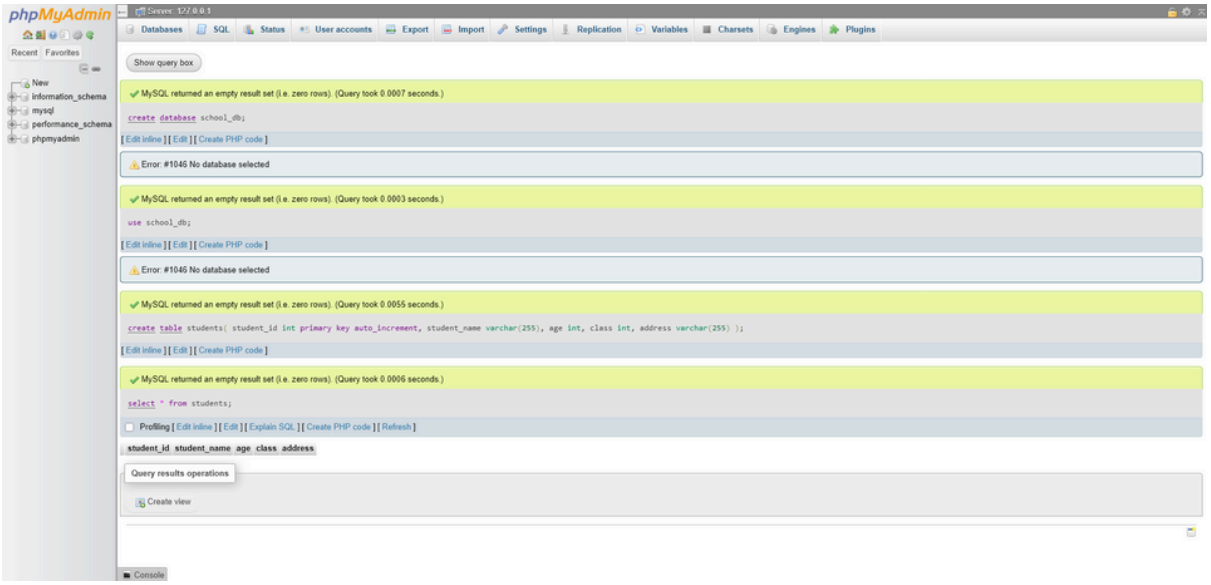
Module 4 – Introduction to DBMS (Lab Exercises)

1 Introduction to SQL

1.1

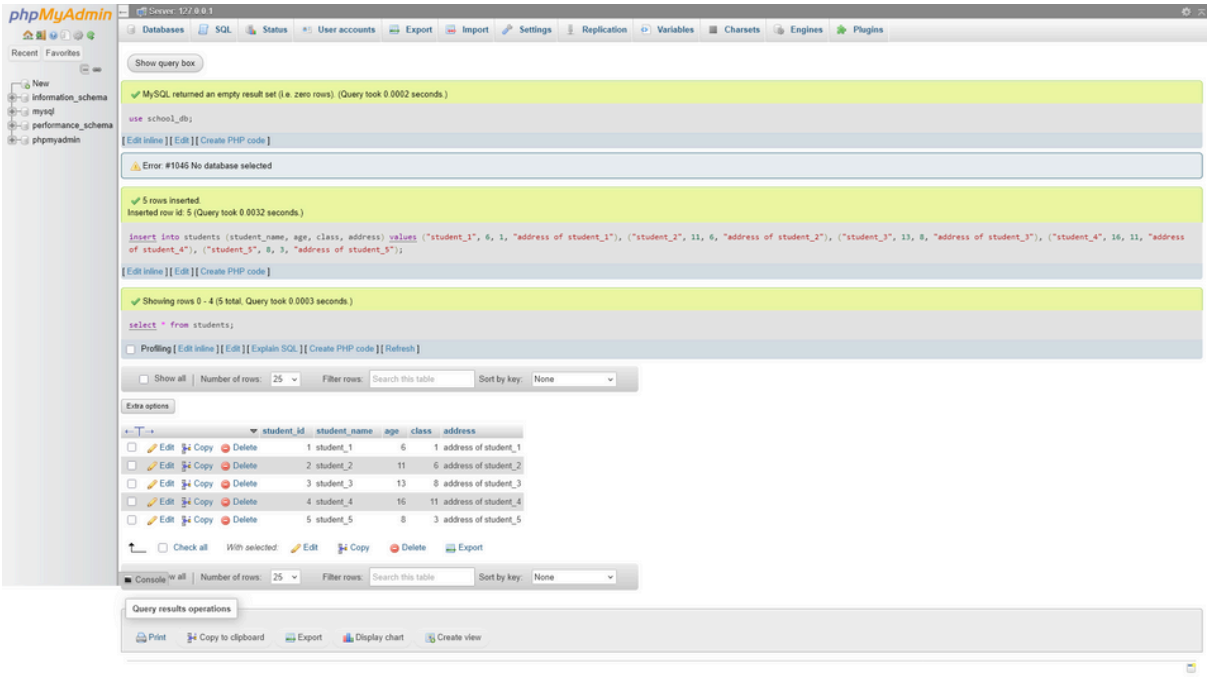
Create a new database named **school_db** and a table called **students** with the following columns: **student_id** , **student_name**, **age**, **class**, and **address**.

```sql
create database school_db;
use school_db;

create table students(
    student_id int primary key auto_increment,
    student_name varchar(255),
    age int,
    class int,
    address varchar(255)
);

select *
from students;
```



1.2 Insert five records into the **students** table and retrieve all records using the **SELECT** statement.

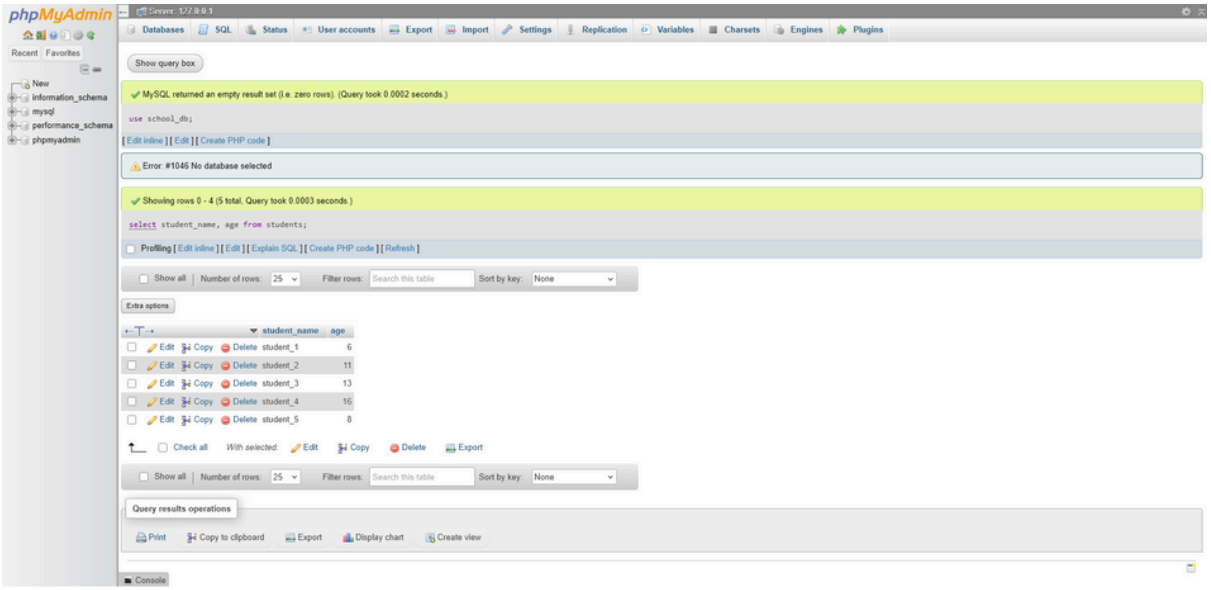
```
use school_db;

insert into students (student_name,age, class, address) values
    ("student_1", 6, 1, "address of student_1"),
    ("student_2", 11, 6, "address of student_2"),
    ("student_3", 13, 8, "address of student_3"),
    ("student_4", 16, 11, "address of student_4"),
    ("student_5", 8, 3, "address of student_5");

select *
from students;
```



2 SQL Syntax

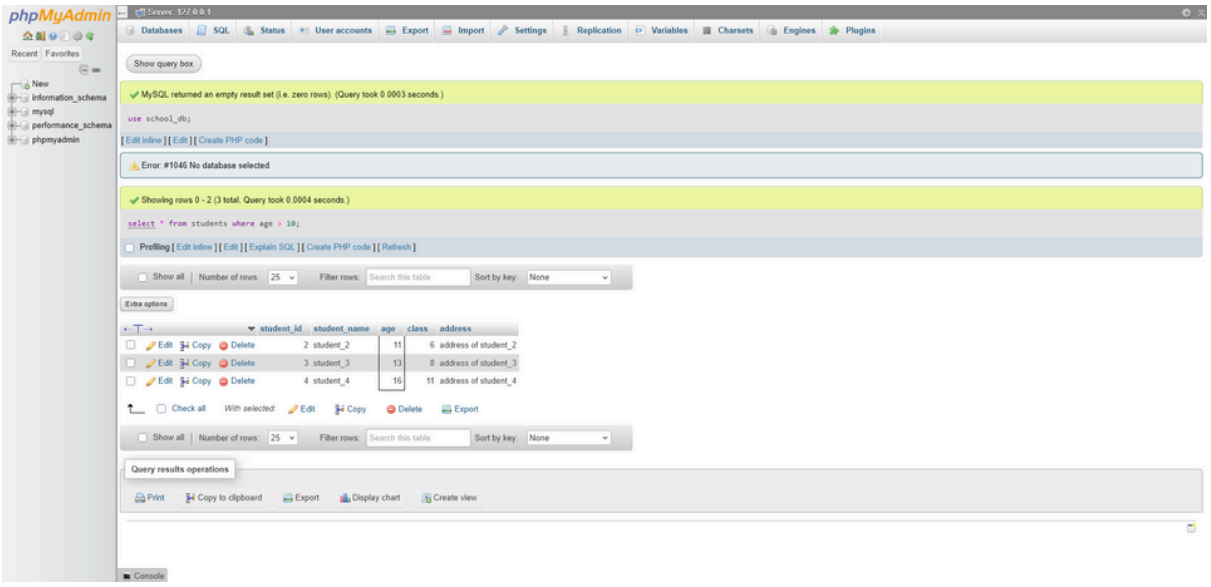
2.1 WriteSQLqueriestoretrievespecificcolumns(**student_name** and **age**) from the **students** table.

```
use school_db;

select student_name, age
from students;
```



2.2 Write SQL queries to retrieve all students whose age is greater than 10.

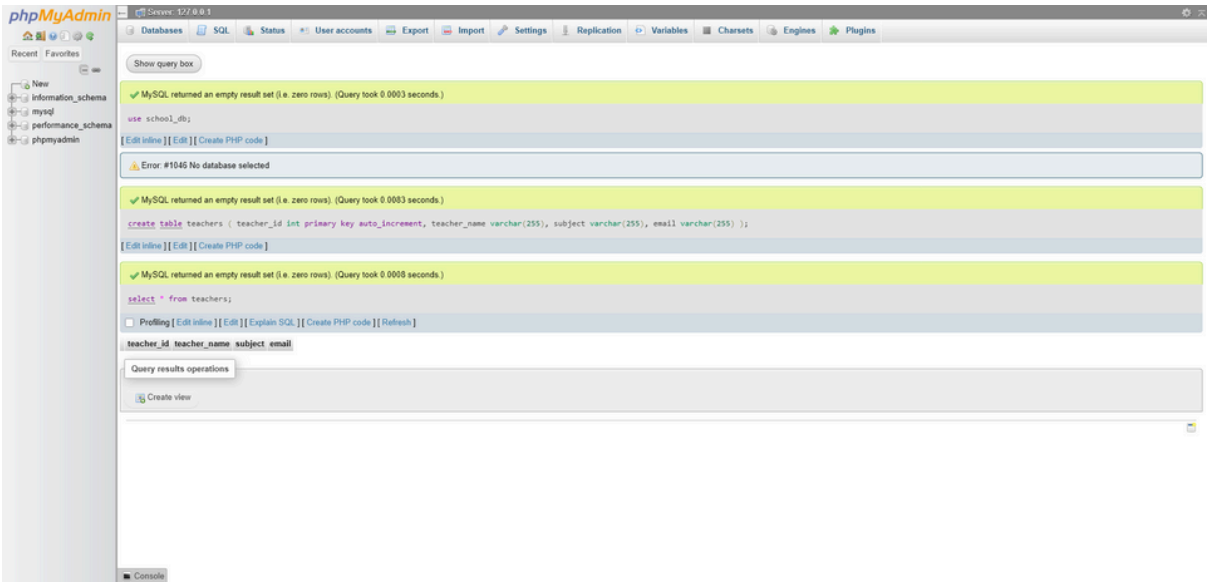
```
use school_db;

select  *
from students
where age > 10;
```



3 SQL Constraints

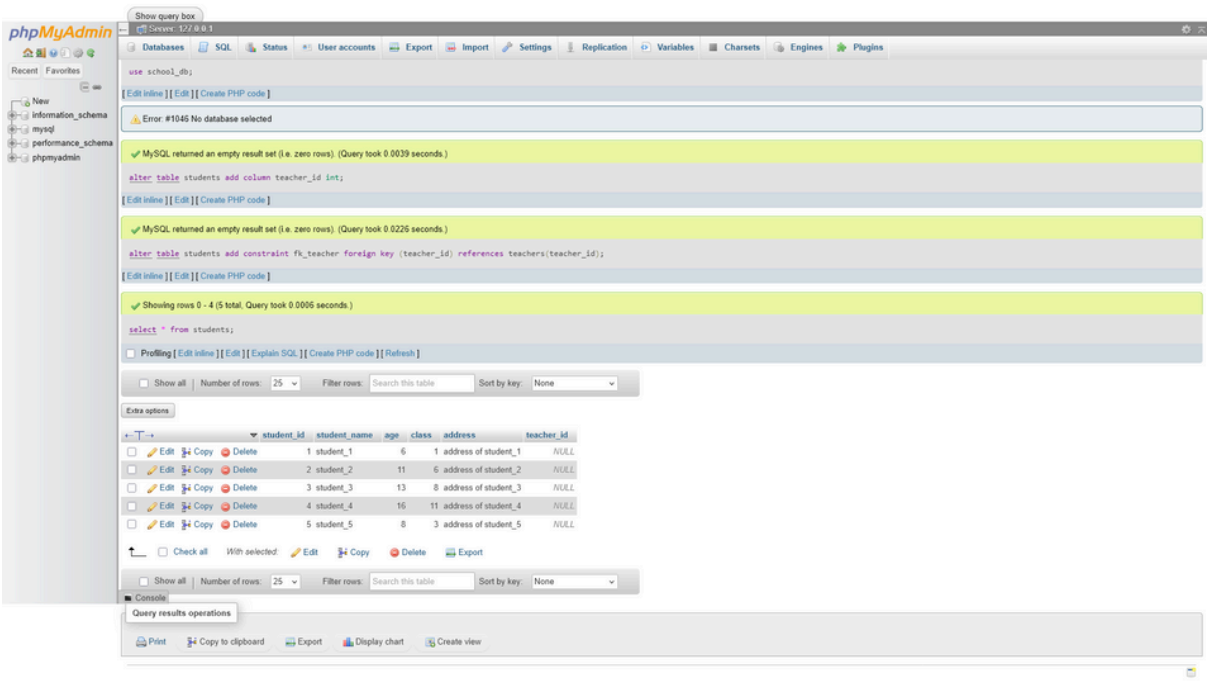
3.1 Create a table **teachers** with the following columns: **teacher id** (Primary Key), **teacher name** (NOT NULL), **teacher subject** (NOT NULL), and **email** (UNIQUE).

```sql
use school_db;

create table teachers (
    teacher_id int primary key auto_increment,
    teacher_name varchar(255),
    subject varchar(255),
    email varchar(255)
);

select *
from teachers;
```



3.2 Implement a **FOREIGN KEY** constraint to relate the **teacher id** from the **teachers** table with the **students** table.

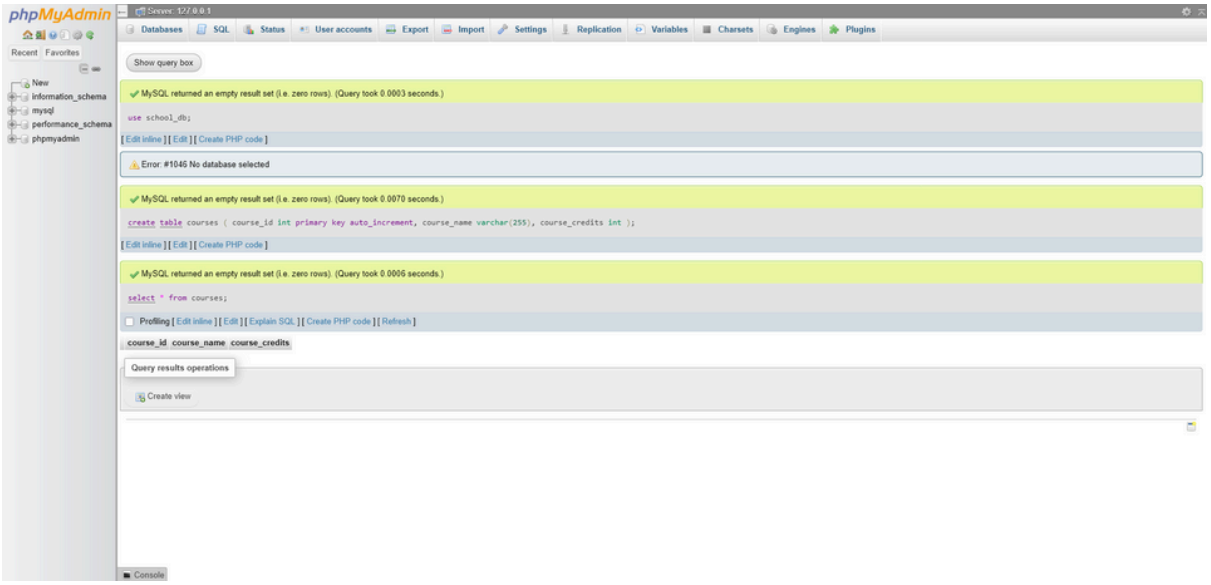
```sql
use school_db;

alter table students
add column teacher_id int;

alter table students
add constraint fk_teacher
foreign key (teacher_id) references teachers(teacher_id);

select *
from students;
```



4 MainSQLCommandsandSub-commands(DDL)

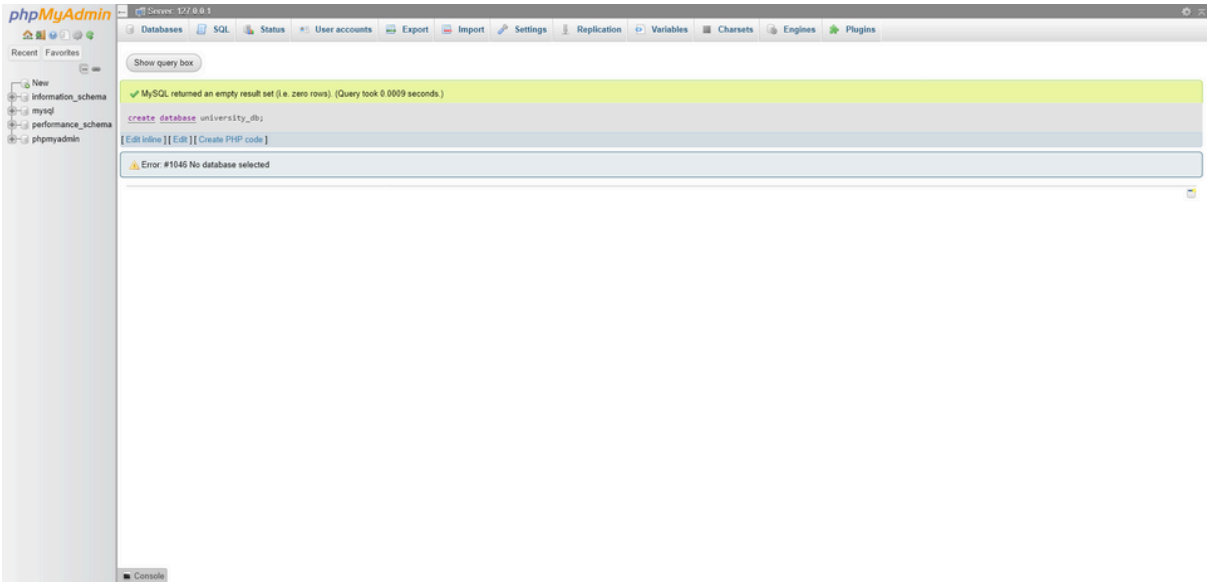
4.1 Createatable **courses** with columns: **course_id** , **course_name**, and**course_credits** . Set the **course_id** as the primary key.

```sql
use school_db;

create table courses (
    course_id int primary key auto_increment,
    course_name varchar(255),
    course_credits int
);

select *
from courses;
```



4.2 Use the **CREATE** command to create a database **university_db**.

```
create database university_db;
```

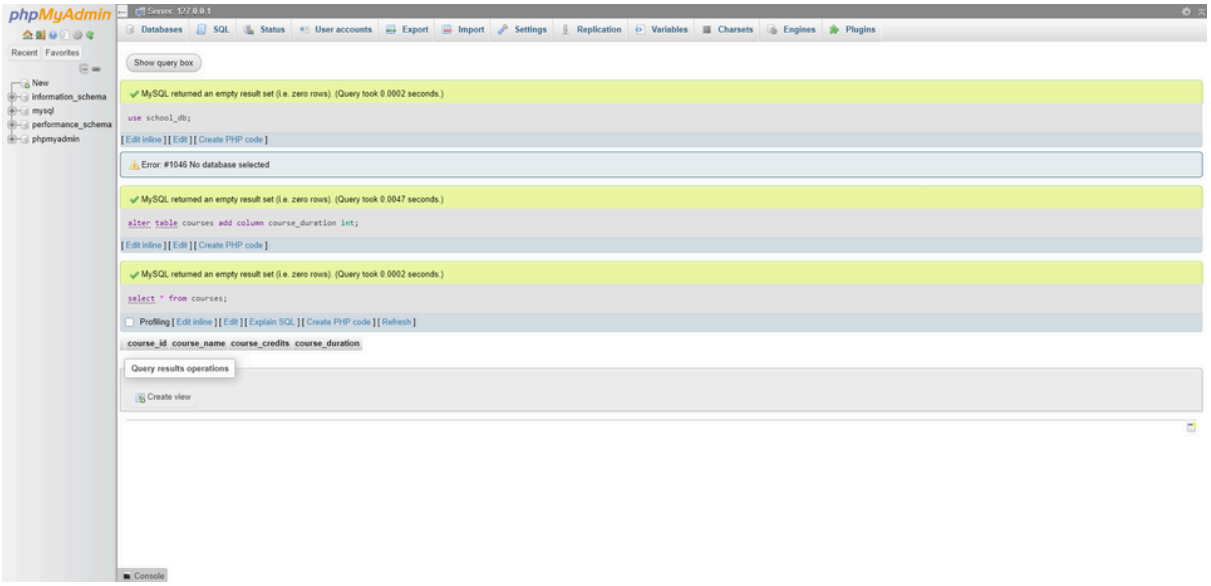


5 ALTER Command

5.1 Modify the **courses** table by adding a column **course_duration** using the **ALTER** command.

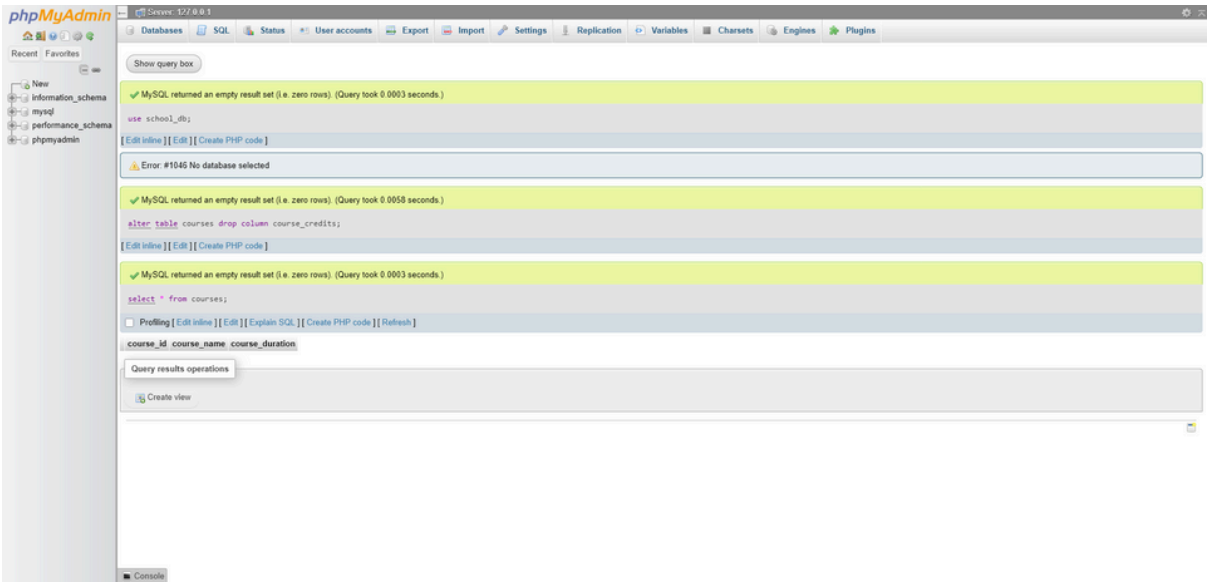
```
use school_db;

alter table courses
add column course_duration int;
```

```
5
6           *
7  from courses;
```



5.2 Dropthe **course_credits** column from the **courses** table.

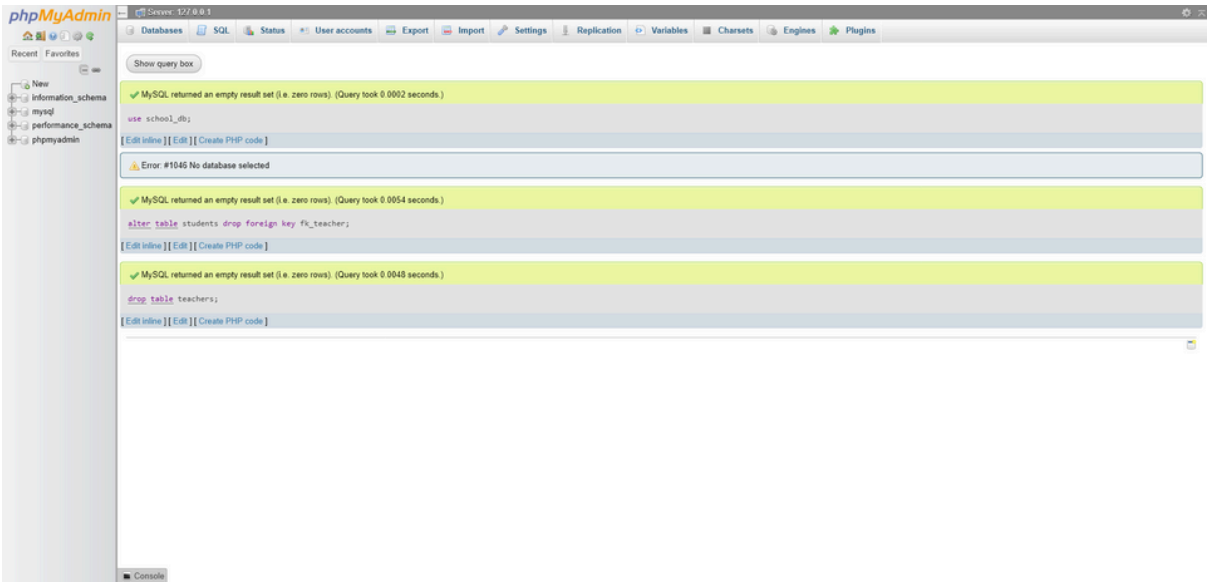
```
1  use school_db;
2
3  alter    table courses
4  drop columncourse_credits;
5
6  select   *
7  from courses;
```



6 DROPCommand

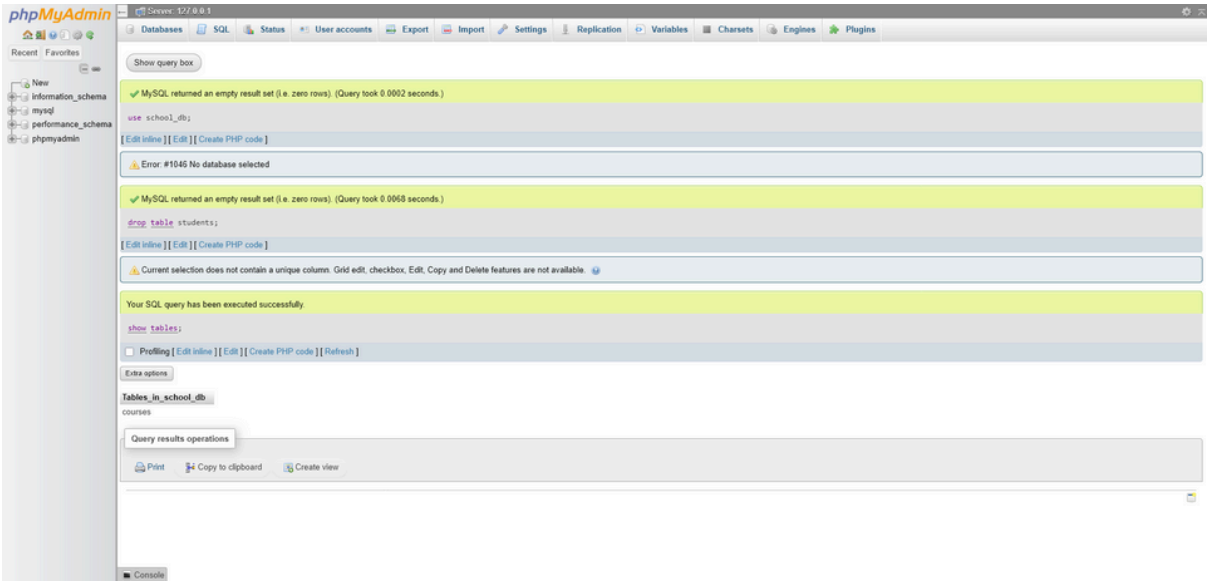
6.1 Dropthe **teachers** table from the **school_db** database.

```
use school_db;

alter table students
drop foreign key fk_teacher;

drop table teachers;
```



6.2 Dropthe**students**tablefromthe **school_db** database and verify that the table has been removed.

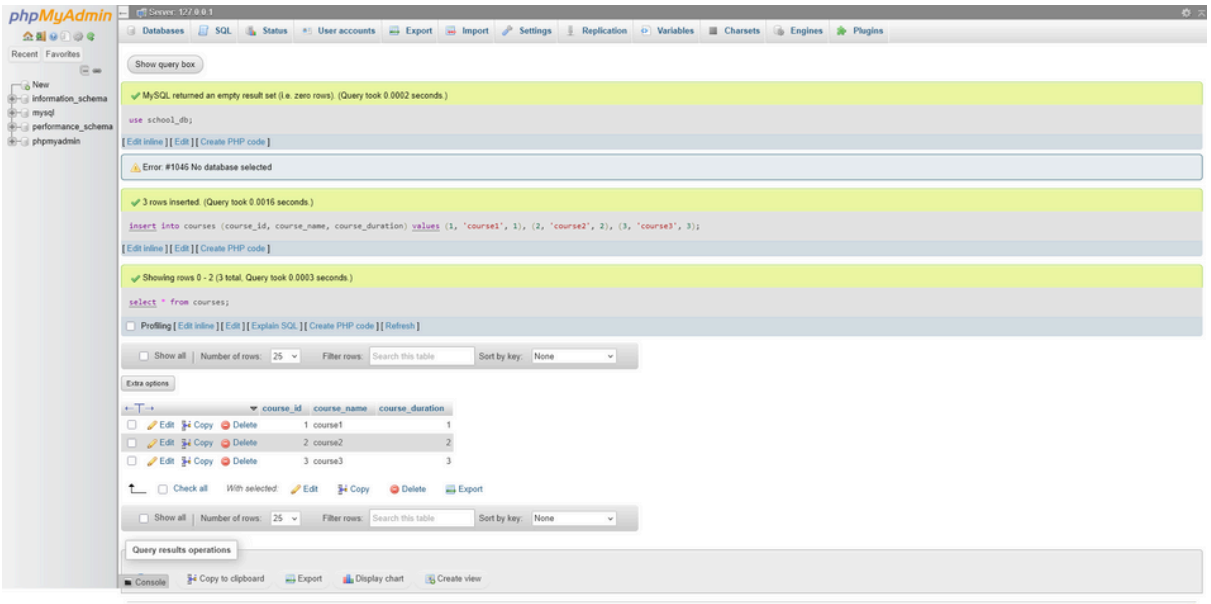
```
use school_db;

drop table students;

      tables;
```



7 DataManipulationLanguage(DML)

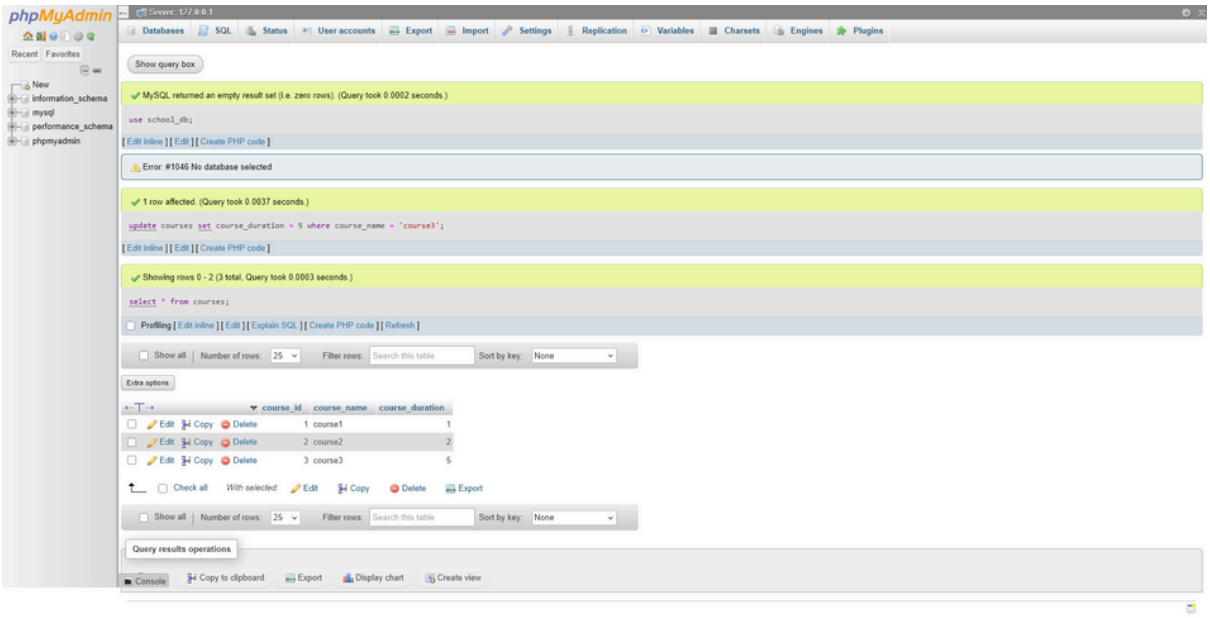
7.1 Insert three records into the **courses** table using the **INSERT** command.

```
use school_db;

insert into courses (course_id, course_name,course_duration) values
    (1, 'course1', 1),
    (2, 'course2', 2),
    (3, 'course3', 3);

select *
from courses;
```



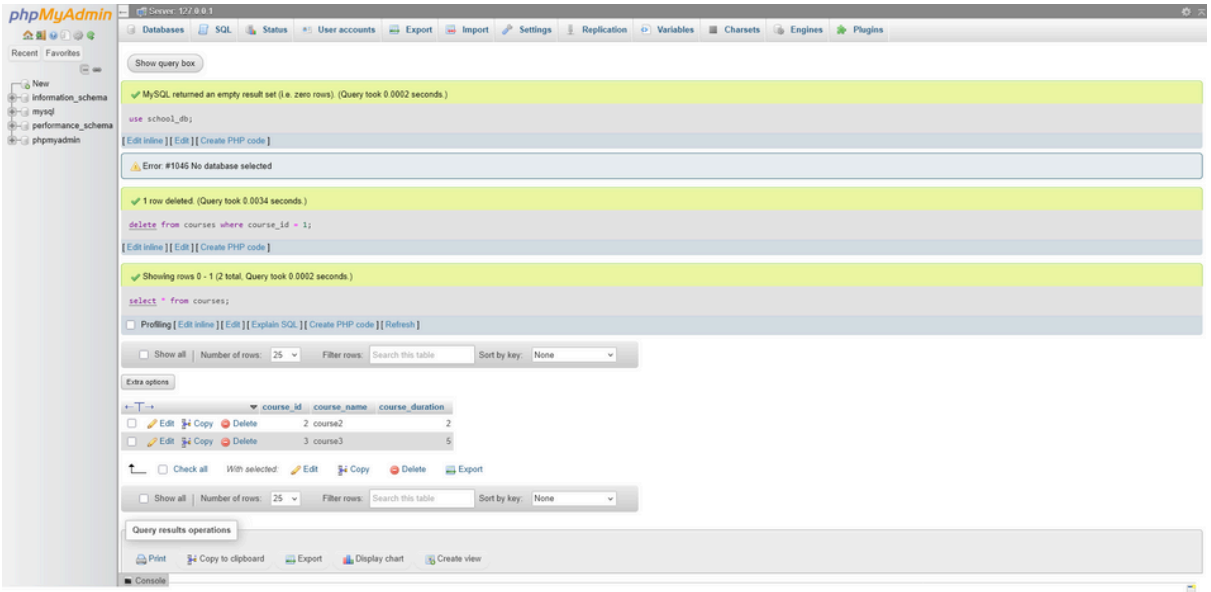
7.2 Updatethecoursedurationofaspecificcourseusingthe UPDATE command.

```
use school_db;

update courses
set  course_duration = 5
where course_name = 'course3';

select  *
from courses;
```



7.3 Deleteacoursewithaspecific course_id from the courses table using the DELETE command.

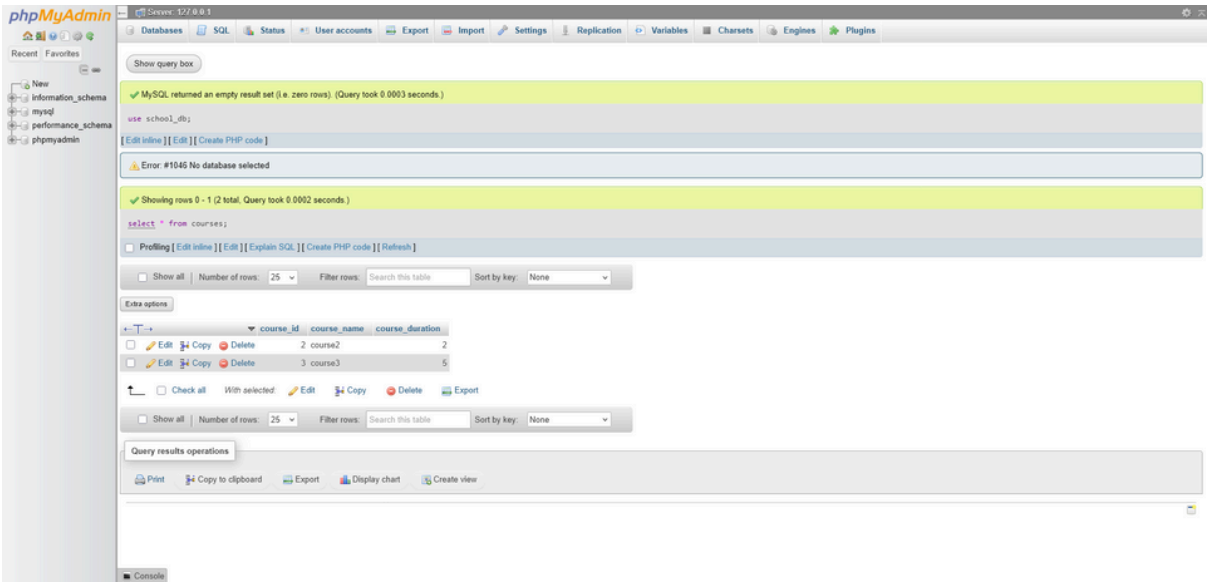
```
use school_db;

delete  from courses
where course_id = 1;

select  *
from courses;
```



8 DataQueryLanguage(DQL)

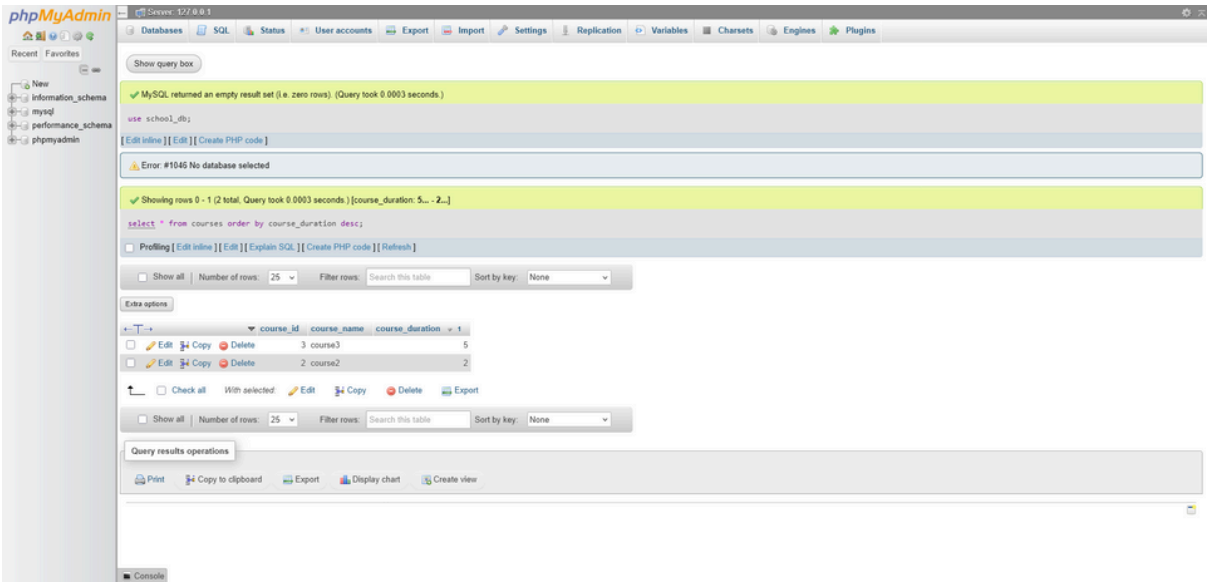
8.1 Retrieve all courses from the **courses** table using the **SELECT** statement.

```
use school_db;

select  *
from courses;
```



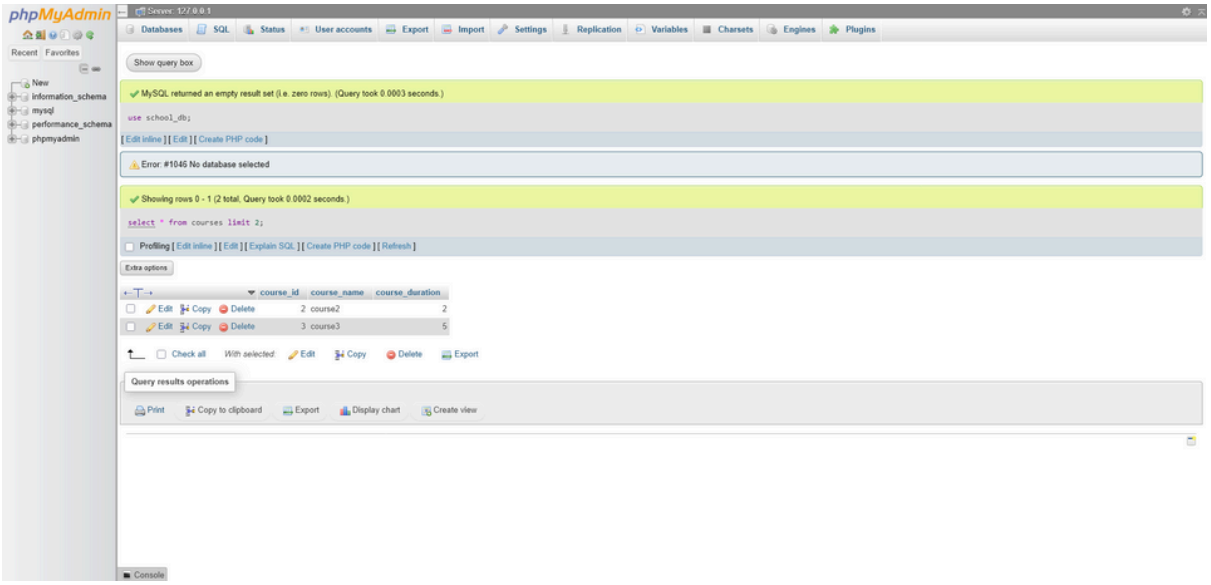
8.2 Sort the courses based on **course_duration** in descending order using **ORDER BY**.

```
use school_db;

select  *
from courses
order  by course_duration desc;
```



8.3 Limit the results of the SELECTquery to show only the top twocoursesusing LIMIT.

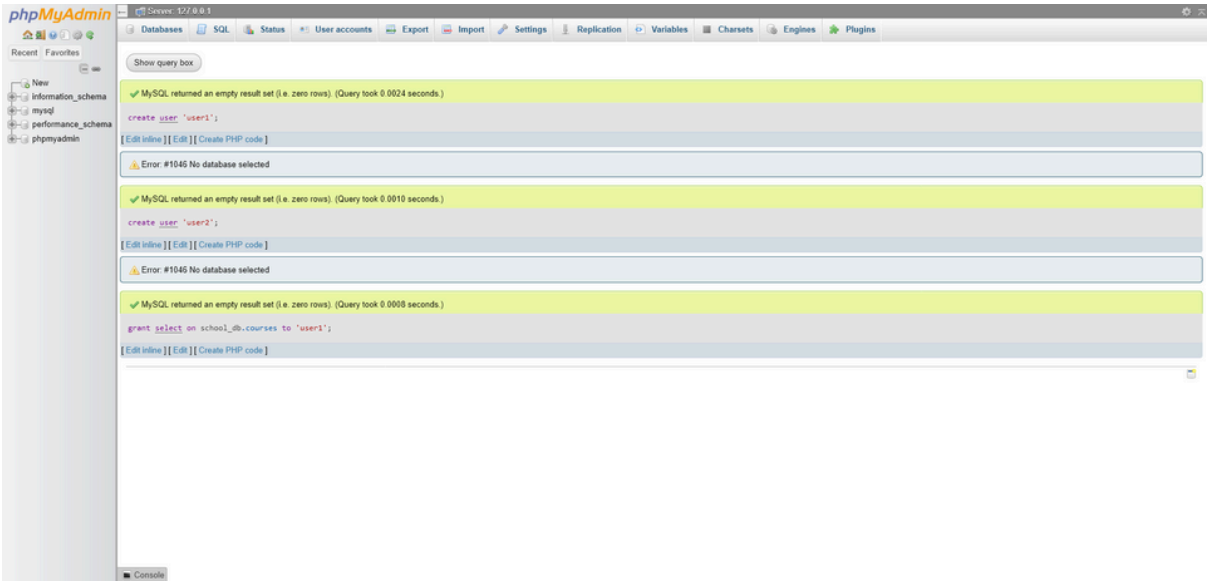
```
use school_db;

select  *
from courses limit  2;
```



9 DataControlLanguage(DCL)

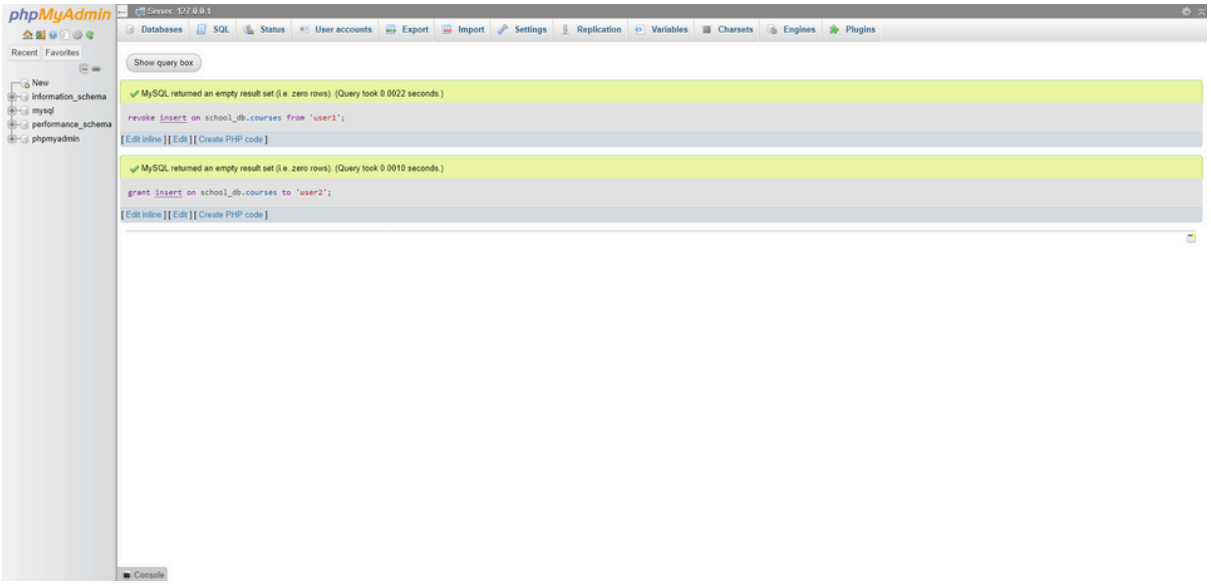
9.1 Create two new users **user1** and **user2** and grant **user1** permission to **SELECT** from the **courses** table.

```
create user 'user1';

create user 'user2';

grant select on school_db.courses
to 'user1';
```



9.2 Revoke the **INSERT** permission from **user1** and give it to **user2**.

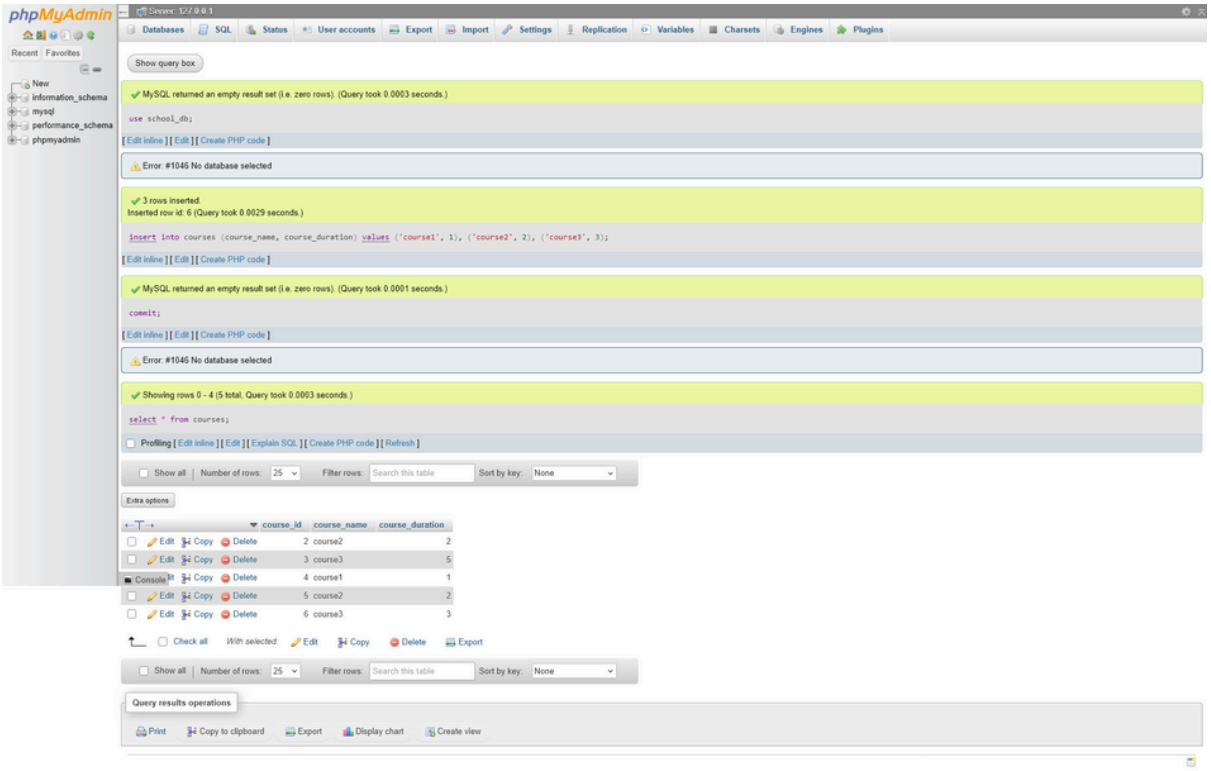
```
revoke insert on school_db.courses
from 'user1';

grant insert on school_db.courses
to 'user2';
```



10 Transaction Control Language (TCL)

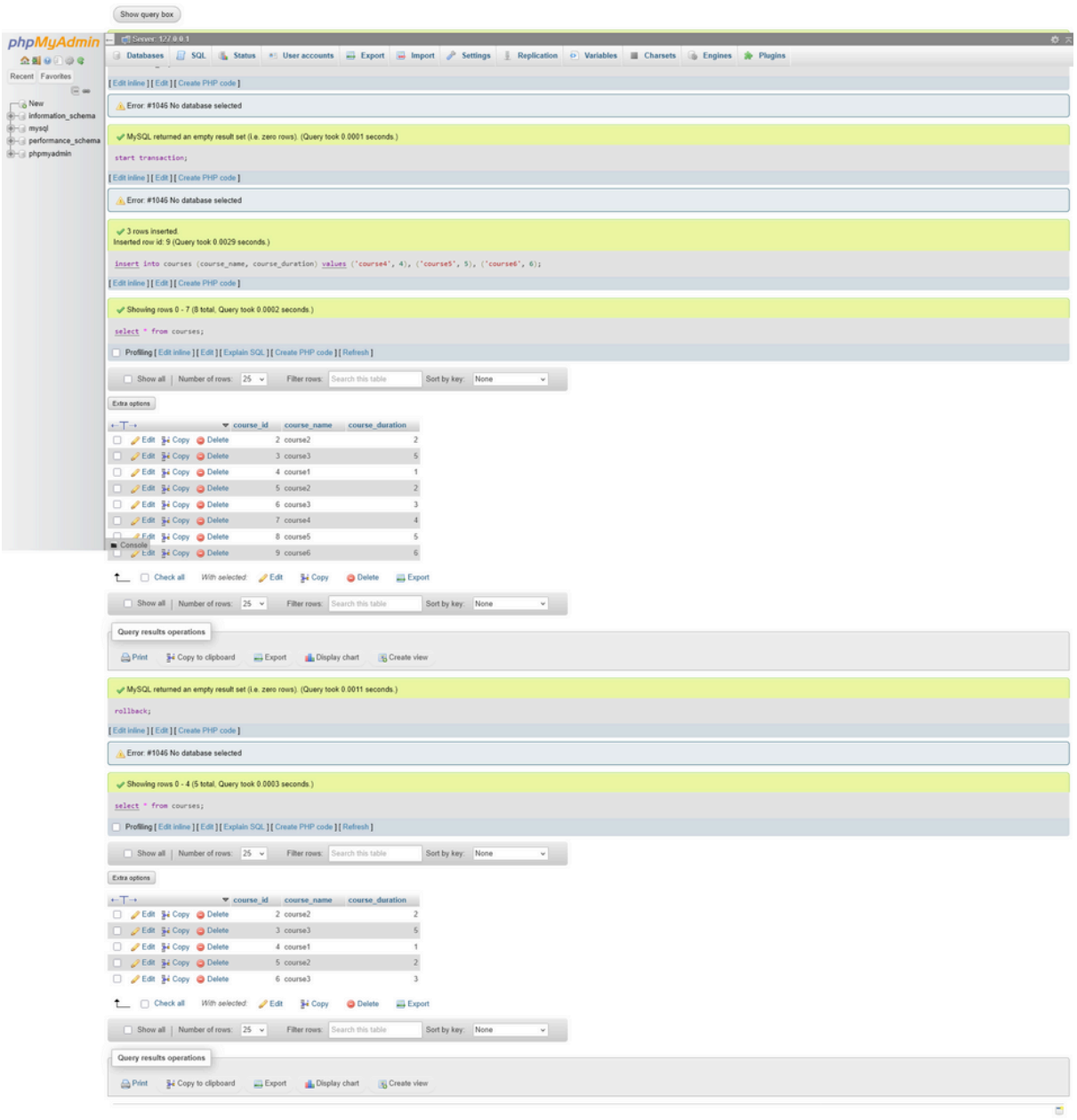
10.1 Insert a few rows into the **courses** table and use **COMMIT** to save the changes.

```
use school_db;

insert into courses (course_name, course_duration) values
    ('course1',      1),
    ('course2',      2),
    ('course3',  3);

commit;

select * from courses;
```



10.2 Insert additional rows, then use ROLLBACK to undo the last insert operation.

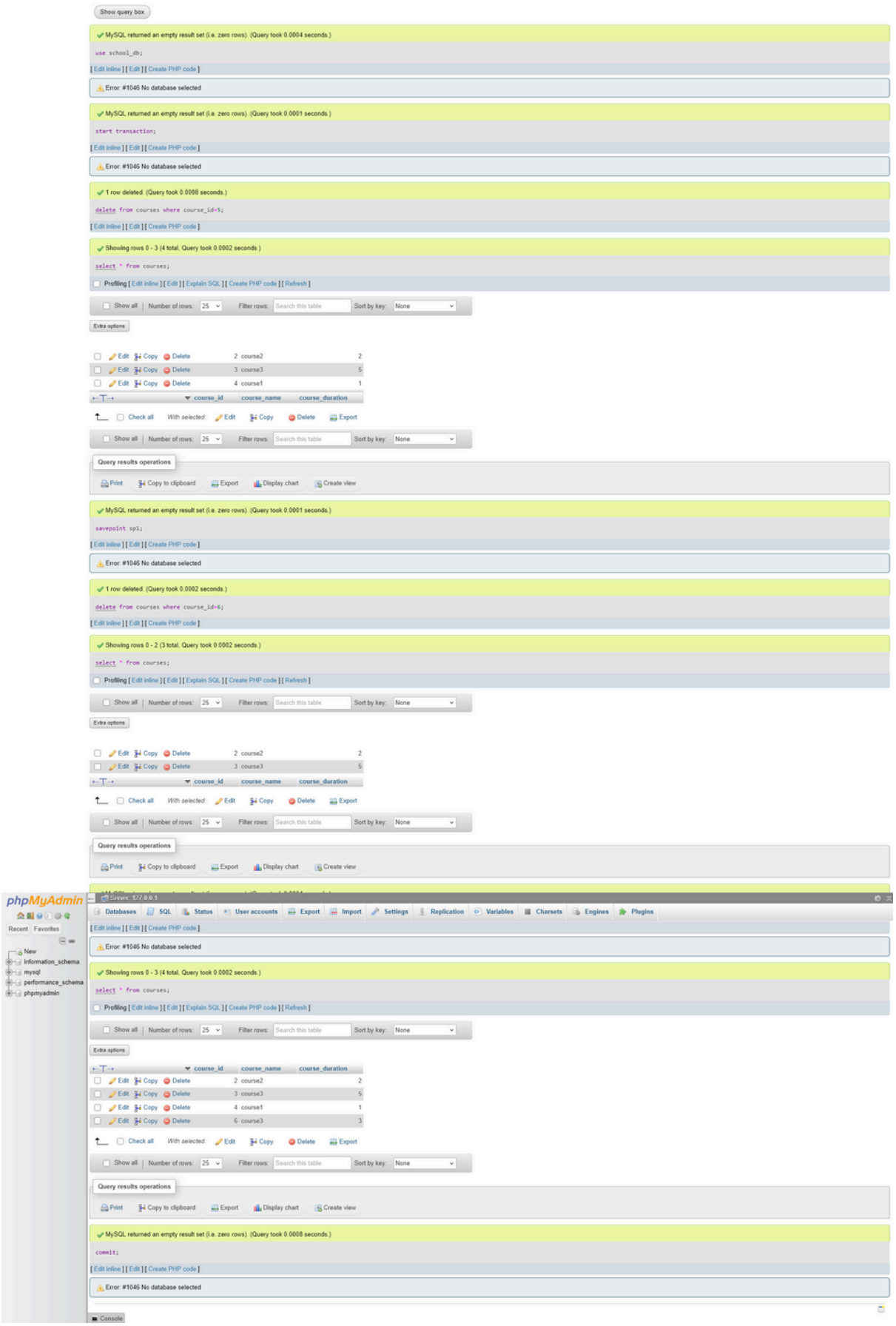
```
use school_db;

start transaction;

insert into courses (course_name, course_duration) values
    ('course4', 4),
    ('course5', 5),
    ('course6', 6);

select * from courses;

rollback ;

select * from courses;
```



10.3 Create a **SAVEPOINT** before updating the **courses** table, and use it to roll back specific changes.

```
use school_db;

start transaction;

delete from courses
where course_id=5;

select * from courses;

savepoint sp1;
```

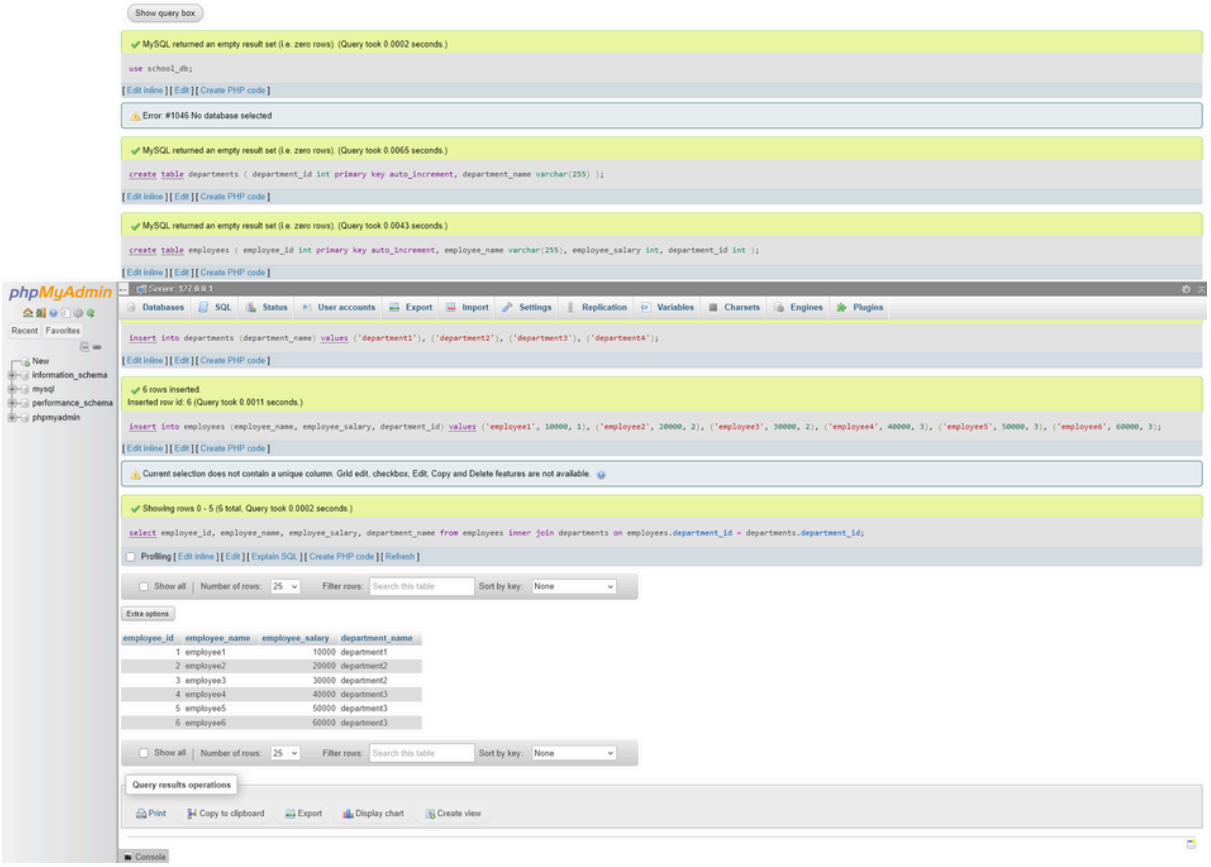
```
11
12 delete  from courses
13 where course_id=6;
14
15 select  *  from courses;
16
17 rollback  to savepoint sp1;
18
19 select  *  from courses;
20
21 commit;
```


Show query box
MySQL returned an empty result set (i.e. zero rows). (Query took 0.0004 seconds.)
use school_db;
[Edit inline] [Edit] [Create PHP code]
Error: #1046 No database selected
MySQL returned an empty result set (i.e. zero rows). (Query took 0.0001 seconds.)
start transaction;
[Edit inline] [Edit] [Create PHP code]
Error: #1046 No database selected
1 row deleted. (Query took 0.0008 seconds.)
delete from courses where course_id=5;
[Edit inline] [Edit] [Create PHP code]
Showing rows 0 - 3 (4 total, Query took 0.0002 seconds.)
select * from courses;
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
Edit Copy Delete 2 course2 2
Edit Copy Delete 3 course3 5
Edit Copy Delete 4 course1 1
course_id course_name course_duration
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
MySQL returned an empty result set (i.e. zero rows). (Query took 0.0001 seconds.)
savepoint sp1;
[Edit inline] [Edit] [Create PHP code]
Error: #1046 No database selected
1 row deleted. (Query took 0.0002 seconds.)
delete from courses where course_id=6;
[Edit inline] [Edit] [Create PHP code]
Showing rows 0 - 2 (3 total, Query took 0.0002 seconds.)
select * from courses;
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
Edit Copy Delete 2 course2 2
Edit Copy Delete 3 course3 5
course_id course_name course_duration
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
phpMyAdmin
Recent Favorites
New
information_schema
mysql
performance_schema
phpmyadmin
Server: 127.0.0.1
Databases SQL Status User accounts Export Import Settings Replication Variables Charsets Engines Plugins
[Edit inline] [Edit] [Create PHP code]
Error: #1046 No database selected
Showing rows 0 - 3 (4 total, Query took 0.0002 seconds.)
select * from courses;
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
course_id course_name course_duration
Edit Copy Delete 2 course2 2
Edit Copy Delete 3 course3 5
Edit Copy Delete 4 course1 1
Edit Copy Delete 6 course3 3
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
MySQL returned an empty result set (i.e. zero rows). (Query took 0.0008 seconds.)
commit;
[Edit inline] [Edit] [Create PHP code]
Error: #1046 No database selected
Console

11 SQL Joins

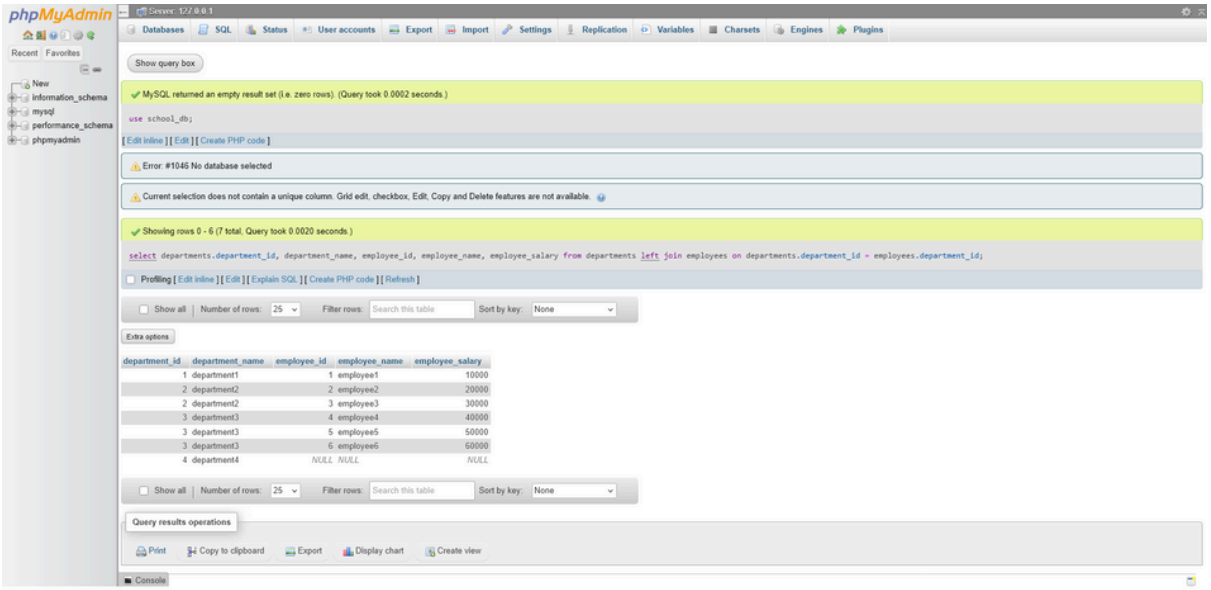
11.1 Create two tables: **departments** and **employees**. Perform an **INNER JOIN** to display employees along with their respective departments.

```sql
use school_db;

create table departments (
    department_id int primary key auto_increment,
    department_name varchar(255)
);

create table employees (
    employee_id int primary key auto_increment,
    employee_name varchar(255),
    employee_salary int,
    department_id int
);

insert into departments (department_name) values
    ('department1'),
    ('department2'),
    ('department3'),
    ('department4');

insert into employees (employee_name, employee_salary, department_id
    ) values
    ('employee1', 10000, 1),
    ('employee2', 20000, 2),
    ('employee3', 30000, 2),
    ('employee4', 40000, 3),
    ('employee5', 50000, 3),
    ('employee6', 60000, 3);

select employee_id, employee_name, employee_salary, department_name
from employees
inner join departments
on employees.department_id = departments.department_id;
```



11.2 Use a **LEFT JOIN** to show all departments, even those without employees.

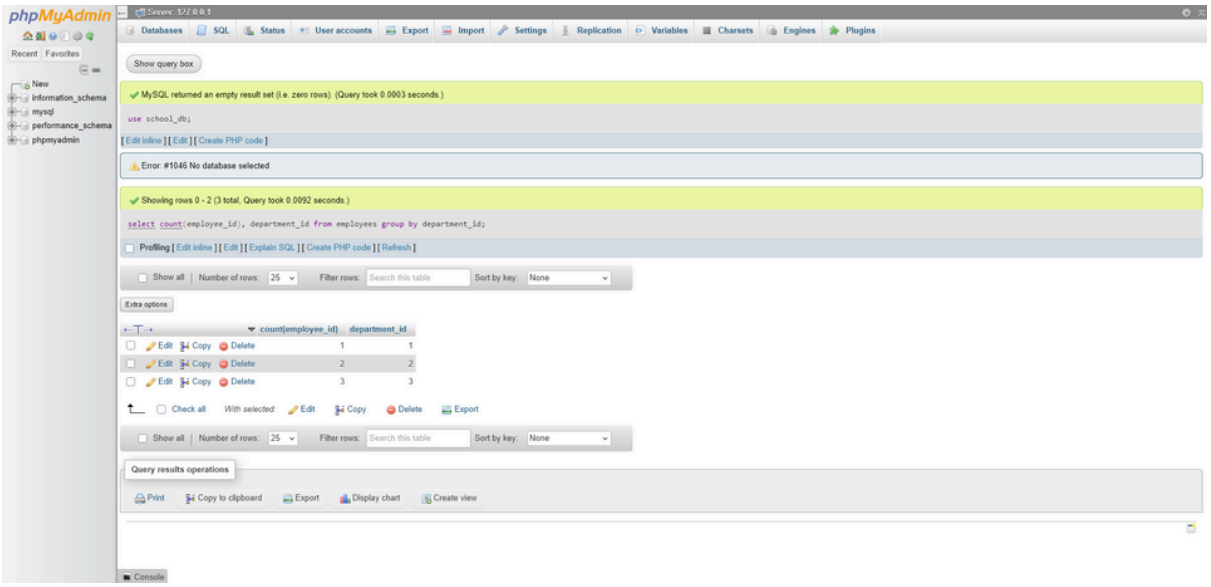
```
use school_db;

select departments.department_id, department_name, employee_id,
    employee_name, employee_salary
fro    departments
m      join   employees
left   departments.department_id  employees.department_id;
on
```



12 SQL Group By

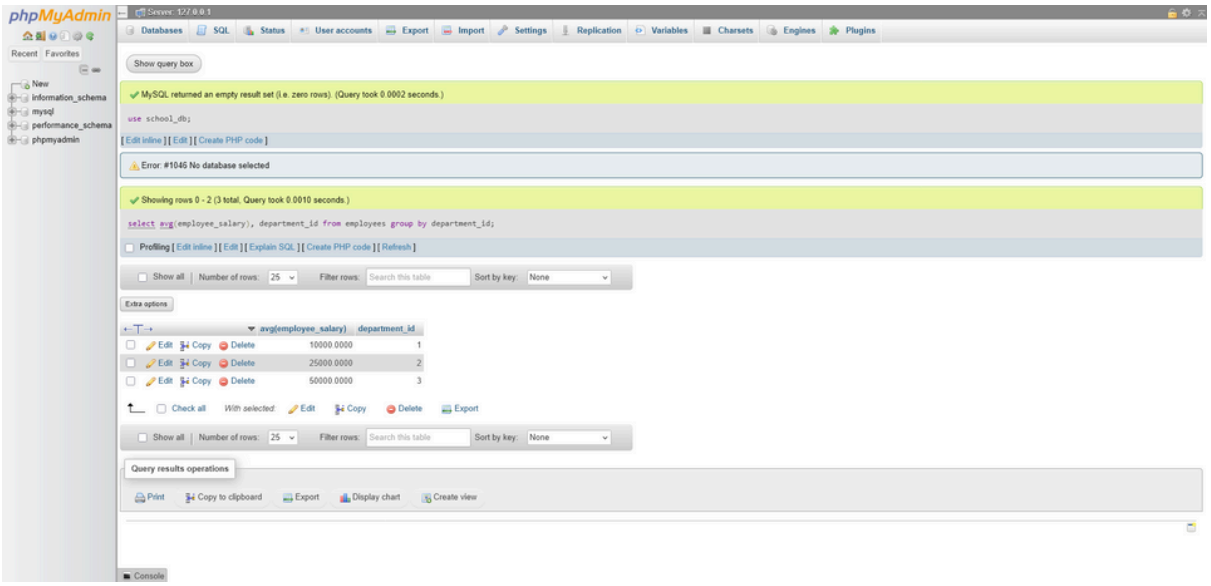
12.1 Groupemployeesbydepartmentandcountthenumberof employees in each department using GROUP BY.

```
use school_db;

select  count(employee_id), department_id
from employees
group by department_id;
```



12.2 UsetheAVGaggregatefunctiontofindtheaveragesalary of employees in each department.

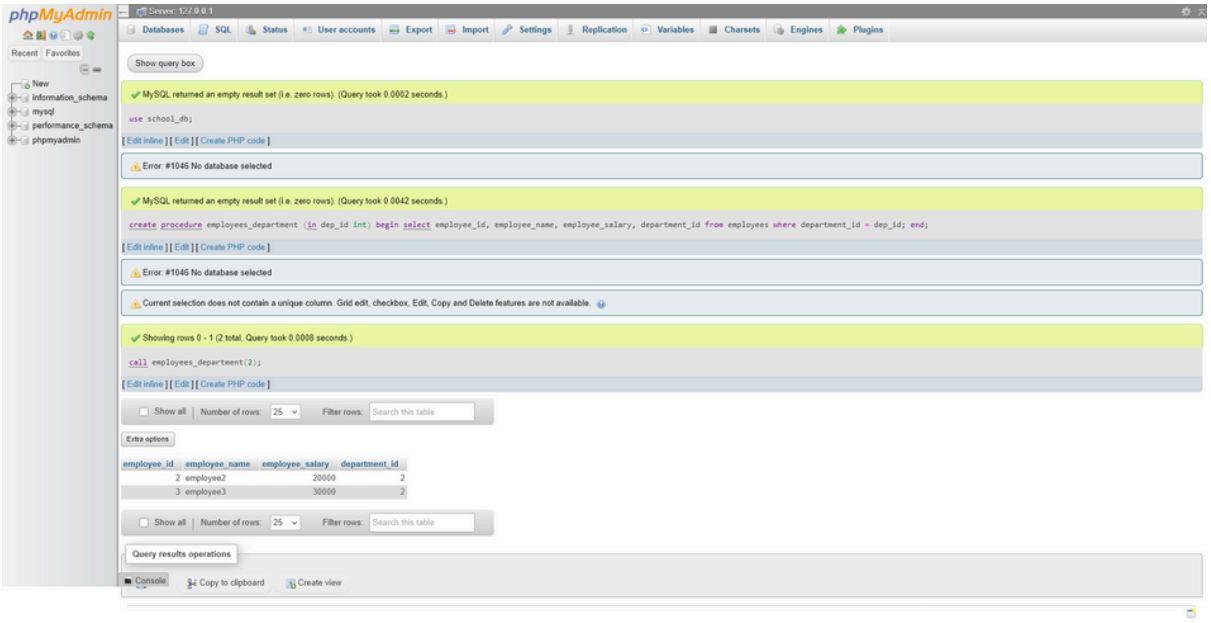
```
use school_db;

select  avg(employee_salary), department_id
from employees
group by department_id;
```



13 SQL Stored Procedure

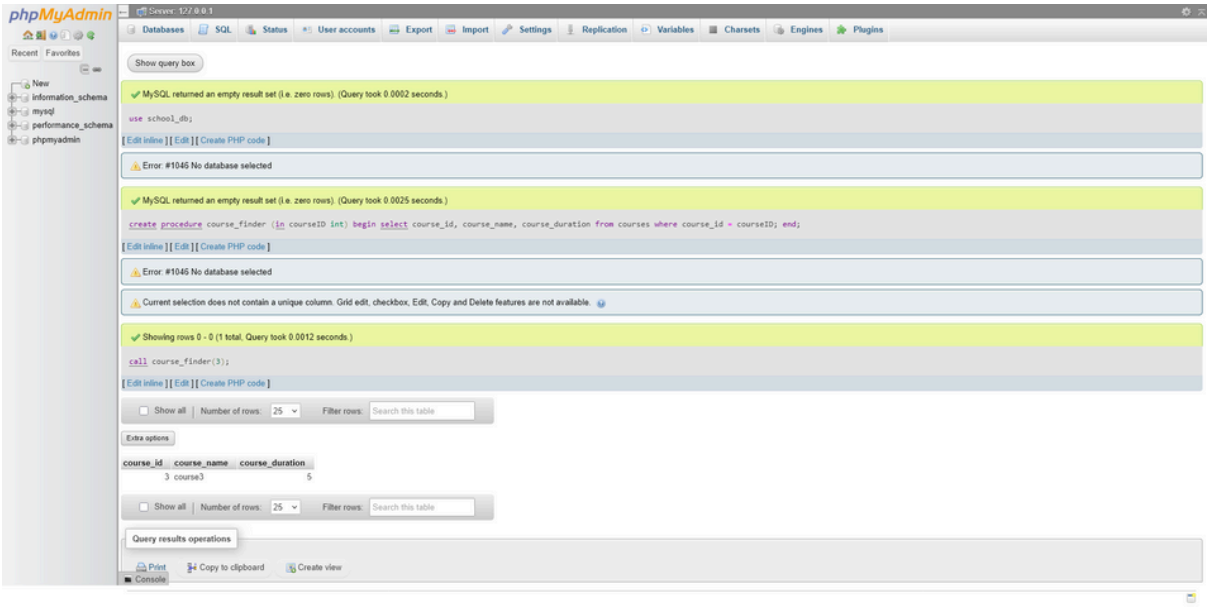
13.1 Write a stored procedure to retrieve all employees from the **employees** table based on department.

```
use school_db;

delimiter $$

create  procedure employees_departme(in  dep_id int)
begin
    select  employee_id, employee_name, employee_salary,
        department_id
    from employees
    where department_id = dep_id;
end $$

delimiter ;


call  employees_department(2);
```



13.2 Writeastoredprocedurethataccepts **course_id** as input and returns the course details.

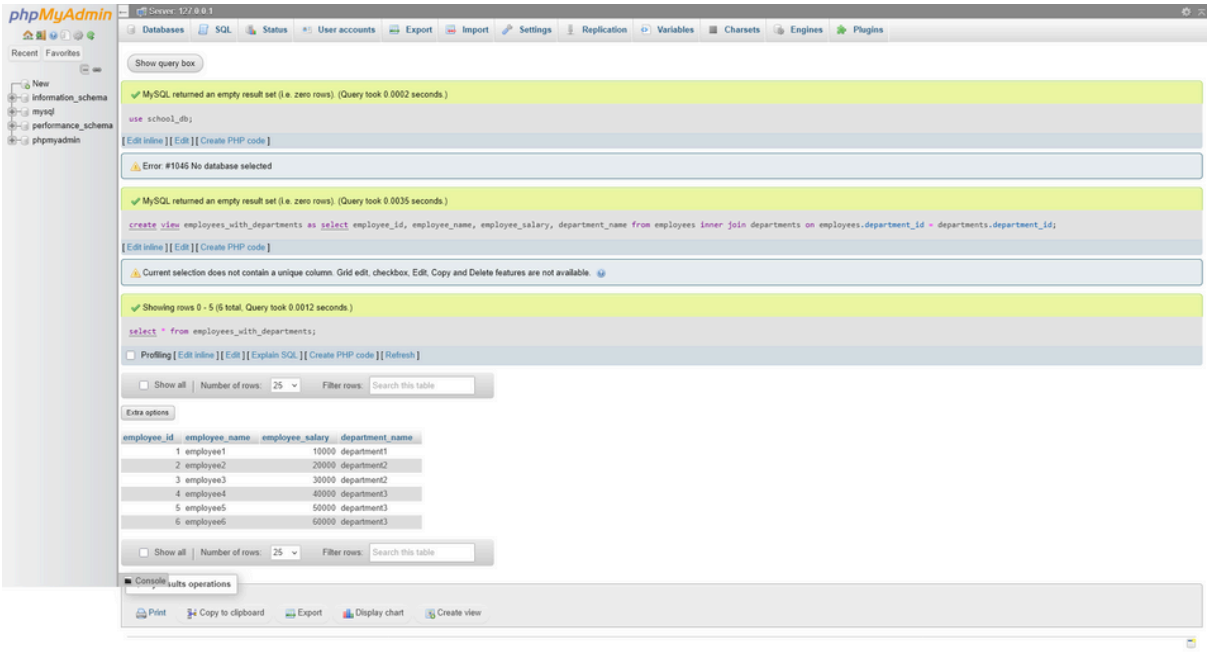
```
use school_db;

delimiter $$

create  procedure course_finder ( in  courseID int)
begin
	select  course_id, course_name, course_duration
	from courses
	where course_id = courseID;
end $$

delimiter ;


call  course_finder(3);
```



14 SQL View

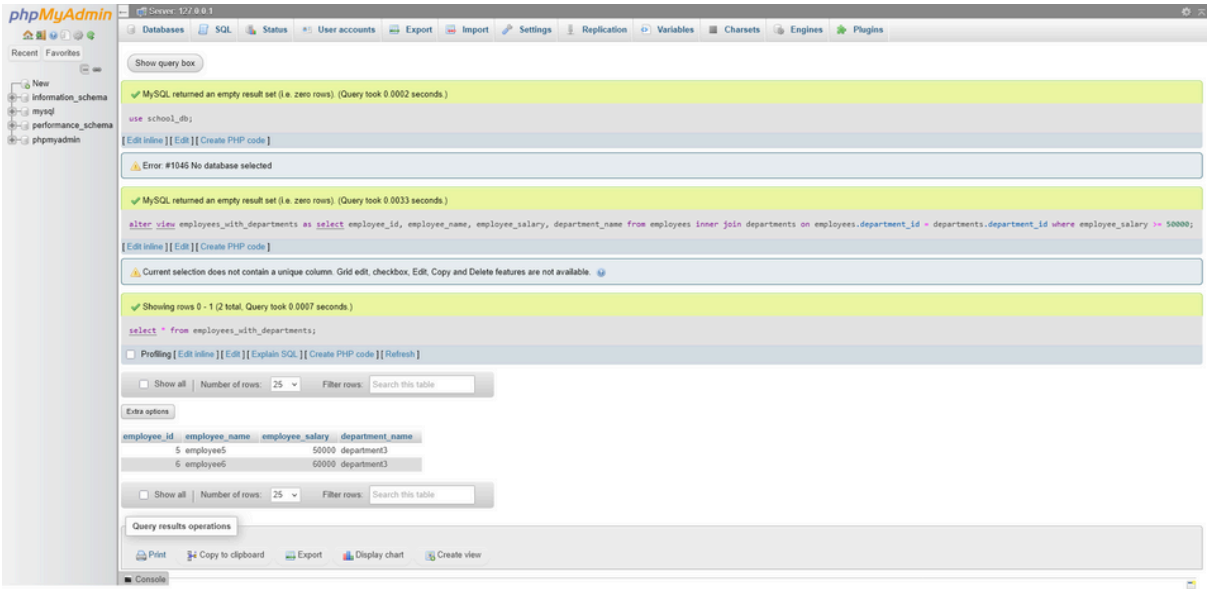
14.1 Create a view to show all employees along with their department names.

```
use school_db;

create view employees_with_departments as
select employee_id, employee_name, employee_salary, department_name
from employees
inner join departments
on employees.department_id = departments.department_id;


select * from employees_with_departments;
```



14.2 Modifytheviewtoexcludeemployeeswhosesalariesare below $50,000.

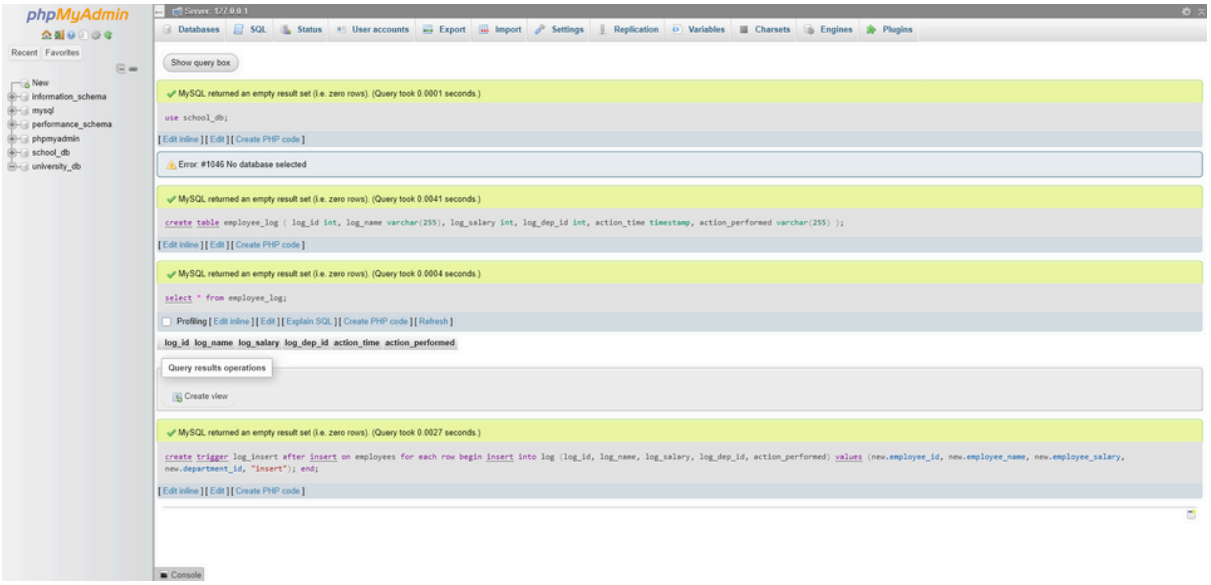
```
use school_db;

alter  view employees_with_departments as
select  employee_id, employee_name, employee_salary, department_name
from employees
inner  join  departments
on employees.department_id = departments.department_id
where employee_salary >= 50000;


select  *  from employees_with_departments;
```



15 SQL Triggers

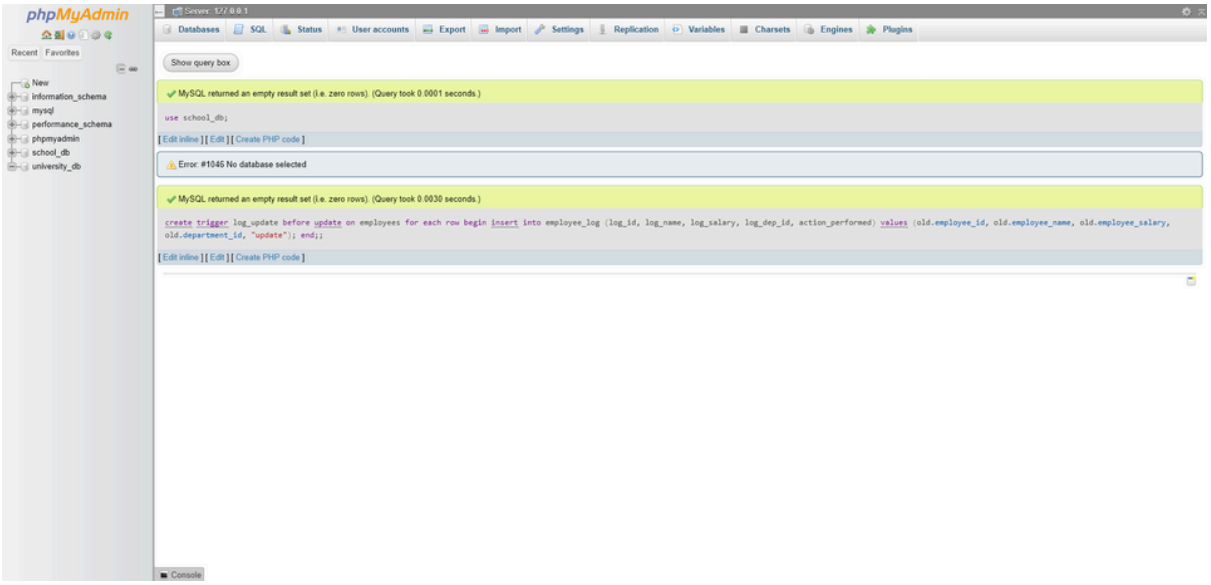
15.1 Create a trigger to automatically log changes to the **employees** table when a new employee is added.

```
use school_db;

create table employee_log (
    log_id int,
    log_name varchar(255),
    log_salary varchar(255),
    log_dep_id int ,
    action_time int ,
    action_performed varchar(255)
);

select * from employee_log;

delimiter $$
create trigger log_insert
after insert on employees
for each row
begin
    insert into log (log_id, log_name, log_salary, log_dep_id,
        action_performed)
    values (new.employee_id, new.employee_name, new.employee_salary,
        new.department_id, "insert");
end $$
delimiter ;
```



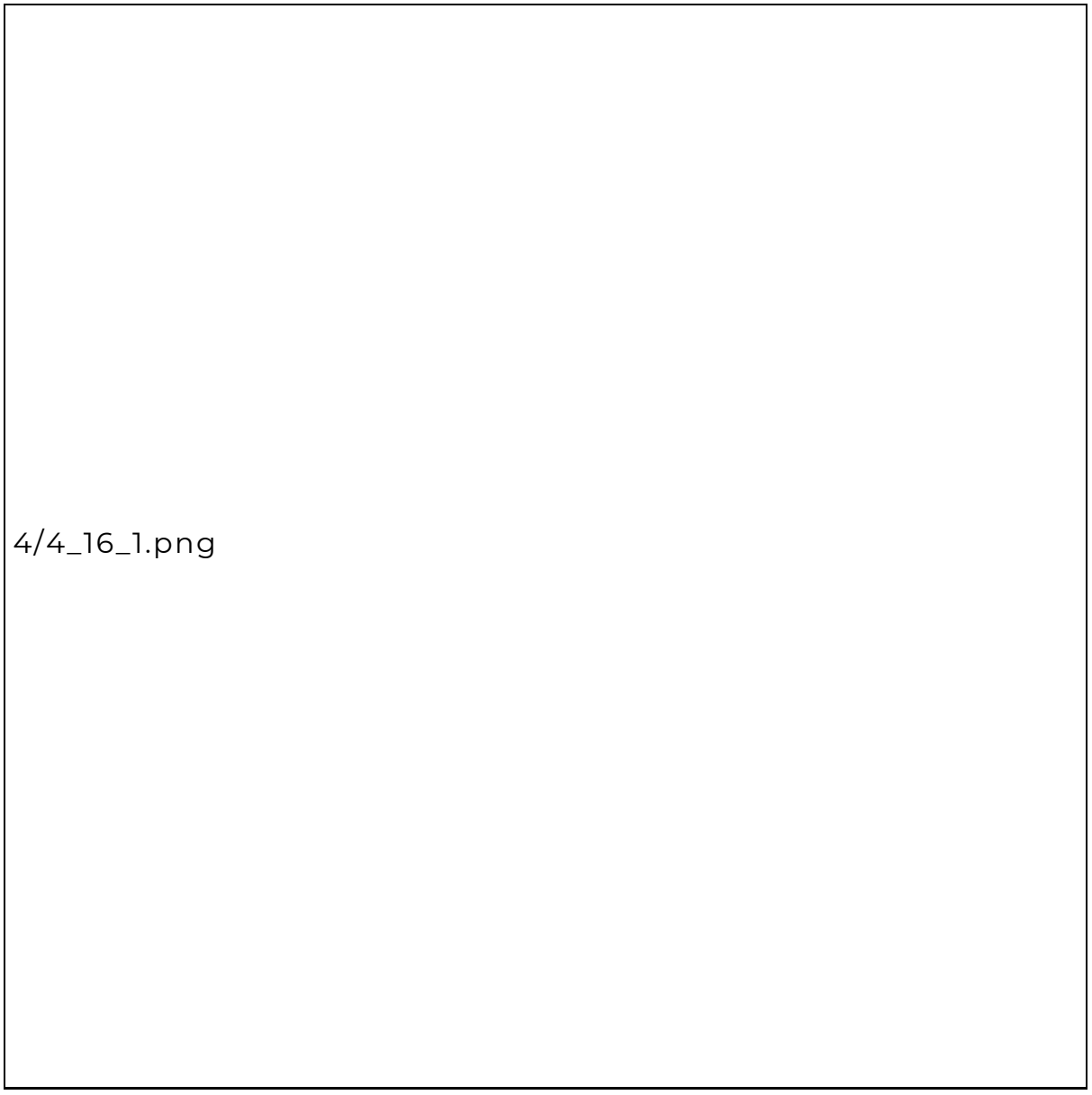
15.2 Create a trigger to update the last modified timestamp whenever an employee record is updated.

```
use school_db;

delimiter $$
create trigger log_update
before update on employees
for each row
begin
    insert into employee_log(log_id, log_name,log_salary,
        log_dep_id, action_performed)
    values (old.employee_id, old.employee_name,old.employee_salary,
        old.department_id, "update");
end; $$
delimiter ;
```



16 Introduction to PL/SQL

16.1 WriteaPL/SQLblocktoprintthetotalnumberof **employees** from the employees table.



4/4_16_1.png

16.2 Create a PL/SQL block that calculates the total sales from an **orders** table.

4/4_16_2.png

17 PL/SQL Control Structures

17.1 Write a PL/SQL block using an **IF-THEN** condition to check the department of an employee.

4/4_17_1.png

17.2 Usea**FOR LOOP**toiteratethroughemployeerecordsand display their names.

4/4_17_2.png

18 SQL Cursors

18.1 WriteaPL/SQLblockusinganexplicitcursortoretrieve and display employee details.

4/4_18_1.png

18.2 Create a cursor to retrieve all courses and display them one by one.

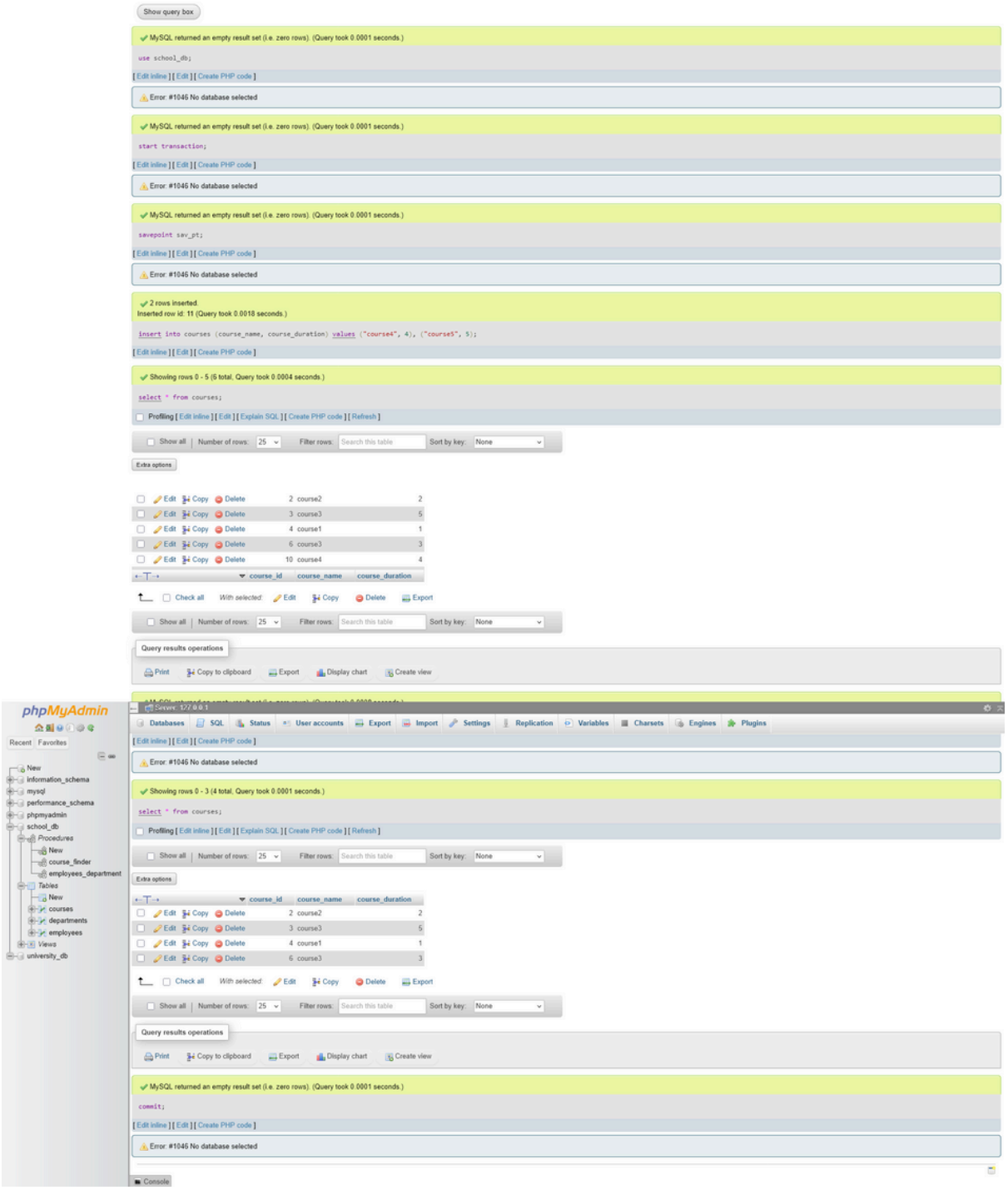
4/4_18_2.png

19 Rollback and Commit Savepoint

19.1 Perform a transaction where you create a savepoint, insert records, then rollback to the savepoint?

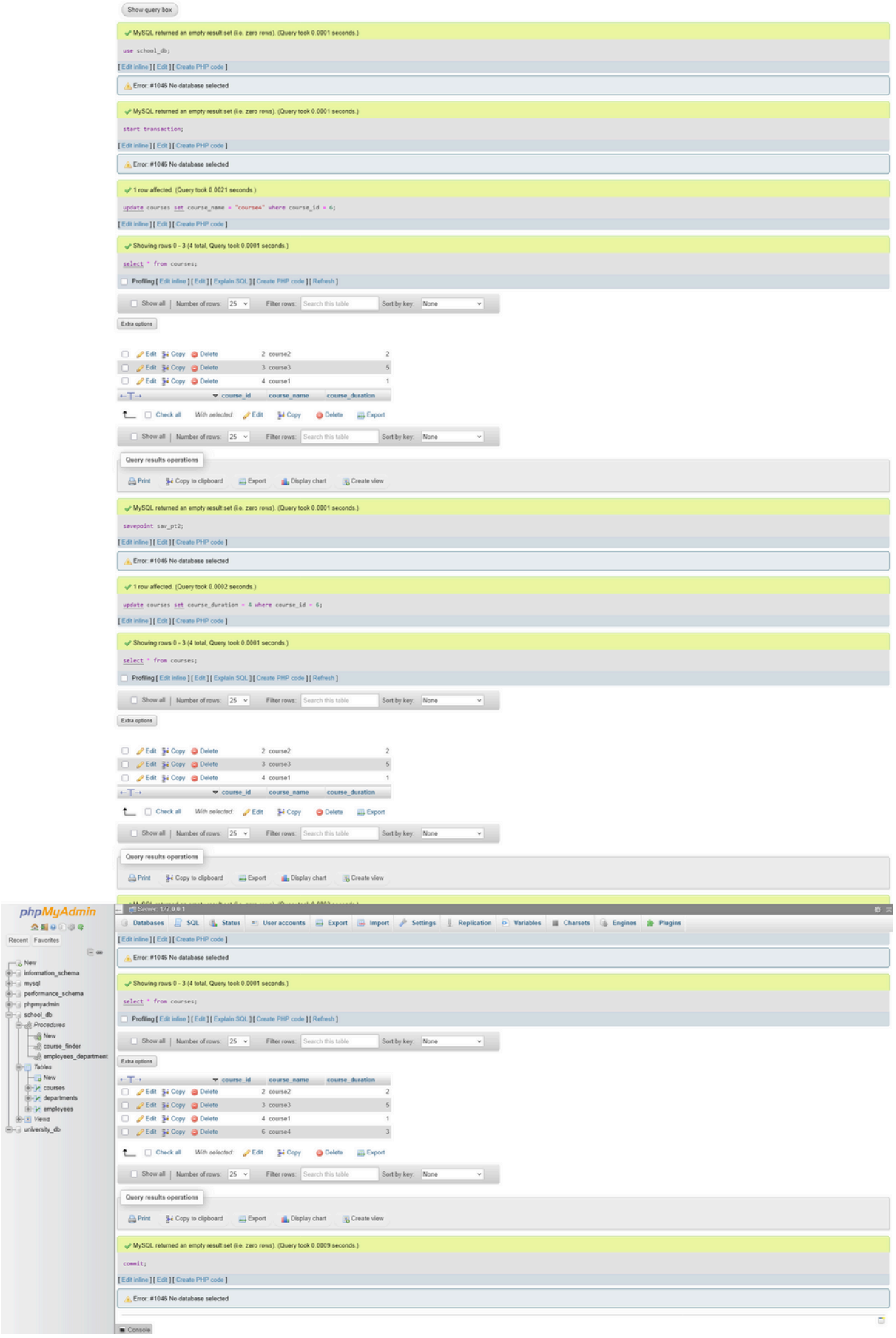
```
use school_db;

start  transaction;

savepoint sav_pt;

insert  into  courses (course_name, course_duration) values
    ("course4",    4),
    ("course5", 5);

```

```
11 select  *  from courses;
12
13 rollback  to savepoint sav_pt;
14
15 select  *  from courses;
16
17 commit;
```



19.2 Commit part of a transaction after using a savepoint and then rollback the remaining changes.

```
use school_db;

start  transaction;

update courses
set  course_name = "course4"
where course_id = 6;

select  *  from courses;

savepoint sav_pt2;

update courses
set  course_duration = 4
where course_id = 6;

select  *  from courses;

rollback  to sav_pt2;

select  *  from courses;

commit;
```


Show query box
MySQL returned an empty result set (i.e. zero rows). (Query took 0.0001 seconds.)
use school_db;
[Edit inline] [Edit] [Create PHP code]
Error: #1046 No database selected
MySQL returned an empty result set (i.e. zero rows). (Query took 0.0001 seconds.)
start transaction;
[Edit inline] [Edit] [Create PHP code]
Error: #1046 No database selected
1 row affected. (Query took 0.0021 seconds.)
update courses set course_name = "course4" where course_id = 6;
[Edit inline] [Edit] [Create PHP code]
Showing rows 0 - 3 (4 total, Query took 0.0001 seconds.)
select * from courses;
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
Edit Copy Delete 2 course2 2
Edit Copy Delete 3 course3 5
Edit Copy Delete 4 course1 1
course_id course_name course_duration
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
MySQL returned an empty result set (i.e. zero rows). (Query took 0.0001 seconds.)
savepoint sav_pt2;
[Edit inline] [Edit] [Create PHP code]
Error: #1046 No database selected
1 row affected. (Query took 0.0002 seconds.)
update courses set course_duration = 4 where course_id = 6;
[Edit inline] [Edit] [Create PHP code]
Showing rows 0 - 3 (4 total, Query took 0.0001 seconds.)
select * from courses;
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
Edit Copy Delete 2 course2 2
Edit Copy Delete 3 course3 5
Edit Copy Delete 4 course1 1
course_id course_name course_duration
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
phpMyAdmin
Recent Favorites
New
information_schema
mysql
performance_schema
phpmyadmin
school_db
Procedures
New
course_finder
employees_department
Tables
New
courses
departments
employees
Views
university_db
Server: 127.0.0.1
Databases SQL Status User accounts Export Import Settings Replication Variables Charsets Engines Plugins
[Edit inline] [Edit] [Create PHP code]
Error: #1046 No database selected
Showing rows 0 - 3 (4 total, Query took 0.0001 seconds.)
select * from courses;
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
course_id course_name course_duration
Edit Copy Delete 2 course2 2
Edit Copy Delete 3 course3 5
Edit Copy Delete 4 course1 1
Edit Copy Delete 6 course4 3
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
MySQL returned an empty result set (i.e. zero rows). (Query took 0.0009 seconds.)
commit;
[Edit inline] [Edit] [Create PHP code]
Error: #1046 No database selected
Console