Relational Algebra Solutions

Q1:

$$\pi_{\text{FIRST\_NAME, LAST\_NAME, SALARY}}(\text{Employee}) - _{\text{SALARY} \lnot} (\pi_{\text{SALARY}}(\sigma_{\text{LAST\_NAME='Bull'}}(\text{Employee})))$$

Q2:

$$\pi_{\text{FIRST\_NAME, LAST\_NAME}}(\sigma_{\text{DEPARTMENT\_NAME='IT'}} (\text{Employee} \bowtie_{\text{Employee.DEPARTMENT\_ID = Departments.DEPARTMENT\_ID}} \mathit{Departments}))$$

Q3:

$$\pi_{\text{FIRST\_NAME, LAST\_NAME}}(\sigma_{\text{MANAGER\_ID} \neq \text{NULL} \wedge \text{COUNTRY\_ID='US'}} (\mathit{Employee} \bowtie_{\text{Employee.DEPARTMENT\_ID = Departments.DEPARTMENT\_ID}} \mathit{Departments} \bowtie_{\text{Departments.LOCATION\_ID = Locations.LOCATION\_ID}} \mathit{Locations}))$$

Q4:

$$\pi_{\text{EMPLOYEE\_ID, FIRST\_NAME, LAST\_NAME}}(\text{Employee} - _{\text{SALARY} \lnot} (\pi_{\text{AVG(SALARY)}}(\text{Employee})))$$

Q5:

$$\pi_{\text{FIRST\_NAME, LAST\_NAME, EMPLOYEE\_ID, JOB\_ID}}(\sigma_{\text{CITY='Toronto'}} (\mathit{Employee} \bowtie_{\text{Employee.DEPARTMENT\_ID = Departments.DEPARTMENT\_ID}} \mathit{Departments} \bowtie_{\text{Departments.LOCATION\_ID = Locations.LOCATION\_ID}} \mathit{Locations}))$$

Q6:

$$\pi_{\text{FIRST\_NAME, LAST\_NAME, EMPLOYEE\_ID, SALARY}}(\sigma_{\text{MANAGER\_ID}=(\pi_{\text{EMPLOYEE\_ID}} (\sigma_{\text{FIRST\_NAME='Payam'}}(\text{Employee})))}(\text{Employee}))$$

Q7:

$$\pi_{\text{DEPARTMENT\_NAME}}(\text{Departments} \cap \text{Employee})$$

Q8:

$$\text{Employee} - _{\text{DEPARTMENT\_ID NOT IN}}(\pi_{\text{DEPARTMENT\_ID}}(\sigma_{\text{MANAGER\_ID} \geq 100 \wedge \text{MANAGER\_ID} \leq 200}(\text{Departments})))$$

Q9:

$$\pi_{\text{FIRST\_NAME, LAST\_NAME, DEPARTMENT\_ID}}(\sigma_{\text{SALARY=MIN(SALARY)}}(\text{Employee}))$$

Q10:

$\pi_{\text{FIRST\_NAME, LAST\_NAME}}(\sigma_{\text{EMPLOYEE\_ID}\in(\pi_{\text{MANAGER\_ID}}(\text{Departments}))}(\text{Employee}))$

Q11:

$\pi_{\text{EMPLOYEE\_ID, FIRST\_NAME, LAST\_NAME, JOB\_ID}}(\sigma_{\text{SALARY}<(\pi_{\text{SALARY}}(\sigma_{\text{JOB\_ID='MK\_MAN'}}(\text{Employee})))}(\text{Employee}))$

Q12:

$\pi_{\text{FIRST\_NAME, LAST\_NAME, SALARY}}(\sigma_{\text{SALARY}>\text{AVG(SALARY)}}(\text{Employee}))$

Q13:

$\pi_{\text{FIRST\_NAME, LAST\_NAME, SALARY}}(\sigma_{\text{SALARY}=(\pi_{\text{MIN\_SALARY}}(\sigma_{\text{Employee.JOB\_ID = Jobs.JOB\_ID}}(\text{Employee})\times\text{Jobs}))}(\text{Employ}$

Q14:

$\pi_{\text{FIRST\_NAME, LAST\_NAME, SALARY}}(\sigma_{\text{SALARY}>\text{AVG(SALARY)}}(Employee \bowtie_{\text{Employee.DEPARTMENT\_ID = Departmer}}$

Q15:

$\pi_{\text{FIRST\_NAME, LAST\_NAME, SALARY}}(\sigma_{\text{SALARY}>(\pi_{\text{SALARY}}(\sigma_{\text{LAST\_NAME='Bell'}}(\text{Employee})))}(\text{Employee}))$

Q16:

$\pi_{\text{FIRST\_NAME, LAST\_NAME, SALARY}}(\sigma_{\text{SALARY}=\text{MIN(SALARY)}}(\text{Employee}))$

Q17:

$\pi_{\text{FIRST\_NAME, LAST\_NAME, SALARY}}(\sigma_{\text{SALARY}>\text{AVG(SALARY)}}(\text{Employee}))$

Q18:

OFFSET 2(Employee) LIMIT 1