COMP9311 16s2

Assignment 3

Database Systems

Last updated: **Wednesday 5th October 0:29am**

Aims

This is a written assignment for you to practise and verify your knowledge on data dependencies, data normalisation, relational algebra, basic transaction and concurrency. You will need to answer all the questions and submit your solution as a PDF file (max 3MB) via the give command. This assignment is worth a total of **45 marks**.

Questions

1. *[16 marks]*

   Consider a relation *R(A,B,C,D,E,F)*. For each of the following sets of functional dependencies (i.e, i. to iv.), assuming that those are the only dependencies that hold for *R*, do the following:

   a. List all of the candidate keys for *R*.

   b. What are the BCNF violations, if any?

   c. Decompose the relation, as necessary, into collections of BCNF relations?

   i. $AD \rightarrow B,\quad C \rightarrow D,\quad BC \rightarrow A,\quad B \rightarrow D$

   ii. $BC \rightarrow E,\quad C \rightarrow AB,\quad AF \rightarrow CD$

   iii. $ABF \rightarrow D,\quad CD \rightarrow E,\quad BD \rightarrow A$

   iv. $AB \rightarrow D,\quad BCD \rightarrow EF,\quad B \rightarrow C$

2. *[12 marks]*

   Assuming the schema from assignment 2 (i.e., the ASX database), give the following queries in relational algebra.

   i. List all the company names that are in the sector of "Technology".

   ii. List all the company codes that have more than five executive members on record (i.e., at least six).

   iii. Output the person names of the executives that are affiliated with more than one company.

   iv. List all the companies (by their Code) that are the only one in their Industry (i.e., no competitors). Same as Assignment 2, please include both Code and Industry in the output.

3. *[9 marks]*

   Suppose relations R, S and T have *r* tuples, *s* tuples and *t* tuples, respectively. Derive the minimum and maximum numbers of tuples that the results of the following expressions can have.

   i. R UNION (S INTERSECT T).

   ii. SEL[c](R × S), for some condition c.

   iii. R - PROJ[a](R JOIN S), for some list of attributes a.

4. *[8 marks]*

   i. For the following execution schedule, construct its precedence graph. Is this schedule serialisable? Explain your answer.

```
T1:R(X) T2:R(X) T1:W(X) T2:W(X) T2:R(Y) T1:R(Y) T1:W(Y) T2:W(X)
```

   ii. For the following execution schedule, construct its precedence graph. Is this schedule serialisable? Explain your answer.

```
T3:R(X) T4:W(Y) T4:W(Z) T1:W(Y) T2:R(Y) T3:R(D) T2:W(X) T1:R(X)
```

Submission

Submission : Login to a CSE Linux machine such as `wagner` and use the give command below to submit the assignment:

```
give cs9311 a3 a3.pdf
```

Deadline : Sunday 16th October 23:59

Late Penalty: Late submissions will receive **zero** marks.