# EXPERIMENT 1

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;

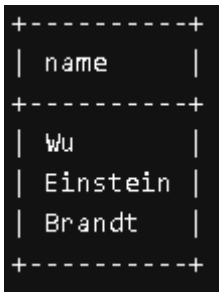
| name | course_id |
|---|---|
| Srinivasan | CS-101 |
| Srinivasan | CS-315 |
| Srinivasan | CS-347 |
| Wu | FIN-201 |
| Mozart | MU-199 |
| Einstein | PHY-101 |
| El Said | HIS-351 |
| Katz | CS-101 |
| Katz | CS-319 |
| Crick | BIO-101 |
| Crick | BIO-301 |
| Brandt | CS-190 |
| Brandt | CS-190 |
| 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 2

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 3

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 4

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 5

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 aniket@localhost IDENTIFIED BY 'aniketraj1331'; GRANT student TO aniket@localhost;

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

**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='aniket@localhost',
  user='root',
  password='aniketraj1331',
  database='adbms'
)

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),
```

```
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()
```

```
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 7

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='aniketrajlocalhost',
  user='root',
  password='aniketraj1331',
  database='adbms'
)

cursor = conn.cursor()

#  Order the tuples in the instructors relation as per
their salary. order_by_salary_query = """
SELECT * FROM
instructor ORDER BY
salary
"""
```

```
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")
```

```
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 8

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='aniket@localhost',
  user='root',
  password='aniketraj1331',
   database='adbms'
)

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:")
```

```
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 aniket@localhost IDENTIFIED
BY 'aniketraj1331' """

cursor.execute(new_role)

grant_user = """
GRANT student TO
aniket@localhost """
```

```
cursor.execute(grant_user)
```

---

```
# Revoke privileges of the new user
revoke_user = """
REVOKE student FROM
aniket@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
aniket@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)
```

```
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 9

```
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)
--------------------------------------------------------------------------------
000028020962310E79DAD541678083F34D04C7597F4FAF0E96224F4E05993B63111
3268ED200
41B9
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)
--------------------------------------------------------------------------------
0000280209E0B2B6CBC62A4509A73B0168855948CE0BD10BC5001F4AD79B080B12
9E78F1DF0
041B9
990000

00002802091BDD768FBC6E4197B0D94EE374114CD80BD10BC5001F4AD79B080B1
29E78F1DF0
041B9
990001

0000280209F5B9EBEAEDA94A45A9BF32CFD67DAE7D0BD10BC5001F4AD79B080B
129E78F1DF
0041B9
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
0000220208E0B2B6CBC62A4509A73B0168855948CE0BD10BC5001F4AD79B080B12
9E78F1DF

    100 raj
0000220208F5B9EBEAEDA94A45A9BF32CFD67DAE7D0BD10BC5001F4AD79B080B
129E78F1DF

    101 shyam
00002202081BDD768FBC6E4197B0D94EE374114CD80BD10BC5001F4AD79B080B1
29E78F1DF


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')))
0000220208E0B2B6CBC62A4509A73B0168855948CE0BD10BC5001F4AD79B080B1
29E78F1DF


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