**Q1. (20 pts)**
Assume that you are given the following SQL commands for table definition.

```
CREATE TABLE Employee
( SSN              INT        NOT NULL,
  Name   VARCHAR(20)  NOT NULL,
  Supervisor       INT,
  DNo              INT,
  PRIMARY KEY(SSN),
  FOREIGN KEY(Supervisor)
       REFERENCES   Employee(SSN),
  FOREIGN KEY(DNo)
       REFERENCES Department(DNumber)
                  ON DELETE  SET NULL
                  ON UPDATE CASCADE);
```

```
CREATE TABLE Department
( DNumber INT              NOT NULL,
  DName            VARCHAR(10),
  Manager  INT,
   PRIMARY KEY(DNumber),
  FOREIGN KEY(Manager)
          REFERENCES Employee(SSN)
                  ON UPDATE SET NULL);
```

Initally both tables are empty.The following SQL commands are executed in the given order. Show the effect of commands on Employee and Department tables after each command call. In case of command rejection, briefly write the reason.

| | |
|---|---|
| a. | **INSERT INTO Employee VALUES (12, "Can", NULL, NULL);** |
| | |
| b. | **INSERT INTO Department VALUES (2, "Eng", 12);** |
| | |
| c. | **INSERT INTO Employee VALUES (15, "Oya", 12, 2);** |
| | |
| d. | **INSERT INTO Department VALUES (5, "Admin", 15);** |
| | |
| e. | **INSERT INTO Employee VALUES (12, "Hikmet", 12, 5);** |
| | |
| f. | **INSERT INTO Employee VALUES (14, "Oya", 12, 5);** |
| | |

| | |
|---|---|
| | |
| g. | **INSERT INTO Employee VALUES (16, NULL, 12, 2);** |
| | |
| h. | **UPDATE Employee SET SSN = 18 WHERE SSN = 15;** |
| | |
| i. | **UPDATE Department SET DNumber = DNumber+1 WHERE DNumber = 5;** |
| | |
| j. | **DELETE FROM Department WHERE DNumber = 2;** |
| | |
| k. | **DELETE FROM Employee WHERE SSN = 12;** |
| | |

**Q2. (30 pts)**

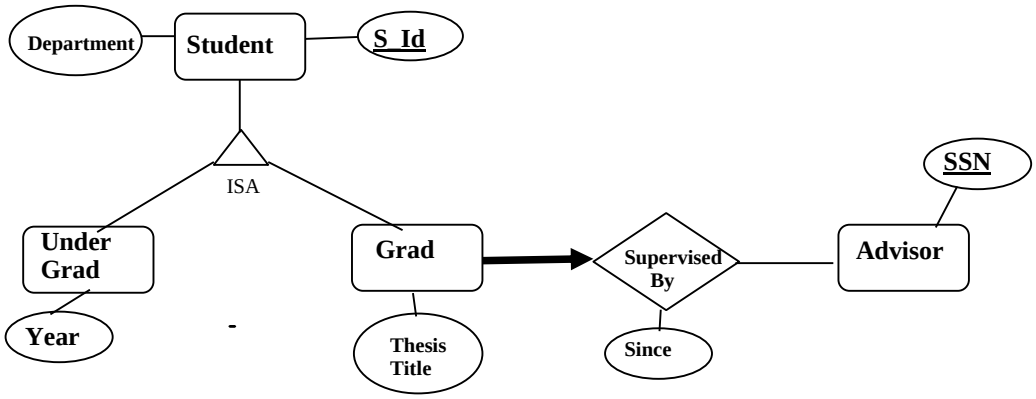
**a)** Draw the **ER** diagram for the following database description:

In a hospital database, following information is modeled.

- Each patient has a unique patient number, last name, first name, address and phone number.
- Doctors have unique doctor id number, last name, first name and medical branch.
- Each medical branch has a branch name and a unique branch id.
- A patient may be diagnosed with several diseases. Each diagnosis is recorded with a disease code, a short description and diagnosis date. Doctor who made the diagnosis is also recorded.
- Treatments have unique treatment id number, and a short description.
- There are two kinds of treatments: medication and operation. If treatment is medication, then effective ingredient is also recorded. If treatment is an operation then related equipment is recorded.
- A patient may be given several treatments. For medical treatments, drug dose and application period of drug are recorded. A patient may be given given the same medical treatment with different application periods.
- For operational treatments, operation date and operation report are recorded.
- For both cases, doctor who attended the treatment must be also recorded. For operational treatments, more than one doctor may attend the operation.

**b)** You are given the following ER diagram.

Write SQL commands to create tables representing the below ER diagram. (You may assume proper types for attributes.)



**Q3. (25 pts)** Consider the following schema that is used for course maintenance, including the students enrolled, their project teams and midterm grades:

Student(ID,Name,Department)
ProjectTeam(TeamName, ID)
Midterm(ID,Grade)

The key fields are underlined. Write relational algebra expressions for the following queries.

(i) Find the Names of students who are in the team with TeamName ’BEE’.

(ii) Find the ID of students who have not been in any team yet.

(iii) Find the TeamNames of teams whose member students are all from Department ’CS’

(iv) Find teams which include all students who got 100 in the midterm.

**Q4. (25 pts)** Consider the following relations that the online bookstore, kitapci.com, maintains. Underlined attributes are keys of those relations. The attributes *cid* and *isbn* in Buy relation are foreign keys referring to *cid* in Customer and *isbn* in Book respectively. The attribute *isbn* in Author is a foreign key referring to *isbn* in Book.

Book(<u>isbn</u>, title, publisher, price)
Author(<u>isbn, assn</u>, aname)
Customer(<u>cid</u>, cname, city, zipcode)
Buy(<u>tid</u>, cid, isbn, year, month, day) // tid is a unique transaction number for each order

(i) Find the list of the names of customers who live in Ankara and spent more than 500 TL in year 2010.

(ii) Find pairs of customers who bought the same book.

(iii) Find cids of those customers who bought books from all publishers.

(iv) Find the cids of customers who are friends of Bob whose cid =1234. Friends of Bob are people who share a common interest with Bob. We consider that two persons share a common interest if they purchased more than 20 *same* books.