Database
Midterm Exam

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Class
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Study Program
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Part 1 Analysis

a. Create the Entity-Relationship Diagram for the following business rule, assume relevant attributes

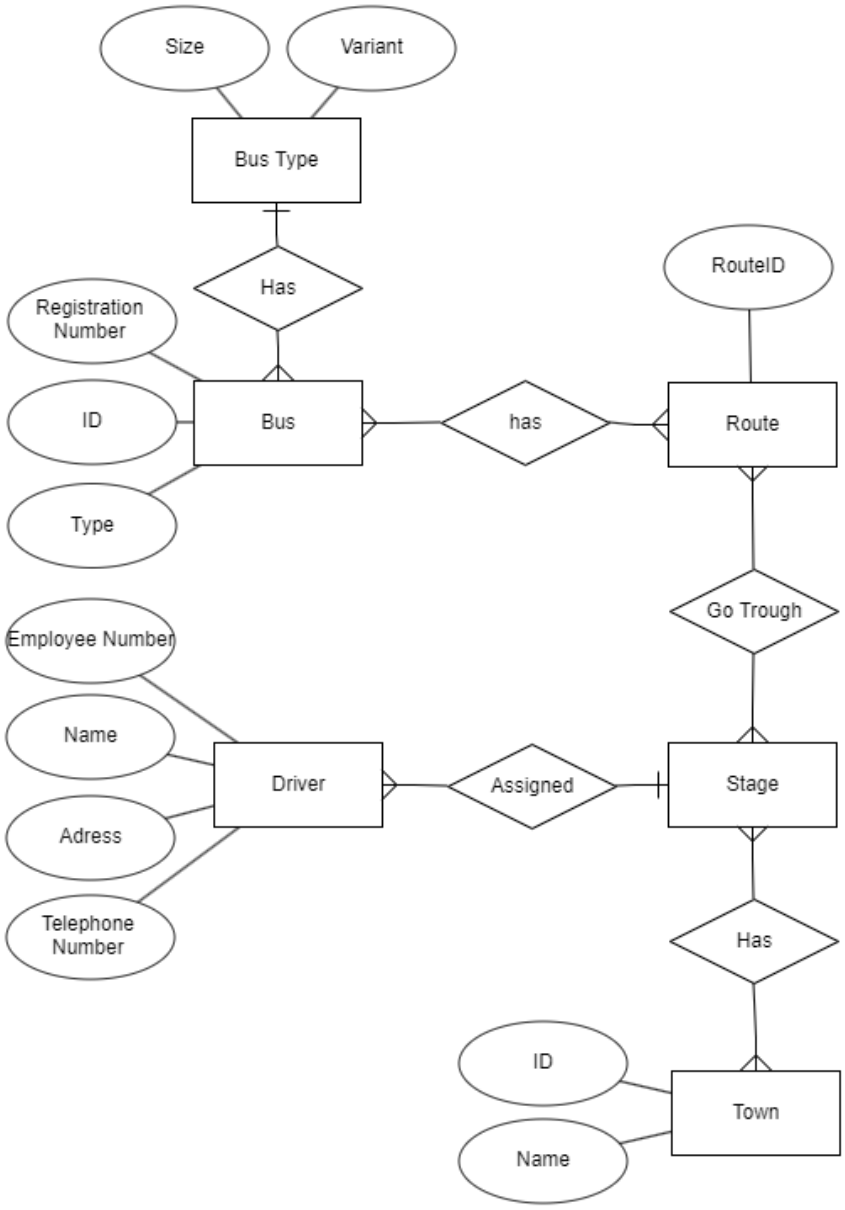


Figure 1: The Entity Relationship Diagram for the problem

b. Transform the ERD into Relationship Schema

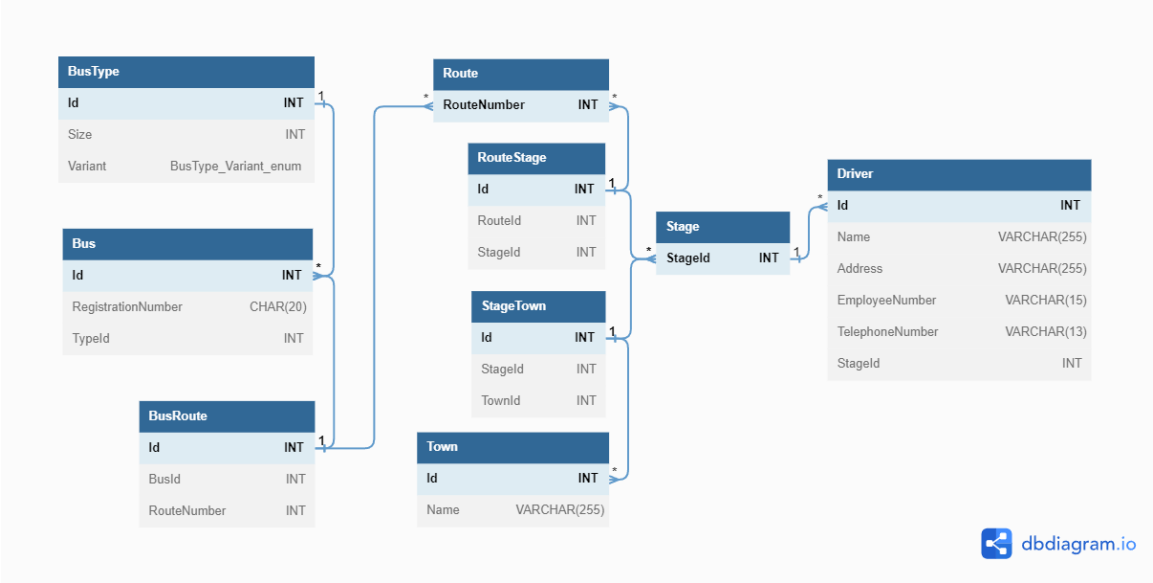


Figure 2: The relational version of the diagram

Query Steps

- Create the database

```
CREATE DATABASE bus_system;
USE bus_system;
```

- Create the tables

```
CREATE TABLE Bus
(
Id                    INT          NOT NULL PRIMARY KEY
 ↪  AUTO_INCREMENT,
RegistrationNumber    CHAR(20)     NOT NULL,
TypeId                INT          NOT NULL
);

CREATE TABLE BusType
(
Id          INT NOT NULL PRIMARY KEY AUTO_INCREMENT,
Size        INT NOT NULL,
Variant     ENUM ('single', 'double') DEFAULT "single"
);
```

```
CREATE TABLE BusRoute
(
Id             INT NOT NULL PRIMARY KEY AUTO_INCREMENT,
BusId          INT NOT NULL,
RouteNumber    INT NOT NULL
);

CREATE TABLE Route
(
RouteNumber INT NOT NULL PRIMARY KEY AUTO_INCREMENT
);

CREATE TABLE RouteStage
(
Id         INT NOT NULL PRIMARY KEY AUTO_INCREMENT,
RouteId    INT NOT NULL,
StageId    INT NOT NULL
);

CREATE TABLE Stage
(
StageId INT NOT NULL PRIMARY KEY AUTO_INCREMENT
);

CREATE TABLE StageTown
(
Id         INT NOT NULL PRIMARY KEY AUTO_INCREMENT,
StageId    INT NOT NULL,
TownId     INT NOT NULL
);

CREATE TABLE Town
(
Id     INT              NOT NULL PRIMARY KEY AUTO_INCREMENT,
Name   VARCHAR(255)     NOT NULL
);

CREATE TABLE Driver
(
Id                 INT              NOT NULL PRIMARY KEY
↪  AUTO_INCREMENT,
```

```
Name              VARCHAR(255)    NOT NULL,
Address           VARCHAR(255)    NOT NULL,
EmployeeNumber    VARCHAR(15)     NOT NULL,
TelephoneNumber   VARCHAR(13)     NOT NULL,
StageId           INT             NOT NULL
);
```

- Create relationships

```
ALTER TABLE Bus
    ADD FOREIGN KEY (Id) REFERENCES BusType (Id);
ALTER TABLE Bus
    ADD FOREIGN KEY (Id) REFERENCES BusRoute (Id);
ALTER TABLE Route
    ADD FOREIGN KEY (RouteNumber) REFERENCES BusRoute (Id);
ALTER TABLE Route
    ADD FOREIGN KEY (RouteNumber) REFERENCES RouteStage (Id);
ALTER TABLE Stage
    ADD FOREIGN KEY (StageId) REFERENCES RouteStage (Id);
ALTER TABLE Stage
    ADD FOREIGN KEY (StageId) REFERENCES StageTown (Id);
ALTER TABLE Driver
    ADD FOREIGN KEY (Id) REFERENCES Stage (StageId);
ALTER TABLE Town
    ADD FOREIGN KEY (Id) REFERENCES StageTown (Id);
```

Part 2 Application

DDL Query

```
CREATE TABLE EMPLOYEE
(
Id      INT             NOT NULL PRIMARY KEY AUTO_INCREMENT,
Fname   VARCHAR(255)    NOT NULL,
Lname   VARCHAR(255)    NOT NULL,
Ssn     CHAR(9)         NOT NULL,
BDate   DATETIME        NOT NULL,
Address VARCHAR(255)    NOT NULL,
Salary  INT             NOT NULL,
Dno     INT             NOT NULL
);
```

```sql
CREATE TABLE PROJECT
(
Id          INT             NOT NULL PRIMARY KEY AUTO_INCREMENT,
Pname       VARCHAR(255)    NOT NULL,
Plocation   VARCHAR(255)    NOT NULL,
Pnumber     INT             NOT NULL,
Dnum        INT             NOT NULL
);

CREATE TABLE DEPENDENT
(
Id              INT             NOT NULL PRIMARY KEY AUTO_INCREMENT,
Essn            CHAR(9)         NOT NULL,
Dependent_name  VARCHAR(255)    NOT NULL,
Relationship    ENUM ('Daughter', 'Spouse', 'Son')
);

CREATE TABLE DEPARTMENT
(
Id              INT             NOT NULL PRIMARY KEY AUTO_INCREMENT,
Dname           VARCHAR(255)    NOT NULL,
Dnumber         INT             NOT NULL,
Mgr_ssn         CHAR(9)         NOT NULL,
Mgr_start_date  DATETIME        NOT NULL
);
```

Query Result

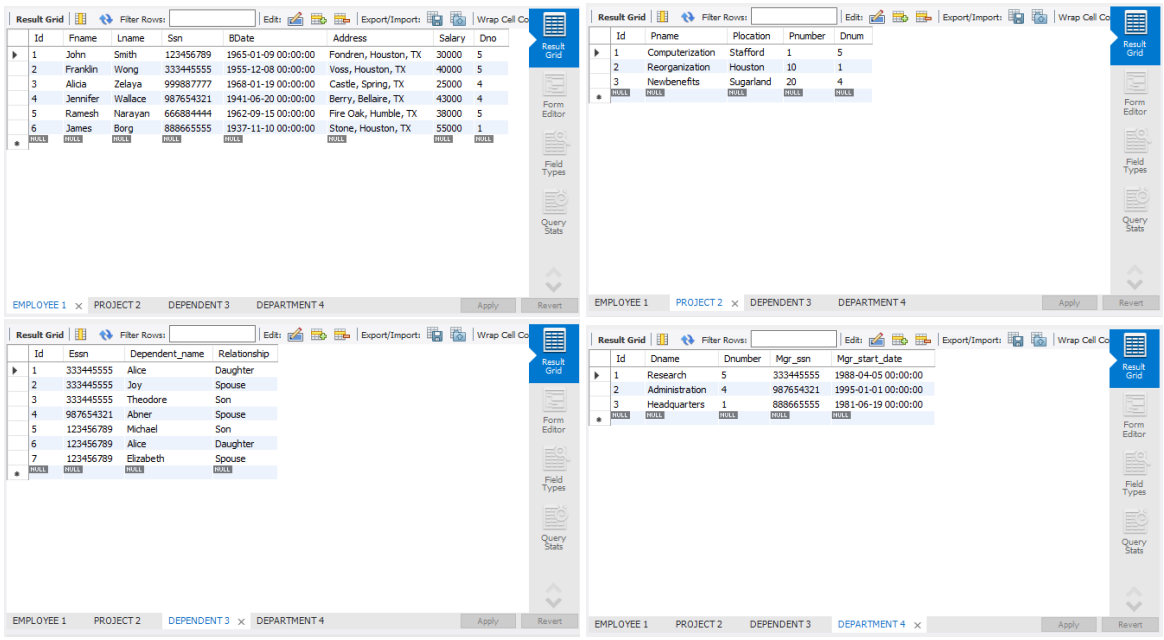
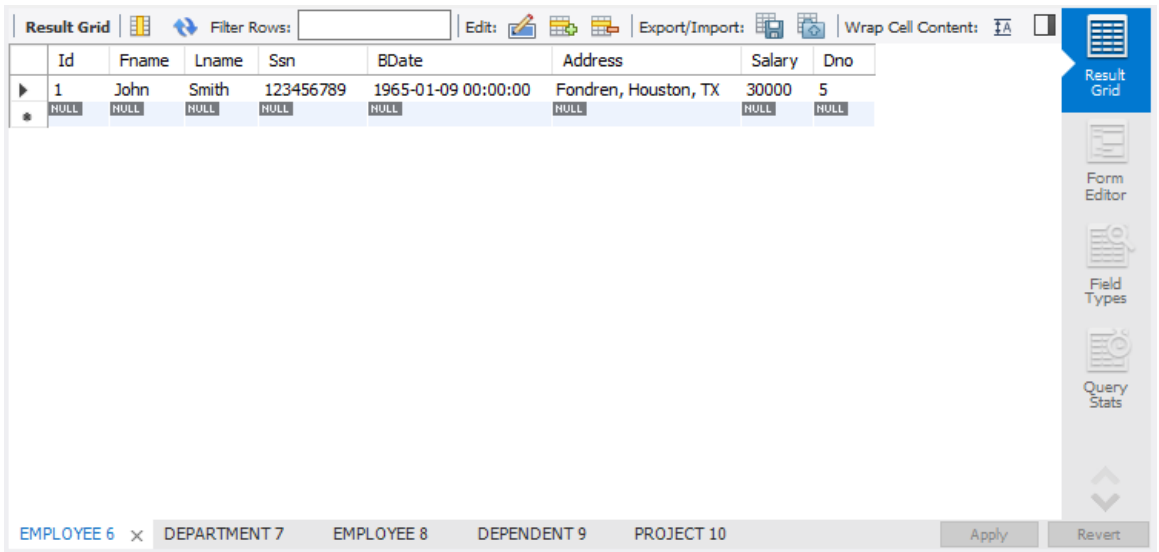


Figure 3: The result of the DDL queries above

A. Create the SQL command to satisfy the followig queries. Write at the space provided.

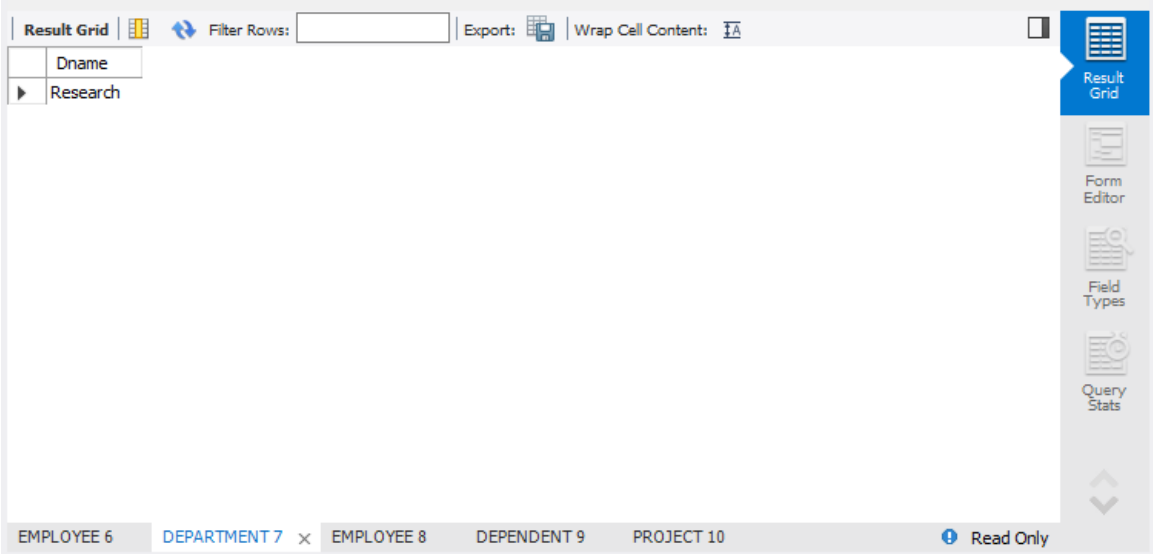
1. Find all information about John Smith

```
SELECT * FROM EMPLOYEE WHERE Fname='John' AND Lname='Smith';
```



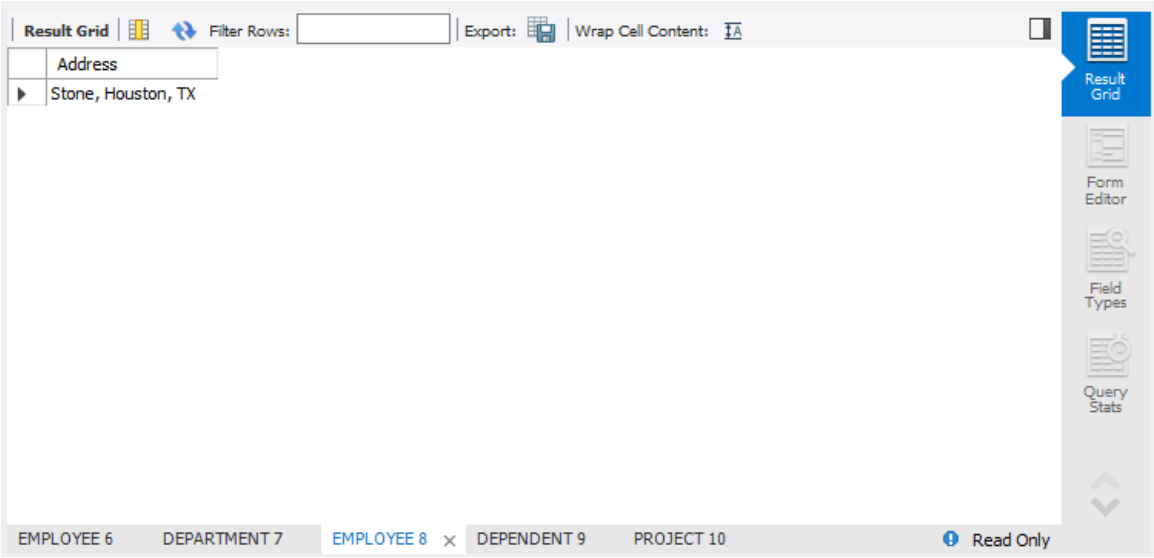
2. What department started on 5 April, 1998?

```
SELECT Dname FROM DEPARTMENT WHERE
↪  Mgr_start_date='1988-04-05';
```



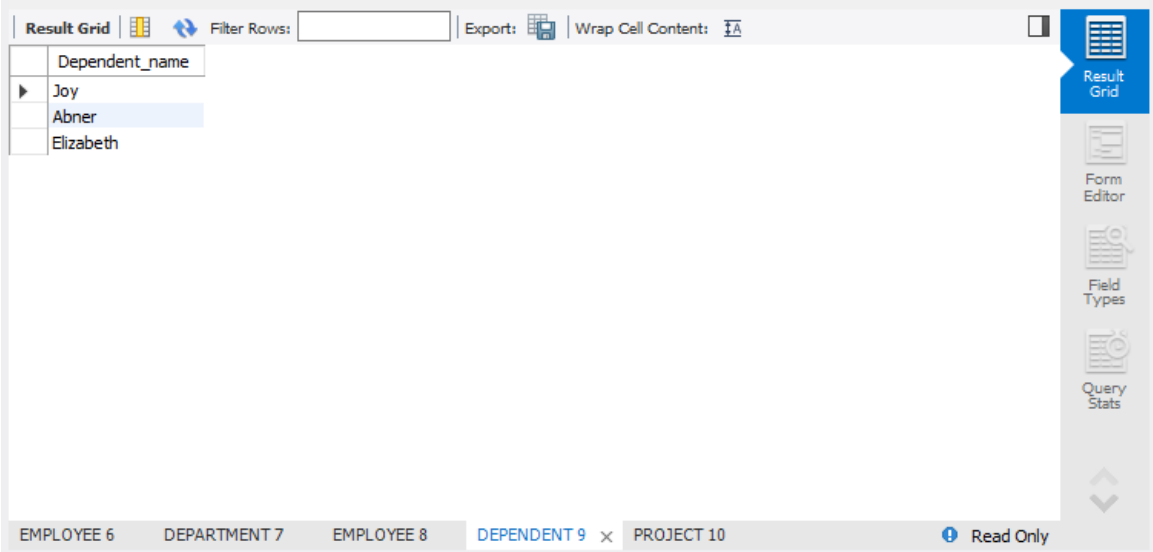
3. Where does James Borg lives?

```
SELECT Address FROM EMPLOYEE WHERE Fname='James' AND
↪  Lname='Borg';
```



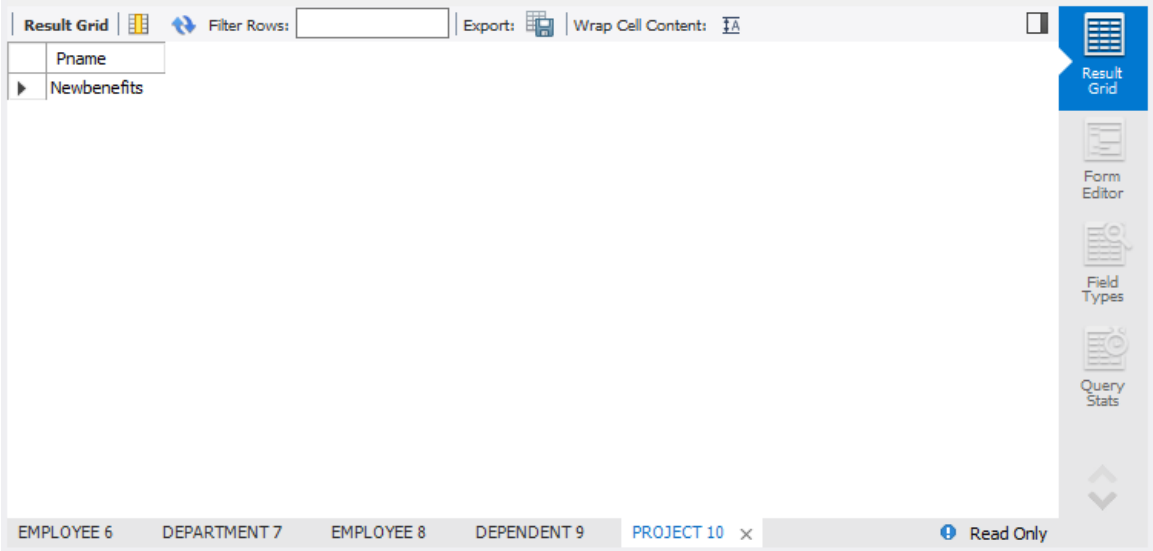
4. Who are the spouses of the employees?

```
SELECT Dependent_name FROM DEPENDENT WHERE
↪  Relationship='Spouse';
```



5. What is the project located at Sugarland?

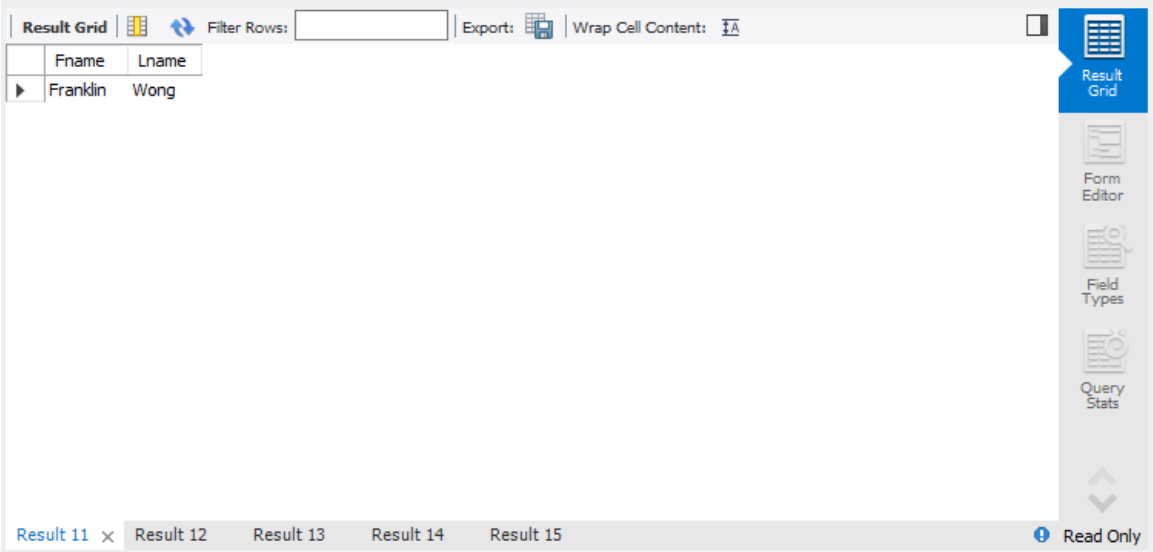
```
SELECT Pname FROM PROJECT WHERE Plocation='Sugarland';
```



B. Create the SQL command to satisfy the followig queries connecting different tables.

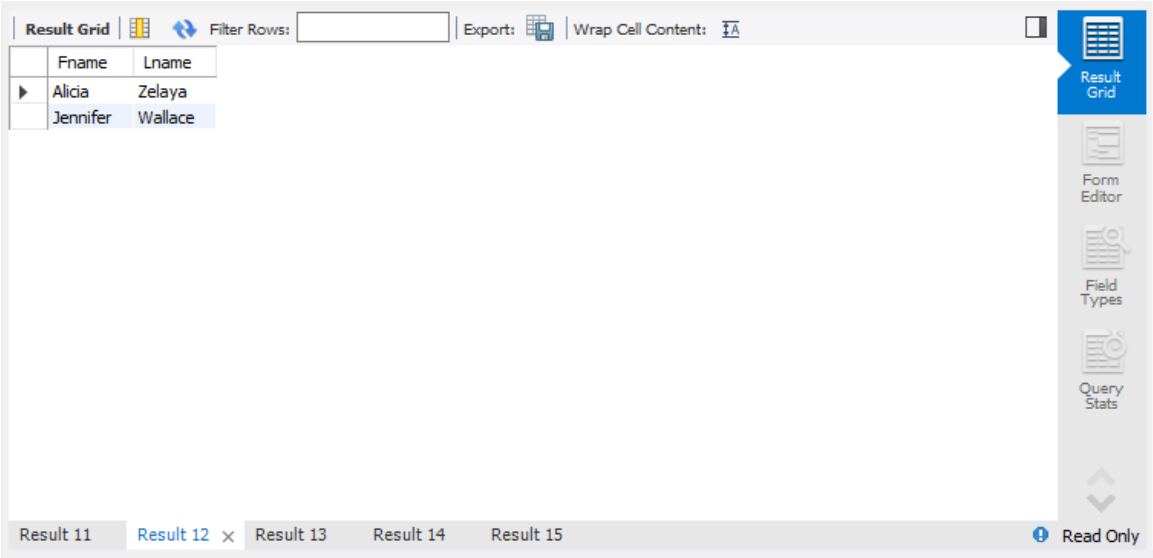
6. Who is the manager of Research department?

```
SELECT
    Fname, Lname
FROM DEPARTMENT
JOIN EMPLOYEE
ON DEPARTMENT.Mgr_ssn=EMPLOYEE.Ssn
WHERE Dname='Research';
```



7. Who are the employees that work on project newbenefits?

```
SELECT
    Fname, Lname
FROM PROJECT
JOIN EMPLOYEE ON PROJECT.Dnum=EMPLOYEE.Dno
WHERE Pname='Newbenefits';
```

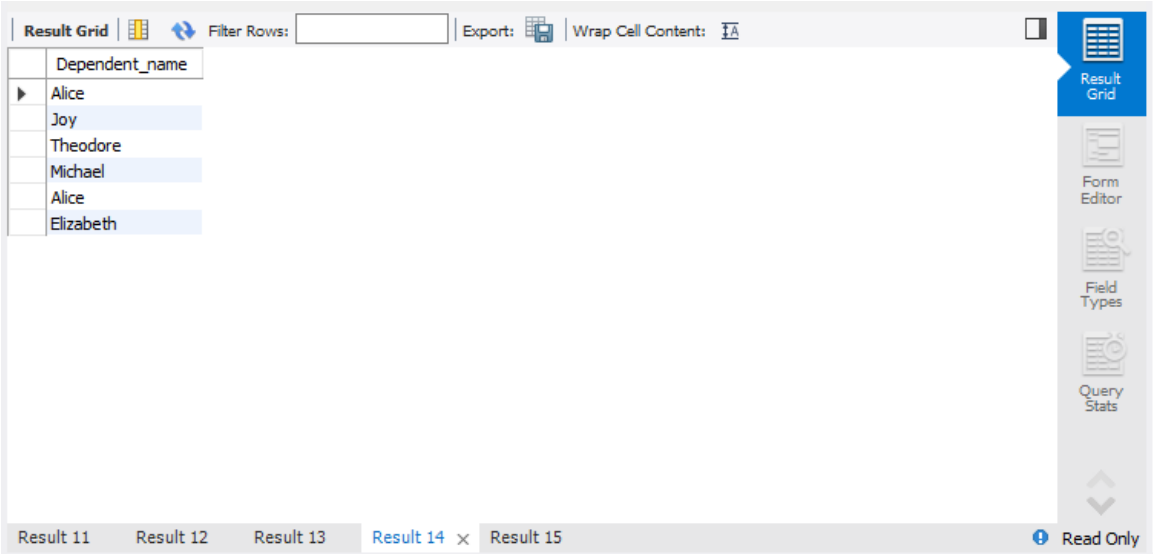


8. Who are dependents of Franklin Wong?

```
SELECT
    Dependent_name
FROM DEPENDENT
JOIN EMPLOYEE
ON EMPLOYEE.Ssn=DEPENDENT.Essn
WHERE Fname='Franklin' AND Lname='Wong';
```

9. Who are the dependents of employees who're assigned to project 'Computerization' ?

```
SELECT
    Dependent_name
FROM DEPENDENT
JOIN EMPLOYEE
ON DEPENDENT.Essn=EMPLOYEE.Ssn
JOIN PROJECT
ON PROJECT.Dnum=EMPLOYEE.Dno
WHERE Pname='Computerization';
```



10. In what department do employees belong, who's dependent are their sons?

```
SELECT
    Dname
FROM DEPARTMENT
JOIN EMPLOYEE
ON DEPARTMENT.Dnumber=EMPLOYEE.Dno
JOIN DEPENDENT
ON DEPENDENT.Essn=EMPLOYEE.Ssn
WHERE Relationship='Son';
```