**Assignment 2**

**Please make sure that you always use notations consistent with lecture notes. Different notations will not be accepted.**

**The deadline for assignment 2 is: Fri 22nd, April 5:00 pm**

## Question 1 (15 marks)

Consider a relation $R$ ($A$, $B$, $C$, $D$, $E$, $G$, $H$, $I$, $J$) and its FD set $F$ = {EC -> B, C->D, G->BH, H->ACD, E->GHI, IJ->EG}

1) Find all the candidate keys for $R$, and list the prime and non-prime attributes of R (2 marks)
2) Calculate the total number of super keys can be found for R? List 5 of them. (2 marks)
3) Determine the highest normal form of R with respect to F. Justify your answer. (2 marks)
4) Find a minimal cover $F_m$ for $F$. (2 marks)
5) Regarding F, is the decomposition R1 = {ABE}, R2 = {CDH}, R3 = {EGHIJ} of $R$ dependency-preserving? Please justify your answer. (2 marks)
6) Regarding F, does the decomposition R1 = {ABE}, R2 = {CDH}, R3 = {EGHIJ} of $R$ satisfy the lossless join property? Please justify your answer. (2 marks)
7) Provide a step-by-step lossless decomposition of R into BCNF normal form. (3 marks)

**Question 2 (10 marks)**

Consider the schedule below. Here, R(*) and W(*) stand for 'Read' and 'Write', respectively. T1, T2, T3, T4 and T5 represent five transactions and $t_i$ represents a time slot.

| | $t_1$ | $t_2$ | $t_3$ | $t_4$ | $t_5$ | $t_6$ | $t_7$ | $t_8$ | $t_9$ | $t_{10}$ | $t_{11}$ | $t_{12}$ | $t_{13}$ | $t_{14}$ | $t_{15}$ | $t_{16}$ | $t_{17}$ | $t_{18}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *T1* | | | R(A) | | | | R(B) | | W(A) | | | | | | W(B) | | | |
| *T2* | R(C) | | | | W(C) | | | | | | | | | | | | | |
| *T3* | | R(B) | | | | | | | | | R(C) | | | | | W(B) | W(C) | |
| *T4* | | | | R(D) | | | | | | | | W(D) | R(A) | | | | | W(A) |
| *T5* | | | | | | R(C) | | R(A) | | W(C) | | | | W(A) | | | | |

Each transaction begins at the time slot of its first Read and commits right after its last Write (same time slot).

Regarding the following questions, give and justify your answers.

1) Assume a checkpoint is made between $t_5$ and $t_6$, what should be done to the five transactions when the crash happens between $t_{15}$ and $t_{16}$. (2 marks)

2) Is the transaction schedule conflict serializable? Give the precedence graph to justify your answer. (2 marks)

3) Construct a schedule (which is different from above) of these five transactions which **causes** deadlock when using two-phase locking protocol. You should clearly indicate all the locks and the corresponding unlocks in your schedule. If no such schedule exists, explain why. (3 marks)

4) Construct a schedule (which is different from above) of these five transactions which **does not cause** deadlock when using two-phase locking protocol. You should clearly indicate all the locks and the corresponding unlocks in your schedule. If no such schedule exists, explain why. (3 marks)

## Assignment Submission

- Students must submit an electronic copy of their answers to the above questions to the course website in Moodle.
- Only **.doc** or **.pdf** file is accepted. The file name should be ass2_**studentID**.doc or ass2_**studentID**.pdf (e.g., **ass2_z5100000.doc** or **ass2_z5100000.pdf**).

Note:

1. For any problems in submissions, please email to comp9311unsw@gmail.com
2. All submissions will be checked for plagiarism.
3. We do not accept e-mail submissions.

The university regards plagiarism as a form of academic misconduct and has very strict rules regarding plagiarism. For UNSW policies, penalties, and information to help avoid plagiarism, please see: https://student.unsw.edu.au/plagiarism as well as the guidelines in the online ELISE tutorials for all new UNSW students: https://subjectguides.library.unsw.edu.au/elise

## Late Submission Penalty

- A hefty 20% of your final mark will be deducted for each additional day (24hr) after the specified submission time and date.
- Submissions that are more than five days late will not be marked.