Library Management System Database

Student Name: Vinay Tiwari
UID: 24BAI70919
Section: 24_AIT_KRG-G2

Aim

To design and implement a Library Management System database using appropriate tables, primary keys, foreign keys, and constraints, and to perform DML operations along with DCL commands such as role creation, privilege granting, and revoking to ensure database security.

Software Requirements

Database Management System

- PostgreSQL

Database Administration Tool

- pgAdmin

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.

Problem Statement

A Library wants to develop a Library Management System database to manage information about books, members, and book issue records efficiently. The database should be designed using appropriate tables, primary keys, foreign keys, and constraints to ensure data integrity.

The system must support basic database operations such as inserting records, updating existing data, and deleting obsolete entries. To ensure database security, a database role named Librarian must be created. This role should be password protected and granted SELECT, INSERT, and DELETE permissions on the required tables. The system administrator (pgAdmin) should also have the ability to revoke these permissions when required using role-based access control.

Learning Outcomes

- Learned how to operate pgAdmin 4
- Learned how to execute SQL queries
- Learned how to create tables in SQL and insert data in tables

Procedures and Steps

Step 1: Database Setup

1. Install PostgreSQL and pgAdmin 4 on your system
2. Open pgAdmin 4 and connect to the PostgreSQL server
3. Create a new database named "LibraryManagement"
4. Verify the database is created successfully

Step 2: Table Design and Creation

Create the following tables:

Books Table

- BookID (Primary Key)
- Title (NOT NULL)
- Author (NOT NULL)
- ISBN (UNIQUE)
- PublishedYear
- Availability (Boolean)

Members Table

- MemberID (Primary Key)
- Name (NOT NULL)
- Email (UNIQUE)
- PhoneNumber
- MembershipDate
- Status (Active/Inactive)

Issue Records Table

- IssueID (Primary Key)
- BookID (Foreign Key → Books.BookID)
- MemberID (Foreign Key → Members.MemberID)
- IssueDate
- ReturnDate
- ActualReturnDate

Step 3: Data Manipulation Language (DML) Operations

1. **INSERT Operations:** Add sample records to each table
2. **UPDATE Operations:** Modify member information and book availability status
3. **DELETE Operations:** Remove obsolete or damaged book records and inactive members

Step 4: Data Control Language (DCL) Operations

Create Role

CREATE ROLE librarian WITH PASSWORD 'secure_password';

Grant Privileges

GRANT SELECT, INSERT, DELETE ON Books TO librarian;
GRANT SELECT, INSERT, DELETE ON Members TO librarian;
GRANT SELECT, INSERT, DELETE ON IssueRecords TO librarian;

Revoke Privileges

REVOKE DELETE ON Books FROM librarian;
REVOKE DELETE ON Members FROM librarian;
REVOKE DELETE ON IssueRecords FROM librarian;

Step 5: Query Execution and Verification

1. Execute SELECT queries to retrieve and verify all table data
2. Test INSERT operations by adding new records
3. Test UPDATE operations by modifying existing records
4. Verify role-based access control by switching to librarian user
5. Test privilege revocation and verify restricted access

Step 6: Documentation and Analysis

1. Document all SQL commands used
2. Verify data integrity constraints are enforced
3. Analyze the effectiveness of role-based access control
4. Create a summary of security measures implemented