Module 4 – Introduction to DBMS (Theory Questions)

1 Introduction to SQL

1.1 What is SQL and why is it essential in data base management?

SQL (Structured Query Language) is used to store, retrieve, and modify data in a Relational Database Management System (RDBMS) such as MySQL, SQL server, PostgreSQL, etc, using specific commands.

Importance of SQL in database management:

1. It helps read, write and manipulate all or specific data in RDBMS.
2. SQL's code is standardized by ISO and ANSI making it portable to different database platforms.
3. It also allows link different tables and secure specific data by allowing applying access restriction to specific users. SQL supports indexing making searching data quicker.
4. It also enables automatic logging by using triggers and potentially help lessen length
5. by using procedures which can be used multiple times throughout the code.
   SQL can also be integrated with various programming languages enabling to make
6. data-driven applications.
   SQL's syntax is quite intuitive and have a big community support making it easier to
7. learn.

1.2 Explain the difference between DBMS and RDBMS.

DBMS	RDBMS
Data is stored in files	Data is stored in tables
No explicit relationships between data	Explicit relationship between data is possible
Does not support normalization, poten- S tially increasing data redundancy	Supports normalization, potentially re- ducesdataredundancy
Does not support distributed databse	Supports distributed databse
Less security and access control features	More security and access control features
Doesnotsupportmultipleusers	Supportsmultipleusers

Lower hardware and software require- Hi ments	gher hardware and software require- Ments
Eg. XML, window registry, forxpro, etc. Eg	. MySQL, SQL server, Oracle, etc.

1.3 Describe the role of SQL in managing relational databases.

1. It is used to define structure, organization and relation of the stored data.
2. It is also used to retrieve stored data from a database.
3. It is also used to update data stored in database by enabling adding, removing, or modifying stored data.
4. SQL supports access control enabling restricted access to specified data for specified users.

Due to support for integrity constraints in SQL, it is used to prevent data corruption

1.4 What are the key features of SQL?

1. It supports adding, modifying and deleting data, the structure it is stored in, relation between them, and databases.
2. It also supports retrieving specific data which meet specified conditions and ability to sort it.
3. SQL supports transaction control allowing to revert back to specified point.
4. SQL also supports restricted data input allowing only particular data to be entered in a given column.

SQL lets make different users and giving each individual access to particular databases

5. and perform certain actions on it.

It is a standardized language making it so it can be written for one database management

6. system and used in a different one without making a lot of changes.

2 SQL Syntax

2.1 What are the basic components of SQL syntax?

1. Databases
2. Tables
3. Queries
4. Constraints
5. Stored procedures6. Transactions

2.2 Write the general structure of an SQL **SELECT** statement.

```
select      column1, column2,column3  ...
from    table_name;
```

2.3 Explain the role of clauses in SQL statements.

Clauses in SQL statements enables various features of SQL such as ordering, filtering, or grouping of data, etc. They help user to communicate to the computer what and how it wants the data from the database.

Role of Clauses in SQL

Clauses help to:

- Select required data from a database
- Filter unnecessary records
- Group records for aggregate functions
- Sort the result set
- Control the structure and execution of a query

Common SQL Clauses and Their Roles

1. SELECT Clause

- **Role:** Specifies the columns or expressions to be retrieved.
- **Purpose:** Defines *what data* should be displayed.
- **Example:**

```
SELECT name, marks FROM students;
```

2. FROM Clause

- **Role:** Specifies the table(s) from which data is fetched.
- **Purpose:** Defines *where the data comes from*.

Example:

```
SELECT * FROM students;
```

3. WHERE Clause

- **Role:** Filters records based on conditions.
- **Purpose:** Retrieves *only specific rows*.

Example:

```
SELECT * FROM students WHERE marks > 60;
```

4. GROUP BY Clause

- **Role:** Groups rows with the same values.
- **Purpose:** Used with aggregate functions like SUM(), AVG(), COUNT().

Example:

```
SELECT department, COUNT(*) FROM employees GROUP BY department;
```

5. HAVING Clause

- **Role:** Filters grouped records.

- **Purpose:** Applies conditions on groups (used after GROUP BY).

Example:

```
SELECT department, COUNT(*)
FROM employees
GROUP BY department
HAVING COUNT(*) > 5;
```

6. ORDER BY Clause

- **Role:** Sorts the result set.
- **Purpose:** Displays records in ascending or descending order.

Example:

```
SELECT * FROM students ORDER BY marks DESC;
```

7. DISTINCT Clause

- **Role:** Removes duplicate rows.
- **Purpose:** Displays only unique values.

Example:

```
SELECT DISTINCT city FROM students;
```

8. LIMIT / TOP Clause

- **Role:** Restricts the number of rows returned.
- **Purpose:** Displays a fixed number of records.

Example (MySQL):

```
SELECT * FROM students LIMIT 5;
```

Order of Execution of SQL Clauses

SQL clauses are logically executed in the following order:

1. **FROM**
2. **WHERE**
3. **GROUP BY**
4. **HAVING**
5. **SELECT**
6. **ORDER BY**
7. **LIMIT**

3 SQL Constraints

3.1 What are constraints in SQL? List and explain the different types of constraints.

Constraints in SQL are used to enforce rules on data stored in a database.

Different types of constraints:

1. **not null**: used to make sure some data is added in the specified column.

2. **unique**: 3.used to restrict repeated entry of data.

primary 4.used to assign a unique id to each row. used to link tables to each other with a**key**:

foreign shared **key**: column between them. used to check if the values in the specified

5. **check**: column satisfies a specified condition.

6. **default**: used to set a specified value to all entries in the specified column.

3.2 Howdo **PRIMARY KEY** and **FOREIGN KEY** constraints differ?

PRIMARY KEY	**FOREIGN KEY**
used to uniquely identify each row of a table	used to link tables with same columns
a table can have only one primary key	a table can have multiple foreign keys
restricts the column to have duplicate values in different rows of the column	allows the columns to have duplicate values in different rows of the columns

Does not support distributed database	Supports distributed databse
Less security and access control features	More security and access control features
Does not support multiple users	Supports multiple users
Lower hardware and software require- Hi ments	gher hardware and software require- Ments
Eg. XML, window registry, forxpro, etc. Eg	. MySQL, SQL server, Oracle, etc.

3.3 What is the role of **NOT NULL** and **UNIQUE** constraints?

1. **NOT NULL**: it is used to make sure values in the specified column are not empty.
2. **UNIQUE**: it is used to make sure values in the specified column are different from each other and there are no duplicates in the column.

4 MainSQLCommandsandSub-commands(DDL)

4.1 Define the SQL Data Definition Language(DDL).

Data Definition Language (DDL) is used to create and modify data in SQL such as table, database, rows, etc.

Main DDL Commands

1. CREATE

- Used to create database objects.

Example:

```
CREATE TABLE Student (
   RollNo INT,
   Name VARCHAR(50),
   Marks INT
);
```

2. ALTER

- Used to modify an existing database object.

Example:

```
ALTER TABLE Student ADD Age INT;
```

3. DROP

- Used to delete database objects permanently.

Example:

```
DROP TABLE Student;
```

4. TRUNCATE

- Removes all records from a table but keeps the table structure.

Example:

```
TRUNCATE TABLE Student;
```

5. RENAME

- Used to rename a database object.

Example:

```
RENAME TABLE Student TO Student_Details;
```

4.2 Explain the **CREATE** command and its syntax.

It is used to create and define new database objects in SQL such as database, table, view, etc.

```
create [database_object] [database_object_name];
```

General syntax:

1

4.3 What is the purpose of specifying data types and constraints during table creation?

The purpose of specifying data types during table creation is to define what kind of data will be stored in that column and to allocate appropriate amount of memory. This ensures that if a different type of data is tried to be entered, compiler gives error. It also helps compiler to perform appropriate operations based on the data type.

The purpose of specifying constraints during table creation is to enforce rules on a specific column or table to ensure data consistency and integrity or restrict data that meet certain condition.

5 ALTERCommand

5.1 What is the use of the **ALTER** command in SQL?

ALTERcommand in SQL is used to make changes to the structure of a table that already exists.

5.2 Howcanyouadd,modify,anddropcolumnsfromatable using **ALTER**?

```
alter table [table_name] add
[column_1_name] datatype_1, add
[column_2_name] ...; datatype_2,
```

1. Add columns:

```
alter table [table_name] modif column
[column_1_nam
y column e] modif [column_2_nam datatype_1, datatype_2,
```

2. Modify columns:

1

y ...; e]

3. Drop columns:

```
alter table [table_name] drop column
[column_name_1] drop column ,
...; [column_name_2

],
```

6 DROP Command

6.1 What is the function of the **DROP** command in SQL?

The DROP command in SQL is used to permanently delete entire database objects such as database, table, constraint, index, etc.

6.2 What are the implication s of dropping a table froma database?

When a table is dropped from a database, all the data stored in it, the structure of and constraints on the columns, triggers associated to it, access privileges granted to the table, and its indexes are permanently deleted.

7 DataManipulationLanguage(DML)

7.1 Define the **INSERT**, **UPDATE** ,and **DELETE** commands in SQL.

1. **INSERT**: it is used to add new rows to a table.
2. **UPDATE**: it is used to change existing data in a table.
3. **DELETE**: it is used rows from a table.

7.2 What is the importance of the **WHERE** clause in **UPDATE** and DELETE operations?

The importance of the WHERE clause in UPDATE and DELETE operations is that it helps ensure only those rows get updated or deleted which satisfy a particular condition. Without the WHERE clause, all the rows of the table will be updated or deleted.

8 DataQueryLanguage(DQL)

8.1 What is the **SELECT** statement, and how is it used to query data?

The SELECT statement is used to get all or selected data from one or multiple table with all or

```
select [column_1], [column_2], ...
from table_name;
```

specified columns with options to group, sort, or filter the data.

8.2 Explain the use of the **ORDER BY** and **WHERE**clauses in SQL queries.

The ORDER BY clause in SQL queries is used to view selected data with a particular column

```
select [column_1], [column_2], ... table_name
from by [column_name]ASC /DESC;
order
```

sorted by either ascending or descending order.

The WHERE clause in SQL queries is used to show only that data which satisfies a given

```
select [column_1], [column_2], ...
from table_name where
[condition];
```

condition.

9 DataControlLanguage(DCL)

9.1 What is the purpose of **GRANT** and **REVOKE** in SQL?

GRANT in SQL is used to grant a user access to a database object, whereas used

REVOKE is to revoke access.

```
grant/revoke [privilege_name] on
[object_name]
to [user_name/public/role_name];
```

9.2 How do you manage privileges using these commands?

- **GRANT** → **Assigns** permissions to users or roles
- **REVOKE** → **Removes** previously assigned permissions

These commands control **who can access or modify database objects**, such as tables, views, and procedures.

Example

GRANT SELECT, UPDATE ON Student TO user1;
REVOKE UPDATE ON Student FROM user1;

10 Transaction Control Language (TCL)

10.1 What is the purpose of the **COMMIT** and **ROLLBACK** commands in SQL?

COMMIT and ROLLBACK commands in SQL are used in transactions for data integrity and consistency.

COMMIT is used to save all the changes in a transaction performed after last COMMIT or

```
start transaction;
[1st        operation];
[2nd ...operation]; commit;
```

ROLLBACK.

```
start transaction;
[1st     operation];[2nd
...          operation];
rollback;
```

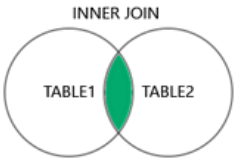
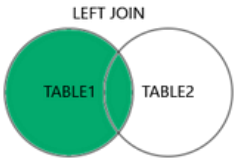
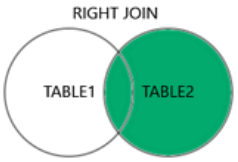
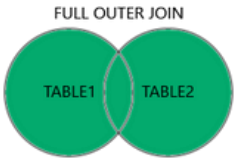
10.2Explain how transactions are managed in SQL databases.

11 SQL Joins

11.1 Explain the concept of **JOIN** in SQL. What is the difference between ,**INNER JOIN LEFT JOIN** , **RIGHT JOIN** ,and **FULL OUTER JOIN**?

JOIN in SQL is used to combine multiple tables based on a common column between two tables.

INNER JOIN	LEFT JOIN	RIGHT JOIN	FULL OUTER JOIN

Returns only rows Re which matching val i ues in both tables. and	turns all rows Returns the left table, in the l therowswhich andther match in the right. m	all rows ft table, owswhich atch n the right.	Returns all rows from both tables which have a match.
			

11.2 Howarejoinsusedtocombinedatafrommultipletables?

Joins are used in SQL to combine data from multiple tables by using JOIN clause in the SELECT statement and mentioning the two tables whose data is to be combined and the common

```
select
        * from
    [table_1]
[inner / left right/      / full  ]  join     [table_2]
on [table_1].[common_column_name=] [table_2].[common_column_name];
```

columns between them based on which they are to be combined.

1
2
3
4

12 SQL Group By

12.1 What is the **GROUP BY** clause in SQL? How is it used with aggregate functions?

The GROUP BY clause in SQL is used to group rows in a table by the values that are common in

```
select      [column_1], [column_2],      ...
from   [table_name] by [column_a], [column_b],
group   ...;
```

a specified column.

1
2
3

The GROUP BY clause in SQL is used with aggregate functions, they operate on each individual

```
select      [column_1], [aggregate_funciton]([column_2]),      ...
from   [table_name] by [column_a], [column_b],
group   ...;
```

group created by the GROUP BY and give the value of the respective operation for each of them.

12.2 Explain the difference between **GROUP BY** and **ORDER BY**.

GROUP BY	ORDER BY
It is used to group rows with same values in a specified column.	It is used to sort rows in ascending or descending order based on the values in a specified column. Not allowed in
Allowed in CREATE VIEW statement.	CREATE VIEW state- ment. Used after GROUP BY in SELECT state-
Used before ORDER BY in SEL statement.	CTment. Controls
Controls the presentation of the rows.	columns. the presentation of the Aggregate functions are not mandatory.
Aggregate functions are mandatory.	

13 SQL Stored Procedure

13.1 WhatisastoredprocedureinSQL,andhowdoesitdiffer from a standard SQL query?

A stored procedure in SQL is a pre-compiled block of SQL statements that are stored in the database and can be executed anytime by calling it without having to rewriting all the statements in the procedure.

- A stored procedure can be written once and used multiple times, eliminating the need to rewrite all the SQL queries multiple times to perform the same task.
- It is faster than a standard SQL query as it is precompiled and stored in the database,
- resulting in reduced parsing time.
- It is also more secure, as a user can be granted access to just the procedure instead of
- the table to perform operations defined in the procedure.
- A stored procedure occupy disk space while a standard SQL statement only exists on
- memory when it is executed.
- As a stored procedure is encapsulated, it is more difficult to test it as compared to a
- standard SQL query.
- It is not possible to debug or version control it unlike a standard SQL query.

13.2 Explain the advantages of using stored procedures.

- They are faster and more efficient as they only need to be compiled once and can be executed multiple times.
-

They also increase productivity as the same code does not have to be written multiple

- times, resulting in decreased development and maintenance time.
  As the commands in a stored procedure are executed as a single block of code, it helps
- reduce server/client traffic.

  A user can only be given permission to a stored procedure bu not the table/s it performs operations on, allowing the user to only perform operations defined in the stored procedure make the data more secured.

14 SQL View

14.1 WhatisaviewinSQL,andhowisitdifferentfromatable?

A view is a virtual table whose columns and data are chosen from preexisting table/s using SELECT query.

View	Table
It is Virtual table.	It is physical object.
Dependent on other table/s.	Independent of other table/s.
Do not occupy space on storage.	Do occupy space on storage.
Views are read-only.	CRUD operations can be performed on tables.
Can aggregate data from multiple tables.	Cannot aggregate data from multiple tables.

14.2 Explain the advantages of using views in SQL databases.

- View is more as a user can be given access to a part of the data instead of the entire database or a table.
- View can be used to combine data from multiple tables with multiple complex queries
- combined in a single query.
  Changing the structure of the table does not affect the views associated with it, which ensures the structure is not affected by the changes to the table.

15 SQL Triggers

15.1 WhatisatriggerinSQL?Describeitstypesandwhen they are used.

A trigger in SQL is a stored procedure in a database which can be set to be executed automatically whenever data is added, updated, or deleted in the database.

Types of trigger in SQL:

1. DDL trigger: This type of trigger gets activated when a database object is created, deleted, or changed. It is used to keep track of changes made to the database.

2. DML trigger: This type of trigger gets activated when data is added, deleted, or changed. It is used to keep track of changes made to a table.

3. Logon trigger: This trigger gets activated when a users logs into the database. It is used to keep track of users logging in to the database.

15.2 Explain the difference between**INSERT**, **UPDATE** ,and **DELE**TE triggers.

The key difference between INSERT, UPDATE, and DELETE triggers is that INSERT is executed when a new data row is added to the specified table, UPDATE is executed when existing data in the specified table is changed, and DELETE is executed when a data row/s is/are removed from the specified table.

16 Introduction to PL/SQL

16.1 WhatisPL/SQL,andhowdoesitextendSQL'scapabilities?

PL/SQL (Procedural Language/Sequence Query Language) is a combination of SQL and procedural programming.
PL/SQL extends SQL's capabilities by adding the ability to have loops (allowing execution of block of SQL statements multiple times), conditions (allowing execution of block of SQL statements only when given condition/s is/are satisfied) and exception handling (allowing the rest of the statements to be executed after error is detected).

16.2 List and explain the benefits of using PL/SQL.

1. Tight integration with SQLAll SQL operations can be performed using PL/SQL as it supports all of its queries and: data types removing the need to switch between both languages.

2. High performance: PL/SQL sends statements in the form of blocks reducing traffic. Also, SQL statements in PL/SQL can be reused, in turn improving performance.

17 PL/SQL Control Structures

17.1 What are control structures in PL/SQL? Explain the IF-THEN and LOOP control structures.

17.2 How do control structures in PL/SQL help in writing complex queries?

18 SQL Cursors

18.1 WhatisacursorinPL/SQL?Explainthedifferencebetween implicit and explicit cursors.

18.2 Whenwouldyouuseanexplicitcursoroveranimplicit one?

19 Rollback and Commit Savepoint

19.1 Explain the concept of **SAVEPOINT** in transaction management. How do **ROLLBACK** and **COMMIT** interact with savepoints?

SAVEPOINT in transaction management is used to enable undoing of changes made by execution of SQL statements after a certain point in a transaction. ROLLBACK to a SAVEPOINT undo all the changes made by running SQL statements after the specified SAVEPOINT. COMMIT is used to save all the changes made by execution of SQL statements in a transaction, inevitably disabling the ability to undo any changes made by executing SQL statements after a SAVEPOINT in the transaction.

19.2 Whenisitusefultousesavepointsinadatabasetransaction?

Savepoints in a database transaction are used to separate it into smaller blocks for error recovery or for debugging/testing.