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DBMS - Homework 01

PART-01

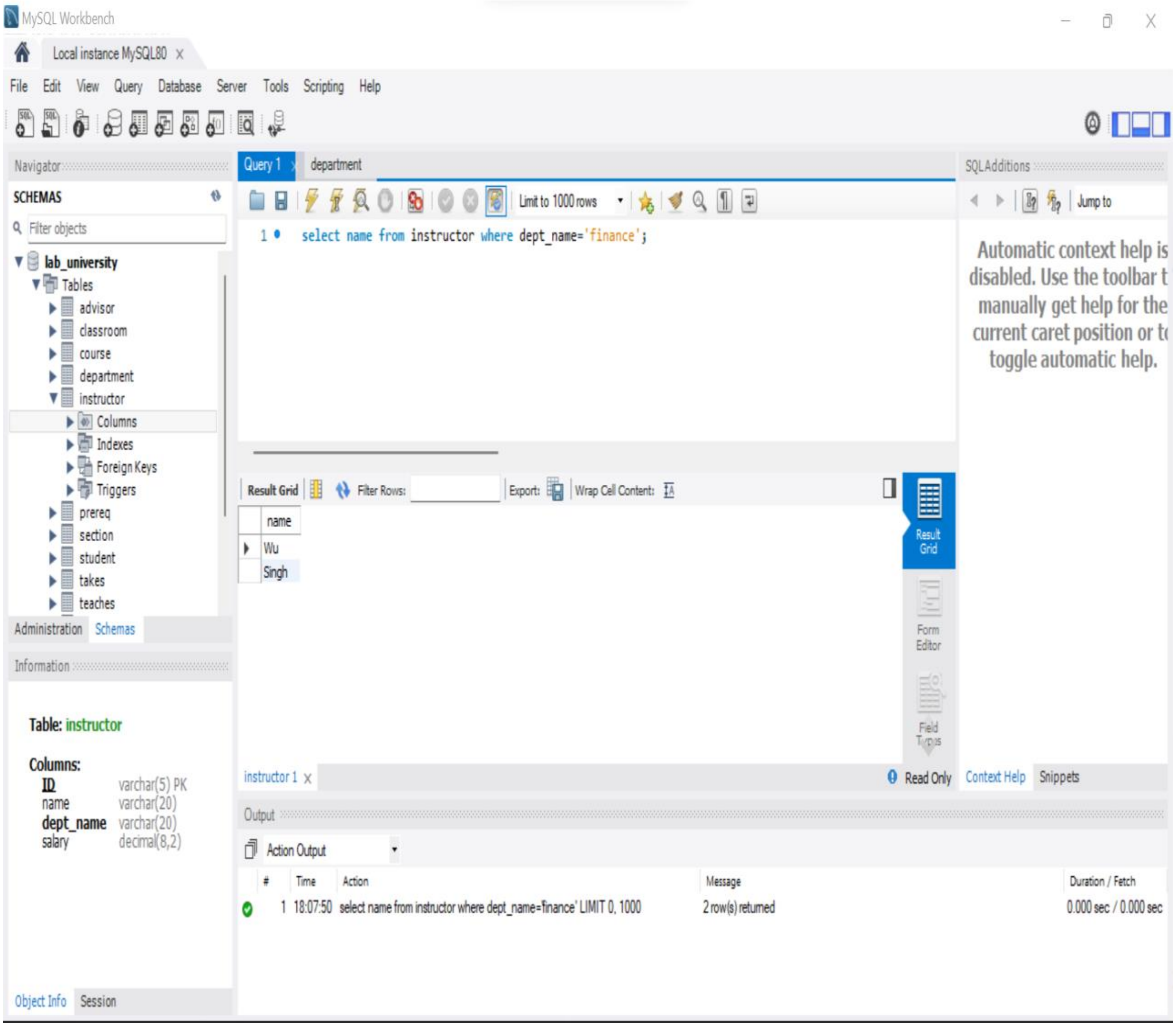
Q1 [5 pt]
Find the names of all the instructors from Finance department.

Solution:

Relational Algebra Expression:
Π(name) (σ (dept_name=” finance”) (instructor))

SQL Query:
select name from instructor where dept_name='finance';

Output:



```
select name from instructor where dept_name='finance';
```

name
Wu
Singh

Automatic context help is disabled. Use the toolbar t manually get help for the current caret position or t toggle automatic help.

Table: instructor

Columns:

ID	varchar(5) PK
name	varchar(20)
dept_name	varchar(20)
salary	decimal(8,2)

```
#  Time      Action                                                           Message            Duration / Fetch
1  18:07:50  select name from instructor where dept_name='finance' LIMIT 0, 1000  2 row(s) returned  0.000 sec / 0.000 sec
```

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Q2 [5 pt]

Find the names of courses in Biology department which have 4 credits.

Solution:

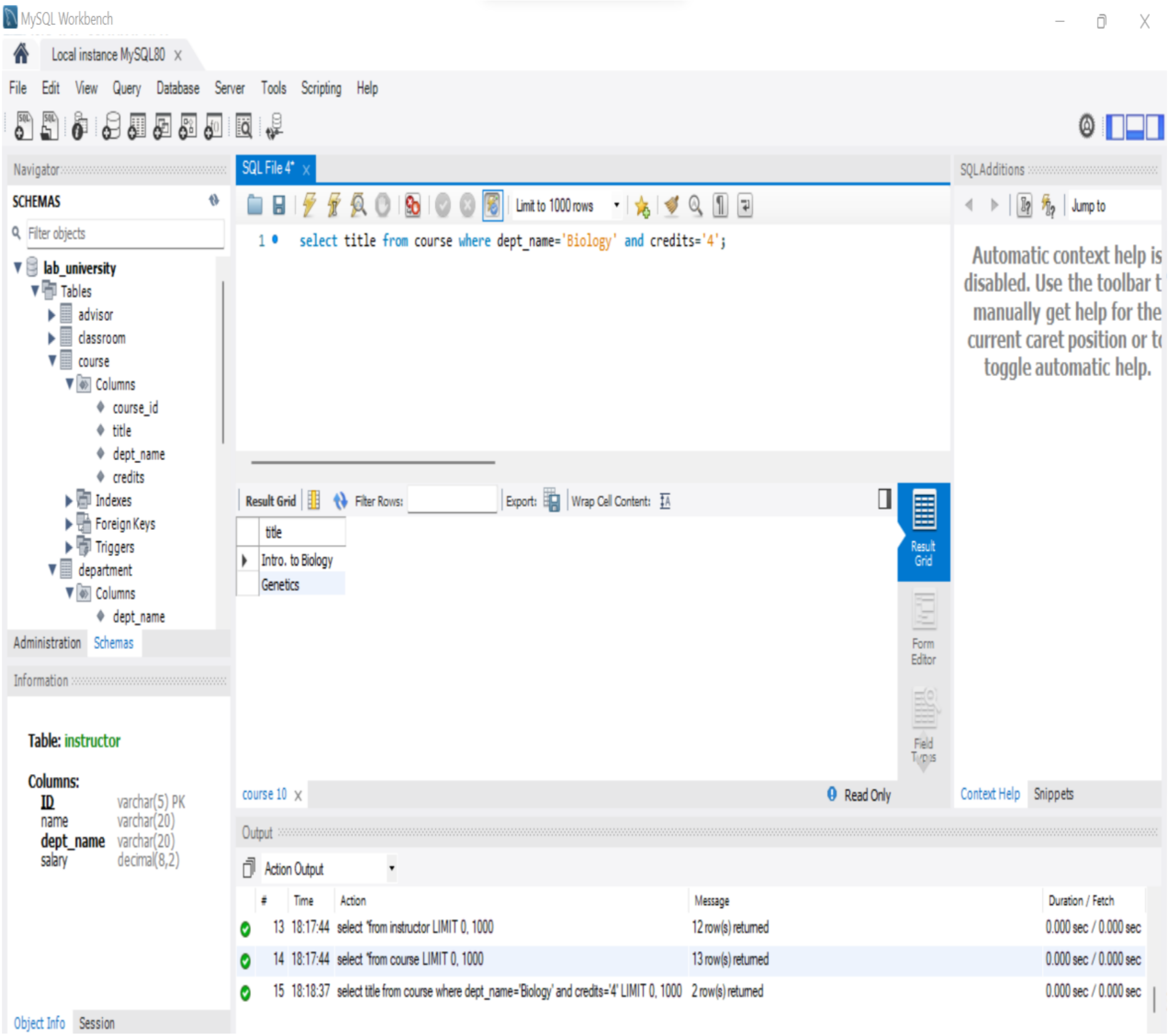
Relational Algebra Expression:

Π(title)(σ (dept_name=”biology” and credits=”4”)(course))

SQL Query:

select title from course where dept_name='Biology' and credits='4';

Output:



```
select title from course where dept_name='Biology' and credits='4';
```

Automatic context help is disabled. Use the toolbar t manually get help for the current caret position or t toggle automatic help.

title
Intro. to Biology
Genetics

Table: instructor

Columns:

ID	varchar(5) PK
name	varchar(20)
dept_name	varchar(20)
salary	decimal(8,2)

	#	Time	Action	Message	Duration / Fetch
✓	13	18:17:44	select *from instructor LIMIT 0, 1000	12 row(s) returned	0.000 sec / 0.000 sec
✓	14	18:17:44	select *from course LIMIT 0, 1000	13 row(s) returned	0.000 sec / 0.000 sec
✓	15	18:18:37	select title from course where dept_name='Biology' and credits='4' LIMIT 0, 1000	2 row(s) returned	0.000 sec / 0.000 sec

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Q3 [5 pt]

Display information about all courses whose name start with letter “I”.

Solution:

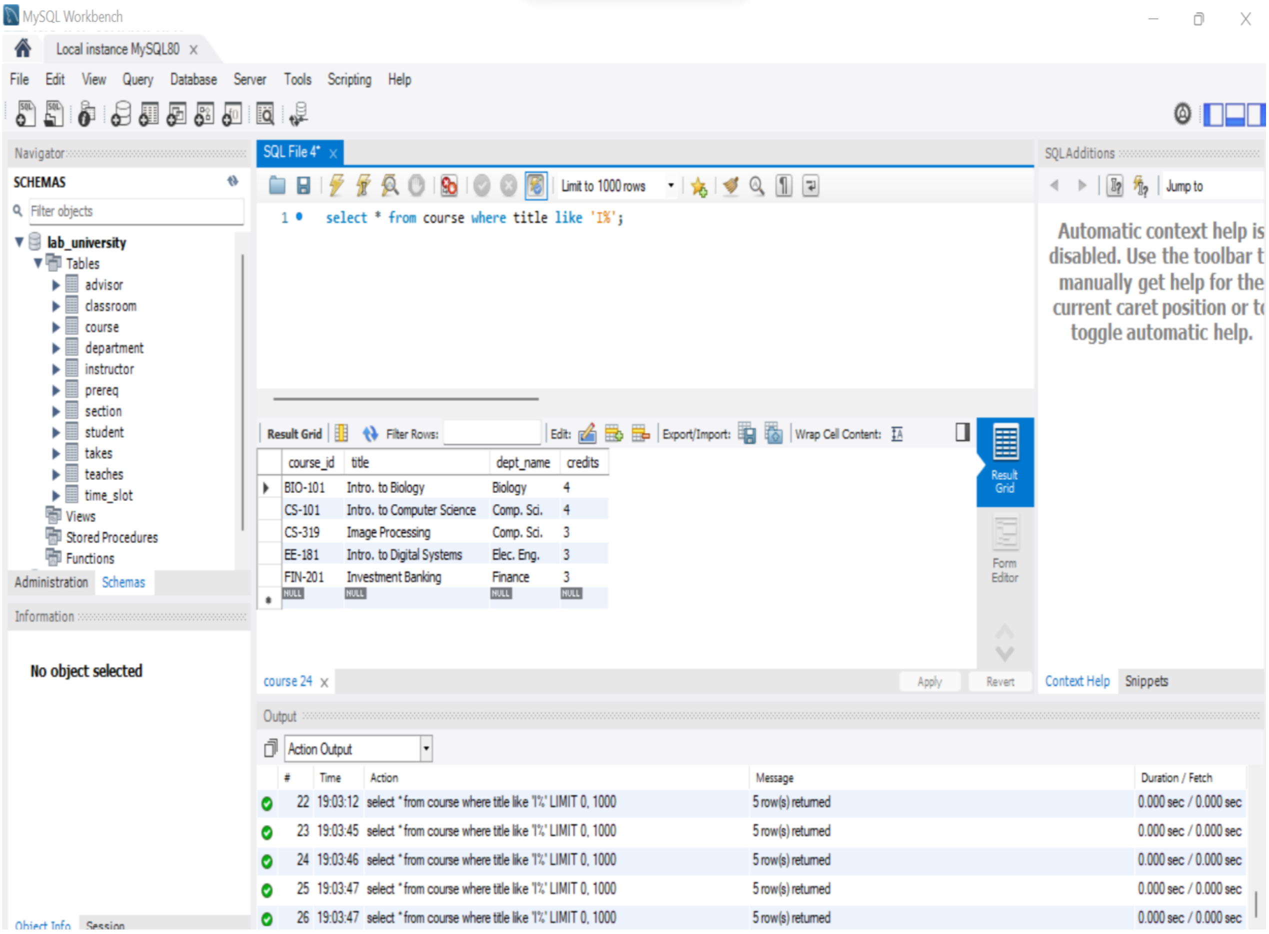
Relational Algebra Expression:

Π(course) (σ (title like 'I%')(course))

SQL Query:

select * from course where title like 'I%';

Output:



```
select * from course where title like 'I%';
```

Automatic context help is disabled. Use the toolbar t manually get help for the current caret position or t toggle automatic help.

course_id	title	dept_name	credits
BIO-101	Intro. to Biology	Biology	4
CS-101	Intro. to Computer Science	Comp. Sci.	4
CS-319	Image Processing	Comp. Sci.	3
EE-181	Intro. to Digital Systems	Elec. Eng.	3
FIN-201	Investment Banking	Finance	3
NULL	NULL	NULL	NULL

```
#   Time      Action                                               Message            Duration / Fetch
22  19:03:12  select * from course where title like 'I%' LIMIT 0, 1000  5 row(s) returned  0.000 sec / 0.000 sec
23  19:03:45  select * from course where title like 'I%' LIMIT 0, 1000  5 row(s) returned  0.000 sec / 0.000 sec
24  19:03:46  select * from course where title like 'I%' LIMIT 0, 1000  5 row(s) returned  0.000 sec / 0.000 sec
25  19:03:47  select * from course where title like 'I%' LIMIT 0, 1000  5 row(s) returned  0.000 sec / 0.000 sec
26  19:03:47  select * from course where title like 'I%' LIMIT 0, 1000  5 row(s) returned  0.000 sec / 0.000 sec
```

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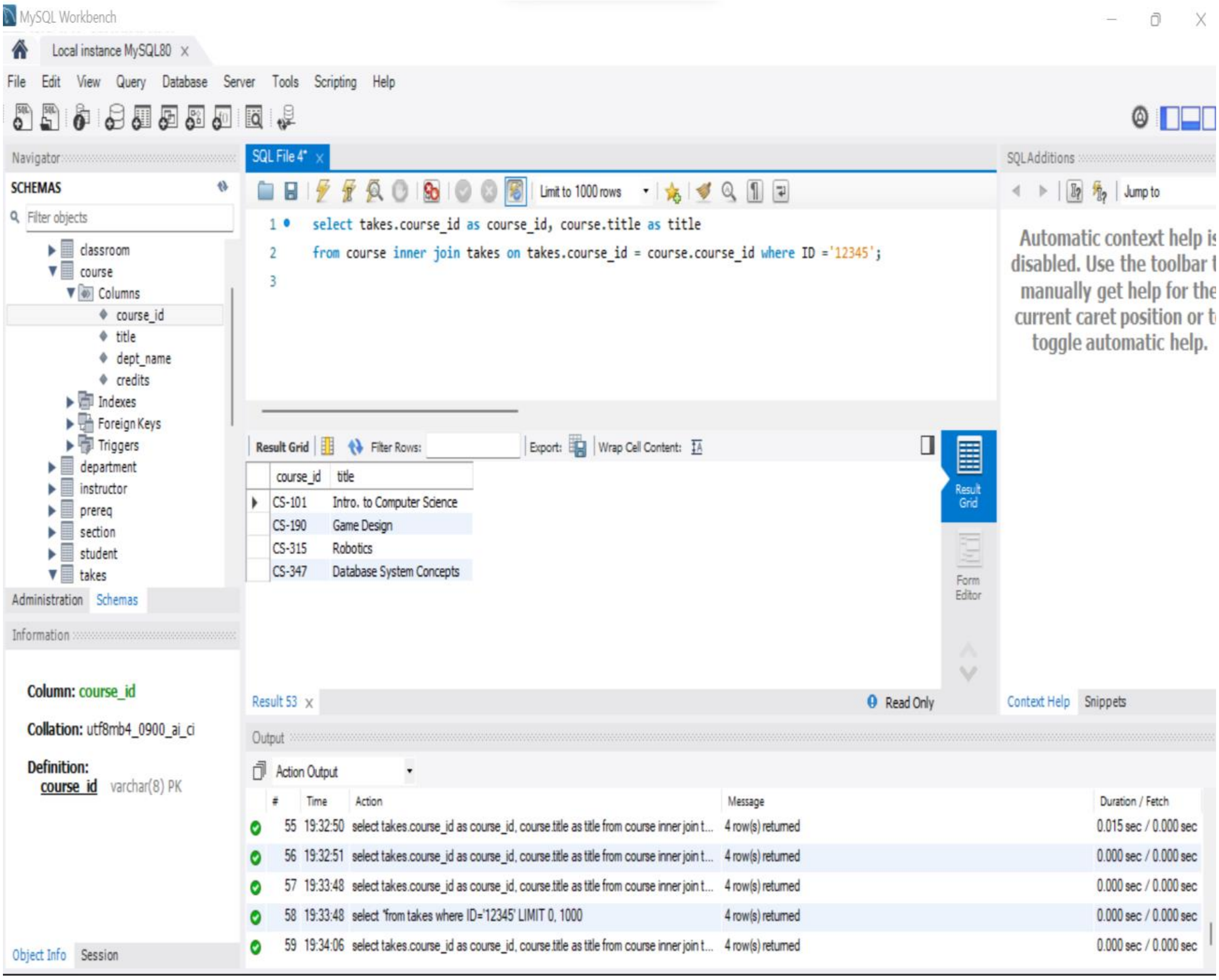
Q4 [5 pt]
Retrieve all course_id and title of all courses taken by the student with ID 12345.

Solution:

Relational Algebra Expression:
Π(takes.course_id,course.title)(σ (ID=’12345’)(course ⋈ takes on course_id))

SQL Query:
select takes.course_id as course_id, course.title as title from course inner join takes on takes.course_id = course.course_id where ID ='12345';

Output:



```
select takes.course_id as course_id, course.title as title
from course inner join takes on takes.course_id = course.course_id where ID ='12345';
```

course_id	title
CS-101	Intro. to Computer Science
CS-190	Game Design
CS-315	Robotics
CS-347	Database System Concepts

Column: course_id
Collation: utf8mb4_0900_ai_ci
Definition:
course_id varchar(8) PK

```
#   Time      Action                                                                        Message            Duration / Fetch
55  19:32:50  select takes.course_id as course_id, course.title as title from course inner join t...  4 row(s) returned  0.015 sec / 0.000 sec
56  19:32:51  select takes.course_id as course_id, course.title as title from course inner join t...  4 row(s) returned  0.000 sec / 0.000 sec
57  19:33:48  select takes.course_id as course_id, course.title as title from course inner join t...  4 row(s) returned  0.000 sec / 0.000 sec
58  19:33:48  select *from takes where ID='12345' LIMIT 0, 1000                              4 row(s) returned  0.000 sec / 0.000 sec
59  19:34:06  select takes.course_id as course_id, course.title as title from course inner join t...  4 row(s) returned  0.000 sec / 0.000 sec
```

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Q5 [10 pt]
Retrieve distinct course_id and names of all the courses taught in 2009 Spring and 2010 Spring.

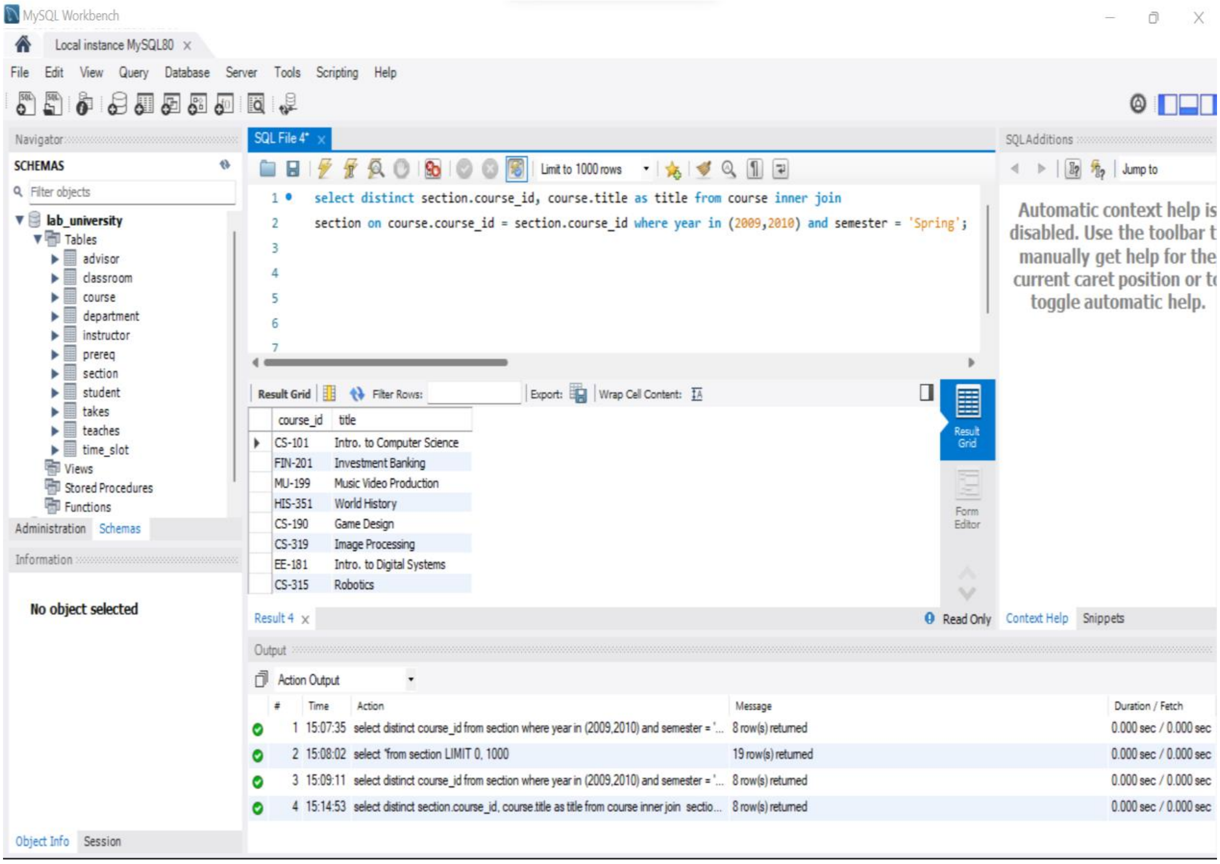
Solution:

Relational Algebra Expression:
Π(section.course_id,course.title)(σ (year in (2009,2010)) and semester = “Spring”)(course ⋈ section on course_id))

SQL Query:

select distinct section.course_id, course.title as title from course inner join section on course.course_id = section.course_id where year in (2009,2010) and semester = 'Spring';

Output:



```
select distinct section.course_id, course.title as title from course inner join
section on course.course_id = section.course_id where year in (2009,2010) and semester = 'Spring';
```

course_id	title
CS-101	Intro. to Computer Science
FIN-201	Investment Banking
MU-199	Music Video Production
HIS-351	World History
CS-190	Game Design
CS-319	Image Processing
EE-181	Intro. to Digital Systems
CS-315	Robotics

```
#  Time      Action                                                                          Message            Duration / Fetch
1  15:07:35  select distinct course_id from section where year in (2009,2010) and semester = '...  8 row(s) returned   0.000 sec / 0.000 sec
2  15:08:02  select *from section LIMIT 0, 1000                                               19 row(s) returned  0.000 sec / 0.000 sec
3  15:09:11  select distinct course_id from section where year in (2009,2010) and semester = '...  8 row(s) returned   0.000 sec / 0.000 sec
4  15:14:53  select distinct section.course_id, course.title as title from course inner join  sectio...  8 row(s) returned   0.000 sec / 0.000 sec
```

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Q6 [10 pt]
Find course_id and name of all courses that taught by instructor from history department.

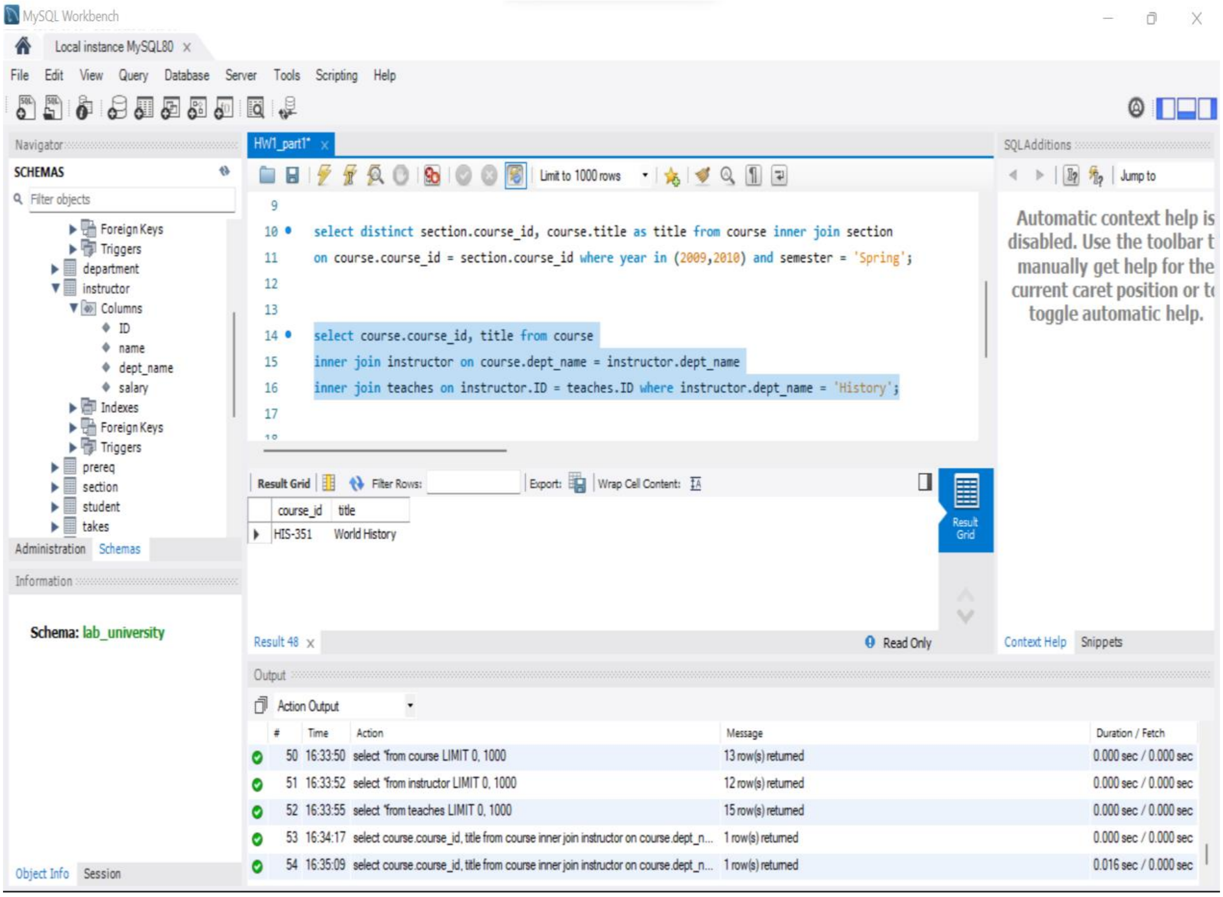
Solution:

Relational Algebra Expression:
Π(course.course_id,course.title)(σ dept_name = “History”)(course ⋈ instructor on dept_name) ⋈ teaches on ID)

SQL Query:

select course.course_id, title from course inner join instructor on course.dept_name = instructor.dept_name inner join teaches on instructor.ID = teaches.ID where instructor.dept_name = 'History';

Output:



Schema: lab_university

```
select distinct section.course_id, course.title as title from course inner join section
on course.course_id = section.course_id where year in (2009,2010) and semester = 'Spring';


select course.course_id, title from course
inner join instructor on course.dept_name = instructor.dept_name
inner join teaches on instructor.ID = teaches.ID where instructor.dept_name = 'History';
```

course_id	title
HIS-351	World History

Automatic context help is disabled. Use the toolbar t manually get help for the current caret position or t toggle automatic help.

#	Time	Action	Message	Duration / Fetch
50	16:33:50	select *from course LIMIT 0, 1000	13 row(s) returned	0.000 sec / 0.000 sec
51	16:33:52	select *from instructor LIMIT 0, 1000	12 row(s) returned	0.000 sec / 0.000 sec
52	16:33:55	select *from teaches LIMIT 0, 1000	15 row(s) returned	0.000 sec / 0.000 sec
53	16:34:17	select course.course_id, title from course inner join instructor on course.dept_n...	1 row(s) returned	0.000 sec / 0.000 sec
54	16:35:09	select course.course_id, title from course inner join instructor on course.dept_n...	1 row(s) returned	0.016 sec / 0.000 sec

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PART-02

Q7[15 pt]
Write SQL DDL statements to create the above tables. Make sure that you capture the primary and foreign key constraints (if applicable), choose appropriate domain (data) type and constraints for each attribute.

Solution:

Salesman Table

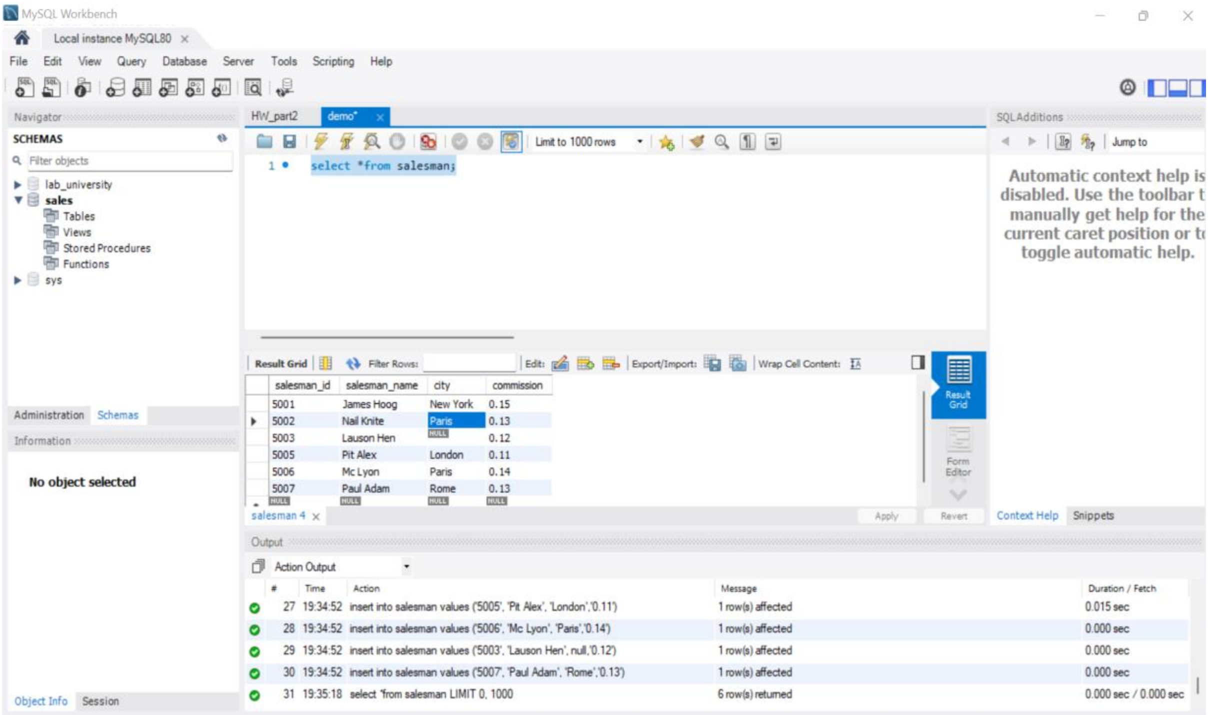
SQL Query to create table:

```
create table salesman (salesman_id int,
                       salesman_name varchar(30),
                       city      varchar(30),
                       commission    decimal(10, 2),
                       primary key (salesman_id));
```

SQL Query to insert values into the table:

```
insert into salesman values ('5001', 'James Hoog', 'New York','0.15');
insert into salesman values ('5002', 'Nail Knite', 'Paris','0.13');
insert into salesman values ('5005', 'Pit Alex', 'London','0.11');
insert into salesman values ('5006', 'Mc Lyon', 'Paris','0.14');
insert into salesman values ('5003', 'Lauson Hen', null,'0.12');
insert into salesman values ('5007', 'Paul Adam', 'Rome','0.13');
```

Output:



```
select *from salesman;
```

salesman_id	salesman_name	city	commission
5001	James Hoog	New York	0.15
5002	Nail Knite	Paris	0.13
5003	Lauson Hen	NULL	0.12
5005	Pit Alex	London	0.11
5006	Mc Lyon	Paris	0.14
5007	Paul Adam	Rome	0.13
NULL	NULL	NULL	NULL

```
#   Time      Action                                                         Message            Duration / Fetch
27  19:34:52  insert into salesman values ('5005', 'Pit Alex', 'London','0.11')    1 row(s) affected  0.015 sec
28  19:34:52  insert into salesman values ('5006', 'Mc Lyon', 'Paris','0.14')      1 row(s) affected  0.000 sec
29  19:34:52  insert into salesman values ('5003', 'Lauson Hen', null,'0.12')      1 row(s) affected  0.000 sec
30  19:34:52  insert into salesman values ('5007', 'Paul Adam', 'Rome','0.13')     1 row(s) affected  0.000 sec
31  19:35:18  select *from salesman LIMIT 0, 1000                                  6 row(s) returned  0.000 sec / 0.000 sec
```

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Customer Table

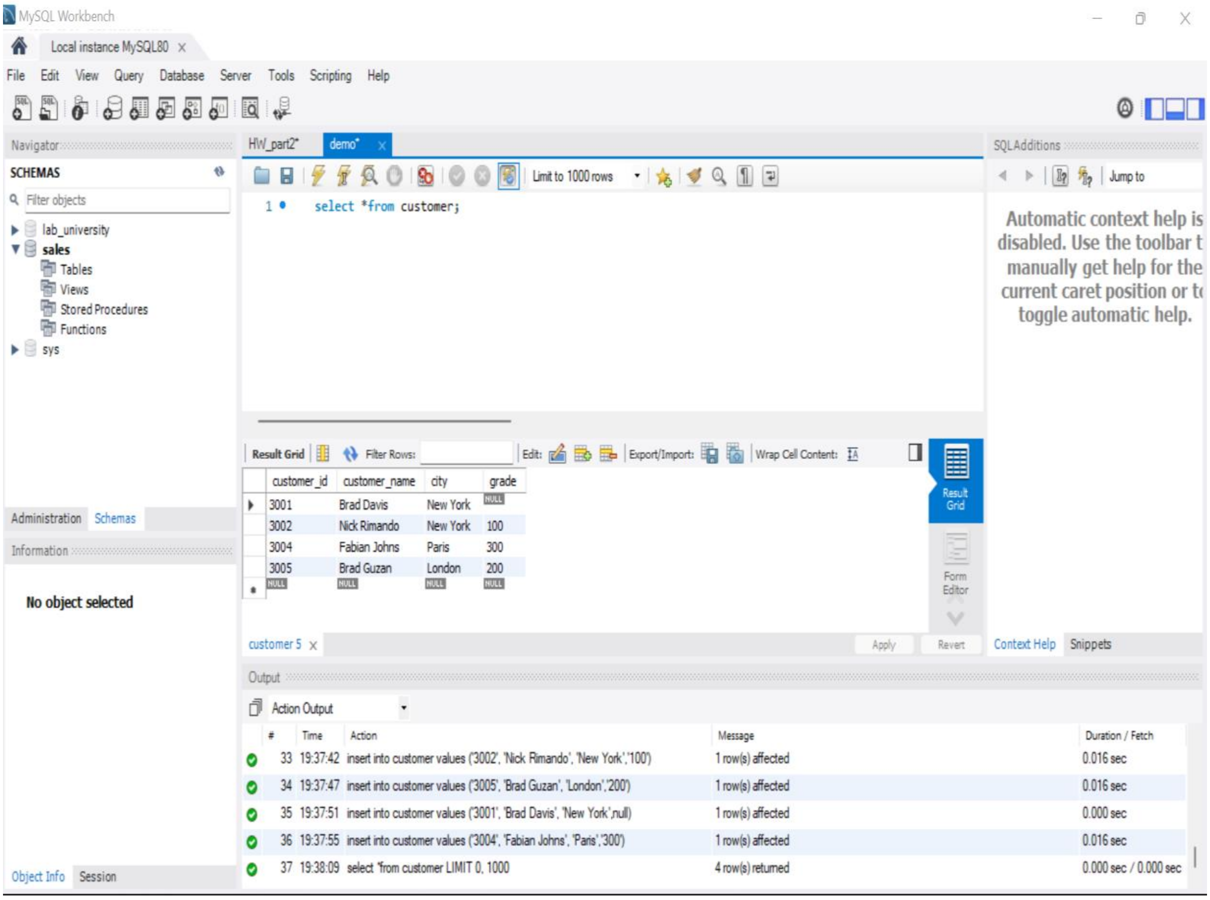
SQL Query to create table:

```
create table customer (customer_id int,
                        customer_name varchar(30),
                        city     varchar(30),
                        grade  int,
                       primary key (customer_id));
```

SQL Query to insert values into the table:

```
 insert into customer values ('3002', 'Nick Rimando', 'New York','100');
 insert into customer values ('3005', 'Brad Guzan', 'London','200');
 insert into customer values ('3001', 'Brad Davis', 'New York',null);
 insert into customer values ('3004', 'Fabian Johns', 'Paris','300');
```

Output:



```
1  select *from customer;
```

	customer_id	customer_name	city	grade
▶	3001	Brad Davis	New York	NULL
	3002	Nick Rimando	New York	100
	3004	Fabian Johns	Paris	300
	3005	Brad Guzan	London	200
*	NULL	NULL	NULL	NULL

	#	Time	Action	Message	Duration / Fetch
✓	33	19:37:42	insert into customer values ('3002', 'Nick Rimando', 'New York','100')	1 row(s) affected	0.016 sec
✓	34	19:37:47	insert into customer values ('3005', 'Brad Guzan', 'London','200')	1 row(s) affected	0.016 sec
✓	35	19:37:51	insert into customer values ('3001', 'Brad Davis', 'New York',null)	1 row(s) affected	0.000 sec
✓	36	19:37:55	insert into customer values ('3004', 'Fabian Johns', 'Paris','300')	1 row(s) affected	0.016 sec
✓	37	19:38:09	select *from customer LIMIT 0, 1000	4 row(s) returned	0.000 sec / 0.000 sec

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Order Table

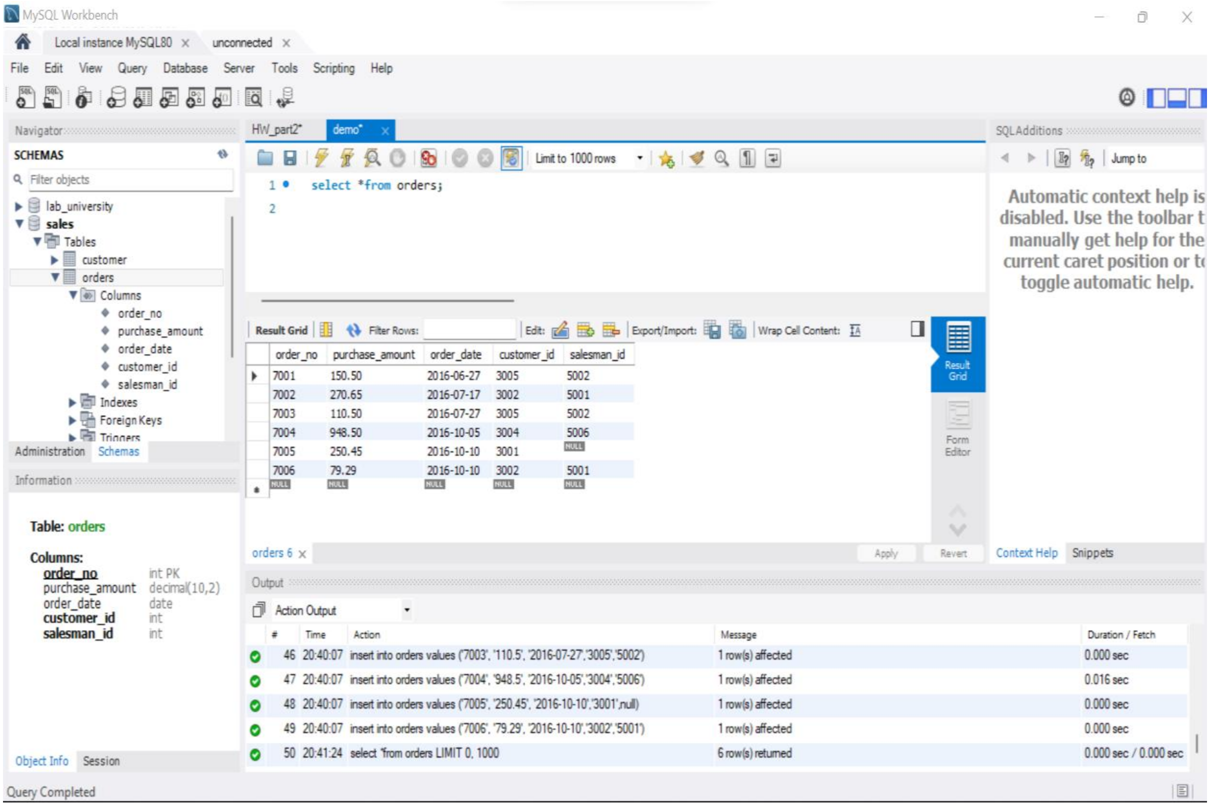
SQL Query to create table:

```
create table orders (order_noint,
                              purchase_amount decimal(10, 2),
                               order_date date,
                               customer_id int,
                               salesman_id int,
                              primary key (order_no),
                 foreign key (customer_id) references customer(customer_id) on delete
cascade,
                 foreign key (salesman_id) references salesman(salesman_id) on delete cascade
            );
```

SQL Query to insert values into the table:

```
insert into orders values ('7001', '150.5', '2016-06-27','3005','5002');
insert into orders values ('7002', '270.65', '2016-07-17','3002','5001');
insert into orders values ('7003', '110.5', '2016-07-27','3005','5002');
insert into orders values ('7004', '948.5', '2016-10-05','3004','5006');
insert into orders values ('7005', '250.45', '2016-10-10','3001',null);
insert into orders values ('7006', '79.29', '2016-10-10','3002','5001');
```

Output:



```
select *from orders;
```

order_no	purchase_amount	order_date	customer_id	salesman_id
7001	150.50	2016-06-27	3005	5002
7002	270.65	2016-07-17	3002	5001
7003	110.50	2016-07-27	3005	5002
7004	948.50	2016-10-05	3004	5006
7005	250.45	2016-10-10	3001	NULL
7006	79.29	2016-10-10	3002	5001
NULL	NULL	NULL	NULL	NULL

Automatic context help is disabled. Use the toolbar t manually get help for the current caret position or to toggle automatic help.

Table: orders

Columns:

order_no	int PK
purchase_amount	decimal(10,2)
order_date	date
customer_id	int
salesman_id	int

#	Time	Action	Message	Duration / Fetch
46	20:40:07	insert into orders values ('7003', '110.5', '2016-07-27','3005','5002')	1 row(s) affected	0.000 sec
47	20:40:07	insert into orders values ('7004', '948.5', '2016-10-05','3004','5006')	1 row(s) affected	0.016 sec
48	20:40:07	insert into orders values ('7005', '250.45', '2016-10-10','3001',null)	1 row(s) affected	0.000 sec
49	20:40:07	insert into orders values ('7006', '79.29', '2016-10-10','3002','5001')	1 row(s) affected	0.000 sec
50	20:41:24	select *from orders LIMIT 0, 1000	6 row(s) returned	0.000 sec / 0.000 sec

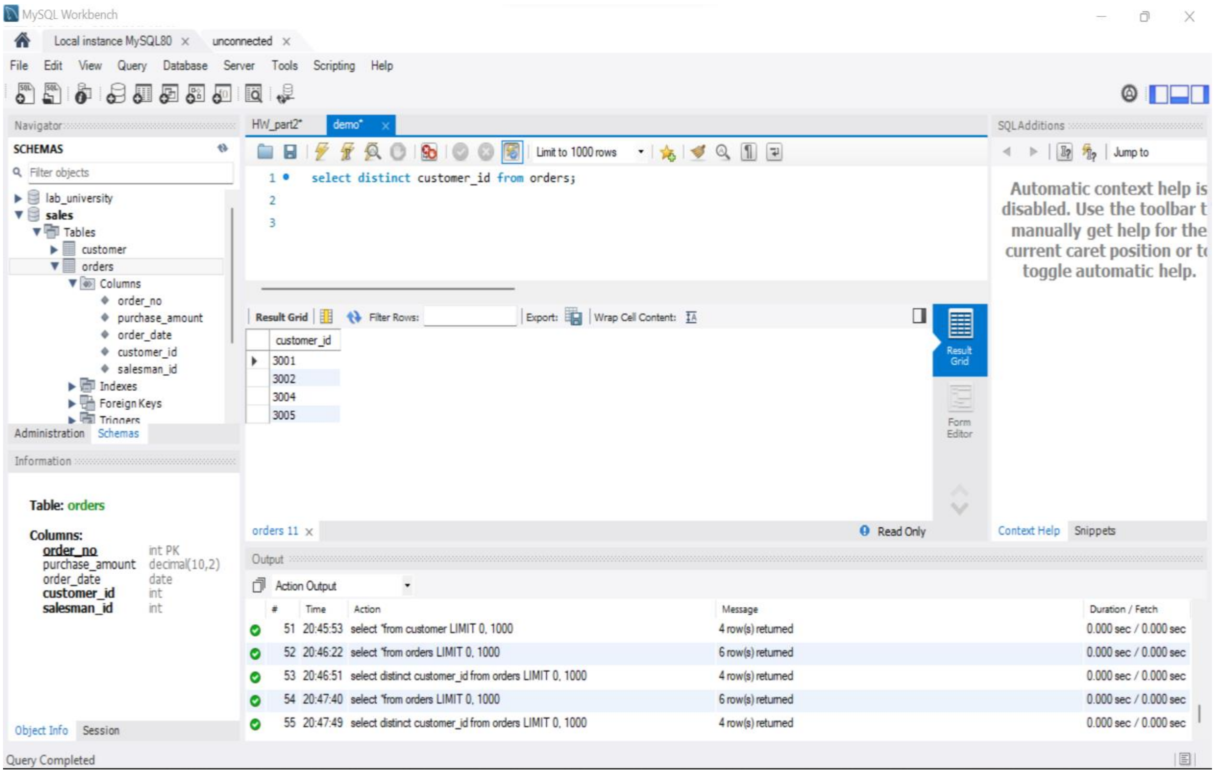
Q8 [5 pt]
Retrieve customer id of all customers from orders table without any repeats.

Solution:

Relational Algebra Expression:
Π(customer_id)(σ (orders))

SQL Query:
select distinct customer_id from orders;

Output:



```
select distinct customer_id from orders;
```

customer_id
3001
3002
3004
3005

Table: orders

Columns:
order_no int PK
purchase_amount decimal(10,2)
order_date date
customer_id int
salesman_id int

```
#   Time      Action                                                  Message             Duration / Fetch
51  20:45:53  select *from customer LIMIT 0, 1000                     4 row(s) returned   0.000 sec / 0.000 sec
52  20:46:22  select *from orders LIMIT 0, 1000                       6 row(s) returned   0.000 sec / 0.000 sec
53  20:46:51  select distinct customer_id from orders LIMIT 0, 1000   4 row(s) returned   0.000 sec / 0.000 sec
54  20:47:40  select *from orders LIMIT 0, 1000                       6 row(s) returned   0.000 sec / 0.000 sec
55  20:47:49  select distinct customer_id from orders LIMIT 0, 1000   4 row(s) returned   0.000 sec / 0.000 sec
```

Query Completed

Q9 [5 pt]

Display the names and city of salesman, who doesn’t belong to the city of Paris.

Solution:

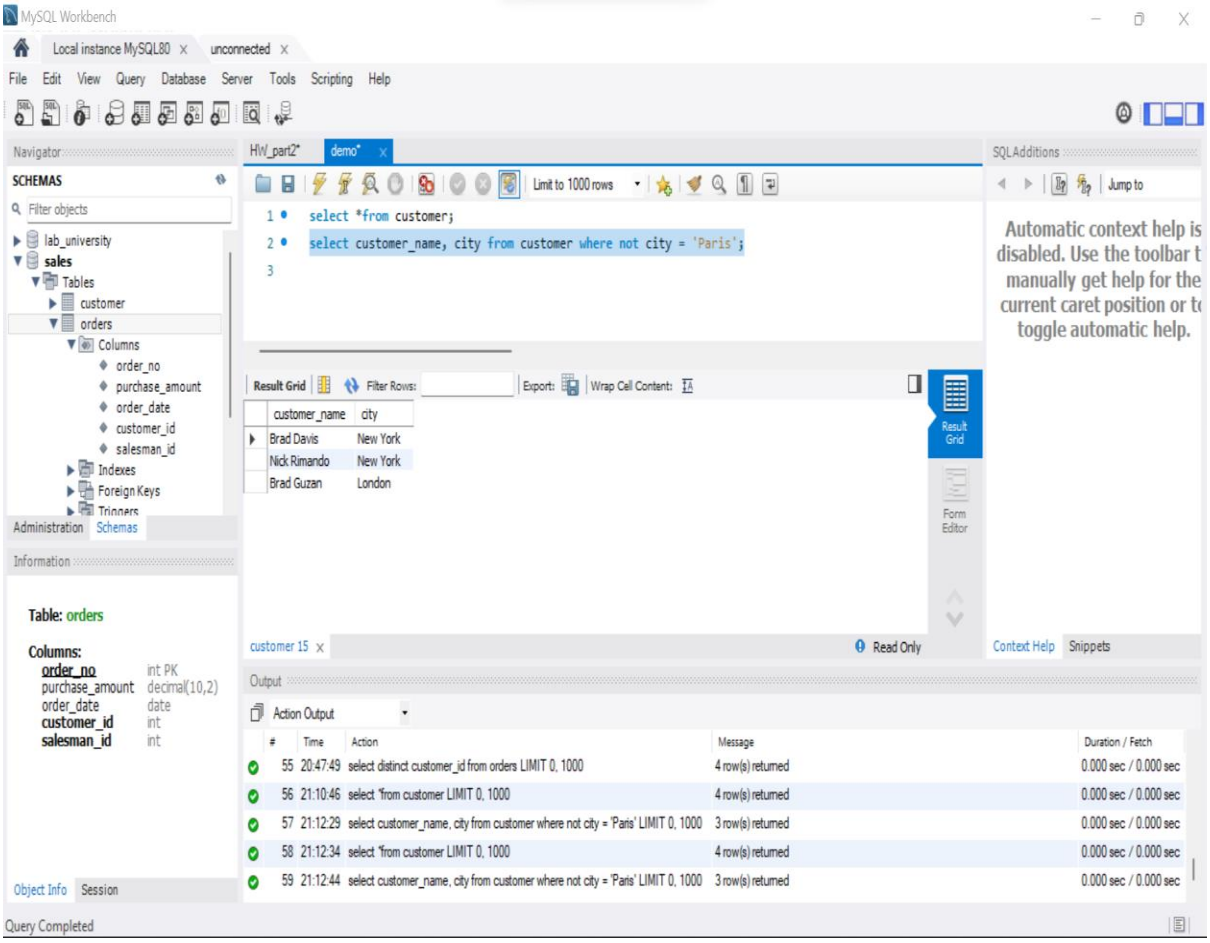
Relational Algebra Expression:

Π(customer_name,city)(σ (city≠Paris)(customer))

SQL Query:

select customer_name, city from customer where not city = 'Paris';

Output:



```
select *from customer;
select customer_name, city from customer where not city = 'Paris';
```

customer_name	city
Brad Davis	New York
Nick Rimando	New York
Brad Guzan	London

Table: orders

Columns:

order_no	int PK
purchase_amount	decimal(10,2)
order_date	date
customer_id	int
salesman_id	int

```
#   Time      Action                                                                      Message            Duration / Fetch
55  20:47:49  select distinct customer_id from orders LIMIT 0, 1000                       4 row(s) returned  0.000 sec / 0.000 sec
56  21:10:46  select *from customer LIMIT 0, 1000                                         4 row(s) returned  0.000 sec / 0.000 sec
57  21:12:29  select customer_name, city from customer where not city = 'Paris' LIMIT 0, 1000  3 row(s) returned  0.000 sec / 0.000 sec
58  21:12:34  select *from customer LIMIT 0, 1000                                         4 row(s) returned  0.000 sec / 0.000 sec
59  21:12:44  select customer_name, city from customer where not city = 'Paris' LIMIT 0, 1000  3 row(s) returned  0.000 sec / 0.000 sec
```

Q10 [5 pt] Find that customer with all information who does not get any grade except NULL.

Solution:

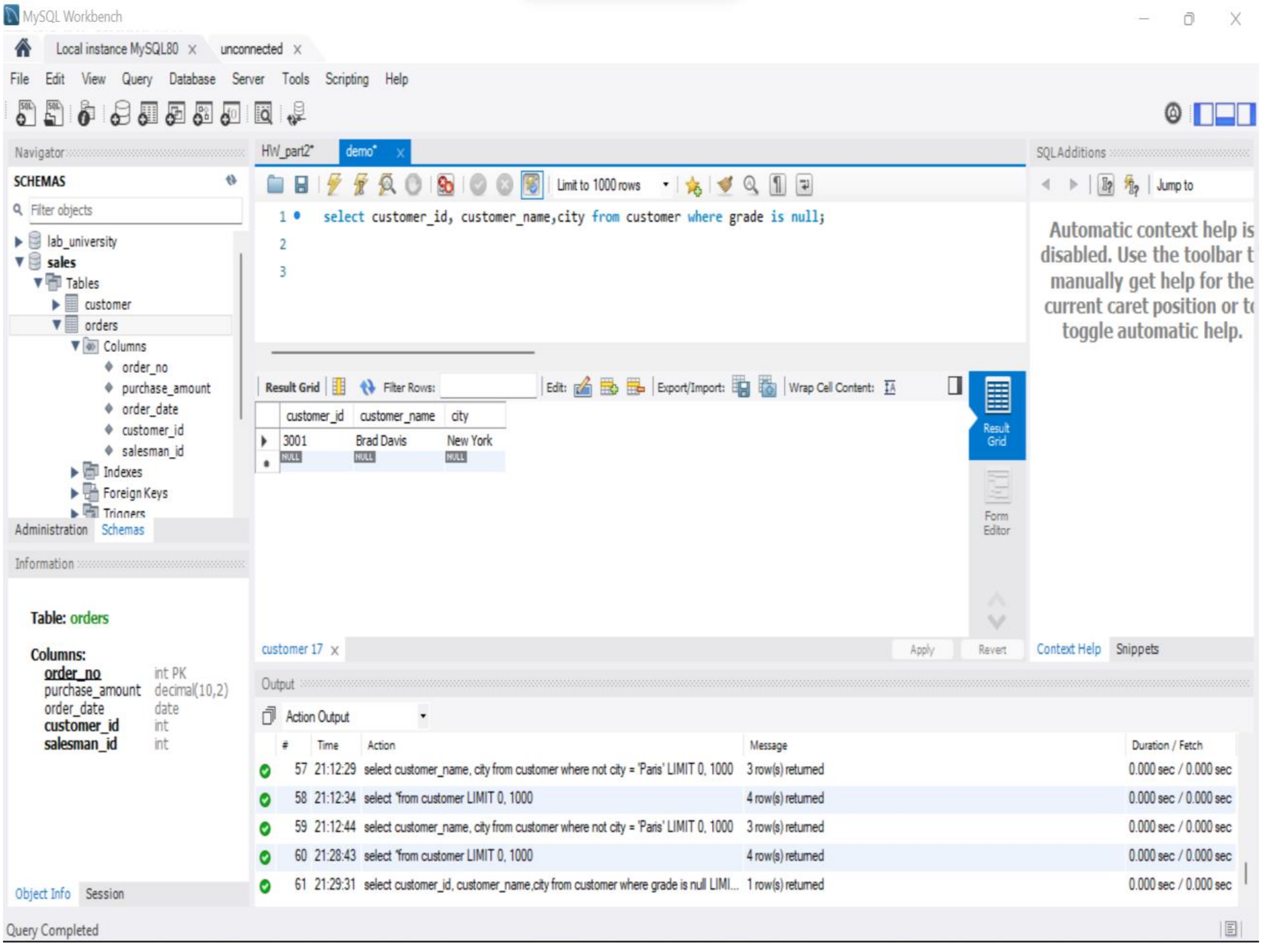
Relational Algebra Expression:

Π(customer_id,customer_name,city)(σ (grade=Null)(customer))

SQL Query:

select customer_id, customer_name,city from customer where grade is null;

Output:



```
select customer_id, customer_name,city from customer where grade is null;
```

	customer_id	customer_name	city
▶	3001	Brad Davis	New York
•	NULL	NULL	NULL

Automatic context help is disabled. Use the toolbar t manually get help for the current caret position or t toggle automatic help.

Table: orders

Columns:

order_no	int PK
purchase_amount	decimal(10,2)
order_date	date
customer_id	int
salesman_id	int

```
  #   Time      Action                                                                  Message            Duration / Fetch
  57  21:12:29  select customer_name, city from customer where not city = 'Paris' LIMIT 0, 1000  3 row(s) returned  0.000 sec / 0.000 sec
  58  21:12:34  select *from customer LIMIT 0, 1000                                     4 row(s) returned  0.000 sec / 0.000 sec
  59  21:12:44  select customer_name, city from customer where not city = 'Paris' LIMIT 0, 1000  3 row(s) returned  0.000 sec / 0.000 sec
  60  21:28:43  select *from customer LIMIT 0, 1000                                     4 row(s) returned  0.000 sec / 0.000 sec
  61  21:29:31  select customer_id, customer_name,city from customer where grade is null LIMI...  1 row(s) returned  0.000 sec / 0.000 sec
```

Query Completed

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Q11[20 pt] Consider the following relational algebra expression.

$$\pi_{salesman\_id,name,city,commission}(\sigma_{(commission\geq 0.10)\cap(commission\leq 0.12)}\ salesman)$$

1) How many attributes will the result have?

   Solution: Salesman_id , name , city and commission → 4 attributes.

2) Write in English what question the expression is trying to answer (e.g. describe what would be the result of the expression).

   Solution:
   Select salesman id, name, city, and commission from salesman table where commission is greater than or equal to 0.10 and commission is lesser than or equal to 0.12. The output will have four columns that is salesman id, name, city and commission. The row data will be based on the condition → commission is greater than or equal to 0.10 and commission is lesser than or equal to 0.12. In simpler terms salesman id, name and city of the individual will be displayed based on the above condition.

3) Translate the expressions into SQL.
   Solution:

```
select salesman_id,name,city,commission from
salesman where commission >=0.10 and commission<=0.12
```