PONDICHERRY UNIVERSITY
(A Central university)

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF COMPUTER SCIENCE

M.Sc. Integrated Computer Science

NAME	:	D A GURUPRIYAN
REG. NO.	:	20384111
SEMESTER	:	VIII - Semester
SUBJECT	:	CSSC 424 – DATABASE SYSTEM LAB

PONDICHERRY UNIVERSITY

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF COMPUTER SCIENCE

BONAFIDE CERTIFICATE

This is to certify that this is a Bonafide record of practical work done by **D A GURUPRIYAN**, having Reg. No. **20384111** semester - VIII from the month February 2024 to June 2024.

FACULTY IN-CHARGE

SUBMITTED FOR THE PRACTICAL EXAM HELD ON: ____________________

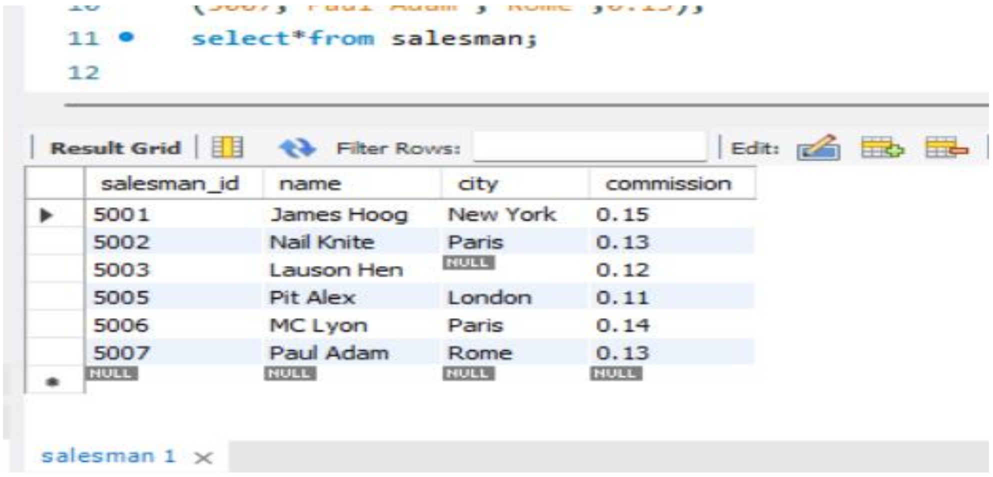
INTERNAL EXAMINER **EXTERNAL EXAMINER**

INDEX

EXPERIMENT 1

SQL Practice 1

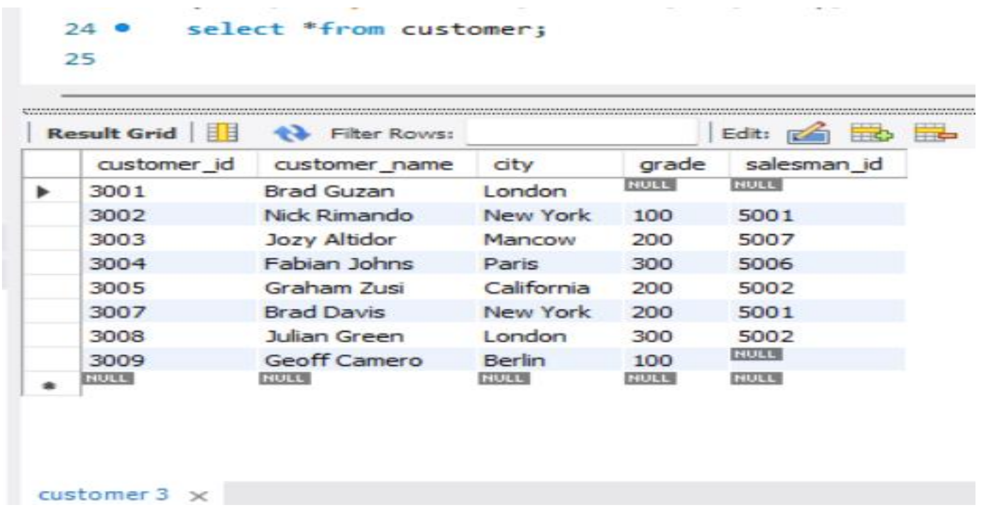
```
create database vamsi;
use vamsi;
create table salesman(salesman_id int primary key,name varchar(30),city varchar(30),commission float);
insert into salesman (salesman_id,name,city,commission)
values(5001,"James Hoog","New York",0.15),
(5002,"Nail Knite","Paris",0.13),
(5005,"Pit Alex","London",0.11),
(5006,"MC Lyon","Paris",0.14),
(5003,"Lauson Hen",null,0.12),
(5007,"Paul Adam","Rome",0.13);
```



```
select*from salesman;
```

salesman_id	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

```
create table customer(customer_id int,customer_name varchar(30),city varchar(30),grade int,salesman_id int,
primary key (customer_id),foreign key (salesman_id) references salesman (salesman_id));
insert into customer1(customer_id,customer_name,city,grade,salesman_id)
values(3002,"Nick Rimando","New York",100,5001),
(3005,"Graham Zusi","California",200,5002),
(3001,"Brad Guzan","London",null,null),
(3004,"Fabian Johns","Paris",300,5006),
(3007,"Brad Davis","New York",200,5001),
(3009,"Geoff Camero","Berlin",100,null),
(3008,"Julian Green","London",300,5002),
(3003,"Jozy Altidor","Mancow",200,5007);
```



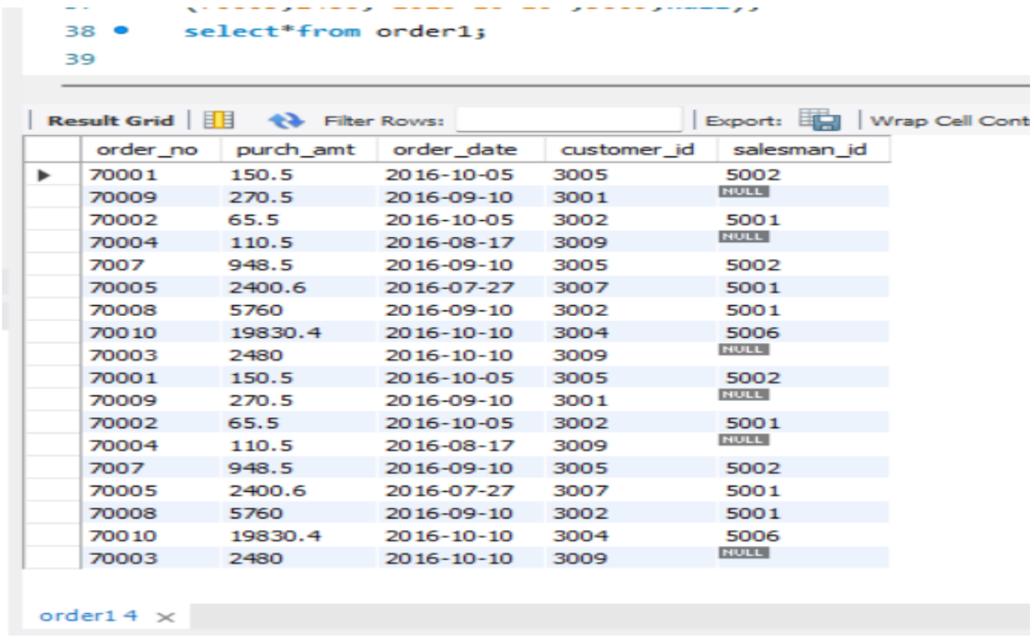
```
select *from customer;
```

Result Grid | Filter Rows: | Edit:

customer_id	customer_name	city	grade	salesman_id
3001	Brad Guzan	London	NULL	NULL
3002	Nick Rimando	New York	100	5001
3003	Jozy Altidor	Mancow	200	5007
3004	Fabian Johns	Paris	300	5006
3005	Graham Zusi	California	200	5002
3007	Brad Davis	New York	200	5001
3008	Julian Green	London	300	5002
3009	Geoff Camero	Berlin	100	NULL
NULL	NULL	NULL	NULL	NULL

customer 3

create table order1(order_no int,purch_amt float,order_date date,customer_id int,salesman_id int);
insert into order1(order_no,purch_amt,order_date,customer_id,salesman_id)
values(70001,150.5,"2016-10-05",3005,5002),
(70009,270.5,"2016-09-10",3001,null),
(70002,65.5,"2016-10-05",3002,5001),
(70004,110.5,"2016-08-17",3009,null),
(7007,948.5,"2016-09-10",3005,5002),
(70005,2400.6,"2016-07-27",3007,5001),
(70008,5760,"2016-09-10",3002,5001),
(70010,19830.43,"2016-10-10",3004,5006),
(70003,2480,"2016-10-10",3009,null);



```
select*from order1;
```

Result Grid | Filter Rows: | Export: | Wrap Cell Cont

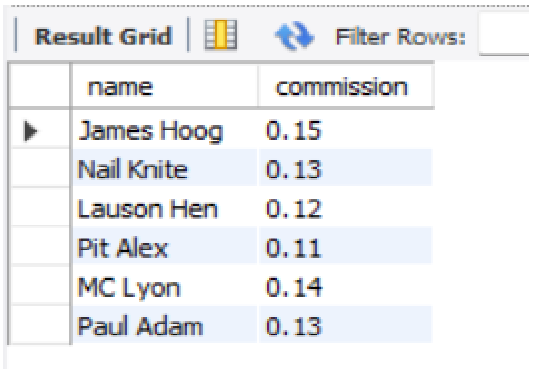
order_no	purch_amt	order_date	customer_id	salesman_id
70001	150.5	2016-10-05	3005	5002
70009	270.5	2016-09-10	3001	NULL
70002	65.5	2016-10-05	3002	5001
70004	110.5	2016-08-17	3009	NULL
7007	948.5	2016-09-10	3005	5002
70005	2400.6	2016-07-27	3007	5001
70008	5760	2016-09-10	3002	5001
70010	19830.4	2016-10-10	3004	5006
70003	2480	2016-10-10	3009	NULL
70001	150.5	2016-10-05	3005	5002
70009	270.5	2016-09-10	3001	NULL
70002	65.5	2016-10-05	3002	5001
70004	110.5	2016-08-17	3009	NULL
7007	948.5	2016-09-10	3005	5002
70005	2400.6	2016-07-27	3007	5001
70008	5760	2016-09-10	3002	5001
70010	19830.4	2016-10-10	3004	5006
70003	2480	2016-10-10	3009	NULL

order1 4

Query 1

• Display name and commission of all the salesmen.

select name,commission from salesman;

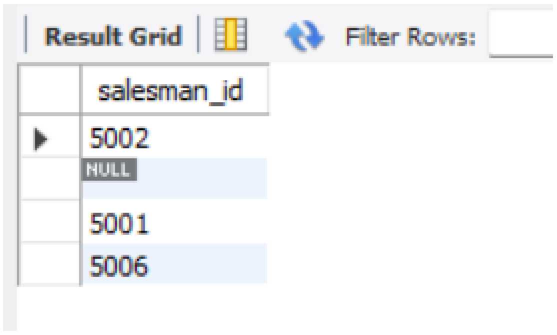


name	commission
James Hoog	0.15
Nail Knite	0.13
Lauson Hen	0.12
Pit Alex	0.11
MC Lyon	0.14
Paul Adam	0.13

Query 2

• Retrieve salesman id of all salesmen from orders table without any repeats.

select distinct salesman_id from order1;

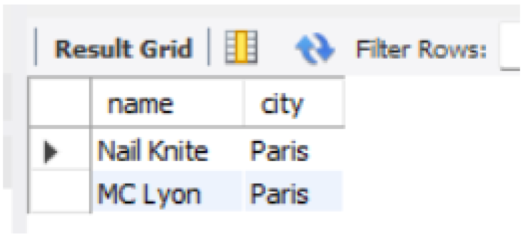


salesman_id
5002
NULL
5001
5006

Query 3

• Display names and city of salesman, who belongs to the city of Paris.

select name,city from salesman where city="paris";

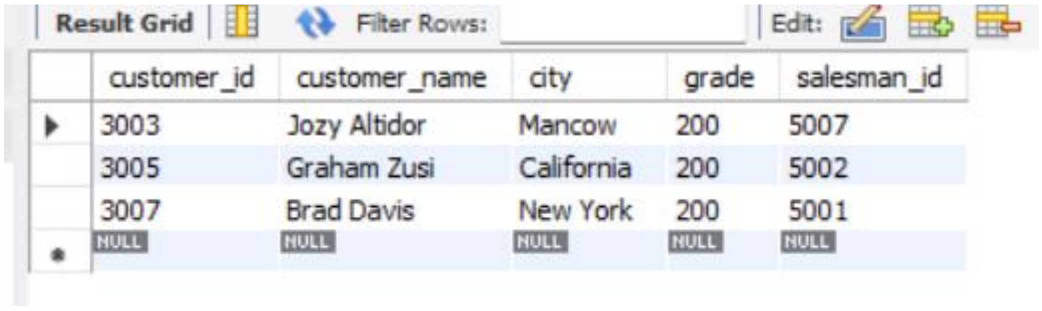


name	city
Nail Knite	Paris
MC Lyon	Paris

Query 4

• Display all the information for those customers with a grade of 200.

select * from customer where grade=200;



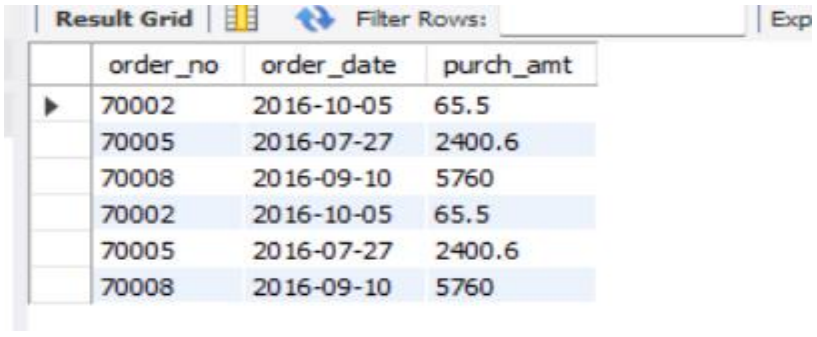
Result Grid | Filter Rows: | Edit:

	customer_id	customer_name	city	grade	salesman_id
▶	3003	Jozy Altidor	Mancow	200	5007
	3005	Graham Zusi	California	200	5002
	3007	Brad Davis	New York	200	5001
*	NULL	NULL	NULL	NULL	NULL

Query 5

• Display the order number, order date and the purchase amount for order(s) which will be delivered by the salesman with ID 5001.

select order_no,order_date,purch_amt from order1 where salesman_id=5001;



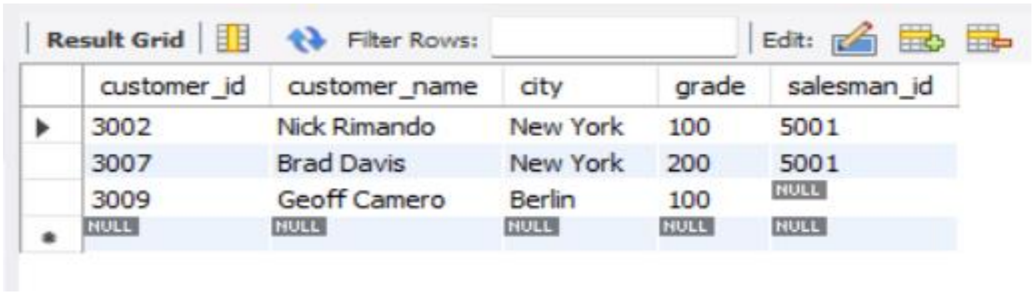
Result Grid | Filter Rows: | Exp

	order_no	order_date	purch_amt
▶	70002	2016-10-05	65.5
	70005	2016-07-27	2400.6
	70008	2016-09-10	5760
	70002	2016-10-05	65.5
	70005	2016-07-27	2400.6
	70008	2016-09-10	5760

Query 6 (table: customer)

• Display all the customers, who are either belongs to the city New York or not had a grade above 100.

select*from customer where city='New York' or not grade>100;

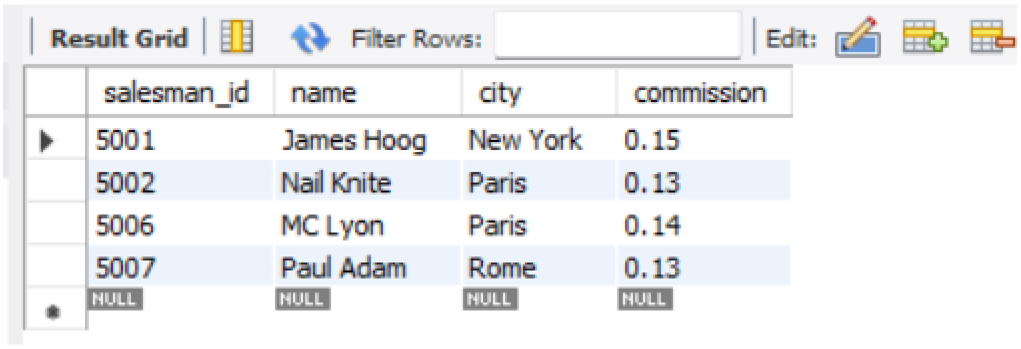


customer_id	customer_name	city	grade	salesman_id
3002	Nick Rimando	New York	100	5001
3007	Brad Davis	New York	200	5001
3009	Geoff Camero	Berlin	100	NULL
NULL	NULL	NULL	NULL	NULL

Query 7 (table: salesman)

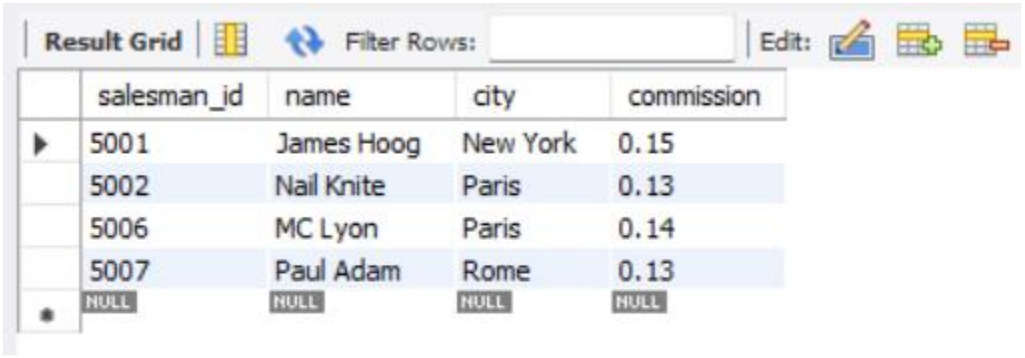
• Find those salesmen with all information who gets the commission within a range of 0.12 and 0.14.

select*from salesman where (0.12<commission>0.14);



salesman_id	name	city	commission
5001	James Hoog	New York	0.15
5002	Nail Knite	Paris	0.13
5006	MC Lyon	Paris	0.14
5007	Paul Adam	Rome	0.13
NULL	NULL	NULL	NULL

select*from salesman where(commission between 0.12 and 0.14);

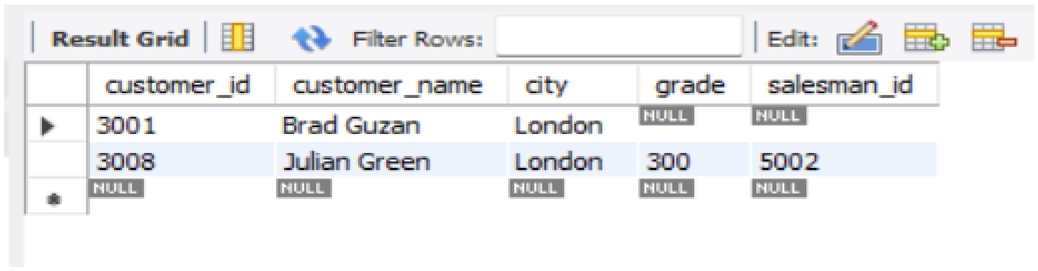


salesman_id	name	city	commission
5001	James Hoog	New York	0.15
5002	Nail Knite	Paris	0.13
5006	MC Lyon	Paris	0.14
5007	Paul Adam	Rome	0.13
NULL	NULL	NULL	NULL

Query 8 (table: customer)

• Find all those customers with all information whose names are ending with the letter 'n'.

select*from customer where customer_name like '%n';

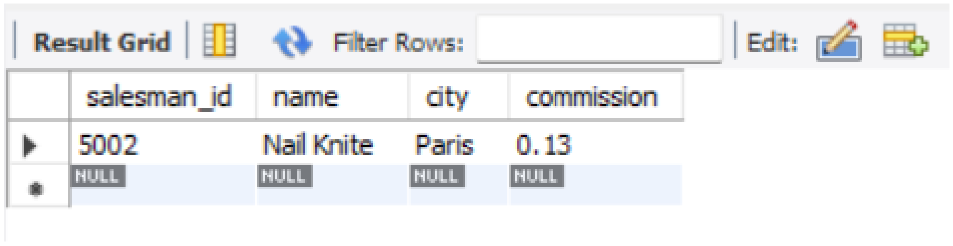

Result Grid | Filter Rows: | Edit:

customer_id	customer_name	city	grade	salesman_id
3001	Brad Guzan	London	NULL	NULL
3008	Julian Green	London	300	5002
NULL	NULL	NULL	NULL	NULL

Query 9 (table: salesmen)

• Find those salesmen with all information whose name containing the 1st character is 'N' and the 4th character is 'l' and rests may be any character.

select*from salesman where name like 'n__l%';

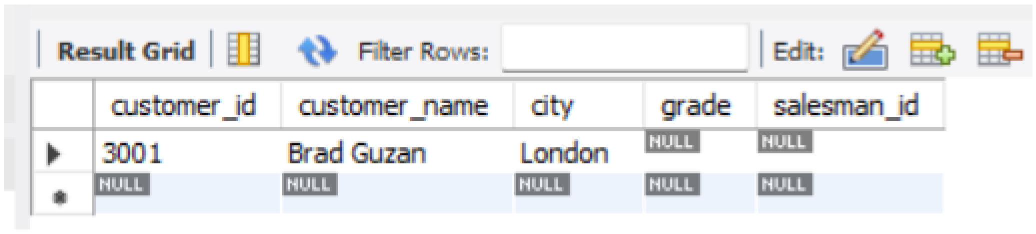

Result Grid | Filter Rows: | Edit:

salesman_id	name	city	commission
5002	Nail Knite	Paris	0.13
NULL	NULL	NULL	NULL

Query 10 (table: customer)

• Find that customer with all information who does not get any grade except NULL.

select*from customer where grade is Null;

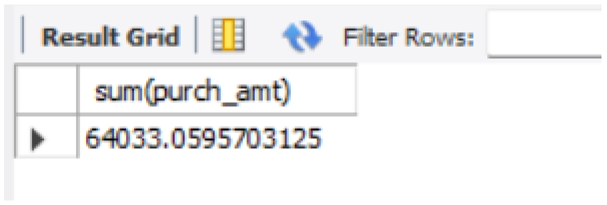

Result Grid | Filter Rows: | Edit:

customer_id	customer_name	city	grade	salesman_id
3001	Brad Guzan	London	NULL	NULL
NULL	NULL	NULL	NULL	NULL

Query 11 (table: orders)

• Find the total purchase amount of all orders.

select sum(purch_amt) from order1;

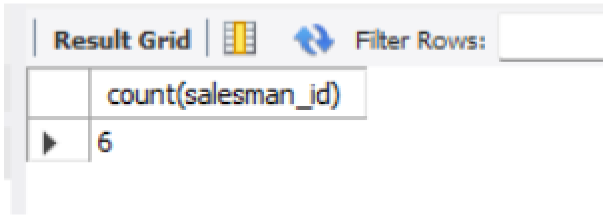


	sum(purch_amt)
▶	64033.0595703125

Query 12 (table: orders)

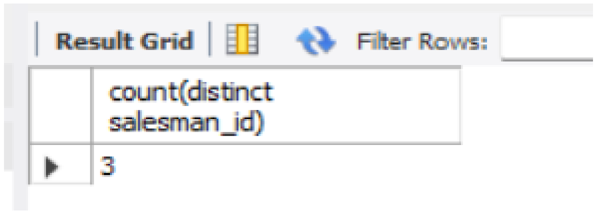
• Find the number of salesman currently listing for all of their customers.

select count(salesman_id) from customer;



	count(salesman_id)
▶	6

select count(distinct salesman_id) from order1;

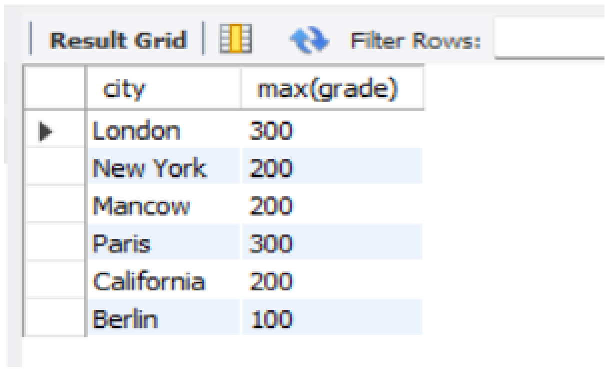


	count(distinct salesman_id)
▶	3

Query 13 (table: customer)

• Find the highest grade for each of the cities of the customers.

select city,max(grade) from customer group by city;

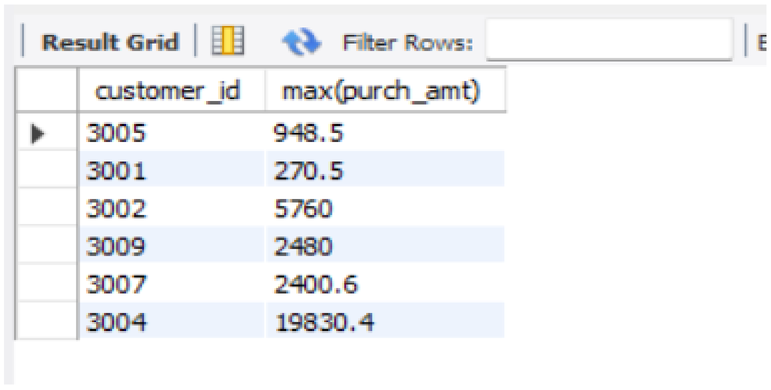


	city	max(grade)
▶	London	300
	New York	200
	Mancow	200
	Paris	300
	California	200
	Berlin	100

Query 14 (table: orders)

• Find the highest purchase amount ordered by the each customer with their ID and highest purchase amount.

select customer_id,max(purch_amt) from order1 group by customer_id;

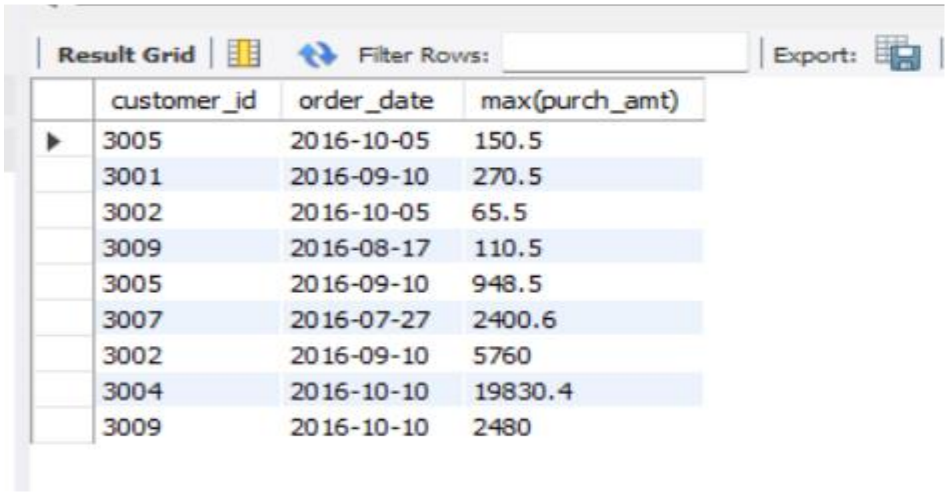


customer_id	max(purch_amt)
3005	948.5
3001	270.5
3002	5760
3009	2480
3007	2400.6
3004	19830.4

Query 15 (table: orders)

• Find the highest purchase amount ordered by the each customer on a particular date with their ID, order date and highest purchase amount.

select customer_id, order_date, max(purch_amt) from order1
group by customer_id, order_date;

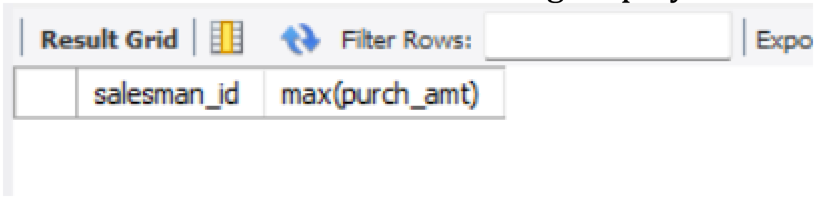


customer_id	order_date	max(purch_amt)
3005	2016-10-05	150.5
3001	2016-09-10	270.5
3002	2016-10-05	65.5
3009	2016-08-17	110.5
3005	2016-09-10	948.5
3007	2016-07-27	2400.6
3002	2016-09-10	5760
3004	2016-10-10	19830.4
3009	2016-10-10	2480

Query 16 (table: orders)

• Find the highest purchase amount on a date '2012-08-17' for each salesman with their ID.

select salesman_id, max(purch_amt) from order1
where order_date = '2012-08-17' group by salesman_id;

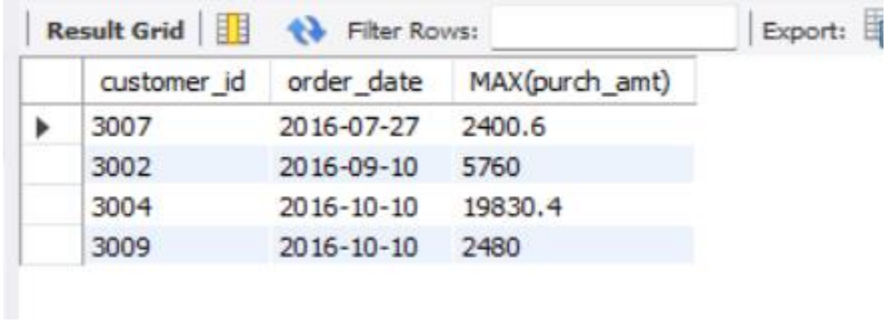


	salesman_id	max(purch_amt)

Query 17 (table: orders)

• Find the highest purchase amount with their customer ID and order date, for only those customers who have the highest purchase amount in a day is more than 2000.

select customer_id, order_date, MAX(purch_amt) from order1
group by customer_id, order_date having max(purch_amt) > 2000.00;

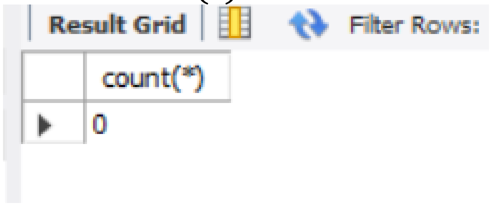


	customer_id	order_date	MAX(purch_amt)
▶	3007	2016-07-27	2400.6
	3002	2016-09-10	5760
	3004	2016-10-10	19830.4
	3009	2016-10-10	2480

Query 18 (table: orders)

• Write a SQL statement that counts all orders for a date August 17th, 2012.

select count(*) from order1 where order_date = '2012-08-17';



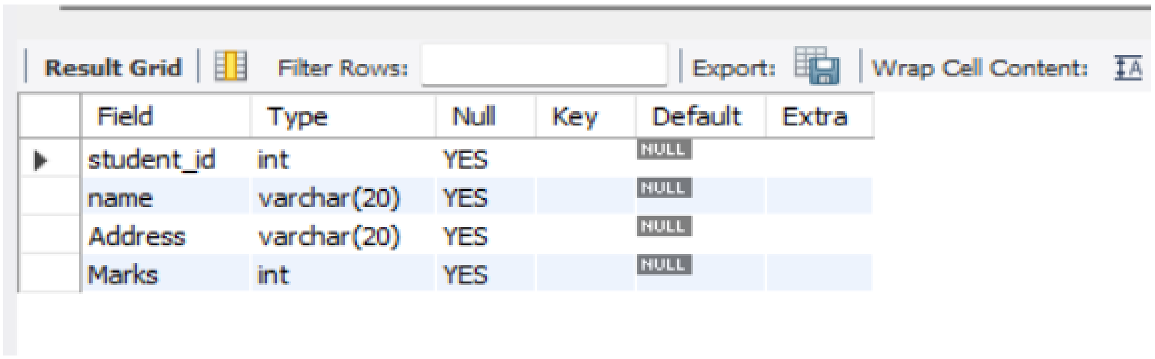
	count(*)
▶	0

EXPERIMENT 2

TRIGGER:-

-- Source code

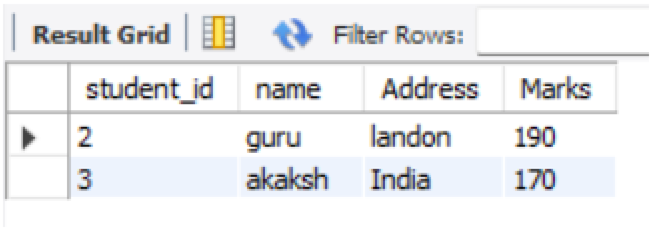
```
create database trigger1;
use trigger1;
-- Create student table
create table student(student_id integer null,name varchar(20),Address
varchar(20),Marks integer(10));
-- Describe student table
desc student;
```



Result Grid | Filter Rows: | Export: | Wrap Cell Content:

Field	Type	Null	Key	Default	Extra
student_id	int	YES		NULL	
name	varchar(20)	YES		NULL	
Address	varchar(20)	YES		NULL	
Marks	int	YES		NULL	

```
-- create trigger
create trigger student_trigger before insert on student for each row set
new.Marks=new.Marks+100;
insert into student(student_id,name,Address,Marks)
values('2','guru','landon','90');
insert into student(student_id,name,Address,Marks)
values('3','akaksh','India','70');
-- Display student table
select*from student;
```

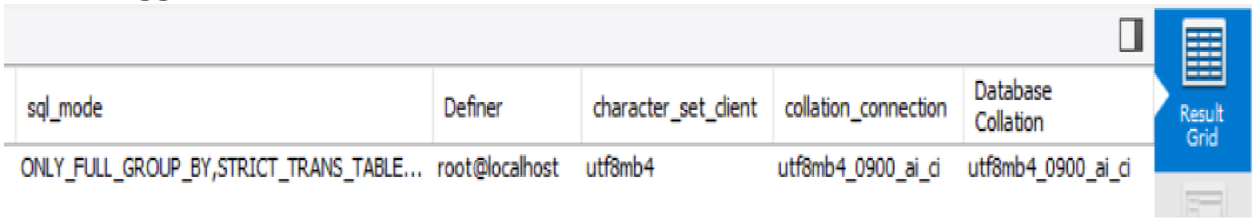


Result Grid | Filter Rows:

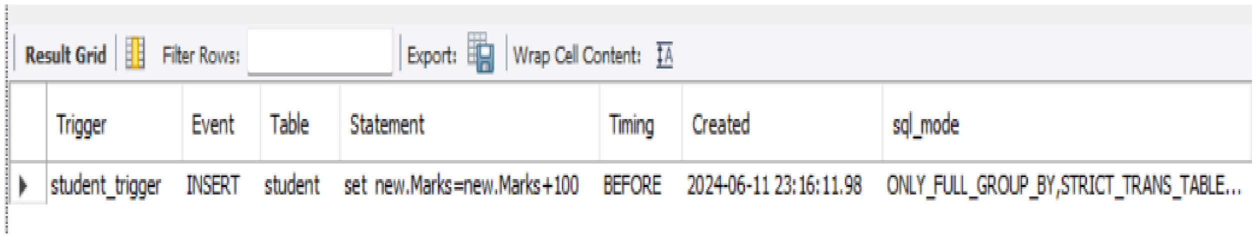
student_id	name	Address	Marks
2	guru	landon	190
3	akaksh	India	170

-- Display trigger

show triggers;



sql_mode	Definer	character_set_client	collation_connection	Database Collation
ONLY_FULL_GROUP_BY,STRICT_TRANS_TABLE...	root@localhost	utf8mb4	utf8mb4_0900_ai_ci	utf8mb4_0900_ai_ci

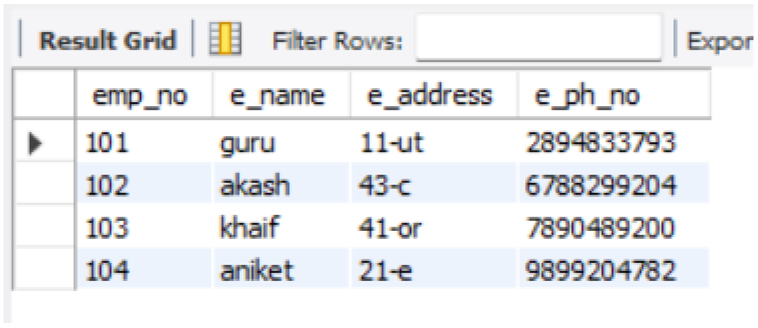


Trigger	Event	Table	Statement	Timing	Created	sql_mode
student_trigger	INSERT	student	set new.Marks=new.Marks+100	BEFORE	2024-06-11 23:16:11.98	ONLY_FULL_GROUP_BY,STRICT_TRANS_TABLE...

EXPERIMENT 3

PROCEDURES:-

```
create database procedures;
create table employees(emp_no integer primary key,e_name varchar(20),e_address varchar(20),e_ph_no varchar(20));
-- Insert table values
insert into employees values(101,'ram','11-ut',2894833793);
insert into employees values(102,'vamsi','43-c',6788299204);
insert into employees values(103,'surya','41-or',7890489200);
insert into employees values(104,'mitra','21-e',9899204782);
-- Create procedures without parameters
DELIMITER $$
create   procedure get_employees ()
begin
select*from employees;
end $$
DELIMITER ;
-- Call procedure
call get_employees();
```

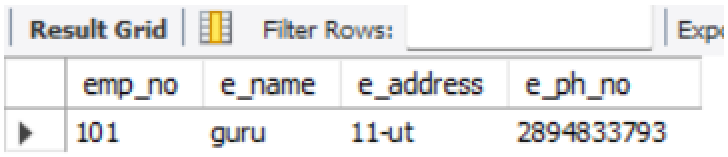


emp_no	e_name	e_address	e_ph_no
101	guru	11-ut	2894833793
102	akash	43-c	6788299204
103	khaif	41-or	7890489200
104	aniket	21-e	9899204782

```
-- create procedures with parameters
DELIMITER $$
create   procedure finds_employees (in id int)
begin
select*from employees where emp_id = id;
```

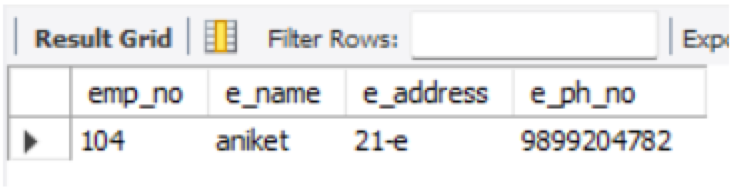
end $$
DELIMITER ;

call finds_employees(101);



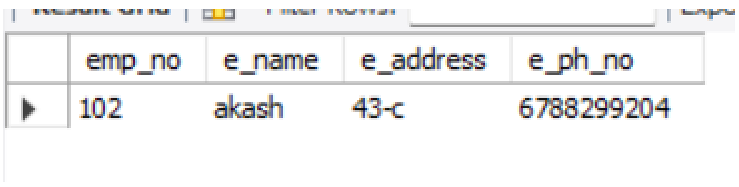
emp_no	e_name	e_address	e_ph_no
101	guru	11-ut	2894833793

call finds_employees(104);



emp_no	e_name	e_address	e_ph_no
104	aniket	21-e	9899204782

call finds_employees(102);



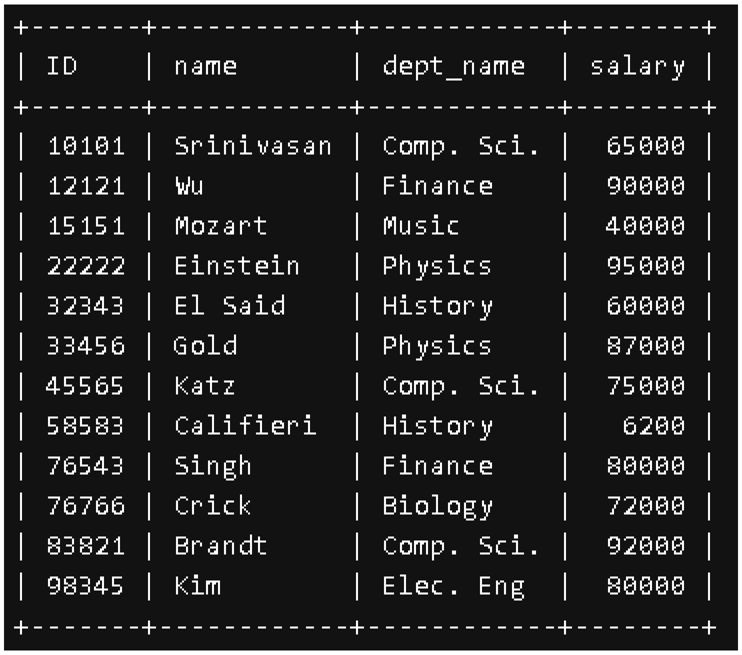
emp_no	e_name	e_address	e_ph_no
102	akash	43-c	6788299204

EXPERIMENT 4

DATE :

1. Create the following Relation (Tables) with primary key integrity constraint

```
-- create
CREATE TABLE instructor (
  ID INTEGER PRIMARY KEY,
  name TEXT NOT NULL,
  dept_name TEXT NOT NULL,
  salary INTEGER NOT NULL
);

-- insert
INSERT INTO instructor (ID, name, dept_name, salary) VALUES
(10101, 'Srinivasan', 'Comp. Sci.', 65000),
(12121, 'Wu', 'Finance', 90000),
(15151, 'Mozart', 'Music', 40000),
(22222, 'Einstein', 'Physics', 95000),
(32343, 'El Said', 'History', 60000),
(33456, 'Gold', 'Physics', 87000),
(45565, 'Katz', 'Comp. Sci.', 75000),
(58583, 'Califieri', 'History', 6200),
(76543, 'Singh', 'Finance', 80000),
(76766, 'Crick', 'Biology', 72000),
(83821, 'Brandt', 'Comp. Sci.', 92000),
(98345, 'Kim', 'Elec. Eng', 80000);
-- fetch
SELECT * FROM instructor;
```



```
+-------+------------+------------+--------+
| ID    | name       | dept_name  | salary |
+-------+------------+------------+--------+
| 10101 | Srinivasan | Comp. Sci. |  65000 |
| 12121 | Wu         | Finance    |  90000 |
| 15151 | Mozart     | Music      |  40000 |
| 22222 | Einstein   | Physics    |  95000 |
| 32343 | El Said    | History    |  60000 |
| 33456 | Gold       | Physics    |  87000 |
| 45565 | Katz       | Comp. Sci. |  75000 |
| 58583 | Califieri  | History    |   6200 |
| 76543 | Singh      | Finance    |  80000 |
| 76766 | Crick      | Biology    |  72000 |
| 83821 | Brandt     | Comp. Sci. |  92000 |
| 98345 | Kim        | Elec. Eng  |  80000 |
+-------+------------+------------+--------+
```

2. Create the following Relation (Tables) teaches

```
CREATE TABLE teaches (
  ID int NOT NULL,
  course_id varchar(255) NOT NULL,
  sec_id int NOT NULL,
  semester varchar(255) NOT NULL,
  year int NOT NULL,
  FOREIGN KEY (ID) REFERENCES instructor(ID)
);

INSERT INTO teaches (ID, course_id, sec_id, semester, year) VALUES
(10101, 'CS-101', 1, 'Fall', 2017),
(10101, 'CS-315', 1, 'Spring', 2018),
(10101, 'CS-347', 1, 'Fall', 2017),
(12121, 'FIN-201', 1, 'Spring', 2018),
(15151, 'MU-199', 1, 'Spring', 2015),
(22222, 'PHY-101', 1, 'Fall', 2017),
```

(32343, 'HIS-351', 1, 'Spring', 2018),

(45565, 'CS-101', 1, 'Spring', 2018),

(45565, 'CS-319', 1, 'Spring', 2018),

(76766, 'BIO-101', 1, 'Summer', 2017),

(76766, 'BIO-301', 1, 'Summer', 2018),

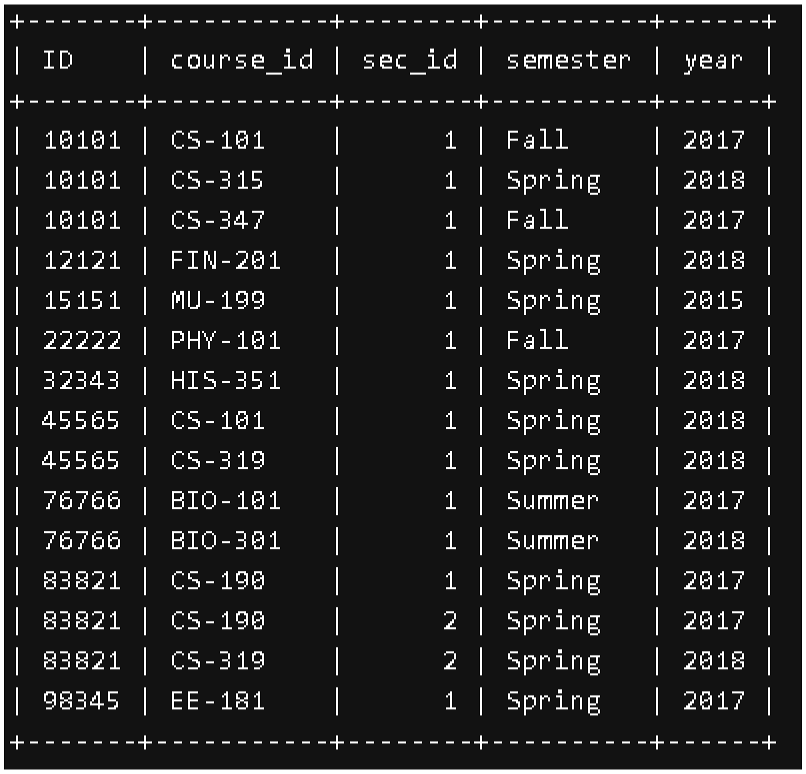
(83821, 'CS-190', 1, 'Spring', 2017),

(83821, 'CS-190', 2, 'Spring', 2017),

(83821, 'CS-319', 2, 'Spring', 2018),

(98345, 'EE-181', 1, 'Spring', 2017);

SELECT * FROM teaches;

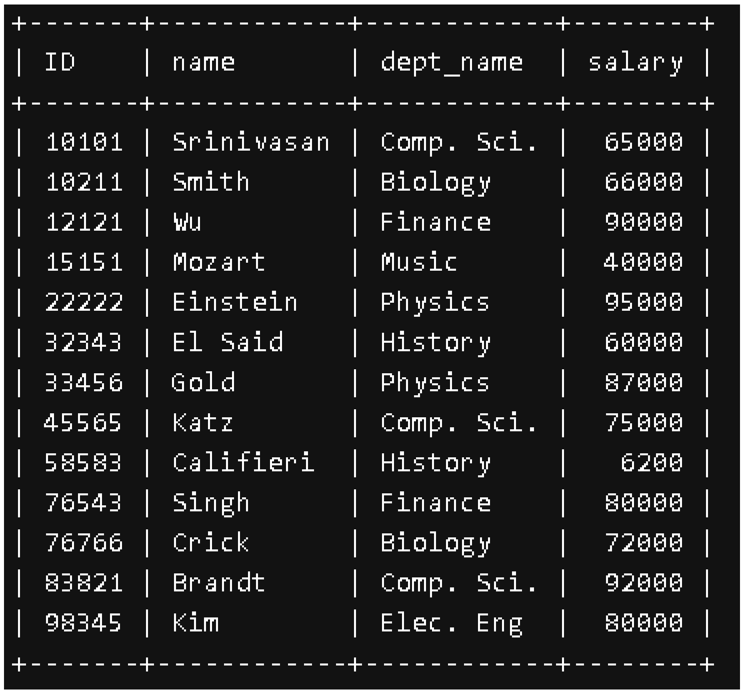


```
+-------+-----------+--------+----------+------+
| ID    | course_id | sec_id | semester | year |
+-------+-----------+--------+----------+------+
| 10101 | CS-101    |      1 | Fall     | 2017 |
| 10101 | CS-315    |      1 | Spring   | 2018 |
| 10101 | CS-347    |      1 | Fall     | 2017 |
| 12121 | FIN-201   |      1 | Spring   | 2018 |
| 15151 | MU-199    |      1 | Spring   | 2015 |
| 22222 | PHY-101   |      1 | Fall     | 2017 |
| 32343 | HIS-351   |      1 | Spring   | 2018 |
| 45565 | CS-101    |      1 | Spring   | 2018 |
| 45565 | CS-319    |      1 | Spring   | 2018 |
| 76766 | BIO-101   |      1 | Summer   | 2017 |
| 76766 | BIO-301   |      1 | Summer   | 2018 |
| 83821 | CS-190    |      1 | Spring   | 2017 |
| 83821 | CS-190    |      2 | Spring   | 2017 |
| 83821 | CS-319    |      2 | Spring   | 2018 |
| 98345 | EE-181    |      1 | Spring   | 2017 |
+-------+-----------+--------+----------+------+
```

3. Insert following additional tuple in instructor ('10211', 'Smith', 'Biology', 66000)

INSERT INTO instructor VALUES ('10211', 'Smith', 'Biology', 66000);

SELECT * FROM instructor;

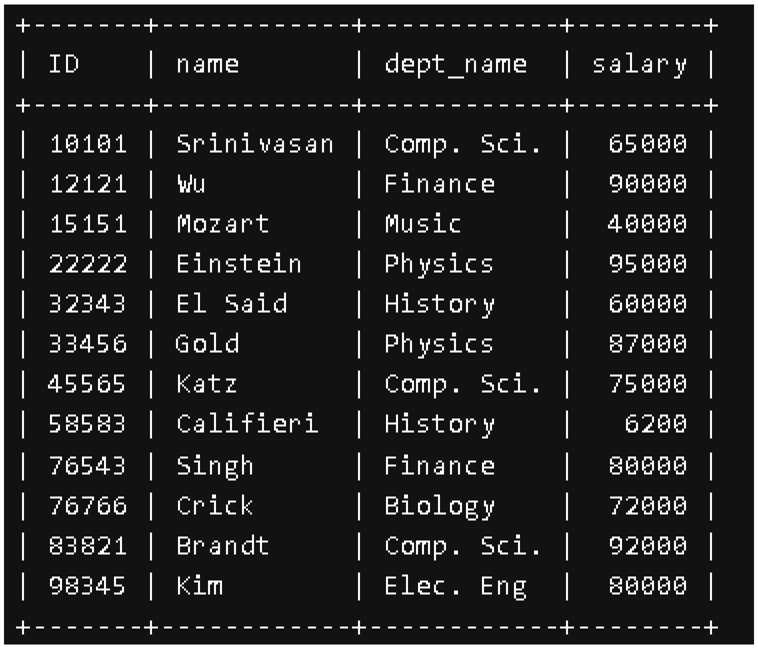


```
+-------+------------+------------+--------+
| ID    | name       | dept_name  | salary |
+-------+------------+------------+--------+
| 10101 | Srinivasan | Comp. Sci. |  65000 |
| 10211 | Smith      | Biology    |  66000 |
| 12121 | Wu         | Finance    |  90000 |
| 15151 | Mozart     | Music      |  40000 |
| 22222 | Einstein   | Physics    |  95000 |
| 32343 | El Said    | History    |  60000 |
| 33456 | Gold       | Physics    |  87000 |
| 45565 | Katz       | Comp. Sci. |  75000 |
| 58583 | Califieri  | History    |   6200 |
| 76543 | Singh      | Finance    |  80000 |
| 76766 | Crick      | Biology    |  72000 |
| 83821 | Brandt     | Comp. Sci. |  92000 |
| 98345 | Kim        | Elec. Eng  |  80000 |
+-------+------------+------------+--------+
```

4. Delete this tuple from instructor ('10211', 'Smith', 'Biology', 66000)

DELETE FROM instructor WHERE ID=10211;

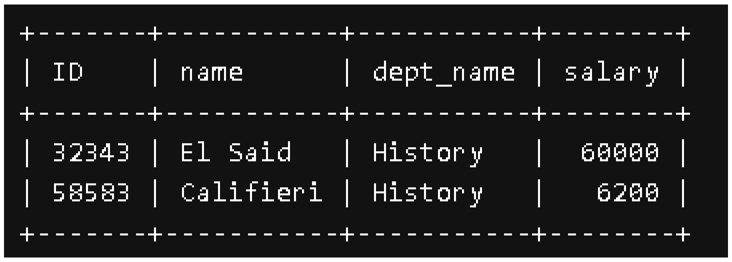
SELECT * FROM instructor;



```
+-------+------------+------------+--------+
| ID    | name       | dept_name  | salary |
+-------+------------+------------+--------+
| 10101 | Srinivasan | Comp. Sci. |  65000 |
| 12121 | Wu         | Finance    |  90000 |
| 15151 | Mozart     | Music      |  40000 |
| 22222 | Einstein   | Physics    |  95000 |
| 32343 | El Said    | History    |  60000 |
| 33456 | Gold       | Physics    |  87000 |
| 45565 | Katz       | Comp. Sci. |  75000 |
| 58583 | Califieri  | History    |   6200 |
| 76543 | Singh      | Finance    |  80000 |
| 76766 | Crick      | Biology    |  72000 |
| 83821 | Brandt     | Comp. Sci. |  92000 |
| 98345 | Kim        | Elec. Eng  |  80000 |
+-------+------------+------------+--------+
```

5. Select tuples from instructor where dept_name = 'History'

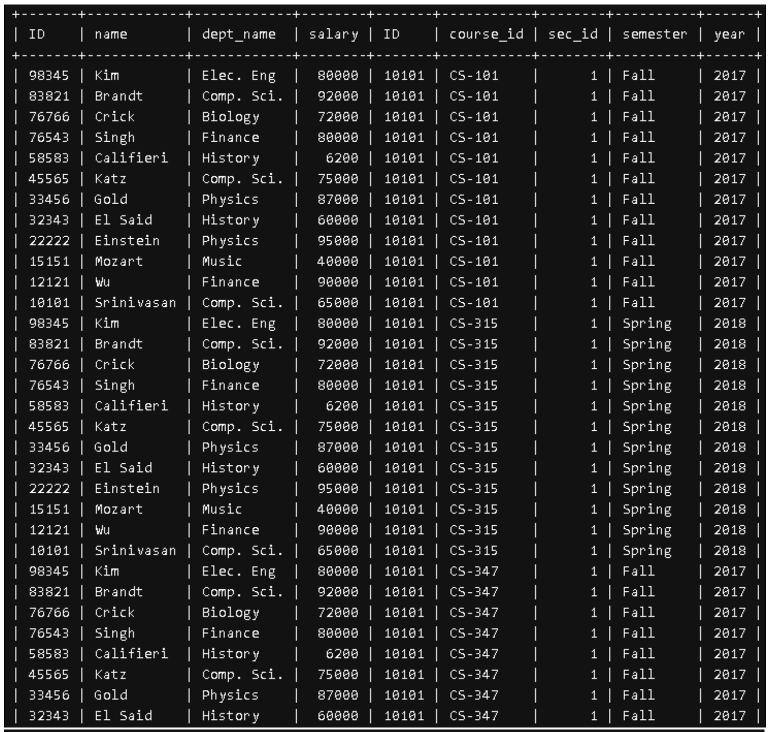
SELECT * FROM instructor where dept_name='History';



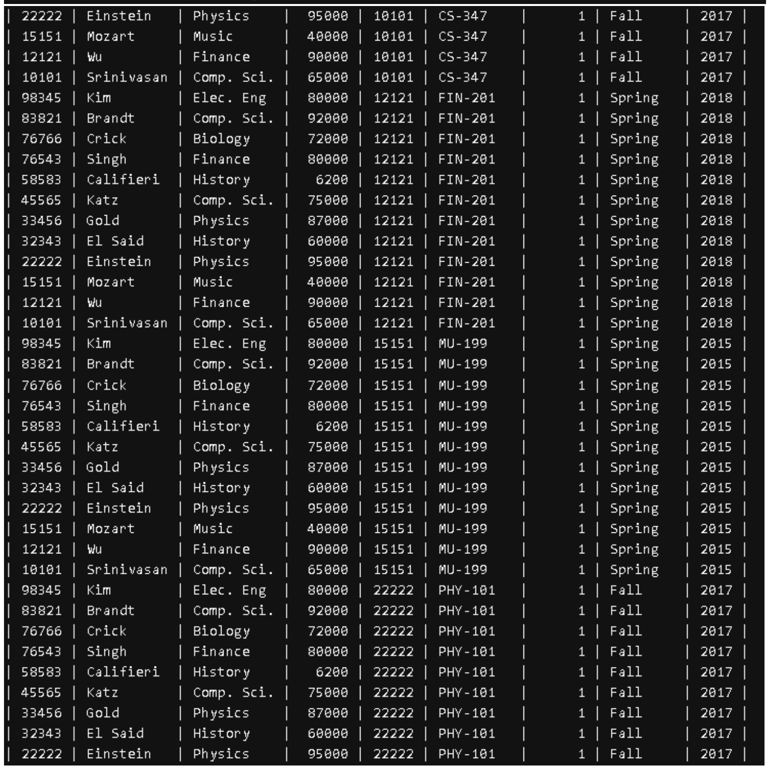
```
+-------+-----------+-----------+--------+
| ID    | name      | dept_name | salary |
+-------+-----------+-----------+--------+
| 32343 | El Said   | History   |  60000 |
| 58583 | Califieri | History   |   6200 |
+-------+-----------+-----------+--------+
```

6. Find the Cartesian product instructor x teaches.

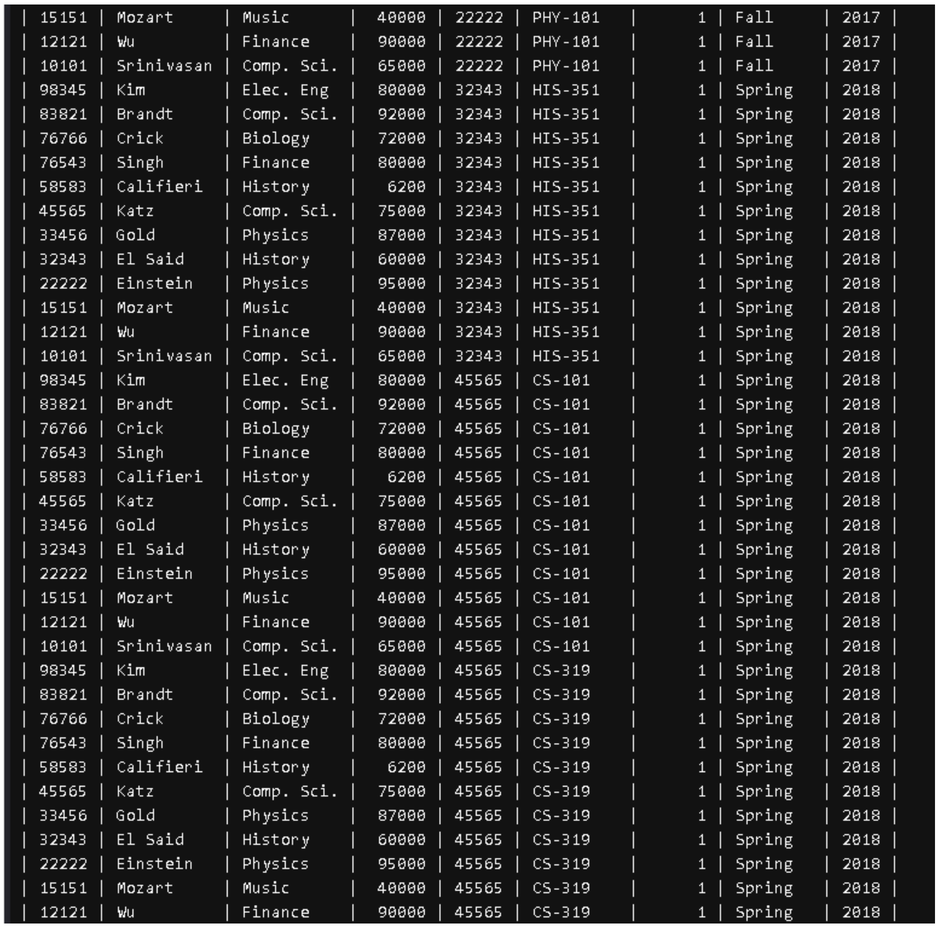
SELECT * FROM instructor CROSS JOIN teaches;



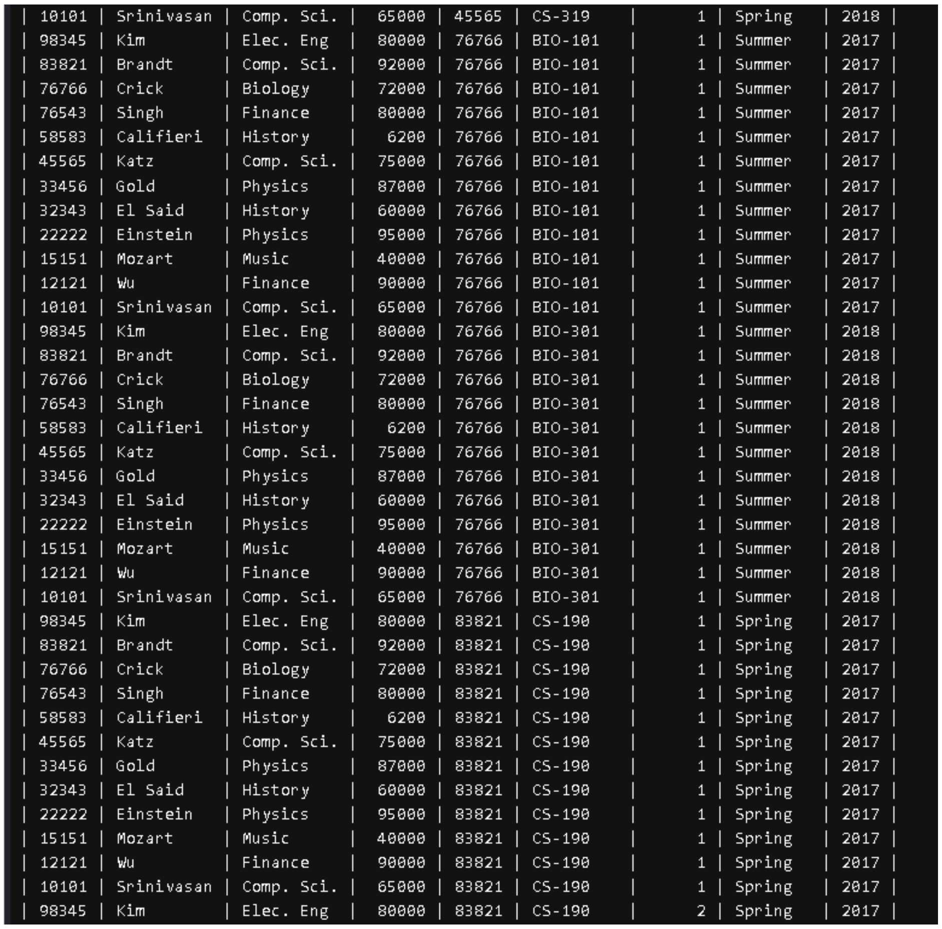
```
+-------+------------+------------+--------+-------+-----------+--------+----------+------+
| ID    | name       | dept_name  | salary | ID    | course_id | sec_id | semester | year |
+-------+------------+------------+--------+-------+-----------+--------+----------+------+
| 98345 | Kim        | Elec. Eng  |  80000 | 10101 | CS-101    |      1 | Fall     | 2017 |
| 83821 | Brandt     | Comp. Sci. |  92000 | 10101 | CS-101    |      1 | Fall     | 2017 |
| 76766 | Crick      | Biology    |  72000 | 10101 | CS-101    |      1 | Fall     | 2017 |
| 76543 | Singh      | Finance    |  80000 | 10101 | CS-101    |      1 | Fall     | 2017 |
| 58583 | Califieri  | History    |   6200 | 10101 | CS-101    |      1 | Fall     | 2017 |
| 45565 | Katz       | Comp. Sci. |  75000 | 10101 | CS-101    |      1 | Fall     | 2017 |
| 33456 | Gold       | Physics    |  87000 | 10101 | CS-101    |      1 | Fall     | 2017 |
| 32343 | El Said    | History    |  60000 | 10101 | CS-101    |      1 | Fall     | 2017 |
| 22222 | Einstein   | Physics    |  95000 | 10101 | CS-101    |      1 | Fall     | 2017 |
| 15151 | Mozart     | Music      |  40000 | 10101 | CS-101    |      1 | Fall     | 2017 |
| 12121 | Wu         | Finance    |  90000 | 10101 | CS-101    |      1 | Fall     | 2017 |
| 10101 | Srinivasan | Comp. Sci. |  65000 | 10101 | CS-101    |      1 | Fall     | 2017 |
| 98345 | Kim        | Elec. Eng  |  80000 | 10101 | CS-315    |      1 | Spring   | 2018 |
| 83821 | Brandt     | Comp. Sci. |  92000 | 10101 | CS-315    |      1 | Spring   | 2018 |
| 76766 | Crick      | Biology    |  72000 | 10101 | CS-315    |      1 | Spring   | 2018 |
| 76543 | Singh      | Finance    |  80000 | 10101 | CS-315    |      1 | Spring   | 2018 |
| 58583 | Califieri  | History    |   6200 | 10101 | CS-315    |      1 | Spring   | 2018 |
| 45565 | Katz       | Comp. Sci. |  75000 | 10101 | CS-315    |      1 | Spring   | 2018 |
| 33456 | Gold       | Physics    |  87000 | 10101 | CS-315    |      1 | Spring   | 2018 |
| 32343 | El Said    | History    |  60000 | 10101 | CS-315    |      1 | Spring   | 2018 |
| 22222 | Einstein   | Physics    |  95000 | 10101 | CS-315    |      1 | Spring   | 2018 |
| 15151 | Mozart     | Music      |  40000 | 10101 | CS-315    |      1 | Spring   | 2018 |
| 12121 | Wu         | Finance    |  90000 | 10101 | CS-315    |      1 | Spring   | 2018 |
| 10101 | Srinivasan | Comp. Sci. |  65000 | 10101 | CS-315    |      1 | Spring   | 2018 |
| 98345 | Kim        | Elec. Eng  |  80000 | 10101 | CS-347    |      1 | Fall     | 2017 |
| 83821 | Brandt     | Comp. Sci. |  92000 | 10101 | CS-347    |      1 | Fall     | 2017 |
| 76766 | Crick      | Biology    |  72000 | 10101 | CS-347    |      1 | Fall     | 2017 |
| 76543 | Singh      | Finance    |  80000 | 10101 | CS-347    |      1 | Fall     | 2017 |
| 58583 | Califieri  | History    |   6200 | 10101 | CS-347    |      1 | Fall     | 2017 |
| 45565 | Katz       | Comp. Sci. |  75000 | 10101 | CS-347    |      1 | Fall     | 2017 |
| 33456 | Gold       | Physics    |  87000 | 10101 | CS-347    |      1 | Fall     | 2017 |
| 32343 | El Said    | History    |  60000 | 10101 | CS-347    |      1 | Fall     | 2017 |
```



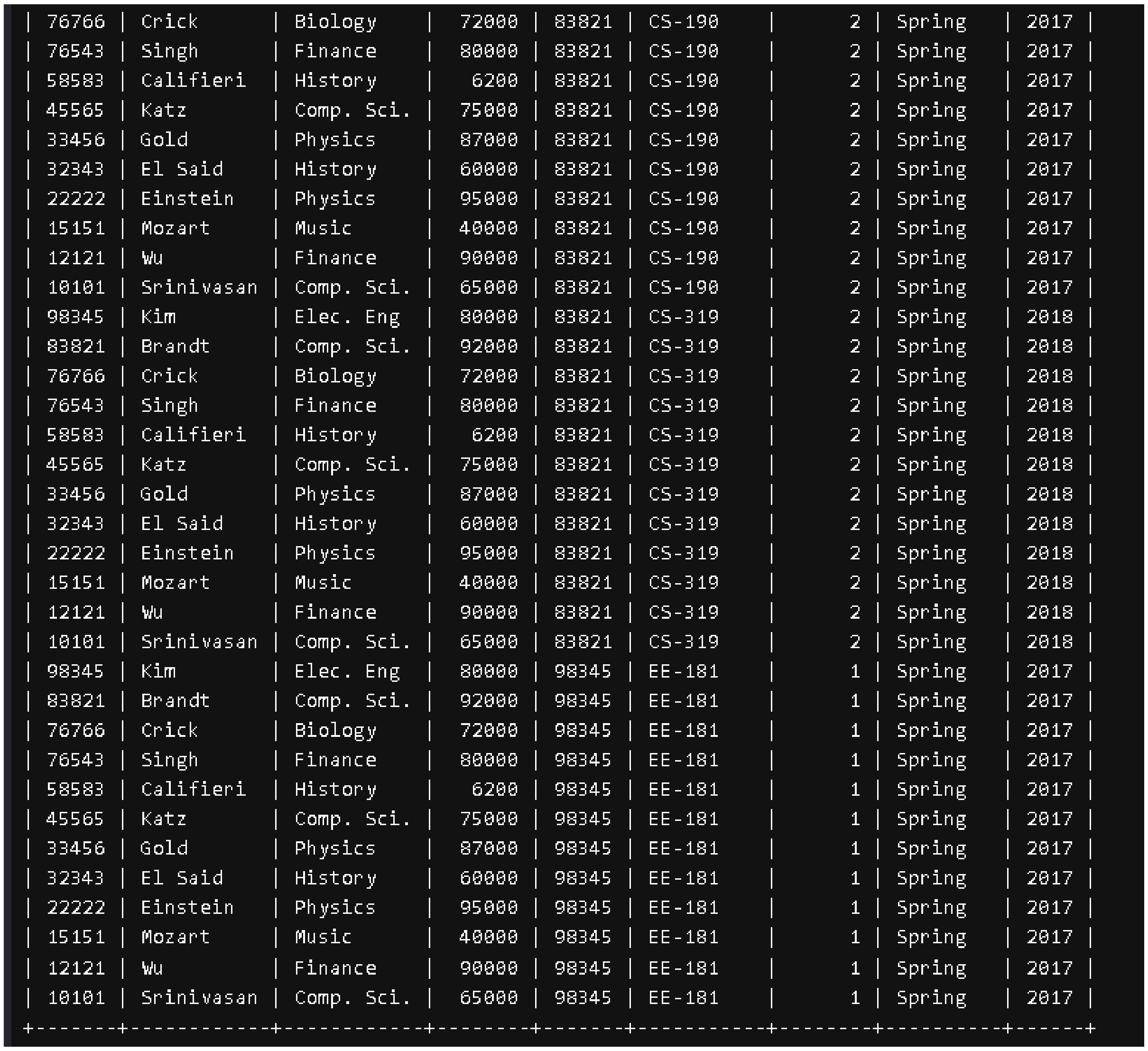
```
| 22222 | Einstein   | Physics    |  95000 | 10101 | CS-347    |      1 | Fall     | 2017 |
| 15151 | Mozart     | Music      |  40000 | 10101 | CS-347    |      1 | Fall     | 2017 |
| 12121 | Wu         | Finance    |  90000 | 10101 | CS-347    |      1 | Fall     | 2017 |
| 10101 | Srinivasan | Comp. Sci. |  65000 | 10101 | CS-347    |      1 | Fall     | 2017 |
| 98345 | Kim        | Elec. Eng  |  80000 | 12121 | FIN-201   |      1 | Spring   | 2018 |
| 83821 | Brandt     | Comp. Sci. |  92000 | 12121 | FIN-201   |      1 | Spring   | 2018 |
| 76766 | Crick      | Biology    |  72000 | 12121 | FIN-201   |      1 | Spring   | 2018 |
| 76543 | Singh      | Finance    |  80000 | 12121 | FIN-201   |      1 | Spring   | 2018 |
| 58583 | Califieri  | History    |   6200 | 12121 | FIN-201   |      1 | Spring   | 2018 |
| 45565 | Katz       | Comp. Sci. |  75000 | 12121 | FIN-201   |      1 | Spring   | 2018 |
| 33456 | Gold       | Physics    |  87000 | 12121 | FIN-201   |      1 | Spring   | 2018 |
| 32343 | El Said    | History    |  60000 | 12121 | FIN-201   |      1 | Spring   | 2018 |
| 22222 | Einstein   | Physics    |  95000 | 12121 | FIN-201   |      1 | Spring   | 2018 |
| 15151 | Mozart     | Music      |  40000 | 12121 | FIN-201   |      1 | Spring   | 2018 |
| 12121 | Wu         | Finance    |  90000 | 12121 | FIN-201   |      1 | Spring   | 2018 |
| 10101 | Srinivasan | Comp. Sci. |  65000 | 12121 | FIN-201   |      1 | Spring   | 2018 |
| 98345 | Kim        | Elec. Eng  |  80000 | 15151 | MU-199    |      1 | Spring   | 2015 |
| 83821 | Brandt     | Comp. Sci. |  92000 | 15151 | MU-199    |      1 | Spring   | 2015 |
| 76766 | Crick      | Biology    |  72000 | 15151 | MU-199    |      1 | Spring   | 2015 |
| 76543 | Singh      | Finance    |  80000 | 15151 | MU-199    |      1 | Spring   | 2015 |
| 58583 | Califieri  | History    |   6200 | 15151 | MU-199    |      1 | Spring   | 2015 |
| 45565 | Katz       | Comp. Sci. |  75000 | 15151 | MU-199    |      1 | Spring   | 2015 |
| 33456 | Gold       | Physics    |  87000 | 15151 | MU-199    |      1 | Spring   | 2015 |
| 32343 | El Said    | History    |  60000 | 15151 | MU-199    |      1 | Spring   | 2015 |
| 22222 | Einstein   | Physics    |  95000 | 15151 | MU-199    |      1 | Spring   | 2015 |
| 15151 | Mozart     | Music      |  40000 | 15151 | MU-199    |      1 | Spring   | 2015 |
| 12121 | Wu         | Finance    |  90000 | 15151 | MU-199    |      1 | Spring   | 2015 |
| 10101 | Srinivasan | Comp. Sci. |  65000 | 15151 | MU-199    |      1 | Spring   | 2015 |
| 98345 | Kim        | Elec. Eng  |  80000 | 22222 | PHY-101   |      1 | Fall     | 2017 |
| 83821 | Brandt     | Comp. Sci. |  92000 | 22222 | PHY-101   |      1 | Fall     | 2017 |
| 76766 | Crick      | Biology    |  72000 | 22222 | PHY-101   |      1 | Fall     | 2017 |
| 76543 | Singh      | Finance    |  80000 | 22222 | PHY-101   |      1 | Fall     | 2017 |
| 58583 | Califieri  | History    |   6200 | 22222 | PHY-101   |      1 | Fall     | 2017 |
| 45565 | Katz       | Comp. Sci. |  75000 | 22222 | PHY-101   |      1 | Fall     | 2017 |
| 33456 | Gold       | Physics    |  87000 | 22222 | PHY-101   |      1 | Fall     | 2017 |
| 32343 | El Said    | History    |  60000 | 22222 | PHY-101   |      1 | Fall     | 2017 |
| 22222 | Einstein   | Physics    |  95000 | 22222 | PHY-101   |      1 | Fall     | 2017 |
```



```
| 15151 | Mozart     | Music      |  40000 | 22222 | PHY-101    |        1 | Fall     | 2017 |
| 12121 | Wu         | Finance    |  90000 | 22222 | PHY-101    |        1 | Fall     | 2017 |
| 10101 | Srinivasan | Comp. Sci. |  65000 | 22222 | PHY-101    |        1 | Fall     | 2017 |
| 98345 | Kim        | Elec. Eng  |  80000 | 32343 | HIS-351    |        1 | Spring   | 2018 |
| 83821 | Brandt     | Comp. Sci. |  92000 | 32343 | HIS-351    |        1 | Spring   | 2018 |
| 76766 | Crick      | Biology    |  72000 | 32343 | HIS-351    |        1 | Spring   | 2018 |
| 76543 | Singh      | Finance    |  80000 | 32343 | HIS-351    |        1 | Spring   | 2018 |
| 58583 | Califieri  | History    |   6200 | 32343 | HIS-351    |        1 | Spring   | 2018 |
| 45565 | Katz       | Comp. Sci. |  75000 | 32343 | HIS-351    |        1 | Spring   | 2018 |
| 33456 | Gold       | Physics    |  87000 | 32343 | HIS-351    |        1 | Spring   | 2018 |
| 32343 | El Said    | History    |  60000 | 32343 | HIS-351    |        1 | Spring   | 2018 |
| 22222 | Einstein   | Physics    |  95000 | 32343 | HIS-351    |        1 | Spring   | 2018 |
| 15151 | Mozart     | Music      |  40000 | 32343 | HIS-351    |        1 | Spring   | 2018 |
| 12121 | Wu         | Finance    |  90000 | 32343 | HIS-351    |        1 | Spring   | 2018 |
| 10101 | Srinivasan | Comp. Sci. |  65000 | 32343 | HIS-351    |        1 | Spring   | 2018 |
| 98345 | Kim        | Elec. Eng  |  80000 | 45565 | CS-101     |        1 | Spring   | 2018 |
| 83821 | Brandt     | Comp. Sci. |  92000 | 45565 | CS-101     |        1 | Spring   | 2018 |
| 76766 | Crick      | Biology    |  72000 | 45565 | CS-101     |        1 | Spring   | 2018 |
| 76543 | Singh      | Finance    |  80000 | 45565 | CS-101     |        1 | Spring   | 2018 |
| 58583 | Califieri  | History    |   6200 | 45565 | CS-101     |        1 | Spring   | 2018 |
| 45565 | Katz       | Comp. Sci. |  75000 | 45565 | CS-101     |        1 | Spring   | 2018 |
| 33456 | Gold       | Physics    |  87000 | 45565 | CS-101     |        1 | Spring   | 2018 |
| 32343 | El Said    | History    |  60000 | 45565 | CS-101     |        1 | Spring   | 2018 |
| 22222 | Einstein   | Physics    |  95000 | 45565 | CS-101     |        1 | Spring   | 2018 |
| 15151 | Mozart     | Music      |  40000 | 45565 | CS-101     |        1 | Spring   | 2018 |
| 12121 | Wu         | Finance    |  90000 | 45565 | CS-101     |        1 | Spring   | 2018 |
| 10101 | Srinivasan | Comp. Sci. |  65000 | 45565 | CS-101     |        1 | Spring   | 2018 |
| 98345 | Kim        | Elec. Eng  |  80000 | 45565 | CS-319     |        1 | Spring   | 2018 |
| 83821 | Brandt     | Comp. Sci. |  92000 | 45565 | CS-319     |        1 | Spring   | 2018 |
| 76766 | Crick      | Biology    |  72000 | 45565 | CS-319     |        1 | Spring   | 2018 |
| 76543 | Singh      | Finance    |  80000 | 45565 | CS-319     |        1 | Spring   | 2018 |
| 58583 | Califieri  | History    |   6200 | 45565 | CS-319     |        1 | Spring   | 2018 |
| 45565 | Katz       | Comp. Sci. |  75000 | 45565 | CS-319     |        1 | Spring   | 2018 |
| 33456 | Gold       | Physics    |  87000 | 45565 | CS-319     |        1 | Spring   | 2018 |
| 32343 | El Said    | History    |  60000 | 45565 | CS-319     |        1 | Spring   | 2018 |
| 22222 | Einstein   | Physics    |  95000 | 45565 | CS-319     |        1 | Spring   | 2018 |
| 15151 | Mozart     | Music      |  40000 | 45565 | CS-319     |        1 | Spring   | 2018 |
| 12121 | Wu         | Finance    |  90000 | 45565 | CS-319     |        1 | Spring   | 2018 |
```



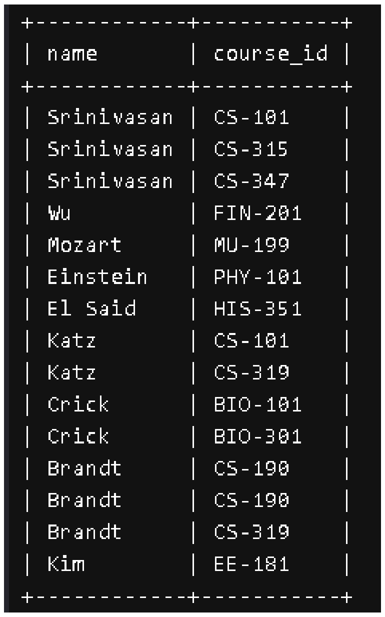
```
| 10101 | Srinivasan | Comp. Sci. |  65000 | 45565 | CS-319    |       1 | Spring   | 2018 |
| 98345 | Kim        | Elec. Eng  |  80000 | 76766 | BIO-101   |       1 | Summer   | 2017 |
| 83821 | Brandt     | Comp. Sci. |  92000 | 76766 | BIO-101   |       1 | Summer   | 2017 |
| 76766 | Crick      | Biology    |  72000 | 76766 | BIO-101   |       1 | Summer   | 2017 |
| 76543 | Singh      | Finance    |  80000 | 76766 | BIO-101   |       1 | Summer   | 2017 |
| 58583 | Califieri  | History    |   6200 | 76766 | BIO-101   |       1 | Summer   | 2017 |
| 45565 | Katz       | Comp. Sci. |  75000 | 76766 | BIO-101   |       1 | Summer   | 2017 |
| 33456 | Gold       | Physics    |  87000 | 76766 | BIO-101   |       1 | Summer   | 2017 |
| 32343 | El Said    | History    |  60000 | 76766 | BIO-101   |       1 | Summer   | 2017 |
| 22222 | Einstein   | Physics    |  95000 | 76766 | BIO-101   |       1 | Summer   | 2017 |
| 15151 | Mozart     | Music      |  40000 | 76766 | BIO-101   |       1 | Summer   | 2017 |
| 12121 | Wu         | Finance    |  90000 | 76766 | BIO-101   |       1 | Summer   | 2017 |
| 10101 | Srinivasan | Comp. Sci. |  65000 | 76766 | BIO-101   |       1 | Summer   | 2017 |
| 98345 | Kim        | Elec. Eng  |  80000 | 76766 | BIO-301   |       1 | Summer   | 2018 |
| 83821 | Brandt     | Comp. Sci. |  92000 | 76766 | BIO-301   |       1 | Summer   | 2018 |
| 76766 | Crick      | Biology    |  72000 | 76766 | BIO-301   |       1 | Summer   | 2018 |
| 76543 | Singh      | Finance    |  80000 | 76766 | BIO-301   |       1 | Summer   | 2018 |
| 58583 | Califieri  | History    |   6200 | 76766 | BIO-301   |       1 | Summer   | 2018 |
| 45565 | Katz       | Comp. Sci. |  75000 | 76766 | BIO-301   |       1 | Summer   | 2018 |
| 33456 | Gold       | Physics    |  87000 | 76766 | BIO-301   |       1 | Summer   | 2018 |
| 32343 | El Said    | History    |  60000 | 76766 | BIO-301   |       1 | Summer   | 2018 |
| 22222 | Einstein   | Physics    |  95000 | 76766 | BIO-301   |       1 | Summer   | 2018 |
| 15151 | Mozart     | Music      |  40000 | 76766 | BIO-301   |       1 | Summer   | 2018 |
| 12121 | Wu         | Finance    |  90000 | 76766 | BIO-301   |       1 | Summer   | 2018 |
| 10101 | Srinivasan | Comp. Sci. |  65000 | 76766 | BIO-301   |       1 | Summer   | 2018 |
| 98345 | Kim        | Elec. Eng  |  80000 | 83821 | CS-190    |       1 | Spring   | 2017 |
| 83821 | Brandt     | Comp. Sci. |  92000 | 83821 | CS-190    |       1 | Spring   | 2017 |
| 76766 | Crick      | Biology    |  72000 | 83821 | CS-190    |       1 | Spring   | 2017 |
| 76543 | Singh      | Finance    |  80000 | 83821 | CS-190    |       1 | Spring   | 2017 |
| 58583 | Califieri  | History    |   6200 | 83821 | CS-190    |       1 | Spring   | 2017 |
| 45565 | Katz       | Comp. Sci. |  75000 | 83821 | CS-190    |       1 | Spring   | 2017 |
| 33456 | Gold       | Physics    |  87000 | 83821 | CS-190    |       1 | Spring   | 2017 |
| 32343 | El Said    | History    |  60000 | 83821 | CS-190    |       1 | Spring   | 2017 |
| 22222 | Einstein   | Physics    |  95000 | 83821 | CS-190    |       1 | Spring   | 2017 |
| 15151 | Mozart     | Music      |  40000 | 83821 | CS-190    |       1 | Spring   | 2017 |
| 12121 | Wu         | Finance    |  90000 | 83821 | CS-190    |       1 | Spring   | 2017 |
| 10101 | Srinivasan | Comp. Sci. |  65000 | 83821 | CS-190    |       1 | Spring   | 2017 |
| 98345 | Kim        | Elec. Eng  |  80000 | 83821 | CS-190    |       2 | Spring   | 2017 |
```



```
| 76766 | Crick      | Biology    |  72000 | 83821 | CS-190    |      2 | Spring   | 2017 |
| 76543 | Singh      | Finance    |  80000 | 83821 | CS-190    |      2 | Spring   | 2017 |
| 58583 | Califieri  | History    |   6200 | 83821 | CS-190    |      2 | Spring   | 2017 |
| 45565 | Katz       | Comp. Sci. |  75000 | 83821 | CS-190    |      2 | Spring   | 2017 |
| 33456 | Gold       | Physics    |  87000 | 83821 | CS-190    |      2 | Spring   | 2017 |
| 32343 | El Said    | History    |  60000 | 83821 | CS-190    |      2 | Spring   | 2017 |
| 22222 | Einstein   | Physics    |  95000 | 83821 | CS-190    |      2 | Spring   | 2017 |
| 15151 | Mozart     | Music      |  40000 | 83821 | CS-190    |      2 | Spring   | 2017 |
| 12121 | Wu         | Finance    |  90000 | 83821 | CS-190    |      2 | Spring   | 2017 |
| 10101 | Srinivasan | Comp. Sci. |  65000 | 83821 | CS-190    |      2 | Spring   | 2017 |
| 98345 | Kim        | Elec. Eng  |  80000 | 83821 | CS-319    |      2 | Spring   | 2018 |
| 83821 | Brandt     | Comp. Sci. |  92000 | 83821 | CS-319    |      2 | Spring   | 2018 |
| 76766 | Crick      | Biology    |  72000 | 83821 | CS-319    |      2 | Spring   | 2018 |
| 76543 | Singh      | Finance    |  80000 | 83821 | CS-319    |      2 | Spring   | 2018 |
| 58583 | Califieri  | History    |   6200 | 83821 | CS-319    |      2 | Spring   | 2018 |
| 45565 | Katz       | Comp. Sci. |  75000 | 83821 | CS-319    |      2 | Spring   | 2018 |
| 33456 | Gold       | Physics    |  87000 | 83821 | CS-319    |      2 | Spring   | 2018 |
| 32343 | El Said    | History    |  60000 | 83821 | CS-319    |      2 | Spring   | 2018 |
| 22222 | Einstein   | Physics    |  95000 | 83821 | CS-319    |      2 | Spring   | 2018 |
| 15151 | Mozart     | Music      |  40000 | 83821 | CS-319    |      2 | Spring   | 2018 |
| 12121 | Wu         | Finance    |  90000 | 83821 | CS-319    |      2 | Spring   | 2018 |
| 10101 | Srinivasan | Comp. Sci. |  65000 | 83821 | CS-319    |      2 | Spring   | 2018 |
| 98345 | Kim        | Elec. Eng  |  80000 | 98345 | EE-181    |      1 | Spring   | 2017 |
| 83821 | Brandt     | Comp. Sci. |  92000 | 98345 | EE-181    |      1 | Spring   | 2017 |
| 76766 | Crick      | Biology    |  72000 | 98345 | EE-181    |      1 | Spring   | 2017 |
| 76543 | Singh      | Finance    |  80000 | 98345 | EE-181    |      1 | Spring   | 2017 |
| 58583 | Califieri  | History    |   6200 | 98345 | EE-181    |      1 | Spring   | 2017 |
| 45565 | Katz       | Comp. Sci. |  75000 | 98345 | EE-181    |      1 | Spring   | 2017 |
| 33456 | Gold       | Physics    |  87000 | 98345 | EE-181    |      1 | Spring   | 2017 |
| 32343 | El Said    | History    |  60000 | 98345 | EE-181    |      1 | Spring   | 2017 |
| 22222 | Einstein   | Physics    |  95000 | 98345 | EE-181    |      1 | Spring   | 2017 |
| 15151 | Mozart     | Music      |  40000 | 98345 | EE-181    |      1 | Spring   | 2017 |
| 12121 | Wu         | Finance    |  90000 | 98345 | EE-181    |      1 | Spring   | 2017 |
| 10101 | Srinivasan | Comp. Sci. |  65000 | 98345 | EE-181    |      1 | Spring   | 2017 |
+-------+------------+------------+--------+-------+-----------+--------+----------+------+
```

7. Find the names of all instructors who have taught some course and the course_id

SELECT i.name, t.course_id FROM instructor i INNER JOIN teaches t on i.ID= t.ID;

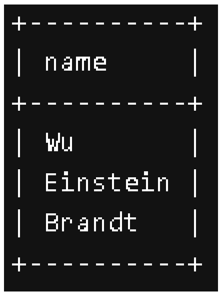

```
+------------+-----------+
| name       | course_id |
+------------+-----------+
| Srinivasan | CS-101    |
| Srinivasan | CS-315    |
| Srinivasan | CS-347    |
| Wu         | FIN-201   |
| Mozart     | MU-199    |
| Einstein   | PHY-101   |
| El Said    | HIS-351   |
| Katz       | CS-101    |
| Katz       | CS-319    |
| Crick      | BIO-101   |
| Crick      | BIO-301   |
| Brandt     | CS-190    |
| Brandt     | CS-190    |
| Brandt     | CS-319    |
| Kim        | EE-181    |
+------------+-----------+
```

8. Find the names of all instructors whose name includes the substring “dar”.

SELECT name FROM instructor where name LIKE "%dar%";

9. Find the names of all instructors with salary between 90,000 and 100,000 (that is, ≥ 90,000 and ≤ 100,000)

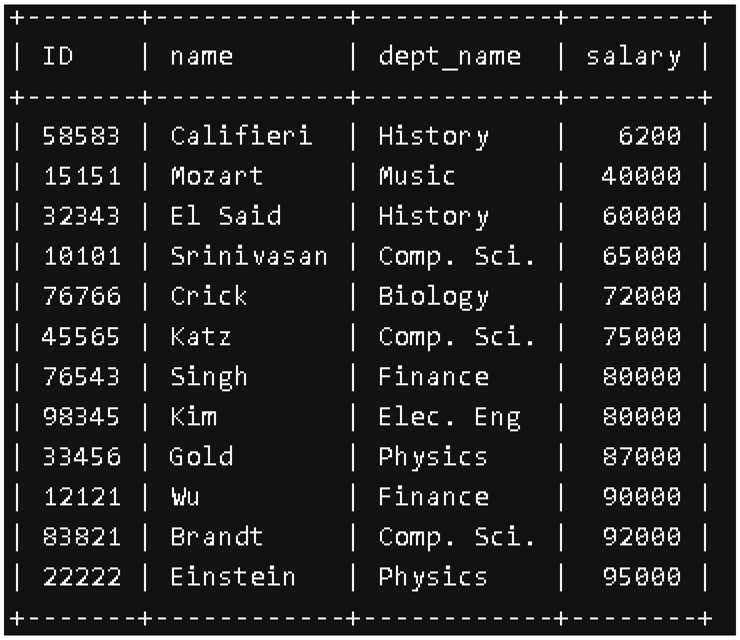
SELECT name FROM instructor where salary>= 90000 AND salary<=100000;


```
+----------+
| name     |
+----------+
| Wu       |
| Einstein |
| Brandt   |
+----------+
```

EXPERIMENT 5

1. Order the tuples in the instructors relation as per their salary.

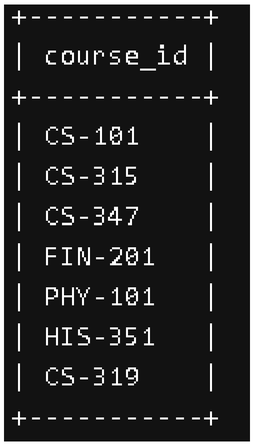
SELECT * FROM instructor ORDER BY salary;



```
+-------+------------+------------+--------+
| ID    | name       | dept_name  | salary |
+-------+------------+------------+--------+
| 58583 | Califieri  | History    |   6200 |
| 15151 | Mozart     | Music      |  40000 |
| 32343 | El Said    | History    |  60000 |
| 10101 | Srinivasan | Comp. Sci. |  65000 |
| 76766 | Crick      | Biology    |  72000 |
| 45565 | Katz       | Comp. Sci. |  75000 |
| 76543 | Singh      | Finance    |  80000 |
| 98345 | Kim        | Elec. Eng  |  80000 |
| 33456 | Gold       | Physics    |  87000 |
| 12121 | Wu         | Finance    |  90000 |
| 83821 | Brandt     | Comp. Sci. |  92000 |
| 22222 | Einstein   | Physics    |  95000 |
+-------+------------+------------+--------+
```

2. Find courses that ran in Fall 2017 or in Spring 2018

SELECT DISTINCT course_id FROM teaches WHERE (semester='Fall'and year=2017)OR (semester='Spring' and year=2018);



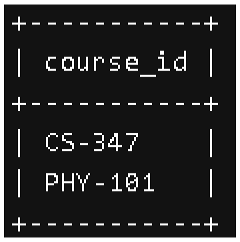
```
+-----------+
| course_id |
+-----------+
| CS-101    |
| CS-315    |
| CS-347    |
| FIN-201   |
| PHY-101   |
| HIS-351   |
| CS-319    |
+-----------+
```

3. Find courses that ran in Fall 2017 and in Spring 2018

SELECT DISTINCT course_id FROM teaches WHERE (semester='Fall'and year=2017) AND (semester='Spring' and year=2018);

4. Find courses that ran in Fall 2017 but not in Spring 2018

SELECT DISTINCT course_id FROM teaches t1 WHERE (t1.semester='Fall'and t1.year=2017) AND NOT EXISTS (SELECT 1 FROM teaches t2 WHERE t2.course_id= t1.course_id AND t2.semester='Spring' AND t2.year=2018);



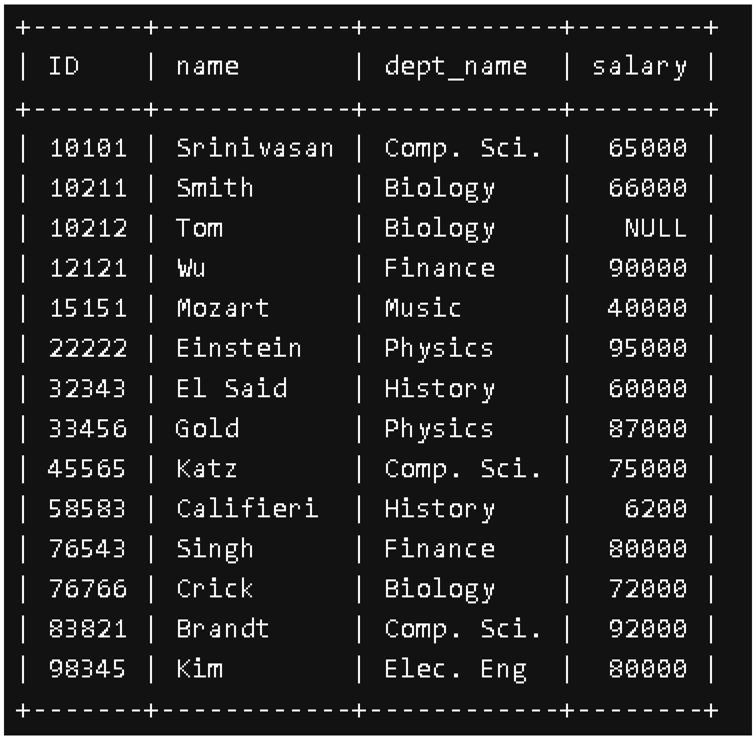
```
+-----------+
| course_id |
+-----------+
| CS-347    |
| PHY-101   |
+-----------+
```

5. Insert following additional tuples in instructor :('10211', 'Smith', 'Biology', 66000), ('10212', 'Tom', 'Biology', NULL)

INSERT INTO instructor VALUES ('10211', 'Smith', 'Biology', 66000), ('10212',

'Tom', 'Biology', NULL);

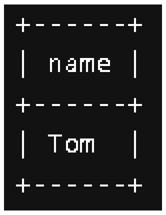
SELECT * FROM instructor;



```
+-------+------------+------------+--------+
| ID    | name       | dept_name  | salary |
+-------+------------+------------+--------+
| 10101 | Srinivasan | Comp. Sci. |  65000 |
| 10211 | Smith      | Biology    |  66000 |
| 10212 | Tom        | Biology    |   NULL |
| 12121 | Wu         | Finance    |  90000 |
| 15151 | Mozart     | Music      |  40000 |
| 22222 | Einstein   | Physics    |  95000 |
| 32343 | El Said    | History    |  60000 |
| 33456 | Gold       | Physics    |  87000 |
| 45565 | Katz       | Comp. Sci. |  75000 |
| 58583 | Califieri  | History    |   6200 |
| 76543 | Singh      | Finance    |  80000 |
| 76766 | Crick      | Biology    |  72000 |
| 83821 | Brandt     | Comp. Sci. |  92000 |
| 98345 | Kim        | Elec. Eng  |  80000 |
+-------+------------+------------+--------+
```

6. Find all instructors whose salary is null.

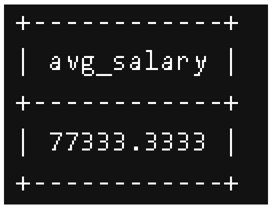
SELECT name FROM instructor WHERE salary IS NULL;



```
+------+
| name |
+------+
| Tom  |
+------+
```

7. Find the average salary of instructors in the Computer Science department.

SELECT AVG(salary) AS avg_salary FROM instructor WHERE dept_name='Comp. Sci.';

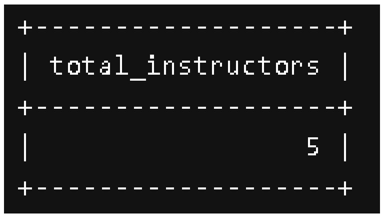


```
+------------+
| avg_salary |
+------------+
| 77333.3333 |
+------------+
```

EXPERIMENT 6

1. Find the total number of instructors who teach a course in the Spring 2018 semester.

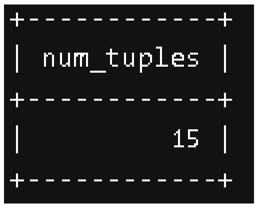
SELECT COUNT(DISTINCT ID) AS total_instructors FROM teaches WHERE semester='Spring' AND year=2018;



```
+-------------------+
| total_instructors |
+-------------------+
|                 5 |
+-------------------+
```

2. Find the number of tuples in the teaches relation

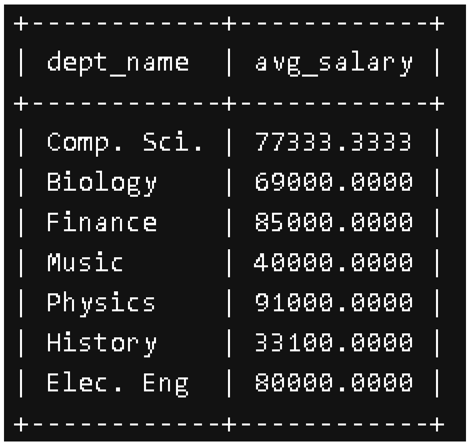
SELECT COUNT(*) AS num_tuples FROM teaches;



```
+------------+
| num_tuples |
+------------+
|         15 |
+------------+
```

3. Find the average salary of instructors in each department

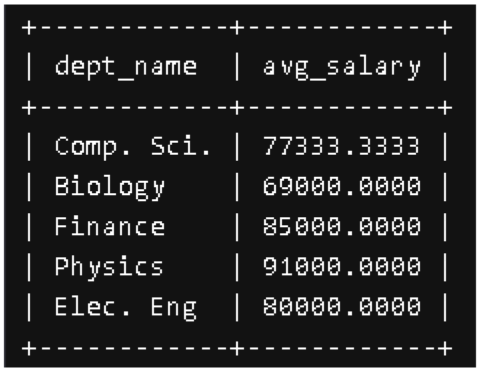
SELECT dept_name, AVG(salary) as avg_salary FROM instructor GROUP BY dept_name;



```
+------------+------------+
| dept_name  | avg_salary |
+------------+------------+
| Comp. Sci. | 77333.3333 |
| Biology    | 69000.0000 |
| Finance    | 85000.0000 |
| Music      | 40000.0000 |
| Physics    | 91000.0000 |
| History    | 33100.0000 |
| Elec. Eng  | 80000.0000 |
+------------+------------+
```

4. Find the names and average salaries of all departments whose average salary is greater than 42000

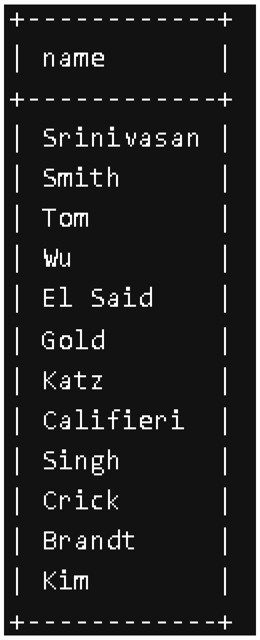
SELECT dept_name, AVG(salary) as avg_salary FROM instructor GROUP BY dept_name HAVING AVG(salary)>42000;



```
+------------+------------+
| dept_name  | avg_salary |
+------------+------------+
| Comp. Sci. | 77333.3333 |
| Biology    | 69000.0000 |
| Finance    | 85000.0000 |
| Physics    | 91000.0000 |
| Elec. Eng  | 80000.0000 |
+------------+------------+
```

5. Name all instructors whose name is neither “Mozart” nor Einstein”

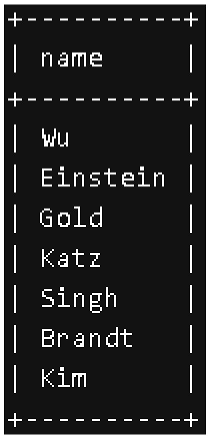
SELECT name FROM instructor WHERE name NOT IN ("Mozart","Einstein");



```
+------------+
| name       |
+------------+
| Srinivasan |
| Smith      |
| Tom        |
| Wu         |
| El Said    |
| Gold       |
| Katz       |
| Califieri  |
| Singh      |
| Crick      |
| Brandt     |
| Kim        |
+------------+
```

6. Find names of instructors with salary greater than that of some (at least one) instructor in the Biology department.

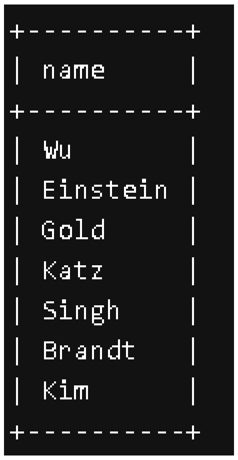
SELECT l.name FROM instructor l WHERE l.salary > (SELECT salary FROM instructor WHERE dept_name='Biology' AND name="Crick");



```
+----------+
| name     |
+----------+
| Wu       |
| Einstein |
| Gold     |
| Katz     |
| Singh    |
| Brandt   |
| Kim      |
+----------+
```

7. Find the names of all instructors whose salary is greater than the salary of all instructors in the Biology department.

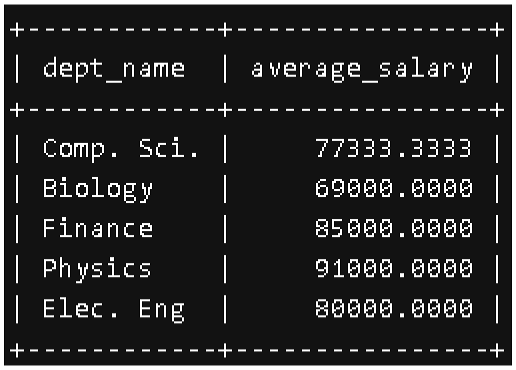
SELECT l.name FROM instructor l WHERE l.salary > (SELECT max(salary) FROM instructor WHERE dept_name='Biology');



```
+----------+
| name     |
+----------+
| Wu       |
| Einstein |
| Gold     |
| Katz     |
| Singh    |
| Brandt   |
| Kim      |
+----------+
```

8. Find the average instructors' salaries of those departments where the average salary is greater than 42,000

SELECT dept_name, AVG(salary) as average_salary FROM instructor GROUP BY dept_name HAVING AVG(salary)>42000;

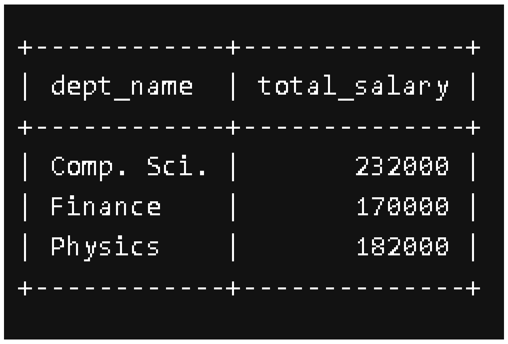


```
+------------+----------------+
| dept_name  | average_salary |
+------------+----------------+
| Comp. Sci. |     77333.3333 |
| Biology    |     69000.0000 |
| Finance    |     85000.0000 |
| Physics    |     91000.0000 |
| Elec. Eng  |     80000.0000 |
+------------+----------------+
```

EXPERIMENT 7

1. Find all departments where the total salary is greater than the average of the total salary at all departments

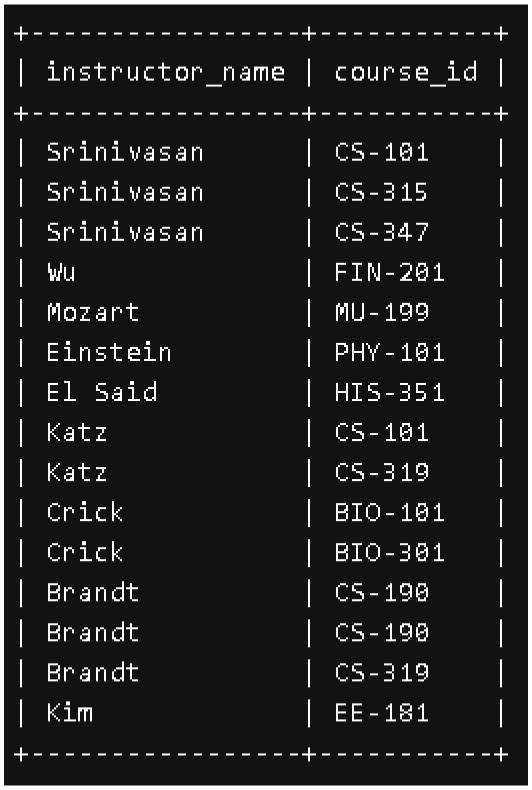
   SELECT dept_name, SUM(salary) AS total_salary
   FROM instructor GROUP BY dept_name
   HAVING SUM(salary) > (SELECT AVG(total_salary) FROM (SELECT SUM(salary) AS total_salary FROM instructor GROUP BY dept_name) AS avg_salary);



```
+------------+--------------+
| dept_name  | total_salary |
+------------+--------------+
| Comp. Sci. |       232000 |
| Finance    |       170000 |
| Physics    |       182000 |
+------------+--------------+
```

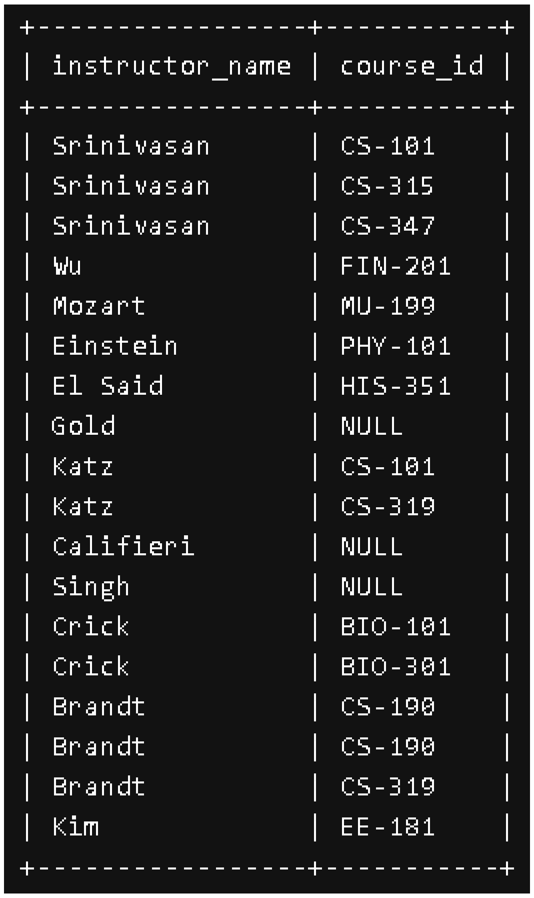
2. List the names of instructors along with the course ID of the courses that they taught

   SELECT i.name AS instructor_name, t.course_id
   FROM instructor i JOIN teaches t ON i.ID = t.ID;



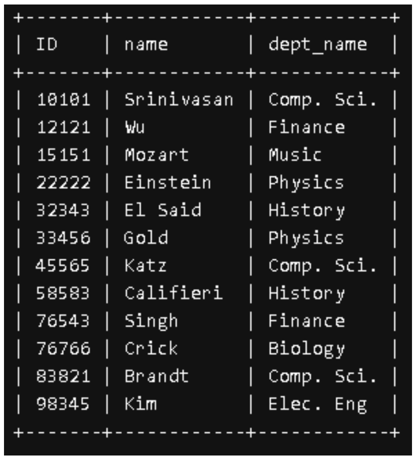
```
+-----------------+-----------+
| instructor_name | course_id |
+-----------------+-----------+
| Srinivasan      | CS-101    |
| Srinivasan      | CS-315    |
| Srinivasan      | CS-347    |
| Wu              | FIN-201   |
| Mozart          | MU-199    |
| Einstein        | PHY-101   |
| El Said         | HIS-351   |
| Katz            | CS-101    |
| Katz            | CS-319    |
| Crick           | BIO-101   |
| Crick           | BIO-301   |
| Brandt          | CS-190    |
| Brandt          | CS-190    |
| Brandt          | CS-319    |
| Kim             | EE-181    |
+-----------------+-----------+
```

3. List the names of instructors along with the course ID of the courses that they taught. In case, an instructor teaches no courses keep the course ID as null.
   SELECT i.name AS instructor_name, t.course_id
   FROM instructor i LEFT JOIN teaches t ON i.ID = t.ID;



```
+-----------------+-----------+
| instructor_name | course_id |
+-----------------+-----------+
| Srinivasan      | CS-101    |
| Srinivasan      | CS-315    |
| Srinivasan      | CS-347    |
| Wu              | FIN-201   |
| Mozart          | MU-199    |
| Einstein        | PHY-101   |
| El Said         | HIS-351   |
| Gold            | NULL      |
| Katz            | CS-101    |
| Katz            | CS-319    |
| Califieri       | NULL      |
| Singh           | NULL      |
| Crick           | BIO-101   |
| Crick           | BIO-301   |
| Brandt          | CS-190    |
| Brandt          | CS-190    |
| Brandt          | CS-319    |
| Kim             | EE-181    |
+-----------------+-----------+
```

4. Create a view of instructors without their salary called faculty
   CREATE VIEW faculty AS SELECT ID, name, dept_name
   FROM instructor;
   SELECT * FROM faculty;



```
+-------+------------+------------+
| ID    | name       | dept_name  |
+-------+------------+------------+
| 10101 | Srinivasan | Comp. Sci. |
| 12121 | Wu         | Finance    |
| 15151 | Mozart     | Music      |
| 22222 | Einstein   | Physics    |
| 32343 | El Said    | History    |
| 33456 | Gold       | Physics    |
| 45565 | Katz       | Comp. Sci. |
| 58583 | Califieri  | History    |
| 76543 | Singh      | Finance    |
| 76766 | Crick      | Biology    |
| 83821 | Brandt     | Comp. Sci. |
| 98345 | Kim        | Elec. Eng  |
+-------+------------+------------+
```

5. Give select privileges on the view faculty to the new user.

   GRANT SELECT ON faculty TO new_user;

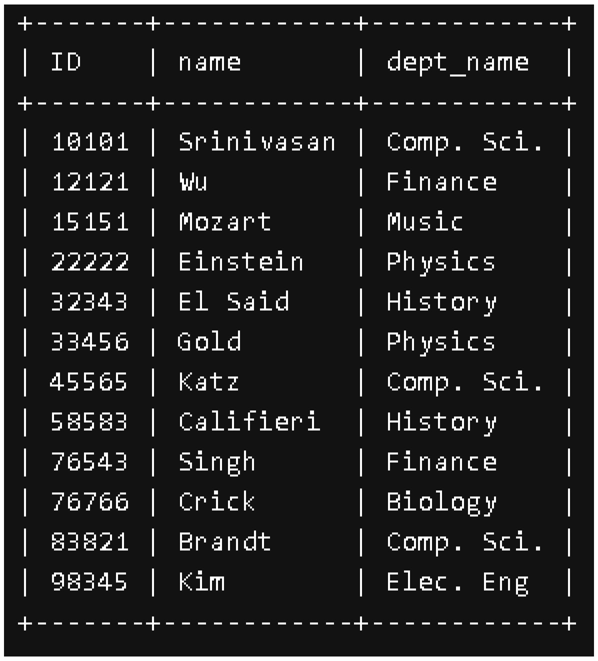
EXPERIMENT 8

1. Create a view of instructors without their salary called faculty

   CREATE VIEW faculty1 AS SELECT ID, name, dept_name

   FROM instructor;

   SELECT * FROM faculty1;

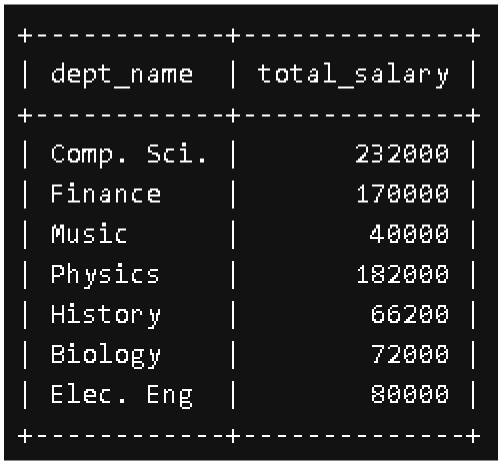


```
+-------+------------+------------+
| ID    | name       | dept_name  |
+-------+------------+------------+
| 10101 | Srinivasan | Comp. Sci. |
| 12121 | Wu         | Finance    |
| 15151 | Mozart     | Music      |
| 22222 | Einstein   | Physics    |
| 32343 | El Said    | History    |
| 33456 | Gold       | Physics    |
| 45565 | Katz       | Comp. Sci. |
| 58583 | Califieri  | History    |
| 76543 | Singh      | Finance    |
| 76766 | Crick      | Biology    |
| 83821 | Brandt     | Comp. Sci. |
| 98345 | Kim        | Elec. Eng  |
+-------+------------+------------+
```

2. Create a view of department salary totals

   CREATE VIEW department_salary_totals AS SELECT dept_name, SUM(salary) AS total_salary FROM instructor GROUP BY dept_name;

   SELECT * FROM department_salary_totals;



```
+------------+-------------+
| dept_name  | total_salary |
+------------+-------------+
| Comp. Sci. |      232000 |
| Finance    |      170000 |
| Music      |       40000 |
| Physics    |      182000 |
| History    |       66200 |
| Biology    |       72000 |
| Elec. Eng  |       80000 |
+------------+-------------+
```

3. Create a role of student

   CREATE ROLE student;

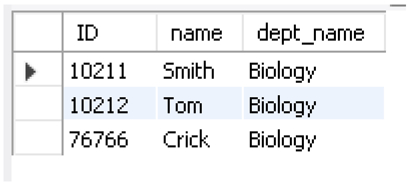
4. Give select privileges on the view faculty to the role student.

   GRANT SELECT ON faculty TO student;

5. Create a new user and assign her the role of student.
   CREATE USER guru@localhost IDENTIFIED BY '1234';
   GRANT student TO guru@localhost;

6. Login as this new user and find all instructors in the Biology department.
   GRANT ALL PRIVILEGES ON student.* TO guru@localhost;

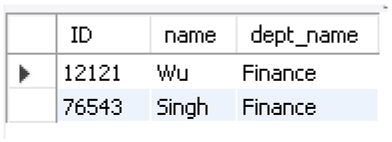
   SELECT * FROM faculty WHERE dept_name = 'Biology';



ID	name	dept_name
10211	Smith	Biology
10212	Tom	Biology
76766	Crick	Biology

7. Revoke privileges of the new user
   REVOKE student FROM guru@localhost;
8. Remove the role of student.
   DROP ROLE student;
9. Give select privileges on the view faculty to the new user.
   GRANT SELECT ON faculty TO guru@localhost;

10. Login as this new user and find all instructors in the finance department.
    SELECT * FROM faculty WHERE dept_name = 'Finance';



	ID	name	dept_name
▶	12121	Wu	Finance
	76543	Singh	Finance

11. Login again as root user
12. Create table teaches2 with same columns as teaches but with additional constraint that that semester is one of fall, winter, spring or summer

```
CREATE TABLE teaches2 (
  ID INT NOT NULL,
  course_id VARCHAR(255) NOT NULL,
  sec_id INT NOT NULL,
  semester VARCHAR(255) NOT NULL CHECK (semester IN ('Fall', 'Winter', 'Spring',
'Summer')),
  year INT NOT NULL,
  FOREIGN KEY (ID) REFERENCES instructor(ID)
);
```

13. Create index ID column of teaches. Compare the difference in time to obtain query results with or without index.
    `CREATE INDEX idx_ID ON teaches (ID);`

14. Drop the index to free up the space.
    `DROP INDEX idx_ID ON teaches;`

EXPERIMENT 9

Accessing the database through Python

1. Insert following additional tuple in instructor : ('10211', 'Smith', 'Biology', 66000)

2. Delete this tuple from instructor : ('10211', 'Smith', 'Biology', 66000)

3. Select tuples from instructor where dept_name = 'History'

4. Find the Cartesian product instructor x teaches.

5. Find the names of all instructors who have taught some course and the course_id

6. Find the names of all instructors whose name includes the substring "dar".

7. Find the names of all instructors with salary between 90,000 and 100,000 (that is, ≥ 90,000 and ≤ 100,000)

```
import mysql.connector


conn = mysql.connector.connect(
  host='localhost',
  user='root',
  password='root123',
  database='exp6'
)


cursor = conn.cursor()


create_table_query = """
CREATE TABLE instructor (
 ID INT PRIMARY KEY,
 name VARCHAR(255) NOT NULL,
 dept_name VARCHAR(255) NOT NULL,
 salary INT
)
"""
```

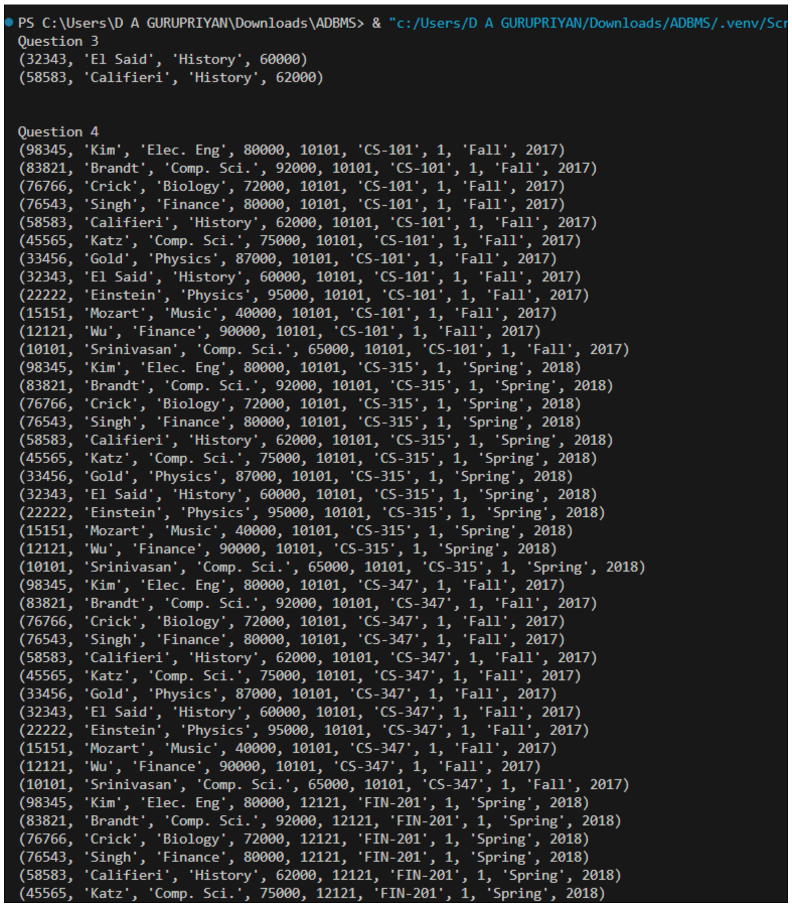
```
cursor.execute(create_table_query)

insert_query = """
INSERT INTO instructor (ID, name, dept_name, salary) VALUES
(10101, 'Srinivasan', 'Comp. Sci.', 65000),
(12121, 'Wu', 'Finance', 90000),
(15151, 'Mozart', 'Music', 40000),
(22222, 'Einstein', 'Physics', 95000),
(32343, 'El Said', 'History', 60000),
(33456, 'Gold', 'Physics', 87000),
(45565, 'Katz', 'Comp. Sci.', 75000),
(58583, 'Califieri', 'History', 62000),
(76543, 'Singh', 'Finance', 80000),
(76766, 'Crick', 'Biology', 72000),
(83821, 'Brandt', 'Comp. Sci.', 92000),
(98345, 'Kim', 'Elec. Eng', 80000)
"""
cursor.execute(insert_query)

create_table_query = """
CREATE TABLE teaches (
 ID INT,
 course_id VARCHAR(255),
 sec_id INT,
 semester VARCHAR(255),
 year INT,
 FOREIGN KEY (ID) REFERENCES instructor(ID)
)
"""
```

```
cursor.execute(create_table_query)


insert_query = """
INSERT INTO teaches (ID, course_id, sec_id, semester, year) VALUES
(10101, 'CS-101', 1, 'Fall', 2017),
(10101, 'CS-315', 1, 'Spring', 2018),
(10101, 'CS-347', 1, 'Fall', 2017),
(12121, 'FIN-201', 1, 'Spring', 2018),
(15151, 'MU-199', 1, 'Spring', 2015),
(22222, 'PHY-101', 1, 'Fall', 2017),
(32343, 'HIS-351', 1, 'Spring', 2018),
(45565, 'CS-101', 1, 'Spring', 2018),
(45565, 'CS-319', 1, 'Spring', 2018),
(76766, 'BIO-101', 1, 'Summer', 2017),
(76766, 'BIO-301', 1, 'Summer', 2018),
(83821, 'CS-190', 1, 'Spring', 2017),
(83821, 'CS-190', 2, 'Spring', 2017),
(83821, 'CS-319', 2, 'Spring', 2018),
(98345, 'EE-181', 1, 'Spring', 2017)
"""
cursor.execute(insert_query)


# 1
insert_query = """
INSERT INTO instructor (ID, name, dept_name, salary) VALUES
('10211', 'Smith', 'Biology', 66000)
"""
cursor.execute(insert_query)
```

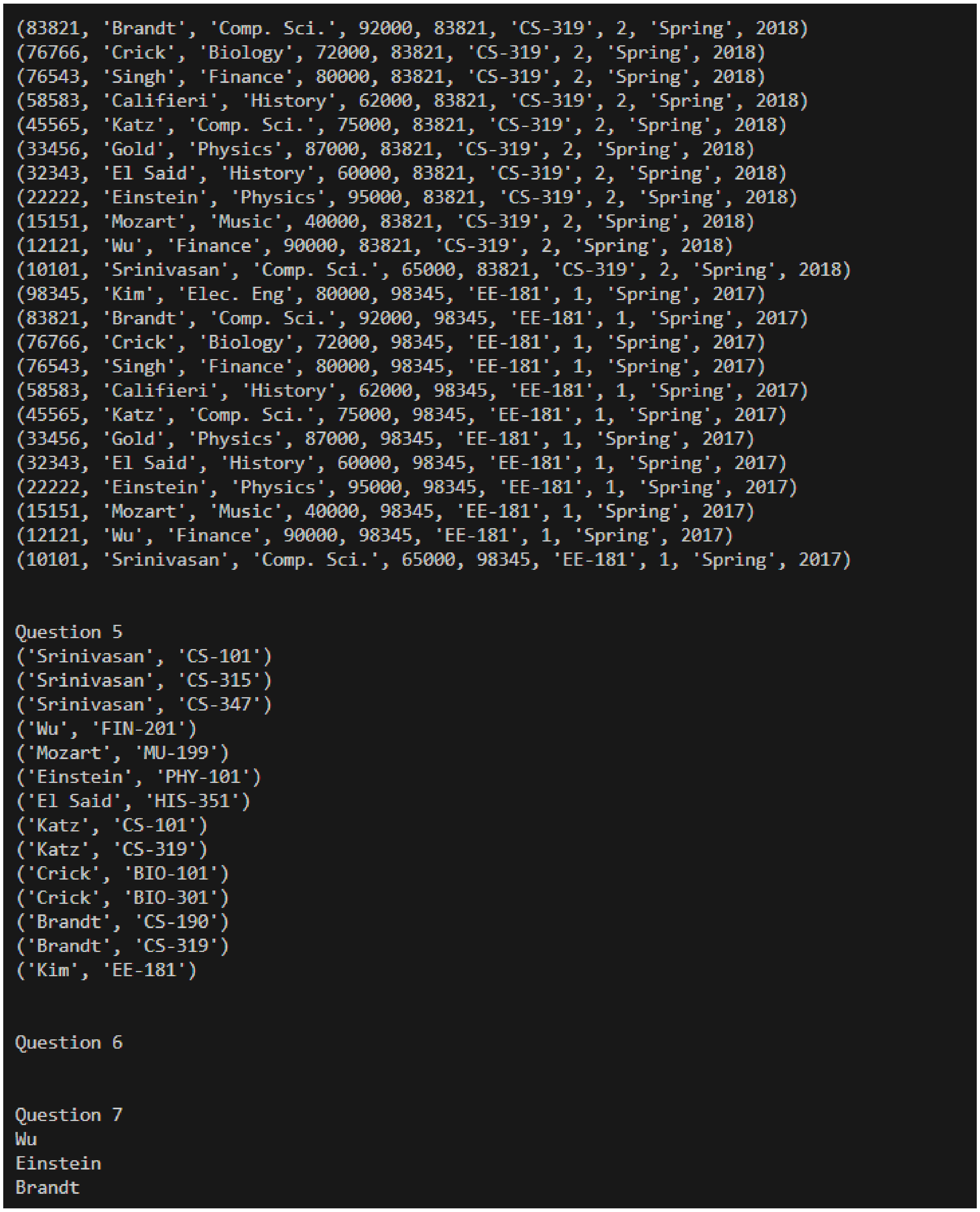
```
# 2

tuple_to_delete = ('10211', 'Smith', 'Biology', 66000)


delete_query = "DELETE FROM instructor WHERE ID = %s AND name = %s AND dept_name = %s AND
salary = %s"

cursor.execute(delete_query, tuple_to_delete)


# 3

dept_name = 'History'


select_query = "SELECT * FROM instructor WHERE dept_name = %s"

cursor.execute(select_query, (dept_name,))


results = cursor.fetchall()


for row in results:

   print(row)


# 4

cartesian_query = """

SELECT * FROM instructor, teaches

"""


cursor.execute(cartesian_query)


results = cursor.fetchall()


for row in results:

   print(row)
```

```
# 5
query = """
SELECT DISTINCT instructor.name, teaches.course_id
FROM instructor
JOIN teaches ON instructor.ID = teaches.ID
"""

# Execute the query
cursor.execute(query)

# Fetch the results
results = cursor.fetchall()

# Print the results
for row in results:
    print(row)

# 6
query = """
SELECT name
FROM instructor
WHERE name LIKE '%dar%'
"""

cursor.execute(query)

results = cursor.fetchall()
```

```
for row in results:
    print(row[0])


# 7
query = """
SELECT name
FROM instructor
WHERE salary BETWEEN 90000 AND 100000
"""


cursor.execute(query)


results = cursor.fetchall()


for row in results:
    print(row[0])


conn.commit()


cursor.close()
conn.close()
```



```
PS C:\Users\D A GURUPRIYAN\Downloads\ADBMS> & "c:/Users/D A GURUPRIYAN/Downloads/ADBMS/.venv/Scr
Question 3
(32343, 'El Said', 'History', 60000)
(58583, 'Califieri', 'History', 62000)


Question 4
(98345, 'Kim', 'Elec. Eng', 80000, 10101, 'CS-101', 1, 'Fall', 2017)
(83821, 'Brandt', 'Comp. Sci.', 92000, 10101, 'CS-101', 1, 'Fall', 2017)
(76766, 'Crick', 'Biology', 72000, 10101, 'CS-101', 1, 'Fall', 2017)
(76543, 'Singh', 'Finance', 80000, 10101, 'CS-101', 1, 'Fall', 2017)
(58583, 'Califieri', 'History', 62000, 10101, 'CS-101', 1, 'Fall', 2017)
(45565, 'Katz', 'Comp. Sci.', 75000, 10101, 'CS-101', 1, 'Fall', 2017)
(33456, 'Gold', 'Physics', 87000, 10101, 'CS-101', 1, 'Fall', 2017)
(32343, 'El Said', 'History', 60000, 10101, 'CS-101', 1, 'Fall', 2017)
(22222, 'Einstein', 'Physics', 95000, 10101, 'CS-101', 1, 'Fall', 2017)
(15151, 'Mozart', 'Music', 40000, 10101, 'CS-101', 1, 'Fall', 2017)
(12121, 'Wu', 'Finance', 90000, 10101, 'CS-101', 1, 'Fall', 2017)
(10101, 'Srinivasan', 'Comp. Sci.', 65000, 10101, 'CS-101', 1, 'Fall', 2017)
(98345, 'Kim', 'Elec. Eng', 80000, 10101, 'CS-315', 1, 'Spring', 2018)
(83821, 'Brandt', 'Comp. Sci.', 92000, 10101, 'CS-315', 1, 'Spring', 2018)
(76766, 'Crick', 'Biology', 72000, 10101, 'CS-315', 1, 'Spring', 2018)
(76543, 'Singh', 'Finance', 80000, 10101, 'CS-315', 1, 'Spring', 2018)
(58583, 'Califieri', 'History', 62000, 10101, 'CS-315', 1, 'Spring', 2018)
(45565, 'Katz', 'Comp. Sci.', 75000, 10101, 'CS-315', 1, 'Spring', 2018)
(33456, 'Gold', 'Physics', 87000, 10101, 'CS-315', 1, 'Spring', 2018)
(32343, 'El Said', 'History', 60000, 10101, 'CS-315', 1, 'Spring', 2018)
(22222, 'Einstein', 'Physics', 95000, 10101, 'CS-315', 1, 'Spring', 2018)
(15151, 'Mozart', 'Music', 40000, 10101, 'CS-315', 1, 'Spring', 2018)
(12121, 'Wu', 'Finance', 90000, 10101, 'CS-315', 1, 'Spring', 2018)
(10101, 'Srinivasan', 'Comp. Sci.', 65000, 10101, 'CS-315', 1, 'Spring', 2018)
(98345, 'Kim', 'Elec. Eng', 80000, 10101, 'CS-347', 1, 'Fall', 2017)
(83821, 'Brandt', 'Comp. Sci.', 92000, 10101, 'CS-347', 1, 'Fall', 2017)
(76766, 'Crick', 'Biology', 72000, 10101, 'CS-347', 1, 'Fall', 2017)
(76543, 'Singh', 'Finance', 80000, 10101, 'CS-347', 1, 'Fall', 2017)
(58583, 'Califieri', 'History', 62000, 10101, 'CS-347', 1, 'Fall', 2017)
(45565, 'Katz', 'Comp. Sci.', 75000, 10101, 'CS-347', 1, 'Fall', 2017)
(33456, 'Gold', 'Physics', 87000, 10101, 'CS-347', 1, 'Fall', 2017)
(32343, 'El Said', 'History', 60000, 10101, 'CS-347', 1, 'Fall', 2017)
(22222, 'Einstein', 'Physics', 95000, 10101, 'CS-347', 1, 'Fall', 2017)
(15151, 'Mozart', 'Music', 40000, 10101, 'CS-347', 1, 'Fall', 2017)
(12121, 'Wu', 'Finance', 90000, 10101, 'CS-347', 1, 'Fall', 2017)
(10101, 'Srinivasan', 'Comp. Sci.', 65000, 10101, 'CS-347', 1, 'Fall', 2017)
(98345, 'Kim', 'Elec. Eng', 80000, 12121, 'FIN-201', 1, 'Spring', 2018)
(83821, 'Brandt', 'Comp. Sci.', 92000, 12121, 'FIN-201', 1, 'Spring', 2018)
(76766, 'Crick', 'Biology', 72000, 12121, 'FIN-201', 1, 'Spring', 2018)
(76543, 'Singh', 'Finance', 80000, 12121, 'FIN-201', 1, 'Spring', 2018)
(58583, 'Califieri', 'History', 62000, 12121, 'FIN-201', 1, 'Spring', 2018)
(45565, 'Katz', 'Comp. Sci.', 75000, 12121, 'FIN-201', 1, 'Spring', 2018)
```


```
(83821, 'Brandt', 'Comp. Sci.', 92000, 83821, 'CS-319', 2, 'Spring', 2018)
(76766, 'Crick', 'Biology', 72000, 83821, 'CS-319', 2, 'Spring', 2018)
(76543, 'Singh', 'Finance', 80000, 83821, 'CS-319', 2, 'Spring', 2018)
(58583, 'Califieri', 'History', 62000, 83821, 'CS-319', 2, 'Spring', 2018)
(45565, 'Katz', 'Comp. Sci.', 75000, 83821, 'CS-319', 2, 'Spring', 2018)
(33456, 'Gold', 'Physics', 87000, 83821, 'CS-319', 2, 'Spring', 2018)
(32343, 'El Said', 'History', 60000, 83821, 'CS-319', 2, 'Spring', 2018)
(22222, 'Einstein', 'Physics', 95000, 83821, 'CS-319', 2, 'Spring', 2018)
(15151, 'Mozart', 'Music', 40000, 83821, 'CS-319', 2, 'Spring', 2018)
(12121, 'Wu', 'Finance', 90000, 83821, 'CS-319', 2, 'Spring', 2018)
(10101, 'Srinivasan', 'Comp. Sci.', 65000, 83821, 'CS-319', 2, 'Spring', 2018)
(98345, 'Kim', 'Elec. Eng', 80000, 98345, 'EE-181', 1, 'Spring', 2017)
(83821, 'Brandt', 'Comp. Sci.', 92000, 98345, 'EE-181', 1, 'Spring', 2017)
(76766, 'Crick', 'Biology', 72000, 98345, 'EE-181', 1, 'Spring', 2017)
(76543, 'Singh', 'Finance', 80000, 98345, 'EE-181', 1, 'Spring', 2017)
(58583, 'Califieri', 'History', 62000, 98345, 'EE-181', 1, 'Spring', 2017)
(45565, 'Katz', 'Comp. Sci.', 75000, 98345, 'EE-181', 1, 'Spring', 2017)
(33456, 'Gold', 'Physics', 87000, 98345, 'EE-181', 1, 'Spring', 2017)
(32343, 'El Said', 'History', 60000, 98345, 'EE-181', 1, 'Spring', 2017)
(22222, 'Einstein', 'Physics', 95000, 98345, 'EE-181', 1, 'Spring', 2017)
(15151, 'Mozart', 'Music', 40000, 98345, 'EE-181', 1, 'Spring', 2017)
(12121, 'Wu', 'Finance', 90000, 98345, 'EE-181', 1, 'Spring', 2017)
(10101, 'Srinivasan', 'Comp. Sci.', 65000, 98345, 'EE-181', 1, 'Spring', 2017)


Question 5
('Srinivasan', 'CS-101')
('Srinivasan', 'CS-315')
('Srinivasan', 'CS-347')
('Wu', 'FIN-201')
('Mozart', 'MU-199')
('Einstein', 'PHY-101')
('El Said', 'HIS-351')
('Katz', 'CS-101')
('Katz', 'CS-319')
('Crick', 'BIO-101')
('Crick', 'BIO-301')
('Brandt', 'CS-190')
('Brandt', 'CS-319')
('Kim', 'EE-181')


Question 6


Question 7
Wu
Einstein
Brandt
```

EXPERIMENT 10

1. Order the tuples in the instructors relation as per their salary.

2. Find courses that ran in Fall 2017 or in Spring 2018

3. Find courses that ran in Fall 2017 and in Spring 2018

4. Find courses that ran in Fall 2017 but not in Spring 2018

5. Insert following additional tuples in instructor ('10211', 'Smith', 'Biology', 66000) ('10212', 'Tom', 'Biology', NULL

6. Find all instructors whose salary is null.

7. Find the average salary of instructors in the Computer Science department.

8. Find the total number of instructors who teach a course in the Spring 2018 semester.

9. Find the number of tuples in the teaches relation

10. Find the average salary of instructors in each department

11. Find the names and average salaries of all departments whose average salary is greater than 42000

12. Name all instructors whose name is neither "Mozart" nor Einstein".

13. Find names of instructors with salary greater than that of some (at least one) instructor in the Biology department.

14. Find the names of all instructors whose salary is greater than the salary of all instructors in the Biology department.

15. Find the average instructors' salaries of those departments where the average salary is greater than 42,000.

16. Find all departments where the total salary is greater than the average of the total salary at all departments

17. List the names of instructors along with the course ID of the courses that they taught.

18. List the names of instructors along with the course ID of the courses that they taught. In case, an instructor teaches no courses keep the course ID as null.

```
import mysql.connector



conn = mysql.connector.connect(

  host='localhost',

  user='root',
    password='root123',

    database='exp6'

)


cursor = conn.cursor()


#  Order the tuples in the instructors relation as per their salary.

order_by_salary_query = """

SELECT * FROM instructor

ORDER BY salary

"""


cursor.execute(order_by_salary_query)


results = cursor.fetchall()


print("Question1:")

for row in results:

    print(row)

print("\n")


# Find courses that ran in Fall 2017 or in Spring 2018

courses_in_spring_or_fall = """

SELECT DISTINCT course_id FROM teaches WHERE (semester='Fall'and year=2017)OR
(semester='Spring' and year=2018)

"""


cursor.execute(courses_in_spring_or_fall)
```

```
results = cursor.fetchall()


print("Question2:")

for row in results:

   print(row)

print("\n")


# Find courses that ran in Fall 2017 and in Spring 2018

courses_in_spring_and_fall = """

SELECT DISTINCT course_id FROM teaches WHERE (semester='Fall'and year=2017) AND
(semester='Spring' and year=2018)

"""


cursor.execute(courses_in_spring_and_fall)


results = cursor.fetchall()


print("Question3:")

for row in results:

   print(row)

print("\n")


# Find courses that ran in Fall 2017 but not in Spring 2018

course_in_fall_only = """

SELECT DISTINCT course_id FROM teaches t1 WHERE (t1.semester='Fall'and t1.year=2017) AND NOT
EXISTS (SELECT 1 FROM teaches t2 WHERE t2.course_id= t1.course_id AND t2.semester='Spring' AND
t2.year=2018)

"""


cursor.execute(course_in_fall_only)
```

```
results = cursor.fetchall()


print("Question4:")
for row in results:
   print(row)
print("\n")


#  Insert following additional tuples in instructor
insert_tuples= """
INSERT INTO instructor VALUES ('10211', 'Smith', 'Biology', 66000), ('10212',
'Tom', 'Biology', NULL )
"""


cursor.execute(insert_tuples)


select_table = """
SELECT * FROM instructor
"""


cursor.execute(select_table)


results = cursor.fetchall()


print("Question5:")
for row in results:
   print(row)
print("\n")
```

```
#  Find all instructors whose salary is null.
instructor_salary_null = """
SELECT name FROM instructor WHERE salary IS NULL
"""


cursor.execute(instructor_salary_null)


results = cursor.fetchall()


print("Question6:")
for row in results:
   print(row)
print("\n")


# Find the average salary of instructors in the Computer Science department.
avg_cs_dept = """
SELECT AVG(salary) AS avg_salary FROM instructor WHERE dept_name='Comp. Sci.'
"""


cursor.execute(avg_cs_dept)


results = cursor.fetchall()


print("Question7:")
for row in results:
   print(row)
print("\n")


#  Find the total number of instructors who teach a course in the Spring 2018 semester.
```

```
instructors_spring = """

SELECT COUNT(DISTINCT ID) AS total_instructors FROM teaches WHERE semester='Spring' AND
year=2018

"""


cursor.execute(instructors_spring)


results = cursor.fetchall()


print("Question8:")

for row in results:

   print(row)

print("\n")


# Find the number of tuples in the teaches relation

teaches_count = """

SELECT COUNT(*) AS num_tuples FROM teaches

"""


cursor.execute(teaches_count)


results = cursor.fetchall()


print("Question9:")

for row in results:

   print(row)

print("\n")


# Find the average salary of instructors in each department
```

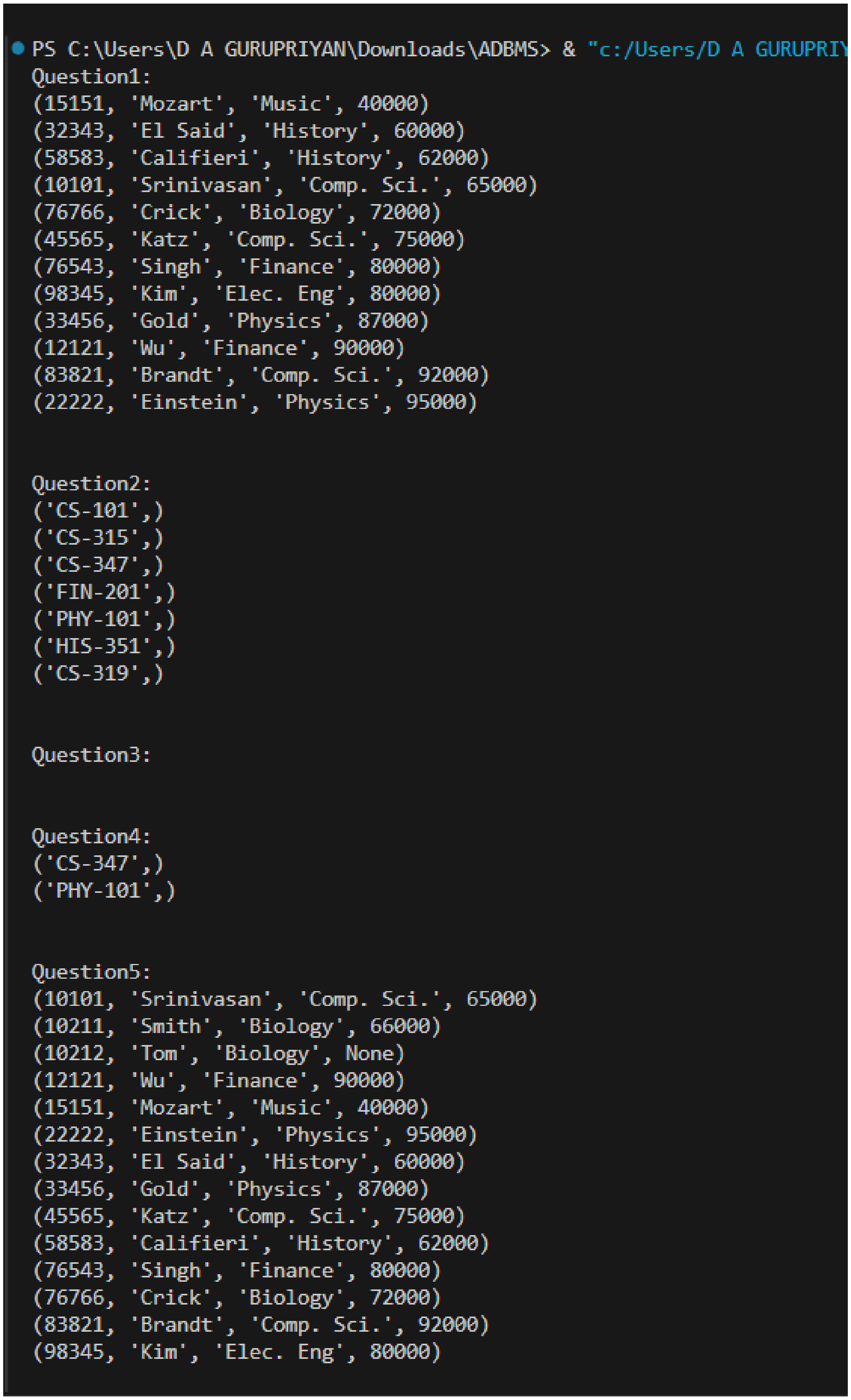
```
avg_instructor = """

SELECT dept_name, AVG(salary) as avg_salary FROM instructor GROUP BY dept_name

"""


cursor.execute(avg_instructor)


results = cursor.fetchall()


print("Question10:")

for row in results:

    print(row)

print("\n")


# Find the names and average salaries of all departments whose average salary is greater than 42000

avg_salary_greater = """

SELECT dept_name, AVG(salary) as avg_salary FROM instructor GROUP BY dept_name HAVING
AVG(salary)>42000

"""


cursor.execute(avg_salary_greater)


results = cursor.fetchall()


print("Question11:")

for row in results:

    print(row)

print("\n")


#  Name all instructors whose name is neither “Mozart” nor Einstein”.
```

```
instructor_name = """
SELECT name FROM instructor WHERE name NOT IN ("Mozart","Einstein")
"""


cursor.execute(instructor_name)


results = cursor.fetchall()


print("Question12:")
for row in results:
   print(row)
print("\n")


#  Find names of instructors with salary greater than that of some (at least one) instructor in the Biology
department.
salary_greater= """
SELECT l.name FROM instructor l WHERE l.salary > (SELECT salary FROM instructor WHERE
dept_name='Biology' AND name="Crick")
"""


cursor.execute(salary_greater)


results = cursor.fetchall()


print("Question13:")
for row in results:
   print(row)
print("\n")
```

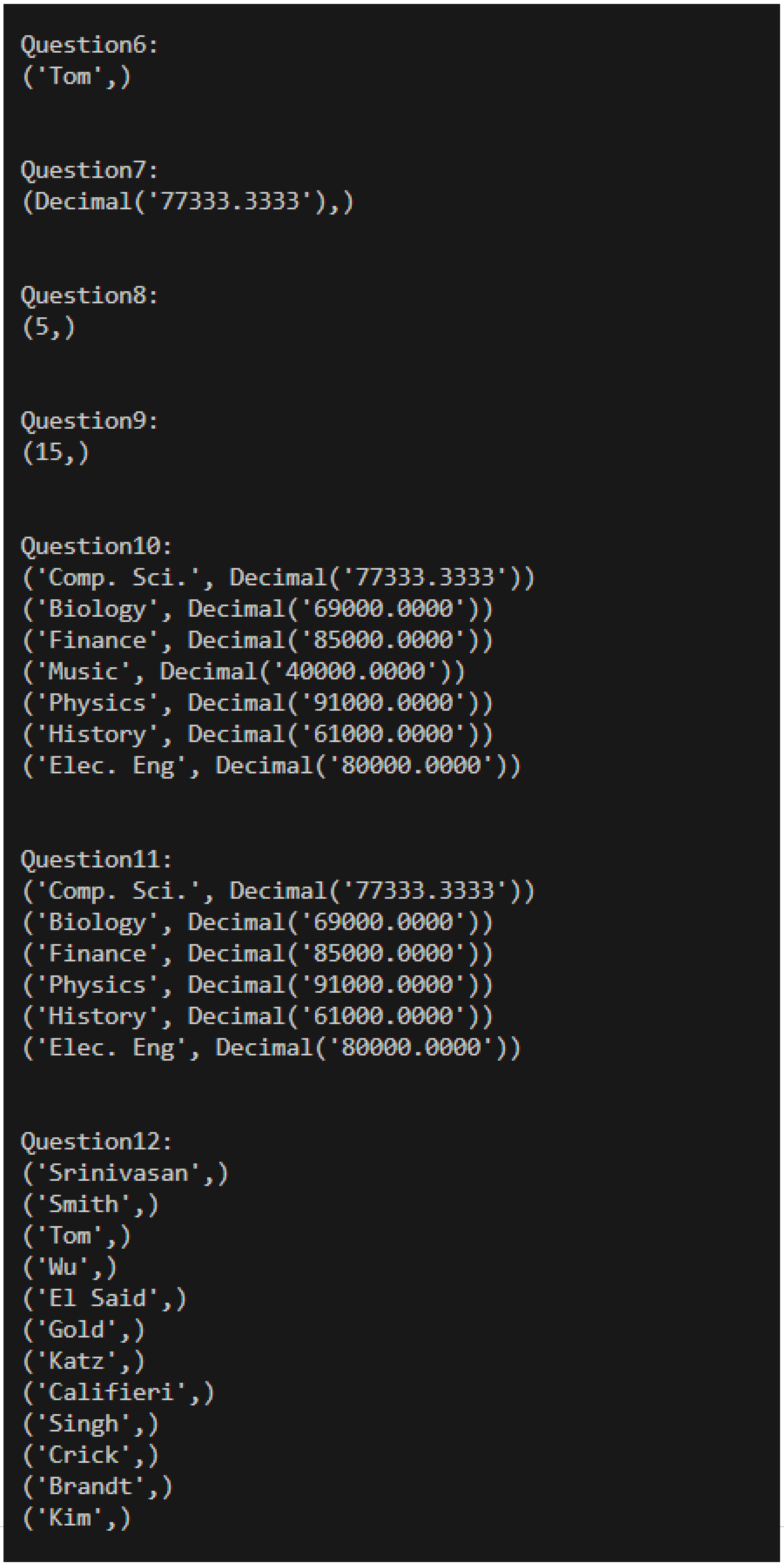
```
# Find the names of all instructors whose salary is greater than the salary of all instructors in the
Biology department.

salary_greater_biology = """

SELECT l.name FROM instructor l WHERE l.salary > (SELECT max(salary) FROM instructor WHERE
dept_name='Biology')

"""


cursor.execute(salary_greater_biology)


results = cursor.fetchall()


print("Question14:")

for row in results:

    print(row)

print("\n")


#  Find the average instructors' salaries of those departments where the average salary is greater than
42,000.

avg_instructor_greater = """

SELECT dept_name, AVG(salary) as average_salary FROM instructor GROUP BY dept_name HAVING
AVG(salary)>42000

"""


cursor.execute(avg_instructor_greater)


results = cursor.fetchall()


print("Question15:")

for row in results:

    print(row)
print("\n")


#  Find all departments where the total salary is greater than the average of the total salary at all
department_salary = """
SELECT dept_name
FROM (
   SELECT dept_name, SUM(salary) AS total_salary
   FROM instructor
   GROUP BY dept_name
) AS department_total_salary
WHERE total_salary > (
   SELECT AVG(total_salary)
   FROM (
      SELECT SUM(salary) AS total_salary
      FROM instructor
      GROUP BY dept_name
   ) AS avg_total_salary
)
"""


cursor.execute(department_salary)


results = cursor.fetchall()


print("Question16:")
for row in results:
   print(row)
print("\n")
```

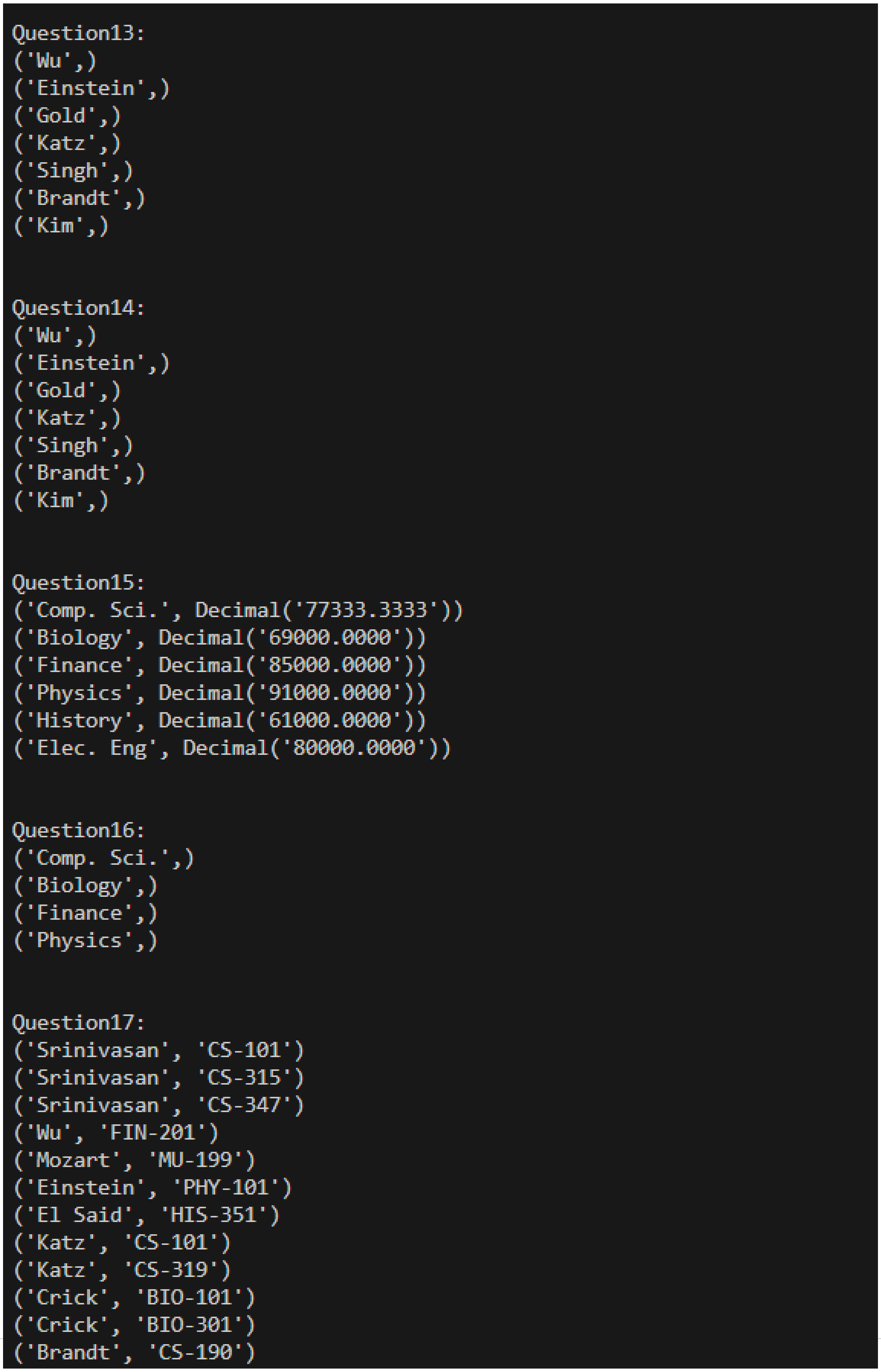
```
#  List the names of instructors along with the course ID of the courses that they taught

instructor_name_with_courseID = """

SELECT instructor.name, teaches.course_id

FROM instructor

JOIN teaches ON instructor.ID = teaches.ID

"""


cursor.execute(instructor_name_with_courseID)


results = cursor.fetchall()


print("Question17:")

for row in results:

   print(row)

print("\n")


#  List the names of instructors along with the course ID of the courses that they taught. In case, an
instructor teaches no courses keep the course ID as null.

instructor_name_with_courseID_with_null = """

SELECT instructor.name, teaches.course_id

FROM instructor

LEFT JOIN teaches ON instructor.ID = teaches.ID

"""


cursor.execute(instructor_name_with_courseID_with_null)


results = cursor.fetchall()


print("Question18:")
```

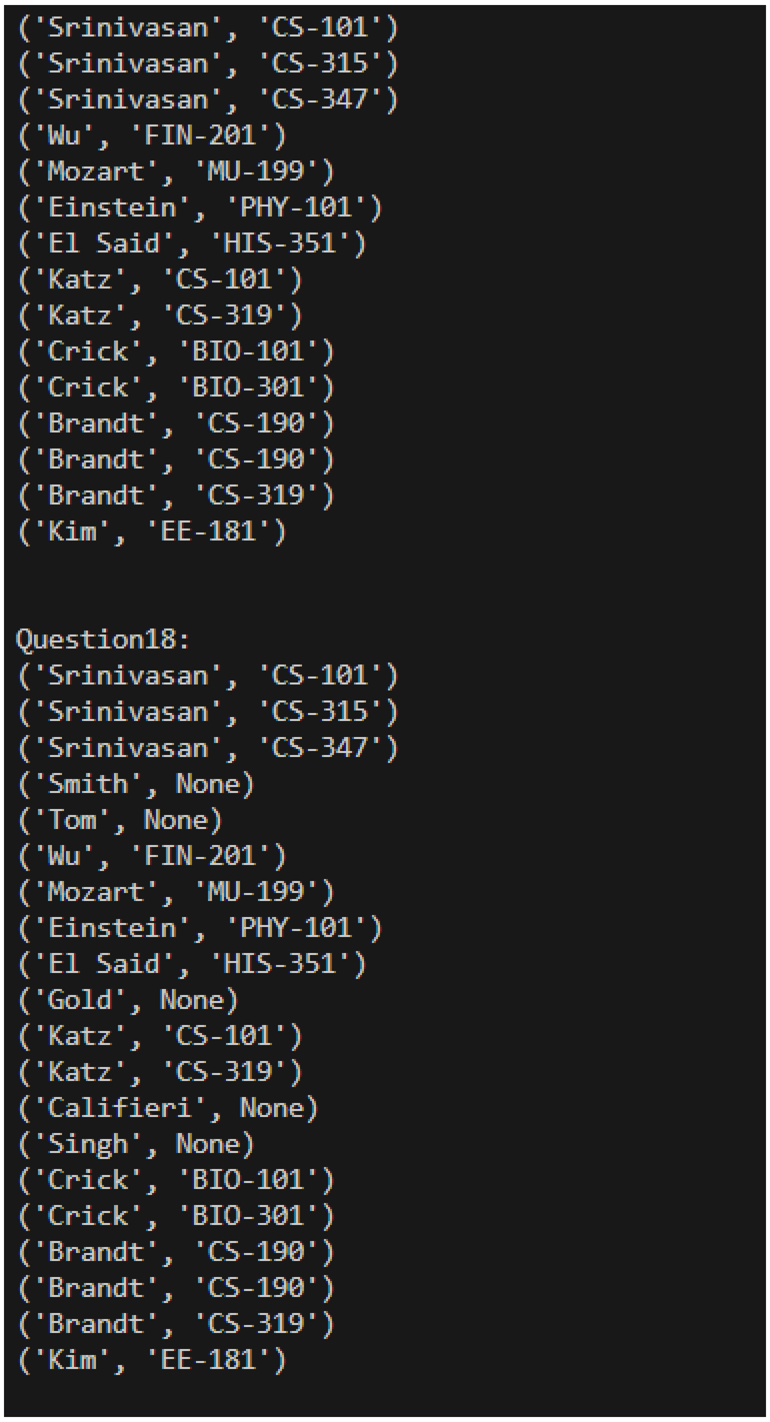
```
for row in results:
   print(row)
print("\n")
```



```
● PS C:\Users\D A GURUPRIYAN\Downloads\ADBMS> & "c:/Users/D A GURUPRIY
  Question1:
  (15151, 'Mozart', 'Music', 40000)
  (32343, 'El Said', 'History', 60000)
  (58583, 'Califieri', 'History', 62000)
  (10101, 'Srinivasan', 'Comp. Sci.', 65000)
  (76766, 'Crick', 'Biology', 72000)
  (45565, 'Katz', 'Comp. Sci.', 75000)
  (76543, 'Singh', 'Finance', 80000)
  (98345, 'Kim', 'Elec. Eng', 80000)
  (33456, 'Gold', 'Physics', 87000)
  (12121, 'Wu', 'Finance', 90000)
  (83821, 'Brandt', 'Comp. Sci.', 92000)
  (22222, 'Einstein', 'Physics', 95000)


  Question2:
  ('CS-101',)
  ('CS-315',)
  ('CS-347',)
  ('FIN-201',)
  ('PHY-101',)
  ('HIS-351',)
  ('CS-319',)


  Question3:


  Question4:
  ('CS-347',)
  ('PHY-101',)


  Question5:
  (10101, 'Srinivasan', 'Comp. Sci.', 65000)
  (10211, 'Smith', 'Biology', 66000)
  (10212, 'Tom', 'Biology', None)
  (12121, 'Wu', 'Finance', 90000)
  (15151, 'Mozart', 'Music', 40000)
  (22222, 'Einstein', 'Physics', 95000)
  (32343, 'El Said', 'History', 60000)
  (33456, 'Gold', 'Physics', 87000)
  (45565, 'Katz', 'Comp. Sci.', 75000)
  (58583, 'Califieri', 'History', 62000)
  (76543, 'Singh', 'Finance', 80000)
  (76766, 'Crick', 'Biology', 72000)
  (83821, 'Brandt', 'Comp. Sci.', 92000)
  (98345, 'Kim', 'Elec. Eng', 80000)
```


```
Question6:
('Tom',)


Question7:
(Decimal('77333.3333'),)


Question8:
(5,)


Question9:
(15,)


Question10:
('Comp. Sci.', Decimal('77333.3333'))
('Biology', Decimal('69000.0000'))
('Finance', Decimal('85000.0000'))
('Music', Decimal('40000.0000'))
('Physics', Decimal('91000.0000'))
('History', Decimal('61000.0000'))
('Elec. Eng', Decimal('80000.0000'))


Question11:
('Comp. Sci.', Decimal('77333.3333'))
('Biology', Decimal('69000.0000'))
('Finance', Decimal('85000.0000'))
('Physics', Decimal('91000.0000'))
('History', Decimal('61000.0000'))
('Elec. Eng', Decimal('80000.0000'))


Question12:
('Srinivasan',)
('Smith',)
('Tom',)
('Wu',)
('El Said',)
('Gold',)
('Katz',)
('Califieri',)
('Singh',)
('Crick',)
('Brandt',)
('Kim',)
```


```
Question13:
('Wu',)
('Einstein',)
('Gold',)
('Katz',)
('Singh',)
('Brandt',)
('Kim',)


Question14:
('Wu',)
('Einstein',)
('Gold',)
('Katz',)
('Singh',)
('Brandt',)
('Kim',)


Question15:
('Comp. Sci.', Decimal('77333.3333'))
('Biology', Decimal('69000.0000'))
('Finance', Decimal('85000.0000'))
('Physics', Decimal('91000.0000'))
('History', Decimal('61000.0000'))
('Elec. Eng', Decimal('80000.0000'))


Question16:
('Comp. Sci.',)
('Biology',)
('Finance',)
('Physics',)


Question17:
('Srinivasan', 'CS-101')
('Srinivasan', 'CS-315')
('Srinivasan', 'CS-347')
('Wu', 'FIN-201')
('Mozart', 'MU-199')
('Einstein', 'PHY-101')
('El Said', 'HIS-351')
('Katz', 'CS-101')
('Katz', 'CS-319')
('Crick', 'BIO-101')
('Crick', 'BIO-301')
('Brandt', 'CS-190')
```



```
('Srinivasan', 'CS-101')
('Srinivasan', 'CS-315')
('Srinivasan', 'CS-347')
('Wu', 'FIN-201')
('Mozart', 'MU-199')
('Einstein', 'PHY-101')
('El Said', 'HIS-351')
('Katz', 'CS-101')
('Katz', 'CS-319')
('Crick', 'BIO-101')
('Crick', 'BIO-301')
('Brandt', 'CS-190')
('Brandt', 'CS-190')
('Brandt', 'CS-319')
('Kim', 'EE-181')


Question18:
('Srinivasan', 'CS-101')
('Srinivasan', 'CS-315')
('Srinivasan', 'CS-347')
('Smith', None)
('Tom', None)
('Wu', 'FIN-201')
('Mozart', 'MU-199')
('Einstein', 'PHY-101')
('El Said', 'HIS-351')
('Gold', None)
('Katz', 'CS-101')
('Katz', 'CS-319')
('Califieri', None)
('Singh', None)
('Crick', 'BIO-101')
('Crick', 'BIO-301')
('Brandt', 'CS-190')
('Brandt', 'CS-190')
('Brandt', 'CS-319')
('Kim', 'EE-181')
```

EXPERIMENT 11

1. Create a view of instructors without their salary called faculty
2. Create a view of department salary totals
3. Create a role of student
4. Give select privileges on the view faculty to the role student.
5. Create a new user and assign her the role of student.
6. Revoke privileges of the new user
7. Remove the role of student.
8. Give select privileges on the view faculty to the new user.
9. Create table teaches2 with same columns as teaches but with additional constraint that that semester is one of fall, winter, spring or summer.
10. Create index ID column of teaches. Compare the difference in time to obtain query results with or without index.
11. Drop the index to free up the space.

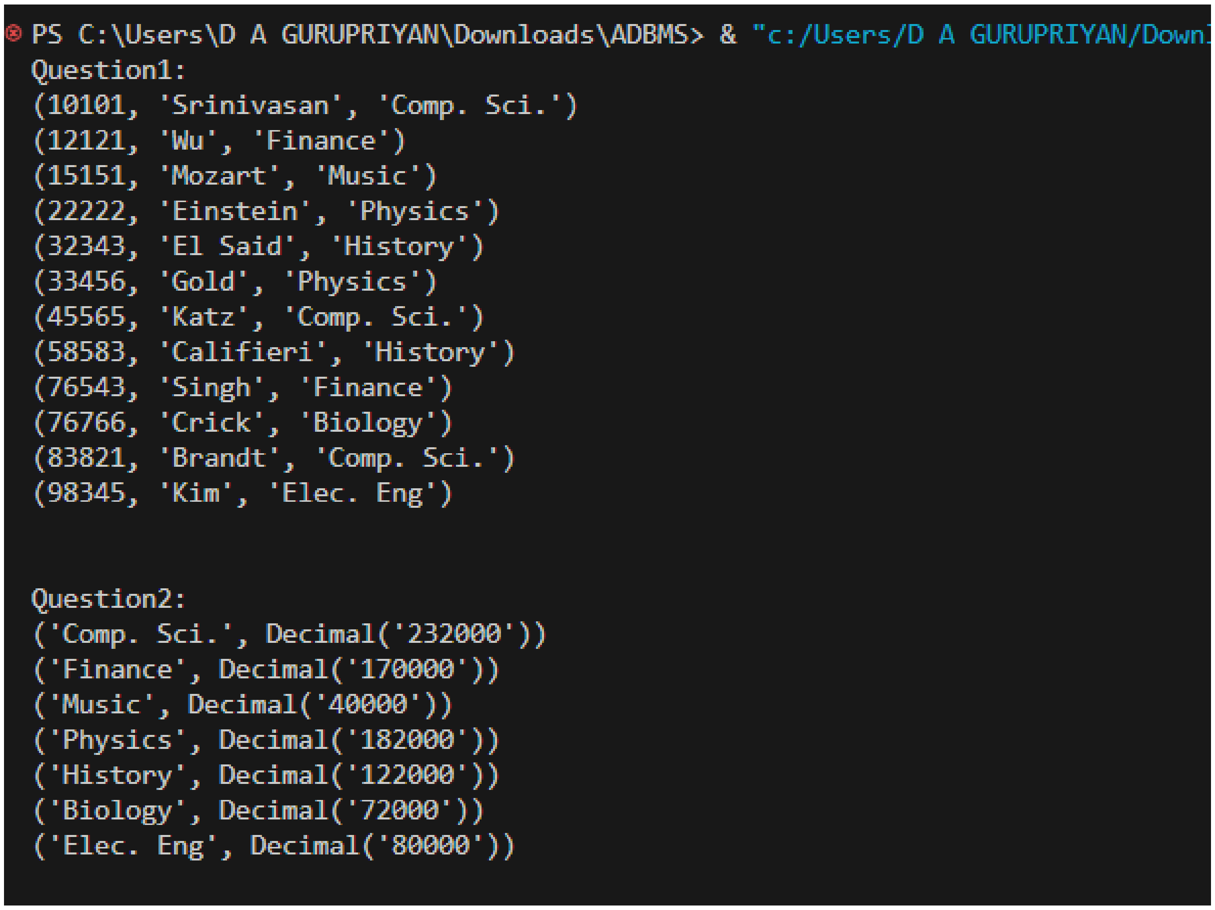
```
import mysql.connector


conn = mysql.connector.connect(
  host='localhost',
  user='root',
  password='root123',
  database='exp6'
)


cursor = conn.cursor()


# Create a view of instructors without their salary called faculty
instructors_view_without_salary = """
```

```
CREATE VIEW faculty AS

SELECT ID, name, dept_name

FROM instructor

"""


cursor.execute(instructors_view_without_salary)


display_instructor_view = """

SELECT *

FROM faculty

"""


cursor.execute(display_instructor_view)


results = cursor.fetchall()


print("Question1:")

for row in results:

    print(row)

print("\n")


#  Create a view of department salary totals

department_salary_view = """

CREATE VIEW department_salary_totals AS SELECT dept_name, SUM(salary) AS total_salary FROM
instructor GROUP BY dept_name

"""


cursor.execute(department_salary_view)
```

```
display_department_view="""
SELECT * FROM department_salary_totals;
"""

cursor.execute(display_department_view)

results = cursor.fetchall()

print("Question2:")
for row in results:
   print(row)
print("\n")

#  Create a role of student
role= """
CREATE ROLE 'student';
"""

cursor.execute(role)

# Give select privileges on the view faculty to the role student.
grant_select = """
GRANT SELECT ON faculty TO student;
"""
cursor.execute(grant_select)

#  Create a new user and assign her the role of student.
new_role = """
CREATE USER guru@localhost IDENTIFIED BY '1234'
```

```
"""

cursor.execute(new_role)

grant_user = """
GRANT student TO guru@localhost
"""

cursor.execute(grant_user)

#  Revoke privileges of the new user
revoke_user = """
REVOKE student FROM guru@localhost
"""

cursor.execute(revoke_user)

#  Remove the role of student.
remove_role = """
DROP ROLE student
"""

cursor.execute(remove_role)

# Give select privileges on the view faculty to the new user
select_user = """
GRANT SELECT ON faculty TO guru@localhost
"""
```

```
cursor.execute(select_user)


#  Create table teaches2 with same columns as teaches but with additional constraint that that semester
is one of fall, winter, spring or summer.

new_table= """

CREATE TABLE teaches2 (

  ID INT NOT NULL,

  course_id VARCHAR(255) NOT NULL,

  sec_id INT NOT NULL,

  semester VARCHAR(255) NOT NULL CHECK (semester IN ('Fall', 'Winter', 'Spring', 'Summer')),

  year INT NOT NULL,

  FOREIGN KEY (ID) REFERENCES instructor(ID)

)

"""


cursor.execute(new_table)


#  Create index ID column of teaches. Compare the difference in time to obtain query results with or
without index.

create_index = """

CREATE INDEX idx_ID ON teaches (ID)

"""


cursor.execute(create_index)


#  Drop the index to free up the space.

drop_index = """

DROP INDEX idx_ID ON teaches

"""

cursor.execute(drop_index)
```



```
PS C:\Users\D A GURUPRIYAN\Downloads\ADBMS> & "c:/Users/D A GURUPRIYAN/Downl
Question1:
(10101, 'Srinivasan', 'Comp. Sci.')
(12121, 'Wu', 'Finance')
(15151, 'Mozart', 'Music')
(22222, 'Einstein', 'Physics')
(32343, 'El Said', 'History')
(33456, 'Gold', 'Physics')
(45565, 'Katz', 'Comp. Sci.')
(58583, 'Califieri', 'History')
(76543, 'Singh', 'Finance')
(76766, 'Crick', 'Biology')
(83821, 'Brandt', 'Comp. Sci.')
(98345, 'Kim', 'Elec. Eng')


Question2:
('Comp. Sci.', Decimal('232000'))
('Finance', Decimal('170000'))
('Music', Decimal('40000'))
('Physics', Decimal('182000'))
('History', Decimal('122000'))
('Biology', Decimal('72000'))
('Elec. Eng', Decimal('80000'))
```

EXPERIMENT 12

```
SQL*Plus: Release 21.0.0.0.0 - Production on Wed May 15 10:51:44 2024

Version 21.3.0.0.0


Copyright (c) 1982, 2021, Oracle.  All rights reserved.


Enter user-name: system

Enter password:

Last Successful login time: Wed May 15 2024 10:29:18 +05:30


Connected to:

Oracle Database 21c Express Edition Release 21.0.0.0.0 - Production

Version 21.3.0.0.0


SQL> create type addr_ty as object

  2  (street varchar2(60),

  3  city varchar2(30),

  4  state char(2),

  5  zip varchar(9));

  6  /


Type created.


SQL> CREATE TYPE person_ty AS OBJECT

  2    (name   varchar2(25),

  3    address  addr_ty);

  4  /
```

```
Type created.

SQL> CREATE TYPE emp_ty AS OBJECT
  2    (empt_id       varchar2(9),
  3    person  person_ty);
  4  /

Type created.

SQL> CREATE TABLE EMP_OO
  2    (full_emp emp_ty);

Table created.

SQL> insert into emp_oo values
  2  (emp_ty('100',
  3  person_ty('Ram',
  4  addr_ty('1000 TU',
  5  'Patiala', 'PB', '147001'))));

1 row created.

SQL> insert into emp_oo values
  2    (emp_ty('101',
  3    person_ty('Sham',
  4    addr_ty('1001 TU',
  5  'Patiala', 'PB', '147001'))));
```

```
1 row created.


SQL> select * from emp_oo;


FULL_EMP(EMPT_ID, PERSON(NAME, ADDRESS(STREET, CITY, STATE, ZIP)))
--------------------------------------------------------------------------------
EMP_TY('100', PERSON_TY('Ram', ADDR_TY('1000 TU', 'Patiala', 'PB', '147001')))
EMP_TY('101', PERSON_TY('Sham', ADDR_TY('1001 TU', 'Patiala', 'PB', '147001')))


SQL> desc emp_oo;
 Name                                      Null?    Type
 ----------------------------------------- -------- ----------------------------
 FULL_EMP                                           EMP_TY


SQL> select e.full_emp.empt_id ID,
  2  e.full_emp.person.name NAME,
  3  e.full_emp.person.address.city CITY
  4  from emp_oo e;


ID         NAME                      CITY
---------- ------------------------- ------------------------------
100        Ram                       Patiala
101        Sham                      Patiala


SQL> Update emp_oo e set
  2     e.full_emp.person.name='Raj'
  3     where
  4     e.full_emp.empt_id='100';
```

```
1 row updated.

SQL> select e.full_emp.empt_id ID,
  2      e.full_emp.person.name NAME,
  3      e.full_emp.person.address.city CITY
  4      from emp_oo e;

ID       NAME                   CITY
--------- ------------------------ -----------------------------
100      Raj                    Patiala
101      Sham                   Patiala

SQL> create or replace type newemp_ty as object (firstname varchar2(25),
  2  lastname varchar2(25), birthdate date,
  3  member function AGE(birthdate in DATE) return NUMBER)
  4  /

Type created.

SQL> create or replace type body newemp_ty as
  2    member function AGE(BirthDate in DATE) return NUMBER is
  3    begin
  4           RETURN ROUND(SysDate - birthdate);
  5    end;
  6  end;
  7  /

Type body created.
```

```
SQL> create table new_emp_oo
  2  (employee newemp_ty);

Table created.

SQL> insert into new_emp_oo values
  2  (newemp_ty('Ram', 'Lal', '12-dec-1976'));

1 row created.

SQL> select e.employee.firstname, e.employee.age(e.employee.birthdate) from
  2  new_emp_oo e;

EMPLOYEE.FIRSTNAME        E.EMPLOYEE.AGE(E.EMPLOYEE.BIRTHDATE)
------------------------- -----------------------------------
Ram                                  17321

SQL> create table new_emp1 of emp_ty;

Table created.

SQL> create type emp_ty1 as object
  2  (empt_id varchar2(9),
  3  person person_ty);
  4  /

Type created.

SQL> create table emp_oo1(full_emp emp_ty1);
```

```
Table created.

SQL> insert into emp_oo1 values
  2      (emp_ty1('101',
  3      person_ty('Sham',
  4      addr_ty('1001 TU',
  5    'Patiala', 'PB', '147001'))));

1 row created.

SQL> insert into new_emp1 values ('100', person_ty('raj', addr_ty('1000 TU', 'Pta', 'Pb', '147001')));


1 row created.

SQL> select * from new_emp1;

EMPT_ID
---------
PERSON(NAME, ADDRESS(STREET, CITY, STATE, ZIP))
--------------------------------------------------------------------------------
100
PERSON_TY('raj', ADDR_TY('1000 TU', 'Pta', 'Pb', '147001'))


SQL> select ref(p) from new_emp1 p;

REF(P)
```

```
--------------------------------------------------------------------------------

000028020962310E79DAD541678083F34D04C7597F4FAF0E96224F4E05993B631113268ED20041B
9

810000



SQL> create type new_dept_oo as object
  2  (depno number(3), dname varchar(20));
  3  /

Type created.

SQL> CREATE TABLE dept_table OF new_dept_oo;

Table created.

SQL> insert into dept_table values(10, 'comp');

1 row created.

SQL> insert into dept_table values(20, 'chem');

1 row created.

SQL> insert into dept_table values(10, 'math');

1 row created.

SQL> select ref(p) from dept_table p;
```

```
REF(P)
--------------------------------------------------------------------------------
0000280209E0B2B6CBC62A4509A73B0168855948CE0BD10BC5001F4AD79B080B129E78F1DF0041
B9
990000

00002802091BDD768FBC6E4197B0D94EE374114CD80BD10BC5001F4AD79B080B129E78F1DF0041
B9
990001

0000280209F5B9EBEAEDA94A45A9BF32CFD67DAE7D0BD10BC5001F4AD79B080B129E78F1DF004
1B9
990002



SQL> create table emp_test_fk(
  2  empno number(3),
  3  name varchar(10),
  4  dept ref new_dept_oo);

Table created.

SQL> desc emp_test_fk
 Name                                      Null?    Type
 ----------------------------------------- -------- ----------------------------
 EMPNO                                              NUMBER(3)
 NAME                                               VARCHAR2(10)
 DEPT                                               REF OF NEW_DEPT_OO
```

```
SQL> set desc depth 2

SQL> desc emp_test_fk

 Name                                      Null?    Type

 ----------------------------------------- -------- ----------------------------

 EMPNO                                              NUMBER(3)

 NAME                                               VARCHAR2(10)

 DEPT                                               REF OF NEW_DEPT_OO

   DEPNO                                            NUMBER(3)

   DNAME                                            VARCHAR2(20)


SQL> insert into emp_test_fk

  2  select 100, 'raj', ref(p) from dept_table p where depno = 10;


2 rows created.


SQL> insert into emp_test_fk

  2  select 101, 'shyam', ref(p) from dept_table p where depno = 20;


1 row created.


SQL> select * from emp_test_fk;


     EMPNO NAME

---------- ----------

DEPT

--------------------------------------------------------------------------------

       100 raj

0000220208E0B2B6CBC62A4509A73B0168855948CE0BD10BC5001F4AD79B080B129E78F1DF
```

```
     100 raj
0000220208F5B9EBEAEDA94A45A9BF32CFD67DAE7D0BD10BC5001F4AD79B080B129E78F1DF

     101 shyam
00002202081BDD768FBC6E4197B0D94EE374114CD80BD10BC5001F4AD79B080B129E78F1DF


SQL> select empno, name, deref(e.dept) from emp_test_fk e;

   EMPNO NAME
---------- ----------
DEREF(E.DEPT)(DEPNO, DNAME)
--------------------------------------------------------------------------------
     100 raj
NEW_DEPT_OO(10, 'comp')

     100 raj
NEW_DEPT_OO(10, 'math')

     101 shyam
NEW_DEPT_OO(20, 'chem')


SQL> select empno, name, deref(e.dept), deref(e.dept).depno depno,
  2  deref(e.dept).dname dname from emp_test_fk e;

   EMPNO NAME
---------- ----------
DEREF(E.DEPT)(DEPNO, DNAME)
```

```
--------------------------------------------------------------------------------

    DEPNO DNAME

---------- --------------------

      100 raj

NEW_DEPT_OO(10, 'comp')

       10 comp


      100 raj

NEW_DEPT_OO(10, 'math')

       10 math


    EMPNO NAME

---------- ----------

DEREF(E.DEPT)(DEPNO, DNAME)

--------------------------------------------------------------------------------

    DEPNO DNAME

---------- --------------------



      101 shyam

NEW_DEPT_OO(20, 'chem')

       20 chem




SQL> create table emp_table_fk

  2  (employee emp_ty,

  3  dept ref new_dept_oo);


Table created.
```

```
SQL> set describe depth 1

SQL> desc emp_table_fk

 Name                          Null?    Type

 ------------------------------------- -------- ---------------------------

 EMPLOYEE                                        EMP_TY

 DEPT                                        REF OF NEW_DEPT_OO


SQL> set describe depth 2

SQL> desc emp_table_fk

 Name                          Null?    Type

 ------------------------------------- -------- ---------------------------

 EMPLOYEE                                        EMP_TY

   EMPT_ID                                     VARCHAR2(9)

   PERSON                                      PERSON_TY

 DEPT                                        REF OF NEW_DEPT_OO

   DEPNO                                       NUMBER(3)

   DNAME                                       VARCHAR2(20)


SQL> set describe depth 3

SQL> desc emp_table_fk

 Name                          Null?    Type

 ------------------------------------- -------- ---------------------------

 EMPLOYEE                                        EMP_TY

   EMPT_ID                                     VARCHAR2(9)

   PERSON                                      PERSON_TY

     NAME                                      VARCHAR2(25)

     ADDRESS                                     ADDR_TY

 DEPT                                        REF OF NEW_DEPT_OO

   DEPNO                                       NUMBER(3)
```

```
  DNAME                                    VARCHAR2(20)


SQL> set describe depth 4
SQL> desc emp_table_fk
 Name                                      Null?    Type
 ----------------------------------------- -------- ----------------------------
 EMPLOYEE                                           EMP_TY
   EMPT_ID                                          VARCHAR2(9)
   PERSON                                           PERSON_TY
     NAME                                           VARCHAR2(25)
     ADDRESS                                        ADDR_TY
       STREET                                       VARCHAR2(60)
       CITY                                         VARCHAR2(30)
       STATE                                        CHAR(2)
       ZIP                                          VARCHAR2(9)
 DEPT                                               REF OF NEW_DEPT_OO
   DEPNO                                            NUMBER(3)
   DNAME                                            VARCHAR2(20)


SQL> INSERT INTO emp_table_fk
  2  VALUES (
  3      emp_ty(
  4          100,
  5          person_ty('ram', addr_ty('10 tu', 'pat', 'pb', '147001'))
  6      ),
  7      (SELECT REF(P)
  8       FROM dept_table P
  9       WHERE depno = 10
 10       AND ROWNUM = 1)
 11  );


1 row created.


SQL> select * from emp_table_fk;


EMPLOYEE(EMPT_ID, PERSON(NAME, ADDRESS(STREET, CITY, STATE, ZIP)))
--------------------------------------------------------------------------------
DEPT
--------------------------------------------------------------------------------
EMP_TY('100', PERSON_TY('ram', ADDR_TY('10 tu', 'pat', 'pb', '147001')))
0000220208E0B2B6CBC62A4509A73B0168855948CE0BD10BC5001F4AD79B080B129E78F1DF




SQL> select e.employee.empt_id id, e.employee.person.name name,
  2  deref(e.dept), deref(e.dept).depno depno,
  3  deref(e.dept).dname dname from emp_table_fk e;


ID       NAME
--------- -------------------------
DEREF(E.DEPT)(DEPNO, DNAME)
--------------------------------------------------------------------------------
    DEPNO DNAME
---------- --------------------
100       ram
NEW_DEPT_OO(10, 'comp')
      10 comp    print(row)
```