

# CS3402 Database Systems

## Homework

Question A. (50 marks)

A database schema consisting of three relations STUDENT, COURSE, and STAFF is created as follows:

```
CREATE TABLE STUDENT (STU_ID CHAR(4),  
                        STUDENT_NAME CHAR(20),  
                        ADDRESS CHAR(20),  
                        BIRTHDATE DATE,  
                        GENDER CHAR(6));
```

```
CREATE TABLE COURSE (COURSE_ID CHAR(6),  
                       COURSE_TITLE CHAR(20),  
                       STAFF_ID CHAR(3),  
                       SECTION NUMBER(2));
```

```
CREATE TABLE STAFF (STAFF_ID CHAR(3),  
                     STAFF_NAME CHAR(20),  
                     GENDER CHAR(6),  
                     DEPARTMENT CHAR(20),  
                     BOSS_ID CHAR(3)  
                     SALARY NUMBER(8,2));
```

Write down a SQL statement for each query below:

- 1) List the names of all male students who were born before 01-01-1995. [5 marks]
- 2) List the names of all students whose name is at least 6 characters long and whose birthdate falls within 01-01-1995 and 01-01-2000. Order the results alphabetically. [5 marks]
- 3) List the names of all courses that are neither taught by SMITH nor by JONES. [6 marks]
- 4) Retrieve the number of courses for each section number. Your output should be in ascending order of section numbers. [6 marks]
- 5) Find the name of every staff member who teaches the exact same number of courses as his/her boss. [7 marks]
- 6) List all staff members whose salary is higher than the average salary. [7 marks]
- 7) Find the names of the staff members who are the boss of some staff member in the Accounting department. [7 marks]
- 8) Find the average number of courses taught per staff member. [7 marks]

Question B. [50 marks]

Specify the following queries on the COMPANY relational database schema shown in Figure 5.5 below using relational algebra expressions. Also **show the result** of each query as it would apply to the database state of Figure 5.6.

#### EMPLOYEE

Fname	Minit	Lname	<u>Ssn</u>	Bdate	Address	Sex	Salary	Super_ssn	Dno
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#### DEPARTMENT

Dname	<u>Dnumber</u>	Mgr_ssn	Mgr_start_date
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#### DEPT\_LOCATIONS

<u>Dnumber</u>	<u>Dlocation</u>
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#### PROJECT

Pname	<u>Pnumber</u>	Plocation	Dnum
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#### WORKS\_ON

<u>Essn</u>	<u>Pno</u>	Hours
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#### DEPENDENT

<u>Essn</u>	<u>Dependent_name</u>	Sex	Bdate	Relationship
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**Figure 5.5**  
Schema diagram for the  
COMPANY relational  
database schema.

**Figure 5.6**

One possible database state for the COMPANY relational database schema.

**EMPLOYEE**

Fname	Minit	Lname	Ssn	Bdate	Address	Sex	Salary	Super_ssn	Dno
John	B	Smith	123456789	1965-01-09	731 Fondren, Houston, TX	M	30000	333445555	5
Franklin	T	Wong	333445555	1955-12-08	638 Voss, Houston, TX	M	40000	888665555	5
Alicia	J	Zelaya	999887777	1968-01-19	3321 Castle, Spring, TX	F	25000	987654321	4
Jennifer	S	Wallace	987654321	1941-06-20	291 Berry, Bellaire, TX	F	43000	888665555	4
Ramesh	K	Narayan	666884444	1962-09-15	975 Fire Oak, Humble, TX	M	38000	333445555	5
Joyce	A	English	453453453	1972-07-31	5631 Rice, Houston, TX	F	25000	333445555	5
Ahmad	V	Jabbar	987987987	1969-03-29	980 Dallas, Houston, TX	M	25000	987654321	4
James	E	Borg	888665555	1937-11-10	450 Stone, Houston, TX	M	55000	NULL	1

**DEPARTMENT**

Dname	Dnumber	Mgr_ssn	Mgr_start_date
Research	5	333445555	1988-05-22
Administration	4	987654321	1995-01-01
Headquarters	1	888665555	1981-06-19

**DEPT\_LOCATIONS**

Dnumber	Dlocation
1	Houston
4	Stafford
5	Bellaire
5	Sugarland
5	Houston

**WORKS\_ON**

Essn	Pno	Hours
123456789	1	32.5
123456789	2	7.5
666884444	3	40.0
453453453	1	20.0
453453453	2	20.0
333445555	2	10.0
333445555	3	10.0
333445555	10	10.0
333445555	20	10.0
999887777	30	30.0
999887777	10	10.0
987987987	10	35.0
987987987	30	5.0
987654321	30	20.0
987654321	20	15.0
888665555	20	NULL

**PROJECT**

Pname	Pnumber	Plocation	Dnum
ProductX	1	Bellaire	5
ProductY	2	Sugarland	5
ProductZ	3	Houston	5
Computerization	10	Stafford	4
Reorganization	20	Houston	1
Newbenefits	30	Stafford	4

**DEPENDENT**

Essn	Dependent_name	Sex	Bdate	Relationship
333445555	Alice	F	1986-04-05	Daughter
333445555	Theodore	M	1983-10-25	Son
333445555	Joy	F	1958-05-03	Spouse
987654321	Abner	M	1942-02-28	Spouse
123456789	Michael	M	1988-01-04	Son
123456789	Alice	F	1988-12-30	Daughter
123456789	Elizabeth	F	1967-05-05	Spouse

(a) Retrieve the names of employees that have at least one dependent. [5 marks]

(b) List the first names of employees who work in the Research department and whose salary is below 39000. [5 marks]

(c) Find the first names of male employees that are not supervised by 'Jennifer Wallace'. [5 marks]

(d) List the first names of all employees who work on the project 'Newbenefits' and who have a daughter as a dependent. [5 marks]

(e) Retrieve the first names of employees who work on every project. [5 marks]

(f) Retrieve the first names of employees who do not work on any project. [7.5 marks]

(g) Retrieve the salary of all male employees working in the department with department number 4. [5 marks]

(h) Find the first names and addresses of employees who work on at least one project located in Houston but whose department has its location in either Sugarland or Bellaire. [7.5 marks]

(i) List the last name of each department manager who has a spouse as a dependent. [5 marks]