Tutorial 5.5 (Week 8)
Relational Algebra

Classroom Exercise

1   The schema of a database containing university-type data is given below. Primary key is underlined for each relation.

```
STUDENT(Sid, Sname, Sex, Age, Year, GPA)
DEPT(Dname, Numphds)
PROF(Pname, Dname)
COURSE(Cno, Cname, Dname)
MAJOR(Dname, Sid)
SECTION(Dname, Cno, Sectno, Pname)
ENROLL(Sid, Grade, Dname, Cno, Sectno)
```

Write the following queries in relational algebra.

(i)   Find the names of professors who work in departments that have fewer than 50 PhD students.

(ii) Find the name(s) of student(s) with the lowest GPA.

(iii) Find the names and majors of students who have taken the 'Database System' course.

(iv) Find the ids, names, and GPAs of the students who have taken all courses from the 'Civil Engineering' department.

2   Consider the following schema for a railway database. Foreign keys in one table refer to primary keys in other tables which have same attribute names.

```
TRAINS(train_num, source_city, destination_city)
DEPARTURES(train_num, date, train_type)
PASSENGERS(passenger_ssn, passenger_name, address)
RESERVATIONS(passenger_ssn, train_num, date, seat_number)
```

Express the following queries using Relational Algebra.

(i) Find the Cities that have direct (non-stop) trains to both *Minneapolis* and *San Francisco.*

(ii) Find the train_num and date of all trains for which there are no reservations.

3   The following questions are to be answered on the following simplified soccer relational schema.

```
Teams (name, groupname, teamid);
Players (name, teamid, matches, numgoals);
Results (teamid-one, teamid-two, scoreone, scoretwo, matchdate);
```

Express the following queries using Relational Algebra.

(i) Lists all the pairs of teamids such that all the matches between each pair of teams that ended in a tie. For simplicity, you can assume that teamid-one is always smaller than teamid-two.

(ii) Find the "names" (not "teamids") of the teams that lost every game they played.

4   Give a relational algebra expression to find the maximum value in the relation R(A) *without using aggregate operations*.

5   Given the following relations, where a, b, c are integer attributes: R(a, b), S(b, c), Write relational algebra expression for the following queries.

Find the top 2 values of a present in R.