数据库概论作业 1

23.07.27

为了简化表达式, 我在作业中大量使用了拓展的象集运算, 其定义为 $Z_F(R) := \Pi_Z(\sigma_F(R))$.

1

(a)

$$person\text{-}name_{company\text{-}name=\text{"BigBank"}}(works)$$

(b)

$$(person\text{-}name, city)_{company\text{-}name=\text{"BigBank"}}(employee \bowtie works)$$

(c)

$$(person\text{-}name, street, city)_{company\text{-}name=\text{"BigBank"} \wedge salary>10000}(employee \bowtie works)$$

(d)

$$\Pi_{person\text{-}name}(employee \bowtie works \bowtie company)$$

2

(a)

$$\begin{aligned}
temp_1 &\leftarrow \sigma_{company\text{-}name=\text{"First Bank Corporation"}}(works) \\
temp_2 &\leftarrow \Pi_{person\text{-}name, company\text{-}name, salary \leftarrow salary*1.1}(temp_1) \\
temp_3 &\leftarrow works - temp_1 \\
works &\leftarrow temp_2 \cup temp_3
\end{aligned}$$

(b)

$$\begin{aligned}
temp_1 &\leftarrow \Pi_{manager\text{-}name \text{ as } person\text{-}name}(manages) \\
temp_2 &\leftarrow works \bowtie temp_1 \\
temp_3 &\leftarrow works - temp_2 \\
temp_4 &\leftarrow (person\text{-}name, company\text{-}name, salary \leftarrow salary * 1.1)_{salary \le 100000}(temp_2) \\
temp_5 &\leftarrow (person\text{-}name, company\text{-}name, salary \leftarrow salary * 1.03)_{salary > 100000}(temp_2) \\
works &\leftarrow temp_3 \cup temp_4 \cup temp_5
\end{aligned}$$

(c)

$$\begin{aligned}
temp &\leftarrow \sigma_{company\text{-}name=\text{"Small Bank Corporation"}}(works) \\
works &\leftarrow works - temp
\end{aligned}$$

3

(a)

$$title_{dept\_name=\text{"Comp. Sci"} \wedge credits=3}(course))$$

(b)

$$\begin{aligned}
temp &\leftarrow course_id_{name=\text{"Einstein"}}(instructor \bowtie teaches) \\
res &\leftarrow \Pi_{ID}(takes \bowtie temp)
\end{aligned}$$

res 即为所求, 下同.

(c)

$$\max_{salary}(instructor)$$

(d)

$$\begin{aligned} n &\leftarrow \max_{salary}(instructor) \\ res &\leftarrow \sigma_{salary=n}(instructor) \end{aligned}$$

(e)

$$\begin{aligned} temp &\leftarrow \sigma_{year=2021 \wedge semester=\text{"Fall"}}(takes) \\ res &\leftarrow_{sec\_id} \mathcal{G}_{\text{count}-\text{distinct}(ID)}(temp) \end{aligned}$$

(f)

$$\begin{aligned} temp_1 &\leftarrow \sigma_{year=2021 \wedge semester=\text{"Fall"}}(takes) \\ temp_2 &\leftarrow_{sec\_id} \mathcal{G}_{\text{count}-\text{distinct}(ID)}(temp) \\ res &\leftarrow \max_{cnt}(temp_2) \end{aligned}$$

(g)

$$\begin{aligned} temp_1 &\leftarrow \sigma_{year=2021 \wedge semester=\text{"Fall"}}(takes) \\ temp_2 &\leftarrow_{sec\_id} \mathcal{G}_{\text{count}-\text{distinct}(ID)}(temp) \\ temp_3 &\leftarrow_{sec\_id} \mathcal{G}_{\text{count}-\text{distinct}(ID) \text{ as } cnt}(temp_2) \\ n &\leftarrow \max_{cnt}(temp_2) \\ temp_4 &\leftarrow sec\_id_{cnt=n}(temp_3) \\ res &\leftarrow section \bowtie temp_4 \end{aligned}$$

4

(a)

$$\begin{aligned} e &\leftarrow \rho_{e(person\text{-}name,es,ec)}(employee) \\ m &\leftarrow \rho_{m(manager\text{-}name,ms,mc)}(employee) \\ temp &\leftarrow manages \bowtie e \bowtie m \\ res &\leftarrow person\text{-}name_{es=ms \wedge ec=mc}(temp) \end{aligned}$$

(b)

$$\begin{aligned} temp &\leftarrow person\text{-}name_{company\text{-}name=\text{"First Bank Corporation"}}(works) \\ res &\leftarrow \Pi_{person\text{-}name}(employee) - temp \end{aligned}$$

(c)

$$\begin{aligned} n &\leftarrow \max_{salary}(\sigma_{company\text{-}name=\text{"Small Bank Corporation"}}(works)) \\ res &\leftarrow person\text{-}name_{salary>n}(works) \end{aligned}$$

5

(a) $\{t \mid \exists u \in r(u[A] = t[A])\}$.

(b) $\{t \mid t \in r \wedge t[B] = 17\}$.

(c) $\{t \mid \exists u \in r \exists v \in s(u[R] = t[R] \wedge v[S] = t[S])\}$.

(d) $\{t \mid \exists u \in r \exists v \in s(u[C] = v[D] \wedge u[A] = t[A] \wedge v[F] = t[F])\}$.

6

(a) $\{\langle x\rangle \mid \exists(y,z)(\langle x,y,z\rangle \in r_1)\}$.

(b) $\{\langle x,y,z\rangle \mid \langle x,y,z\rangle \in r_1 \wedge y = 17\}$.

(c) $\{\langle x,y,z\rangle \mid \langle x,y,z\rangle \in r_1 \vee \langle x,y,z\rangle \in r_2\}$.

(d) $\{\langle x,y,z\rangle \mid \langle x,y,z\rangle \in r_1 \wedge \langle x,y,z\rangle \in r_2\}$

(e) $\{\langle x,y,z\rangle \mid \langle x,y,z\rangle \in r_1 \wedge \langle x,y,z\rangle \notin r_2\}$.

(f) $\{\langle x,y,z\rangle \mid \exists(u,v)(\langle x,y,u\rangle \in r_1 \wedge \langle v,y,z\rangle \in r_2)\}$.