Assignment 2

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Question 6:
Find the pid and name of each person who works for Google and who has a strictly higher salary than some other person who he or she knows and who also works for Google.

$$\pi_{pid,pname}(P \bowtie \pi_{pid}(\sigma_{cname=\textbf{Google}}(W_1)) \bowtie_{W_1.pid=K.pid1} K \bowtie_{K.pid2=W_2.pid \wedge . salary<W_1.salary} (\sigma_{W_2.cname='\textbf{Google}'}(W_2)))$$

Question 7:
Find the cname of each company with headquarter in Bloomington, but not located in Indianapolis, along with the pid, name, and salary of each person who works for that company and who has the next-to-lowest salary at that company.

cnamecuper (CC):

$$\pi_{cname}((\pi_{C.cname}(\sigma_{headquarter=\textbf{Cupertino}}(C)) \bowtie (\sigma_{city\neq\textbf{Indianapolis}}(cL)))$$

notLowest (NL):

$$\pi_{W_1.cname}(W_1 \bowtie_{W_1.cname=W_2.cname \wedge W_2.salary<W_1.salary} W_2)$$

notSecondLowest (NSL):

$$\pi_{NL_1.cname,NL_1.salary}(NL_1 \bowtie_{NL_1.cname=NL_2.cname \wedge NL_1.salary>NL_2.salary} NL_2)$$

secondLowestSalary (SLS):

$$(\pi_{NL.cname,NL.salary}(NL) - \pi_{NSL.cname,NSL.salary}(NSL))$$

Final Answer:

$$\pi_{W.cname,P.pid,P.pname,W.salary}(P \bowtie W \bowtie_{W.cname=SLS.cname \wedge W.salary=SLS.salary} SLS \bowtie_{w.cname=CC.cname} CC)$$

Question 8:
Find each (c; p) pair where c is the cname of a company and p is the pid of a person who works for that company and who is known by all other persons who work for that company.

possibleCombinations (pC):

$$\rho_{cname,pid,pid2}(\pi_{W_1.cname,W_1.pid,W_2.pid}(W_1 \bowtie_{w1.cname=w2.cname \wedge W_1.pid \neq W_2.pid} W_2))$$

knowsSameCompany (KSC):

$$\pi_{W_1.cname,W_1.pid,K.pid2}(W_1 \bowtie_{W_1.pid=K.pid1} K \bowtie_{W_2.pid=K.pid2 \wedge W_1.cname=W_2.cname} W2)$$

excludeCombi (EX):

$$\pi_{PC.cname,PC.pid,PC.pid2}(PC - KSC)$$

Final Answer:

$$\pi_{cname,pid}(\pi_{cname,pid}(W) - \pi_{cname,pid2}(EX))$$

Question 9:
Find each skill that is not a jobskill of any person who works for Yahoo or for Net ix.

skillsyahnet(SYN):

$$\pi_{skill}(pS \bowtie (\sigma_{cname=\textbf{Yahoo} \vee cname=\textbf{Netflix}}(W)))$$

Final Answer:

$$\pi_{skill}(S - SYN)$$

Question 10:
Find the pid and name of each person who manages all-but-one person who works for Google.

googleemployees(GE):

$$\pi_{pid}(\sigma_{W.cname=\textbf{Google}} W)$$

mngrgglempl (MGG):

$$\pi_{hm.mid}(hm \bowtie_{hm.eid=w.pid} (\sigma_{cname=\textbf{Google}}(W)))$$

managerемployer (MG):

$$\pi_{hm.mid,w1.pid}(hm \bowtie_{hm.eid,w.pid} (\sigma_{cname=\textbf{Google}}(W)))$$

combinations (CMB):

$$MGGXGE$$

notManager (NM):

$$\pi_m id(CMB - MG)$$

Final Answer:

$$\pi_{P.pid,P.pname}(\pi_{mid}(MGG - (NM - MGG)) \bowtie_{mid=P.pid} P)$$

Question 11:
Some person has a salary that is strictly lower than that of each of the persons who he or she manages.

Approach: First find the minimum salary of employees under each manager. Then need to show that there exists a manager whose salary is lesser than the minimum salary of the employees under him/her.

employeenonminsalary (EMS):
This view gives all salaries except minimum salary of employees under each manager.

$$\begin{aligned}&\pi_{A.mid,A.salary}(\\&(\rho_{A(mid,salary)}(hm_1 \bowtie_{hm_1.eid=W_1.pid} W_1))\\&\qquad \bowtie_{A.mid=B.mid \wedge A.salary>B.salary}\\&(\rho_{B(mid,salary)}(hm_2 \bowtie_{hm_2.eid=W_2.pid} W_2)))\end{aligned}$$

managerminsalary (MMS):
This view is to get minimum salary of employees under each manager which is generated by excluding records from EMS.

$$\pi_{mid,salary}((hm \bowtie_{hm.eid=W.pid} W) - EMS)$$

Final Answer : Now, if there is a manager who is having lower than all his employees, then his salary should be lesser than minimum salary of employees, which we check here.

$$\pi_{hm.mid}(hm \bowtie_{hm.mid=W.pid} W \bowtie_{hm.mid=MMS.mid \wedge W.salary<MMS.salary} MMS) \neq \phi$$

Question 12:
No person knows all persons who work for Google.

Approach: First I will try to get possible combinations of everyone knowing google employees. After removing tuples of knows (K) from those combinations, if we will still have all pids same as in Person, that means no person knows all google employees.

google (g): To find the pids of Google employees.

$$\pi_{pid}(\sigma_{W.cname=\textbf{Google}}(W))$$

combinations (CMB): To find the possible combinations of each Person with google employees.

$$\rho_{pid1,pid2}(\sigma_{P.pid\neq g.pid}(\pi_{pid}(P)Xg))$$

Final Answer: After removing knows (K) combinations from CMB, we should still have all the pids same as in Person.

$$\pi_{pid}(P) \subseteq \pi_{pid1}(CMB - K)$$

Question 13:
Each person knows all of his or her managers.

Approach: hasManager has combinations of employees, managers. If each employee should know all of his managers, then all those combinations should be in Knows (K) table.

$$(\pi_{eid,mid}(hm) - \pi_{pid1,pid2}(K)) = \phi$$
$$or$$
$$\pi_{eid,mid}(hm) \subseteq K$$

Question 14:
Each employee and his or her managers work for the same company.

Approach: Tried to create a relation with both manager and employee company in each tuple. Then filtering for the rows where both companies are different which should be empty according to the question.

$$(\sigma_{W_1.cname\neq W_2.cname}(hm \bowtie_{hm.mid=W_1.pid} W_1 \bowtie_{hm.eid=W_2.pid} W_2)) = \phi$$

Question 15:
The attribute pid is a primary key of the Person relation.

Approach: The idea is to check pid is unique. If the join is not causing duplicates, then we can confirm that pid is unique. So the relation of the join should be subset of the projection of the same.

$$(P_1 \bowtie_{P_1.pid=P_2.pid} P_2) \subseteq (\pi_{P_1.*,P_2.*}(P_1 \bowtie_{P_1.pid=P_2.pid} P_2))$$