1) Find names of all Juniors who are enrolled in a class taught by I. Teach.

Student → S ⇌ Enrolled → E ⇌ Class → C ⇌ Faculty → F

sname	level	snum	snum	cname	name	Fid	fid	fname
major	age				meets_at	room	dept_id	
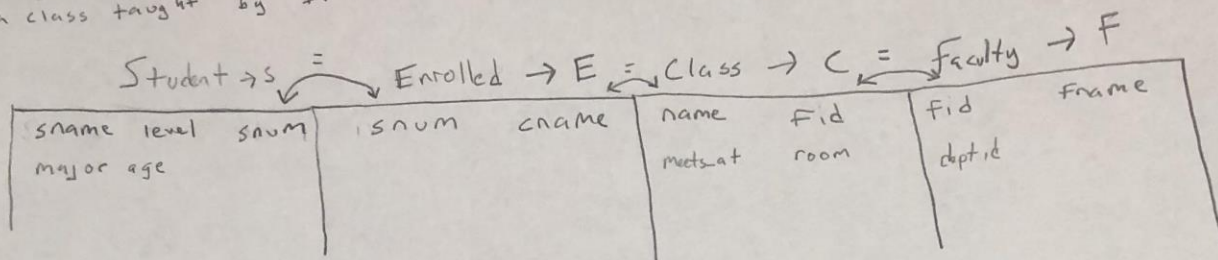
① $\rho\left(\sigma_{S.snum = E.snum}(S \times E)\right) \rightarrow T_1$

③ $\rho\left(\sigma_{C.Fid = F.Fid}(T_2 \times F)\right) \rightarrow T_3$

② $\rho\left(\sigma_{E.cname = C.name}(T_1 \times C)\right) \rightarrow T_2$

④ $\pi_{S.sname}\left(\sigma_{S.level = JR \wedge F.fname = I.Teach}(T_3)\right)$
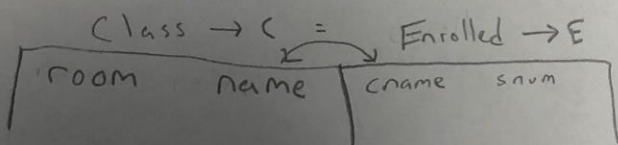
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2) Find the age of the oldest who is either a History major or enrolled in a class taught by I. Teach.

Using T_3 from Q1

$_{max(s.age)}G\left(\sigma_{S.major = History \vee F.fname = I.Teach}(T_3)\right)$

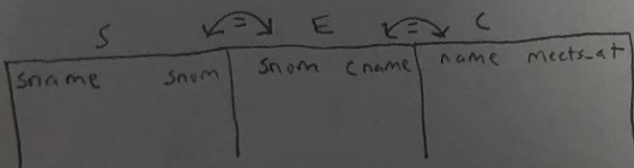**3)** Find the names of all classes that either meet in R128 or have 5 or more students.

Class → C ⇌ Enrolled → E

room	name	cname	snum

① $\rho\left(\sigma_{C.name = E.cname}(C \times E)\right) \rightarrow T_1$

② $\rho\left(_{C.name, C.room}G_{cnt(snum) \rightarrow SC}(T_1)\right) \rightarrow T_2$

③ $\pi_{C.name}\left(\sigma_{C.room = R128 \vee SC \geq 5}(T_2)\right)$

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4) Find the names of all students enrolled in two classes which meet at same time.

Using T_2 from Q1

	S			E			C	
sname	snum	snum	cname	name	meets_at

① $\rho\left(_{S.sname, S.snum}G_{cnt(distinct\ C.meets\_at) \rightarrow dcnt,\ cnt(C.meets\_at) \rightarrow cnt}(T_2)\right) \rightarrow T_3$

② $\pi_{S.sname}\left(\sigma_{T_3.dcnt \neq T_3.cnt}(T_3)\right)$

5) Find the names of faculty members which teach in every room in which a class is taught

① $P(\pi_{c.room, c.fid}(c)) \to T_1$

② $P(\pi_{c.room}(c)) \to T_2$

③ $P(T_1 / T_2) \to T_3$

④ $P\left(\sigma_{\substack{T_3.fid = \\ F.fid}}(T_3 \times F)\right) \to T_4$

⑤ $\pi_{f.fname}(T_4)$

---

6) Find names of faculty members who's combined enrollment for all classes is < 5.

① $P\left(\sigma_{\substack{C.name = \\ E.cname}}(C \times E)\right) \to T_1$

② $P\left(_{C.fid}G_{cnt(snum)}(T_1)\right) \to T_2$
$\phantom{②P(_{C.fid}G}\to scnt$

③ $P\left(\sigma_{T_2.scnt < 5}(T_2)\right) \to T_3$

④ $\pi_{F.fname}\left(\sigma_{\substack{T_3.fid = \\ f.fid}}(T_3 \times F)\right)$

---

7) Print the level and average age of each level

① $P\left(_{S.level}G_{Avg(s.age)}(s)\right) \to T_1$
$\to level \quad \to avg\_age$

② Print (T_1)

---

8) Q7 + except JR

① $P\left(\sigma_{s.level \neq JR}(s)\right) \to T_1$

② $P\left(_{T_1.level}G_{Avg(T_1.age)}(T_1)\right) \to T_2$
$\to level \quad \to avg\_age$

③ Print (T_2)

---

9) For each faculty member that has taught classes only in R128, print name and class count.

① $P\left(\sigma_{\substack{F.fid = \\ C.fid}}(F \times C)\right) \to T_1$

② $P\left(_{F.fid}G_{cnt(c.name)}(T_1)\right) \to T_2$
$\to cnt$

③ $P\left(\sigma_{\substack{F.fid = \\ C.fid \wedge \\ c.room = \\ R128}}(F \times C)\right) \to T_3$

④ $P\left(_{F.fid}G_{cnt(c.name)}(T_3)\right) \to T_4$
$\to cnt$

⑤ $P\left(\sigma_{\substack{T_2.cnt = (T_3 \times T_4)) \\ T_4.cnt \wedge \\ T_3.fid = \\ T_4.fid}}\right) \to T_5$

⑥ $\pi_{\substack{F.fname, \\ T_5.cnt}}\left(\sigma_{\substack{F.fid = \\ T_5.fid}}(F \times T_5)\right)$

10) Find names of students enrolled in max # classes

① $\rho\left(_{E.snum}G_{cnt(E.cname)}(E)\right) \to T_1$
$\qquad \to count$

② $\rho\left(G_{max(T_1.count)}(T_1)\right) \to T_2$
$\qquad \to max$

③ $\rho\left(\sigma_{\substack{T_1.count= \\ T_2.max}}(T_1 \times T_2)\right) \to T_3$

④ $\Pi_{S.sname}\left(\sigma_{\substack{S.snum= \\ T_3.snum}}(S \times T_3)\right)$

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11) Find names of students not enrolled in any classes

① $\rho\left(\Pi_{E.snum}(E)\right) \to T_1$

② $\rho\left(\Pi_{S.snum}(S)\right) \to T_2$

③ $\rho\left(T_2 - T_1\right) \to T_3$

④ $\Pi_{S.sname}\left(\sigma_{\substack{S.snum= \\ T_3.snum}}(S \times T_3)\right)$

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12) For each age value that appears in Students, find the level value that appears most often.

① $\rho\left(_{S.age, S.level}G_{cnt(S.snum)}(S)\right) \to T_1$
$\qquad \to cnt$

② $\rho\left(_{T_1.age}G_{max(T_1.cnt)}(T_1)\right) \to T_2$
$\qquad \to max$

③ $\Pi_{\substack{T_1.age, \\ T_1.level}}\left(\sigma_{\substack{T_1.cnt= \\ T_2.max \land \\ T_1.age = \\ T_2.age}}(T_1 \times T_2)\right)$

age	level	cnt

X cnt = max

age	max

$\downarrow$ age, level

age	level