Module 4 – Introduction to DBMS Introduction to SQL

Theory Questions:

1. What is SQL, and why is it essential in database management?

SQL (Structured Query Language) is a standard language used to create, manage, and retrieve data from relational databases. It is essential because it allows users to efficiently store, retrieve, update, and manage large volumes of structured data.

2. Explain the difference between DBMS and RDBMS.

DBMS	RDBMS
Stores data as files	Stores data in tables (relations)
No relationship between data	Uses relationships via keys
Less secure	More secure
Examples: File system	Examples: MySQL, Oracle

3. Describe the role of SQL in managing relational databases.

SQL helps define database structure, insert/update/delete data, retrieve information, control access, and manage transactions in relational databases.

4. What are the key features of SQL?

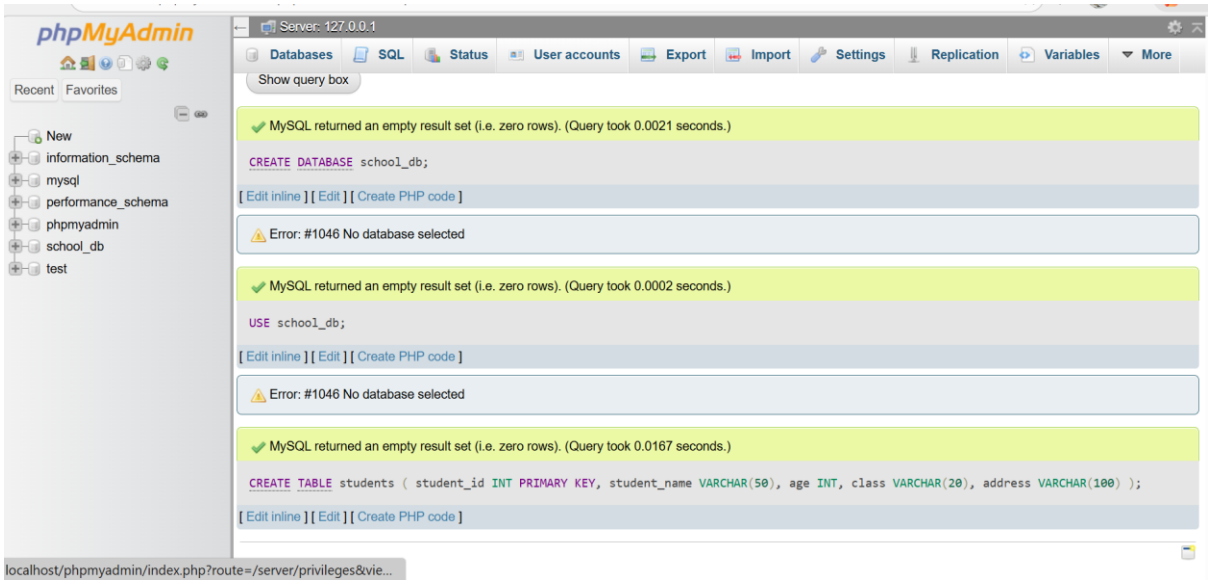
Key features of SQL

- Easy to learn
- Standardized language
- Supports CRUD operations
- Secure and scalable
- Works with large databases

LAB EXERCISES:

• Lab 1: Create a new database named school_db and a table called students with the following columns: student_id, student_name, age, class, and address

```
CREATE DATABASE school_db;
USE school_db;

CREATE TABLE students (
    student_id INT PRIMARY KEY,
    student_name VARCHAR(50),
    age INT,
    class VARCHAR(20),
    address VARCHAR(100)
);
```



. • Lab 2: Insert five records into the students table and retrieve all records using the SELECT statement.

INSERT INTO students VALUES

(1, 'Sweta', 12, '6A', 'Delhi'),

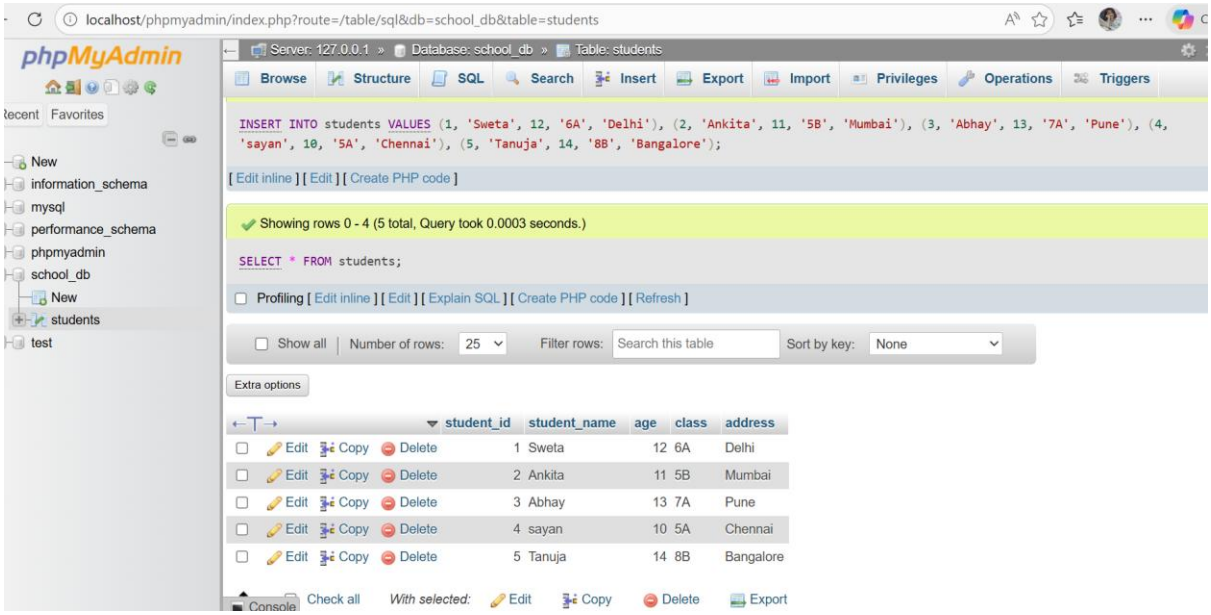
(2, 'Ankita', 11, '5B', 'Mumbai'),

(3, 'Abhay', 13, '7A', 'Pune'),

(4, 'Sayan', 10, '5A', 'Chennai'),

(5, 'Tanuja', 14, '8B', 'Bangalore');

SELECT * FROM students;



2. SQL Syntax

The basic components of SQL syntax include:

- **Keywords** – Reserved words such as SELECT, FROM, WHERE, INSERT, UPDATE, DELETE
- **Identifiers** – Names of database objects like tables and columns
- **Clauses** – Parts of SQL statements that define specific actions (e.g., WHERE, ORDER BY)
- **Operators** – Used to compare or manipulate data (=, >, <, AND, OR)
- **Expressions** – Combinations of columns, operators, and values
- **Literals** – Fixed values such as numbers or strings (10, 'John')

2. Write the general structure of an SQL SELECT statement

SELECT column1, column2, ...

FROM table_name

WHERE condition

ORDER BY column_name;

(Note: WHERE and ORDER BY clauses are optional.)

3. Explain the role of clauses in SQL statements

Clauses define different parts of an SQL statement and control how data is retrieved or manipulated:

- **SELECT** – Specifies which columns to display
- **FROM** – Specifies the table containing the data
- **WHERE** – Filters records based on conditions
- **ORDER BY** – Sorts the result set
- **GROUP BY** – Groups rows with similar values
- **HAVING** – Filters grouped data

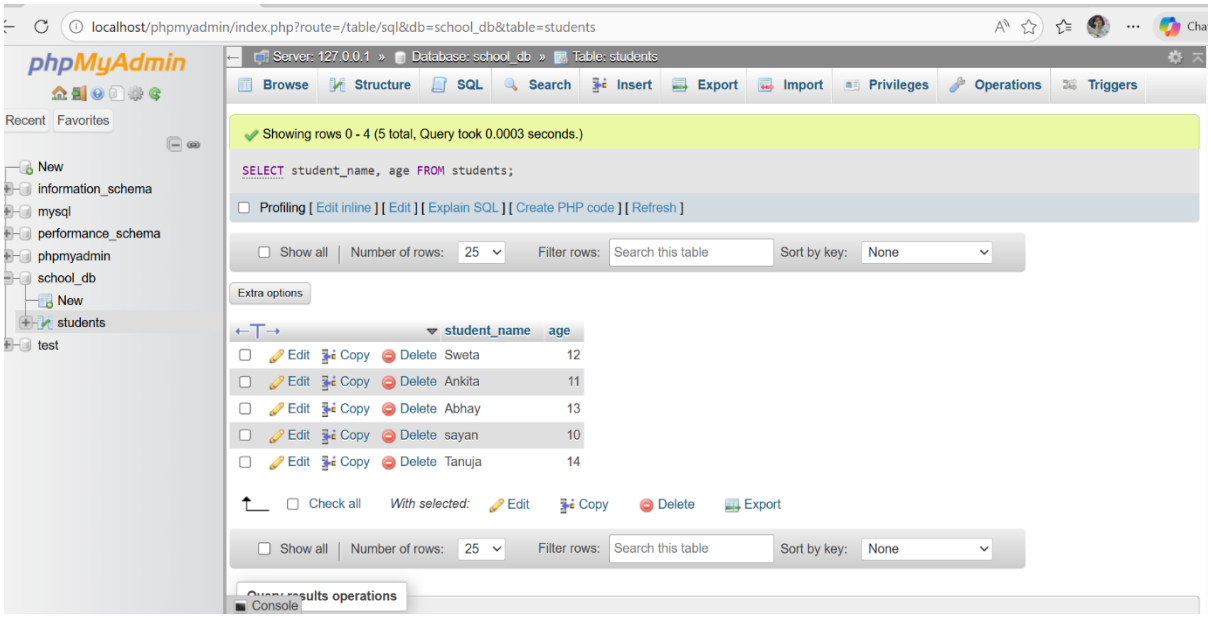
Each clause performs a specific function and together they form a complete SQL query.

LAB EXERCISES

Lab 1: Retrieve specific columns (student_name and age) from the students table

SELECT student_name, age

FROM students;

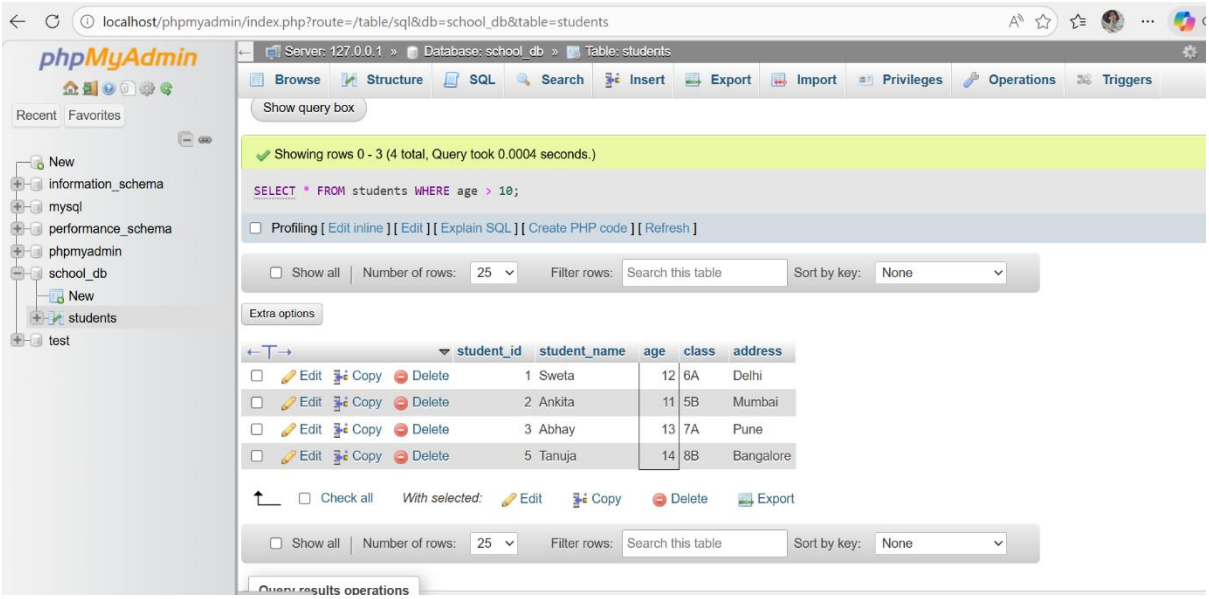


Lab 2: Retrieve all students whose age is greater than 10

SELECT *

FROM students

WHERE age > 10;


localhost/phpmyadmin/index.php?route=/table/sql&db=school_db&table=students
phpMyAdmin
Recent
Favorites
New
information_segment
mysql
performance_schema
phpmyadmin
school_db
New
students
test
Server: 127.0.0.1 » Database: school_db » Table: students
Browse
Structure
SQL
Search
Insert
Export
Import
Privileges
Operations
Triggers
Show query box
Showing rows 0 - 3 (4 total, Query took 0.0004 seconds.)
SELECT * FROM students WHERE age > 10;
Profiling [Edit inline] [Edit] [Explain SQL] [Create PHP code] [Refresh]
Show all
Number of rows: 25
Filter rows: Search this table
Sort by key: None
Extra options
student_id
student_name
age
class
address
Edit Copy Delete 1 Sweta 12 6A Delhi
Edit Copy Delete 2 Ankita 11 5B Mumbai
Edit Copy Delete 3 Abhay 13 7A Pune
Edit Copy Delete 5 Tanuja 14 8B Bangalore
Check all
With selected:
Edit
Copy
Delete
Export
Show all
Number of rows: 25
Filter rows: Search this table
Sort by key: None
Query results operations

3. SQL Constraints

Theory Questions

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

Constraints are rules applied to table columns to enforce data integrity and maintain accuracy in the database. Common types of constraints:

1. **PRIMARY KEY** – Uniquely identifies each row in a table. Cannot contain NULL values.
2. **FOREIGN KEY** – Ensures referential integrity by linking a column in one table to a primary key in another table.
3. **NOT NULL** – Ensures a column cannot have NULL values.
4. **UNIQUE** – Ensures all values in a column are unique.
5. **CHECK** – Ensures values in a column satisfy a specific condition (e.g., age > 0).
6. **DEFAULT** – Assigns a default value to a column if no value is specified during insertion.

2. How do PRIMARY KEY and FOREIGN KEY constraints differ?

Constraint	Purpose	Key Points
PRIMARY KEY	Uniquely identifies each row in its own table	Cannot be NULL; only one primary key per table
FOREIGN KEY	Maintains referential integrity by linking to a primary key in another table	Can have duplicate values; ensures consistency across tables

3. What is the role of NOT NULL and UNIQUE constraints?

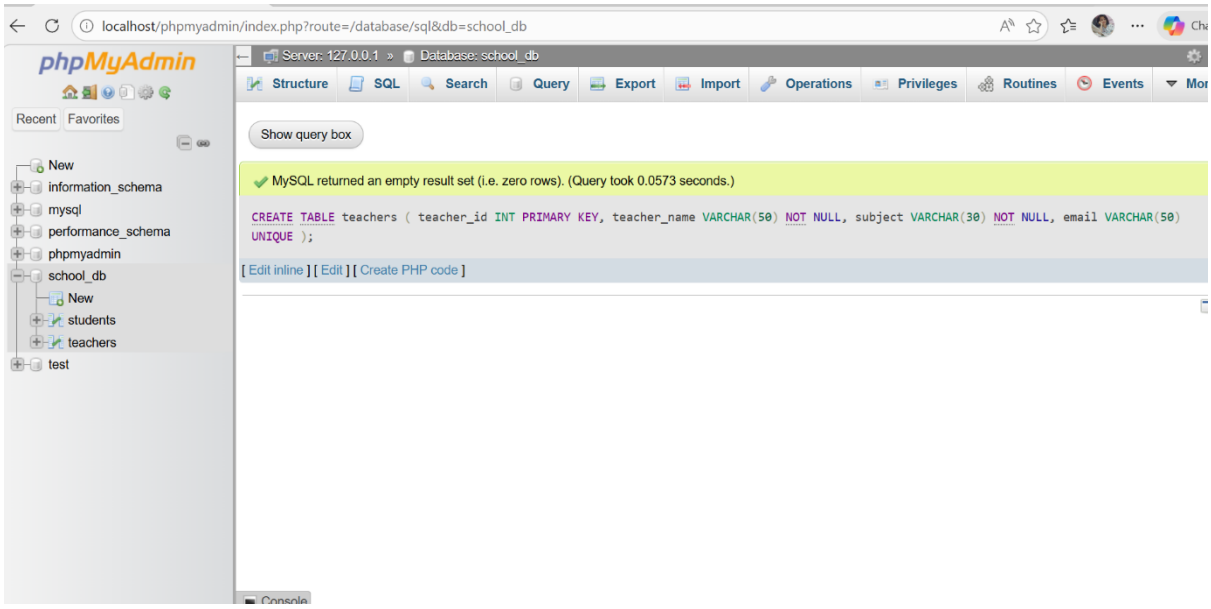
- **NOT NULL**: Ensures a column must always have a value; it cannot be left empty.

- **UNIQUE**: Ensures that all values in the column are distinct; no duplicates are allowed.

LAB EXERCISES

Lab 1: Create a teachers table with constraints

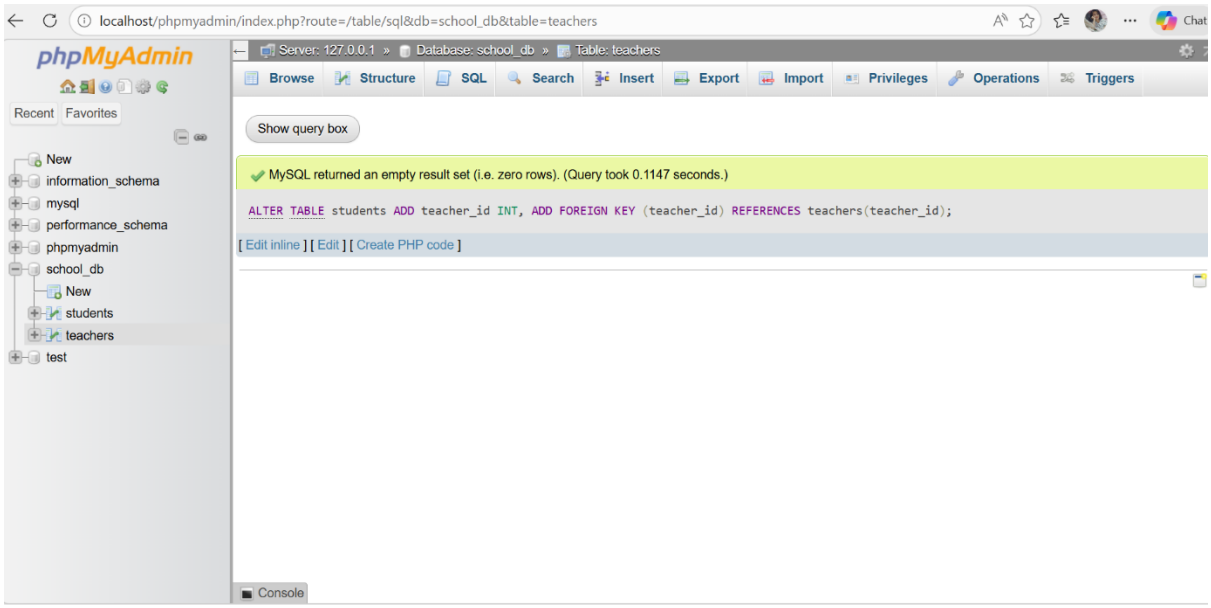
```
CREATE TABLE teachers (
    teacher_id INT PRIMARY KEY,
    teacher_name VARCHAR(50) NOT NULL,
    subject VARCHAR(50) NOT NULL,
    email VARCHAR(100) UNIQUE
);
```



Lab 2: Implement a FOREIGN KEY constraint to relate teacher_id with students table

Assuming the students table has a teacher_id column to reference the teacher:

```
ALTER TABLE students
ADD teacher_id INT,
ADD CONSTRAINT fk_teacher
FOREIGN KEY (teacher_id) REFERENCES teachers(teacher_id);
```


localhost/phpmyadmin/index.php?route=/table/sql&db=school_db&table=teachers
phpMyAdmin
Recent
Favorites
New
information_schema
mysql
performance_schema
phpmyadmin
school_db
New
students
teachers
test
Server: 127.0.0.1 » Database: school_db » Table: teachers
Browse
Structure
SQL
Search
Insert
Export
Import
Privileges
Operations
Triggers
Show query box
MySQL returned an empty result set (i.e. zero rows). (Query took 0.1147 seconds.)
ALTER TABLE students ADD teacher_id INT, ADD FOREIGN KEY (teacher_id) REFERENCES teachers(teacher_id);
[Edit inline] [Edit] [Create PHP code]
Console

4. Main SQL Commands and Sub-commands (DDL)

Theory Questions

1. Define the SQL Data Definition Language (DDL).

Data Definition Language (DDL) is a subset of SQL used to define, modify, and manage the structure of database objects.
DDL commands deal with the **schema** of the database rather than the data itself.

Common DDL commands include:

- CREATE
- ALTER
- DROP
- TRUNCATE
- RENAME

2. Explain the CREATE command and its syntax.

The **CREATE** command is used to create new database objects such as databases, tables, views, and indexes.

General syntax for creating a table:

```
CREATE TABLE table_name (
   column1 datatype constraints,
   column2 datatype constraints,
   ...
);
```

General syntax for creating a database:

```
CREATE DATABASE database_name;
```

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

- **Data types** define the kind of data a column can store (e.g., INT, VARCHAR, DATE) and help maintain data accuracy.
- **Constraints** enforce rules on the data to ensure integrity and consistency (e.g., PRIMARY KEY, NOT NULL, UNIQUE).

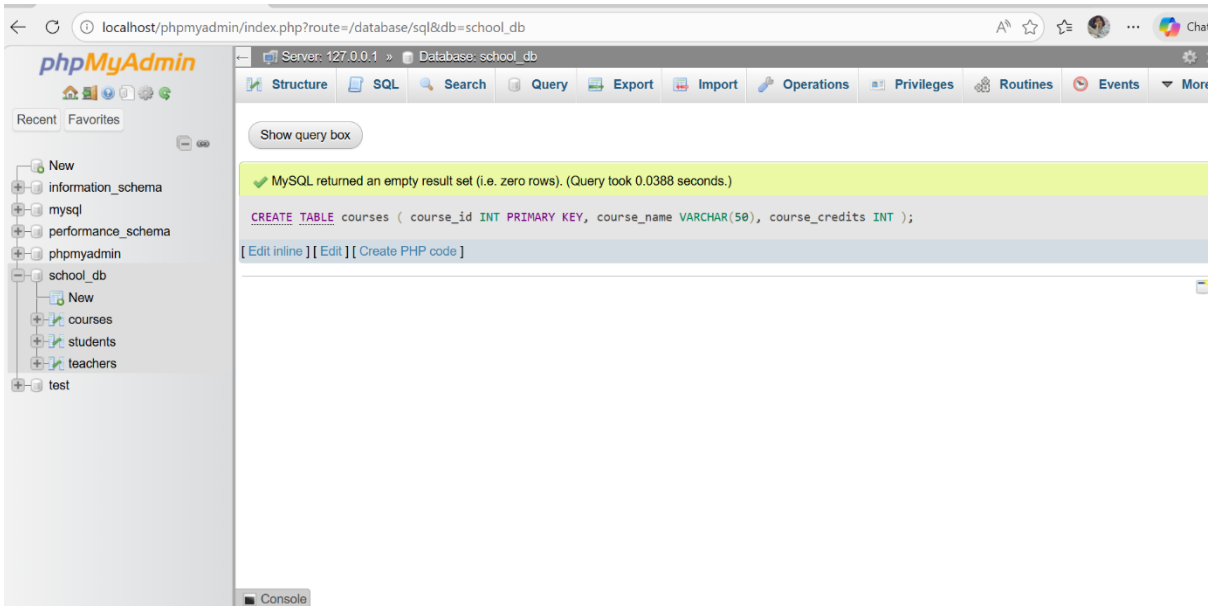
Together, they:

- Prevent invalid data entry
- Improve data reliability
- Enforce business rules at the database level

LAB EXERCISES

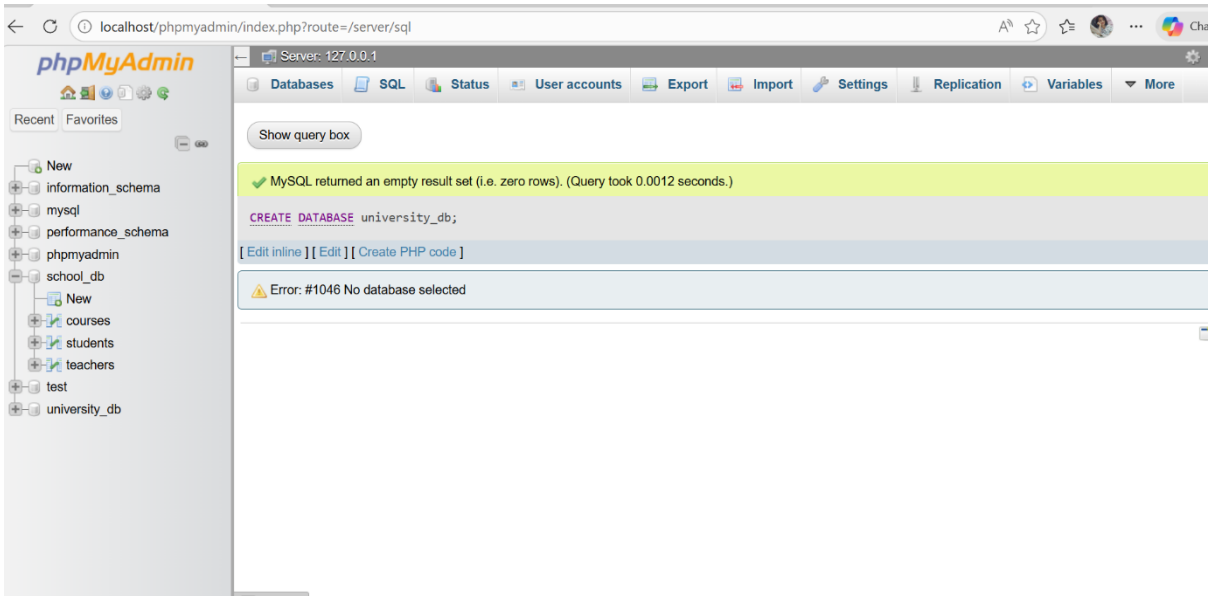
Lab 1: Create a courses table

```
CREATE TABLE courses (
    course_id INT PRIMARY KEY,
    course_name VARCHAR(100),
    course_credits INT
);
```



Lab 2: Create a database named university_db

```
CREATE DATABASE university_db;
```


localhost/phpmyadmin/index.php?route=/server/sql
phpMyAdmin
Recent
Favorites
New
information_schema
mysql
performance_schema
phpmyadmin
school_db
New
courses
students
teachers
test
university_db
Server: 127.0.0.1
Databases
SQL
Status
User accounts
Export
Import
Settings
Replication
Variables
More
Show query box
MySQL returned an empty result set (i.e. zero rows). (Query took 0.0012 seconds.)
CREATE DATABASE university_db;
[Edit inline] [Edit] [Create PHP code]
Error: #1046 No database selected

ALTER COMMAND

Theory Questions

1. What is the use of the ALTER command in SQL?

The **ALTER** command is used to **change the structure of an existing table** in a database.
It allows you to:

- Add new columns
- Modify existing columns
- Drop columns
- Rename columns or tables (in some DBMS) It does **not** change the data inside the table directly, only the table structure.

2. How can you add, modify, and drop columns from a table using ALTER?

Add a column

ALTER TABLE table_name

ADD column_name datatype;

Modify a column

ALTER TABLE table_name

MODIFY column_name new_datatype;

Drop a column

ALTER TABLE table_name

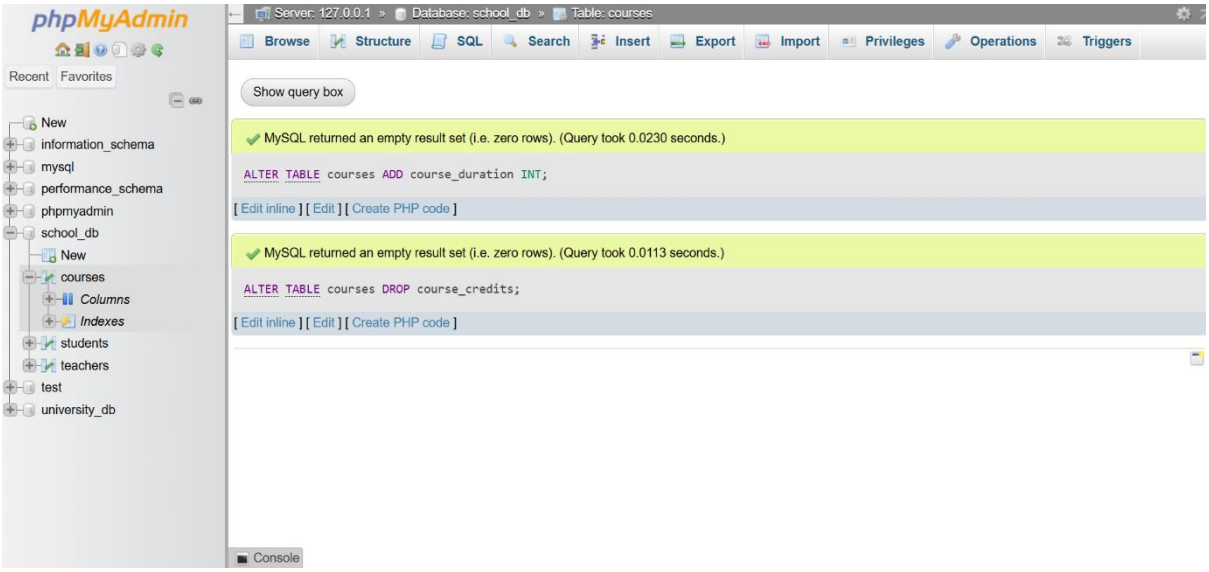
DROP column_name;

LAB EXERCISES

Lab 1: Add a column course_duration to the courses table

ALTER TABLE courses

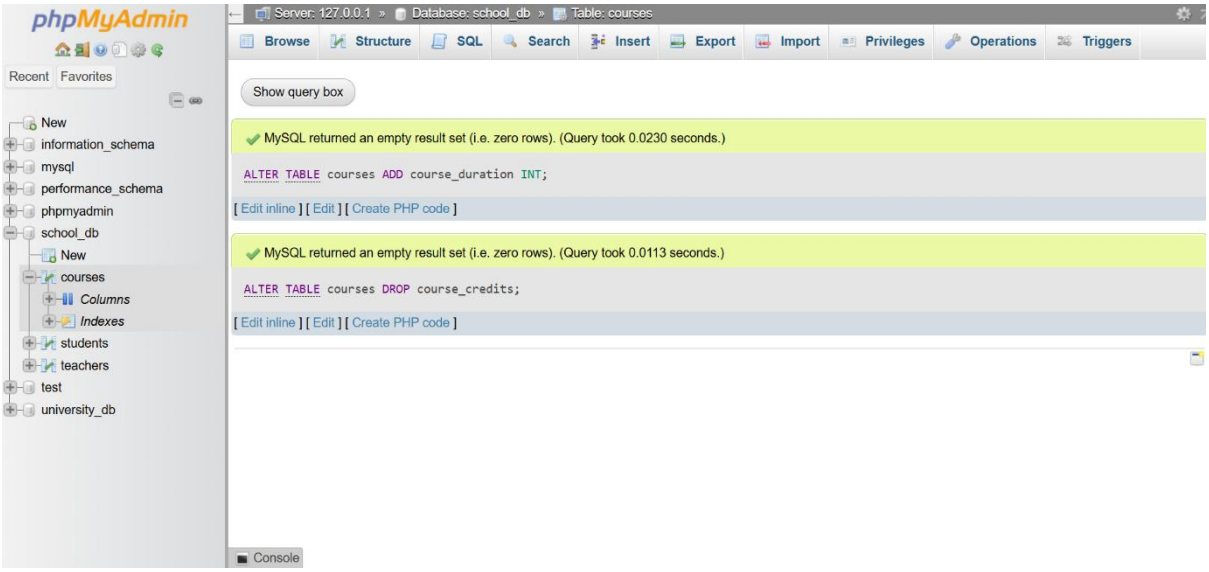
ADD course_duration INT;



Lab 2: Drop the course_credits column from the courses table

ALTER TABLE courses

DROP course_credits;



6. DROP Command

Theory Questions

1. What is the function of the DROP command in SQL?

The **DROP** command is used to **permanently delete database objects** such as:

- Tables
- Databases
- Views
- Indexes

When a table is dropped, **both the table structure and all its data are removed permanently** from the database.

2. What are the implications of dropping a table from a database?

- All **records stored in the table are permanently deleted**
- The **table structure is removed**
- Any **indexes, triggers, and constraints** associated with the table are also deleted
- The action **cannot be rolled back** (unless backups exist)
- Any queries or applications depending on the table may stop working

LAB EXERCISES

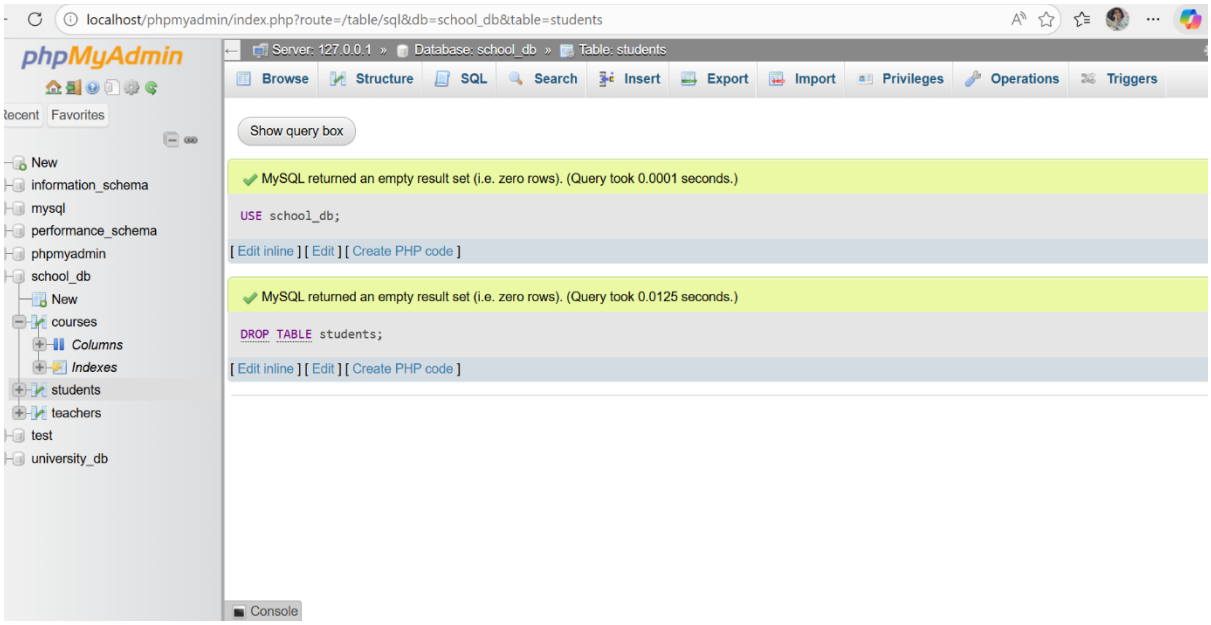
Lab 1: Drop the teachers table from the school_db database

```
USE school_db;

DROP TABLE teachers;
```

Lab 2: Drop the students table from the school_db database and verify its removal

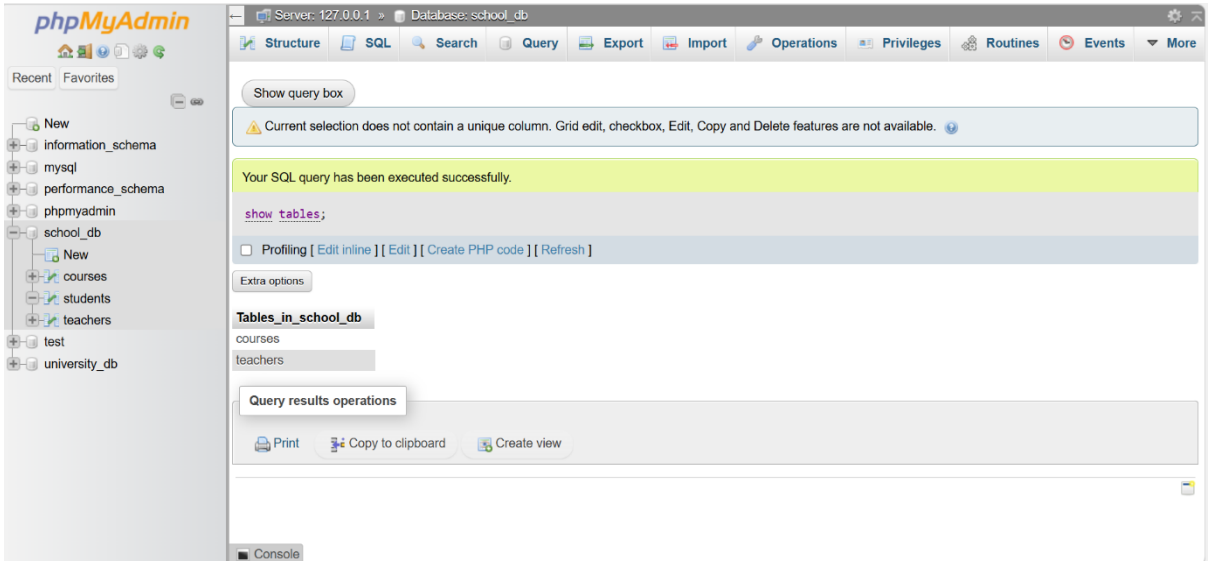
Step 1: Drop the table

```
USE school_db;

DROP TABLE students;
```



Step 2: Verify that the table has been removed

SHOW TABLES;



7. Data Manipulation Language (DML)

Theory Questions

1. Define the INSERT, UPDATE, and DELETE commands in SQL

INSERT
The **INSERT** command is used to **add new records (rows)** into a table.

INSERT INTO table_name VALUES (...);

UPDATE
The **UPDATE** command is used to **modify existing records** in a table.

UPDATE table_name SET column = value WHERE condition;

DELETE
The **DELETE** command is used to **remove records** from a table.

DELETE FROM table_name WHERE condition;

2. What is the importance of the WHERE clause in UPDATE and DELETE operations?

The **WHERE clause** is crucial because:

- It specifies **which rows should be updated or deleted**
- Prevents **accidental modification or deletion of all records**
- Ensures **data accuracy and safety**

LAB EXERCISES

Lab 1: Insert three records into the courses table

INSERT INTO courses (course_id, course_name, course_duration)

VALUES

(1, 'SQL', 30),

(2, 'Java', 45),

(3, 'Python', 40);

Lab 2: Update the course duration of a specific course

UPDATE courses

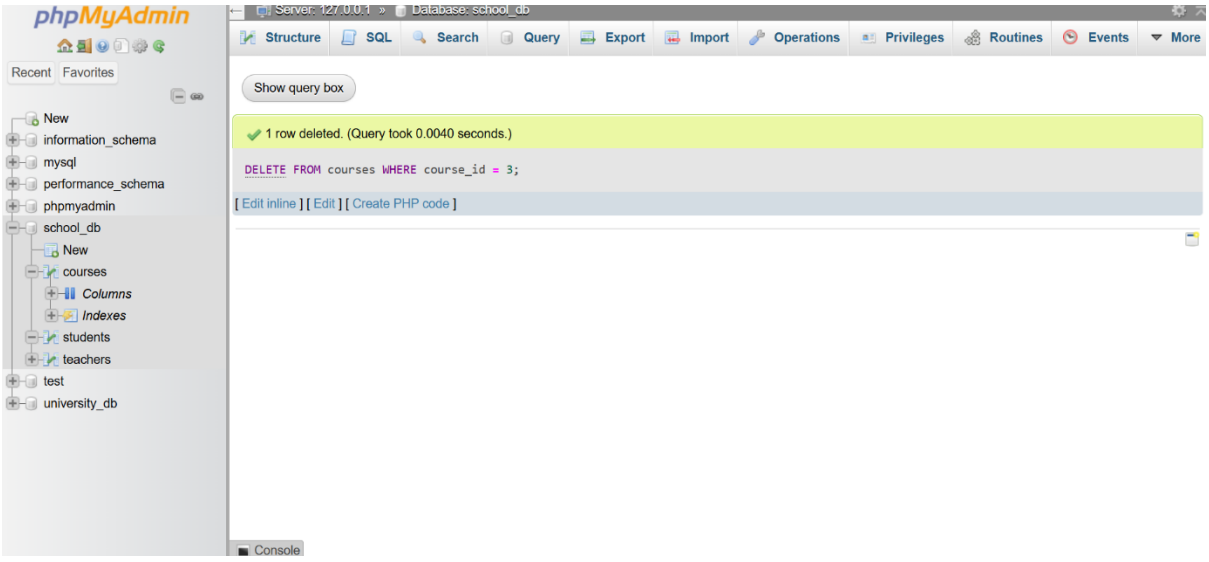
SET course_duration = 50

WHERE course_id = 2;

Lab 3: Delete a course with a specific course_id

DELETE FROM courses

WHERE course_id = 3;



8. Data Query Language (DQL)

Theory Questions

1. What is the SELECT statement, and how is it used to query data?

The **SELECT** statement is used to **retrieve data from one or more tables** in a database.
It allows users to:

- Fetch all or specific columns
- Apply conditions
- Sort results
- Limit the number of records displayed

Basic syntax:

SELECT column_name(s)

FROM table_name;

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

WHERE Clause

- Used to **filter records** based on conditions
- Returns only rows that satisfy the given condition

SELECT * FROM courses

WHERE course_duration > 5;

ORDER BY Clause

- Used to **sort the result set**

- Can be sorted in **ascending (ASC)** or **descending (DESC)** order

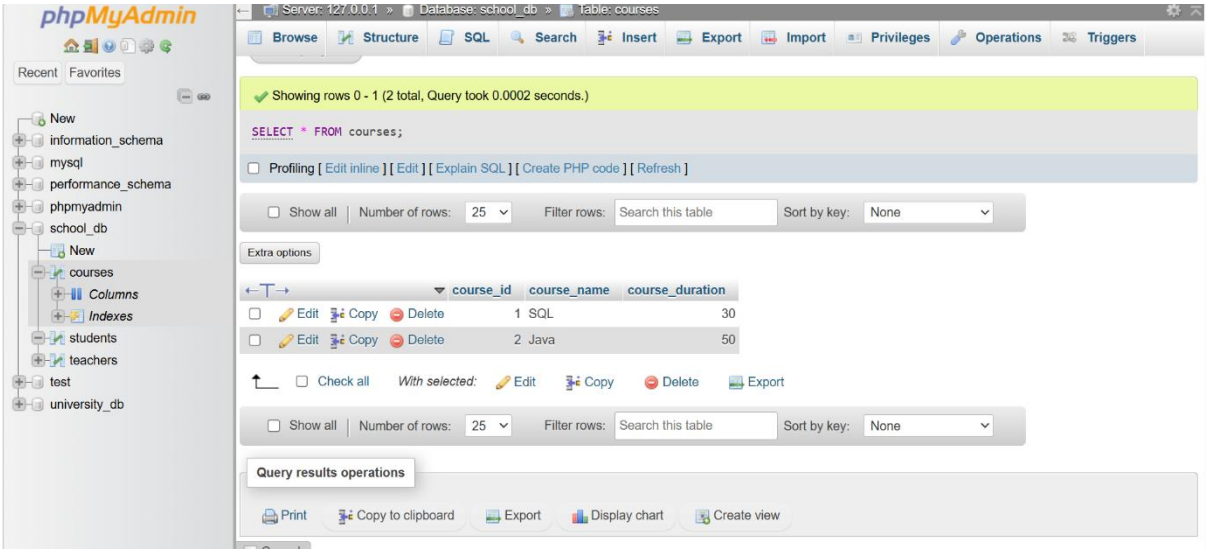
SELECT * FROM courses

ORDER BY course_duration DESC;

LAB EXERCISES

Lab 1: Retrieve all courses from the courses table

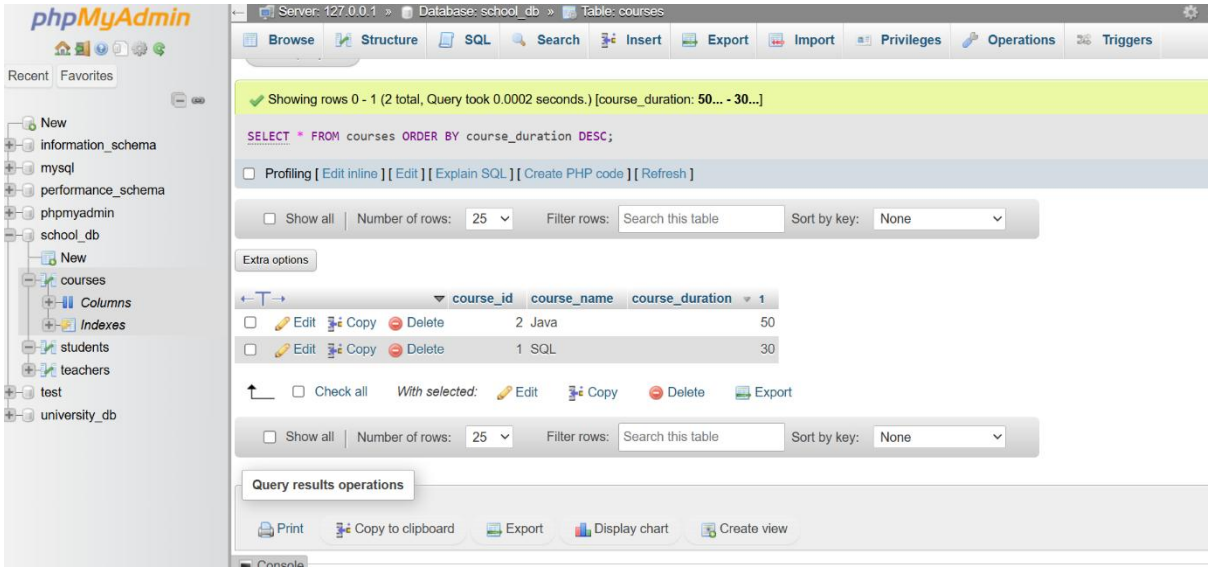
SELECT * FROM courses;



Lab 2: Sort the courses based on course_duration in descending order

SELECT * FROM courses

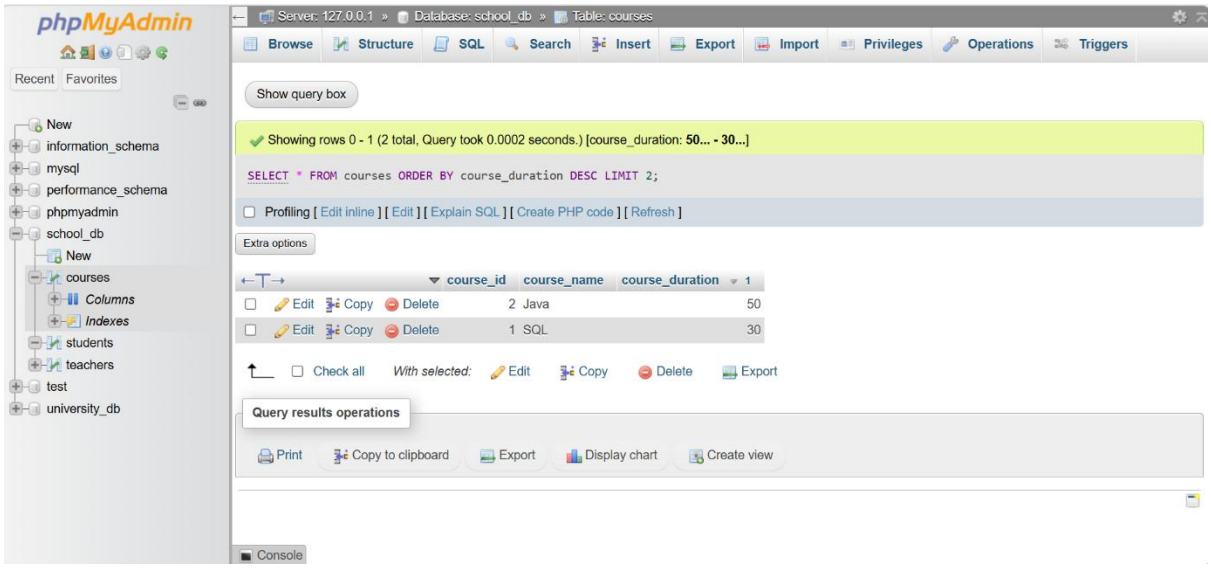
ORDER BY course_duration DESC;



Lab 3: Show only the top two courses using LIMIT

SELECT * FROM courses

LIMIT 2;



9. Data Control Language (DCL)

Theory Questions

1. What is the purpose of GRANT and REVOKE in SQL?

GRANT

- Used to **give permissions (privileges)** to users or roles
- Controls access to database objects like tables, views, and procedures

REVOKE

- Used to **remove previously granted permissions**
- Helps maintain database security

2. How do you manage privileges using these commands?

Privileges are managed by:

- Assigning specific permissions (SELECT, INSERT, UPDATE, DELETE)
- Granting access only to required users
- Revoking permissions when they are no longer needed

Example:

GRANT SELECT ON courses TO user1;

REVOKE SELECT ON courses FROM user1;

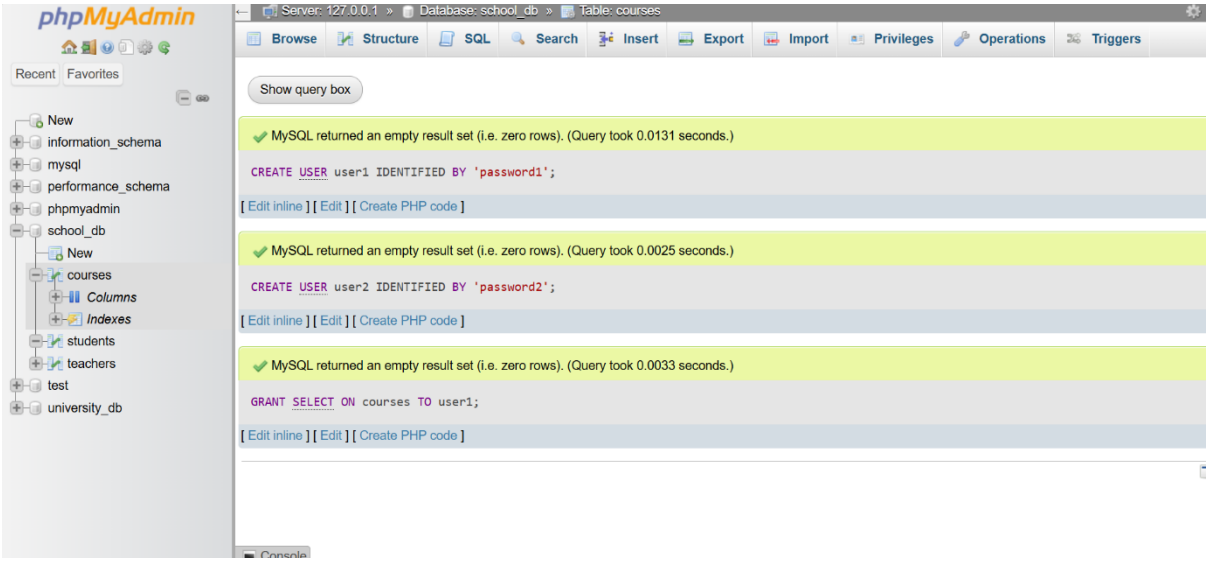
LAB EXERCISES

Lab 1: Create two users and grant SELECT permission to user1

CREATE USER 'user1'@'localhost' IDENTIFIED BY 'password1';

CREATE USER 'user2'@'localhost' IDENTIFIED BY 'password2';

GRANT SELECT ON courses TO 'user1'@'localhost';



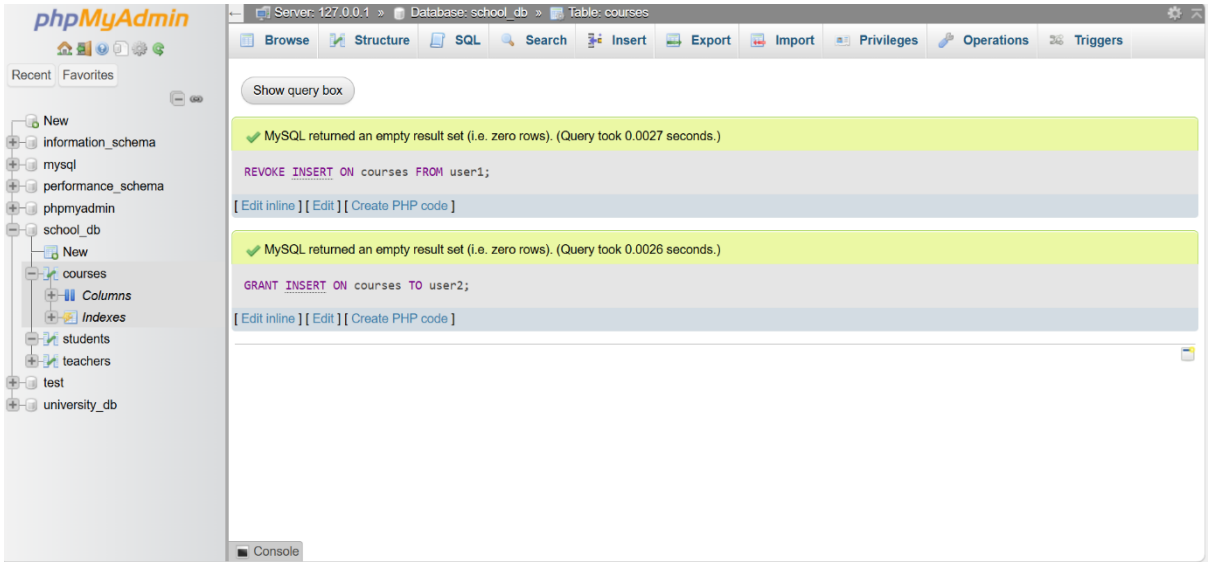
Lab 2: Revoke INSERT permission from user1 and grant it to user2

Revoke INSERT from user1

REVOKE INSERT ON courses FROM 'user1'@'localhost';

Grant INSERT to user2

GRANT INSERT ON courses TO 'user2'@'localhost';


phpMyAdmin
Recent
Favorites
New
information_schema
mysql
performance_schema
phpmyadmin
school_db
New
courses
Columns
Indexes
students
teachers
test
university_db
Server: 127.0.0.1 » Database: school_db » Table: courses
Browse
Structure
SQL
Search
Insert
Export
Import
Privileges
Operations
Triggers
Show query box
MySQL returned an empty result set (i.e. zero rows). (Query took 0.0027 seconds.)
REVOKE INSERT ON courses FROM user1;
[Edit inline] [Edit] [Create PHP code]
MySQL returned an empty result set (i.e. zero rows). (Query took 0.0026 seconds.)
GRANT INSERT ON courses TO user2;
[Edit inline] [Edit] [Create PHP code]
Console

Transaction Control Language (TCL)

Theory Questions

1. What is the purpose of the COMMIT and ROLLBACK commands in SQL?

COMMIT

- Permanently **saves all changes** made during the current transaction
- After COMMIT, changes cannot be undone

ROLLBACK

- **Undoes changes** made during the current transaction
- Restores the database to its last committed state

2. Explain how transactions are managed in SQL databases

A **transaction** is a sequence of one or more SQL statements treated as a **single unit of work**.
Transactions follow the **ACID properties**:

- **Atomicity** – All operations succeed or none do
- **Consistency** – Database remains valid before and after transaction
- **Isolation** – Transactions do not interfere with each other
- **Durability** – Committed data is permanently saved

Transactions are managed using:

- BEGIN / START TRANSACTION
- COMMIT
- ROLLBACK
- SAVEPOINT

LAB EXERCISES

Lab 1: Insert rows and use COMMIT to save changes

```
START TRANSACTION;

INSERT INTO courses (course_id, course_name, course_duration)
VALUES
(201, 'Artificial Intelligence', 10),
(202, 'Machine Learning', 9);

COMMIT;
```

Lab 2: Insert rows and use ROLLBACK to undo changes

```
START TRANSACTION;

INSERT INTO courses (course_id, course_name, course_duration)
VALUES
(203, 'Blockchain', 6);

ROLLBACK;
```

Lab 3: Use SAVEPOINT to roll back specific changes

```
START TRANSACTION;

UPDATE courses
SET course_duration = 12
WHERE course_id = 201;
```

```
SAVEPOINT before_second_update;

UPDATE courses
SET course_duration = 11
WHERE course_id = 202;

ROLLBACK TO before_second_update;

COMMIT;
```

11. SQL Joins

Theory Questions

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

A **JOIN** in SQL is used to **combine rows from two or more tables** based on a **related column** (usually a primary key–foreign key relationship).

Types of JOINs

JOIN Type	Description
INNER JOIN	Returns only the rows that have **matching values in both tables**
LEFT JOIN (LEFT OUTER JOIN)	Returns **all rows from the left table** and matching rows from the right table; unmatched rows show NULL
RIGHT JOIN (RIGHT OUTER JOIN)	Returns **all rows from the right table** and matching rows from the left table
FULL OUTER JOIN	Returns **all rows from both tables**; unmatched rows contain NULL values

2. How are joins used to combine data from multiple tables?

Joins combine data by:

- Matching a **common column** between tables
- Allowing queries to retrieve related information stored across different tables
- Reducing data redundancy by following database normalization principles

Example:

SELECT e.name, d.department_name

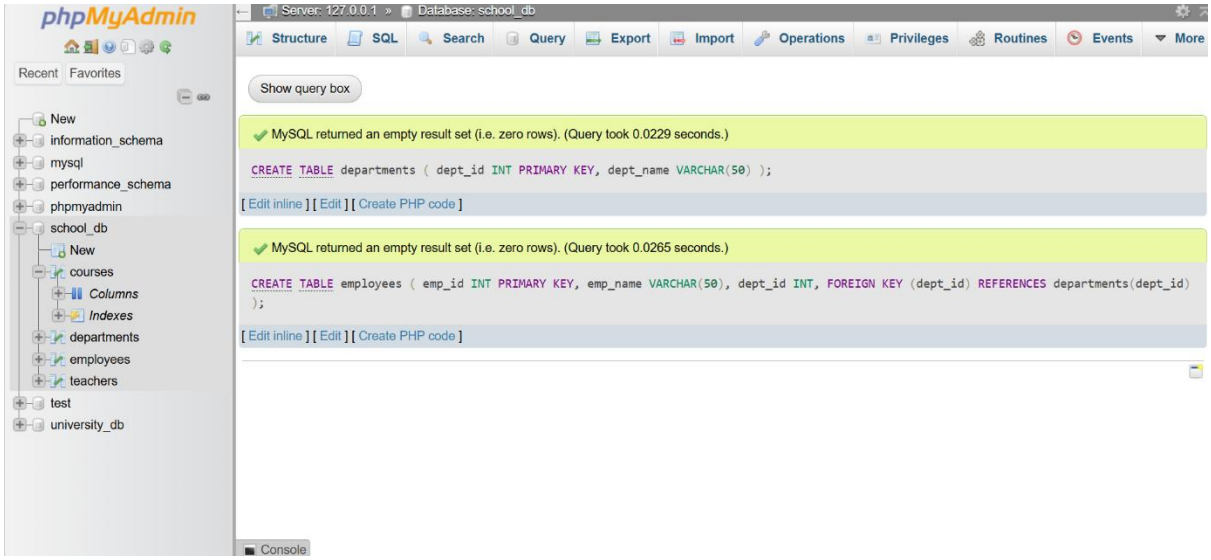
```
FROM employees e
JOIN departments d
ON e.department_id = d.department_id;
```

LAB EXERCISES

Lab 1: Create tables and perform an INNER JOIN

Create departments table

```
CREATE TABLE departments (
    dept_id INT PRIMARY KEY,
    dept_name VARCHAR(50)
);
```



Create employees table

```
CREATE TABLE employees (
    emp_id INT PRIMARY KEY,
    emp_name VARCHAR(50),
    dept_id INT,
    FOREIGN KEY (dept_id) REFERENCES departments(dept_id)
);
```

Insert sample data

INSERT INTO departments VALUES

(1, 'CSE'),

(2, 'IT'),

INSERT INTO employees VALUES

(1, 'Sweta', 1),

(2, 'Brijesh', 2),

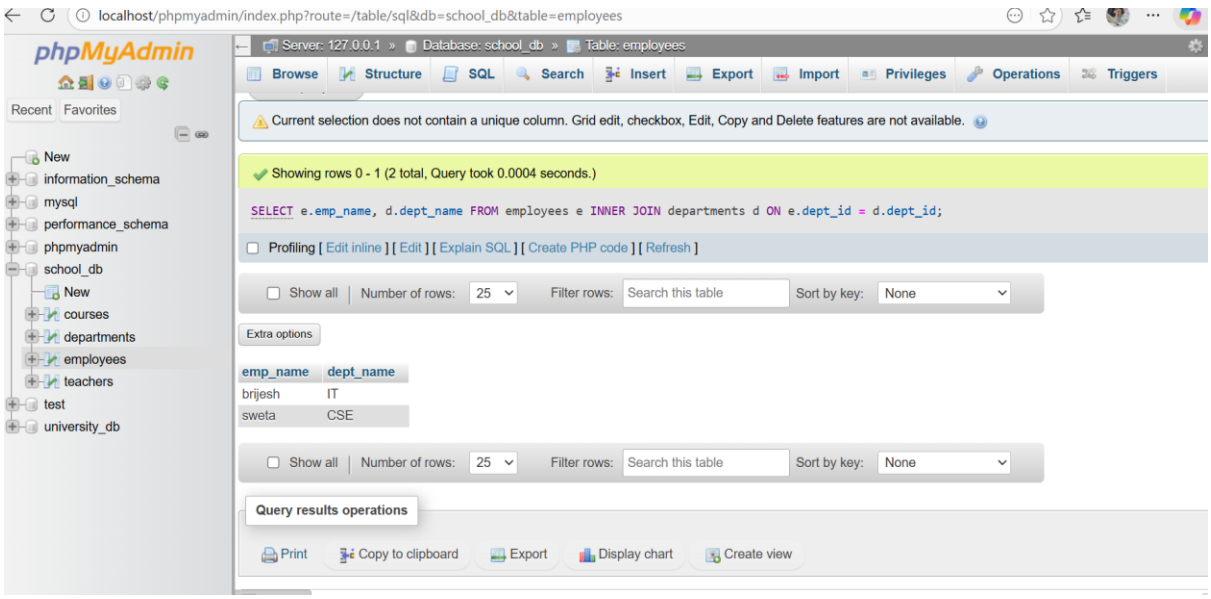
INNER JOIN query

SELECT e.emp_name, d.dept_name

FROM employees e

INNER JOIN departments d

ON e.dept_id = d.dept_id;



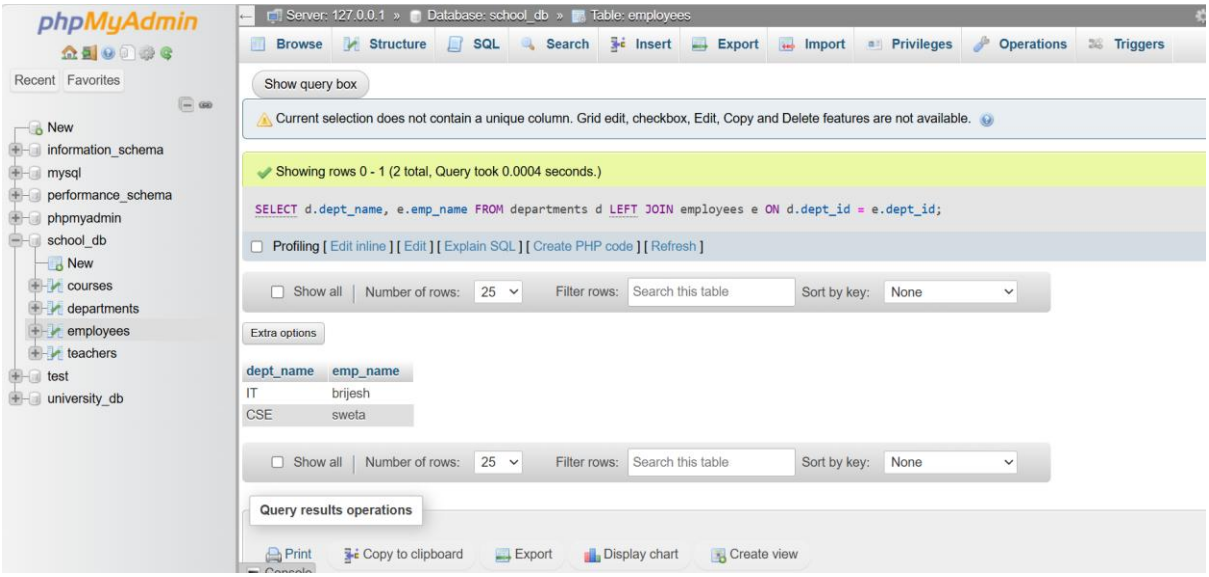
Lab 2: Use LEFT JOIN to show all departments

SELECT d.dept_name, e.emp_name

FROM departments d

LEFT JOIN employees e

ON d.dept_id = e.dept_id;



12. SQL GROUP BY

Theory Questions

1. What is the GROUP BY clause in SQL? How is it used with aggregate functions?

The **GROUP BY** clause is used to **group rows that have the same values** in one or more columns.
It is commonly used with **aggregate functions** to perform calculations on each group.

Common aggregate functions:

- COUNT() – counts rows
- SUM() – calculates total
- AVG() – calculates average
- MIN() – finds minimum value
- MAX() – finds maximum value

Example:

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

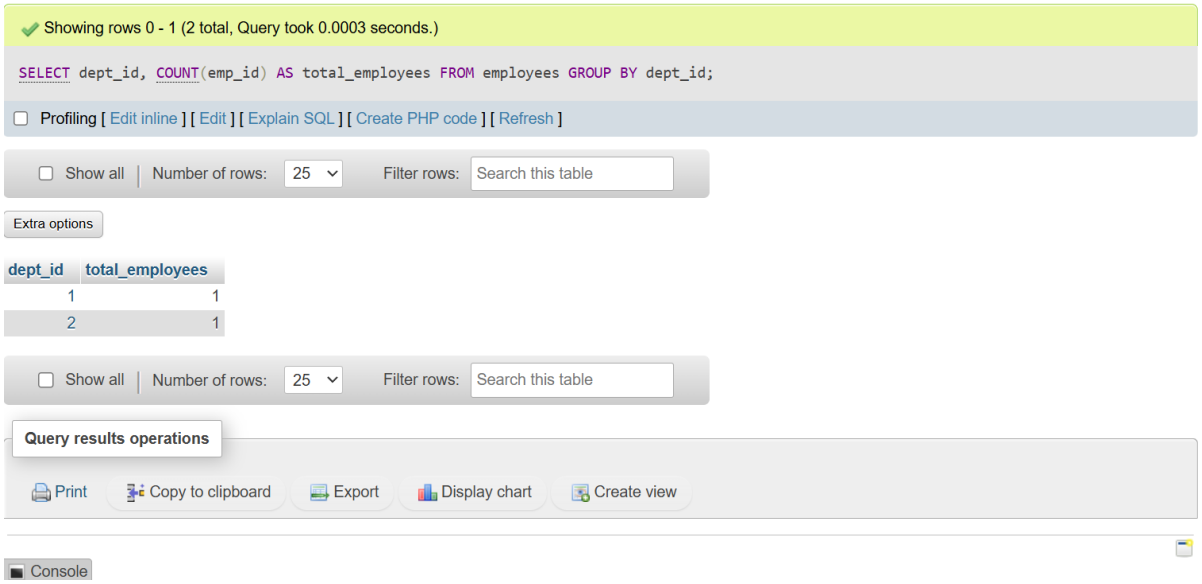
2. Explain the difference between GROUP BY and ORDER BY

GROUP BY	ORDER BY
Groups rows into summary rows	Sorts rows in the result set
Used with aggregate functions	Used for display ordering
Reduces number of rows	Does not change row count
Works before ORDER BY	Executes after GROUP BY

LAB EXERCISES

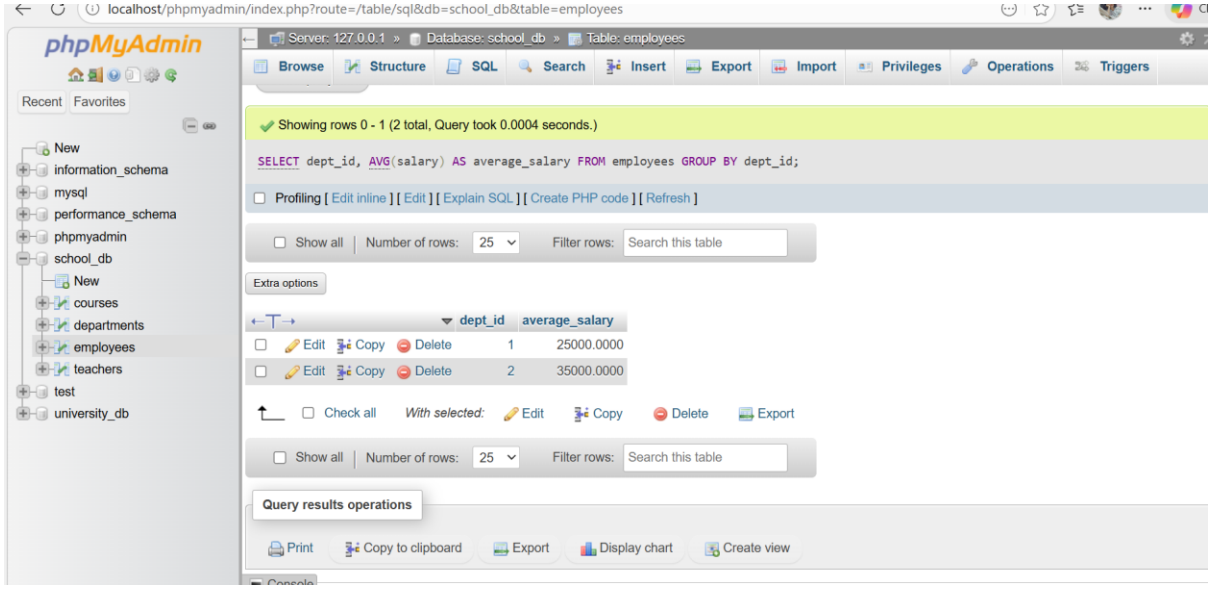
Lab 1: Count employees in each department

```
SELECT dept_id, COUNT(emp_id) AS total_employees
FROM employees
GROUP BY dept_id;
```



Lab 2: Find the average salary in each department

```
SELECT dept_id, AVG(salary) AS average_salary
FROM employees
GROUP BY dept_id;
```


localhost/phpmyadmin/index.php?route=/table/sql&db=school_db&table=employees
phpMyAdmin
Recent
Favorites
New
information_schema
mysql
performance_schema
phpmyadmin
school_db
New
courses
departments
employees
teachers
test
university_db
Server: 127.0.0.1 » Database: school_db » Table: employees
Browse
Structure
SQL
Search
Insert
Export
Import
Privileges
Operations
Triggers
Showing rows 0 - 1 (2 total, Query took 0.0004 seconds.)
SELECT dept_id, AVG(salary) AS average_salary FROM employees GROUP BY dept_id;
Profiling [Edit inline] [Edit] [Explain SQL] [Create PHP code] [Refresh]
Show all
Number of rows: 25
Filter rows: Search this table
Extra options
dept_id
average_salary
Edit Copy Delete 1 25000.0000
Edit Copy Delete 2 35000.0000
Check all
With selected:
Edit
Copy
Delete
Export
Show all
Number of rows: 25
Filter rows: Search this table
Query results operations
Print
Copy to clipboard
Export
Display chart
Create view

13. SQL Stored Procedure

1. What is a stored procedure in SQL, and how does it differ from a standard SQL query?

A **stored procedure** is a **precompiled set of one or more SQL statements** stored in the database and executed as a single unit.

Difference between Stored Procedure and SQL Query:

Stored Procedure	**SQL Query**
Stored in the database	Written and executed on the fly
Can accept parameters	Parameters are limited
Can contain multiple SQL statements	Usually a single statement
Improves performance	Executed every time
Can include logic (IF, LOOP)	No control statements

2. Explain the advantages of using stored procedures.

Advantages of Stored Procedures:

1. **Improved performance** (precompiled)
2. **Reusability** – write once, use many times
3. **Security** – direct table access can be restricted
4. **Reduced network traffic**
5. **Better maintainability**
6. **Supports programming logic** (conditions, loops)

LAB EXERCISES

Assumed Table Structures

```
employees (
   emp_id INT,
```

```
    emp_name VARCHAR(100),
    department VARCHAR(50),
    salary DECIMAL(10,2)
);

courses (
    course_id INT,
    course_name VARCHAR(100),
    duration INT,
    fees DECIMAL(10,2)
);
```

Lab 1: Stored Procedure to Retrieve Employees by Department

Stored Procedure

```
DELIMITER //

CREATE PROCEDURE GetEmployeesByDepartment (
    IN dept_name VARCHAR(50)
)
BEGIN
    SELECT *
    FROM employees
    WHERE department = dept_name;
END //

DELIMITER ;
```

Execution

```
CALL GetEmployeesByDepartment('HR');
```

Lab 2: Stored Procedure to Return Course Details Using course_id

Stored Procedure

```
DELIMITER //

CREATE PROCEDURE GetCourseDetails (
    IN c_id INT
)
BEGIN
```

```
    SELECT *
    FROM courses
    WHERE course_id = c_id;
END //

DELIMITER ;
```

Execution

```
CALL GetCourseDetails(201);
```

SQL view

1. What is a view in SQL, and how is it different from a table?

A **view** in SQL is a **virtual table** that is created using a **SELECT query**. It does not store data itself; it displays data from one or more tables.

Difference between View and Table

View	Table
Virtual table	Physical table
Does not store data	Stores data permanently
Created using SELECT query	Created using CREATE TABLE
Uses less storage	Requires storage
Data is always up-to-date	Data stored independently

2. Explain the advantages of using views in SQL databases.

Advantages of Views:

1. **Data security** – restrict access to sensitive columns
2. **Simplifies complex queries**
3. **Provides data abstraction**
4. **Improves query consistency**
5. **Easy maintenance**
6. **Reusable queries**

LAB EXERCISES

Assumed Table Structures

```
employees (
    emp_id INT,
    emp_name VARCHAR(100),
    salary DECIMAL(10,2),
    dept_id INT
);

departments (
    dept_id INT,
    dept_name VARCHAR(100)
);
```

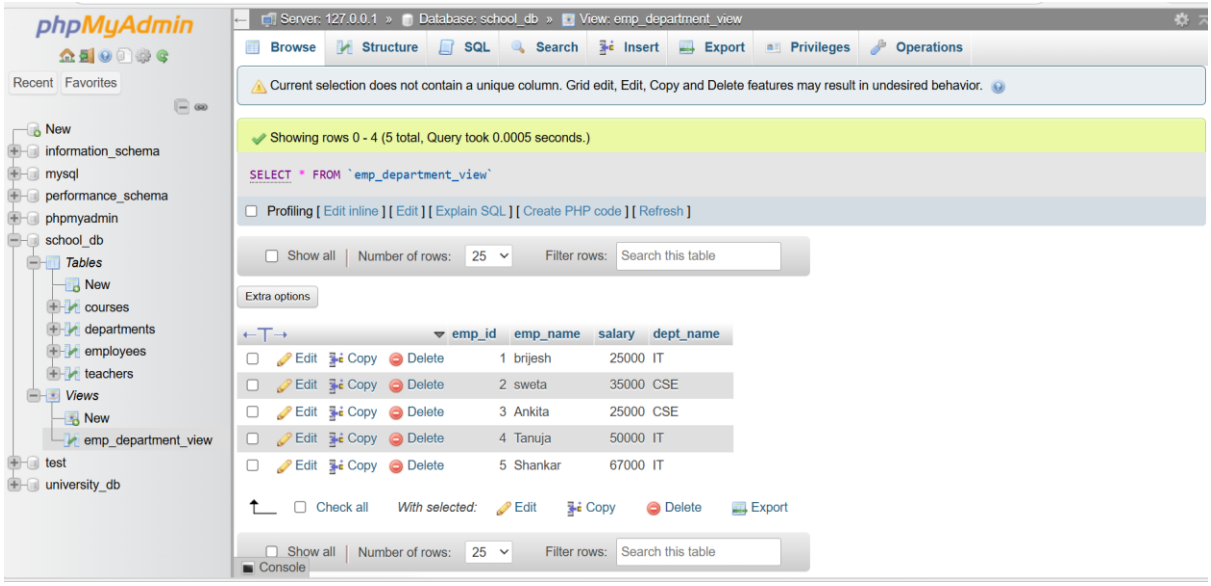
Lab 1: Create a View Showing Employees with Department Names

Create View

```
CREATE VIEW emp_department_view AS
SELECT
    e.emp_id,
    e.emp_name,
    e.salary,
    d.dept_name
FROM employees e
JOIN departments d
ON e.dept_id = d.dept_id;
```

Use the View

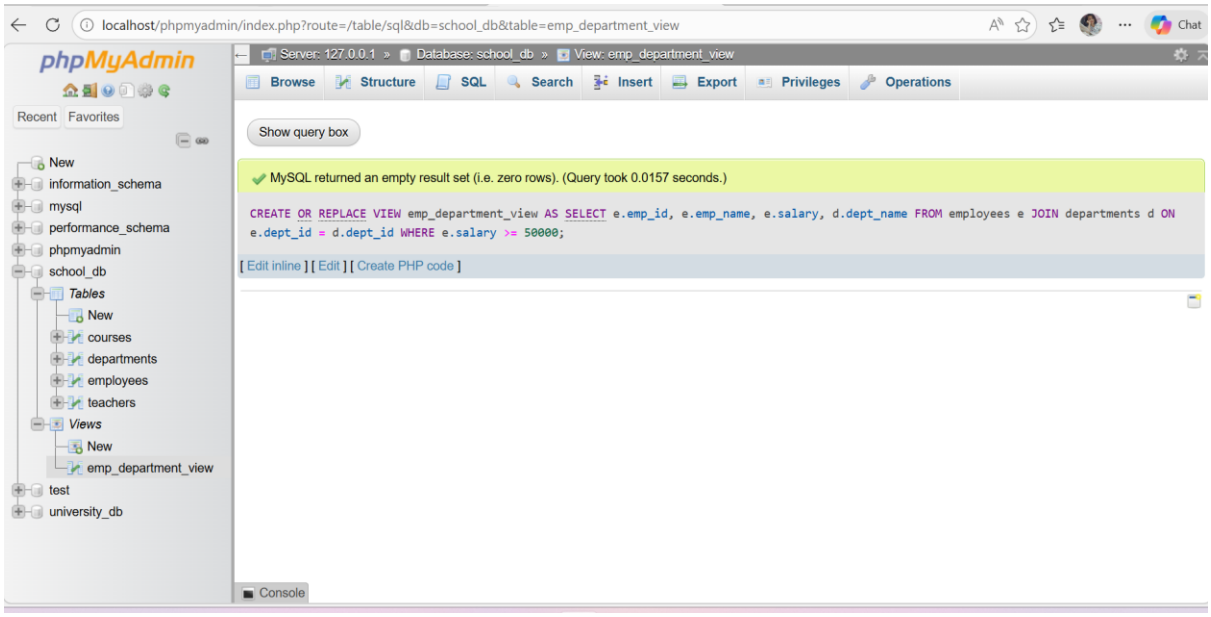
SELECT * FROM emp_department_view;

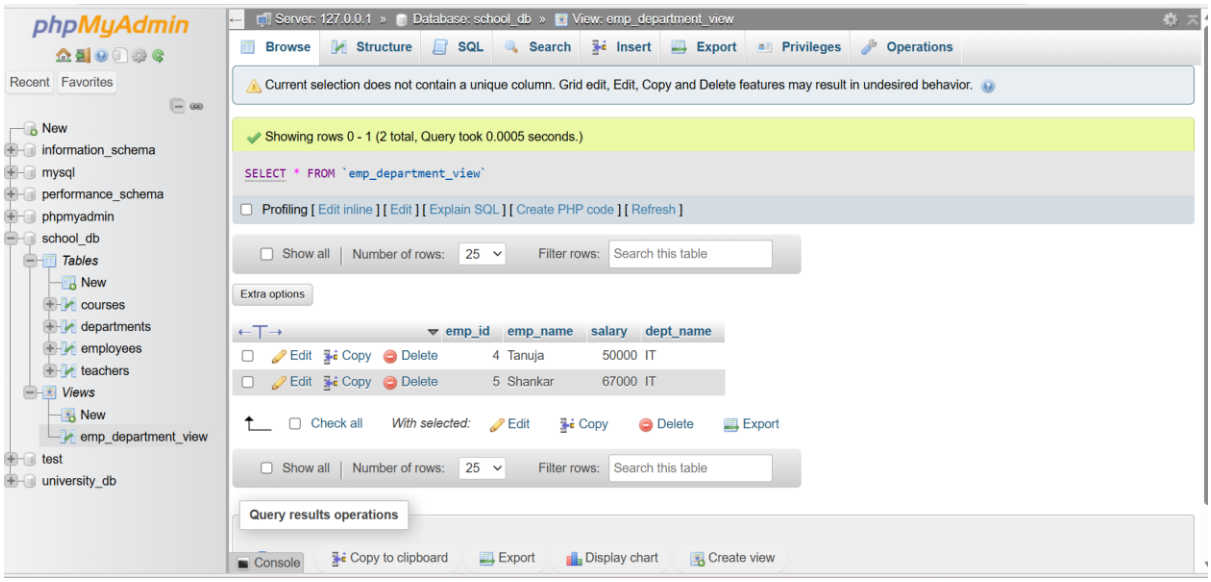


Lab 2: Modify the View to Exclude Employees with Salary Below $50,000

Modify View (Using CREATE OR REPLACE)

```
CREATE OR REPLACE VIEW emp_department_view AS
SELECT
    e.emp_id,
    e.emp_name,
    e.salary,
    d.dept_name
FROM employees e
JOIN departments d
ON e.dept_id = d.dept_id
WHERE e.salary >= 50000;
```




phpMyAdmin
Recent
Favorites
New
information_schema
mysql
performance_schema
phpmyadmin
school_db
Tables
New
courses
departments
employees
teachers
Views
New
emp_department_view
test
university_db
Server: 127.0.0.1 » Database: school_db » View: emp_department_view
Browse
Structure
SQL
Search
Insert
Export
Privileges
Operations
Current selection does not contain a unique column. Grid edit, Edit, Copy and Delete features may result in undesired behavior.
Showing rows 0 - 1 (2 total, Query took 0.0005 seconds.)
SELECT * FROM `emp_department_view`
Profiling [Edit inline] [Edit] [Explain SQL] [Create PHP code] [Refresh]
Show all
Number of rows: 25
Filter rows: Search this table
Extra options
emp_id
emp_name
salary
dept_name
Edit Copy Delete 4 Tanuja 50000 IT
Edit Copy Delete 5 Shankar 67000 IT
Check all
With selected:
Edit
Copy
Delete
Export
Show all
Number of rows: 25
Filter rows: Search this table
Query results operations
Console
Copy to clipboard
Export
Display chart
Create view

TRIGGER IN SQL

Theory Questions

1. What is a trigger in SQL? Describe its types and when they are used.

A **trigger** in SQL is a **database object** that automatically executes (fires) a set of SQL statements **in response to specific events** on a table or view.

Types of Triggers

Based on Timing

1. **BEFORE Trigger**
    - Executes **before** INSERT, UPDATE, or DELETE
    - Used for validation or modifying data before saving
2. **AFTER Trigger**
    - Executes **after** INSERT, UPDATE, or DELETE
    - Used for logging or auditing

Based on Event

1. **INSERT Trigger** – fires when a new record is added
2. **UPDATE Trigger** – fires when a record is modified
3. **DELETE Trigger** – fires when a record is removed

2. Explain the difference between INSERT, UPDATE, and DELETE triggers.

Trigger Type	Fires When	Common Usage
INSERT	New row is added	Logging new records
UPDATE	Existing row is modified	Tracking changes
DELETE	Row is removed	Backup or audit

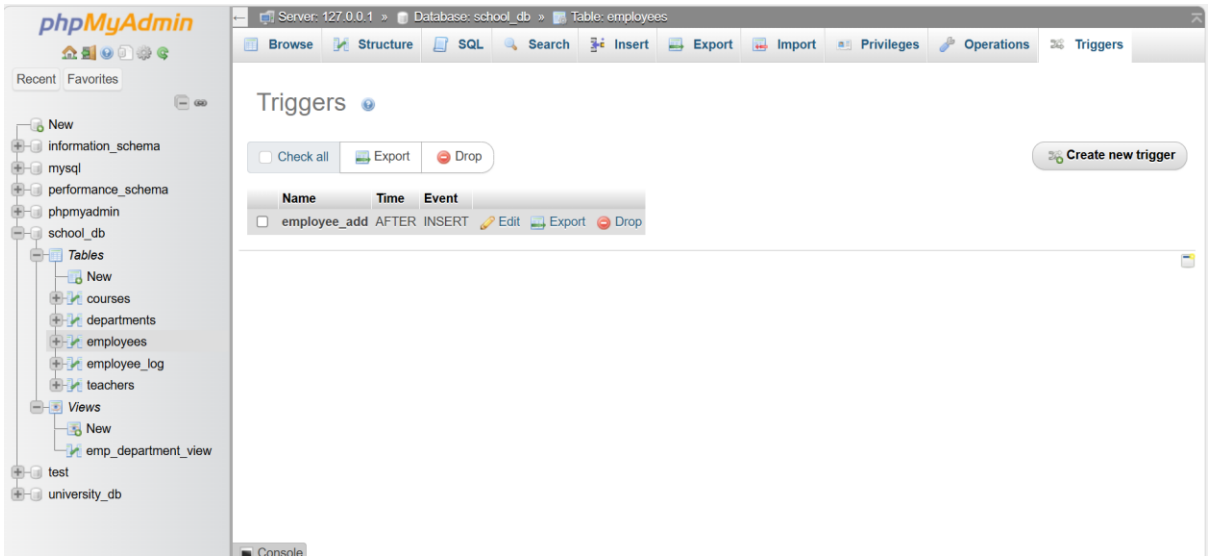
LAB EXERCISES

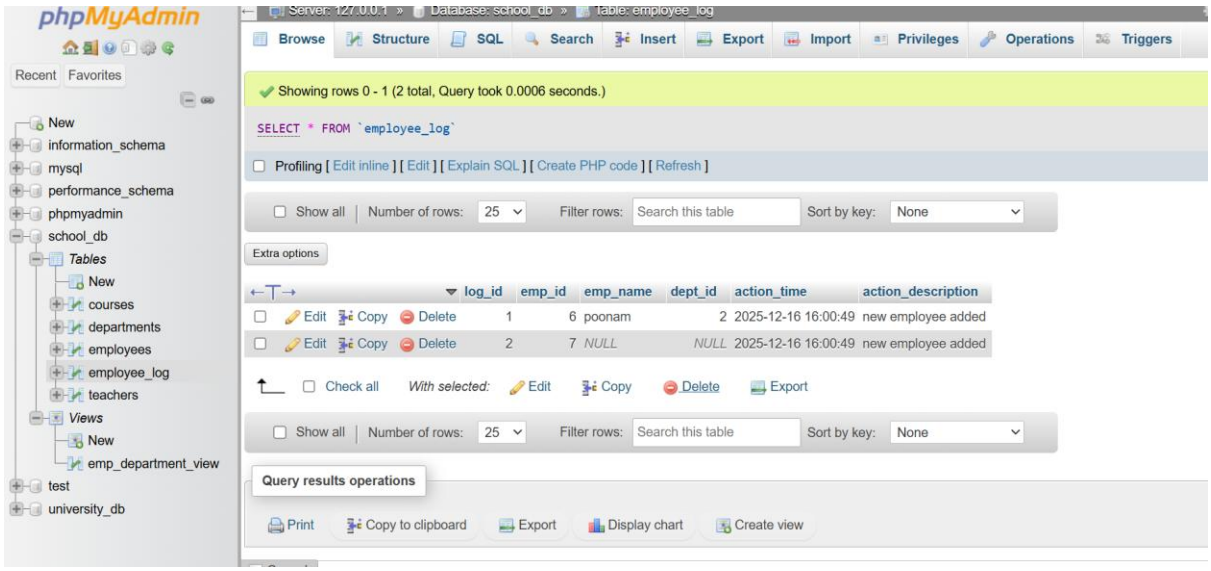
Assumed Table Structures

```
employees (
    emp_id INT PRIMARY KEY,
    emp_name VARCHAR(100),
    department VARCHAR(50),
    salary DECIMAL(10,2),
    last_modified TIMESTAMP
);

employee_log (
    log_id INT AUTO_INCREMENT PRIMARY KEY,
    emp_id INT,
    action VARCHAR(50),
    action_time TIMESTAMP
);
```

Lab 1: Trigger to Log When a New Employee Is Added

```
CREATE TABLE employee_log
(   log_id INT AUTO_INCREMENT PRIMARY KEY,
emp_id INT,
emp_name VARCHAR(200),
 dept_id INT,
action_time DATETIME,
action_description VARCHAR(200)
 );
DELIMITER $$
CREATE TRIGGER employee_add
 AFTER INSERT
 ON employee
FOR EACH ROW
BEGIN
INSERT INTO employee_log (emp_id, emp_name, dept_id, action_time,
action_description)
VALUES (NEW.emp_id, NEW.emp_name, NEW.dept_id, NOW(), 'new employee
added');
END $$
DELIMITER ;
```


phpMyAdmin
Recent Favorites
New
information_schema
mysql
performance_schema
phpmyadmin
school_db
Tables
New
courses
departments
employees
employee_log
teachers
Views
New
emp_department_view
test
university_db
Server: 127.0.0.1 » Database: school_db » Table: employees
Browse Structure SQL Search Insert Export Import Privileges Operations Triggers
Triggers
Check all Export Drop
Create new trigger
Name Time Event
employee_add AFTER INSERT Edit Export Drop
Console


phpMyAdmin
Recent Favorites
New
information_schema
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phpmyadmin
school_db
Tables
New
courses
departments
employees
employee_log
teachers
Views
New
emp_department_view
test
university_db
Server: 127.0.0.1 » Database: school_db » Table: employee_log
Browse Structure SQL Search Insert Export Import Privileges Operations Triggers
Showing rows 0 - 1 (2 total, Query took 0.0006 seconds.)
SELECT * FROM `employee_log`
Profiling [Edit inline] [Edit] [Explain SQL] [Create PHP code] [Refresh]
Show all | Number of rows: 25 Filter rows: Search this table Sort by key: None
Extra options
log_id emp_id emp_name dept_id action_time action_description
Edit Copy Delete 1 6 poonam 2 2025-12-16 16:00:49 new employee added
Edit Copy Delete 2 7 NULL NULL 2025-12-16 16:00:49 new employee added
Check all With selected: Edit Copy Delete Export
Show all | Number of rows: 25 Filter rows: Search this table Sort by key: None
Query results operations
Print Copy to clipboard Export Display chart Create view

Lab 2: Trigger to Update last_modified on Employee Update

```
DELIMITER $$

CREATE TRIGGER emp_modification

BEFORE UPDATE ON employee

FOR EACH ROW

BEGIN

INSERT INTO employee_log (emp_id, emp_name, dept_id, salary, action_time, action_description) VALUES (NEW.emp_id, NEW.emp_name, NEW.dept_id, NEW.salary, NOW(),'UPDATED');

END$$

 DELIMITER ;
```

PL/SQL

Theory Questions

1. What is PL/SQL, and how does it extend SQL's capabilities?

PL/SQL (Procedural Language / SQL) is Oracle's procedural extension of SQL that allows developers to write **blocks of code** containing **SQL statements along with programming constructs**.

How PL/SQL extends SQL:

- SQL works only with data manipulation
- PL/SQL adds:
    - Variables
    - Conditional statements (IF, CASE)
    - Loops (LOOP, WHILE, FOR)
    - Exception handling
- Allows writing complete programs inside the database

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

Benefits of PL/SQL:

1. **Improved performance** – multiple SQL statements executed in one block
2. **Reduced network traffic**
3. **Better error handling** using exceptions
4. **Modular programming** (procedures, functions)
5. **Secure code** stored inside the database
6. **Reusability and maintainability**

LAB EXERCISES

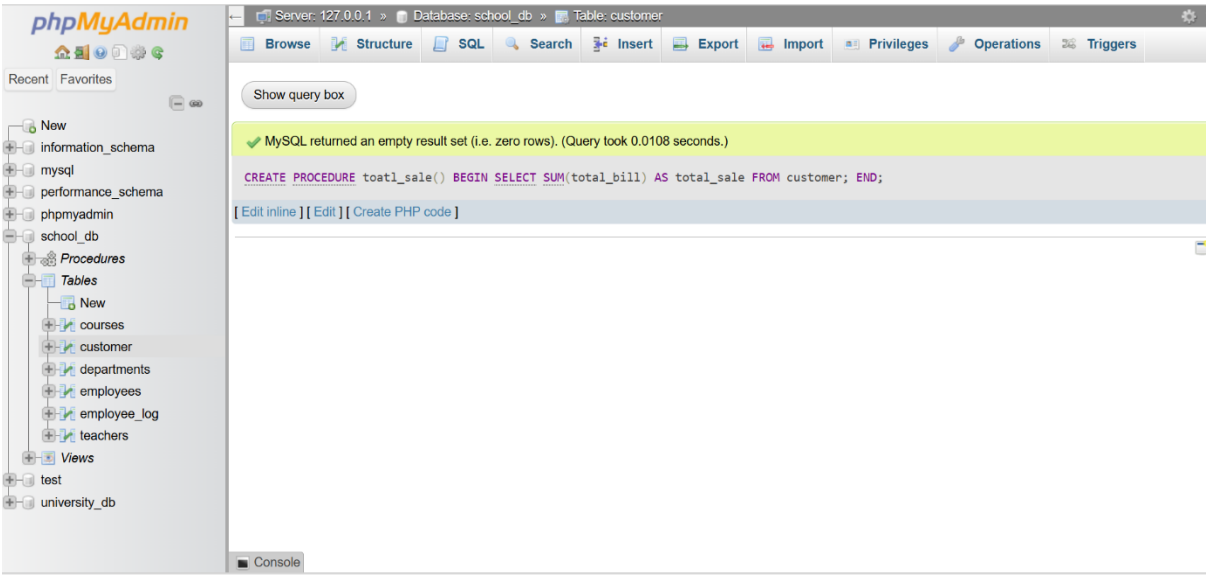
Lab 1: PL/SQL Block to Print Total Number of Employees

```
DECLARE
   total_employees NUMBER;
BEGIN
   SELECT COUNT(*)
   INTO total_employees
   FROM employees;

   DBMS_OUTPUT.PUT_LINE('Total Employees: ' || total_employees);
END;
/
```

• Lab 2: Create a PL/SQL block that calculates the total sales from an orders table

```
DELIMITER //
CREATE PROCEDURE total_sale()
BEGIN
SELECT SUM(total_bill) as total_sale from customer;
END //
DELIMITER ;
```


phpMyAdmin
Recent Favorites
New
information_schema
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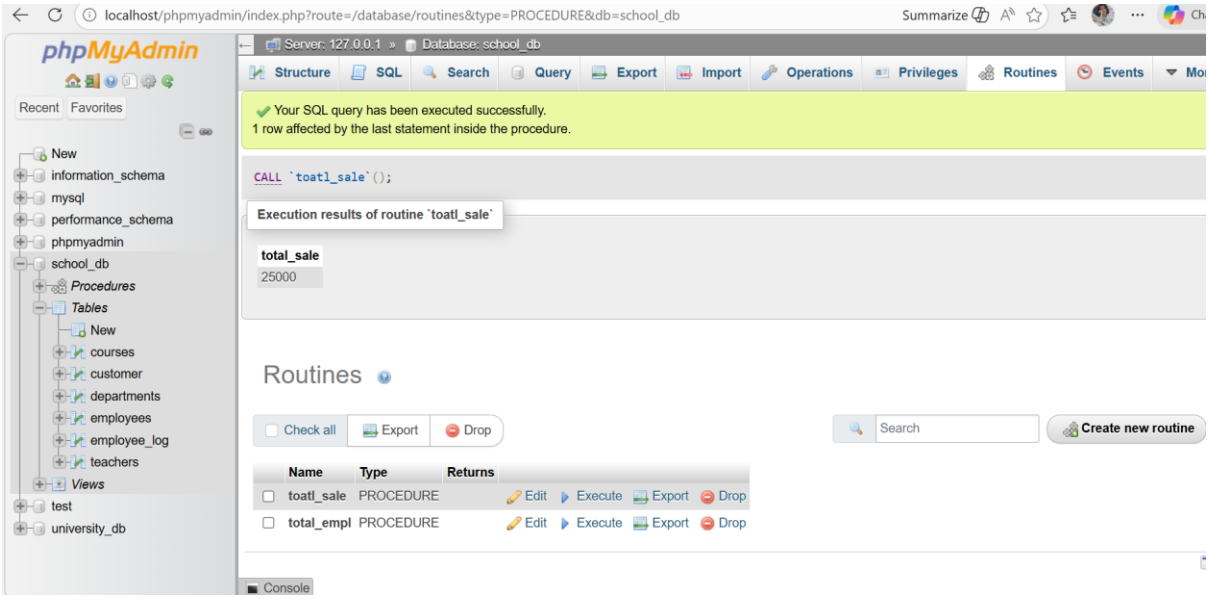
school_db
Procedures
Tables
New
courses
customer
departments
employees
employee_log
teachers
Views
test
university_db
Server: 127.0.0.1 » Database: school_db » Table: customer
Browse Structure SQL Search Insert Export Import Privileges Operations Triggers
Show query box
MySQL returned an empty result set (i.e. zero rows). (Query took 0.0108 seconds.)
CREATE PROCEDURE toatl_sale() BEGIN SELECT SUM(total_bill) AS total_sale FROM customer; END;
[Edit inline] [Edit] [Create PHP code]
Console


localhost/phpmyadmin/index.php?route=/database/routines&type=PROCEDURE&db=school_db
Summarize
phpMyAdmin
Recent Favorites
New
information_schema
mysql
performance_schema
phpmyadmin
school_db
Procedures
Tables
New
courses
customer
departments
employees
employee_log
teachers
Views
test
university_db
Server: 127.0.0.1 » Database: school_db
Structure SQL Search Query Export Import Operations Privileges Routines Events
Your SQL query has been executed successfully.
1 row affected by the last statement inside the procedure.
CALL `toatl_sale`();
Execution results of routine `toatl_sale`
total_sale
25000
Routines
Check all Export Drop
Search
Create new routine
Name Type Returns
toatl_sale PROCEDURE Edit Execute Export Drop
total_empl PROCEDURE Edit Execute Export Drop
Console

17. PL/SQL Control Structures

Theory Questions:

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

What are control structures?

Control structures in PL/SQL are programming constructs that **control the flow of execution** of a program. They allow PL/SQL programs to make decisions, repeat statements, and execute code conditionally.

PL/SQL control structures are mainly classified into:

1. **Conditional control structures**
2. **Iterative (looping) control structures**
3. **Sequential control structures**

A. IF-THEN Control Structure

The **IF-THEN** structure is used to execute a block of statements **only when a condition is true**.

Syntax

```
IF condition THEN
  statements;
END IF;
```

IF-THEN-ELSE

```
IF condition THEN
  statements;
ELSE
  statements;
END IF;
```

IF-THEN-ELSIF

```
IF condition1 THEN
  statements;
ELSIF condition2 THEN
  statements;
ELSE
  statements;
END IF;
```

Example

```
IF salary > 50000 THEN
  bonus := salary * 0.10;
ELSE
  bonus := salary * 0.05;
END IF;
```

Use:

- Decision making
- Validation of data
- Conditional execution of SQL statements

B. LOOP Control Structure

Loops are used to **execute a set of statements repeatedly** until a condition is met.

Types of loops in PL/SQL

1. Basic LOOP

Executes until an explicit EXIT condition is met.

```
LOOP
  statements;
```

```
  EXIT WHEN condition;
END LOOP;
```

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

Control structures in PL/SQL allow programmers to combine **procedural logic with SQL**, making it possible to handle complex database operations that cannot be achieved using SQL alone.

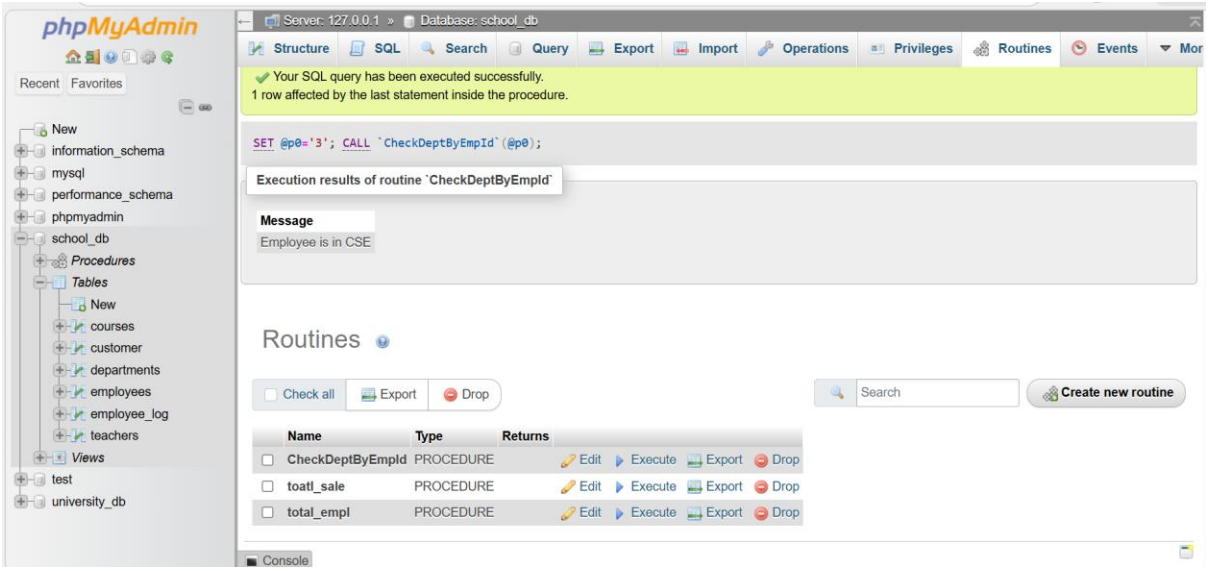
Key ways they help:

3. **Conditional execution of queries**
   Using `IF-THEN-ELSE`, different SQL statements can be executed based on conditions such as input values or query results.
4. **Row-by-row processing**
   Loop structures (`FOR`, `WHILE`, `LOOP`) allow repeated execution of SQL statements, enabling processing of multiple rows returned by a query.
5. **Data validation and business logic**
   Conditions can be checked before inserting, updating, or deleting data, ensuring data integrity and enforcement of business rules.
6. **Dynamic decision making**
   Queries can behave differently at runtime based on variable values, making programs flexible and adaptive.
7. **Error handling and control flow**
   Control structures help manage exceptions and guide program flow during errors, improving reliability.

LAB EXERCISES:

• Lab 1: Write a PL/SQL block using an IF-THEN condition to check the department of an employee.

```
DELIMITER //
CREATE PROCEDURE CheckDeptByEmpId(IN emp INT)
BEGIN
DECLARE temp_name VARCHAR(100);
SELECT d.dept_name INTO temp_name
FROM employee e
JOIN departments d ON e.dept_id = d.dept_id
WHERE e.emp_id = emp;
IF temp_name IS NOT NULL THEN
SELECT CONCAT('Employee is in ', temp_name) AS
Message;
ELSE
SELECT 'Employee id is invalid ' AS Message;
END IF;
END //
DELIMITER ;
```


phpMyAdmin
Recent Favorites
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information_schema
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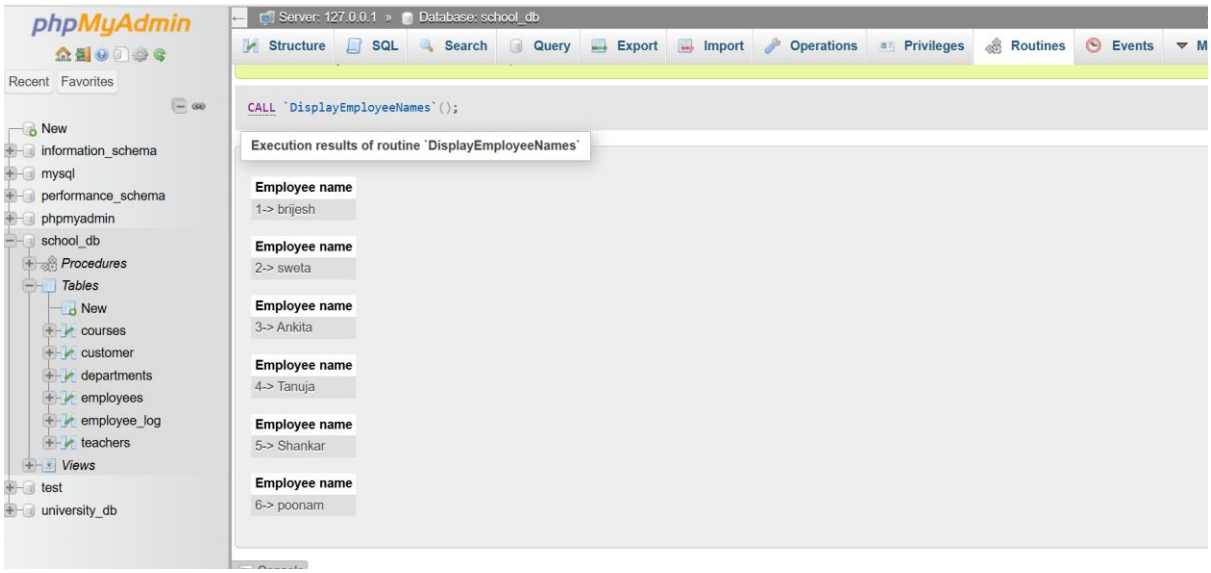
phpmyadmin
school_db
Procedures
Tables
New
courses
customer
departments
employees
employee_log
teachers
Views
test
university_db
Server: 127.0.0.1 » Database: school_db
Structure SQL Search Query Export Import Operations Privileges Routines Events Mor
Your SQL query has been executed successfully.
1 row affected by the last statement inside the procedure.
SET @p0='3'; CALL `CheckDeptByEmpId`(@p0);
Execution results of routine `CheckDeptByEmpId`
Message
Employee is in CSE
Routines
Check all Export Drop
Search
Create new routine
Name Type Returns
CheckDeptByEmpId PROCEDURE Edit Execute Export Drop
toatl_sale PROCEDURE Edit Execute Export Drop
total_empl PROCEDURE Edit Execute Export Drop
Console

• Lab 2: Use a FOR LOOP to iterate through employee records and display their names.

```
DELIMITER //
CREATE PROCEDURE DisplayEmployeeNames()
BEGIN
DECLARE total INT DEFAULT 0;
DECLARE counter INT DEFAULT 1;
DECLARE empName VARCHAR(100);
SELECT COUNT(*) INTO total FROM employees;
WHILE counter <= total DO
SELECT emp_name INTO empName
FROM employees
WHERE emp_id = counter;
SELECT CONCAT(counter, '-> ', empName) AS
'Employee name';
SET counter = counter + 1;
END WHILE;
END //
DELIMITER ;
```


phpMyAdmin
Recent
Favorites
New
information_schema
mysql
performance_schema
phpmyadmin
school_db
Procedures
Tables
New
courses
customer
departments
employees
employee_log
teachers
Views
test
university_db
Server: 127.0.0.1 » Database: school_db
Structure
SQL
Search
Query
Export
Import
Operations
Privileges
Routines
Events
CALL `DisplayEmployeeNames`();
Execution results of routine `DisplayEmployeeNames`
Employee name
1-> brijesh
Employee name
2-> sweta
Employee name
3-> Ankita
Employee name
4-> Tanuja
Employee name
5-> Shankar
Employee name
6-> poonam

18. SQL Cursors Theory Questions:

1. What is a cursor in PL/SQL?

A **cursor** in PL/SQL is a pointer to a **private SQL work area** that stores information about the execution of a SQL statement. It allows PL/SQL to **process the rows returned by a SQL query one at a time**.

Whenever a SQL statement is executed, Oracle creates a cursor to:

- Parse the SQL statement
- Execute it
- Store and retrieve the result set

Implicit vs. Explicit Cursors

Feature	Implicit Cursor	Explicit Cursor
Created by	Oracle automatically	Programmer explicitly
Used for	INSERT, UPDATE, DELETE, and SELECT INTO	SELECT statements returning multiple rows
Declaration	Not required	Required
Cursor name	SQL	User-defined
Control over processing	Limited	Full control
Cursor attributes	SQL%FOUND, SQL%NOTFOUND, SQL%ROWCOUNT	cursor_name%FOUND, etc.

Implicit Cursor Example

```
BEGIN
  UPDATE employees
  SET salary = salary * 1.1
```

```
  WHERE department_id = 10;

  IF SQL%ROWCOUNT > 0 THEN
    DBMS_OUTPUT.PUT_LINE('Rows updated');
  END IF;
END;
```

Explicit Cursor Example

```
DECLARE
  CURSOR emp_cur IS
    SELECT employee_id, salary FROM employees;
  v_emp_id employees.employee_id%TYPE;
  v_salary employees.salary%TYPE;
BEGIN
  OPEN emp_cur;
  LOOP
```

LAB EXERCISES:

• Lab 1: Write a PL/SQL block using an explicit cursor to retrieve and display employee details.

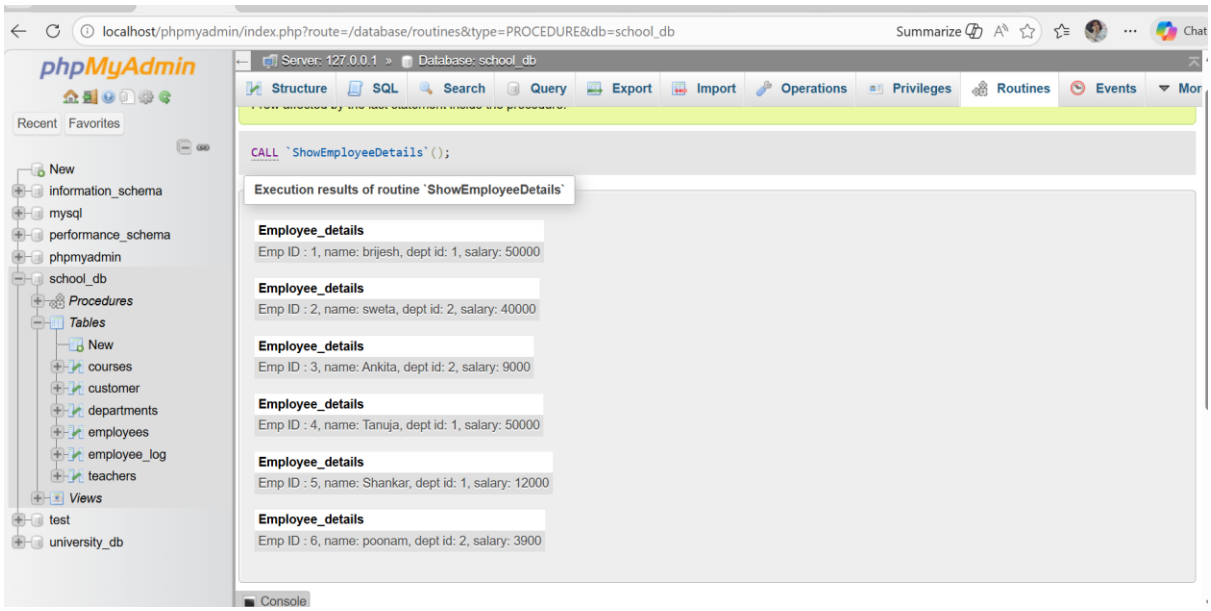
```
DELIMITER //

CREATE PROCEDURE ShowEmployeeDetails()

BEGIN

DECLARE h_id INT;

DECLARE h_name VARCHAR(100);

DECLARE h_dept INT;

DECLARE h_salary INT;

DECLARE done INT DEFAULT 0;

DECLARE emp_cursor CURSOR FOR

SELECT emp_id, emp_name, dept_id, salary FROM

employees;

DECLARE CONTINUE HANDLER FOR NOT FOUND

SET done = 1;

OPEN emp_cursor;

read_loop: LOOP

FETCH emp_cursor INTO h_id, h_name, h_dept,

h_salary;

IF done = 1 THEN

LEAVE read_loop;

END IF;

SELECT CONCAT('Emp ID : ', h_id, ', name: ', h_name,

', dept id: ', h_dept, ', salary: ', h_salary) AS

Employee_details;
```

END LOOP;

CLOSE emp_cursor;

END //

DELIMITER ;



- Lab 2: Create a cursor to retrieve all courses and display them one by one.

DELIMITER //

CREATE PROCEDURE ShowCourses()

BEGIN

DECLARE c_id INT;

DECLARE c_name VARCHAR(100);

DECLARE c_duration VARCHAR(50);

DECLARE done INT DEFAULT 0;

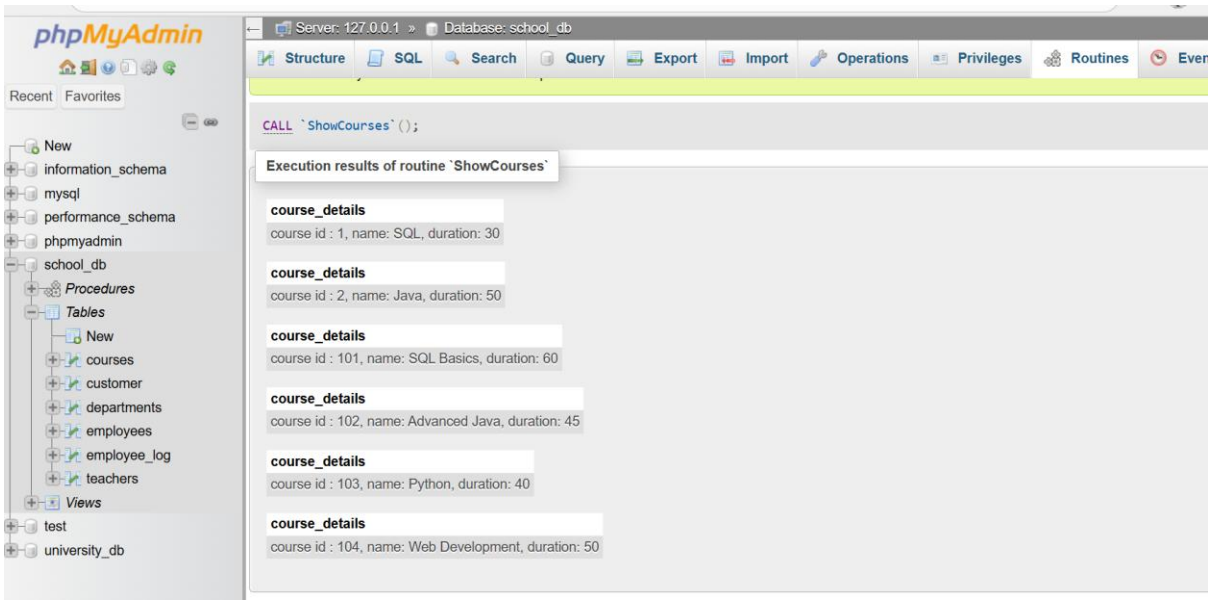
DECLARE course_cursor CURSOR FOR

SELECT course_id, course_name, course_duration

FROM courses;

DECLARE CONTINUE HANDLER FOR NOT FOUND

```
SET done = 1;
OPEN course_cursor;
read_loop: LOOP
FETCH course_cursor INTO c_id, c_name, c_duration;
IF done = 1 THEN
LEAVE read_loop;
END IF;
SELECT CONCAT('course id : ', c_id, ', name: ',
c_name, ', duration: ', c_duration) AS course_details;
END LOOP;
CLOSE course_cursor;
END //
DELIMITER ;
```



19. Rollback and Commit Savepoint

Theory Questions:

1. Concept of SAVEPOINT in Transaction Management

A SAVEPOINT is a marker set within a transaction that allows you to roll back part of the transaction without undoing the entire transaction.

It enables partial rollback, giving finer control over transaction management.

Syntax

SAVEPOINT savepoint_name;

Interaction of SAVEPOINT with ROLLBACK and COMMIT

ROLLBACK

- ROLLBACK TO savepoint_name;
    - Reverses all changes made after the specified savepoint
    - Changes made before the savepoint remain intact
- ROLLBACK;
    - Cancels the entire transaction
    - Removes all savepoints

COMMIT

- COMMIT;
    - Makes all changes permanent
    - Eliminates all savepoints
    - After a commit, rollback to any savepoint is not possible

Example

INSERT INTO orders VALUES (101, 'Laptop');

```
SAVEPOINT sp1;

INSERT INTO orders VALUES (102, 'Phone');
SAVEPOINT sp2;

DELETE FROM orders WHERE order_id = 101;

ROLLBACK TO sp2;  -- Undoes DELETE only
COMMIT;           -- Saves remaining changes
```

2. When is it useful to use savepoints?

Savepoints are useful when:

- Performing complex transactions with multiple steps
- You want to undo only part of a transaction when an error occurs
- Handling conditional logic within a transaction
- Reducing the cost of rolling back a long transaction
- Implementing error recovery in stored procedures
- Testing intermediate transaction states

Real-World Example

In an online order system:

1. Create customer record
2. Create order
3. Process payment

If payment fails, you can rollback to a savepoint before payment, instead of canceling the entire order creation.

LAB EXERCISES:

• Lab 1: Perform a transaction where you create a savepoint, insert records, then rollback to the savepoint.

```
START TRANSACTION;

INSERT INTO employee (emp_name, dept_id, salary)

VALUES ('abhay', 2, 70000);

SAVEPOINT after_first_insert;

INSERT INTO employee (emp_name, dept_id, salary)

 VALUES ('sayan', 1, 52000);

 ROLLBACK TO after_first_insert;

COMMIT;
```

• Lab 2: Commit part of a transaction after using a savepoint and then rollback the remaining changes.

```
START TRANSACTION;

INSERT INTO courses (course_id, course_name, course_duration)

 VALUES (1009, 'cloud basics', '6 months');

 SAVEPOINT after_first_course;

 INSERT INTO courses (course_id, course_name, course_duration)

VALUES (1010, 'data analytics', '7 months');

 RELEASE SAVEPOINT after_first_course;

 COMMIT;

START TRANSACTION;

INSERT INTO courses (course_id, course_name, course_duration)

 VALUES (1011, 'ai ml', '8 months');

SAVEPOINT after_new_course;

INSERT INTO courses (course_id, course_name, course_duration)

 VALUES (1012, 'seo', '5 months');

ROLLBACK TO after_new_course;

 COMMIT;

CREATE DATABASE library_db;
```

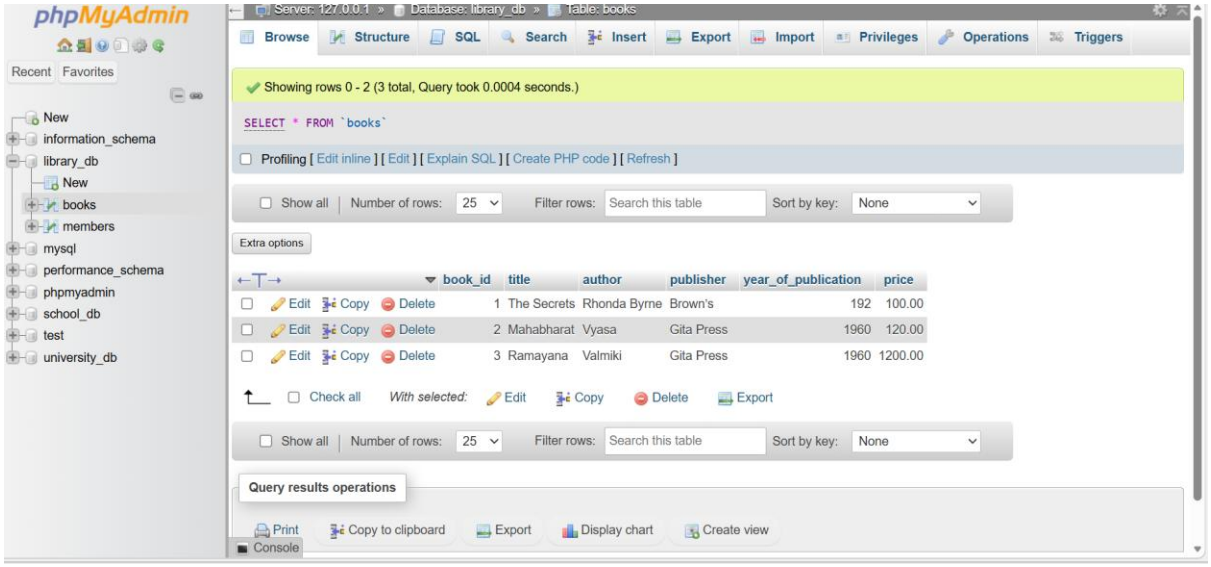
EXTRA LAB PRACTISE FOR DATABASE CONCEPTS

1.Introduction to SQL LAB EXERCISES:

- Lab 3: Create a database called library_db and a table books with columns: book_id, title, author, publisher, year_of_publication, and price.

Insert five records into the table.

```
USE library_db;


CREATE TABLE books (
   book_id INT PRIMARY KEY,
   title VARCHAR(100),
   author VARCHAR(100),
   publisher VARCHAR(100),
   year_of_publication INT,
   price DECIMAL(6,2)
);


INSERT INTO books VALUES
(1, 'The Secrets', 'Rhonda Byrne', 'Brown’s ', 192, 100),
(2, 'Mahabharat', 'Vyasa', 'Gita Press', 1960, 120),
(3, 'Ramayana', 'Valmiki', 'Secker & Warbur',2020,1200);
```



• Lab 4: Create a table members in library_db with columns: member_id, member_name, date_of_membership, and email. Insert five records into this table.

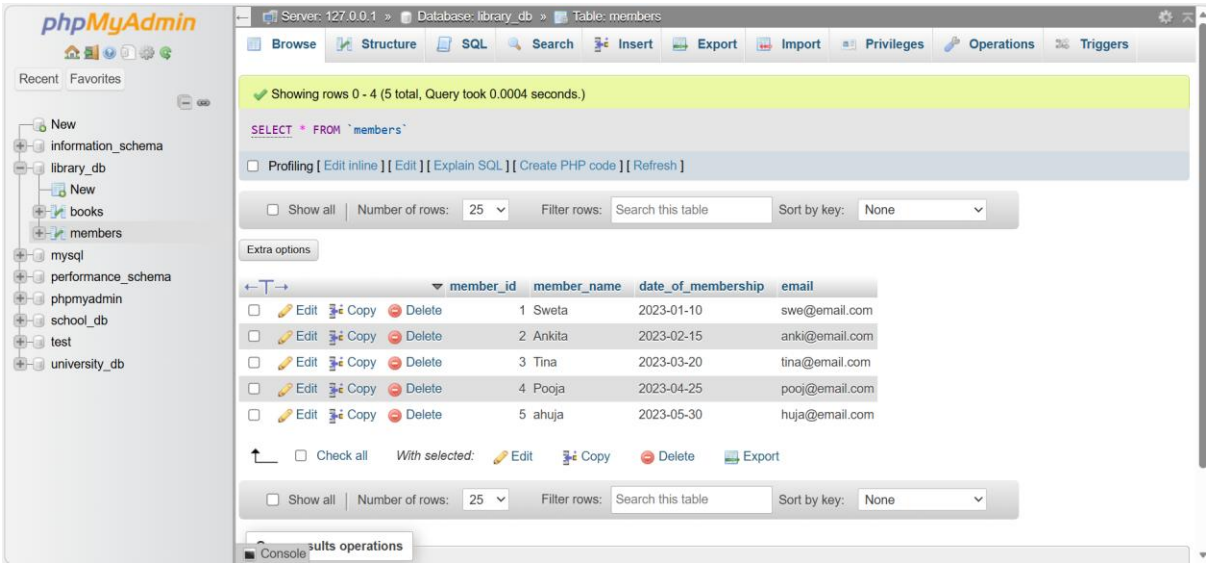
```
USE library_db;

CREATE TABLE members (
    member_id INT AUTO_INCREMENT PRIMARY KEY,
    member_name VARCHAR(100),
    date_of_membership DATE,
    email VARCHAR(100)
);

INSERT INTO members (member_name, date_of_membership, email) VALUES
('Sweta', '2023-01-10', 'swe@email.com'),
```

('Ankita', '2023-02-15', 'anki@email.com'),

('Tina', '2023-03-20', 'tina@email.com'),

('Pooja', '2023-04-25', 'pooj@email.com'),

('ahuja', '2023-05-30', 'huja@email.com');



2. SQL Syntax LAB EXERCISES:

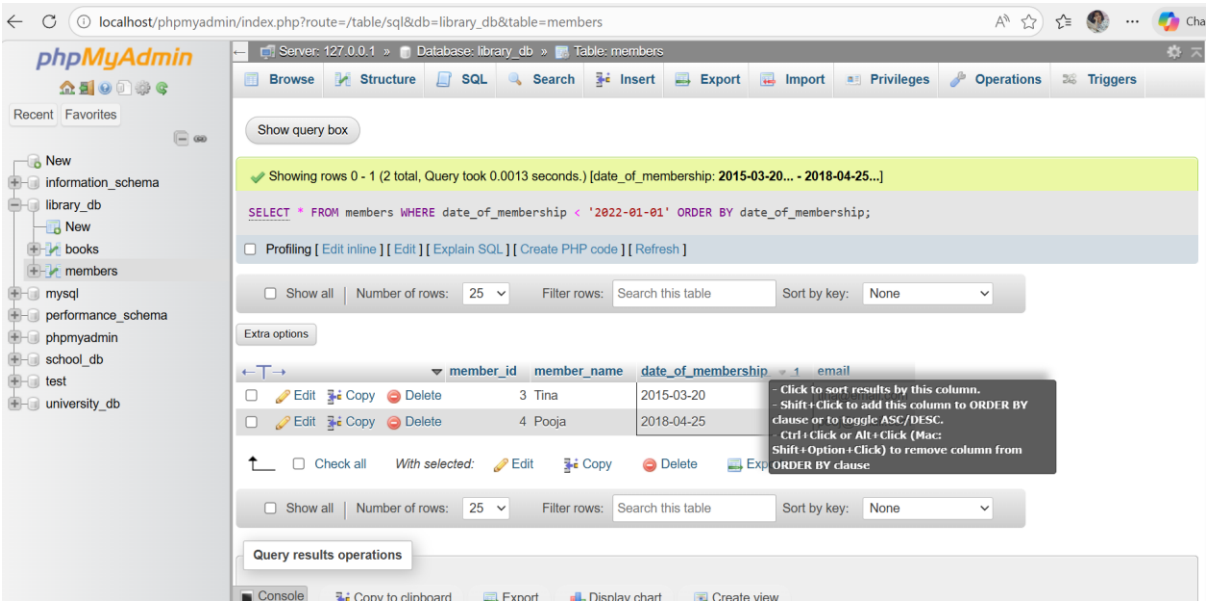
• Lab 3: Retrieve all members who joined the library before 2022. Use appropriate SQL syntax with WHERE and ORDER BY.

SELECT *

FROM members

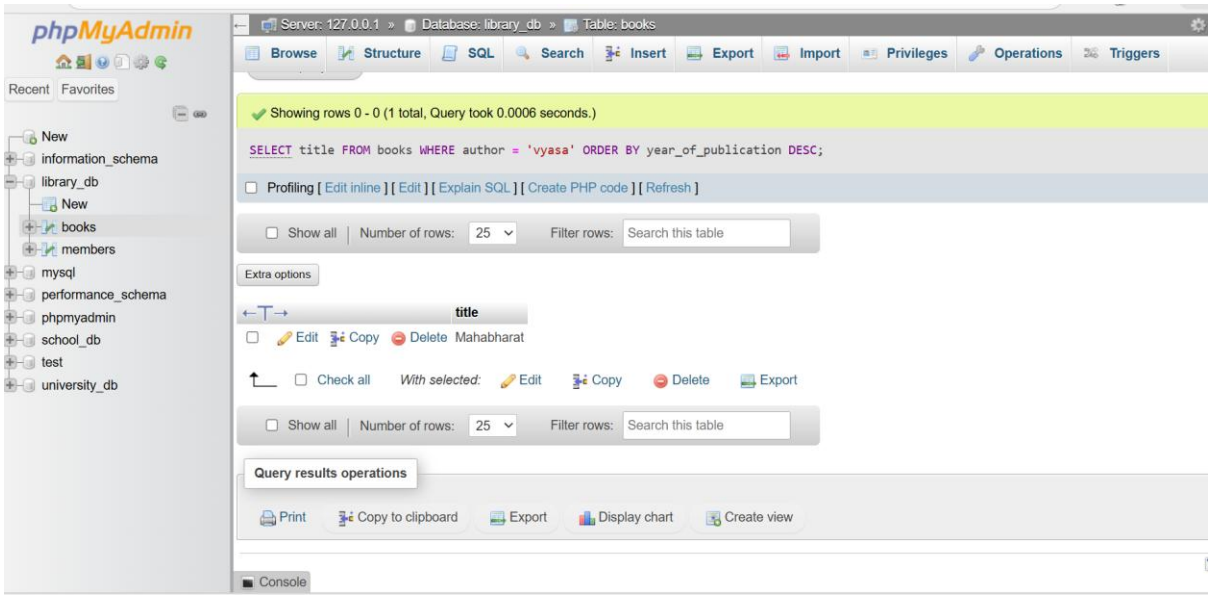
WHERE date_of_membership < '2022-01-01'

ORDER BY date_of_membership;



• Lab 4: Write SQL queries to display the titles of books published by a specific author. Sort the results by year_of_publication in descending order

```
SELECT title
FROM books
WHERE author = 'vyasa'
ORDER BY year_of_publication DESC;
```



4. SQL Constraints LAB EXERCISES:

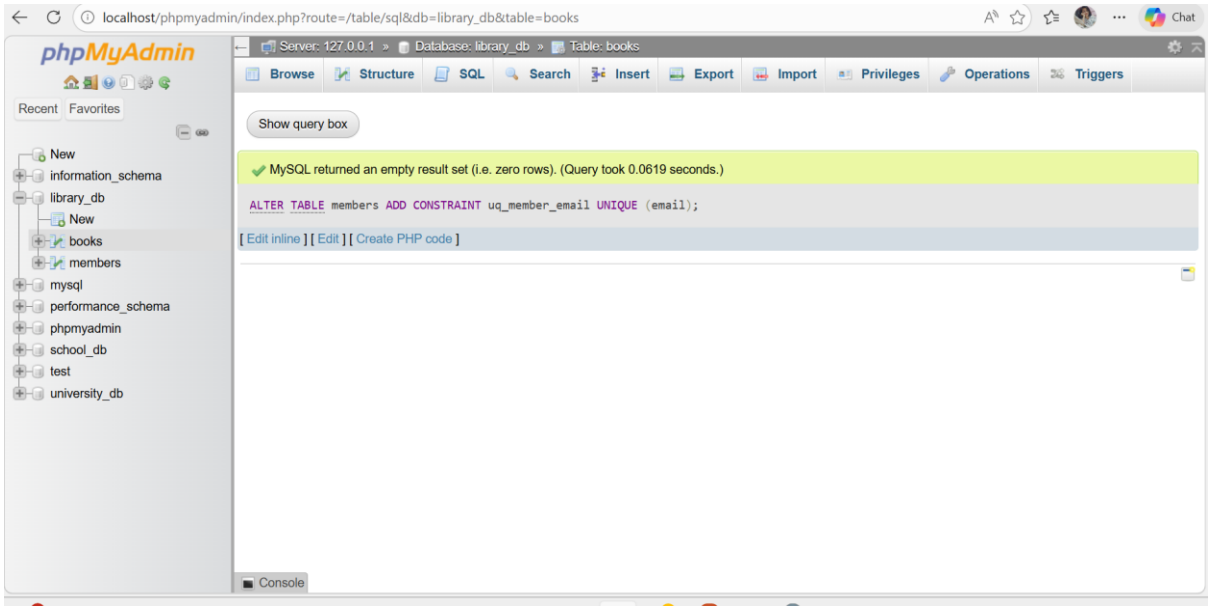
• Lab 3: Add a CHECK constraint to ensure that the price of books in the books table is greater than 0.

• Lab 4: Modify the members table to add a UNIQUE constraint on the email column, ensuring that each member has a unique email address.

ALTER TABLE members

ADD CONSTRAINT uq_member_email

UNIQUE (email);

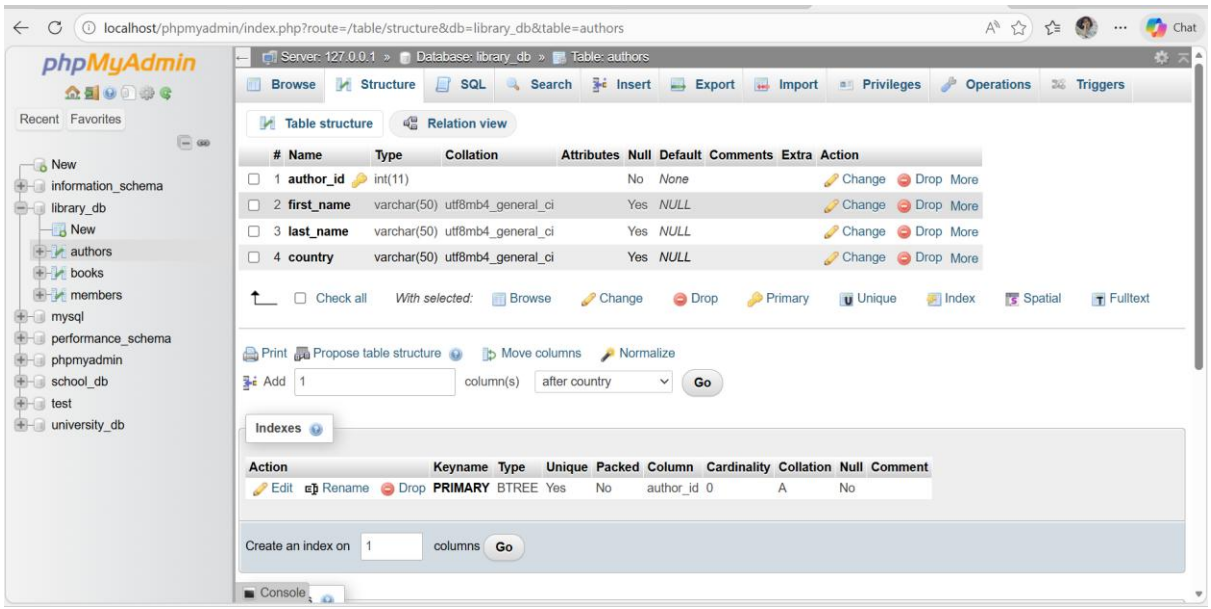


5. Main SQL Commands and Sub-commands (DDL)

LAB EXERCISES:

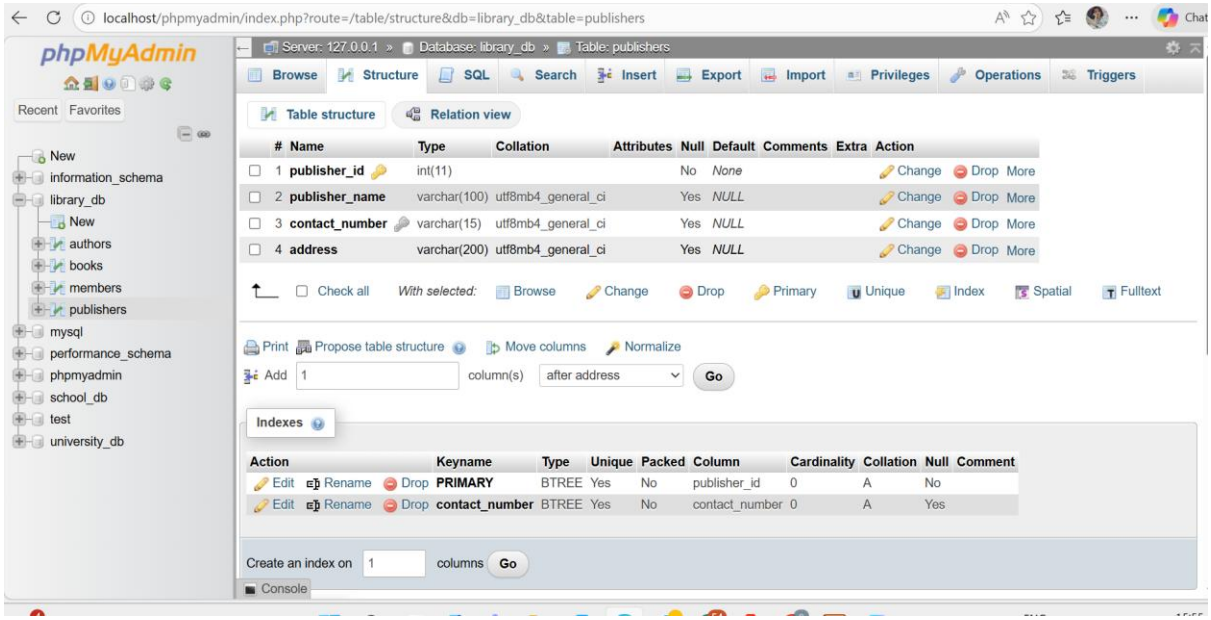
• Lab 3: Create a table authors with the following columns: author_id, first_name, last_name, and country. Set author_id as the primary key.

```
USE library_db;


CREATE TABLE authors (
    author_id INT PRIMARY KEY,
    first_name VARCHAR(50),
    last_name VARCHAR(50),
    country VARCHAR(50)
);
```



• Lab 4: Create a table publishers with columns: publisher_id, publisher_name, contact_number, and address. Set publisher_id as the primary key and contact_number as unique.

```
CREATE TABLE publishers (
 publisher_id INT PRIMARY KEY,
 publisher_name VARCHAR(100),
 contact_number VARCHAR(15),
 address VARCHAR(200),
 UNIQUE (contact_number)
 );
```



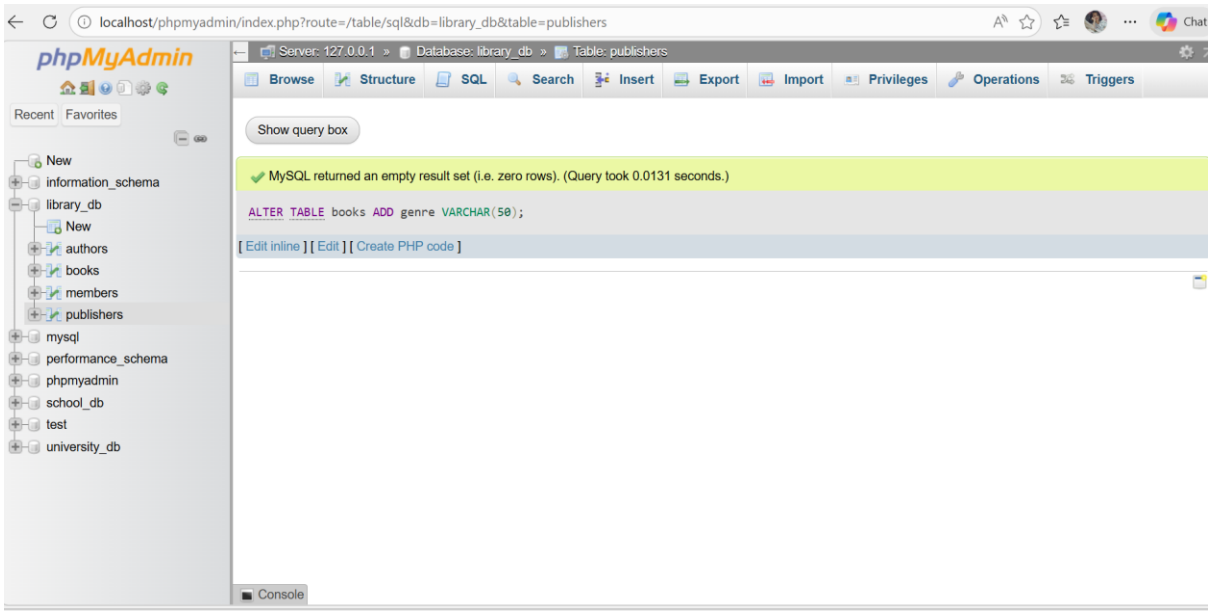
6. ALTER Command

LAB EXERCISES:

• Lab 3: Add a new column genre to the books table. Update the genre for all existing records.

ALTER TABLE books

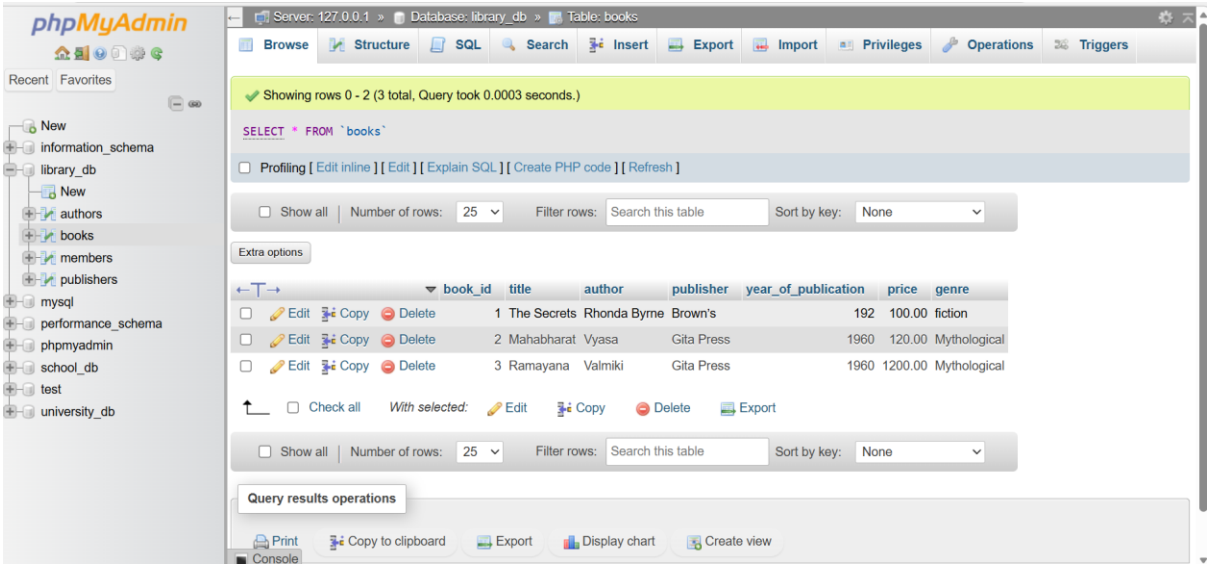
ADD genre VARCHAR(50);



UPDATE books SET genre = 'fiction' WHERE book_id = 1;

UPDATE books SET genre = 'Mythological' WHERE book_id = 2;

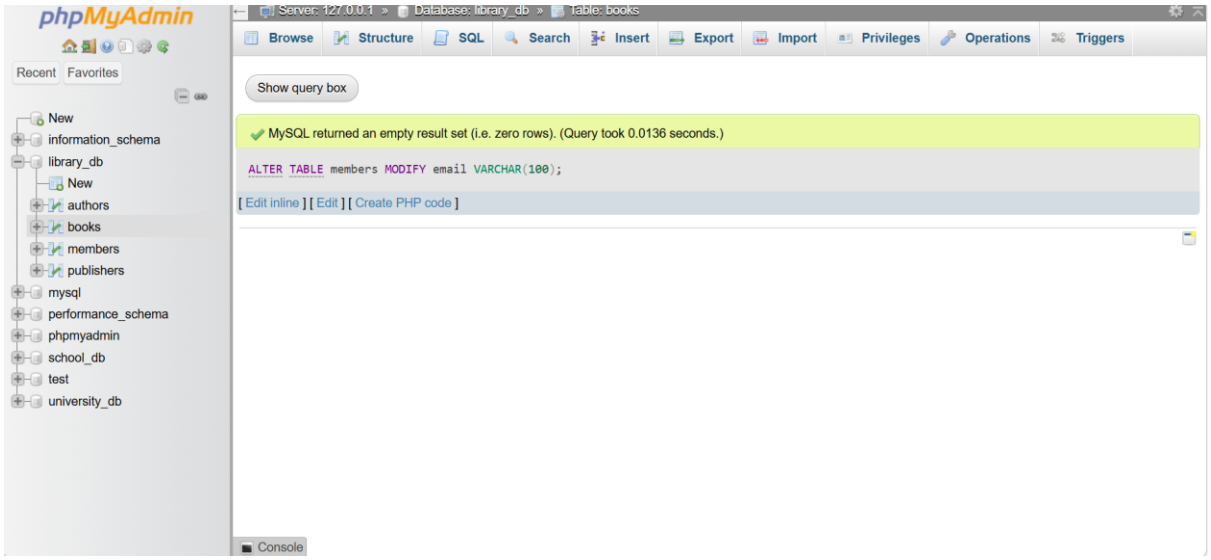
UPDATE books SET genre = 'Mythological' WHERE book_id = 3;



Lab 4: Modify the members table to increase the length of the email column to 100 characters.

ALTER TABLE members

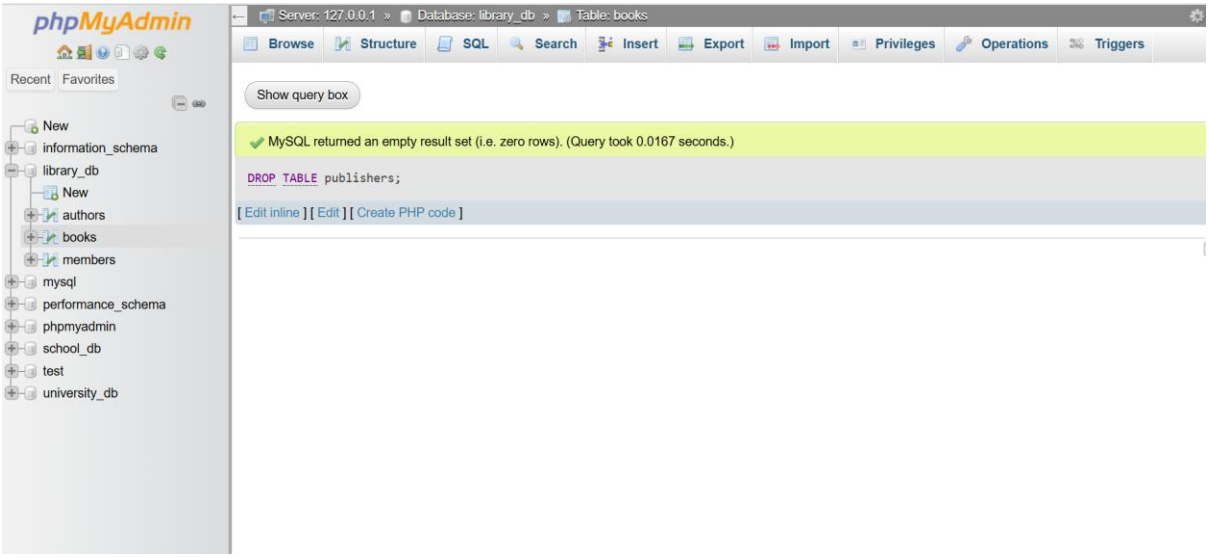
MODIFY email VARCHAR(100);



7. DROP Command LAB EXERCISES:

• Lab 3: Drop the publishers table from the database after verifying its structure.

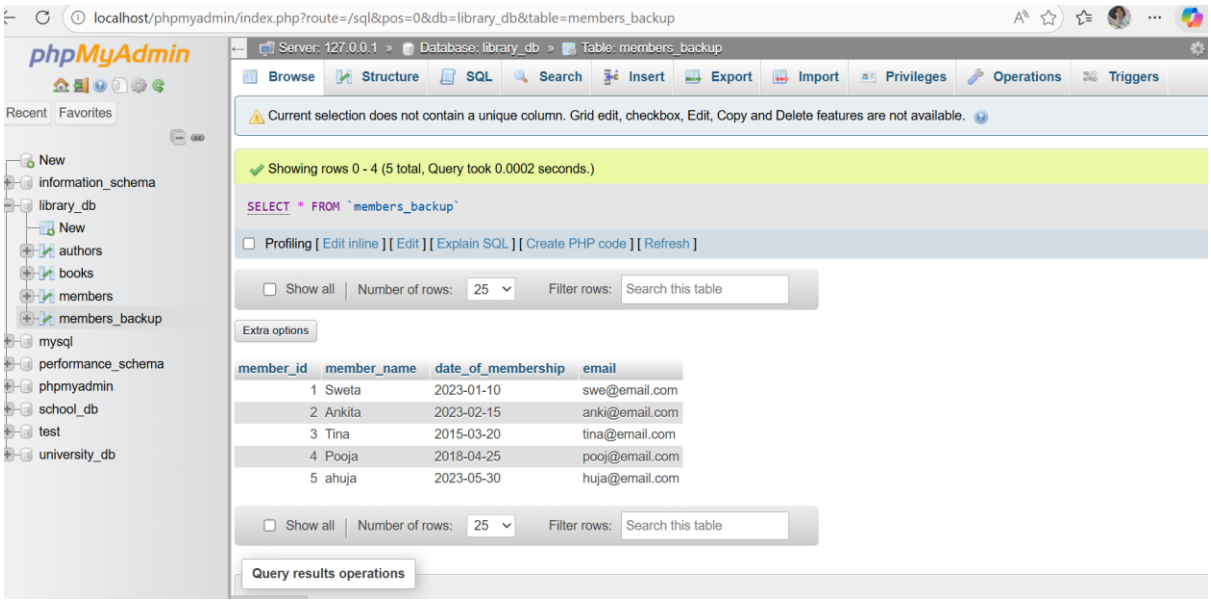
DROP TABLE publishers;



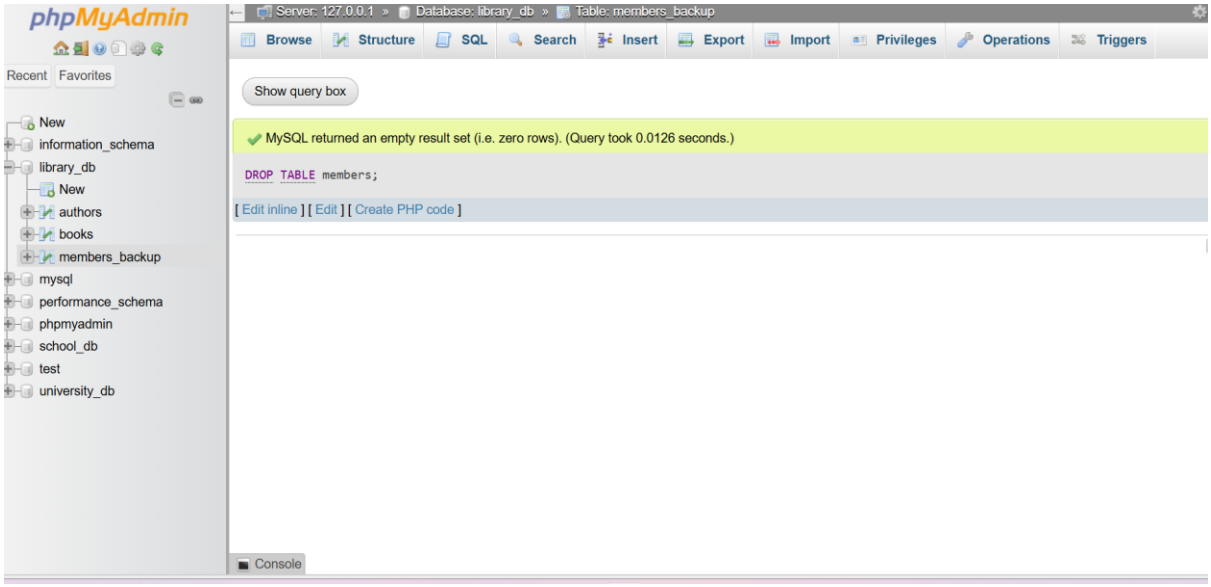
• Lab 4: Create a backup of the members table and then drop the original members table.

CREATE TABLE members_backup AS

SELECT * FROM members;



DROP TABLE members;



8. Data Manipulation Language (DML)

LAB EXERCISES:

- **Lab 4: Insert three new authors into the authors table, then update the last name of one of the authors.**

INSERT INTO authors

(author_id, first_name, last_name, country)

VALUES (1, 'vyasa', 'Ved', 'India'),

(2, 'Valmiki', 'Maharishi', 'India'),

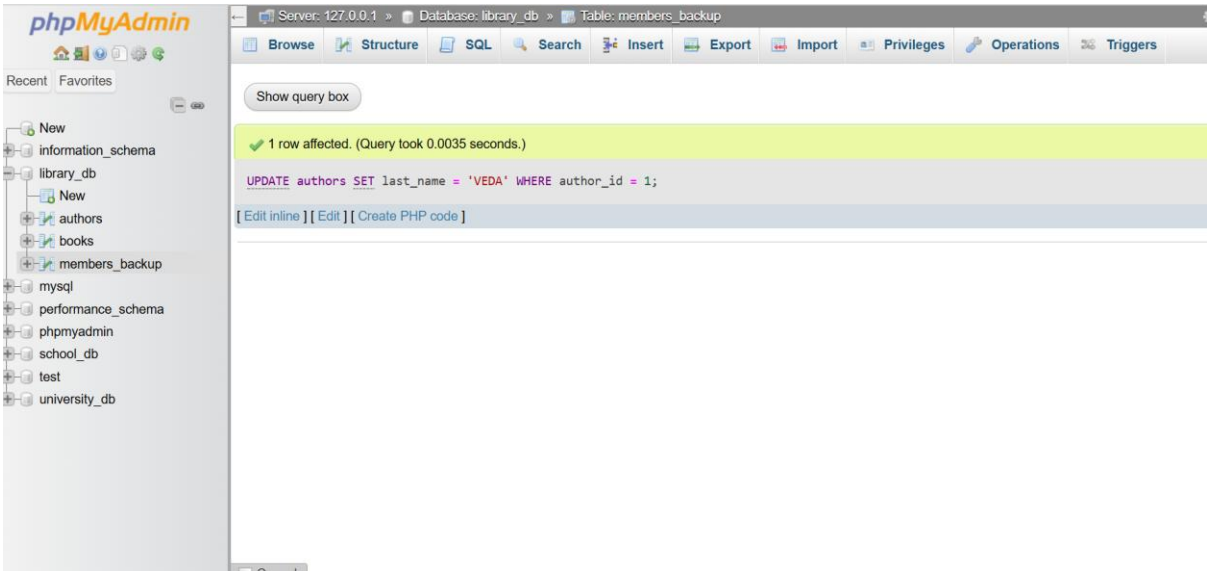
(3, 'Rhoda', 'Byres', 'USA');

- **Lab 5: Delete a book from the books table where the price is higher than $100**

UPDATE authors

SET last_name = 'VEDA'

WHERE author_id = 1;



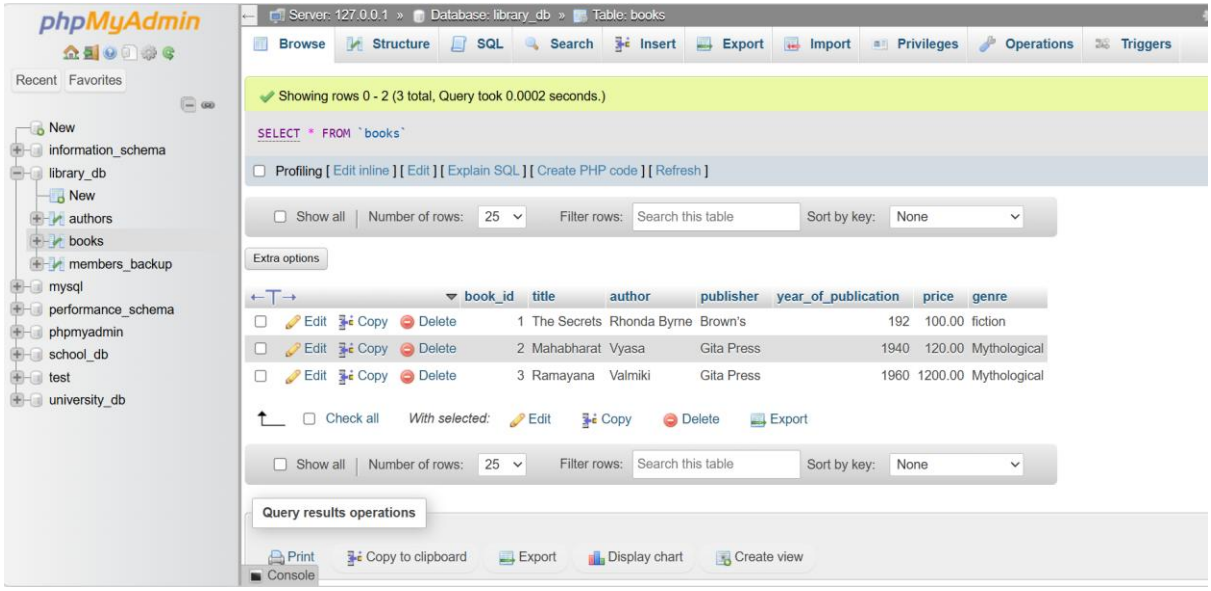
9. UPDATE Command LAB EXERCISE:

- **Lab 3: Update the year_of_publication of a book with a specific book_id.**

UPDATE books

SET year_of_publication = 1940

WHERE book_id = 2;

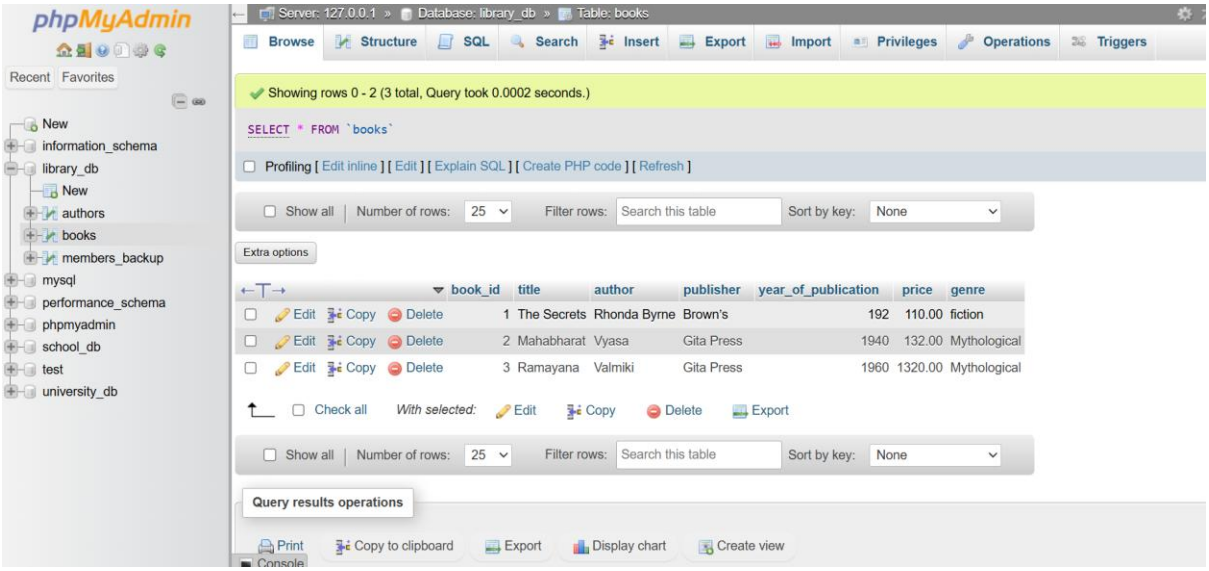


- **Lab 4: Increase the price of all books published before 2015 by 10%.**

UPDATE books

SET price = price * 1.10

WHERE year_of_publication < 2015;

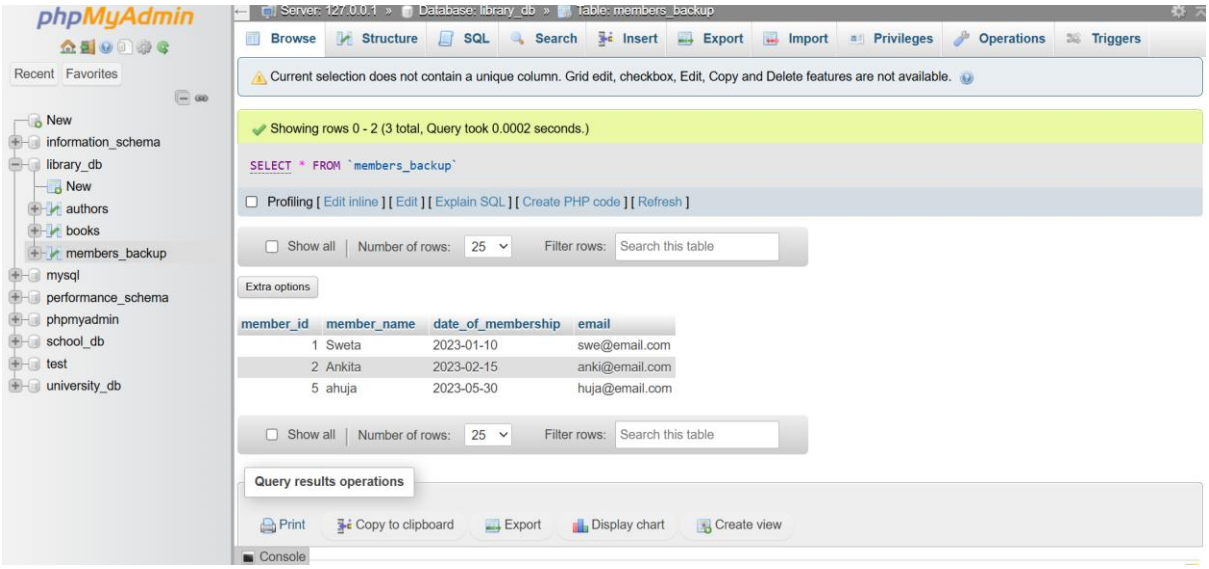


10.DELETE Command LAB EXERCISES:

• Lab 3: Remove all members who joined before 2020 from the members table.

DELETE FROM members

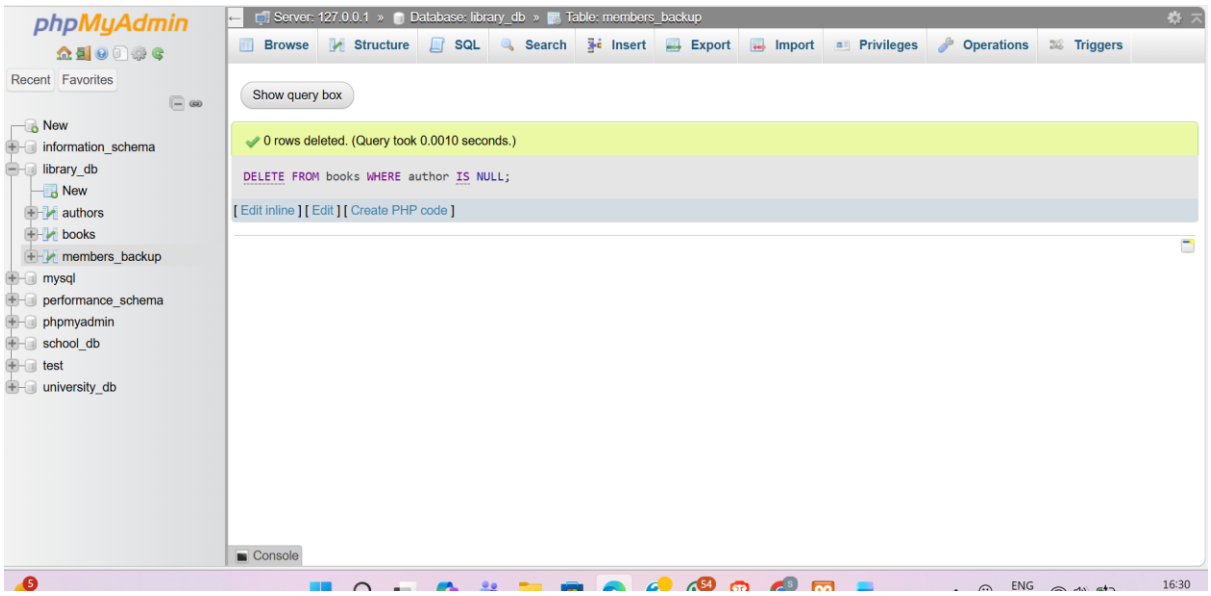
WHERE date_of_membership < '2020-01-01';



- **Lab 4: Delete all books that have a NULL value in the author column.**

DELETE FROM books

WHERE author IS NULL;

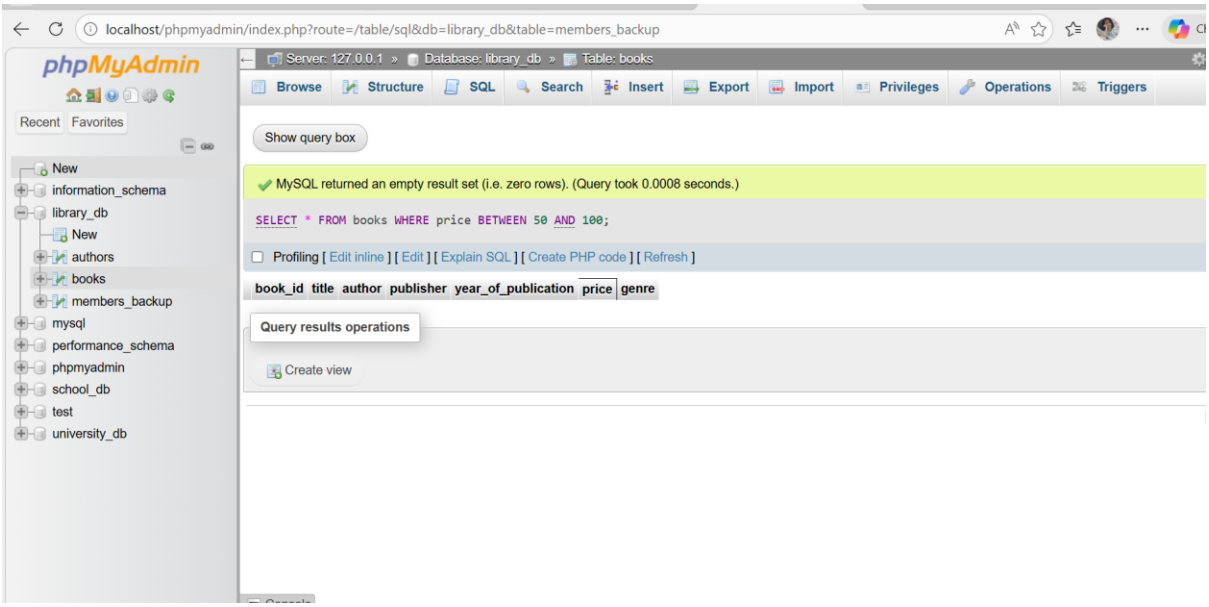


10.Data Query Language (DQL)

LAB EXERCISES:

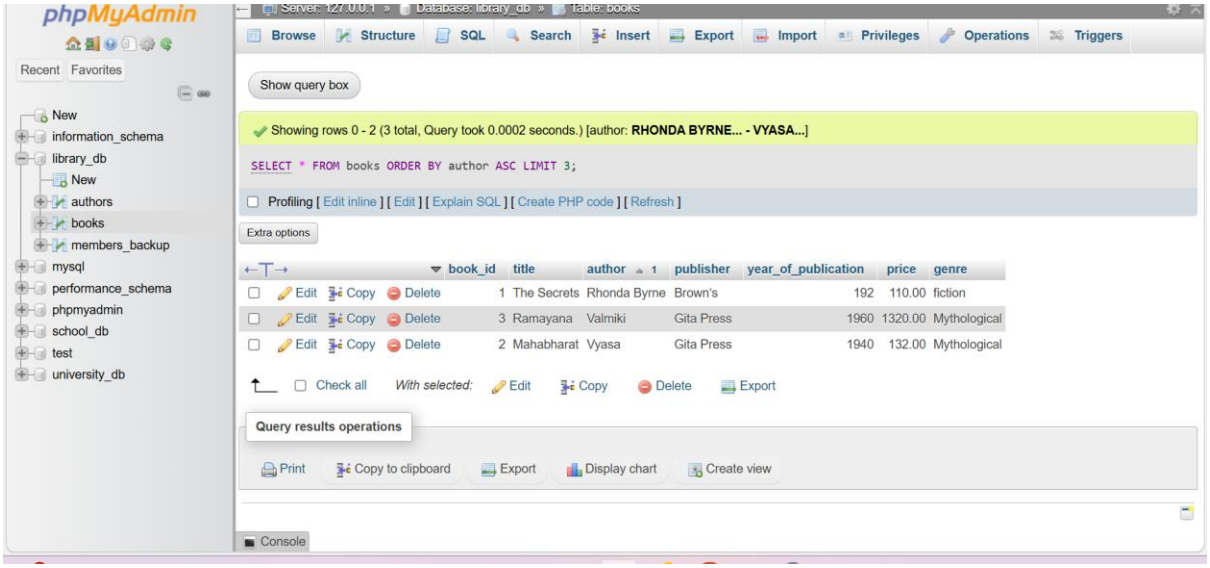
- **Lab 4: Write a query to retrieve all books with price between $50 and $100.**

```
SELECT *

FROM books

WHERE price BETWEEN 50 AND 100;
```



- **Lab 5: Retrieve the list of books sorted by author in ascending order and limit the results to the top 3 entries.**

```
SELECT *

FROM books

ORDER BY author ASC

LIMIT 3;
```

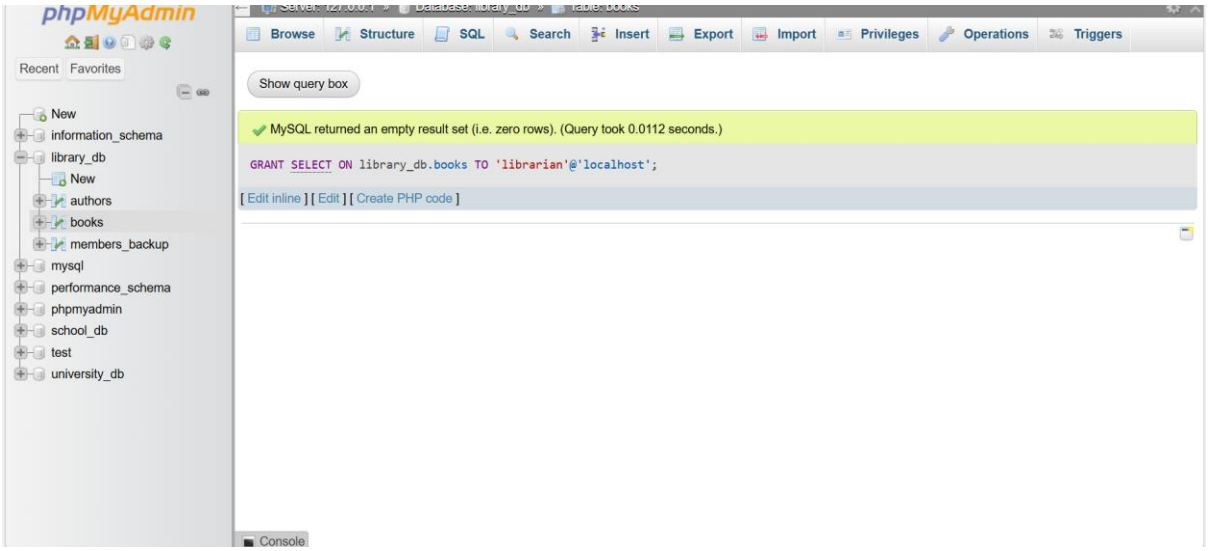

phpMyAdmin
Recent Favorites
New
information_segment
library_db
New
authors
books
members_backup
mysql
performance_schema
phpmyadmin
school_db
test
university_db
Server: 127.0.0.1 » Database: library_db » Table: books
Browse Structure SQL Search Insert Export Import Privileges Operations Triggers
Show query box
Showing rows 0 - 2 (3 total, Query took 0.0002 seconds.) [author: RHONDA BYRNE... - VYASA...]
SELECT * FROM books ORDER BY author ASC LIMIT 3;
Profiling [Edit inline] [Edit] [Explain SQL] [Create PHP code] [Refresh]
Extra options
book_id title author 1 publisher year_of_publication price genre
Edit Copy Delete 1 The Secrets Rhonda Byrne Brown's 192 110.00 fiction
Edit Copy Delete 3 Ramayana Valmiki Gita Press 1960 1320.00 Mythological
Edit Copy Delete 2 Mahabharat Vyasa Gita Press 1940 132.00 Mythological
Check all With selected: Edit Copy Delete Export
Query results operations
Print Copy to clipboard Export Display chart Create view
Console

Data Control Language (DCL)

LAB EXERCISES:

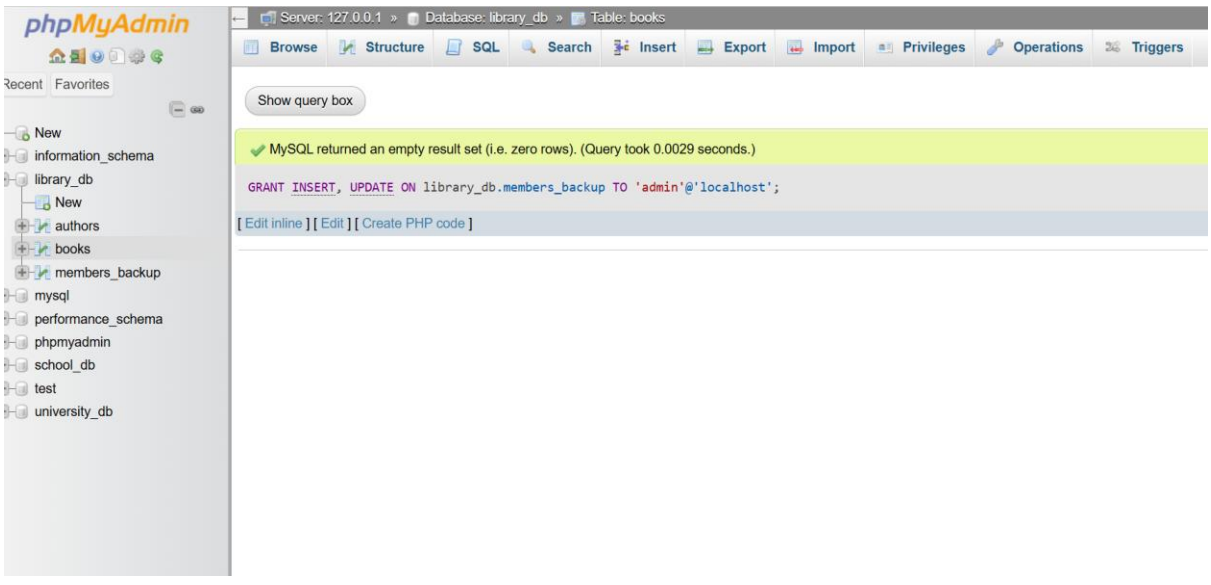
• Lab 3: Grant SELECT permission to a user named librarian on the books table.

GRANT SELECT ON library_db.books TO 'librarian'@'localhost';



• Lab 4: Grant INSERT and UPDATE permissions to the user admin on the members table.

GRANT INSERT, UPDATE ON library_db.members TO 'admin'@'localhost';



11.REVOKE Command LAB EXERCISES:

- **Lab 3: Revoke the INSERT privilege from the user librarian on the books table.**
- **Lab 4: Revoke all permissions from user admin on the members table**.

12.Transaction Control Language (TCL)

LAB EXERCISES:

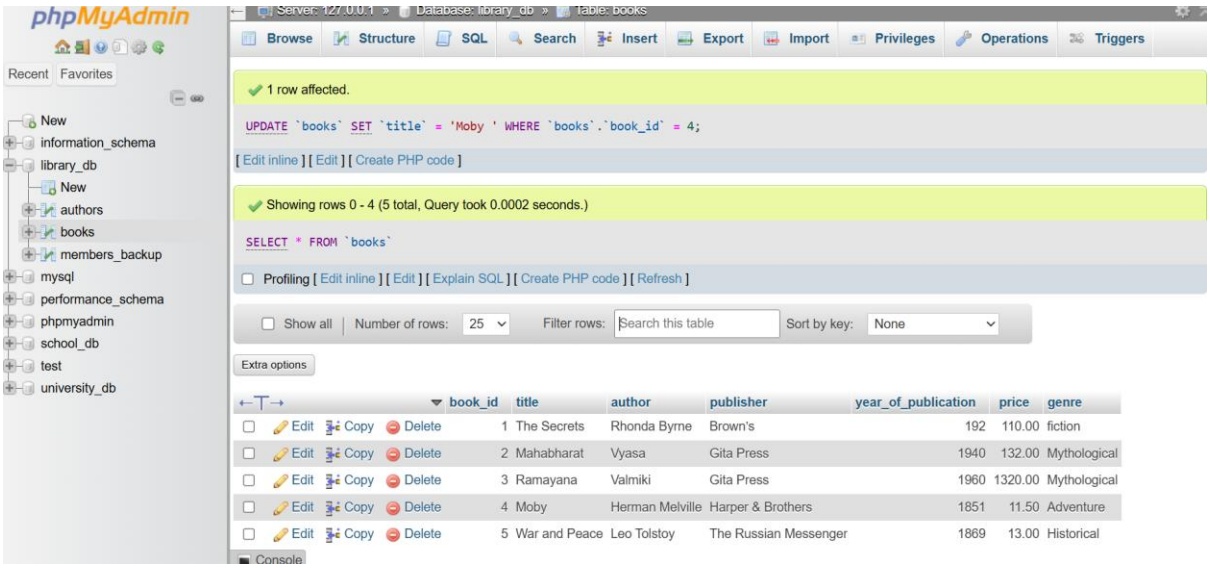
• Lab 3: Use COMMIT after inserting multiple records into the books table, then make another insertion and perform a ROLLBACK.

START TRANSACTION;

INSERT INTO books (book_id, title, author, publisher, year_of_publication, price, genre) VALUES

(4, 'Moby ', 'Herman Melville', 'Harper & Brothers', 1851, 11.50, 'Adventure'),

(5, 'War and Peace', 'Leo Tolstoy', 'The Russian Messenger', 1869, 13.00, 'Historical');



COMMIT;

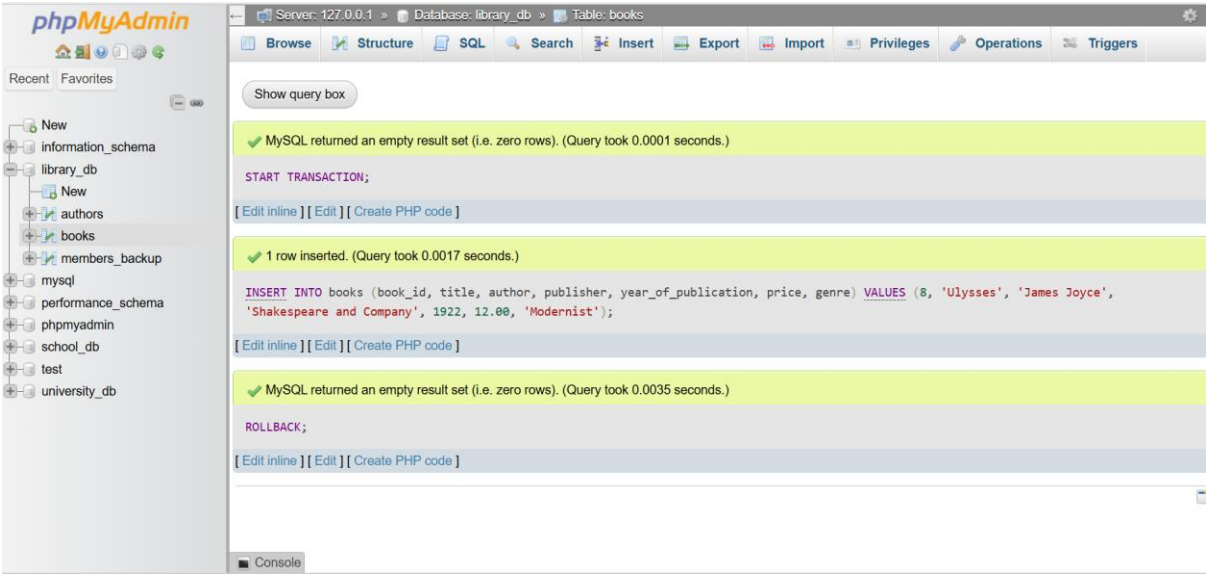
• Lab 4: Set a SAVEPOINT before making updates to the members table, perform some updates, and then roll back to the SAVEPOINT

START TRANSACTION;

INSERT INTO books (book_id, title, author, publisher, year_of_publication, price, genre) VALUES

(8, 'Ulysses', 'James Joyce', 'Shakespeare and Company', 1922, 12.00, 'Modernist');

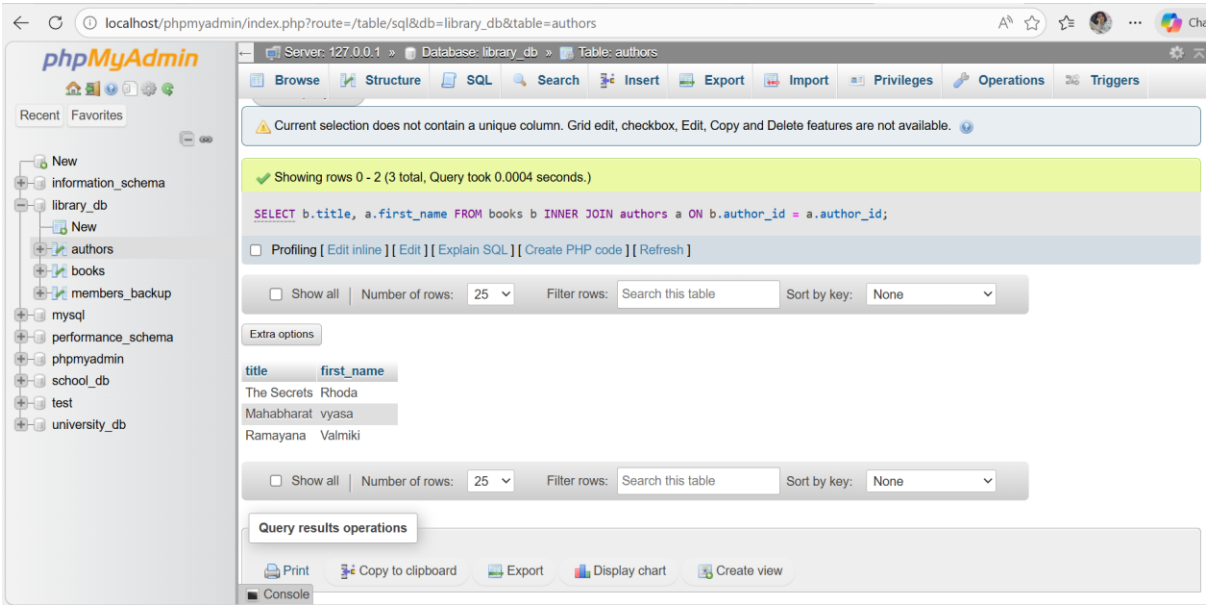
ROLLBACK;



13.SQL Joins LAB EXERCISES:

• Lab 3: Perform an INNER JOIN between books and authors tables to display the title of books and their respective authors' names.

```
SELECT
    b.title,
    a.first_name
FROM books b
INNER JOIN authors a
    ON b.author_id = a.author_id;
```



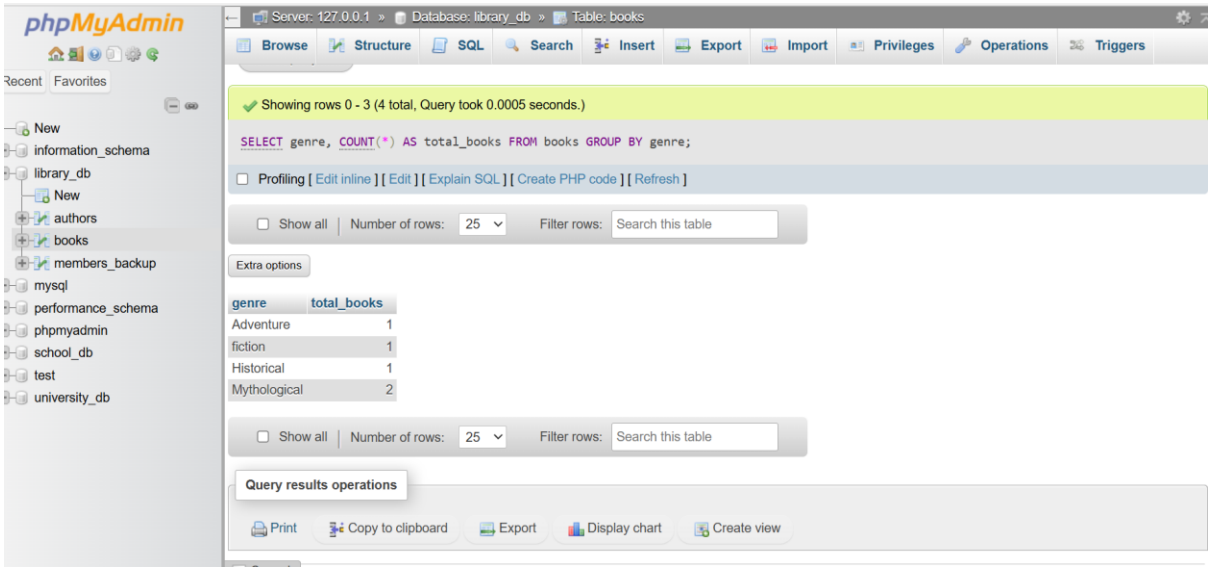
• Lab 4: Use a FULL OUTER JOIN to retrieve all records from the books and authors tables, including those with no matching entries in the other table.

```
SELECT
   b.title,
   a.first_name
FROM books b
FULL OUTER JOIN authors a
   ON b.author_id = a.author_id;
```

15. SQL Group By LAB EXERCISES:

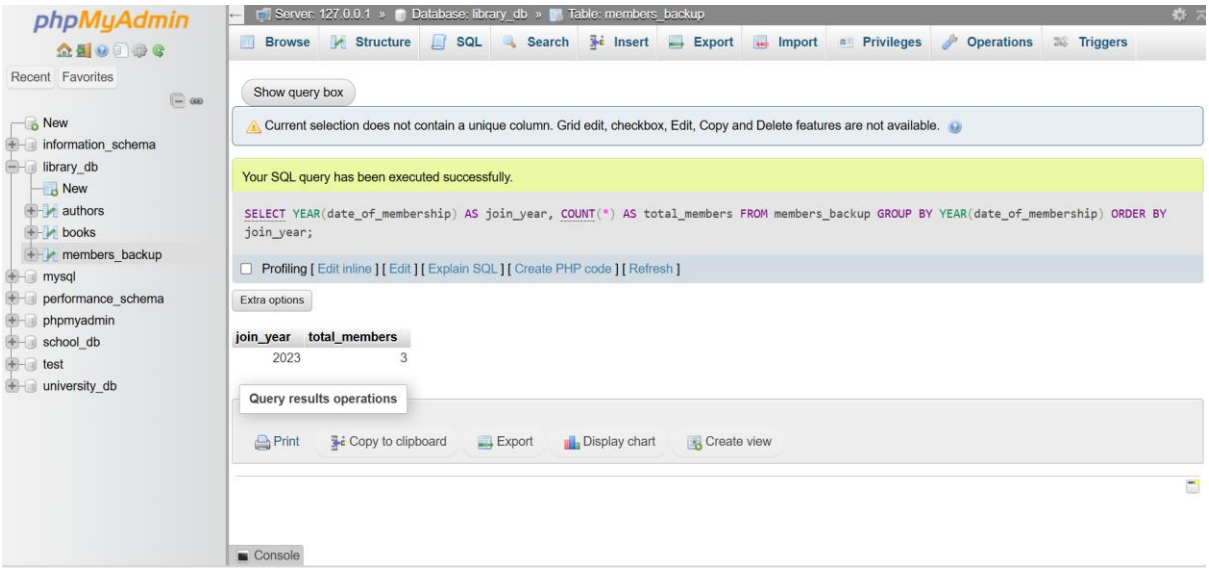
- **Lab 3: Group books by genre and display the total number of books in each genre.**

```
SELECT
  genre,
  COUNT(*) AS total_books
FROM books
GROUP BY genre;
```



• Lab 4: Group members by the year they joined and find the number of members who joined each year.

```
SELECT
 YEAR(date_of_membership) AS join_year,
COUNT(*) AS total_members
FROM members_backup
GROUP BY YEAR(date_of_membership)
ORDER BY join_year;
```

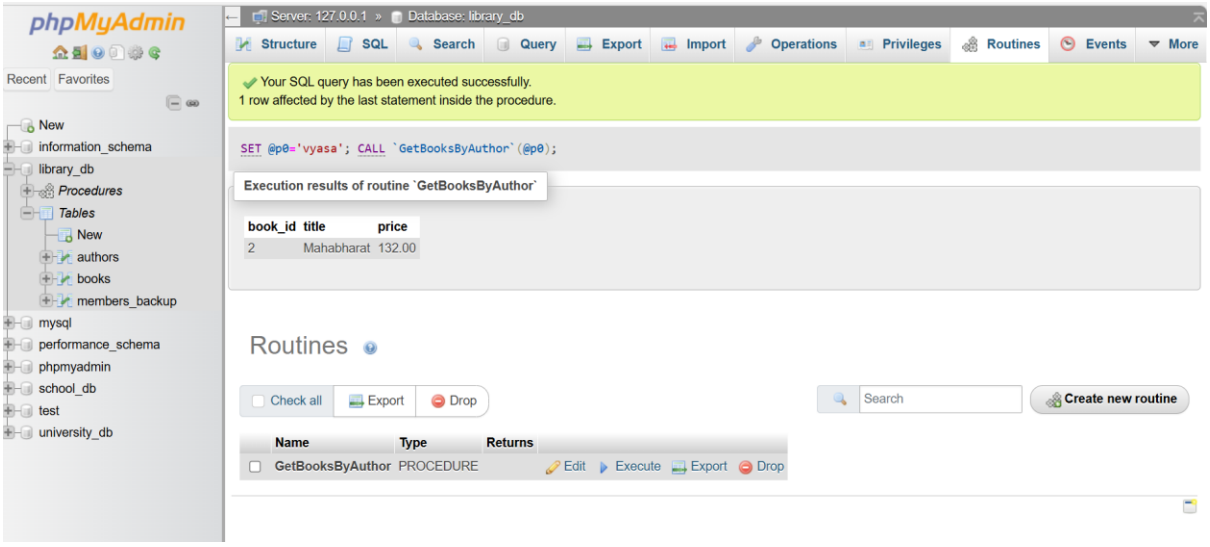


16. SQL Stored Procedure

LAB EXERCISES:

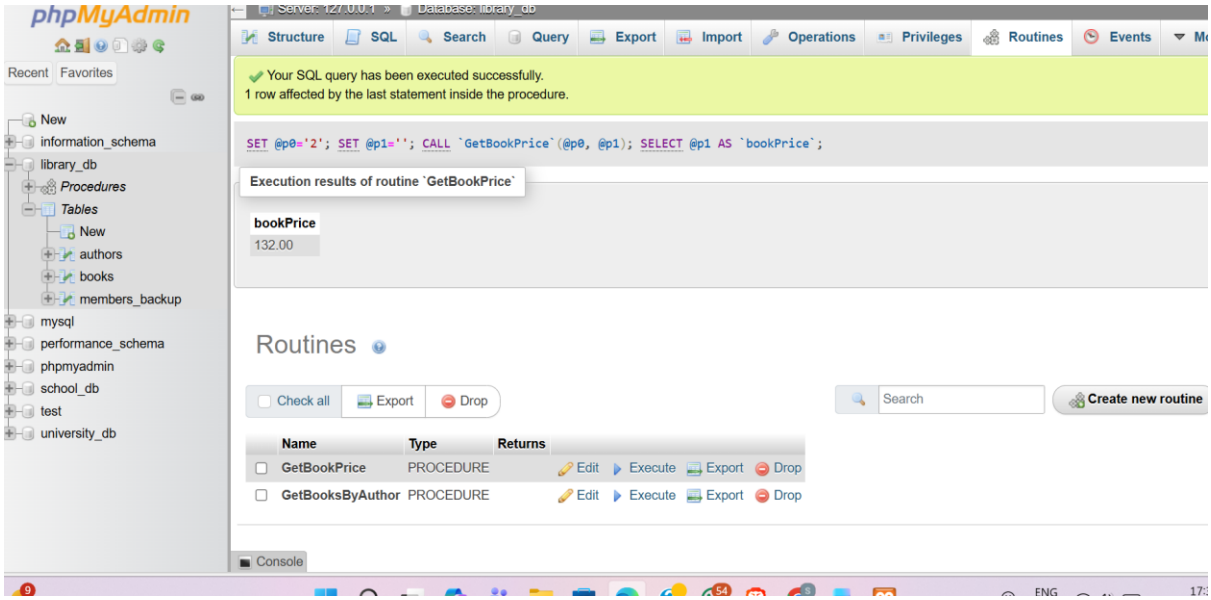
- **Lab 3: Write a stored procedure to retrieve all books by a particular author.**

```
DELIMITER //

CREATE PROCEDURE GetBooksByAuthor (
   IN authorName VARCHAR(100)
)
BEGIN
   SELECT
      b.book_id,
      b.title,
      b.price
   FROM books b
   INNER JOIN authors a
      ON b.author_id = a.author_id
   WHERE a.first_name = authorName;
END //

DELIMITER ;
```


phpMyAdmin
Recent
Favorites
New
information_schema
library_db
Procedures
Tables
New
authors
books
members_backup
mysql
performance_schema
phpmyadmin
school_db
test
university_db
Server: 127.0.0.1 » Database: library_db
Structure
SQL
Search
Query
Export
Import
Operations
Privileges
Routines
Events
More
Your SQL query has been executed successfully.
1 row affected by the last statement inside the procedure.
SET @p0='vyasa'; CALL `GetBooksByAuthor`(@p0);
Execution results of routine `GetBooksByAuthor`
book_id title price
2 Mahabharat 132.00
Routines
Check all
Export
Drop
Search
Create new routine
Name Type Returns
GetBooksByAuthor PROCEDURE
Edit
Execute
Export
Drop

• Lab 4: Write a stored procedure that takes book_id as an argument and returns the price of the book

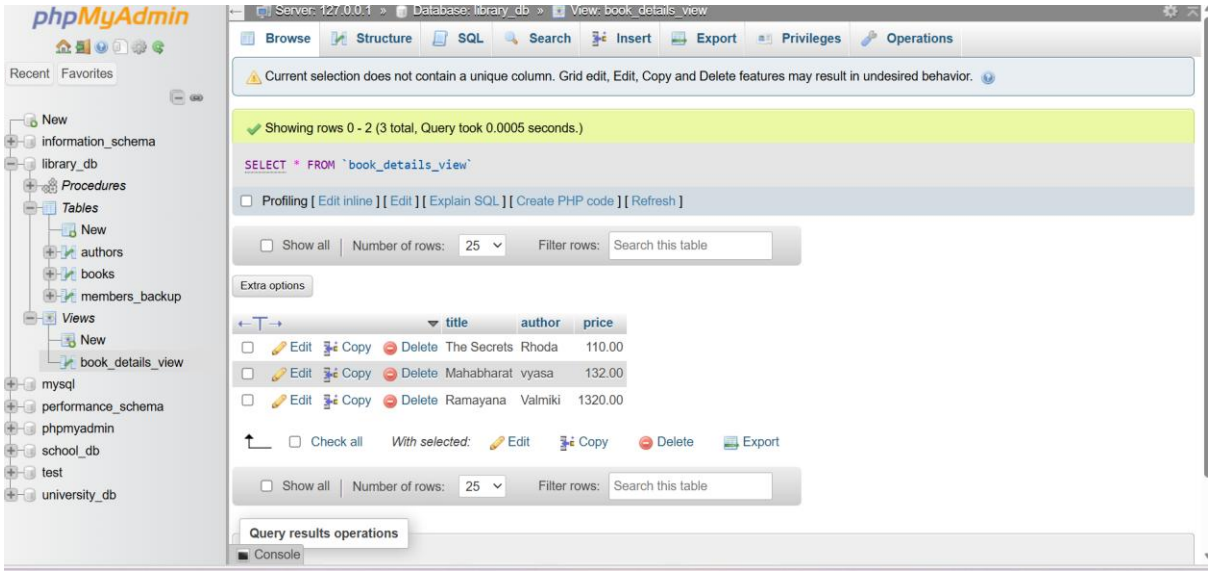
```
DELIMITER //

CREATE PROCEDURE GetBookPrice (
    IN bookId INT,
    OUT bookPrice DECIMAL(10,2)
)
BEGIN
    SELECT price
    INTO bookPrice
    FROM books
    WHERE book_id = bookId;
END //

DELIMITER ;
```



17. SQL View LAB EXERCISES:

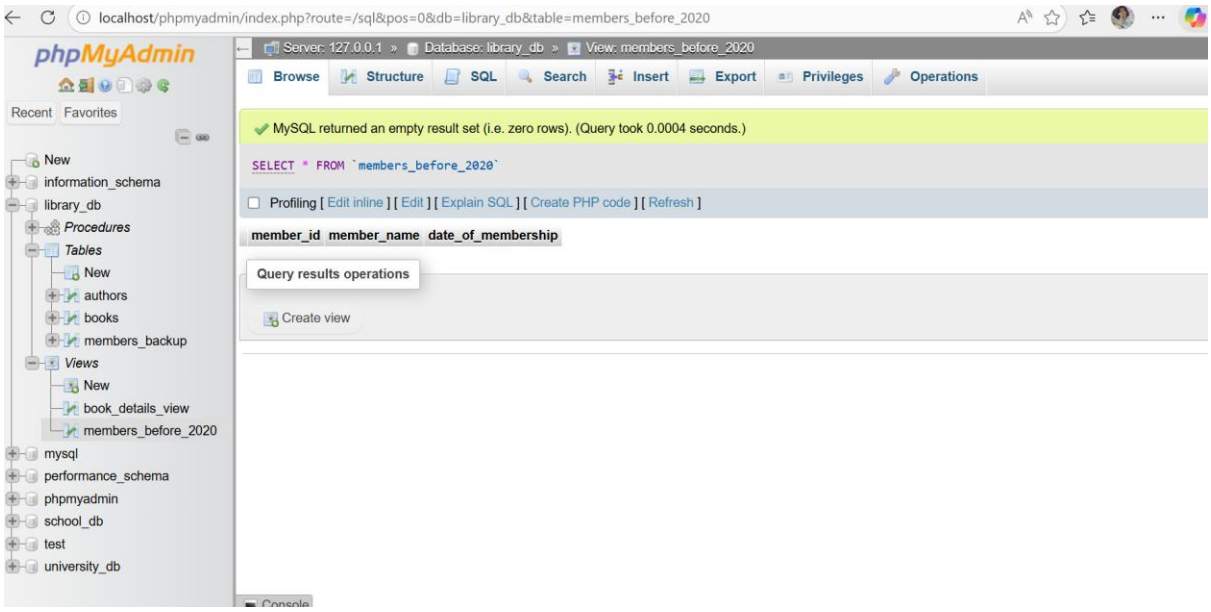
• Lab 3: Create a view to show only the title, author, and price of books from the books table.

```
CREATE VIEW book_details_view AS
SELECT
    b.title,
    a.first_name AS author,
    b.price
FROM books b
INNER JOIN authors a
    ON b.author_id = a.author_id;
```



• Lab 4: Create a view to display members who joined before 2020.

```
CREATE VIEW members_before_2020 AS
SELECT
    member_id,
   member_name,
    date_of_membership
FROM members_backup
WHERE date_of_membership< '2020-01-01';
```



18. SQL Trigger LAB EXERCISES:

• Lab 3: Create a trigger to automatically update the last_modified timestamp of the books table whenever a record is updated.

```
books(
   book_id INT,
   title VARCHAR(100),
   price DECIMAL(10,2),
   last_modified TIMESTAMP
)
DELIMITER //

CREATE TRIGGER trg_update_last_modified
BEFORE UPDATE ON books
FOR EACH ROW
BEGIN
   SET NEW.last_modified = CURRENT_TIMESTAMP;
END //

DELIMITER ;
```

• Lab 4: Create a trigger that inserts a log entry into a log_changes table whenever a DELETE operation is performed on the books table.

```
DELIMITER //

CREATE TRIGGER trg_log_book_delete
AFTER DELETE ON books
FOR EACH ROW
BEGIN
   INSERT INTO log_changes (book_id, action, action_date)
   VALUES (OLD.book_id, 'DELETE', CURRENT_TIMESTAMP);
END //

DELIMITER ;
```

19. Introduction to PL/SQL LAB EXERCISES:

• Lab 3: Write a PL/SQL block to insert a new book into the books table and display a confirmation message.

```
BEGIN
   INSERT INTO books (book_id, title, author, price)
   VALUES (101, 'Database Management Systems', 'C.J. Date', 550);

   DBMS_OUTPUT.PUT_LINE('New book inserted successfully.');
END;
/
```

• Lab 4: Write a PL/SQL block to display the total number of books in the books table

```
DECLARE
   total_books NUMBER;
BEGIN
   SELECT COUNT(*)
   INTO total_books
   FROM books;

   DBMS_OUTPUT.PUT_LINE('Total number of books: ' || total_books);
END;
/
```

20. PL/SQL Syntax LAB EXERCISES:

• Lab 3: Write a PL/SQL block to declare variables for book_id and price, assign values, and display the results.

```
DECLARE
   v_book_id   NUMBER := 101;
   v_price     NUMBER := 450;
BEGIN
   DBMS_OUTPUT.PUT_LINE('Book ID: ' || v_book_id);
   DBMS_OUTPUT.PUT_LINE('Book Price: ' || v_price);
END;
/
```

• Lab 4: Write a PL/SQL block using constants and perform arithmetic operations on book prices.

```
DECLARE
   c_discount_rate CONSTANT NUMBER := 0.10;   -- 10% discount
   v_original_price NUMBER := 500;
   v_discount_amount NUMBER;
   v_final_price NUMBER;
BEGIN
   v_discount_amount := v_original_price * c_discount_rate;
   v_final_price := v_original_price - v_discount_amount;

   DBMS_OUTPUT.PUT_LINE('Original Price: ' || v_original_price);
   DBMS_OUTPUT.PUT_LINE('Discount Amount: ' || v_discount_amount);
   DBMS_OUTPUT.PUT_LINE('Final Price after Discount: ' || v_final_price);
END;
/
```

21. PL/SQL Control Structures LAB EXERCISES:

• Lab 3: Write a PL/SQL block using IF-THEN-ELSE to check if a book's price is above $100 and print a message accordingly.

```
DECLARE
   v_price NUMBER := 120;
BEGIN
   IF v_price > 100 THEN
      DBMS_OUTPUT.PUT_LINE('The book price is above $100.');
   ELSE
      DBMS_OUTPUT.PUT_LINE('The book price is $100 or below.');
   END IF;
END;
/
```

• Lab 4: Use **a FOR LOOP in PL/SQL to display the details of all books one by one.**

```
BEGIN
   FOR rec IN (SELECT book_id, title, price FROM books) LOOP
      DBMS_OUTPUT.PUT_LINE(
         'Book ID: ' || rec.book_id ||
         ', Title: ' || rec.title ||
         ', Price: ' || rec.price
      );
   END LOOP;
END;
/
```

22. SQL Cursors

LAB EXERCISES:

• Lab 3: Write a PL/SQL block using an explicit cursor to fetch and display all records from the members table.

```
DECLARE
   CURSOR c_members IS
      SELECT member_id, name, join_date FROM members;

   v_member_id members.member_id%TYPE;
   v_name      members.name%TYPE;
   v_join_date members.join_date%TYPE;
BEGIN
   OPEN c_members;

   LOOP
      FETCH c_members INTO v_member_id, v_name, v_join_date;
      EXIT WHEN c_members%NOTFOUND;

      DBMS_OUTPUT.PUT_LINE(
         'Member ID: ' || v_member_id ||
         ', Name: ' || v_name ||
         ', Join Date: ' || v_join_date
      );
   END LOOP;
```

```
    CLOSE c_members;
END;
/
```

• Lab 4: Create a cursor to retrieve books by a particular author and display their titles.

```
DECLARE
    CURSOR c_books IS
        SELECT title
        FROM books
        WHERE author = 'C.J. Date';

    v_title books.title%TYPE;
BEGIN
    OPEN c_books;

    LOOP
        FETCH c_books INTO v_title;
        EXIT WHEN c_books%NOTFOUND;

        DBMS_OUTPUT.PUT_LINE('Book Title: ' || v_title);
    END LOOP;

    CLOSE c_books;
END;
/
```

23. Rollback and Commit Savepoint

LAB EXERCISES:

• Lab 3: Perform a transaction that includes inserting a new member, setting a SAVEPOINT, and rolling back to the savepoint after making updates.

```
-- Insert a new member

INSERT INTO members_backup (member_id, member_name,
date_of_membership)

VALUES (201, 'Amit Patel', SYSDATE);

SAVEPOINT after_insert;

UPDATE members

SET name = 'Amit P.'

WHERE member_id = 201;

ROLLBACK TO after_insert;

COMMIT;
```

• Lab 4: Use COMMIT after successfully inserting multiple books into the books table, then use ROLLBACK to undo a set of changes made after a savepoint.

```
INSERT INTO books (book_id, title, price)
VALUES (301, 'SQL Basics', 250);

INSERT INTO books (book_id, title, price)
VALUES (302, 'Advanced PL/SQL', 400);

COMMIT;

SAVEPOINT book_changes;
UPDATE books
SET price = 300
WHERE book_id = 301;

DELETE FROM books
WHERE book_id = 302;

ROLLBACK TO book_changes;
COMMIT;
```