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COS 221 Tutorial 2

- This tutorial takes place on **17 March 2025**.
- This tutorial consists of **3 questions**.
- The tutorial does not contribute towards your final marks.

Question 1: Relational Model and SQL - Queries, SQL, RA, RC (domain and tuple) (0 marks)

Using the COMPANY database and the queries presented in Lectures 12 and 13, given below.

Query 7: List the names of managers who have at least one dependent.

Figure 3.6
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

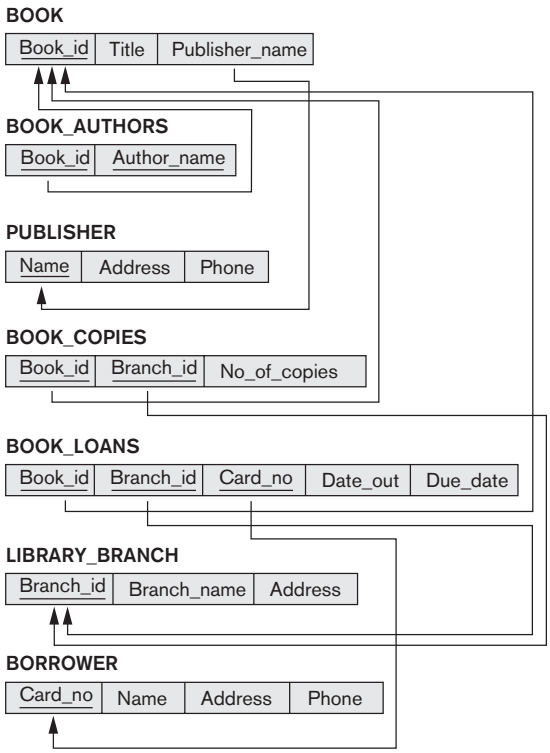
Pname	Pnumber	Plocation	Dnum
ProductX	1	Bellaire	5
ProductY	2	Sugarland	5
ProductZ	3	Houston	5
Computerization	10	Stafford	4
Reorganization	20	Houston	1
Newbenefits	30	Stafford	4

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

Question 2: ..... (23 marks)

Consider the relational database schema for the LIBRARY database. The database is used to keep track of books, borrowers, and book loans. Referential integrity constraints are shown as directed arcs in the figure. Answer the questions which follow.



2.1 Write Relational Algebra expressions to determine:

a) The names the borrowers who took books out on 28 February 2018. You may assume a date is in the form dd/mm/yyyy. (2)

b) The total number of books per library branch. (2)

2.2 Write Domain Relational Calculus expressions to determine:

a) The address of branch(es) with the name "Brooklyn". (2)

b) A list of all book titles and their authors. (2)

2.3 Write Tuple Relational Calculus expressions to determine:

a) The due date for all books borrowed by John Sithole. (2)

b) The name of the publisher(s) of a book titled "Great Expectations". (2)

2.4 Write SQL expressions to:

a) Insert a new borrower, (328820001, 'Marten Fisher', '123 Fake St, Springfield', 406 582 2400), in the database. (2)

b) Update the database to increase the number of copies for the book `Here Comes a Candle` by one in the Bozeman branch. (3)

c) Delete a borrower with Card_no 5 if they have no books on loan. (3)

d) List the titles of all the books by "Jane Austen". (3)

Question 3: 3 ..... (0 marks)

Consider the following database schema for a company:

- **Employee**(*EmployeeID*, *Name*, *ManagerID*)

Where:

- *EmployeeID*: Unique identifier for each employee
- *Name*: Name of the employee
- *ManagerID*: ID of the employee's manager (referencing *EmployeeID*)

Table 1: Employee

EmployeeID	**Name**	**ManagerID**
1	Alice	NULL
2	Bob	1
3	Charlie	1
4	Dave	2
5	Eve	2
6	Frank	3

Write a relational algebra expression to retrieve all employees who are either directly or indirectly

managed by Alice (EmployeeID = 1). Use recursive closure operations and Union in relational algebra to find all subordinates of Alice.