CS1270 Homework #1

Banner ID: B01532164

Warmup #1

For dealership:

Super keys:

1) dealership_name
2) dealership_name + city
3) dealership_name + country
4) dealership_name + city + county

Candidates keys:

1) dealership_name

Primary keys:

1) dealership_name

For cars

Super keys:

1) car_id + dealership_name
2) car_id + dealership_name + car_name
3) car_id + dealership_name + year_made
4) car_id + dealership_name + car_name + year_made

Candidate keys:

1) car_id + dealership_name

Primary keys

1) car_id + dealership_name

Warmup #2

1. $\pi_{\text{driver\_id}}(\sigma_{\text{age>45 AND state="Rhode Island"}}(\text{driver}))$
2. $\pi_{\text{driver\_name}}(\sigma_{\text{year\_produced>1990 AND year\_produced<2000}}(\text{driver} \bowtie \text{car}))$
3. $\pi_{\text{car\_id}}(\text{car}) - \pi_{\text{car\_id}}(\sigma_{\text{state="Rhode Island"}}(\text{driver}))$
4. $_{\text{model}}\mathbf{g}_{\text{avg(year\_produced)}}(\text{car})$

Problem #3

1 Answer:

#natural join table department and course to get the information about which course is provided by which department

$\text{Temp1} \leftarrow \text{department} \bowtie \text{course}$

#find courses from departments in CIT building

$\text{Temp2} \leftarrow \pi_{\text{course\_id}}(\sigma_{\text{building = "CIT"}}(\text{Temp1}))$

#natural join table student and takes to get information about which student takes which courses and save column "s-ID", "name" and "course-id" only

$\text{Temp3} \leftarrow \pi_{\text{s\_ID,name,course\_id}}(\text{student} \bowtie \text{takes})$

#natural join table Temp3 and Temp2 to find the students that take courses from departments in CIT building

$\text{Temp4} \leftarrow \pi_{\text{s\_ID,name}}(\text{Temp3} \bowtie \text{Temp2})$

#Find the students don't take courses from departments in CIT building

$\text{Result} \leftarrow \pi_{\text{s\_ID,name}}(\text{students}) - \text{Temp4}$

2 Answer:

#get only course-id, sec-id and time-slot from table section

$\text{Temp1} \leftarrow \pi_{\text{course\_id,sec\_id,time\_slot}}(\text{section})$

#cartesian product of Temp1 itself and get all combinations of courses

$\text{Temp2} \leftarrow \text{Temp1} \times \text{Temp1}$

#rename the columns to make it more readable

$\text{Temp3} \leftarrow \rho_{Temp3(\text{course\_id1, sec\_id1,time\_slot1,course\_id2,sec\_id2,time\_slot2})}(\text{Temp2})$

#select the different courses that have the same time-slot

$\text{Temp4} \leftarrow \sigma_{\text{time\_slot1=time\_slot2 AND course\_id1!=course\_id2 AND sec\_id1!=sec\_id2}}(\text{Temp3})$

#get course-id and sec-id

$\text{Result} \leftarrow \pi_{\text{course\_id,sec\_id}}(\text{Temp4})$

3 Answer:

 # natural join table instructor and teaches to find information which instructor teaches which courses and save column "i-id", "name" and "course-id"

$\text{Temp1} \leftarrow \pi_{\text{i\_id,name,course\_id}}(\text{instructor} \bowtie \text{teaches})$

#find courses from "CS" or "Math" departments

$\text{Temp2} \leftarrow \pi_{\text{course\_id}}(\sigma_{\text{dept\_name="Computer Science" Or dept\_name="Math"}}(\text{course}))$

#find courses with no prerequisites

$\text{Temp3} \leftarrow \pi_{\text{course\_id}}(\text{courses}) - \pi_{\text{course\_id}}(\text{prereq})$

#find courses in the "Computer Science" or "Math" department or with no prerequisites

$\text{Temp4} \leftarrow \text{Temp2} \cup \text{Temp3}$

 # natural join table Temp1 and Temp4 to get the i-id and name of instructor that teaches courses in Temp4

$\text{Result} \leftarrow \pi_{\text{i\_id,name}}(\text{Temp1} \bowtie \text{Temp4})$

Problem #4

1 Answer:

#natural join table takes and course to get information about which student takes which courses and the course's department and save column "s-ID", and "dept-name" only

$\text{Temp1} \leftarrow \pi_{\text{s\_ID,dept\_name}}(\text{takes} \bowtie \text{course})$

#group Temp1 by dept-name and count the students that take courses from the department

$\alpha \leftarrow {}_{dept\_name}\boldsymbol{g}_{count(s\_id)}(\text{Temp1})$

2(a) Answer:

$\text{result\_a} \leftarrow \rho_{result(\text{t\_name,t\_count,s\_name,s\_count})}(\alpha \times \alpha)$

2(b) Answer:

$\text{result\_b} \leftarrow \sigma_{\text{t\_count<s\_count}}(\text{course})$

2(c) Answer:

$\text{result\_c} \leftarrow \pi_{\text{t\_name,t\_count}}(\text{result\_a} - \text{result\_b})$

3 Answer:

$$\pi_{\text{t\_name,t\_count}}(\rho_{result(\text{t\_name,t\_count,s\_name,s\_count})}(\alpha \times \alpha) - \sigma_{\text{t\_count<s\_count}}(\rho_{result(\text{t\_name,t\_count,s\_name,s\_count})}(\alpha \times \alpha)))$$

Problem #5

1(a) Answer:

$$\alpha \leftarrow \pi_{\text{s\_ID,course\_id}}(\sigma_{\text{dept\_name="Math"}}(\text{takes} \bowtie \text{course}))$$

1(b) Answer:

$$\beta \leftarrow \pi_{\text{course\_id}}(\sigma_{\text{dept\_name="Math"}}(\text{course}))$$

1(c) Answer:

$$\gamma \leftarrow \pi_{\text{s\_ID}}(\alpha) \times \beta$$

2(a) Answer:

$$\delta \leftarrow \gamma - \alpha$$

2(b) Answer:

$$\text{result} \leftarrow \pi_{\text{s\_ID}}(\alpha) - \pi_{\text{s\_ID}}(\delta)$$

3 Answer:

Step1:

 # Find all student IDs and the course IDs they take that are from "Math" department

$$\alpha \leftarrow \pi_{\text{s\_ID,course\_id}}(\sigma_{\text{dept\_name="Math"}}(\text{takes} \bowtie \text{course}))$$

Step2:

 # Find the course IDs for all "Math" courses.

$$\beta \leftarrow \pi_{\text{course\_id}}(\sigma_{\text{dept\_name="Math"}}(\text{course}))$$

Step3:

#Find the IDs of all students who have taken all "Math" courses. This is a more complicated way to do "division".

$$\text{result} \leftarrow \pi_{\text{s\_ID}}(\alpha) - \pi_{\text{s\_ID}}(\pi_{\text{s\_ID}}(\alpha) \times \beta - \alpha)$$