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TCSS445, Databases
Relational Algebra Homework

1.) Specify the following queries on the COMPANY relational database schema shown the in Figure above, using relational algebra in linear notation. Also show the result of each query as it would apply to the database state of figures above. Show the tree notation for the first two queries.

(a)Retrieve the names of employees in department 4 who work at least 10 hours per week on the 'Computerization' project.

$$R(Fnm, Mint, Lnm, Ssn, Bdt, Adrs, Sx, Slry, Sprssn, Dno, Essn, Pno, Hrs)$$
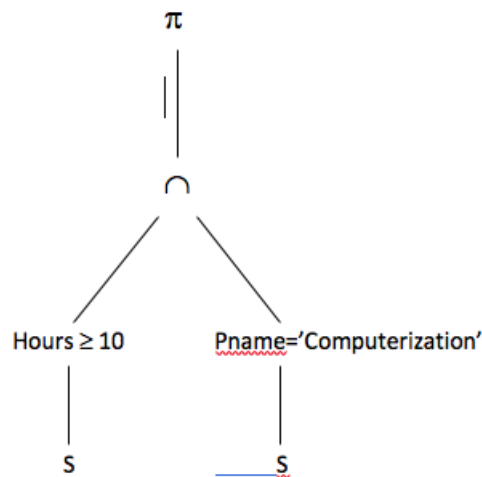$$:= \; EMPLOYEE \bowtie_{Ssn=Essn} WORKS\_ON$$

$$S(Fnm, Mint, Lnm, Ssn, Bdt, Adrs, Sx, Slry, Sprssn, Dno, Essn, Pno, Hrs, Pname,$$
$$Pnumber, Plocation, Dnum) \; := R \bowtie_{Pno=Pnumber} PROJECT$$
$$\pi_{Fname,Minit,Lname}(\sigma_{hours>=10 \; AND \; Pname='Computerization' \; AND \; Dno=4}(S))$$

result :

Fname	Minit	Lname
▶ Alicia	J	Zelaya
Ahmad	V	Jabbar

*The resulting tree notation looks something like this :*

(b)List the names of employees who have a dependent with the same first name as themselves.

$$R(Fnm, Mint, Lnm, Ssn, Bdt, Adrs, Sx, Slry, Sprssn, Dno, Essn, Dependent\_name, Sex,$$

$$Bdate, Relation) := EMPLOYEE \bowtie_{Ssn=Essn} DEPENDENT$$

$$\pi_{Fname,Minit,Lname}(\sigma_{Fname=Dependent_name}(R))$$

Based on the current database, this query returned no results.
The tree notation for this query is as follows:

$$\pi_{Fname,Minit,Lname}$$

|

$$\sigma_{Fname=Dependent\_name}$$

|

R
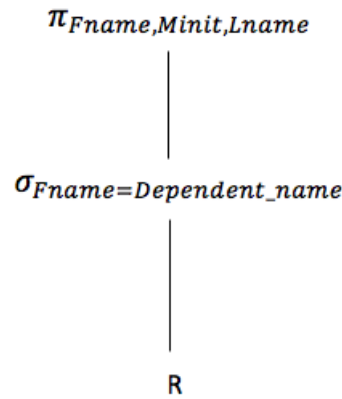
(c)Find the names of employees that are directly supervised by 'James Borg'.

$$R := \pi_{Ssn}(\sigma_{Fname='James' \cap Lnames='Borg}(EMPLOYEE))$$

$$\pi_{Fname,Minit,Lname}(\sigma_{Super\_ssn=R.ssn}(EMPLOYEE))$$

result :

Fname	Minit	Lname
Franklin	T	Wong
Jennifer	S	Wallace

(d)For each project, list the project name and the total hours per week (by all employees) spent on that project.

$$R(Essn, Pno, Hours, Pname, Pnumber, Plocation, Dnum) :=$$

$$WORKS\_ON \bowtie_{Pno=Pnumber} PROJECT$$

2

$$\gamma_{Pname,SUM(hours)}(R)$$

Pname	AVG(hours)
▶ Computerization	18.333333333333332
Newbenefits	18.333333333333332
ProductX	26.25
ProductY	12.5
ProductZ	25
Reorganization	12.5

result :

(e)Retrieve the names of employees who work on every project.

$$T := \pi_{count(Pname)}(PROJECT)$$

$$R(Fnm, Mint, Lnm, Ssn, Bdt, Adrs, Sx, Slry, Sprssn, Dno, Essn, Pno, Hrs)$$
$$:= EMPLOYEE \bowtie_{EMPLOYEE.Ssn=WORKS\_ON.Essn} WORKS\_ON$$

$$S(Fnm, Mint, Lnm, Ssn, Bdt, Adrs, Sx, Slry, Sprssn, Dno, Essn, Pno, Hrs, Pname,$$
$$Pnumber, Plocation, Dnum) := R \bowtie_{WORKS\_ON.Pno=PROJECT.Pnumber} PROJECT$$
$$\pi_{Fname,Minit,Lname}(\sigma_{count(Pno)=T}\gamma_{Essn,count(Pno)}(S))$$

Based on the current database, this query returns no results.

(f)Retrieve the names of employees who work on every project.

$$R(Fnm, Mint, Lnm, Ssn, Bdt, Adrs, Sx, Slry, Sprssn, Dno, Essn, Pno, Hrs)$$
$$:= EMPLOYEE \bowtie_{EMPLOYEE.Ssn=WORKS\_ON.Essn} WORKS\_ON$$

$$S(Fnm, Mint, Lnm, Ssn, Bdt, Adrs, Sx, Slry, Sprssn, Dno, Essn, Pno, Hrs, Pname,$$
$$Pnumber, Plocation, Dnum) := R \bowtie_{WORKS\_ON.Pno=PROJECT.Pnumber} PROJECT$$
$$\pi_{Fname,Minit,Lname}(\sigma_{count(Pno)=0}\gamma_{Essn,count(Pno)}(S))$$

Based on the current database, this query returns no results.

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(g)For each department, retrieve the department name, and the average salary of employees working in that department.

$$R(Fnm, Mint, Lnm, Ssn, Bdt, Adrs, Sx, Slry, Sprssn, Dno, Dnm, Dnum,$$

$$Mgr\_ssn, Mgr\_strt\_dt) := EMPLOYEE \bowtie_{Dno=Dnumber} DEPARTMENT$$

$$\gamma_{Dname, AVG(Salary)}(R)$$

Dname	avg(Salary)
▶ Administration	31000.0000
Headquarters	55000.0000
Research	33444.4444

$result:$

(h)Retrieve each the average salary of all female employees.

$$\pi_{avg(Salary)}(\sigma_{Sex='F'}(EMPLOYEE))$$

(i) Find the names and addresses of employees who work on at least one project located in Houston but whose department has no location in Houston.

$$R(Essn, Pno, Hours, Pname, Pnum, Ploc, Dnum) := WORKS\_ON \bowtie_{Pno=Pnumber} PROJECT$$

$$S(Essn) := \pi_{Essn}(\sigma_{Plocation='Houston'}(R))$$

$$T(Dnum) := \pi_{Dnumber}(\sigma_{Dlocation='Houston'}(DEPT\_LOCATIONS))$$

$$\pi_{Fname, Minit, Lname, Address}(\sigma_{Ssn=S \ AND \ Dno \neq T}(EMPLOYEE))$$

Fname	Minit	Lname	Address
▶ Jennifer	S	Wallace	291 Berry, Bellaire, TX

$result$

(j)Retrieve the last names of department managers who have no dependents.

$$R(Mgr\_ssn) := \pi_{Mgr\_ssn}(DEPARTMENT)$$

$$S(Essn) := \pi_{Essn}(DEPENDENT)$$

$$\pi_{Lname}(\sigma_{Ssn=R \ AND \ Ssn\neq S})$$

Lname
Borg

result :

2. Consider the two tables T1 and T2 shown in Figure. Show the results of the following operations.

TABLE T1

P	Q	R
10	a	5
15	b	8
25	a	6

TABLE T2

A	B	C
10	b	6
25	c	3
10	b	5

a. T1 ⋈$_{T1.P = T2.A}$ T2
b. T1 ⋈$_{T1.Q = T2.B}$ T2
c. T1 ⟕ $_{T1.P = T2.A}$ T2 (⟕ is Left Outer Join)
d. T1 ⟖$_{T1.Q = T2.B}$ T2 (⟖ is Right Outer Join)
e. T1 ⟗ T2 (⟗ is Full Outer Join)

a.

P	Q	R	A	B	C
10	a	5	10	b	6
25	a	6	25	c	3
10	a	5	10	b	5

b.

P	Q	R	A	B	C
15	b	8	10	b	6
15	b	8	10	b	5

c.

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

5

d.

P	Q	R	A	B	C
15	b	8	10	b	6
15	b	8	10	b	5
NULL	NULL	NULL	25	c	3

e.

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