# Database
# Midterm Exam


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1i

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# 1 Analysis

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

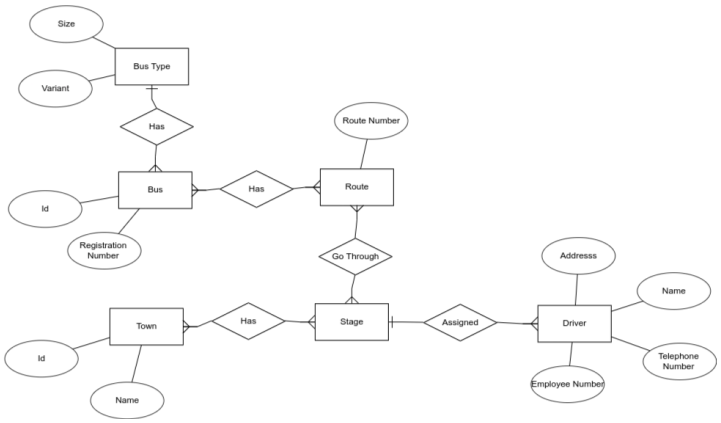



Figure 1: The Entity Relationship Diagram for the problem

b.) Transform the ERD into Relational Schema

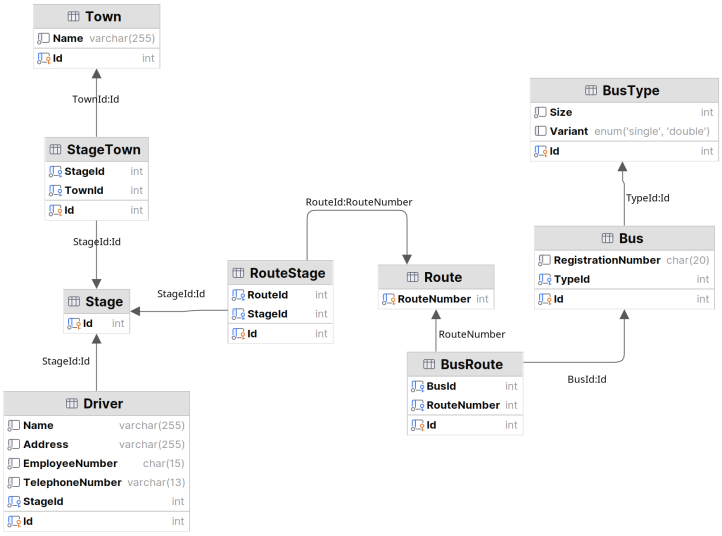



Figure 2: The relational version of the diagram

### Query Steps

- Create the database and use it as the default schema.

```
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
(
    Id 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  CHAR(15)     NOT NULL,
    TelephoneNumber VARCHAR(13)  NOT NULL,
    StageId         INT          NOT NULL
);
```

- Create relationships

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

# 2 Application

## A. DDL Query

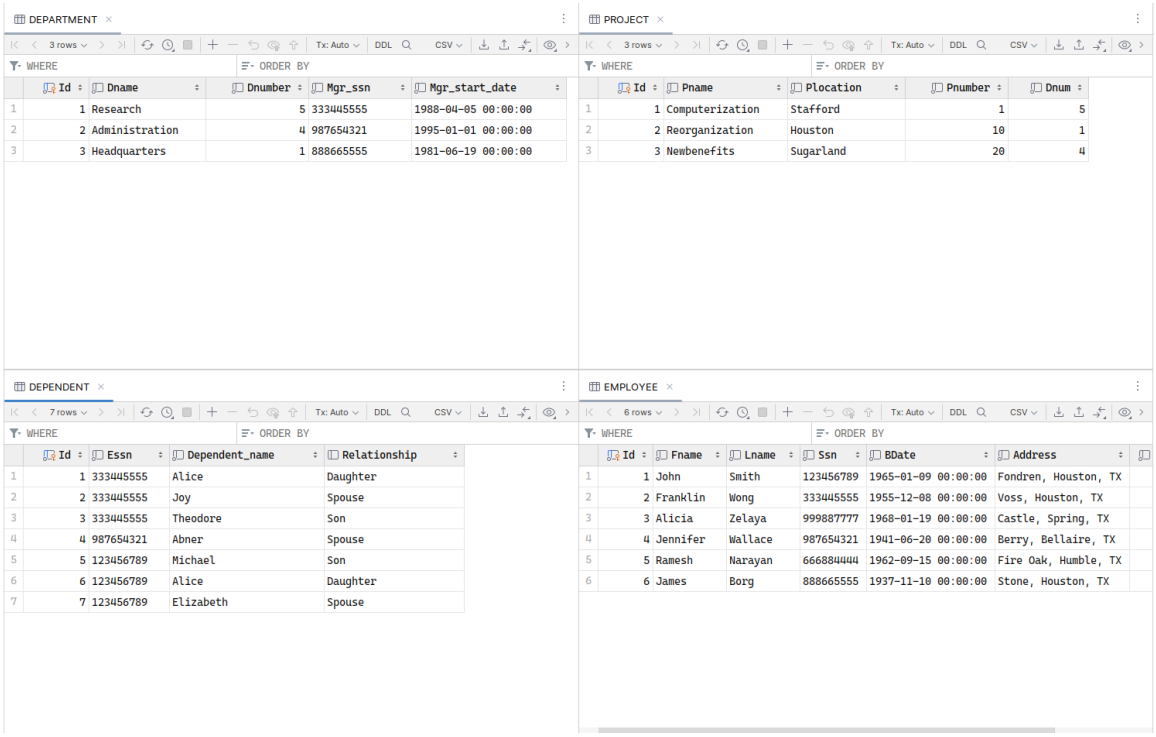
```
CREATE TABLE EMPLOYEE
(
    Id      INT          NOT NULL PRIMARY KEY AUTO_INCREMENT,
    Fname   VARCHAR(255) NOT NULL,
    Lname   VARCHAR(255) NOT NULL,
    Ssn     CHAR(9)      NOT NULL,
    BDate   DATETIME     NOT NULL,
    Address VARCHAR(255) NOT NULL,
    Salary  INT          NOT NULL,
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

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
);
```

B. **Query Result**



DEPARTMENT

| | Id | Dname | Dnumber | Mgr_ssn | Mgr_start_date |
|---|---|---|---|---|---|
| 1 | 1 | Research | 5 | 333445555 | 1988-05-05 00:00:00 |
| 2 | 2 | Administration | 4 | 987654321 | 1995-01-01 00:00:00 |
| 3 | 3 | Headquarters | 1 | 888665555 | 1981-06-19 00:00:00 |

PROJECT

| | Id | Pname | Plocation | Pnumber | Dnum |
|---|---|---|---|---|---|
| 1 | 1 | Computerization | Stafford | 1 | 5 |
| 2 | 2 | Reorganization | Houston | 10 | 1 |
| 3 | 3 | Newbenefits | Sugarland | 20 | 4 |

DEPENDENT

| | Id | Essn | Dependent_name | Relationship |
|---|---|---|---|---|
| 1 | 1 | 333445555 | Alice | Daughter |
| 2 | 2 | 333445555 | Joy | Spouse |
| 3 | 3 | 333445555 | Theodore | Son |
| 4 | 4 | 987654321 | Abner | Spouse |
| 5 | 5 | 123456789 | Michael | Son |
| 6 | 6 | 123456789 | Alice | Daughter |
| 7 | 7 | 123456789 | Elizabeth | Spouse |

EMPLOYEE

| | Id | Fname | Lname | Ssn | BDate | Address |
|---|---|---|---|---|---|---|
| 1 | 1 | John | Smith | 123456789 | 1965-01-09 00:00:00 | Fondren, Houston, TX |
| 2 | 2 | Franklin | Wong | 333445555 | 1955-12-08 00:00:00 | Voss, Houston, TX |
| 3 | 3 | Alicia | Zelaya | 999887777 | 1968-01-19 00:00:00 | Castle, Spring, TX |
| 4 | 4 | Jennifer | Wallace | 987654321 | 1941-06-20 00:00:00 | Berry, Bellaire, TX |
| 5 | 5 | Ramesh | Narayan | 666884444 | 1962-09-15 00:00:00 | Fire Oak, Humble, TX |
| 6 | 6 | James | Borg | 888665555 | 1937-11-10 00:00:00 | Stone, Houston, TX |

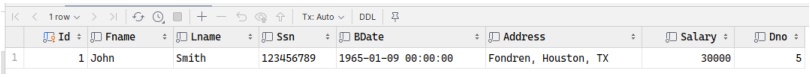
Figure 3: The result of the DDL queries above

## 2.1 Questions

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

1. Find all information about John Smith

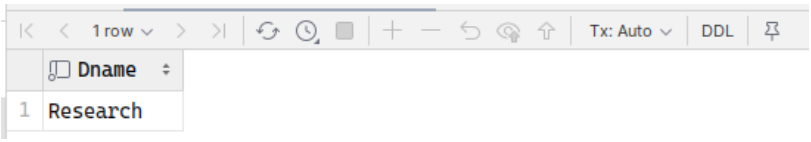
```
SELECT * FROM EMPLOYEE WHERE Fname='John' AND Lname='Smith';
```



| | Id | Fname | Lname | Ssn | BDate | Address | Salary | Dno |
|---|---|---|---|---|---|---|---|---|
| 1 | 1 | John | Smith | 123456789 | 1965-01-09 00:00:00 | Fondren, Houston, TX | 30000 | 5 |

2. What department started on 5 April, 1998?

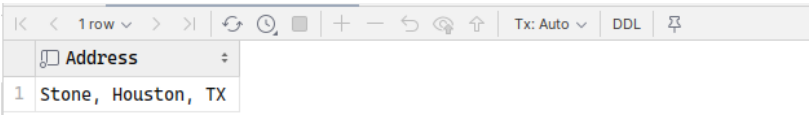
```
SELECT Dname FROM DEPARTMENT WHERE Mgr_start_date='1988-04-05';
```



| | Dname |
|---|---|
| 1 | Research |

3. Where does James Borg lives?

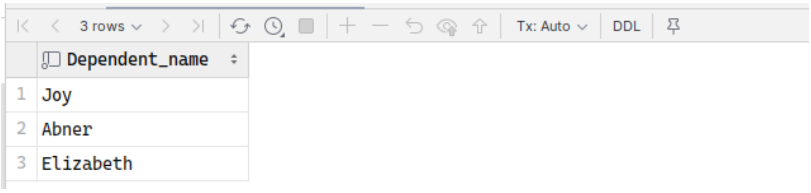
```
SELECT Address FROM EMPLOYEE WHERE Fname='James' AND Lname='Borg';
```



| | Address |
|---|---|
| 1 | Stone, Houston, TX |

4. Who are the spouses of the employees?

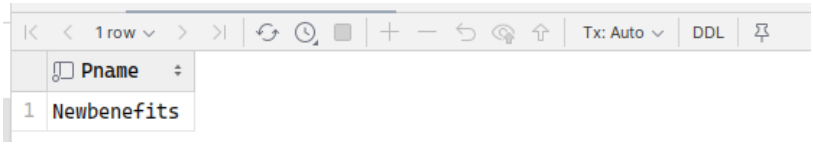
```
SELECT Dependent_name FROM DEPENDENT WHERE Relationship='Spouse';
```



| | Dependent_name |
|---|---|
| 1 | Joy |
| 2 | Abner |
| 3 | Elizabeth |

5. What is the project located at Sugarland?

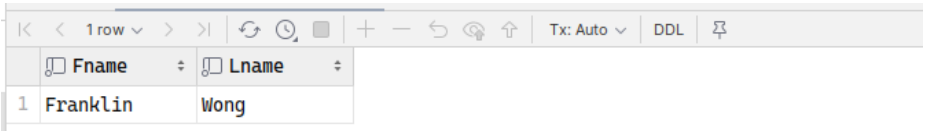
```
SELECT Pname FROM PROJECT WHERE Plocation='Sugarland';
```




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

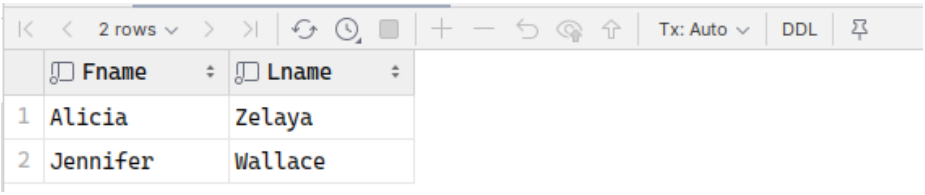
6. Who is the manager of Research department?

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



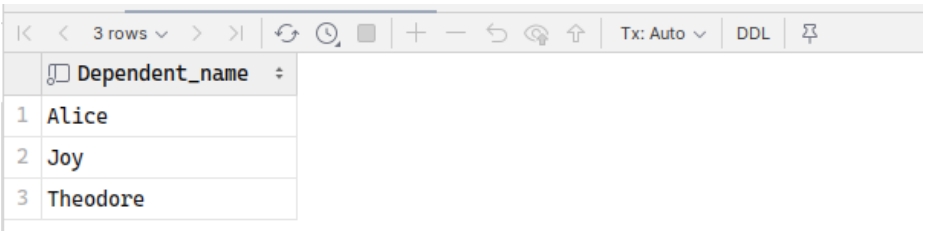

7. Who are the employees that work on project newbenefits?

```
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';
```

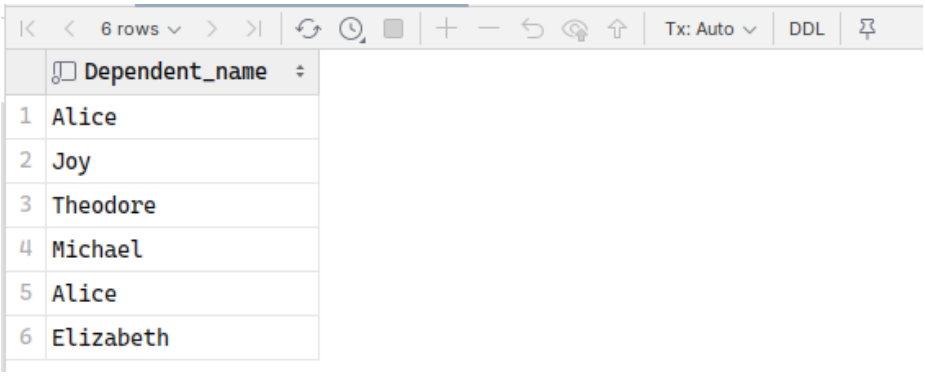


3 rows | Tx: Auto | DDL

| | Dependent_name |
|---|---|
| 1 | Alice |
| 2 | Joy |
| 3 | Theodore |

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';
```



6 rows | Tx: Auto | DDL

| | Dependent_name |
|---|---|
| 1 | Alice |
| 2 | Joy |
| 3 | Theodore |
| 4 | Michael |
| 5 | Alice |
| 6 | Elizabeth |

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';
```


| | Dname |
|---|---|
| 1 | Research |
| 2 | Research |