

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

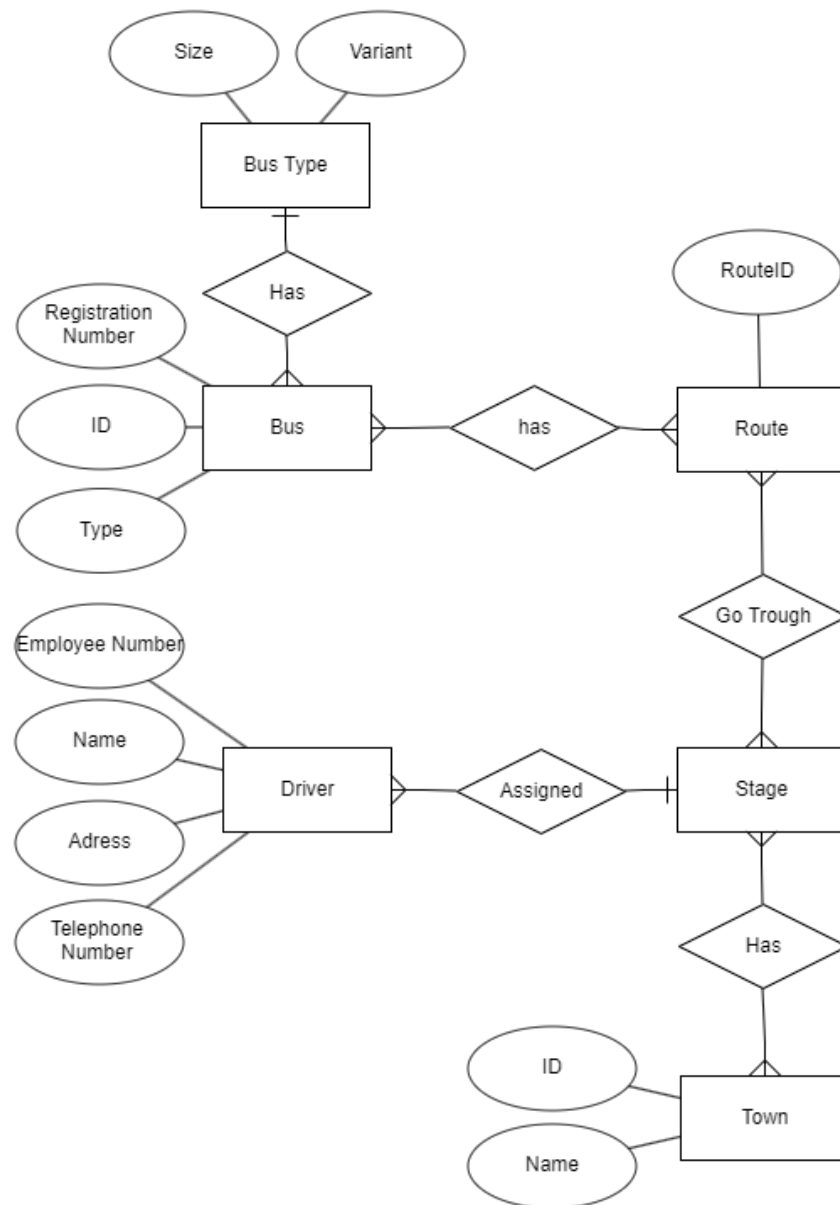


Figure 1: The Entity Relationship Diagram for the problem

b. Transform the ERD into Relationship Schema

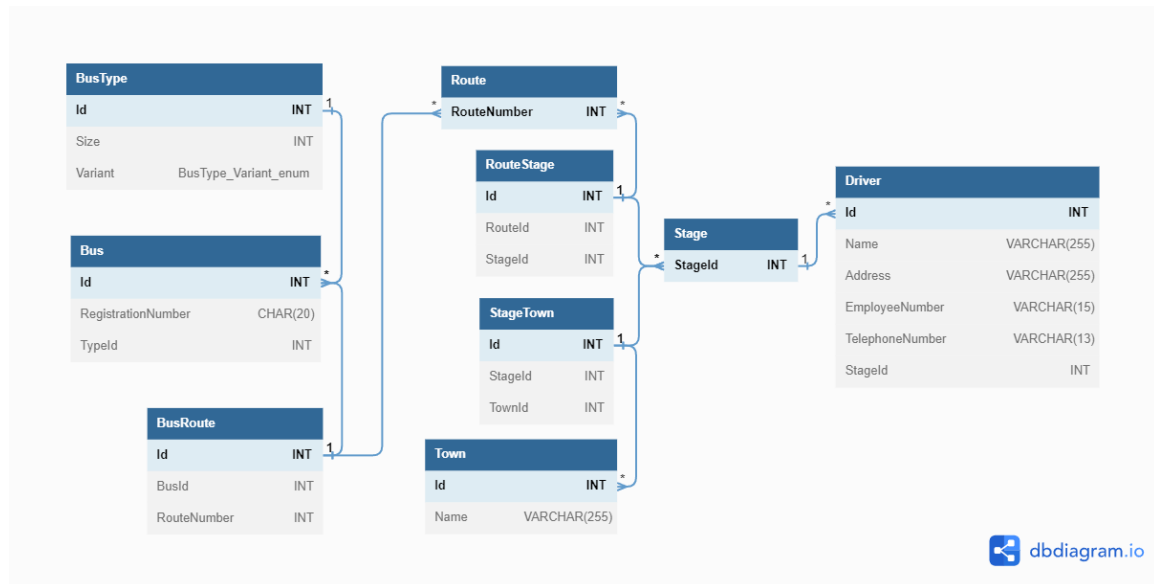


Figure 2: The relational version of the diagram

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
);
```

```
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

The figure consists of four screenshots of a database application interface, each showing a 'Result Grid' with query results. The interface includes a toolbar with options like 'Filter Rows', 'Edit', 'Export/Import', and 'Wrap Cell Content'. A sidebar on the right contains icons for 'Form Editor', 'Field Types', and 'Query Stats'. At the bottom, there are tabs for 'EMPLOYEE 1', 'PROJECT 2', 'DEPENDENT 3', and 'DEPARTMENT 4', along with 'Apply' and 'Revert' buttons.

Top Left Screenshot (EMPLOYEE 1):

Id	Fname	Lname	Ssn	BDate	Address	Salary	Dno
1	John	Smith	123456789	1965-01-09 00:00:00	Fondren, Houston, TX	30000	5
2	Franklin	Wong	333445555	1955-12-08 00:00:00	Voss, Houston, TX	40000	5
3	Alicia	Zelaya	999887777	1968-01-19 00:00:00	Castle, Spring, TX	25000	4
4	Jennifer	Wallace	987654321	1941-06-20 00:00:00	Berry, Belaire, TX	43000	4
5	Ramesh	Narayan	666884444	1962-09-15 00:00:00	Fire Oak, Humble, TX	38000	5
6	James	Borg	888665555	1937-11-10 00:00:00	Stone, Houston, TX	55000	1

Top Right Screenshot (PROJECT 2):

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

Bottom Left Screenshot (DEPENDENT 3):

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

Bottom Right Screenshot (DEPARTMENT 4):

Id	Dname	Dnumber	Mgr_ssn	Mgr_start_date
1	Research	5	333445555	1988-04-05 00:00:00
2	Administration	4	987654321	1995-01-01 00:00:00
3	Headquarters	1	888665555	1981-06-19 00:00:00

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';`

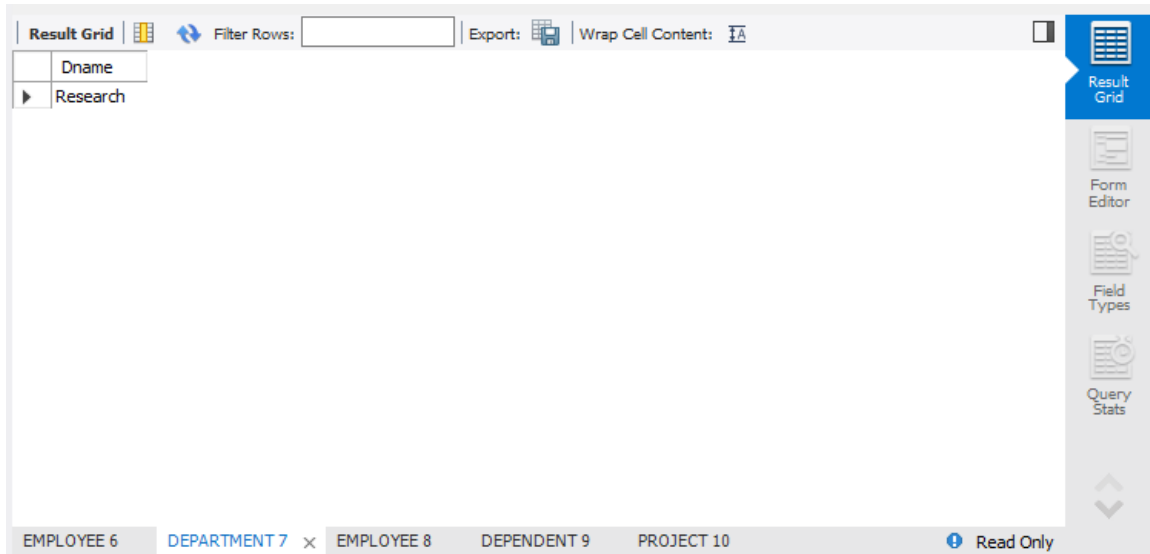
The screenshot shows a 'Result Grid' with the following data:

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

The interface includes a toolbar with options like 'Filter Rows', 'Edit', 'Export/Import', and 'Wrap Cell Content'. A sidebar on the right contains icons for 'Form Editor', 'Field Types', and 'Query Stats'. At the bottom, there are tabs for 'EMPLOYEE 6', 'DEPARTMENT 7', 'EMPLOYEE 8', 'DEPENDENT 9', and 'PROJECT 10', along with 'Apply' and 'Revert' buttons.

2. What department started on 5 April, 1998?

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

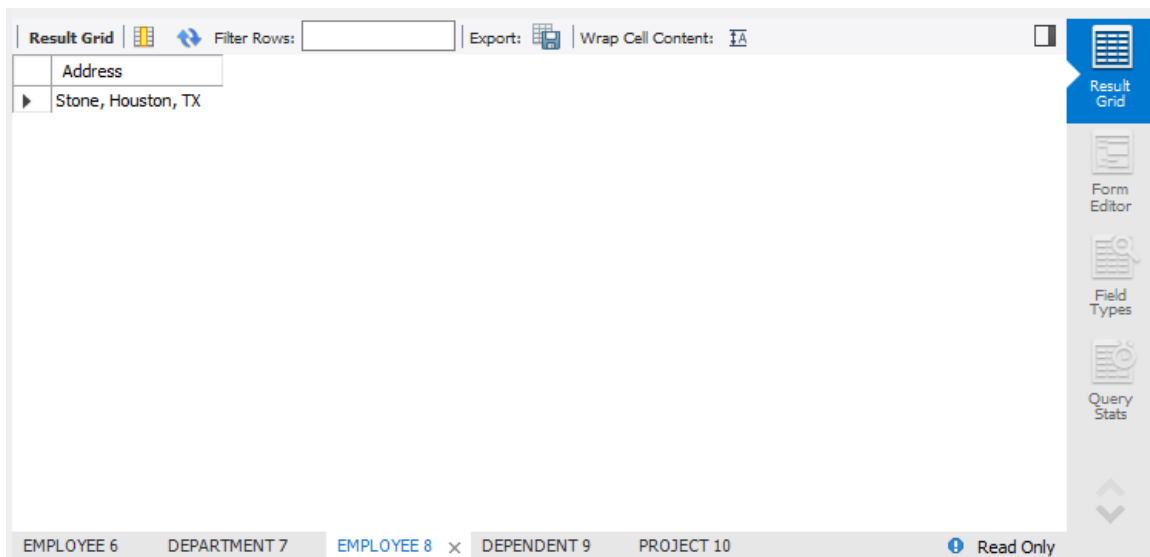


The screenshot shows a database query result grid. The top toolbar includes a 'Filter Rows' input field, an 'Export' button, and a 'Wrap Cell Content' button. The result grid displays a single row with the department name 'Research'. The bottom status bar shows the current query is 'DEPARTMENT 7' and the database is in 'Read Only' mode.

Dname
Research

3. Where does James Borg lives?

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



The screenshot shows a database query result grid. The top toolbar includes a 'Filter Rows' input field, an 'Export' button, and a 'Wrap Cell Content' button. The result grid displays a single row with the address 'Stone, Houston, TX'. The bottom status bar shows the current query is 'EMPLOYEE 8' and the database is in 'Read Only' mode.

Address
Stone, Houston, TX

4. Who are the spouses of the employees?

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

The screenshot shows a database application window with a 'Result Grid' tab selected. The grid displays the results of a query on the DEPENDENT table. The first column is 'Dependent_name'. The results are:

Dependent_name
Joy
Abner
Elizabeth

The interface includes a 'Filter Rows' field, 'Export' and 'Wrap Cell Content' buttons, and a sidebar with 'Form Editor', 'Field Types', and 'Query Stats' options. The bottom status bar shows 'EMPLOYEE 6', 'DEPARTMENT 7', 'EMPLOYEE 8', 'DEPENDENT 9', and 'PROJECT 10' tabs, with a 'Read Only' indicator.

5. What is the project located at Sugarland?

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

The screenshot shows a database application window with a 'Result Grid' tab selected. The grid displays the results of a query on the PROJECT table. The first column is 'Pname'. The results are:

Pname
Newbenefits

The interface includes a 'Filter Rows' field, 'Export' and 'Wrap Cell Content' buttons, and a sidebar with 'Form Editor', 'Field Types', and 'Query Stats' options. The bottom status bar shows 'EMPLOYEE 6', 'DEPARTMENT 7', 'EMPLOYEE 8', 'DEPENDENT 9', and 'PROJECT 10' tabs, with a 'Read Only' indicator.

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';
```

	Fname	Lname
▶	Franklin	Wong

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';
```

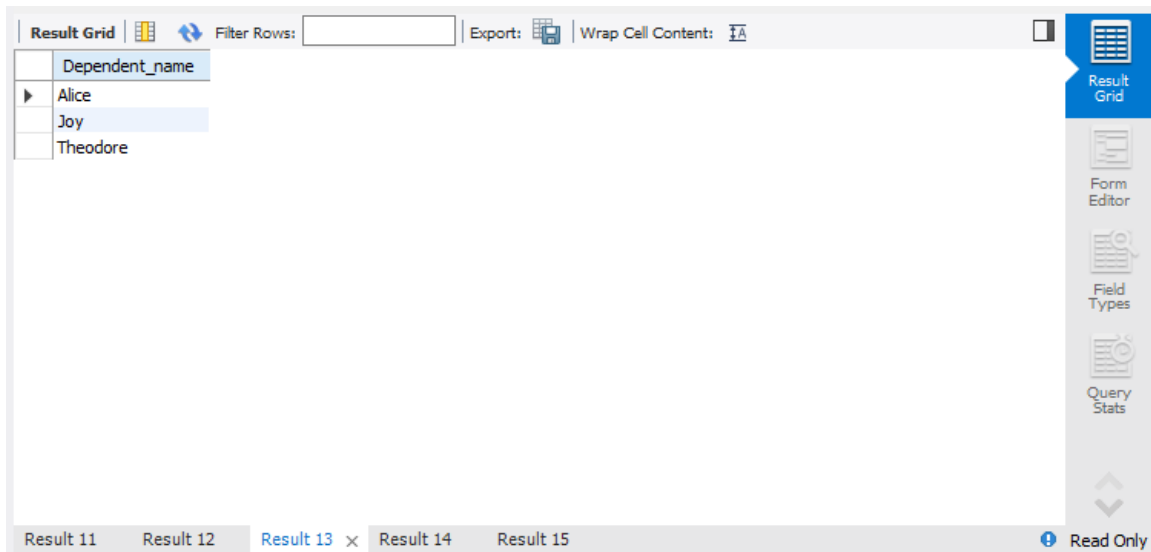


The screenshot shows a database query result grid. The grid has two columns: 'Fname' and 'Lname'. The first row contains 'Alicia' and 'Zelaya'. The second row contains 'Jennifer' and 'Wallace'. The grid is titled 'Result Grid' and has a 'Filter Rows' field. The 'Result Grid' button is highlighted in blue. The bottom of the window shows tabs for 'Result 11', 'Result 12' (selected), 'Result 13', 'Result 14', and 'Result 15'. A 'Read Only' status is indicated at the bottom right.

Fname	Lname
Alicia	Zelaya
Jennifer	Wallace

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';
```



The screenshot shows a database query result grid. The top toolbar includes a 'Result Grid' button, a 'Filter Rows' input field, an 'Export' button, and a 'Wrap Cell Content' button. The main area displays a table with the following data:

Dependent_name
Alice
Joy
Theodore

The bottom of the window shows a tabbed interface with tabs for 'Result 11', 'Result 12', 'Result 13' (which is active), 'Result 14', and 'Result 15'. A 'Read Only' status indicator is visible in the bottom right corner.

-
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';
```

Dependent_name
Alice
Joy
Theodore
Michael
Alice
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';
```

