Question Bank and with Solution

On

(Relational Algebra)

Consider the following tables.

student

id	name
1234	joe
4000	hector
2000	ling

enrolledIn

id	code
1234	cs1500
1234	cs1200
1234	cs2001
4000	cs3010
4000	ma3000

subject

code	lecturer
cs1500	curtis
cs2001	dave
cs3010	curtis
cs2001	olivier
ma3000	roger

Figure out which relational algebra operations were used to obtain each of the following tables.

1.

name
joe
hector
ling

Solution: $\pi_{name}(student)$

2.

lecturer
curtis
dave
olivier
roger

Solution: $\pi_{lecturer}(subject)$

3.

code	lecturer
cs3010	curtis
cs1500	Curtis

Solution:

$\sigma_{lecturer=curtis}(subject)$

$\sigma_{code=cs1500 \text{ OR } code=cs3010}(subject)$

There are two ways to get this table. Try to list both. Hint: Use an OR in the selection condition for one method.

4.

id	name
1234	joe
4000	hector

Solution:

$\sigma_{name=joe \text{ OR } name=hector}(student)$

$\pi_{id,\ name}(student \bowtie enrolledIn)$

$student - \sigma_{name=ling}(student)$

There are three ways to get this table. *Hint*: How about using the difference operator?

5.

id	name	id	code
1234	joe	1234	cs1500
1234	joe	1234	cs1200
1234	joe	1234	cs2001
1234	joe	4000	cs3010
1234	joe	4000	ma3000

Solution: Many ways are possible. Here are two.

$\sigma_{name = joe}(student \bowtie enrolledIn)$

$\sigma_{name = joe}(student) \bowtie enrolledIn$

6.

id	name	id	code
1234	joe	1234	cs1500
1234	joe	1234	cs1200
1234	joe	1234	cs2001

Solution: Many ways are possible. Here is one.

$student \bowtie_{student.id = enrolledIn.id} enrolledIn$

7.

id	name	code
1234	joe	cs1500
1234	joe	cs1200
1234	joe	cs2001

Solution: Many ways are possible. Here is one.

$\sigma_{name=joe}(student \bowtie enrolledIn)$

8.

id	code
1234	cs1500
1234	cs1200
1234	cs2001

Solution:

$\pi_{id,code}(\sigma_{name=joe}(student \bowtie enrolledIn)$

$\sigma_{id=1234}(enrolledIn)$

9.

id	name	code	lecturer
4000	hector	cs3010	curtis
4000	hector	ma3000	roger

Solution: $(\sigma_{name=hector}(student)) \bowtie enrolledIn \bowtie subject$

10.

name	lecturer
joe	curtis
hector	curtis

Solution: $\pi_{name, lecturer}(\sigma_{lecturer=curtis}(subject \bowtie enrolledIn \bowtie student))$

Write the following queries in the relational algebra using the relational schema.

student(id, name)

enrolledIn(id, code)

subject(code, lecturer)

1. What are the names of students enrolled in cs3020?
2. Which subjects is Hector taking?
3. Who teaches cs1500?
4. Who teaches cs1500 or cs3020?
5. Who teaches at least two different subjects?
6. What are the names of students in cs1500 or cs3010?
7. What are the names of students in both cs1500 and cs1200?
8. What are the names of students in at least two different subjects?
9. What are the codes of all the subjects taught?
10. What are the names of all the students?
11. What are the names of all the students in cs1500?
12. What are the names of students taking a subject taught by Roger.
13. What are the names of students who are taking a subject not taught by Roger?

Solutions to Formulating Queries in Relational Algebra: -

1. $\textit{Solution}: \Pi_{name}(\sigma_{cs3020=code}(\text{student} \bowtie \text{enrolledIn}))$
2. $\textit{Solution}: \Pi_{code}(\sigma_{name=Hector}(\text{student} \bowtie \text{enrolledIn}))$
3. $\textit{Solution}: \Pi_{lecturer}(\sigma_{code=cs1500}(\text{subject}))$
4. $\textit{Solution}: \Pi_{lecturer}(\sigma_{code=cs1500 \text{ OR } code=cs3020}(\text{subject}))$

5.

Solution: For this query we have to relate `subject` to itself. To disambiguate the relation, we will call the `subject` relation *R* or *S*.

$\Pi_{\text{lecturer}}(\ \sigma_{R.\text{lecturer} = S.\text{lecturer AND } R.\text{code} <> S.\text{code}}(R \bowtie S))$

6.

Solution: $\Pi_{\text{name}}(\ \sigma_{\text{code=cs1500}}(\text{student} \bowtie \text{enrolledIn})) \cup \Pi_{\text{name}}(\ \sigma_{\text{code=cs3010}}(\text{student} \bowtie \text{enrolledIn}))$

7.

Solution: $\Pi_{\text{name}}(\ \sigma_{\text{code=cs1500}}(\text{student} \bowtie \text{enrolledIn})) \cap \Pi_{\text{name}}(\ \sigma_{\text{code=cs3010}}(\text{student} \bowtie \text{enrolledIn}))$

8.

Solution: For this query we have to relate `enrolledIn` to itself. To disambiguate the relation, we will call the `enrolledIn` relation *R* or *S*.

$\Pi_{\text{name}}(\text{student} \bowtie (\ \sigma_{R.\text{id} = S.\text{id AND } R.\text{code} <> S.\text{code}}(R \bowtie S)))$

9.

Solution: $\Pi_{\text{code}}(\text{subject})$

10.

Solution: $\Pi_{\text{name}}(\text{student})$

11.

Solution: $\Pi_{\text{name}}(\ \sigma_{\text{code=cs1500}}(\text{student} \bowtie \text{enrolledIn}))$

12.

Solution: $\Pi_{\text{name}}(\ \sigma_{\text{lecturer=Roger}}(\text{student} \bowtie \text{enrolledIn} \bowtie \text{subject}))$

13.

Solution: $\Pi_{\text{name}}(\ \sigma_{\text{lecturer} <> \text{Roger}}(\text{student} \bowtie \text{enrolledIn} \bowtie \text{subject}))$