# Assignment 4

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October 7, 2020

## RA Expression for the Queries

### Question 1

$$\pi_{pid,name}(p \bowtie w \bowtie (\pi_{cname}(\sigma_{city=\textbf{Bloomington}}(s1)))) \cap \\ \pi_{p.pid,p.name}(p_1 \bowtie_{p.pid=pid1} K \bowtie_{pid2=s.pid} (\pi_{pid}(\sigma_{city=\textbf{Chicago}}(s))))$$

### Question 2

$$\texttt{jobSkill} - \pi_{skill}(\sigma_{cname=\textbf{Yahoo} \vee cname=\textbf{Netflix}}(personskill \bowtie worksfor))$$

### Question 3

$$\texttt{E} = \pi_{pid,cname,skill}(S \bowtie W)$$

$$\pi_{E_1.cname}(E_1 \bowtie_{E_1.skill=E_2.skill \wedge E_1.pid \neq E_2.pid \wedge E_1.cname=E_2.cname} E_2)$$

### Question 4

$$\texttt{googlePeople} = \pi_{pid}(\sigma_{cname=\textbf{Google}}W)$$
$$\texttt{amazonProgramming} = \pi_{pid}(\sigma_{cname=\textbf{Amazon}}W) \cap \pi_{pid}(\sigma_{skill=\textbf{Programming}}S)$$

$$\pi_{P.pid,P.name}(P \bowtie_{K.pid1=P.pid} K \bowtie_{K.pid2=googlePeople.pid} googlePeople) - \\ \pi_{P.pid,P.name}(P \bowtie_{K.pid1=P.pid} K \bowtie_{K.pid2=amazonProgramming.pid} amazonProgramming)$$

### Question 5

$$\texttt{ibm} = \pi_{pid,name,salary}(\sigma_{cname=\textbf{IBM}}(P \bowtie W))$$
$$\texttt{ibmDatabase} = \pi_{ibm.pid,ibm.name,ibm.salary}(\sigma_{S.skill=\textbf{Databases}}(ibm \bowtie S))$$

$$\pi_{pid,name}(ibm) - \\ \pi_{ibm.pid,ibm.name}(ibm \bowtie_{ibm.pid \neq ibmDatabase.pid \wedge ibm.salary <= ibmDatabase.salary} ibmDatabase)$$

## Question 6

$\texttt{salaryAbove55k} = \pi_{pid2}(\sigma_{salary>55000}(W)))$
$\texttt{knowsPeople} = \pi_{pid1,name,pid2}(P \bowtie_{P.pid=K.pid1} K)$

$\pi_{pid,name}(P) - \pi_{pid1,name}(knowsPeople \bowtie salaryAbove55k)$

## Question 7

$\texttt{netflixWorkers} = \pi_{pid2}(\sigma_{birthyear>1985}P) \cap \pi_{pid2}(\sigma_{cname=\textbf{Netflix} \wedge salary>=55000}W)$
$\texttt{allPeople} = \pi_{pid,name}(P)$
$\texttt{knownPairs} = \pi_{pid1,name,pid2}(allPeople \bowtie_{(} pid = pid1)K)$

$\pi_{pid,name}(allPeople) - (\pi_{pid,name}(allPeople \times netflixWorkers - knownPairs))$

## Question 8

$\texttt{salaryLessThan55k} = \pi_{pid2}(\sigma_{salary<55000}(W)))$
$\texttt{E} = \pi_{cname,pid}(W - salaryLessThan55k \bowtie W_1)$

$\pi_{cname}(C - E)$

## Question 9

$\texttt{E} = \pi_{pid,skill1,skill2}((S \times J) - (S_1 \bowtie_{(} S_1.pid = S_2.pid)S_2))$

$\pi_{skill1,skill2}((J_1 \times J_2) - (E))$

## Question 10

$\texttt{people} = \pi_{pid}(W)$
$\texttt{companyNames} = \pi_{cname}(C)$
$\texttt{pairs} = \pi_{pid1,name,pid2}(allPeople \bowtie_{(} pid = pid2)K)$

$people \times companyNames \times J - \pi_{pid1,cname,skill}(pairs \times J_1 - \pi_{pid1,cname,pid2,skill}(pairs \bowtie_{pid2=pid} S))$

## Question 11

$\texttt{companyNames} = \pi_{cname}(C)$
$\texttt{E} = \pi_{cname1,cname2,salary}((W \times companyNames) - (W_1 \bowtie_{W_2.salary \geq W_1.salary} W_2)$

$\pi_{cname1,cname2}((companyNames_1 \times companyNames_2) - E)$

## Question 12.a

$$(E_1 - (E_1 \times \pi_{()}(F))) \cup (E_2 \times \pi_{()}(F))$$

## Question 12.b

The SQL Query for the above RA can be written as follows:

```
select e1.*
from   E1 e1
where  not exists (select distinct row() from F)
union
select e2.*
from   E2 e1
where  exists (select distinct row() from F);
```

## Question 13

$(\mathrm{A}_i sEmpty : true - A_i sEmpty : true \times \pi_{()}(A)) \cup (A_i sEmpty : false \times \pi_{()}(A))$

## Question 14

The property of R being transitive can be found out only if

R - $\pi_{R_1.A,R_2.B}(R_1 \bowtie_{R_1.B=R_2.A} R_2) = \emptyset$

This can be expressed in If - Then - Else form as follows

IF R - $\pi_{R_1.A,R_2.B}(R_1 \bowtie_{R_1.B=R_2.A} R_2) = \emptyset$

THEN return(isTransitive:true)

ELSE return(isTransitive:false)

## Question 15.a

$\mathrm{E3} = (\pi_{A,B}(\pi_A(E1) \times \pi_B(E2)))$
$E4 = E3 - \pi_{A,B}(E1 \bowtie E2)$

The final expressions using the above expressions can be written as follows
$\pi_A(E4 - \pi_{A,B}(E4_1 \bowtie_{E4_1.A=E4_2.A \wedge E4_1.B \neq E4_2.B} E4_2))$

## Question 15.b

$\mathrm{E1} = \pi_{pid,skill}((\sigma_{birthyear<1990}(P) \bowtie S)$
$E2 = \pi_{skill}((\sigma_{cname=\mathbf{Amazon}}(W) \bowtie S)$
$E3 = \pi_{pid,skill}(\pi_{pid}(E1) \times \pi_{skill}(E2))$
$E4 = E3 - \pi_{pid,skill}(E1 \bowtie E2)$

The final expressions using the above expressions can be written as follows
$\pi_{pid}(E4 - \pi_{pid,skill}(E4_1 \bowtie_{E4_1.pid=E4_2.pid \wedge E4_1.skill \neq E4_2.skill} E4_2))$