

COP 4710 Homework 1

Relations:

Student:

snum: integer	sname: string	major: string	level: string	age: integer
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Class:

name: string	meets_at: time	room: string	fid: integer
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Enrolled:

snum: integer	cname: string
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Faculty:

fid: integer	fname: string	deptid: integer
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For queries table names will be:

Students: S

Class: C

Enrolled: E

Faculty: F

Queries:

1. Find the names of all the Juniors (level = JR) who are enrolled in a class taught by I. Teach.

$$\Pi_{S.sname} \left(\sigma_{S.level = JR_1} (S \times E \times C \times F) \right)$$

$$S.snum = E.snum \wedge$$

$$E.cname = C.cname \wedge$$

$$C.fid = F.fid \wedge$$

$$F.name = I_Teach$$

2. Find the age of the oldest student who is either a History major or enrolled in a course taught by I. Teach.

$$\left(\sigma_{\substack{S.major \\ = History \\ \vee \\ F.name \\ = I_Teach}} \left(\sigma_{\substack{S.snum = E.snum \\ E.cname = C.cname \\ C.fid = F.fid}} (S \times E \times C \times F) \right) \right) \downarrow T_1$$

$$\boxed{G_{max}(S.age)(T_1)}$$

3. Find the names of all the classes that either meet in room R128 or have five or more students enrolled.

$$\sigma_{\substack{C.name \\ = E.name}} (C \times E) \rightarrow T_1$$

$$\begin{matrix} C_g \\ T_1.name \end{matrix} \xrightarrow{\substack{cnt_T(T_1) \\ cnt_T(T_1.snum) \\ \rightarrow num}} (T_1) \rightarrow T_2$$

$$\Pi_{T_2.name} \left[\begin{array}{l} \sigma_{\substack{T_2.num \\ \geq 5}} \vee \\ C.room = R128 \end{array} \left(\sigma_{\substack{T_2.name \\ = C.name}} (T_2 \times C) \right) \right]$$

4. Find the names of all students who are enrolled in two classes that meet at the same time.

$$T_1 \leftarrow \sigma_{\begin{matrix} (S \times E \times C) \\ S.snum = E.snum \wedge \\ E.cname = C.name \end{matrix}}$$

$$\rho(T_1) \rightarrow T_2$$

$$\pi_{T_1.name} \left(\sigma_{\begin{matrix} (T_1 \times T_2) \\ T_1.cname \neq T_2.cname \wedge \\ T_1.meets_at = T_2.meets_at \wedge \\ T_1.snum = T_2.snum \end{matrix}} \right)$$

5. Find the names of faculty members who teach in every room in which some class is taught.

$$\sigma_{c.fid = f.fid} (C \times F) \rightarrow T_1$$

$$\pi_{T_1.fname} (T_1 \div (\pi_{c.name}^C))$$

6. Find the names of faculty members for whom the combined enrollment of the courses that they teach is less than five.

$$\begin{aligned} & \sim (C \times E \times F) \rightarrow T_1 \\ & C.name = E.cname \wedge \\ & C.fid = F.fid \end{aligned}$$

$$T_1.fname \rightarrow \text{cnt}(E.snum) \xrightarrow{\rightarrow num} T_2$$

$$\pi_{T_2.fname} (\sim_{T_2.num < 5} T_2)$$

7. Print the level and the average age of students for that level, for each level.

S.level $\left(\begin{array}{c} \text{avg (s.age)} \\ \rightarrow \text{avgAge} \end{array} \right) (S)$

8. Print the level and the average age of students for that level, for all levels except JR.

S.level $\left(\begin{array}{c} \text{avg (s.age)} \\ \rightarrow \text{avgAge} \end{array} \right) (S) \rightarrow T_1$

$\sim T_1.\text{level} \neq \text{JR} (T_1)$

9. For each faculty member that's has taught classes only in room R128, print the faculty member's name and the total number of classes she or he has taught.

$\sim F.\text{fid} = C.\text{fid} (F \times C) \rightarrow T_1$

$T_1.\text{fid} \left(\begin{array}{c} \text{cnt (dist (T_1.room))} \\ \rightarrow \text{roomNum} \end{array} \right) (T_1) \rightarrow T_2$

T_3
 \swarrow
 $a \quad (T_2 \times T_1)$
 $T_2.fid = T_1.fid \wedge$
 $T_2.roomNum = 1 \wedge$
 $T_4.room = R128$

$T_3.name$
 \hookrightarrow
 $(cnt(T_3.name)) (T_3)$
 $\rightarrow class_count$

10. Find the names of students enrolled in the maximum number of classes.

$\sim (S \times E) \rightarrow T_1$
 $S.snum = E.snum$

$T_1.snum \rightarrow G_{cnt}(T_1.name)(T_1) \rightarrow T_2$
 $\rightarrow class_cnt$

$G_{max}(T_2.class_cnt)(T_2) \rightarrow T_3$
 $\rightarrow max_cnt$

$\Pi_{T_2.sname} \left(\sigma_{T_2.class_cnt = max_cnt} (T_2 \times T_3) \right)$

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11. Find the names of students not enrolled in any classes.

$\alpha (S \times E) \rightarrow T_1$
 $S.snum = E.snum$

$\Pi_{S.sname} (S) - \Pi_{T_1.sname} (T_1)$

12. For each age value that appears in Students, find the level value that appears most often. For example, if there are more FR level students aged 18 than SR, JR, or SO students aged 18, you should print the pair (18, FR).

$$\Pi_{s.age, n}(s) \rightarrow T_1$$

$$T_1.age, T_1.level \rightarrow \text{cnt}(T_1.level) \rightarrow T_2$$

$\rightarrow level_cnt$

$$T_2.age \rightarrow \text{max}(T_2.level_cnt) \rightarrow T_2$$