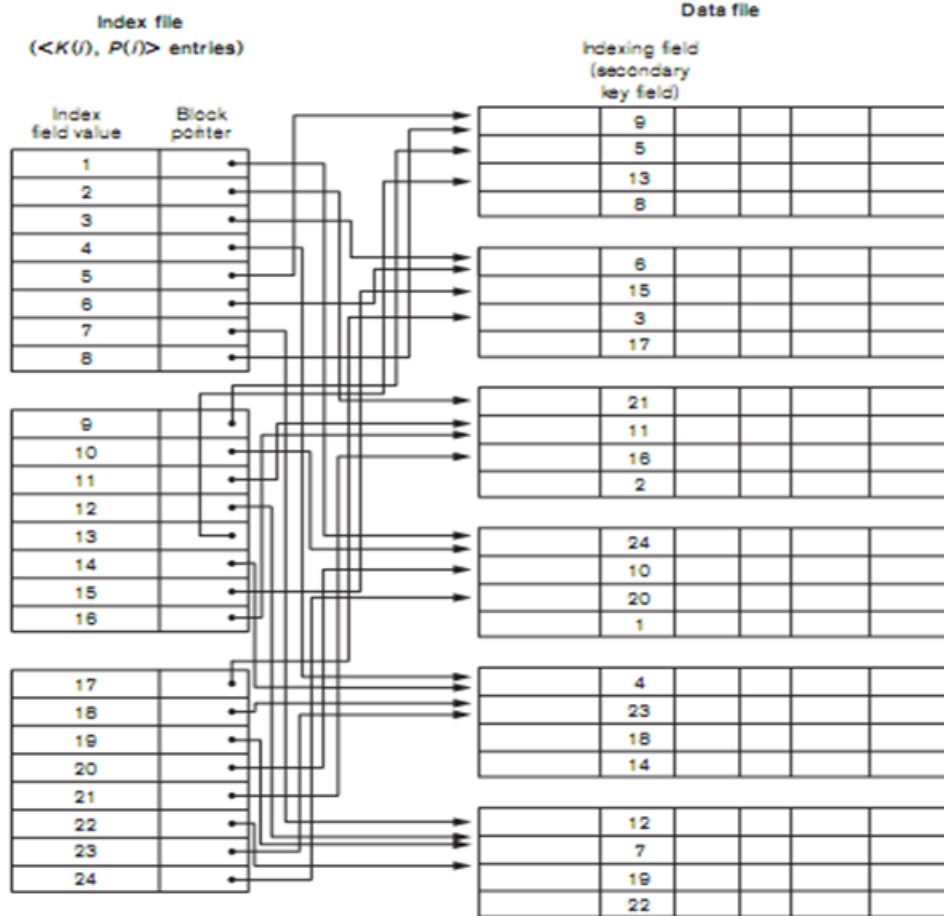### 14. How would you explain Heap (unordered) file organization? Mention the drawbacks.

The most basic type of organization where records are placed in a order in which they are inserted. New records are placed at the end of the file. Such files are known as heap files or pile files. It is used to collect and store records for future use. **Inserting** a new record is very efficient – the last disk block of file is copied into buffer ; the new record is added and the block is rewritten back to the disk. The address of the last file block is kept in the file header. **Searching** for a record using any search condition involves linear search through the file block by block. **Deleting** a record is also a slow process because we need to first locate the record to be deleted. The program first find the a block, copies the block into the buffer, then delete the record from the buffer and finally rewrite the block back to the disk. This results in wastage of storage space. Another technique is to have an extra bit/byte for each record called the **deletion marker**.

A record is deleted for a certain value in the deletion marker. A different value for the marker indicates that the record cannot be deleted. Both the above methods require periodic reorganization of the file to reclaim the unused space. This organization is also referred to as **sequential file organization**.

15. Explain secondary indexing with an example.

A secondary index provides a secondary means of accessing a file for which some primary access already exists. The secondary index may be on a field which is a candidate key and has a unique value in every record or a non-key with duplicate values. The index is an ordered file with two fields. The first field is of the same data type as the non-ordering field of the data file called the indexing field. The second is either a block pointer or a record pointer. There can be many secondary indexes on the same file. When the secondary index access structure on a key field has distinct value for every record is also referred to as secondary key.

A dense secondary index (with block pointers) on a nonordering key field of a file.

Index file
(<$K(i)$, $P(i)$> entries)

Data file

Indexing field
(secondary
key field)

Index field value	Block pointer
1	•
2	•
3	•
4	•
5	•
6	•
7	•
8	•

Index field value	Block pointer
9	•
10	•
11	•
12	•
13	•
14	•
15	•
16	•

Index field value	Block pointer
17	•
18	•
19	•
20	•
21	•
22	•
23	•
24	•

9				
5				
13				
8				

6				
15				
3				
17				

21				
11				
16				
2				

24				
10				
20				
1				

4				
23				
18				
14				

12				
7				
19				
22				

1. Analyze the use of Create statement
   - **A. describe the layout of a table**
   - B. extract rows from a table
   - C. modify the contents of a table
   - D. delete rows in a table

2. Can you tell which of the following in SQL are used to sort therows?
   - A. select statement
   - B. avg function
   - **C. order by clause**
   - D. group by clause

3. Can you tell which of the following built-in SQL function counts the number of rows satisfying the where clause?
   - A. Min
   - B. Max
   - C. Avg
   - **D. Count**

4. Identify the SQL statement is used to make changes to the existing data
   - **A. update**
   - B. alter
   - C. append
   - D. drop

5. Identify the SQL command to extract a vertical subset of in a relation
   - A. select
   - **B. project**
   - C. join
   - D. insert

6. What is the acronym for DDL
   - **A. Data definition language**
   - B. Data description language
   - C. Data descriptive language
   - D. Definition data language

7. Can you tell me, on executing DELETE command, if you get an error "foreign key constraint"- what does it imply?
   - A. Foreign key not defined
   - B. Table is empty
   - C. Connectivity issue
   - **D. Data is present in the other table**

8. Identify the command that contains a set of SQL statements for operating on data
    A. DDL
    B.**DML**
    C. DCL
    D. TCL

9. Can you tell the acronym of SQL
    A. Simple query language
    B. Simple querying language
    C. **Structured Query Language**
    D. Structured querying language

10. Which operator in SQL is used to join two or more conditions and displays a row that satisfies all the conditions?
    A. **And operator**
    B. Or operator
    C. Not operator
    D. Equal Operator

11. Can you tell how much storage space does DATETIME data type in MySQL require?
    A. 4 bytes
    B. 2 bytes
    C. **8 bytes**
    D. 1 byte

12. What is the maximum length of the char columns in MySQL is
    A. **255 bytes**
    B. 65, 535 bytes
    C. 256 bytes
    D. None of the mentioned

13. What is the default format for "Date" data type in MySQL?
    A. **YYYY-MM-DD**
    B. MM-YYYY-DD
    C. DD-MM-YYYY
    D. DD-MON-YYYY

(Questions for skills)

14. Can you tell, what will be the output of a query given below?

    SELECT person_id, Fname, lname FROM person;

    A. **Show only columns (person_id, Fname, lname) and rows related to these columns**
    B. Show only columns (person_id, Fname, lname)
    C. Show all rows
    D. Show all columns except (person_id, Fname, lname)

15. Identify the clause is used to determine "which column to include in the query sets"?
    A. **SELECT**
    B. FROM

C. WHERE

D. ORDER BY

16. Identify the clause is used to "Filters out unwanted data"?

A. FROM

B. <u>WHERE</u>

C. SELECT

D. ORDER BY

17. Can you tell, which of the following command is used to "Modify the existing field of the table"?

A. <u>ALTER</u>

B. FROM

C. SELECT

D. MODIFY

18. Can you tell, which among the following is not a "query clause"?

A. <u>WHERE</u>

B. MODIFY

C. ALTER

D. FROM

19. Identify the command used to execute the structured query language

A. DCL

B.<u>DDL</u>

C. DML

D. None of the mentioned

20. Do you know, which among the following tags belong to Data definition language?

A. SELECT

B. FROM

C. WHERE

D. <u>All of the mentioned</u>

21. Do you know, which among the following tags belong to Data Manipulation language?

A. <u>UPDATE</u>

B. ALTER

C. MODIFY

D. All of the mentioned

22. Can you tell, which are the two languages used in Mysql?

A. <u>DML/DDL</u>

B. DDL/DCL

C. DML/DDM

D. None of the mentioned

23. Identify the keyword used for sorting the data in descending order in Mysql?

A. <u>DESC</u>

B. ASC

C. ALTER

D. MODIFY

24. Can you tell which among the following operators is/are belongs to "Equality conditions"?

    A. <>

    B. !=

    C. ≡

    D. >/<

25. Can you tell which clause is used to "filter out unwanted Groups"?

    A.**HAVING**

    B. FROM

    C. WHERE

    D. SELECT

<div align="center">

Long Questions (4 marks)

(Questions for Applications)

</div>

1. Explain CREATE statement in MySQL with example?

The CREATE TABLE statement is used to create a new table in the database. Tables are defined in part by the columns they contain. Each column has a specific data type which specifies how data is stored in the column. When creating a new table, you must decide on the appropriate data type of the column. These data types are then specified in the CREATE TABLE Statement.

Syntax:

a. The general format of CREATE command is

CREATE TABLE tablename (column1 data type(size),
column2 data type(size),
column3 datatype(size),
.
.
column-n data type(size)
);

b. We can create a table from another table in SQL.
The syntax is as follows

CREATE TABLE<new table> (<column 1>, <column 2>)
AS SELECT <column 1>, <column 2> FROM <existing table>;

a. Create a table called student that contains roll number, name and marks in three subjects mysql>
use jahnavi; Database changed
mysql> create table student
-> (rollnoint(2),
-> name varchar(15),
-> m1 int(2),
-> m2 int(2),
-> m3 int(2)
);
Query OK, 0 rows affected (0.14 sec)

2. Explain ALTER statement in MySQL with example?

The structure of a table can be modified by using the ALTER TABLE command. ALTER TABLE allows the user to change the structure of the existing table

- Add or delete the columns
- Create or destroy indexes
- Change the data type of existing columns
- Rename columns or table itself

ALTER TABLE works by making a temporary copy of the original table.

Syntax:

a. Adding new columns
   ALTER TABLE <table name>
   ADD(<new column><data type>(size),
                    :
   <new column><data type>(size));

b. Modifying existing columns
   ALTER TABLE <table name>
   MODIFY(<column><new datatype>(new-size));

Example:

a. Add a new column Total with data type number and size
2. mysql> alter table student
 ->add (total number (2)
);
 Query OK, 3 rows affected (0.17 sec)
Records: 3 Duplicates: 0 Warnings: 0

mysql> select * from student;
```
+--------+--------+------+-----+-------+
| rollno | name | m1 | m2 | m3 | total  |
+--------+--------+-----+-----+-------+
| 1      | Rama | 89 | 70 |  75  NULL |
| 2      | Bheem| 80 | 70 |65 | NULL  |
| 3      | Shyam | 60 | 57 | 55| NULL  |
+--------+--------+-----+-----+---+-------+
```
3 rows in set (0.00 sec)

3. Explain UPDATE statement in MySQL with example?

The UPDATE command is used to change or modify data values in a table. The UPDATE verb in MYSQL is used to either update all the rows or selected rows in a table. The UPDATE statement updates columns in the existing table's rows with new values. The WHERE clause, if given, specifies which rows should be updated. Otherwise all the rows areupdated.

Syntax:

a. UPDATE <Table name>
SET <column1>=<expression>,

.
.
<column n>=<expression>;

b. UPDATE<Table name>
SET <column1>=<expression>,
.
.
<column n>=<expression>;
WHERE<condition>;

Example:

a. Increment the marks of all students by 10 in subject2
mysql> update student set m2=m2+10;
Query OK, 3 rows affected (0.03 sec)
Rows matched: 3 Changed: 3 Warnings: 0

b. Update the total of all the students
mysql> update student
 -> set total=m1+m2+m3;
Query OK, 3 rows affected (0.03 sec)
Rows matched: 3 Changed: 3 Warnings: 0

mysql> select * from student;
```
+--------+-------+----+----+----+-------+
| rollno |name| m1 | m2 | m3 | total |
+--------+-------+----+----+----+-------+
|   1    | Rama | 89 | 70 | 75 | 234 |
|   2    | Bheem| 80 | 70 | 65 | 215 |
|   3    | Shyam | 60 | 57 | 55 | 172 |
+--------+-------+----+----+--------+-------+
3 rows in set (0.00 sec)
```

4. Explain DELETE statement in MySQL with example?

The DELETE command is used to delete rows from a table that satisfies the condition and returns the number of records that were deleted. If the DELETE command is executed without a WHERE clause then, all rows are deleted.

Syntax:

a. DELETE FROM<table name> WHERE<condition>;
b. DELETE FROM<table name>;

Example:

a. Remove the all details of student named Raja.
mysql> delete from student wherename='Raja';
query ok. 1 row affected.

b.Delete all records.
mysql> delete from student;
query ok. 3 row affected.

5. Distinguish between GROUP BY and ORDER BY clause with examples?

The GROUP BY clause tells Oracle to group rows based on distinct values that exists from specified columns. The group by clause creates a data set containing several sets of records grouped together based on a condition.

Syntax:

SELECT <column 1><column 2>……<column n>,
AGGREGATE FUNCTION (Expression)
FROM table name WHERE <condition>
GROUP BY <column 1><column 2>……<column n>;
HAVING <aggregate condition>;

Example:

a. Display the number of students in each course.
mysql> select course, count(*) "Numberof Students" from studentgroup by course;
 COURSE Number of Students

 ----
bca 2
bbm 2
mca 2
Query OK, 3 rows affected

b. Display the maximum total from each course mysql> select course, max(total) from student group by course;

COURSE   MAX(TOTAL)
----
bca 235
bbm   210
mca 165
Query OK, 3 rows affected

The **ORDER BY** clause is used in a SELECT statement to sort results either in ascending or descending order. Oracle sorts query results in ascending order by default.

Syntax:

 SELECT column-list
 FROM table_name [WHERE condition]
 [ORDER BY column1 [, column2, ..columnN] [DESC]];

Example:

a. Display the student details in ascending order of marks. mysql> select * from student order by total;

+..........+.............+_____+_____+____-+_____+
| rollno|name | m1 | m2 | m3 | total|
+_____+_____+____+_____+_____+_____+
| 3 | Shyam | 60 | 57 | 55 | 172 |

```
| 2   | Bheem | 80 | 70 | 65 | 215 |
| 1   | Rama  | 89 | 70 | 75 | 234 |
+.........+............+......+.......+......+.......+_____+
```
3 rows in set (0.00 sec)

b. Display the student names and marks in subject 1 in descending order mysql> select name,m1 from student order by m1 desc;

```
+............+_____+
| name | m1 |
+............+_____+
| Rama | 89 |
| Bheem| 80 |
| Shyam | 60 |
+............+_____+
```
 3 rows in set (0.00 sec)

6. What do you think is a correlated sub query? Give example.

A correlated subquery is one where a subquery references a column from a table in the parent query. A correlated subquery is evaluated once for each row of the parent statement, which can be any of the SELECT, UPDATE or DELETE.

Example:

Consider the information in the following tables.
MYSQL> select * from employ;

EMPNO	ENAME	SAL	DEPTNO
E001	Raja	6000	D002
E002	Rani	7000	D00
E003	Jaya	5000	D002
E004	Ranbir	8000	D002
E005	Rajni	4000	D002
E006	Sita	5500	D002

MYSQL> select * from depart;

DNO	DNAME	LOC
D001	accounts	Chennai
D002	research	Mumbai
D003	HRD	bangalore
D004	EDP	hyderabad
D005	Inventory	Goa

4 rows affected

a. Display the names of employees who are working in Chennai
MYSQL> select ename from employ
 -> where deptno in (select dno from depart where loc='chennai');

ENAME

 Rani
 Ranbir
2 rows affected

b. Display the location where Sita is working
MYSQL> select loc from depart
2 where dno=(select deptno from employ where ename='Sita');

LOC

 Bangalore

7. What do you see as the use of pattern matching using % and _ in the LIKE clause?

The LIKE operator is used to list all rows in a table whose column values match a specified pattern. It is useful when you want to search rows to match a specific pattern, or when you do not know the entire value.

Example:

a. List the names of students whose name begins with 'S'.
mysql> select name from student where name like 'S%'

NAME

Sriram
Sita
Shyam
3 rows in set (0.00 sec)

b. List the name and roll number of students whose name ends with 'a'.
mysql> select rollno,name from student where name like '%a';
ROLLNO NAME

-------------- ---------------
   14   Gita
   16   Sita
2 rows in set (0.00 sec)

c. List the names of students who have 'i' as the second letter in their name.
mysql> select name from student where name like '_i%';
 NAME

  Gita
  Sita
2 rows in set (0.00 sec)

d. List the course whose name ends with the letter 'm'.
mysql>select course from student where course like '%m'

COURSE
----
bbm
bbm
2 rows in set (0.00 sec)

(Questions for Skills)

8. Find any four data types that a table in MYSQL can hold?

TYPE	SIZE	DESCRIPTION
CHAR[Length]	Length bytes	A fixed-length field from 0 to 255 characters long.
VARCHAR(Length)	String length + 1 bytes	A fixed-length field from 0 to 255 characters long.
INT[Length]	4 bytes	Range of -2,147,483,648 to 2,147,483,647 or 0 to 4,294,967,295 unsigned.
FLOAT	4 bytes	A small number with a floating decimal point
DOUBLE[Length , Decimals]	8 bytes	A large number with a floating decimal point

9. **Debate on various forms of SELECT statement in MYSQL with example**?

The SELECT command is used to retrieve rows from one or more table.

Syntax:

  a. To select all rows and all columns SELECT * FROM <table name>;
  b. To retrieve selected columns and all rows SELECT column1, column2 FROM<table name>;
  c. To retrieve selected columns and all rows SELECT column1, column2 FROM
  d. <table name >WHERE<condition>;
  e. To retrieve selected columns and selected rows SELECT column1, column2 FROM<table name>WHERE <condition>;

Example:

a. Display the details of all the students

mysql> select * from student;

```
+-------+-------+----+----+----+
| rollno | name  | m1 | m2 | m3 |
+-------+-------+----+----+----+
|   1   | Rama  | 89 | 70 | 75 |
|   2   | Bheem | 80 | 70 | 65 |
|   3   | Shyam | 60 | 57 | 55 |
+-------+-------+----+----+----+
3 rows in set (0.00 sec)
```

b. Display the roll number and names of all the students

mysql> select rollno,name from student;

```
+-------+-------+
| rollno | name  |
+-------+-------+
|   1   | Rama  |
|   2   | Bheem |
|   3   | Shyam |
```

```
+..........+.............+
3 rows in set (0.00 sec)
```

c. Display the details of students who got more than 75 in subject 1

mysql> select * from student -> where m1>75;

```
+..........+.............+_____+_____+_____+
|rollno |   name | m1 | m2 | m3 |
+..........+.............+-_____+_____+_____+
|   1   |Rama  |  89 | 70 |  75  |
|   2   |Bheem |  80 | 70 |  65  |
+..........+.............+......+_____+_____+
 2 rows in set (0.01 sec)
```

10. **Find any four aggregate functions in MYSQL?**

An aggregate function performs a calculation on multiple values and returns a single value.

1) COUNT

- The COUNT function returns the total number of values in the specified field.
- Returns the number of rows in a table.
- It works on both numeric and non-numeric data types.

2) SUM

- SUM function which returns the sum of all the values in the specified column.

3) AVG

- Returns the average of the values in a column.

4) MIN

- Returns the minimum value in a given column.

5) MAX

- Returns the maximum value in a given column.

Examples:

AVG – Returns the average of the values in a column
E.g. Display the average total of all the students
mysql> select avg(total) as "Average" from student;

Average

171.666667

MAX – Returns the maximum value in a given column
E.g. Display the maximum total from student table
mysql> select max(total) as "Maximum Total" from student;

Maximum Total

      235

MIN – Returns the minimum value in a given column

E.g. Display the minimum total from student table
mysql> select min(total) as "Minimum Total" from student;

Minimum Total

    100

COUNT – Returns the number of rows in a table
E.g. Display the number of students in student table mysql> select count(*) from student;
COUNT(*)

    6

 SUM – Returns the sum of values in a given column
E.g. Display the sum total of marks in subject1 from student table
mysql> select sum(m1) as "Marks in Subject1" from student;
Marks in Subject1

      295

11. Debate on range searching and pattern matching predicates with examples?

In order to select data that is within a range of values, the BETWEEN operator is used. The BETWEEN operator allows the selection of rows that contain values within a specified lower and upper limit. The two values in between the range must be linked with a keyword AND. The BETWEEN operator can be used with both character and numeric data types.

 Example:

A . List the details of students whose total is in the range 180 and 250. mysql> select * from student where total between 180 and 250

ROLLNO	NAME	M1	M2	M3	TOTAL	COURSE
12	Sriram	70	90	75	235	bca
17	Shyam	80	60	70	210	bbm

2 rows in set (0.00 sec)

Pattern Matching
LIKE Operator : The LIKE operator is used to list all rows in a table whose column values match a specified pattern. It is useful when you want to search rows to match a specific pattern, or when you do not know the entire value. For this purpose we use a the following wildcard character• % allows to match any string of any length
• _ allows to match on a single character.

 Example:

a. List the names of students whose name begins with 'S'.
mysql> select name from student where name like 'S%'
            NAME

            Sriram
          Sita
          Shyam
        3 rows in set (0.00 sec)

b. List the name and roll number of students whose name ends with 'a'.
mysql> select rollno,name from student where name like '%a';

```
ROLLNO    NAME
   14        Gita
   16        Sita
2 rows in set (0.00 sec)
```

c. List the names of students who have 'i' as the second letter in their name.
mysql> select name from student where name like '_i%';
```
    NAME
----------------------
    Gita
    Sita
```

12. Find any four built in string functions in MYSQL withexamples.

Function Name	Return Value	Examples
LOWER (string_value)	All the letters in 'string_value' is converted to lowercase.	mysql> select lower('Srinivas'); LOWER ('S srinivas
UPPER (string_value)	All the letters in 'string_value' is converted to uppercase.	mysql> select upper('Srinivas'); UPPER ('S SRINIVAS
LTRIM (string_value, trim_text)	All occurrences of 'trim_text' is removed from the left of 'string_value'.	mysql> select ltrim('nivas','ni'); LTR vas
RTRIM (string_value, trim_text)	All occurrences of 'trim_text' is removed from the right of 'string_value'.	MYSQL>select rtrim('srinivas','nivas'); RTRI sri

13. Find any four built in numeric functions in MYSQL withexamples.

Function Name	Return Value	Examples
ABS (x)	Absolute value of the number 'x'	mysql> select abs (-26); ABS (-26) 26
CEIL (x)	Integer value that is Greater than or equal to the number 'x'	mysql> select ceil (34.6);CEIL (34.6) 35
FLOOR (x)	Integer value that is Less than or equal to the number 'x'	mysql> select floor (34.6);FLOOR (34.6) 34
TRUNC (x, y)	Truncates value of number 'x' up to 'y' decimal places	mysql> select trunc(38.546,2) ; TRUNC (38.546,2) 38.54

14. Debate on the purpose of GRANT command with anexample.

The grant statement provides various types of access to database objects.

Syntax:

GRANT<privileges> ON <object name> TO <user name>;

Privileges:

It can be any of the following values:

Privilege	Description
SELECT	Ability to perform SELECT statements on the table.
INSERT	Ability to perform INSERT statements on the table.
UPDATE	Ability to perform UPDATE statements on the table.
DELETE	Ability to perform DELETE statements on the table.
INDEX	Ability to create an index on an existing table.
CREATE	Ability to perform CREATE TABLE statements.
ALTER	Ability to perform ALTER TABLE statements to change the table definition.
DROP	Ability to perform DROP TABLE statements.
GRANT OPTION	Allows you to grant the privileges that you possess to other users.
ALL	Grants all permissions except GRANT OPTION.

Object:

The name of the database objects that you are granting permissions for. In the case of granting privileges on a table, this would be the table name.

User:

The name of the user that will be granted these privileges.

Example:

Granting EXECUTE privileges on a function in MySQL.: If there is a function named "CalculateSalary" and you want to grant EXECUTE access to the user named Amit, then the following GRANT statement should be executed.

GRANT EXECUTE ON FUNCTION Calculatesalary TO 'Amit'@localhost';

15. Debate on sub query with an example.

A subquery is a form of MYSQL statement that appears inside another MYSQL statement. It is also called a nested query. The statement containing the subquery is called parent query. The parent statement uses the result set returned by the subquery. It can be used for,

· Inserting records in the target table
· Create and insert records in a table
· Update records in targettable
· To provide values for conditions in the WHERE, HAVING, IN clause used with SELECT, UPDATE and DELETEcommands.

The concept of using a subquery in the FROM clause of the SELECT statement is called

inline view.

Example:

Consider the information in the following tables.

MYSQL> select * from employ;

EMPNO	ENAME	SAL	DEPTNO
E001	Raja	6000	D002
E002	Rani	7000	D001
E003	Jaya	5000	D003
E004	Ranbir	8000	D001
E005	Rajni	4000	D004
E006	Sita	5500	D003

6 rows affected.

MYSQL> select * from depart;

DNO	DNAME	LOC
D001	accounts	Chennai
D002	research	Mumbai
D003	HRD	bangalore
D004	EDP	hyderabad
D005	Inventory	Goa

4 rows affected

a. Display the names of employees who are working in Chennai.
MYSQL> select ename fromemploy
-> where deptno in (select dno from depart where loc='chennai');

ENAME

Rani
Ranbir
2 rows affected