

EMPLOYEE									
FNAME	MINIT	LNAME	<u>SSN</u>	BDATE	ADDRESS	SEX	SALARY	SUPERSSN	DNO

DEPARTMENT			
DNAME	<u>DNUMBER</u>	MGRSSN	MGRSTARTDATE

DEPT_LOCATIONS	
<u>DNUMBER</u>	<u>DLOCATION</u>

PROJECT			
PNAME	<u>PNUMBER</u>	PLOCATION	DNUM

WORKS_ON		
<u>ESSN</u>	<u>PNO</u>	HOURS

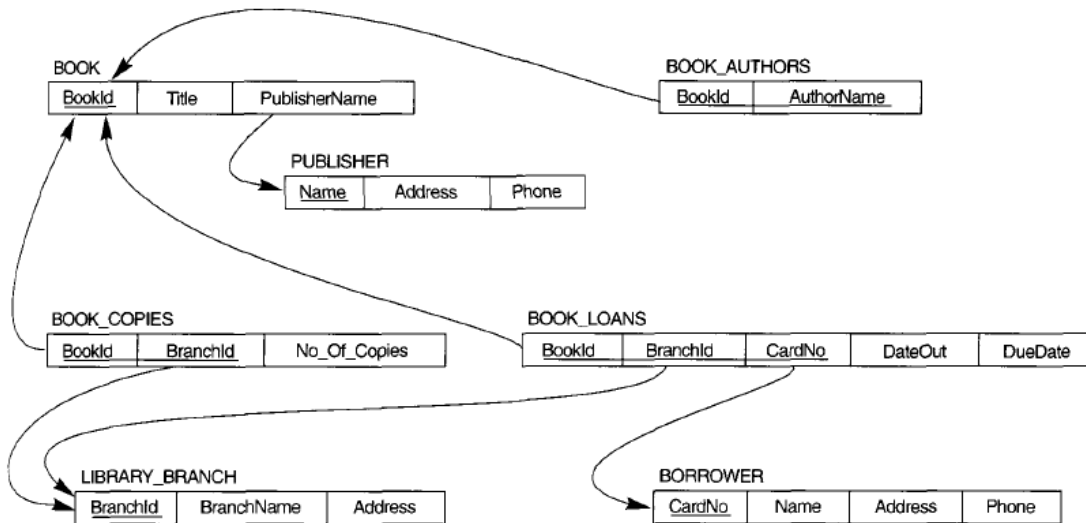
  

DEPENDENT				
<u>ESSN</u>	<u>DEPENDENT_NAME</u>	SEX	BDATE	RELATIONSHIP

1. Consider a COMPANY relational database schema shown above, which is used to keep track of employees, departments, projects under departments, the dependents of the employees, employees working on projects.

Write down Relational Algebra statements for the following queries:

- a) List the names of all employees who have a dependent with the same first name as themselves.
- b) List the names of all employees with two or more dependents
- c) Retrieve the names of employees who have no dependents
- d) List the names of managers who have at least one dependent.
- e) Find the names of all employees who are directly supervised by 'Franklin Wong'.
- f) Retrieve the names of all employees who do not work on any project.
- g) For each department, retrieve the department name and the average salary of all employees working in that department.
- h) Retrieve the average salary of all female employees.
- i) Find the names and addresses of all employees who work on at least one project located in Houston but whose department has no location in Houston.
- j) List the last names of all department managers who have no dependents.



2. Consider the LIBRARY relational database schema shown above, which is used to keep track of books, borrowers, and book loans. Referential integrity constraints are shown as directed arcs.

Write down relational expressions (relational algebra and relational tuple calculus) for the following queries:

- How many copies of the book titled *The Lost Tribe* are owned by the library branch whose name is 'Sharpstown'?
- How many copies of the book titled *The Lost Tribe* are owned by each library branch?
- Retrieve the names of all borrowers who do not have any books checked out.
- For each book that is loaned out from the 'Sharpstown' branch and whose DueDate is today, retrieve the book title, the borrower's name, and the borrower's address.
- For each library branch, retrieve the branch name and the total number of books loaned out from that branch.
- Retrieve the names, addresses, and number of books checked out for all borrowers who have more than five books checked out.
- For each book authored (or coauthored) by 'Stephen King,' retrieve the title and the number of copies owned by the library branch whose name is 'Central.'

Table T1			Table T2		
P	Q	R	A	B	C
10	a	5	10	b	6
15	b	8	25	c	3
25	a	6	10	b	5

3. Consider the two tables T1 and T2 shown in figure above. Show the results of the following operations:
  - i) T1 JOIN ON T1.P= T2.A T2
  - ii) T1 JOIN ON T1.Q = T2.B T2
  - iii) T1 LEFT JOIN ON T1 .P = T2.A T2
  - iv) T1 RIGHT JOIN ON T1 .Q=T2.B T2
  - v) T1 U T2
  - vi) T1 JOIN ON (T1.P = T2.A AND T1.R = T2.C) T2
4. Show how you may specify the following relational algebra operations in both tuple and domain relational calculus.
  - a.  $\sigma_{A=C}(R(A, B, C))$
  - b.  $\pi_{\langle A, B \rangle}(R(A, B, C))$
  - c.  $R(A, B, C) * S(C, D, E)$
  - d.  $R(A, B, C) \cup S(A, B, C)$
  - e.  $R(A, B, C) \cap S(A, B, C)$
  - f.  $R(A, B, C) - S(A, B, C)$
  - g.  $R(A, B, C) \times S(D, E, F)$
  - h.  $R(A, B) \div S(A)$