Practice Queries

CS 4604 (Fall 2008)

September 02, 2008

Consider the following tables.

```
 student              enrolledIn                 subject
    id  |  name          id    |   code          code  | lecturer
------------------     --------------------    ---------------------
   1234 |  joe          1234   |   cs1500        cs1500 |  curtis
   4000 | hector        1234   |   cs1200        cs2001 |  dave
   2000 |  ling         1234   |   cs2001        cs3010 |  curtis
                        4000   |   cs3010        cs2001 |  olivier
                        4000   |   ma3000        ma3000 |  roger
```

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

1.

```
 name
---------
 joe
 hector
 ling
```

2.

```
lecturer
---------
 curtis
 dave
 olivier
 roger
```

3.

```
  code  | lecturer
---------------------
 cs3010 |  curtis
 cs1500 |  Curtis
```

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

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

6.

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

7.

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

8.

id	code
1234	cs1500
1234	cs1200
1234	cs2001

9.

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

10.

name	lecturer
joe	curtis
hector	curtis

Solutions

1.

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

2.

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

3.

Solution:

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

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

4.

Solution:

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

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

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

5.

Solution: Many ways are possible. Here are two.

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

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

6.

Solution: Many ways are possible. Here is one.

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

7.

Solution: Many ways are possible. Here is one.

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

8.

Solution:

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

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

9.

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

10.

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

Formulating Queries in Relational Algebra

Give 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.

Solution: $\Pi_{\text{name}}(\sigma_{\text{cs3020=code}}(\text{student} \bowtie \text{enrolledIn}))$

2.

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

3.

Solution: $\Pi_{\text{lecturer}}(\sigma_{\text{code=cs1500}}(\text{subject}))$

4.

Solution: $\Pi_{\text{lecturer}}(\sigma_{\text{code=cs1500 OR code=cs3020}}(\text{subject}))$

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

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