DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

CHANDIGARH UNIVERSITY

Discover. Learn. Empower.

Experiment 1.1

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Branch: BE-AIT-CSE

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1. Aim:

EASY LEVEL PROBLEM: To create author and book tables linked by a foreign key, insert sample data, and use an INNER JOIN to display each book's title with its author's name and country, demonstrating basic SQL joins and relational design.

MEDIUM LEVEL PROBLEM:

Create normalized tables for departments and courses linked by a foreign key, insert sample data, use a subquery to count and filter departments offering more than two courses, and grant SELECT-only access to a specific user on the courses table, demonstrating subqueries, filtering, and access control in SQL.

2. Objective:

Design related tables for authors-books and departments-courses with foreign keys; insert sample data; use INNER JOIN to link books with authors, subqueries to find departments with over two courses, and grant SELECT-only access to a user—demonstrating core SQL concepts of relational design, data retrieval, and access control.

3. Theory:

This exercise involves foundational concepts of relational databases and SQL operations. Relational databases organize data into tables (called relations), where each table consists of rows (records or tuples) and columns (attributes or fields).

Tables are linked by keys: a primary key uniquely identifies each record in a table, and a foreign key establishes a relationship between tables by referring to a primary key in

another table. This structure supports efficient data storage, retrieval, and ensures data integrity through referential constraints.

SQL (Structured Query Language) is the standard language used to create, manipulate, and query relational databases. Key SQL operations used here include:

- Table creation and data insertion: Defining tables with appropriate columns and constraints (like foreign keys), then inserting sample data into them.
- INNER JOIN: A fundamental join operation that links rows between two tables based on a matching key, allowing combined information to be retrieved (e.g., books linked with their authors).
- Subqueries with aggregation: Using nested queries to compute summary data (such as counting courses per department) and filtering results based on aggregate conditions.
- Access control: Managing database security by granting specific privileges (e.g., SELECT-only permission) to users, limiting their ability to modify data.

Together, these concepts demonstrate relational database design principles, how to model relationships using keys, retrieve meaningful combined data across tables, analyze data subsets through subqueries, and implement basic security measures in an SQL environment. This approach enables organized, consistent, and secure management of interconnected data.

This theory provides the conceptual foundation behind creating author-book and department-course database schemas, performing joins and subqueries for data retrieval, and applying access restrictions in practice.

4. Procedure:

1. Design Tables:
   - Create an Author table to store author details (e.g., AUTHOR_ID, AUTHOR_NAME, Country)
   - Create a Book table to store book details (e.g., BOOK_ID, Title, AUTHOR_ID), with a foreign key AUTHOR_ID referencing the Author table
   - Create a Department table to store department details (e.g., DEPARTMENT_ID, DEPARTMENT_NAME)
   - Create a Course table to store course details (e.g., COURSE_ID, COURSE_NAME, DEPARTMENT_ID), with a foreign key DEPARTMENT_ID referencing the Department table

2. Insert Sample Data:

- Insert at least three records into the Author table
- Insert at least three records into the Book table linking to authors through AUTHOR_ID
- Insert five departments into the Department table
- Insert at least ten courses into the Course table, distributed among the departments via DEPARTMENT_ID

3. Perform SQL Operations:

- Use an INNER JOIN query to retrieve and display each book's title, corresponding author's name, and author's country by joining the Book and Author tables on AUTHOR_ID
- Use a subquery with aggregation (COUNT) on the Course table grouped by DEPARTMENT_ID to find the number of courses per department
- Filter the departments to retrieve only those having more than two courses based on the subquery result

4. Apply Access Control:

- Grant SELECT permission on the Course table to a specific user to restrict data access to read-only

5. Code:

```
USE AIT_1B
GO

IF NOT EXISTS (SELECT 1 FROM TBL_AUTHOR)
BEGIN
   INSERT INTO TBL_AUTHOR (AUTHOR_ID, AUTHOR_NAME, COUNTRY) VALUES
   (1, 'J.K. Rowling', 'United Kingdom'),
   (2, 'George R.R. Martin', 'United States'),
   (3, 'Haruki Murakami', 'Japan'),
   (4, 'Isabel Allende', 'Chile'),
   (5, 'Chinua Achebe', 'Nigeria'),
   (6, 'Gabriel Garcia Marquez', 'Colombia'),
   (7, 'Toni Morrison', 'United States'),
   (8, 'Leo Tolstoy', 'Russia'),
   (9, 'Jane Austen', 'United Kingdom'),
   (10, 'Mark Twain', 'United States');
END
GO
```

```
IF NOT EXISTS (SELECT 1 FROM TBL_BOOKS)
BEGIN
   INSERT INTO TBL_BOOKS (BOOK_ID, BOOK_TITLE, AUTHORID) VALUES
   (1, 'Harry Potter and the Sorcerer''s Stone', 1),
   (2, 'A Game of Thrones', 2),
   (3, 'Norwegian Wood', 3),
   (4, 'The House of the Spirits', 4),
   (5, 'Things Fall Apart', 5),
   (6, 'One Hundred Years of Solitude', 6),
   (7, 'Beloved', 7),
   (8, 'War and Peace', 8),
   (9, 'Pride and Prejudice', 9),
   (10, 'Adventures of Huckleberry Finn', 10);
END
GO

SELECT B.BOOK_TITLE AS [Book Title], A.AUTHOR_NAME AS [Author Name],
A.COUNTRY AS [Country]
FROM TBL_BOOKS AS B
INNER JOIN TBL_AUTHOR AS A ON B.AUTHORID = A.AUTHOR_ID
GO

IF NOT EXISTS (SELECT 1 FROM TBL_DEPARTMENT)
BEGIN
   INSERT INTO TBL_DEPARTMENT (DEPARTMENT_ID, DEPARTMENT_NAME)
VALUES
   (1, 'Computer Science'),
   (2, 'Mathematics'),
   (3, 'Physics'),
   (4, 'Chemistry'),
   (5, 'English Literature');
END
GO

IF NOT EXISTS (SELECT 1 FROM TBL_COURSE)
BEGIN
   INSERT INTO TBL_COURSE (COURSE_ID, COURSE_NAME, DEPARTMENT_ID)
VALUES
   (1, 'Data Structures', 1),
   (2, 'Operating Systems', 1),
   (3, 'Algorithms', 1),
   (4, 'Calculus', 2),
   (5, 'Linear Algebra', 2),
```

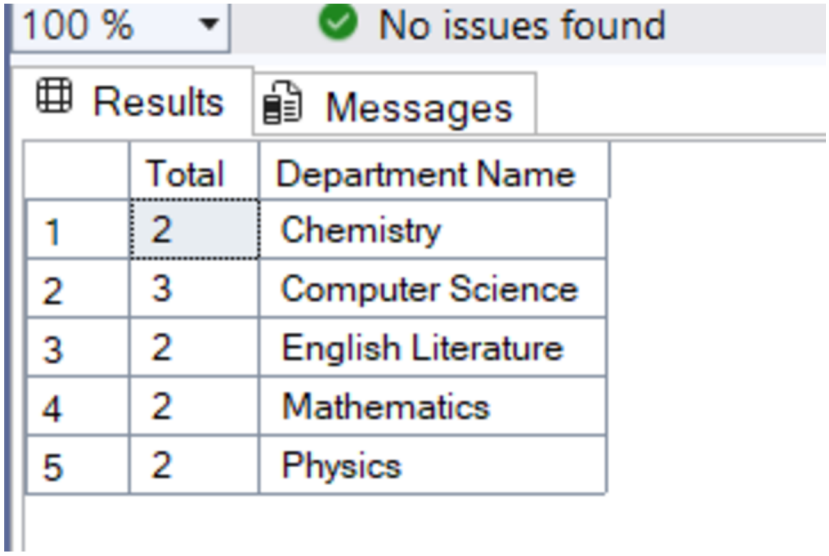
```
    (6, 'Quantum Mechanics', 3),
    (7, 'Electromagnetism', 3),
    (8, 'Organic Chemistry', 4),
    (9, 'Physical Chemistry', 4),
    (10, 'Shakespearean Literature', 5),
    (11, 'Modern Poetry', 5);
END
GO

SELECT COUNT(COURSE_NAME) AS Total, DEPARTMENT_NAME AS [Department
Name]
FROM TBL_COURSE
INNER JOIN TBL_DEPARTMENT ON TBL_COURSE.DEPARTMENT_ID =
TBL_DEPARTMENT.DEPARTMENT_ID
GROUP BY TBL_DEPARTMENT.DEPARTMENT_NAME
GO

SELECT DEPARTMENT_NAME
FROM TBL_DEPARTMENT
WHERE DEPARTMENT_ID IN (
    SELECT DEPARTMENT_ID
    FROM TBL_COURSE
    GROUP BY DEPARTMENT_ID
    HAVING COUNT(*) > 2
)
GO

IF NOT EXISTS (SELECT * FROM sys.server_principals WHERE name =
'TEST_LOGIN_SNEHA')
BEGIN
    CREATE LOGIN TEST_LOGIN_SNEHA WITH PASSWORD =
'TESTLOGIN@123SNEHA';
END
GO

IF NOT EXISTS (SELECT * FROM sys.database_principals WHERE name =
'TEST_LOGIN_SNEHA')
BEGIN
    CREATE USER TEST_LOGIN_SNEHA FOR LOGIN TEST_LOGIN_SNEHA;
END
GO

GRANT SELECT ON TBL_COURSE TO TEST_LOGIN_SNEHA;
GO
```

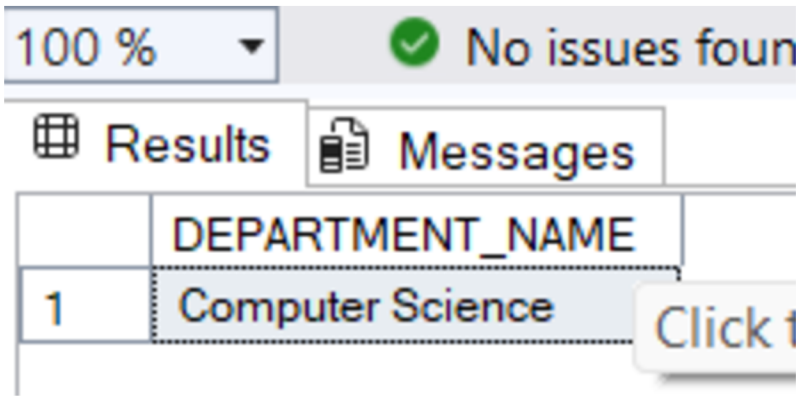
6. Output:

100 % No issues found

Results Messages

	Book Title	Author Name	Country
1	Harry Potter and the Sorcerer's Stone	J.K. Rowling	United Kingdom
2	A Game of Thrones	George R.R. Martin	United States
3	Norwegian Wood	Haruki Murakami	Japan
4	The House of the Spirits	Isabel Allende	Chile
5	Things Fall Apart	Chinua Achebe	Nigeria
6	One Hundred Years of Solitude	Gabriel Garcia Marquez	Colombia
7	Beloved	Toni Morrison	United States
8	War and Peace	Leo Tolstoy	Russia
9	Pride and Prejudice	Jane Austen	United Kingdom
10	Adventures of Huckleberry Finn	Mark Twain	United States





7. Learning Outcomes:

1. Understandhow to design a relational schema for a real-world system.
2. Practicecreating and linking tables using SQL.
3. UseJOINstoquery multi-table data meaningfully.
4. Implementdata access control using GRANT/REVOKE.