



SAMSKRUTI COLLEGE OF ENGINEERING & TECHNOLOGY

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Course Hand Out

Subject Name: DATABASE MANAGEMENT SYSTEM

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UNIT -I

KEY POINTS:

Introduction

A DBMS (Database management system) is used to create and maintain the structure of a database, and then to enter, manipulate and retrieve the data it stores. Creating an efficient database design is the key to effectively using a database to support an organization's business operations(1).

A database management system (DBMS) is a computer software that manages databases, it may use any of a variety of database models, such as the hierarchical DBMS, network DBMS and relational DBMS . In large systems, a DBMS allows users and other software to store and retrieve data in a structured way.

Data is nothing but facts and statistics stored or free flowing over a network, generally it's raw and unprocessed.

Data becomes information when it is processed, turning it into something meaningful.

Example: Name, age, weight, height, video, voice etc.

A Database is a collection of related data organised in a way that data can be easily accessed, managed and updated. Database can be software based or hardware based, with one sole purpose, storing data.

Larry Ellison, the co-founder of Oracle was amongst the first few, who realised the need for a software based Database Management System.

A DBMS is a software that allows creation, definition and manipulation of database, allowing users to store, process and analyse data easily. DBMS provides us with an interface or a tool, to perform various operations like creating database, storing data in it, updating data, creating tables in the database and a lot more.

DBMS also provides protection and security to the databases. It also maintains data consistency in case of multiple users.

Here are some examples of popular DBMS used these days:

MySql Oracle SQL Server IBM DB2 PostgreSQL Amazon SimpleDB (cloud based) etc.

History

1960's-1970's: The emergence of the first type of DBMS, the hierarchical DBMS. **IBM** had the first model, developed on IBM 360 and their (DBMS) was called IMS, originally it was written for the Apollo program. This type of DBMS was based on binary trees, where the shape was like a tree and relations were only limited between parent and child records. The benefits were numerous; less redundant data, data independence, security and integrity, which all lead to efficient searches. Nonetheless; there were some disadvantages such as; complex implementation, was hard to manage because of the absence of standards, which made it harder to handle many relationships.

1960's-1970's: The emergence of the network DBMS. **Charles Bachmann** developed first DBMS at Honeywell, Integrated Data Store (IDS) then a group called CODASYL who is responsible for the creation of COBOL, had that system standardized. However; the CODASYL group invented what they call the "**CODASYL APPROACH**". Based on that approach many systems using network DBMS were developed for business use. In this model, each record can have multiple parents in comparison with one in the hierarchical DBMS. It is made of sets of relationships where a set represents a one to many relationship between the owner and the member. The main and unfortunate disadvantage was that the System was complex and there was difficulty in design and maintenance, it is believed that the Lack of structural independence was the main cause.

1970's- 1990's: The emergence of the relational DBMS on the hands of **Edgar Codd**. He worked at IBM, and he was unhappy with the navigational model of the CODASYL APPROACH. To him, a tool for searching, such as a search facility was very useful, and it was absent. In 1970, he proposed a new approach to database construction, which made the creation of a Relational DBMS intended for Large Shared Data Banks, possible and easy to grab. Moreover; This was a new system for entering data and working with big databases, where the idea was to use a table of records. All tables will be then linked by either one to one relationships, one to many, or many to many. when elements took space and were not useful, it was easy to remove them from the original table, and all the other "entries" in other tables linked to this record were removed. Worth mentioning, is that two initial projects were launched, the **R** program at IBM, and **INGRES** program at the university of California. In 1985, the object oriented DBMS was developed, but it did not have any booming commercial profit because of the high unjustified costs to change systems, and format. In 1990, the DBMS took on a new

object oriented approach joint with relational DBMS . In this approach, text, multimedia, internet and web use in conjunction with DBMS were available and possible.

Past and present

In the early years of computing, a **punch card** was used in unit record machines for input, data storage and processing this data. Data was entered offline and for both data, and computer programs input. This input method is similar to voting machines nowadays. This was the only method, where it was fast to enter data, and retrieve it, but not to manipulate or edit it.

After that era, there was the introduction of the file type entries for data, then the DBMS as hierarchical, network, and relational.

File systems Vs DBMS:

The typical file processing system is supported by the operating systems. Files are created and manipulated by writing programs so the permanent records are stored in various files. Before the advent of DBMS, organizations typically stored the information using such systems.

Ex: Using COBOL we can maintain several files (collection of records) to access those files we have to go through the application programs which have written for creating files, updating file, inserting the records

The problems in file processing system are

- Data redundancy and consistency
- Difficulty in accessing data
- Data isolation
- Integrity problems
- Atomicity problems
- Security problems

To solve the above problems DBMS has been invented.

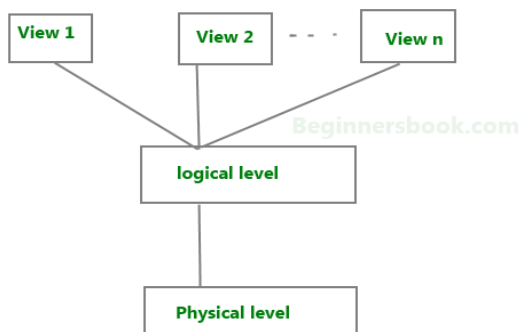
Data Model is a logical structure of Database. It describes the design of database to reflect entities, attributes, relationship among data, constrains etc.

Data models define how the logical structure of a database is modeled. Data Models are fundamental entities to introduce abstraction in a DBMS. Data models define how data is connected to each other and how they are processed and stored inside the system.

The very first data model could be flat data-models, where all the data used are to be kept in the same plane. Earlier data models were not so scientific, hence they were prone to introduce lots of duplication and update anomalies.

Levels of data abstraction

There are mainly three levels of data abstraction: Internal Level: Actual PHYSICAL storage structure and access paths. Conceptual or Logical Level: Structure and constraints for the entire database. External or View level: Describes various user views



Three Levels of data abstraction

Entity-Relationship Model

Entity-Relationship (ER) Model is based on the notion of real-world entities and relationships among them. While formulating real-world scenario into the database model, the ER Model creates entity set, relationship set, general attributes, and constraints.

ER Model is best used for the conceptual design of a database.

ER Model is based on:

Entities and their attributes.

Relationships among entities.

Entity

An entity in an ER Model is a real-world entity having properties called attributes. Every attribute is defined by its set of values called domain.

For example, in a school database, a student is considered as an entity. Student has various attributes like name, age, class, etc.

Relational Model

The most popular data model in DBMS is the Relational Model. It is more scientific a model than others. This model is based on first-order predicate logic and defines a table as an n-ary relation.

The main highlights of this model are:

Data is stored in tables called relations.

Relations can be normalized.

In normalized relations, values saved are atomic values.

Each row in a relation contains a unique value.

Database Design is a collection of processes that facilitate the designing, development, implementation and maintenance of enterprise data management systems. Properly designed database are easy to maintain, improves data consistency and are cost effective in terms of disk storage space. The database designer decides how the data elements correlate and what data must be stored.

Two Types of Database Techniques

Normalization

ER Modeling

Database Design and ER Diagrams

An **Entity–relationship model (ER model)** describes the structure of a database with the help of a diagram, which is known as **Entity Relationship Diagram (ER Diagram)**. An ER model is a design or blueprint of a database that can later be implemented as a database. The main components of E-R model are: entity set and relationship set.

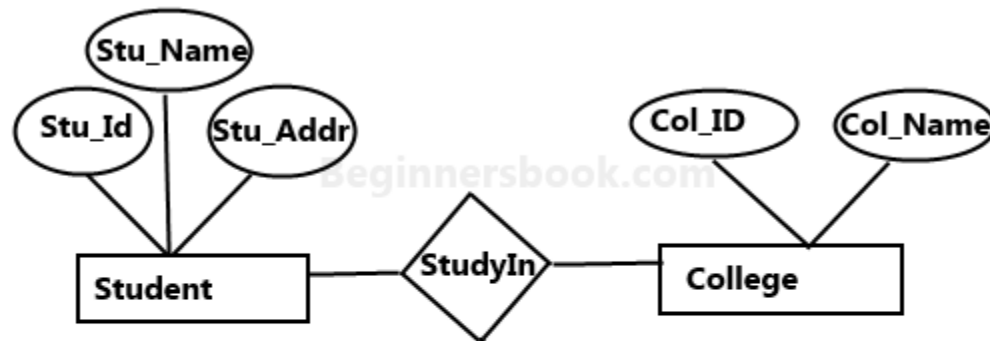
What is an Entity Relationship Diagram (ER Diagram)?

An ER diagram shows the relationship among entity sets. An entity set is a group of similar entities and these entities can have attributes. In terms of DBMS, an entity is a table or attribute of a table in database, so by showing relationship among tables and their attributes, ER diagram shows the complete logical structure of a database. Let's have a look at a simple ER diagram to understand this concept.

A simple ER Diagram:

In the following diagram we have two entities Student and College and their relationship. The relationship between Student and College is many to one as a college can have many students however a student cannot study in multiple colleges at the same time. Student entity has attributes such as Stu_Id, Stu_Name

Stu_Addr and College entity has attributes such as Col_ID & Col_Name.



Sample E-R Diagram

Here are the geometric shapes and their meaning in an E-R Diagram. We will discuss these terms in detail in the next section(Components of a ER Diagram) of this guide so don't worry too much about these terms now, just go through them once.

UNIT -II

Introduction to the Relational Model

Relational data model is the primary data model, which is used widely around the world for data storage and processing. This model is simple and it has all the properties and capabilities required to process data with storage efficiency.

Concepts

Tables – In relational data model, relations are saved in the format of Tables. This format stores the relation among entities. A table has rows and columns, where rows represents records and columns represent the attributes.

Tuple – A single row of a table, which contains a single record for that relation is called a tuple.

Relation instance – A finite set of tuples in the relational database system represents relation instance. Relation instances do not have duplicate tuples.

Relation schema – A relation schema describes the relation name (table name), attributes, and their names.

Relation key – Each row has one or more attributes, known as relation key, which can identify the row in the relation (table) uniquely.

Attribute domain – Every attribute has some pre-defined value scope, known as attribute domain.

Constraints

Every relation has some conditions that must hold for it to be a valid relation. These conditions are called **Relational Integrity Constraints**. There are three main integrity constraints –

- Key constraints
- Domain constraints
- Referential integrity constraints

Key Constraints

There must be at least one minimal subset of attributes in the relation, which can identify a tuple uniquely. This minimal subset of attributes is called **key** for that relation. If there are more than one such minimal subsets, these are called *candidate keys*.

Key constraints force that –

- in a relation with a key attribute, no two tuples can have identical values for key attributes.
- a key attribute can not have NULL values.

Key constraints are also referred to as Entity Constraints.

Domain Constraints

Attributes have specific values in real-world scenario. For example, age can only be a positive integer. The same constraints have been tried to employ on the attributes of a relation. Every attribute is bound to have a specific range of values. For example, age cannot be less than zero and telephone numbers cannot contain a digit outside 0-9.

Referential integrity Constraints

Referential integrity constraints work on the concept of Foreign Keys. A foreign key is a key attribute of a relation that can be referred in other relation.

Referential integrity constraint states that if a relation refers to a key attribute of a different or same relation, then that key element must exist.

Best Practices for creating a Relational Model

- Data need to be represented as a collection of relations
- Each relation should be depicted clearly in the table
- Rows should contain data about instances of an entity
- Columns must contain data about attributes of the entity
- Cells of the table should hold a single value
- Each column should be given a unique name
- No two rows can be identical
- The values of an attribute should be from the same domain

Advantages of using Relational model

- **Simplicity:** A relational data model is simpler than the hierarchical and network model.
- **Structural Independence:** The relational database is only concerned with data and not with a structure. This can improve the performance of the model.

- **Easy to use:** The relational model is easy as tables consisting of rows and columns is quite natural and simple to understand
- **Query capability:** It makes possible for a high-level query language like SQL to avoid complex database navigation.
- **Data independence:** The structure of a database can be changed without having to change any application.
- **Scalable:** Regarding a number of records, or rows, and the number of fields, a database should be enlarged to enhance its usability.

Disadvantages of using Relational model

- Few relational databases have limits on field lengths which can't be exceeded.
- Relational databases can sometimes become complex as the amount of data grows, and the relations between pieces of data become more complicated.
- Complex relational database systems may lead to isolated databases where the information cannot be shared from one system to another.

Summary

- The Relational database model represents the database as a collection of relations (tables)
- Attribute, Tables, Tuple, Relation Schema, Degree, Cardinality, Column, Relation instance, are some important components of Relational Model
- Relational Integrity constraints are referred to conditions which must be present for a valid relation
- Domain constraints can be violated if an attribute value is not appearing in the corresponding domain or it is not of the appropriate data type
- Insert, Select, Modify and Delete are operations performed in Relational Model

- The relational database is only concerned with data and not with a structure which can improve the performance of the model
- Advantages of relational model is simplicity, structural independence, ease of use, query capability, data independence, scalability.
- Few relational databases have limits on field lengths which can't be exceeded.

Relational Algebra

Relational algebra is a procedural query language, which takes instances of relations as input and yields instances of relations as output. It uses operators to perform queries. An operator can be either **unary** or **binary**. They accept relations as their input and yield relations as their output. Relational algebra is performed recursively on a relation and intermediate results are also considered relations.

The fundamental operations of relational algebra are as follows –

- Select
- Project
- Union
- Set different
- Cartesian product
- Rename

We will discuss all these operations in the following sections.

Select Operation (σ)

It selects tuples that satisfy the given predicate from a relation.

Notation – $\sigma_p(r)$

Where σ stands for selection predicate and r stands for relation. p is propositional logic formula which may use connectors like **and**, **or**, and **not**. These terms may use relational operators like $=$, \neq , \geq , $<$, $>$, \leq .

For example –

$\sigma_{\text{subject} = \text{"database"}}(\text{Books})$

Output – Selects tuples from books where subject is 'database'.

$\sigma_{\text{subject} = \text{"database"} \text{ and } \text{price} = \text{"450"}}(\text{Books})$

Output – Selects tuples from books where subject is 'database' and 'price' is 450.

$\sigma_{\text{subject} = \text{"database"} \text{ and } \text{price} = \text{"450"} \text{ or } \text{year} > \text{"2010"}}(\text{Books})$

Output – Selects tuples from books where subject is 'database' and 'price' is 450 or those books published after 2010.

Project Operation (Π)

It projects column(s) that satisfy a given predicate.

Notation – $\Pi_{A_1, A_2, A_n}(r)$

Where A_1, A_2, A_n are attribute names of relation r .

Duplicate rows are automatically eliminated, as relation is a set.

For example –

$\Pi_{\text{subject, author}}(\text{Books})$

Selects and projects columns named as subject and author from the relation Books.

Union Operation (\cup)

It performs binary union between two given relations and is defined as –

$r \cup s = \{ t \mid t \in r \text{ or } t \in s \}$

Notation – $r \cup s$

Where **r** and **s** are either database relations or relation result set (temporary relation).

For a union operation to be valid, the following conditions must hold –

- **r**, and **s** must have the same number of attributes.
- Attribute domains must be compatible.
- Duplicate tuples are automatically eliminated.

$\Pi_{\text{author}}(\text{Books}) \cup \Pi_{\text{author}}(\text{Articles})$

Output – Projects the names of the authors who have either written a book or an article or both.

Set Difference ($-$)

The result of set difference operation is tuples, which are present in one relation but are not in the second relation.

Notation – $r - s$

Finds all the tuples that are present in **r** but not in **s**.

$\Pi_{\text{author}}(\text{Books}) - \Pi_{\text{author}}(\text{Articles})$

Output – Provides the name of authors who have written books but not articles.

Cartesian Product (\times)

Combines information of two different relations into one.

Notation – $r \times s$

Where **r** and **s** are relations and their output will be defined as –

$r \times s = \{ q \ t \mid q \in r \text{ and } t \in s \}$

$\sigma_{\text{author} = \text{tutorialspoint}}(\text{Books} \times \text{Articles})$

Output – Yields a relation, which shows all the books and articles written by tutorialspoint.

Rename Operation (ρ)

The results of relational algebra are also relations but without any name. The rename operation allows us to rename the output relation. 'rename' operation is denoted with small Greek letter **rho** ρ .

Notation – $\rho_x(E)$

Where the result of expression **E** is saved with name of **x**.

Additional operations are –

- Set intersection
- Assignment
- Natural join

Relational Calculus

In contrast to Relational Algebra, Relational Calculus is a non-procedural query language, that is, it tells what to do but never explains how to do it.

Relational calculus exists in two forms –

Tuple Relational Calculus (TRC)

Filtering variable ranges over tuples

Notation – $\{T \mid \text{Condition}\}$

Returns all tuples T that satisfies a condition.

For example –

$\{ T.name \mid \text{Author}(T) \text{ AND } T.article = 'database' \}$

Output – Returns tuples with 'name' from Author who has written article on 'database'.

TRC can be quantified. We can use Existential (\exists) and Universal Quantifiers (\forall).

For example –

$\{ R \mid \exists T \in \text{Authors}(T.\text{article}='database' \text{ AND } R.\text{name}=T.\text{name}) \}$

Output – The above query will yield the same result as the previous one.

Domain Relational Calculus (DRC)

In DRC, the filtering variable uses the domain of attributes instead of entire tuple values (as done in TRC, mentioned above).

Notation –

$\{ a_1, a_2, a_3, \dots, a_n \mid P(a_1, a_2, a_3, \dots, a_n) \}$

Where a_1, a_2 are attributes and **P** stands for formulae built by inner attributes.

For example –

$\{ \langle \text{article}, \text{page}, \text{subject} \rangle \mid \in \text{TutorialsPoint} \wedge \text{subject} = 'database' \}$

Output – Yields Article, Page, and Subject from the relation TutorialsPoint, where subject is database.

Just like TRC, DRC can also be written using existential and universal quantifiers. DRC also involves relational operators.

The expression power of Tuple Relation Calculus and Domain Relation Calculus is equivalent to Relational Algebra.

ASSIGNMENT QUESTIONS

Unit – 1	
2marks questions	
1	Define a Database and DBMS.
2	List the properties of ER Diagram.
3	What are instances and schemas?
4	Discuss about DDL.
5	What are the types of Database Users? Define the role of database administrator?
3marks questions	
1	Explain three levels of Abstraction.
2	Define Entities, Attributes, Entity Sets, Relationships & Relationship sets?
3	Write Short notes on altering tables and views.
4	What are Integrity Constraints?
5	Define a View? How it is different from table.
5 marks questions	
1	What is Data Model? What are different data models? Explain E-R model & relational model briefly.
2	Explain Database users, interfaces, DBA & functions of DBA.
3	Explain Relational Database Architecture.
4	Construct an E-R diagram for a online shopping system like Jabong /Flipkart(May 2015)
5	Explain Various Features of E-R Model.
Unit -2	
2 marks questions	
1	Explain integrity constraints over relations.
2	Discuss about outer join.

3	What are Set operations? Explain?
4	Define Selection and Projection in Relational Algebra?
5	Define TRC & DRC.
3marks questions	
1.	Create Employee, Dept Tables.
2	Write short notes on Join operations?
3	What are nested queries and correlated nested queries?
4	What is a Trigger? Explain the importance of using a trigger?
5	What are aggregative operations in SQL?
5 marks questions	
1.	What are Application Programs? Explain Database Access for Application Programs.
2.	What is Null Attribute? Explain About Strong & weak entities with examples.
3.	Explain Tuple Relational Calculus.
4	Explain Domain Relational Calculus.
5	How can we convert relationship sets with key constraints into tables? Explain.
Unit – 3	
2 marks questions	
1.	What is functional dependency?
2	Define second Normal Form.
3	What are redundancy problems in database?
4	What Normal Form? List different Normal Forms.
5	What is schema refinement?
3 marks	
1	Write about JOIN dependencies.

2	Describe 2NF with example.
3	Describe inclusion dependencies.
4	Describe 5NF with example.
5	Define BCNF with example.

5marks questions

1	What is functional dependency? Explain computing closures of F with suitable examples
2	Explain different Normal forms based on functional dependencies.
3	Write short notes on difference, union, rename, Cartesian product in relational algebra.
4	Explain about loss-less join decomposition?
5	Explain about dependency preserving decomposition.

Unit -4

2 marks questions

1	Define transaction. Write about transaction states.
2	What is meant by remote backup system?
3	List properties of transaction?
4	Define serializability.
5	Define timestamp.

3 marks questions

1.	What are ACID properties? Explain.
2	What are the concurrency control protocols?
3	Write short note on time stamped protocols?
4	Describe serializability with example.
5	Describe the recovery system in transaction management.

5 marks questions

1.	Explain ARIES in detail.
2.	How the lock manager implements lock and unlock request. Explain
3	What is meant by concurrency control?
4	What is log? What is log tail? Explain the concept of check point log record.
5	Discuss about failure with loss of nonvolatile storage.

Unit -5

2 marks

1.	What is an index? Give an example.
2	How to compute the disk access time?
3	Discuss about primary indexes.
4	Define indexed sequential access methods.
5	Define hash based indexing.

3 marks

1	What are advantages of tree structured indexes?
2	What is meant by Linear hashing?
3	Describe dynamic index structure.
4	Explain about hash file organization.
5	Describe tree based indexing

5 marks questions

1.	What is extendable hashing? How it is different from linear hashing.
2.	Explain log based recovery technique.
3	What are different RAID levels. Explain.
4	Discuss about cluster indexes, indexed sequential file access methods?
5	What is B+ Tree? Explain the insertion operation in B+ trees?

Database Management Systems

Unit Wise Question Bank

Unit-1

1. (a) Explain about File Processing System(Disadvantages of FPS)
(b) Explain advantages of DBMS over file systems.
2. Explain Database users, user interfaces, DBA & functions of DBA.
3. What are Application Programs? Explain Database Access for Application Programs
4. State & explain various features of E-R model.
5. Draw & explain Relational Database Architecture.
- 6 (a) Briefly explain the Database Design process.
(b) Define these terms: Entity, Entity set, Attribute, Key.
- 7 (a) What is null attribute? Explain weak & strong entities with suitable examples.
- 8 (a) Construct an ER diagram for a bank Database.

Unit – 2

1. Explain in detail about properties of relational Algebra.
2. How to convert relationship sets with key constraints into tables? Explain.
3. List & explain various relational algebra operations with examples.
4. How to translate E-R diagram with aggregation? Explain.
5. Explain Tuple relational calculus.
6. Explain Domain relational calculus.
7. What is Nested Query? Explain about correlated queries with examples.
8. Describe about outer joins with suitable examples.
9. Explain about integrity constraints.

10. Explain about a) Triggers b) Assertions c) Active databases

Unit 3

1. Explain first, second and third normal forms with suitable examples.

2. Write a short note on schema refinement.

3. Explain closures of a set of FD's and attribute closures.

4. Explain functional dependency with an example?

5. Compare Third NF and BCNF, explain with examples?

6. Explain about inclusion dependencies.

7. What is decomposition? What are the problems caused by decomposition

8. What is redundancy? What are the problems caused by redundancy?

Unit 4

1. What is schedule? Explain about serial & non serial schedules.

2. Define serializability. Explain types of serializability.

3. What is meant by concurrency control?

4. What is Thomas write rule?

5. Explain advanced recovery Techniques?

6. Explain shadow-copy technique for Atomicity and Durability?

7. Explain cascade less schedule with example.

8. What are Different RAID levels? Explain.

Unit 5

1. What is the need of indexing? Explain primary and secondary indexing.

2. How the concurrency control is done in B+ trees? Explain.

3. Explain about indexed sequential access method (ISAM).

4. Compare linear hashing & extendible hashing.

5 (a) How the Data is stored in External Storage?

(b) Explain file organization & indexing?

Database Management Systems [Objective Questions]

UNIT – 1

1. An _____ is a set of entities of the same type that share the same properties, or attributes .

a) Entity set b) Attribute set c) Relation set d) Entity model

2. Entity is a

a) Object of relation b) Present working model c) Thing in real world d) Model of relation

3. The descriptive property possessed by each entity set is _____ .

a) Entity b) Attribute c) Relation d) Model

4. The function that an entity plays in a relationship is called that entity's _____.

a) Participation b) Position c) Role d) Instance

5. 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) Multi valued attribute d) Derived attribute

6. The attribute AGE is calculated from DATE_OF_BIRTH . The attribute AGE is

a) Single valued b) Multi valued c) Composite d) Derived

7. Not applicable condition can be represented in relation entry as

a) NA b) 0 c) NULL d) Blank Space

8. Which of the following can be a multi valued attribute ?

a) Phone_number b) Name c) Date_of_birth d) All of the mentioned

9. Which of the following is a single valued attribute

a) Register_number b) Address c) SUBJECT_TAKEN d) Reference

10. In a relation between the entities the type and condition of the relation should be specified . That is called as _____ attribute

a) Descriptive b) Derived c) Recursive d) Relative

11. Which of the following gives a logical structure of the database graphically ?
a) Entity-relationship diagram b) Entity diagram c) Database diagram d) Architectural representation
12. The entity relationship set is represented in E-R diagram as
a) Double diamonds b) Undivided rectangles c) Dashed lines d) Diamond
13. The Rectangles divided into two parts represents
a) Entity set b) Relationship set c) Attributes of a relationship set d) Primary key
14. Consider a directed line(->) from the relationship set advisor to both entity sets instructor and student. This indicates _____ cardinality
a) One to many b) One to one c) Many to many d) Many to one
15. We indicate roles in E-R diagrams by labeling the lines that connect _____ to _____.
a) Diamond , diamond b) Rectangle, diamond c) Rectangle, rectangle
d) Diamond, rectangle
16. An entity set that does not have sufficient attributes to form a primary key is termed a _____.
a) Strong entity set b) Variant set c) Weak entity set d) Variable set
17. For a weak entity set to be meaningful, it must be associated with another entity set, called the
a) Identifying set b) Owner set c) Neighbour set d) Strong entity set
18. Weak entity set is represented as
a) Underline b) Double line c) Double diamond d) Double rectangle
19. If you were collecting and storing information about your music collection, an album would be considered a(n) _____.
a) Relation b) Entity c) Instance d) Attribute
20. What term is used to refer to a specific record in your music database; for instance; information stored about a specific album?

a) Relation b) Instance c) Table c) Column

21. _____, express the number of entities to which another entity can be associated via a relationship set.

- a) Mapping Cardinality b) Relational Cardinality c) Participation Constraints
- d) None of the mentioned

22. An entity in A is associated with at most one entity in B, and an entity in B is associated with at most one entity in A. This is called as

- a) One-to-many b) One-to-one c) Many-to-many d) Many-to-one

23. An entity in A is associated with at most one entity in B. An entity in B, however, can be associated with any number (zero or more) of entities in A.

- a) One-to-many b) One-to-one c) Many-to-many d) Many-to-one

24. Data integrity constraints are used to:

- a) Control who is allowed access to the data b) Ensure that duplicate records are not entered into the table c) Improve the quality of data entered for a specific property
- d) Prevent users from changing the values stored in the table

25. Establishing limits on allowable property values, and specifying a set of acceptable, predefined options that can be assigned to a property are examples of:

- a) Attributes b) Data integrity constraints c) Method constraints d) Referential integrity constraints

26. Which of the following can be addressed by enforcing a referential integrity constraint?

- a) All phone numbers must include the area code b) Certain fields are required (such as the email address, or phone number) before the record is accepted
- c) Information on the customer must be known before anything can be sold to that customer
- d) Then entering an order quantity, the user must input a number and not some text (i.e., 12 rather than 'a dozen')

27. _____ is a special type of integrity constraint that relates two relations & maintains consistency across the relations.

- a) Entity Integrity Constraints b) Referential Integrity Constraints
- c) Domain Integrity Constraints d) Domain Constraints

28. Which one of the following uniquely identifies the elements in the relation?

- a) Secondary Key b) Primary key c) Foreign key d) Composite key

29. Drop Table cannot be used to drop a table referenced by a _____ constraint.

- a) Local Key b) Primary Key c) Composite Key d) Foreign Key

30. _____ is preferred method for enforcing data integrity

- a) Constraints b) Stored Procedure c) Triggers d) Cursors

31. Which one of the following is a set of one or more attributes taken collectively to uniquely identify a record?

- a) Candidate key b) Sub key c) Super key d) Foreign key

32. Consider attributes ID , CITY and NAME . Which one of this can be considered as a super key ?

- a) NAME b) ID c) CITY d) CITY , ID

33. The subset of super key is a candidate key under what condition ?

- a) No proper subset is a super key b) All subsets are super keys
c) Subset is a super key d) Each subset is a super key

34. A _____ is a property of the entire relation, rather than of the individual tuples in which each tuple is unique.

- a) Rows b) Key c) Attribute d) Fields

35. Which one of the following attribute can be taken as a primary key ?

- a) Name b) Street c) Id d) Department

36. Which one of the following cannot be taken as a primary key ?

- a) Id b) Register number c) Dept_id d) Street

37. A attribute in a relation is a foreign key if the _____ key from one relation is used as an attribute in that relation .

- a) Candidate b) Primary c) Super d) Sub

38. The relation with the attribute which is the primary key is referenced in another relation. The relation which has the attribute as primary key is called

- a) Referential relation b) Referencing relation c) Referenced relation d) Referred relation

39. The _____ is the one in which the primary key of one relation is used as a normal attribute in another relation .

- a) Referential relation b) Referencing relation c) Referenced relation

d) Referred relation

40. A _____ integrity constraint requires that the values appearing in specified attributes of any tuple in the referencing relation also appear in specified attributes of at least one tuple in the referenced relation.

- a) Referential b) Referencing c) Specific d) Primary

UNIT-2

1. Using which language can a user request information from a database ?

- a) Query b) Relational c) Structural d) Compiler

2. Student(ID, name, dept name, tot_cred)

In this query which attribute form the primary key?

- a) Name b) Dept c) Tot_cred d) ID

3. Which one of the following is a procedural language ?

- a) Domain relational calculus b) Tuple relational calculus c) Relational algebra

d) Query language

4. The_____ operation allows the combining of two relations by merging pairs of tuples, one from each relation, into a single tuple.

- a) Select b) Join c) Union d) Intersection

5. The result which operation contains all pairs of tuples from the two relations, regardless of whether their attribute values match.

- a) Join b) Cartesian product c) Intersection d) Set difference

6. The _____operation performs a set union of two “similarly structured” tables

- a) Union b) Join c) Product d) Intersect

7. The most commonly used operation in relational algebra for projecting a set of tuple from a relation is

- a) Join b) Projection c) Select d) Union

8. The _____ operator takes the results of two queries and returns only rows that appear in both result sets.

- a) Union b) Intersect c) Difference d) Projection

9. A _____ is a pictorial depiction of the schema of a database that shows the relations in the database, their attributes, and primary keys and foreign keys.

- a) Schema diagram b) Relational algebra c) Database diagram d) Schema flow

10. The _____ provides a set of operations that take one or more relations as input and

return a relation as an output.

a) Schematic representation b) Relational algebra c) Scheme diagram d) Relation flow

11. Using which language can a user request information from a database ?

a) Query b) Relational c) Structural d) Compiler

12. Student(ID, name, dept name, tot_cred)

In this query which attribute form the primary key?

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13. Which one of the following is a procedural language ?

a) Domain relational calculus b) Tuple relational calculus

c) Relational algebra d) Query language

14. The _____ operation allows the combining of two relations by merging pairs of tuples, one from each relation, into a single tuple.

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15. The result which operation contains all pairs of tuples from the two relations, regardless of whether their attribute values match.

a) Join b) Cartesian product c) Intersection d) Set difference

16. The _____ operation performs a set union of two “similarly structured” tables

a) Union b) Join c) Product d) Intersect

17. The most commonly used operation in relational algebra for projecting a set of tuple from a relation is

a) Join b) Projection c) Select d) Union

18. The _____ operator takes the results of two queries and returns only rows that appear in both result sets.

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19. A _____ is a pictorial depiction of the schema of a database that shows the relations in the database, their attributes, and primary keys and foreign keys.

a) Schema diagram b) Relational algebra c) Database diagram d) Schema flow

20. The _____ provides a set of operations that take one or more relations as input and return a relation as an output.

a) Schematic representation b) Relational algebra

c) Scheme diagram d) Relation flow

21. Relational Algebra is a _____ query language that takes two relation as input and produces another relation as output of the query.

a) Relational b) Structural c) Procedural d) Fundamental

22. Which of the following is a fundamental operation in relational algebra ?

a) Set intersection b) Natural join c) Assignment d) None of the mentioned

23. Which of the following is used to denote the selection operation in relational algebra ?

a) Pi (Greek) b) Sigma (Greek) c) Lambda (Greek) d) Omega (Greek)

24. For select operation the _____ appear in the subscript and the _____ argument appears in the paranthesis after the sigma.

a) Predicates, relation b) Relation, Predicates

c) Operation, Predicates d) Relation, Operation

25. The _____ operation, denoted by $-$, allows us to find tuples that are in one relation but are not in another.

- a) Union b) Set-difference c) Difference d) Intersection

26. Which is a unary operation:

- a) Selection operation b) Primitive operation c) Projection operation
d) Generalized selection

27. Which is a join condition contains an equality operator:

- a) Equijoins b) Cartesian c) Natural d) Left

28. In precedence of set operators the expression is evaluated from

- a) Left to left b) Left to right c) Right to left d) From user specification

29. Which of the following is not outer join ?

- a) Left outer join b) Right outer join c) Full outer join d) All of the mentioned

30. The assignment operator is denoted by

- a) \rightarrow b) \leftarrow c) $=$ d) $==$

31. Which one of the following is used to define the structure of the relation ,deleting relations and relating schemas ?

- a) DML(Data Manipulation Language) b) DDL(Data Definition Language)
c) Query d) Relational Schema

32. Which one of the following provides the ability to query information from the database and to insert tuples into, delete tuples from, and modify tuples in the database ?

- a) DML(Data Manipulation Language) b) DDL(Data Definition Language)
c) Query d) Relational Schema

33. Create table employee (name varchar ,id integer)

What type of statement is this ?

- a) DML b) DDL c) View d) Integrity constraint

34. Select * from employee

What type of statement is this?

- a) DML b) DDL c) View d) Integrity constraint

35. The basic data type char(n) is a _____ length character string and varchar(n) is _____ length character.

- a) Fixed, equal b) Equal, variable c) Fixed, variable d) Variable, equal

36. An attribute A of datatype varchar(20) has the value "Avi" . The attribute B of datatype char(20) has value "Reed" .Here attribute A has _____ spaces and attribute B has _____ spaces .

- a) 3, 20 b) 20, 4 c) 20 , 20 d) 3, 4

37. To remove a relation from an SQL database, we use the _____ command.

- a) Delete b) Purge c) Remove d) Drop table

38. Delete from r; r – relation

This command performs which of the following action ?

- a) Remove relation b) Clear relation entries c) Delete fields d) Delete rows

39. Insert into instructor values (10211, 'Smith', 'Biology', 66000);

What type of statement is this ?

- a) Query b) DML c) Relational d) DDL

40. Updates that violate _____ are disallowed .

a) Integrity constraints b) Transaction control c) Authorization d) DDL constraints

UNIT-3

1. Aggregate functions are functions that take a _____ as input and return a single value.

a) Collection of values b) Single value c) Aggregate value d) Both a & b

2. Select _____

from instructor

where dept name= 'Comp. Sci.';

Which of the following should be used to find the mean of the salary ?

a) Mean(salary) b) Avg(salary) c) Sum(salary) d) Count(salary)

3. Select count (____ ID)

from teaches

where semester = 'Spring' and year = 2010;

If we do want to eliminate duplicates, we use the keyword _____ in the aggregate expression.

a) Distinct b) Count c) Avg d) Primary key

4. All aggregate functions except _____ ignore null values in their input collection.

a) Count(attribute) b) Count(*) c) Avg d) Sum

5. A Boolean data type that can take values true, false, and _____ .

a) 1 b) 0 c) Null d) Unknown

6. The _____ connective tests for set membership, where the set is a collection of values produced by a select clause. The _____ connective tests for the absence of set membership.

a) Or, in b) Not in, in c) In, not in d) In, or

7. Which of the following should be used to find all the courses taught in the Fall 2009 semester but not in the Spring 2010 semester .

a) Select distinct course id from section

where semester = 'Fall' and year= 2009 and

course id not in (select course id

from section

where semester = 'Spring' and year= 2010);

b) Select distinct course_id

from instructor

where name not in ('Fall', 'Spring');

c) (Select course id

from section

where semester = 'Spring' and year= 2010)

d) Select count (distinct ID)

from takes

where (course id, sec id, semester, year) in (select course id, sec id, semester, year

from teaches

where teaches.ID= 10101);

8. The phrase "greater than at least one" is represented in SQL by _____.

a) < all b) < some c) > all d) > some

9. Which of the following is used to find all courses taught in both the Fall 2009 semester and in the Spring 2010 semester .

a) Select course id from section as S where semester = 'Fall' and year= 2009 and exists (select * from section as T where semester = 'Spring' and year= 2010 and S.course id= T.course id);

b) Select name from instructor where salary > some (select salary from instructor where dept name = 'Biology');

c) Select count (distinct ID) from takes where (course id, sec id, semester, year) in (select course id, sec id, semester, year from teaches where teaches.ID= 10101);

d) (Select course id from section where semester = 'Spring' and year= 2010)

10. We can test for the nonexistence of tuples in a subquery by using the _____ construct.

a) Not exist b) Not exists c) Exists d) Exist

11. Select dept_name, ID, avg (salary)

from instructor group by dept_name;

This statement is erroneous because

a) Avg(salary) should not be selected b) Dept_id should not be used in group by clause c) Misplaced group by clause d) Group by clause is not valid in this query

12. SQL applies predicates in the _____ clause after groups have been formed, so aggregate functions may be used.

a) Group by b) With c) Where d) Having

13. Aggregate functions can be used in the select list or the _____ clause of a select statement or subquery. They cannot be used in a _____ clause.

a) Where, having b) Having, where c) Group by, having d) Group by, where

14. The _____ keyword is used to access attributes of preceding tables or subqueries in the from clause.

a) In b) Lateral c) Having d) With

15. Which of the following creates temporary relation for the query on which it is defined ?

a) With b) From c) Where d) Select

16. With max_budget (value) as

(select max(budget)

from department)

select budget

from department, max_budget

where department.budget = max budget.value;

In the query given above which one of the following is a temporary relation ?

a) Budget b) Department c) Value d) Max_budget

17. Subqueries cannot:

a) Use group by or group functions b) Retrieve data from a table different from the one in the outer query c) Join tables d) Appear in select, update, delete, insert statements.

18. Which of the following is not a aggregate function ?

a) Avg b) Sum c) With d) Min

19. The EXISTS keyword will be true if:

a) Any row in the subquery meets the condition only.

b) All rows in the subquery fail the condition only.

c) Both of these two conditions are met.

d) Neither of these two conditions is met.

20. How can you find rows that do not match some specified condition?

a) EXISTS b) Double use of NOT EXISTS c) NOT EXISTS

d) None of the mentioned is correct.

21. Which of the following creates a virtual relation for storing the query ?

a) Function b) View c) Procedure d) None of the mentioned

22. Which of the following is the syntax for views where v is view name ?

a) Create view v as "query name"; b) Create "query expression" as view;

c) Create view v as "query expression"; d) Create view "query expression";

23. Select course_id

from physics_fall_2009

where building= 'Watson';

Here the tuples are selected from the view. Which one denotes the view.

a) Course_id b) Watson c) Building d) physics_fall_2009

24. Materialised views make sure that

a) View definition is kept stable b) View definition is kept up-to-date

c) View definition is verified for error d) View is deleted after specified time

25. Updating the value of the view

a) Will affect the relation from which it is defined b) Will not change the view definition

c) Will not affect the relation from which it is defined d) Cannot determine

26. SQL view is said to be updatable (that is, inserts, updates or deletes can be applied on the view) if which of the following conditions are satisfied by the query defining the view?

a) The from clause has only one database relation.

b) The query does not have a group by or having clause.

c) The select clause contains only attribute names of the relation, and does not have any expressions, aggregates, or distinct specification.

d) All of the mentioned

27. Which of the following is used at the end of the view to reject the tuples which do not satisfy the condition in where clause ?

a) With b) Check c) With check d) All of the mentioned

29. For the view Create view instructor_info as select ID, name, building from instructor, department where instructor.dept name= department.dept name;

If we insert tuple into the view as insert into instructor_info values ('69987', 'White', 'Taylor');

What will be the values of the other attributes in instructor and department relations?

a) Default value b) Null c) Error statement d) 0

30. Create view faculty as Select ID, name, dept name from instructor;

Find the error in this query .

a) Instructor b) Select c) View ...as d) None of the mentioned

31. In the _____ normal form, a composite attribute is converted to individual attributes.

A) First B) Second C) Third D) Fourth

32. A table on the many side of a one to many or many to many relationship must:

a) Be in Second Normal Form (2NF) b) Be in Third Normal Form (3NF)

c) Have a single attribute key d) Have a composite key

33. Tables in second normal form (2NF):

a) Eliminate all hidden dependencies

b) Eliminate the possibility of a insertion anomalies

c) Have a composite key d) Have all non key fields depend on the whole primary key

34. Which-one ofthe following statements about normal forms is FALSE?

a) BCNF is stricter than 3 NF

b) Lossless, dependency -preserving decomposition into 3 NF is always possible

c) Loss less, dependency – preserving decomposition into BCNF is always possible

d) Any relation with two attributes is BCNF

35. Functional Dependencies are the types of constraints that are based on_____

a) Key b) Key revisited c) Superset key d) None of these

36. Which is a bottom-up approach to database design that design by examining the relationship between attributes:

a) Functional dependency b) Database modeling c) Normalization d) Decomposition

37. Which forms simplifies and ensures that there is minimal data aggregates and repetitive groups:

a) 1NF b) 2NF c) 3NF d) All of the mentioned

38. Which forms has a relation that possesses data about an individual entity:

a) 2NF b) 3NF c) 4NF d) 5NF

39. Which forms are based on the concept of functional dependency:

a) 1NF b) 2NF c) 3NF d) 4NF

40. Empdt1(empcode, name, street, city, state,pincode).

For any pincode, there is only one city and state. Also, for given street, city and state, there is just one pincode. In normalization terms, empdt1 is a relation in

a) 1 NF only b) 2 NF and hence also in 1 NF c) 3NF and hence also in 2NF and 1NF

d) BCNF and hence also in 3NF, 2NF and 1NF

UNIT-4

1. Consider money is transferred from (1)account-A to account-B and (2) account-B to account-A. Which of the following form a transaction ?

- a) Only 1 b) Only 2 c) Both 1 and 2 individually d) Either 1 or 2
2. A transaction is delimited by statements (or function calls) of the form _____.
- a) Begin transaction and end transaction b) Start transaction and stop transaction
c) Get transaction and post transaction d) Read transaction and write transaction
3. Identify the characteristics of transactions
- a) Atomicity b) Durability c) Isolation d) All of the mentioned
4. Which of the following has “all-or-none” property ?
- a) Atomicity b) Durability c) Isolation d) All of the mentioned
5. The database system must take special actions to ensure that transactions operate properly without interference from concurrently executing database statements. This property is referred to as
- a) Atomicity b) Durability c) Isolation d) All of the mentioned
6. The property of transaction that persists all the crashes is
- a) Atomicity b) Durability c) Isolation d) All of the mentioned
7. _____ states that only valid data will be written to the database.
- a) Consistency b) Atomicity c) Durability d) Isolation
8. Transaction processing is associated with everything below except
- a) Producing detail summary or exception reports
b) Recording a business activity c) Confirming a action or triggering a response
d) Maintaining a data
9. The Oracle RDBMS uses the ____ statement to declare a new transaction start and its properties.
- a) BEGIN b) SET TRANSACTION c) BEGIN TRANSACTION d) COMMIT
10. ____ means that the data used during the execution of a transaction cannot be used by a second transaction until the first one is completed.
- a) Consistency b) Atomicity c) Durability d) Isolation
11. In SQL, which command is used to issue multiple CREATE TABLE, CREATE VIEW and GRANT statements in a single transaction?
- a) CREATE PACKAGE b) CREATE SCHEMA c) CREATE CLUSTER
d) All of the mentioned
12. In SQL, the CREATE TABLESPACE is used
- a) To create a place in the database for storage of scheme objects, rollback segments, and naming the data files to comprise the tablespace.
b) To create a database trigger. c) To add/rename data files, to change storage
d) All of the mentioned
13. Which character function can be used to return a specified portion of a character string?
- a) INSTR b) SUBSTRING c) SUBSTR d) POS
14. Which of the following is TRUE for the System Variable \$date\$?
- a) Can be assigned to a global variable. b) Can be assigned to any field only during design time.
c) Can be assigned to any variable or field during run time.
d) Can be assigned to a local variable.
15. What are the different events in Triggers?
- a) Define, Create b) Drop, Comment c) Insert, Update, Delete d) Select, Commit
16. Which is the subset of SQL commands used to manipulate Oracle Database Structures, including tables?

- a) Data Definition Language b) Data Manipulation Language c) Data Described Language
d) Data Retrieval Language
17. The SQL statement `SELECT SUBSTR('123456789', INSTR('abcabcabc','b'), 4) FROM EMP;` prints
a) 6789 b) 2345 c) 1234 d) 456789
18. Which of the following SQL command can be used to modify existing data in a database table?
a) MODIFY b) UPDATE c) CHANGE d) NEW
19. When SQL statements are embedded inside 3GL, we call such a program as
a) Nested query b) Nested programming c) Distinct query d) Embedded SQL
20. _____ provides option for entering SQL queries as execution time, rather than at the development stage.
a) PL/SQL b) SQL*Plus c) SQL d) Dynamic SQL
21. A transaction may not always complete its execution successfully. Such a transaction is termed
a) Aborted b) Terminated c) Closed d) All of the mentioned
22. If an transaction is performed in a database and committed, the changes are taken to the previous state of transaction by
a) Flashback b) Rollback c) Both a and b d) Cannot be done
23. Each modification done in database transaction are first recorded into the
a) Harddrive b) Log c) Disk d) Datamart
24. When the transaction finishes the final statement the transaction enters into
a) Active state b) Committed state c) Partially committed state
d) Abort state
25. The name of the transaction file shall be provided by the operator and the file that contains the edited transactions ready for execution shall be called
a) Batch. Exe b) Trans. Exe c) Opt. Exe d) Edit.Exe
26. Which of the following is an atomic sequence of database actions?
a) Transaction b) Concurrency c) Relations d) All of the mentioned
27. If the state of the database no longer reflects a real state of the world that the database is supposed to capture, then such a state is called
a) Consistent state b) Parallel state c) Atomic state d) Inconsistent state
28. _____ means that data used during the execution of a transaction cannot be used by a second transaction until the first one is completed.
a) Serializability b) Atomicity c) Isolation d) Time stamping
29. DBMS periodically suspends all processing and synchronizes its files and journals through the use of
a) Checkpoint facility b) Backup facility c) Recovery manager d) Database change log
30. Which of the following is not a state in transaction ?
a) Active b) Terminated c) Aborted d) Partially committed
31. In order to maintain transactional integrity and database consistency, what technology does a DBMS deploy?
a) Triggers b) Pointers c) Locks d) Cursors
32. A lock that allows concurrent transactions to access different rows of the same table is

known as a

a) Database-level lock b) Table-level lock c) Page-level lock d) Row-level lock

33. Which of the following are introduced to reduce the overheads caused by the log-based recovery?

a) Checkpoints b) Indices c) Deadlocks d) Locks

34. Which of the following protocols ensures conflict serializability and safety from deadlocks?

a) Two-phase locking protocol b) Time-stamp ordering protocol

c) Graph based protocol d) Both (a) and (b) above

35. Which of the following is the block that is not permitted to be written back to the disk?

a) Dead code b) Read only c) Pinned d) Zapped

36. If transaction T_i gets an explicit lock on the file F_c in exclusive mode, then it has an -

_____ on all the records belonging to that file.

a) Explicit lock in exclusive mode b) Implicit lock in shared mode

c) Explicit lock in shared mode. d) Implicit lock in exclusive mode

37. Which refers to a property of computer to run several operation simultaneously and possible as computers await response of each other

a) Concurrency b) Deadlock c) Backup d) Recovery

38. All lock information is managed by a _____, which is responsible for assigning and policing the locks used by the transactions.

a) Scheduler b) DBMS c) Lock manager d) Locking agent

39. The _____ lock allows concurrent transactions to access the same row as long as they require the use of different fields within that row.

a) Table-level b) Page-level c) Row-level d) Field-level

40. Which of the following is a procedure for acquiring the necessary locks for a transaction where all necessary locks are acquired before any are released?

a) Record controller b) Exclusive lock c) Authorization rule d) Two phase lock