

BİLGİSAYAR MÜHENDİSLİĞİ
BLM2058/BLM258
ARASINAV
(120 dakika)

Cevaplarınızı tek bir pdf dosyasına dönüştürerek yüklemeniz gerekmektedir. Eğer bir kağıda cevabınızı yazıp fotoğrafını yüklüyorsanız lütfen okunaklı olduğundan emin olun. Dosyanızı ÖğrenciNumarasi.pdf şeklinde isimlendiriniz. Soruları dikkatlice okuyunuz.

1. (30 p) COMPANY şemasını (CompanySchema.pdf) tanımlamak için aşağıdaki veri tanımlama ifadelerinin verildiğini varsayalım. (Assume that the following data definition statements for defining the COMPANY schema (CompanySchema.pdf) are given.)

```
CREATE TABLE EMPLOYEE (Fname VARCHAR(15), NOT NULL, Minit CHAR, Lname VARCHAR(15) NOT NULL, Ssn CHAR(9) NOT NULL, Bdate DATE, Address VARCHAR(30), Sex CHAR, Salary DOUBLE, Super_ssn CHAR(9), Dno INT NOT NULL DEFAULT 1, PRIMARY KEY (Ssn), FOREIGN KEY (Super_ssn) REFERENCES EMPLOYEE(Ssn) ON DELETE SET NULL ON UPDATE CASCADE, FOREIGN KEY (Dno) REFERENCES DEPARTMENT(Dnumber) ON DELETE SET DEFAULT ON UPDATE CASCADE);

CREATE TABLE DEPARTMENT (Dname VARCHAR(15) NOT NULL, Dnumber INT NOT NULL, Mgr_ssn CHAR(9) NOT NULL DEFAULT '888665555', Mgr_start_date DATE, PRIMARY KEY (Dnumber), FOREIGN KEY (Mgr_ssn) REFERENCES EMPLOYEE(Ssn) ON DELETE SET DEFAULT ON UPDATE CASCADE);

CREATE TABLE DEPT_LOCATIONS (Dnumber INT NOT NULL, Dlocation VARCHAR(15) NOT NULL, PRIMARY KEY (Dnumber, Dlocation), FOREIGN KEY (Dnumber) REFERENCES DEPARTMENT(Dnumber) ON DELETE CASCADE ON UPDATE CASCADE);

CREATE TABLE PROJECT (Pname VARCHAR(15) NOT NULL, Pnumber INT NOT NULL, Plocation VARCHAR(15), Dnum INT NOT NULL DEFAULT 1, PRIMARY KEY (Pnumber), FOREIGN KEY (Dnum) REFERENCES DEPARTMENT (Dnumber) ON DELETE SET DEFAULT ON UPDATE CASCADE);

CREATE TABLE WORKS_ON (Essn CHAR(9) NOT NULL, Pno INT NOT NULL DEFAULT 20, Hours DOUBLE NOT NULL, PRIMARY KEY (Essn, Pno), FOREIGN KEY (Essn) REFERENCES EMPLOYEE(Ssn) ON DELETE CASCADE ON UPDATE CASCADE; FOREIGN KEY (Pno) REFERENCES EMPLOYEE(Pnumber) ON DELETE SET DEFAULT ON UPDATE CASCADE);

CREATE TABLE DEPENDENT (Essn CHAR(9) NOT NULL, Dependent_name VARCHAR(15) NOT NULL, Sex CHAR, Bdate DATE, Relationship VARCHAR(8), PRIMARY KEY (Essn, Dependent_Name), FOREIGN KEY (Essn) REFERENCES EMPLOYEE(ssn) ON DELETE CASCADE ON UPDATE
```

Aşağıdaki işlemlerden her birinin CompanySchema.pdf dokümanında yer alan veritabanı durumuna bağımsız olarak uygulandığını varsayalım. Eğer işlemin uygulanması sırasında ihlal edilen kısıtlar varsa kısıtların ismini ve nasıl ihlal edildiğini yazınız. Eğer işlem uygulanabiliyorsa, işlem sonucunda elde edilen veritabanı tablolarını gösteriniz. Sadece güncellenen tabloları göstermeniz yeterlidir. (Suppose that each of the following update operations is applied independently to the database state given in CompanySchema.pdf. For each operation, write the name of all constraints if any. Also, write the reason for the violation. Write the new state of each table after each operation if the operation is not restricted. Show only the updated tables.)

- Insert <'ProductA',4,'Bellaire',2> into PROJECT
- Insert <'Production',4,'943775543','1998-10-01'> into DEPARTMENT
- Insert <'677678989',NULL,'40.0'> into WORKS_ON
- Delete the PROJECT tuple with Pname='ProductX'
- Delete the DEPARTMENT tuple with Dnumber=4
- Modify the Dnumber attribute of the DEPARTMENT tuple with Dnumber=4 to 2.

2. (24 puan) Aşağıdaki sorguları CompanySchema.pdf dokümanında verilen veritabanı için SQL dilinde yazınız. (Write the following queries in SQL on the relational database schema for COMPANY database given in CompanySchema.pdf.)

1. Maaşı 30 000 den fazla olan çalışanların soy isimlerini bulunuz. (Find the last name of employees who have salary greater than 30 000.) `select lname from employees where salary>30000`
2. 'Stafford' ta yer alan projelerde çalışan kişilerin ortalama maaşlarını bulunuz. (Find the average salary of employees who works on the projects which are located in 'Stafford'.)
`select avg(salary) from employee,dept,locations where dno=dnumber and dlocation = "Stafford";`
3. Her bir yöneticinin toplam çalışma süresini bulunuz. (Find the total working hours of each manager.) `select essn sum(hours) from works_on,department where essn=mgr_ssn;`
4. Hiç bir çalışanı olmayan projelerin isimlerini bulunuz. (Find the name of the projects on which no employee works.) `select pname from project where pname not in (select pno from works_on where pno = pnumber);`

3. (30 p) Verilen tabloları kullanarak ilişkisel cebirde verilen aşağıdaki işlemlerin sonuçlarını yazınız. (Using tables given below, show the results of the following operations given in relational algebra.)

A

| a1 | a2 | a3 | a4 |
|----|----|----|----|
| 2 | 3 | 4 | 5 |
| 1 | 8 | 12 | 3 |
| 5 | 6 | 7 | 4 |

B

| b1 | b2 | b3 |
|----|----|----|
| 2 | 4 | 3 |
| 4 | 12 | 11 |

C

| c1 | c2 |
|----|----|
| 4 | 4 |
| 6 | 4 |
| 4 | 12 |
| 4 | 7 |
| 7 | 6 |
| 7 | 12 |
| 6 | 7 |
| 7 | 4 |

- a) $A \times (\sigma_{B.b2>10} B)$
- b) $A \bowtie_{A.a4=B.b3} B$
- c) $A \bowtie_{(A.a1=B.b1 \text{ AND } A.a3=B.b2)} B$
- d) $B \cup (\pi_{(a1, a2, a3)} A)$
- e) $\rho_{(d1, d2, d3)}(c1 \text{ } \mathcal{S}_{\text{COUNT } c2, \text{ SUM } c2} C)$
- f) $C \div (\rho_{(c2)} (\pi_{(a3)} A))$

STUDENT

| Name | Student_number | Class | Major |
|-------|----------------|-------|-------|
| Smith | 17 | 1 | CS |
| Brown | 8 | 2 | CS |

COURSE

| Course_name | Course_number | Credit_hours | Department |
|---------------------------|---------------|--------------|------------|
| Intro to Computer Science | CS1310 | 4 | CS |
| Data Structures | CS3320 | 4 | CS |
| Discrete Mathematics | MATH2410 | 3 | MATH |
| Database | CS3380 | 3 | CS |

SECTION

| Section_identifier | Course_number | Semester | Year | Instructor |
|--------------------|---------------|----------|------|------------|
| 85 | MATH2410 | Fall | 07 | King |
| 92 | CS1310 | Fall | 07 | Anderson |
| 102 | CS3320 | Spring | 08 | Knuth |
| 112 | MATH2410 | Fall | 08 | Chang |
| 119 | CS1310 | Fall | 08 | Anderson |
| 135 | CS3380 | Fall | 08 | Stone |

GRADE_REPORT

| Student_number | Section_identifier | Grade |
|----------------|--------------------|-------|
| 17 | 112 | B |
| 17 | 119 | C |
| 8 | 85 | A |
| 8 | 92 | A |
| 8 | 102 | B |
| 8 | 135 | A |

PREREQUISITE

| Course_number | Prerequisite_number |
|---------------|---------------------|
| CS3380 | CS3320 |
| CS3380 | MATH2410 |
| CS3320 | CS1310 |

4. (16 p) Yukarıdaki veritabanı durumuna uygulanan aşağıdaki sorguların sonuçlarını yazınız. (Show the result of the following queries as it would apply to the database state given above.)

1. **SELECT DISTINCT Name FROM STUDENT WHERE Major='CS';**
2. **SELECT GRADE_REPORT.Student_number, SUM(Credit_hours), COUNT(*) FROM GRADE_REPORT, SECTION, COURSE WHERE GRADE_REPORT.Section_identifier=SECTION.Section_identifier AND SECTION.Course_number=COURSE.Course_number GROUP BY GRADE_REPORT.Student_number;**
3. **SELECT Name, Course_name, C.Course_number, Credit_hours, Semester, Year, Grade FROM STUDENT ST, COURSE C, SECTION S, GRADE_REPORT G WHERE Class=1 AND Major='CS' AND ST.Student_number=G.Student_number AND G.Section_identifier=S.Section_identifier AND S.Course_number=C.Course_number;**
4. **SELECT Name, Major FROM STUDENT WHERE NOT EXISTS (SELECT * FROM GRADE_REPORT WHERE Student_number= STUDENT.Student_number AND Grade<>'B');**