```sql
-- Department Table
CREATE TABLE Department (
    dept_id INT PRIMARY KEY,
    dept_name VARCHAR(50) NOT NULL,
    dept_start_date DATE
);

-- Student Table
CREATE TABLE Student (
    stu_id INT PRIMARY KEY,
    stu_name VARCHAR(50) NOT NULL,
    stu_age INT CHECK(stu_age > 0),
    dept_id INT,
    FOREIGN KEY (dept_id) REFERENCES Department(dept_id)
);

-- Staff Table
CREATE TABLE Staff (
    staff_id INT PRIMARY KEY,
    staff_name VARCHAR(50) NOT NULL,
    start_date DATE,
    retired_date DATE,
    dept_id INT,
    FOREIGN KEY (dept_id) REFERENCES Department(dept_id)
);

-- Course Table
CREATE TABLE Course (
    course_id INT PRIMARY KEY,
    course_name VARCHAR(50) NOT NULL,
    credits INT CHECK(credits > 0),
    dept_id INT,
    FOREIGN KEY (dept_id) REFERENCES Department(dept_id)
);

-- StudentCourse Table (Many-to-Many: Students <-> Courses)
CREATE TABLE StudentCourse (
    stu_id INT,
    course_id INT,
    PRIMARY KEY (stu_id, course_id),
    FOREIGN KEY (stu_id) REFERENCES Student(stu_id),
    FOREIGN KEY (course_id) REFERENCES Course(course_id)
);

-- StaffCourse Table (Many-to-Many: Staff <-> Courses)
CREATE TABLE StaffCourse (
    staff_id INT,
    course_id INT,
    PRIMARY KEY (staff_id, course_id),
    FOREIGN KEY (staff_id) REFERENCES Staff(staff_id),
    FOREIGN KEY (course_id) REFERENCES Course(course_id)
```

```sql
INSERT INTO Department (dept_id, dept_name, dept_start_date) VALUES
(1, 'IT', '2000-02-15'),
(2, 'CSE', '1990-06-04'),
(3, 'ECE', '1976-09-21'),
(4, 'EEE', '1963-12-11'),
(5, 'MECH', '1927-01-31'),
(6, 'CIVIL', '1879-04-25');

-- Student Data
INSERT INTO Student (stu_id, stu_name, stu_age, dept_id) VALUES
(10001, 'karuppa', 18, 1),
(10002, 'tamil', 20, 1),
(10003, 'mari', 19, 1),
(20001, 'adithya', 20, 2),
(20002, 'anand', 18, 2),
(20003, 'pravin', 19, 2),
(30001, 'vasanth', 18, 3),
(30002, 'mani', 20, 3),
(30003, 'guna', 18, 3),
(40001, 'vijay', 19, 4),
(40002, 'viswa', 18, 4),
(40003, 'ganesh', 19, 4),
(50001, 'muthu', 18, 5),
(50002, 'vignesh', 20, 5),
(50003, 'siva', 18, 5),
(60001, 'santhosh', 19, 6),
(60002, 'thiru', 18, 6),
(60003, 'ragul', 18, 6);

-- Staff Data
INSERT INTO Staff (staff_id, staff_name, start_date, retired_date, dept_id) VALUES
(1001, 'Sundar', '2012-06-15', NULL, 1),
(1002, 'Vasu', '2013-08-21', NULL, 2),
(1003, 'Durga', '2014-01-10', '2024-03-31', 3),
(1004, 'Selvan', '2015-05-19', NULL, 4),
(1005, 'Kabilan', '2016-09-01', NULL, 5),
(1006, 'Lakshmi', '2017-02-16', '2023-11-30', 6),
(1007, 'Velan', '2018-12-05', NULL, 1),
(1008, 'Kanda', '2019-07-20', NULL, 2),
(1009, 'Arun', '2020-04-01', NULL, 3),
(1010, 'Kumar', '2021-10-15', NULL, 4),
(1011, 'Rohit', '2022-06-30', NULL, 5),
(1012, 'Meena', '2023-03-15', NULL, 6),
(1013, 'Prakash', '2023-07-21', '2025-02-28', 1),
(1014, 'Divya', '2024-01-12', NULL, 2),
(1015, 'Sanjay', '2024-04-18', NULL, 3),
(1016, 'moni', '2015-02-15', NULL, 4),
(1017, 'saran', '2011-05-09', NULL, 5);
```

```sql
-- Course Data
INSERT INTO Course (course_id, course_name, credits, dept_id) VALUES
(101, 'linear algebra', 4, 1),
(102, 'discrete', 4, 1),
(103, 'digital logic', 3, 2),
(104, 'statistics', 4, 2),
(105, 'ECA', 3, 3),
(106, 'circuit analysis', 2, 3),
(107, 'C++', 3, 4),
(108, 'AIML', 4, 4),
(109, 'Eng Mechanics', 3, 5),
(110, 'metal theory', 2, 5),
(111, 'fluid mechanics', 3, 6);
```

```
--inner join

--query 1
select d.dept_id,d.dept_name,count(s.*) count from Department d
join Student s
on d.dept_id=s.dept_id
group by d.dept_id;;


 dept_id | dept_name | count
---------+-----------+-------
       4 | EEE       |     3
       6 | CIVIL     |     3
       2 | CSE       |     3
       3 | ECE       |     3
       5 | MECH      |     3
       1 | IT        |     3

--query 2
select d.dept_id,d.dept_name ,count(s.*) from Department d
join staff s
on d.dept_id=s.dept_id
group by d.dept_id;

 dept_id | dept_name | count
---------+-----------+-------
       4 | EEE       |     3
       6 | CIVIL     |     2
       2 | CSE       |     3
       3 | ECE       |     3
       5 | MECH      |     3
       1 | IT        |     3
```

```
--left join
select d.dept_id,d.dept_name,s.staff_name from department as d
left join staff s
on d.dept_id=s.dept_id;

 dept_id | dept_name | staff_name
---------+-----------+------------
       1 | IT        | Sundar
       2 | CSE       | Vasu
       3 | ECE       | Durga
       4 | EEE       | Selvan
       5 | MECH      | Kabilan
       6 | CIVIL     | Lakshmi
       1 | IT        | Velan
       2 | CSE       | Kanda
       3 | ECE       | Arun
       4 | EEE       | Kumar
       5 | MECH      | Rohit
       6 | CIVIL     | Meena
       1 | IT        | Prakash
       2 | CSE       | Divya
       3 | ECE       | Sanjay
       4 | EEE       | moni
       5 | MECH      | saran
       8 | MINING    |
       7 | PPT       |
(19 rows)
```

```
-right join
elect d.dept_id,d.dept_name,s.staff_name from department as d
ight join staff s
n d.dept_id=s.dept_id;

dept_id | dept_name | staff_name | retired_date
--------+-----------+------------+--------------
      1 | IT        | Sundar     |
      2 | CSE       | Vasu       |
      3 | ECE       | Durga      | 2024-03-31
      4 | EEE       | Selvan     |
      5 | MECH      | Kabilan    |
      6 | CIVIL     | Lakshmi    | 2023-11-30
      1 | IT        | Velan      |
      2 | CSE       | Kanda      |
      3 | ECE       | Arun       |
      4 | EEE       | Kumar      |
      5 | MECH      | Rohit      |
      6 | CIVIL     | Meena      |
      1 | IT        | Prakash    | 2025-02-28
      2 | CSE       | Divya      |
      3 | ECE       | Sanjay     |
      4 | EEE       | moni       |
      5 | MECH      | saran      |
        |           | kalai      |
        |           | mani       |
```

```
--full join
select d.dept_id,d.dept_name,s.staff_name from department as d
full join staff s
on d.dept_id=s.dept_id;
```

dept_id	dept_name	staff_name
1	IT	Sundar
2	CSE	Vasu
3	ECE	Durga
4	EEE	Selvan
5	MECH	Kabilan
6	CIVIL	Lakshmi
1	IT	Velan
2	CSE	Kanda
3	ECE	Arun
4	EEE	Kumar
5	MECH	Rohit
6	CIVIL	Meena
1	IT	Prakash
2	CSE	Divya
3	ECE	Sanjay
4	EEE	moni
5	MECH	saran
		kalai
		mani
8	MINING	
7	PPT	

```
-cross join
elect d.dept_id,d.dept_name,s.course_name from department as d
ross join course s;
```

dept_id	dept_name	course_name
1	IT	linear algebra
1	IT	discrete
1	IT	digital logic
1	IT	statistics
1	IT	ECA
1	IT	circuit analysis
1	IT	C++
1	IT	AIML
1	IT	Eng Mechanics
1	IT	metal theory
1	IT	fluid mechanics
2	CSE	linear algebra
2	CSE	discrete
2	CSE	digital logic
2	CSE	statistics
2	CSE	ECA
2	CSE	circuit analysis
2	CSE	C++
2	CSE	AIML
2	CSE	Eng Mechanics
2	CSE	metal theory
2	CSE	fluid mechanics
3	ECE	linear algebra
3	ECE	discrete
3	ECE	digital logic
3	ECE	statistics
3	ECE	ECA
3	ECE	circuit analysis
3	ECE	C++
3	ECE	AIML
3	ECE	Eng Mechanics
3	ECE	metal theory
3	ECE	fluid mechanics
4	EEE	linear algebra
4	EEE	discrete
4	EEE	digital logic
4	EEE	statistics
4	EEE	ECA
4	EEE	circuit analysis
4	EEE	C++
4	EEE	AIML
4	EEE	Eng Mechanics
4	EEE	metal theory

```
--natural join

select d.dept_id,d.dept_name,s.course_name from department as d
natural join course s;

 dept_id | dept_name |   course_name
---------+-----------+-----------------
       1 | IT        | linear algebra
       1 | IT        | discrete
       2 | CSE       | digital logic
       2 | CSE       | statistics
       3 | ECE       | ECA
       3 | ECE       | circuit analysis
       4 | EEE       | C++
       4 | EEE       | AIML
       5 | MECH      | Eng Mechanics
       5 | MECH      | metal theory
       6 | CIVIL     | fluid mechanics

CREATE TABLE hod (
    hod_id INT PRIMARY KEY,
    hod_name VARCHAR(50),
    dept_id INT,
    start_date DATE,
    FOREIGN KEY (dept_id) REFERENCES department(dept_id)
);

-- Insert values
INSERT INTO hod (hod_id, hod_name, dept_id, start_date) VALUES
(1001, 'Sundar', 1, '2012-06-15'),
(1002, 'Vasu',   2, '2013-08-21'),
(1003, 'Durga',  3, '2014-01-10'),
(1016, 'moni',   4, '2015-02-15'),
(1017, 'saran',  5, '2011-05-09'),
(1006, 'Lakshmi',6, '2017-02-16');
```

```
-- self join
select distinct s1.dept_id,s1.staff_id,s1.staff_name,s1.retired_date from staff s1
join staff s2
on s1.staff_id=s2.hod_id;
```

dept_id	staff_id	staff_name	retired_date
2	1002	Vasu	
5	1017	saran	
3	1003	Durga	2024-03-31
1	1001	Sundar	
6	1006	Lakshmi	2023-11-30
4	1016	moni	

```sql
--marks table
CREATE TABLE marks (
    roll_no INT PRIMARY KEY,
    s1 INT,
    s2 INT,
    s3 INT,
    s4 INT,
    s5 INT,
    tot_marks INT,
    avg_marks DECIMAL(5,2)
);

--values
INSERT INTO marks (roll_no, s1, s2, s3, s4, s5, tot_marks, avg_marks) VALUES
(10001, 85, 78, 90, 88, 76, 417, 83.00),
(10002, 80, 70, 75, 68, 72, 365, 73.00),
(10003, 90, 88, 84, 79, 85, 426, 85.00),

(20001, 77, 82, 86, 80, 78, 403, 80.00),
(20002, 88, 91, 87, 85, 83, 434, 86.00),
(20003, 69, 73, 70, 75, 72, 359, 71.00),

(30001, 92, 89, 90, 93, 91, 455, 91.00),
(30002, 65, 70, 68, 72, 74, 349, 69.00),
(30003, 78, 82, 85, 80, 79, 404, 80.00),

(40001, 86, 84, 88, 82, 80, 420, 84.00),
(40002, 90, 89, 87, 91, 88, 445, 89.00),
(40003, 75, 78, 80, 74, 76, 383, 76.00),

(50001, 85, 87, 89, 83, 88, 432, 86.00),
(50002, 92, 94, 91, 93, 95, 465, 93.00),
(50003, 70, 72, 68, 74, 73, 357, 71.00),

(60001, 88, 86, 90, 85, 87, 436, 87.00),
(60002, 81, 80, 79, 83, 82, 405, 81.00),
(60003, 76, 75, 78, 77, 74, 380, 76.00),

(70001, 90, 87, 76, 94, 92, 439, 87.00),
(70002, 89, 87, 67, 73, 92, 408, 81.00),
(70003, 95, 90, 75, 80, 79, 419, 83.00),

(80002, 80, 85, 88, 87, 82, 422, 84.40);
```

```
--query 1
find first mark student details

select m.roll_no,s.stu_name,m.tot_marks,m.avg_marks from student s
join marks m
on m.roll_no=s.stu_id
where m.tot_marks=(
select max(tot_marks) from marks
);

 roll_no | stu_name | tot_marks | avg_marks
---------+----------+-----------+-----------
   50002 | vignesh  |       465 |     93.00
(1 row)

--query 2
find the student detaila who avg marks are greater than avg avg marks

select s.stu_name,m.avg_marks from student s
join marks m
on s.stu_id=m.roll_no
where avg_marks>(select avg(avg_marks) from marks);

 stu_name | avg_marks
----------+-----------
 karuppa  |     83.00
 mari     |     85.00
 anand    |     86.00
 vasanth  |     91.00
 vijay    |     84.00
 viswa    |     89.00
 muthu    |     86.00
 vignesh  |     93.00
 santhosh |     87.00

--query3
find the student details who score3d more than karuppa

select s.stu_name,m.tot_marks from student as s
join marks m
on m.roll_no=s.stu_id
where m.tot_marks<(
select m1.tot_marks from student s1
join marks m1
on s1.stu_id=m1.roll_no
where stu_name='karuppa'
);

 stu_name | tot_marks
----------+-----------
 tamil    |       365
 adithya  |       403
```

```
--query 4
find the students who belong to the Muthu department

select stu_name from student
where dept_id=(
select dept_id from student
where stu_name='muthu'
);

 stu_name
----------
 muthu
 vignesh
 siva

--query 5
find student details who scored highest marks in each department

select stu_name,dept_id,m.tot_marks from student s
join marks m
on m.roll_no=s.stu_id
where m.tot_marks in(
select max(m1.tot_marks) from student s1
join marks m1
on m1.roll_no=s1.stu_id
where s1.dept_id=s.dept_id
);

 stu_name | dept_id | tot_marks
----------+---------+-----------
 mari     |       1 |       426
 anand    |       2 |       434
 vasanth  |       3 |       455
 viswa    |       4 |       445
 vignesh  |       5 |       465
 santhosh |       6 |       436
(6 rows)
```