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

2.

> *Solution*: $\Pi_{\text{lecturer}}(\text{subject})$

3.

> *Solution*:
>
> $\sigma_{\text{lecturer=curtis}}(\text{subject})$
>
> $\sigma_{\text{code=cs1500 OR code=cs3010}}(\text{subject})$

4.

> *Solution*:
>
> $\sigma_{\text{name=joe OR name=hector}}(\text{student})$
>
> $\Pi_{\text{id, name}}(\text{student} \bowtie \text{enrolledIn})$
>
> $\text{student} - \sigma_{\text{name=ling}}(\text{student})$

5.

> *Solution*: Many ways are possible. Here are two.
>
> $\sigma_{\text{name = joe}}(\text{student} \bowtie \text{enrolledIn})$
>
> $\sigma_{\text{name = joe}}(\text{student}) \bowtie \text{enrolledIn}$

6.

> *Solution*: Many ways are possible. Here is one.
>
> student $\bowtie_{\text{student.id = enrolledIn.id}}$ enrolledIn

7.

> *Solution*: Many ways are possible. Here is one.
>
> $\sigma_{\text{name=joe}}$(student $\bowtie$ enrolledIn)

8.

> *Solution*:
>
> $\pi_{\text{id,code}}($ $\sigma_{\text{name=joe}}$(student $\bowtie$ enrolledIn)
>
> $\sigma_{\text{id=1234}}$(enrolledIn)

9.

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

10.

> *Solution*: $\pi_{\text{name, lecturer}}($ $\sigma_{\text{lecturer=curtis}}$(subject $\bowtie$ enrolledIn $\bowtie$ 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*: $\pi_{name}(\sigma_{cs3020=code}(student \bowtie enrolledIn))$

2.

> *Solution*: $\pi_{code}(\sigma_{name=Hector}(student \bowtie enrolledIn))$

3.

> *Solution*: $\pi_{lecturer}(\sigma_{code=cs1500}(subject))$

4.

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

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

6.

> *Solution*: $\pi_{name}(\sigma_{code=cs1500}(student \bowtie enrolledIn)) \cup \pi_{name}(\sigma_{code=cs3010}(student \bowtie enrolledIn))$

7.

> *Solution*: $\pi_{name}(\sigma_{code=cs1500}(student \bowtie enrolledIn)) \cap \pi_{name}(\sigma_{code=cs3010}(student \bowtie enrolledIn))$

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

9.

> *Solution*: $\pi_{code}(\text{subject})$

10.

> *Solution*: $\pi_{name}(\text{student})$

11.

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

12.

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

13.

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