CS 353 Spring 2024
Homework 1 Solutions

Q.1 [88 pts, 8 pts each]

(a)

$\prod_{\text{e-id, e-name}} (\sigma_{\text{e-dept = "Construction"}} (\text{employee}) \bowtie \text{works} \bowtie \sigma_{\text{p-city = "Ankara"} \wedge \text{budget > 1,000,000}} (\text{project}))$

(b)

$\prod_{\text{e-id, e-name}} (\sigma_{\text{e-city = p-city "} \wedge \text{rank > 5}} (\text{employee} \bowtie \text{works} \bowtie \text{project}))$

(c)

$\prod_{\text{e-id, e-name, p-id}} (\sigma_{\text{e-dept = "Construction"}} (\text{employee}) \bowtie \text{works}) \div \prod_{\text{p-id}} (_{\text{p-city = "Istanbul"}} (\text{project}))$

(d)

$\prod_{\text{e-id, e-name}} ((\sigma_{\text{e-city = "Ankara"}} (\text{employee}) \bowtie \sigma_{\text{duty = "Technician"} \wedge \text{since = 2020}} (\text{works})) \bowtie \sigma_{\text{salary > 100,000}} (\text{paying}))$

(e)

$\prod_{\text{p-id, p-name}} (\sigma_{\text{p-city = "Istanbul"}} (\text{project})) - \prod_{\text{p-id, p-name}} (\sigma_{\text{p-city = "Istanbul"}} (\text{project}) \bowtie \text{works} \bowtie \text{employee} \bowtie \sigma_{\text{salary <= 100,000}} (\text{paying}))$

(f)

$\text{Temp} \leftarrow \mathcal{G}_{\text{max(rank) as rank}} (\text{paying})$

$\prod_{\text{salary}} (\text{Temp} \bowtie \text{paying})$

(g)

$\text{p-city}\ \mathcal{G}_{\text{count(*) as nr-of-projects, sum(budget) as total-budget}} (\text{project})$

(h)

$\text{rank}\ \mathcal{G}_{\text{count(*) as cnt}} (\sigma_{\text{e-city = "Ankara"}} (\text{employee}) \bowtie \text{works} \bowtie \sigma_{\text{budget > 1,000,000}} (\text{project}))$

(i)

$\text{T1} \leftarrow \sigma_{\text{p-city = "Istanbul"}} (\text{project})$

$\text{T2} \leftarrow \sigma_{\text{p-city = "Ankara"}} (\text{project})$

$\prod_{\text{p-id, p-name}} (\sigma_{\text{p-city = "Istanbul"}} (\text{project})) - \prod_{\text{T1.p-id, T1.p-name}} (\sigma_{\text{T1.budget < T2.budget}} (\text{T1 X T2}))$

(j)

$\text{Temp} \leftarrow \text{p-id}\ \mathcal{G}_{\text{sum(salary) as total\_salary}} (\sigma_{\text{p-city = "Ankara"}} (\text{project}) \bowtie \text{works} \bowtie \text{employee} \bowtie \text{paying})$

$\prod_{\text{p-id, p-name}} (\sigma_{\text{budget >= 2*total\_salary}} (\text{project} \bowtie \text{Temp}))$

(k)

$T1 \leftarrow \mathcal{G}_{\max(budget)\ as\ budget}(\sigma_{p\text{-}city = \text{“Ankara”}}(project))$

$T2 \leftarrow \prod_{p\text{-}id}(project \bowtie T1)$

$\prod_{e\text{-}id,\ salary}(T2 \bowtie works \bowtie employee \bowtie paying)$

Q.2 [12 pts]

We can disprove that by providing an example (instance for each of R, S) that shows:
$\prod_{R.A}(R) - \prod_{R.A}(R \cap S) \neq \prod_{R.A}(R) \cap \prod_{R.A}(R - S)$

R

A	**B**
a1	b1
a1	b2

S

A	**B**
a1	b1

$\prod_{R.A}(R) - \prod_{R.A}(R \cap S)$:

A

$\prod_{R.A}(R) \cap \prod_{R.A}(R - S)$:

A
a1