

- ① Requires you to first group all the students, then count distinct guides for each student.
- (i)  $\pi_{\text{Student}} (\sigma_{\text{COUNT}(\text{guide-id}) > 1} \text{GROUP-BY} (\text{Student}, \text{COUNT}(\text{guide-id})) \text{guide}))$
- (ii)  $\pi_{\text{Student}} (\sigma_{\text{COUNT}(\text{guide-id}) > 1} (\text{Student GROUP-BY COUNT}(\text{guide-id})) \text{guide}))$
- ② Note that  $\text{AVG}(\text{GPA})$  is constrained to an individual department, thus we need to calculate the Avg's by dept first.  
lets create a partial view first
- $(\text{AVG}(\text{GPA}) \text{ Group-by dept})(\text{student}) \rightarrow \text{produces all the dept averages}$
- $\pi_{(\text{name}, \text{dept})} (\text{Student}_{(s)} \bowtie (\sigma_{(s.\text{gpa} > \text{AVG}(\text{GPA}))} (\text{AVG}(\text{GPA}) \text{ Group-by dept})(\text{student})))$
- ③ Refers to question ② where individual topper from respective dept is needed to be computed first.
- (i) lets produce a partial view with the students with max gpa in their respective department.
- $(\text{MAX}(\text{GPA}) \text{ Group-by Dept})(\text{student}) \rightarrow \text{produces the partial view}$
- (ii) Now lets fetch the names of those students who have higher gpa in their respective department.
- $\pi_{(\text{name})} (\text{Student}_{(s)} \bowtie (\sigma_{(s.\text{gpa} == \text{MAX}(\text{GPA}))} (\text{MAX}(\text{GPA}) \text{ Group-by Dept})(\text{student})))$
- ④  $x_a : (\text{Guide}_{(g)} \bowtie \text{Student}_{(s)})$   
 $x_b : (\text{Guide}_{(g')} \bowtie \text{Student}_{(s')})$   
 $x_c : x_a \bowtie x_b$   
 $p : (s.\text{dept} != s'.\text{dept}) \text{ AND } (s.\text{student-id} != s'.\text{student-id})$   
 $\text{fa} : (\sigma_{g.\text{guide-id} == g'.\text{guide-id} \text{ AND } p})(x_c)$   
 $\pi_{(\text{i}.name \neq \text{o}.name)} (\text{fa})$
- ↑  
Students from diff  
deps & diff  
students*

⑤ In-order to find the guide with AVG gpa among, we first need to compute JOIN operation on primary-key ID: ie phone number in our case

$\times_a: (\text{Guide}_{(g)} \bowtie \text{Student}_{(s)})$   
 $s.\text{phone} == g.\text{phone}$

→ we need to compute the guide GPA avg now

$\times_a': \text{AVG}(\text{GPA}) \text{ Group-by } (\text{Guide-id}, \text{Guide-name}) (\times_a)$

↓  
 produces a table (partial view) with list of guide id, name along with the GPA average.

This table is the basis for the maximum avg gpa.

$\times_b: \cancel{\times_a} \text{ Group-by } (\text{MAX}(\text{AVG}(\text{GPA}))) (\times_a')$

$\pi_{(\text{guide})} (\sigma (\times_a'. \text{AVG}(\text{GPA})) = \text{Group-by } (\text{MAX}(\text{AVG}(\text{GPA}))) (\times_a') (\times_a))$

⑥ To find the list of students who have the same phone no. in both tables,

→ we first need to join the tables

$\pi_{(\text{name})} (\text{Student}_{(s)} \bowtie \text{Guide}_{(g)})$   
 $s.\text{phone} == g.\text{phone}$

⑦  $\times_a: (\text{COUNT}(\text{DISTINCT Dept}) \text{ Group-by } g.\text{guide-id}, g.\text{name}) ($

$\text{Guide}_{(g)} \bowtie \text{Student}_{(s)}$   
 $g.\text{phone} == s.\text{phone}$

$\pi_{(\text{name})} (\sigma (\text{COUNT}(\text{DISTINCT Dept}) > 1) \times_a)$

⑧ → fetch depts of Dr. jennifer

→ fetch all students enrolled in Dr. jennifers depts

$\times_a: (\text{Guide}_{(g)} \bowtie \text{Student}_{(s)})$   
 $g.\text{phone} == s.\text{phone}$

$\times_b: \pi_{\text{Dept}} (\sigma g.\text{name} == 'Dr. jenifer' (\times_a))$

$\pi_{(\text{student-name})} (\pi_{(\text{name}, \text{Dept})} (\text{Student}) \div \times_b)$

⑨  $\rightarrow$  guides guiding highest no. of students in CSE dept.

$$x_a: \left( \text{Guide}_{(g)} \bowtie_{g.\text{phone} == s.\text{phone}} \text{Student}_{(s)} \right)$$

$$x_b: \sigma_{\text{dept} == \text{CSE}} (x_a)$$

$$x_c: \text{COUNT}(s.\text{phone})(x_b) \text{ Group-by } g.\text{guide-name}$$

$$x_d: \overline{\pi} \text{ MAX}(x_c)$$
$$\pi \text{ MAX}(\text{COUNT}(s.\text{phone})(x_b))(x_c)$$

$$\pi_{g.\text{name}} \text{ for } (\text{COUNT}(s.\text{phone})(x_b) = x_d(x_c))$$

⑩  $\pi_{(name, dept)} \left( \text{Student}_{(s)} \bowtie \left( \sigma(gpa < \text{MEDIAN}(gpa)) \right) \left( \text{MEDIAN}(gpa) \right. \right. \\ \left. \left. \text{Group-by Dept} \right) \right)$