Question Bank and with Solution

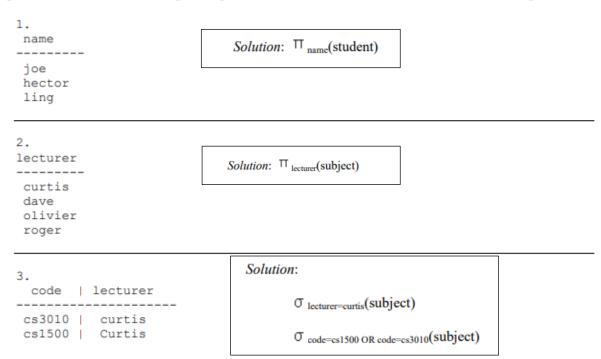
On

(Relational Algebra)

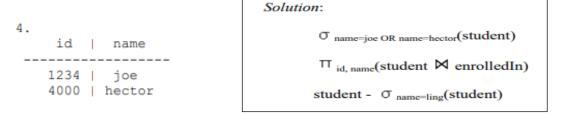
Consider the following tables.

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.



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



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

5. id | name | id code Solution: Many ways are possible. Here are two. 1234 1234 | joe cs1500 | 1234 1234 | joe cs1200 $\sigma_{\text{name = joe}}(\text{student } \bowtie \text{enrolledIn})$ 1234 1234 cs2001 joe 1234 | joe 4000 cs3010 σ name = joe(student) M enrolledIn 1234 | joe 4000 ma3000 6. id | name | id code Solution: Many ways are possible. Here is one. 1234 | joe 1234 cs1500 student ⋈_{student.id} = enrolledIn enrolledIn | 1234 1234 | joe cs1200 1234 | joe 1234 cs2001 7. Solution: Many ways are possible. Here is one. id | name | code σ name=joe(student ⋈ enrolledIn) 1234 | joe cs1500 cs1200 1234 | joe 1234 | joe cs2001 8. Solution: id | code $\Pi_{id,code}(\sigma_{name=ioe}(student \bowtie enrolledIn))$ 1234 | cs1500 1234 | cs1200 1234 | cs2001 σ id=1234(enrolledIn) id | name | code | lecturer 4000 | hector | cs3010 curtis 4000 | hector | ma3000 roger Solution: (♂ name=hector(student)) ⋈ enrolledIn ⋈ subject 10.

Solution: ☐ name, lecturer(☐ lecturer=curtis(subject ⋈ enrolledIn ⋈ student))

lecturer

curtis

curtis

joe | hector |

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.

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.

4.

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Solution: T lecturer( T code=cs1500 OR code=cs3020(subject))
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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.

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\Pi_{\text{lecturer}}( \sigma_{R.\text{lecturer} = S.\text{lecturer AND }R.\text{code} <> S.\text{code}(R \bowtie S))}
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6.

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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}))
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7.

```
Solution: \sqcap_{\text{name}} (\sigma_{\text{code=cs1500}}(student \bowtie enrolledIn)) \cap \sqcap_{\text{name}} (\sigma_{\text{code=cs3010}}(student \bowtie enrolledIn))
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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.

```
\prod_{\text{name}} (\text{student} \bowtie ( \sigma_{R.id-S.id \text{ AND } R.\text{code}} (R \bowtie S)))
```

9.

10.

11.

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

12.

13.

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