

SOLUTIONS

Database Comprehensive Exam, October 18 1996

Answer 1.

Relational Algebra

```
(a) PROJECT[E1.studentID] (  
    SELECT[E1.studentID = E2.studentID and  
        E1.course# = C1.course# and  
        E2.course# = C2.course# and  
        C1.dept <> C2.dept] (  
        (enroll(E1) X enroll(E2) X course(C1) X course(C2))))
```

where rel-name(R) renames relation rel-name as R.

Answer 2. SQL 1:

```
SELECT DISTINCT studentID  
FROM Enroll  
WHERE NOT EXIST  
    (SELECT *  
     FROM Course  
     WHERE Enroll.course#=Course.course# and dept="physics")
```

Answer 3. SQL 2:

- 2.a Best: SELECT B FROM R; (since duplicates may be returned)
- 2.b Next best: select avg(A) from R; (since avg can't be expressed)

Answers 4.

- Answer 4.a: 1. ID or name can be key
- Answer 4.b: 2. Need name (or Id) and dept
- Answer 4.c: 3. Also need partial crossproduct

Answers 5:

Answer 5.a: AB, BC, and BD.

Answer 5.b: no. All attributes are in some key, so there cannot be a 3NF violation.

Answer 5.c: C->D or D->A are examples of BCNF violations.
In each case the left side does not include a key.