

Worksheet -1.1

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1. Aim/Overview of the practical:

To design and implement a sample database system using DDL, DML, and DCL commands, including database creation, data manipulation, schema modification, and role-based access control to ensure data integrity and secure, read-only access for authorized users.

2. Objective:

To gain practical experience in implementing Data Definition Language (DDL), Data Manipulation Language (DML), and Data Control Language (DCL) operations in a real database environment. This will also include implementing role-based privileges to secure data.

An organization wants to design a sample database system to manage Departments, Employees, and Projects. The database must ensure data integrity, controlled access, and proper privilege management for different users.

Requirements:

1. Database Design:

- Create multiple tables such as Department, Employee, and Project.
- Define appropriate PRIMARY KEY and FOREIGN KEY constraints.
- Enforce NOT NULL, UNIQUE, and CHECK constraints where necessary.

2. Data Manipulation

- Insert sample records into all tables.
- Perform UPDATE operations to modify existing records.
- Perform DELETE operations while maintaining referential integrity.

3. Access Control & Security

- Create a role/user for a reporting staff member.
- Grant ONLY SELECT privilege on required tables to this role/user.
- Explicitly REVOKE CREATE privilege so that the user cannot create any database objects.
- Ensure the user has read-only access to the database.

4. Schema Modification

- Use ALTER TABLE to add or modify a column.
- Drop a table that is no longer required using DROP TABLE.

3. S/W Requirement:

- Oracle Database Express Edition
- pgAdmin.

Procedure:

1. Start PostgreSQL Environment

Open pgAdmin and connect to the PostgreSQL server using administrator (superuser) credentials.

2. Create Tables Using DDL Commands

Create the Department, Employee, and Project tables using CREATE TABLE statements. Define PRIMARY KEY and FOREIGN KEY constraints to maintain referential integrity. Apply NOT NULL, UNIQUE, and CHECK constraints to ensure data consistency.

3. Insert Sample Records

Insert sample data into all tables using INSERT statements to populate the database.

4. Perform Data Manipulation Operations

Modify existing records using the UPDATE command.

Remove records using the DELETE command while maintaining referential integrity.

5. Check Current User

Use SELECT CURRENT_USER; to verify the active database user in pgAdmin.

6. Create Role for Reporting Staff

Create a new role for reporting staff using the CREATE ROLE command with login privileges.

7. Grant Read-Only Access

Grant ONLY SELECT privilege on Department, Employee, and Project tables to the reporting staff role.

8. Restrict Unauthorized Operations

Revoke INSERT, UPDATE, and DELETE privileges to prevent data modification.

Revoke CREATE privilege on the public schema to restrict object creation.

9. Modify Database Schema

Use the ALTER TABLE command to modify the structure of the Employee table.

10. Drop Unnecessary Table

Remove the Project table using the DROP TABLE command when it is no longer required.

11. Verify Permissions and Output

Log in using the reporting staff role and verify that only read-only access is allowed.

4. Code:

```
-- 1
CREATE TABLE Department
( deptm_id INT PRIMARY
KEY,
deptm_name VARCHAR(30) UNIQUE NOT NULL
);
CREATE TABLE Employee
( emp_id INT PRIMARY
KEY,
emp_name VARCHAR(30) NOT NULL,
salary INT CHECK (salary >
0), deptm_id INT,
CONSTRAINT fk_dpt FOREIGN KEY (deptm_id) REFERENCES Department(deptm_id)
);
CREATE TABLE Project (
project_id INT PRIMARY KEY,
project_name VARCHAR(30) NOT NULL,
deptm_id INT,
CONSTRAINT fk_project_dpt FOREIGN KEY (deptm_id) REFERENCES
Department(deptm_id)
);
-- 2
INSERT INTO Department VALUES
(1, 'HR'),
(2, 'FINANCE'),
(3, 'IT'),
(4, 'SALES');
INSERT INTO Employee VALUES
(101, 'SANCHIT KATOCH', 50000, 2),
(102, 'ROSHAN K SINGH', 45000, 1),
(103, 'Anindita', 42000, 3),
(104, 'Ankush', 43000, 4);
INSERT INTO Project VALUES
(201, 'Payroll System', 2),
(202, 'Web Application', 2),
(203, 'Cyber Security', 1);
--3
UPDATE Employee
SET salary = 56750
WHERE emp_id = 102;
```

```
DELETE FROM Project
WHERE project_id = 202;
SELECT CURRENT_USER;
CREATE ROLE report_staff
WITH LOGIN PASSWORD 'staff111';
SELECT CURRENT_USER;
GRANT SELECT ON Department TO report_staff;
GRANT SELECT ON Employee TO report_staff;
GRANT SELECT ON Project TO report_staff;
REVOKE CREATE ON SCHEMA public FROM report_staff;
REVOKE INSERT, UPDATE, DELETE ON Department FROM report_staff;
REVOKE INSERT, UPDATE, DELETE ON Employee FROM report_staff;
REVOKE INSERT, UPDATE, DELETE ON Project FROM report_staff;
--4
ALTER TABLE Project
ALTER COLUMN project_name TYPE VARCHAR(100);
DROP TABLE Project;
```

```
SELECT*FROM department;
SELECT*FROM project;
SELECT*FROM employee;
```

5. Output:

DEPARTMENT TABLE :-

	deptm_id [PK] integer	deptm_name character varying (30)
1	1	HR
2	2	FINANCE
3	3	IT
4	4	SALES

PROJECT TABLE :-

	project_id [PK] integer	project_name character varying (100)	deptm_id integer
1	201	Payroll System	2
2	203	Cyber Security	1

EMPLOYEE TABLE :-

	emp_id [PK] integer	emp_name character varying (30)	salary integer	deptm_id integer
1	101	SANCHIT KATOCH	50000	2
2	103	Anindita	42000	3
3	104	Ankush	43000	4
4	102	ROSHAN K SINGH	56750	1

CURRENT USER :-

	current_user name
1	postgres

READ-ONLY ACCESS via GRANT :-

```
Data Output  Messages  Notifications
ERROR:  must be owner of table project

SQL state: 42501
```

6. Learning Outcome:

Create a database and tables with constraints

Insert, query, update, and delete data

Alter table structure dynamically

Create roles/users and manage privileges (GRANT/REVOKE)

Query PostgreSQL system tables to verify privileges

Understand DDL (CREATE/ALTER), DML (INSERT/UPDATE/DELETE), DCL (GRANT/REVOKE), and basic SELECT queries.