Ex. 6.16 (a, b, d, e, f, g, i, j)

Specify the following queries on the COMPANY relational database schema shown in Figure 5.5, using the relational operators discussed in this chapter. Also show the result of each query as it would apply to the database state in Figure 3.6.

a. Retrieve the names of all employees in department 5 who work more than 10 hours per week on the ProductX project.
b. List the names of all employees who have a dependent with the same first name as themselves.
d. For each project, list the project name and the total hours per week (by all employees) spent on that project.
e. Retrieve the names of all employees who work on every project.
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.
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.

SOLUTION

Symbols used to write a relational algebra query

σ → SELECT

π → PROJECT

$\bowtie$ → EQUI JOIN

$*$ → NATURAL JOIN

$\mathcal{J}$ → FUNATION

$\div$ → DIVISION

$-$ → SET DIFFERENCE

a) Names of all employees in department 5 who work on the project ProductX for more than 10 hrs/wk

$R1 \leftarrow (\sigma_{PNAME = \text{'ProductX'}}(PROJECT))$

Details of the project whose PNAME is 'ProductX'

Checks table WORKS_ON for PNO = 1

$R2 \leftarrow (R1) \bowtie_{PNUMBER = PNO} (WORKS\_ON)$

$R3 \leftarrow (EMPLOYEE) *_{SSN = ESSN} (\sigma_{HOURS>10}(R2))$

Gives EMPLOYEE details based on the SSN number which is same as ESSN no. of result R2

$Result \leftarrow \pi_{FNAME, LNAME}(\sigma_{DNO=5}(R3))$

Displays only FNAME and LNAME of output obtained from R3

Result of the query:

LNAME	FNAME
Smith	John
English	Joyce

b) Names of employee whose first name and dependent first name is same.

$R1 \leftarrow (\text{EMPLOYEE}) \bowtie_{(\text{SSN} = \text{ESSN}) \text{ AND } (\text{FNAME} = \text{DEPENDENT\_NAME})} (\text{DEPENDENT})$

$\text{Result} \leftarrow \pi_{\text{FNAME, LNAME}} (R1)$

Retrieves details of employees whose SSN of EMPLOYEE table is same as SSN of DEPENDENT table and whose FNAME of EMPLOYEE table is the same as DEPENDENT_NAME of DEPENDENT table

Result of the query : EMPTY

d) Display project name and total hrs/wk spent on it.

$R_2 \leftarrow (PNO, TOT\_HRS) \leftarrow PNO\ \mathcal{F}\ SUM\ HOURS\ (WORKS\_ON)$

$Result \leftarrow \pi_{FNAME, TOT\_HRS}\left((R1) \bowtie_{PNO = PNUMBER} (PROJECT)\right)$

Gives PNO and sum of hours from WORKS_ON table

Gives PNAME and TOT_HRS by performing a EQUIJOIN b/w WORKS_ON table and PROJECT table.

Performed by matching PNO of WORKS_ON table with PNUMBER of PROJECT table

Result of the query:

PNAME	TOT_HRS
Product X	32.5
Product Y	37.5
Product Z	50.0
Computerization	55.0
Reorganization	25.0
New Benefits	35.0

e) Names of the employees who work on every project

$R1 \leftarrow \pi_{PNO, SSN}(WORKS\_ON)$

Output PNO & SSN from WORKS_ON table

$R2 \leftarrow \pi_{PNUMBER}(PROJECT)$

Output PNUMBER from PROJECT table

$R3 \leftarrow \pi_{FNAME, LNAME}(R1 \div R2)$

Output FNAME & LNAME after performing $R1 \div R2$

$Result \leftarrow \pi_{FNAME, LNAME}(EMPLOYEE * R3)$

Output FNAME and LNAME after performing natural join on EMPLOYEE & R3

Result of the query:

FNAME	LNAME

f) Names of employees who do not work on any project

$R1 \leftarrow \pi_{SSN}(EMPLOYEE)$ → SSN of all employees from EMPLOYEE table

$R2(SSN) \leftarrow \pi_{ESSN}(WORKS\_ON)$ → ESSN from WORKS_ON table

$R3 \leftarrow R1 - R2$ → Difference of result from R1 & R2

$Result \leftarrow \pi_{FNAME, LNAME}(EMPLOYEE * R3)$ → Performs natural join on EMPLOYEE & R3

Result

FNAME	LNAME

8)

Display DEPARTMENT name and DEPARTMENT's average salary

$R1 \left(DNUMBER, AVG\text{-}SAL\right) \leftarrow {}_{DNO}\mathcal{F}_{AVG\ SALARY}\left(EMPLOYEE\right)$

$Result \leftarrow \pi_{DNUMBER, AVG\_SAL}\left(R1 * DEPARTMENT\right)$

Avg salary of each department from EMPLOYEE table

Output Avg. salary of each department after performing the natural join of R1 & DEPARTMENT

Results :

DNUMBER	AVG_SAL
Research	33250
Administrative	31000
Headquarters	55000

i) Display names and addresses of employees

$$R1(SSN) \leftarrow \pi_{ESSN}\left((WORKS\_ON) \bowtie_{PNO=PNUMBER} \left(\sigma_{PLOCATION='HOUSTON'}(PROJECT)\right)\right)$$

$$R2 \leftarrow \pi_{DNUMBER}(DEPARTMENT) - \pi_{DNUMBER}\left(\sigma_{PLOCATION='HOUSTON'}(DEPARTMENT)\right)$$

$$R3 \leftarrow \pi_{SSN}\left((EMPLOYEE) \bowtie_{DNO=DNUMBER} (R2)\right)$$

$$R4 \leftarrow R1 - R3$$

$$RESULT \leftarrow \pi_{FNAME, LNAME, ADDRESS}(EMPLOYEE * R4)$$

RESULT :

FNAME	LNAME	ADDRESS
Jennifer	Wallace	291 Berry, Bellaire, TX

j)

Display last names of managers

$R1(SSN) \leftarrow \pi_{MGRSSN}(DEPARTMENT)$

$R2(SSN) \leftarrow \pi_{ESSN}(DEPENDENT)$

$R3 \leftarrow R1 - R2$

$Result \leftarrow \pi_{FNAME, LNAME}(EMPLOYEE * R3)$

Result

FNAME	LNAME
James	Borg.