

B561 Advanced Database Concepts
Assignment 2
Fall 2022

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Q4) Reconsider Problem 1. Find each triple (c, p, s) where c is the cname of a company, p is the pid of a person who earns the lowest salary at that company and knows at least someone who has Operating Systems skill, and s is the salary of p.

- (a) Formulate this query in Relational Algebra in standard notation. (4.5 points)

$$\pi_{wf.cname, wf.pid, wf.salary}(\sigma_{ps.skill='OperatingSystems'}(worksFor\ wf \bowtie_{wf.pid=k.pid1}\ knows\ k \bowtie_{ps.pid=k.pid2}\ personSkill\ ps))$$

—

$$\pi_{wf.cname, wf.pid, wf.salary}(\sigma_{ps.skill='OperatingSystems'}(worksFor\ wf \bowtie_{wf.pid=k.pid1}\ knows\ k \bowtie_{ps.pid=k.pid2}\ personSkill\ ps \bowtie_{wf.cname=wf2.cname \wedge wf2.salary < wf.salary}\ worksFor\ wf2\))$$

Q5) Reconsider Problem 2. Find the name, salary and city of each person who (a) lives in a city where no one has the Networks skill and (b) earns the highest salary in his/her company.

- (b) Formulate this query in Relational Algebra in standard notation. (4.5 points)

$$\pi_{p.pname, wf.salary, p.city}(person\ p \bowtie worksFor\ wf)$$

—

$$\pi_{p.pname, wf.salary, p.city} \left(\sigma_{ps.skill='Networks'}(person\ p \bowtie_{p.pid=wf.pid}\ worksFor\ wf \bowtie_{p1.pid=p.pid \wedge p1.city=p.city}\ person\ p1 \bowtie_{p.pid=ps.pid}\ personSkill\ ps) \right)$$

—

$$\pi_{p.pname, wf.salary, p.city} \left(\sigma_{wf.cname=wf2.cname \wedge wf.salary < wf2.salary}(person\ p \bowtie worksFor\ wf \bowtie worksFor\ wf2) \right)$$

Q6) Reconsider Problem 3. Find each pair $(c1, c2)$ of cnames of different companies such that no employee of $c1$ and no employee of $c2$ live in Chicago.

- (c) Formulate this query in Relational Algebra in standard notation. (4.5 points)

$$\pi_{c1.cname, c2.cname} (company\ c1 \bowtie_{c1.cname <> c2.cname} company\ c2)$$

-

$$\pi_{c1.cname, c2.cname} (\sigma_{p.city = 'Chicago'} (company\ c1 \bowtie_{c1.cname <> c2.cname} company\ c2 \bowtie_{wf.cname = c1.cname} worksFor\ wf \bowtie_{person\ p}))$$

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$$\pi_{c1.cname, c2.cname} (\sigma_{p1.city = 'Chicago'} (company\ c1 \bowtie_{c1.cname <> c2.cname} company\ c2 \bowtie_{wf1.cname = c2.cname} worksFor\ wf1 \bowtie_{person\ p1}))$$

Q7)

Each manager knows all of his/her employees. (6 points)

$$\pi_{eid,mid} (hasManager) \subseteq \pi_{pid1,pid2} (Knows)$$

Q8)

No person who works at Amazon knows at-most 2 people. (6 points)

- Persons who work for Amazon

$$E1 = \pi_{wf.pid} (\sigma_{wf.cname='Amazon'}(worksFor wf))$$

- Person who knows at least 3 people

$$E2 = \pi_{k.pid1} (\sigma_{k.pid1=k1.pid1 \wedge k.pid2 \neq k1.pid2} (k \bowtie (\sigma_{k.pid1=k2.pid1 \wedge k.pid2 \neq k2.pid2 \wedge k1.pid2 \neq k2.pid2} (k1 \bowtie k2))))$$

Constraint

$$E1 \not\subseteq E2$$

Q9)

Some person who works for a company headquartered at Cupertino has a salary less than person with no skills. (6 points)
(Assumption: Only 1 person with no skills)

- Persons working for companies headquartered in Cupertino along with their salaries.

$$E1 = \pi_{wf.pid, wf.salary} (\sigma_{c.headquarter='Cupertino'}(worksFor wf \bowtie_{wf.cname=c.cname} company c))$$

- Person with no skills

$$E2 = \pi_{pid} (person p) - \pi_{ps.pid} (personSkill ps)$$

- the salary of the person with no skills

$$E3 = \pi_{wf.salary}(E2 \bowtie worksFor wf)$$

Constraint

$$\pi_{E1.pid} \left(\sigma_{E1.salary < E3}(E1) \right) = \emptyset$$

