# 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:**

<span style="color:red">**Fri 6, Aug 5:00 pm**</span>

## Question 1 (15 marks)

Consider a relation $R(A, B, C, D, E, G, H, I, J)$ and its FD set $F = \{J \rightarrow AB, BC \rightarrow GE, AH \rightarrow CD, G \rightarrow B, DG \rightarrow EH, H \rightarrow I\}$.

1) Check if $A \rightarrow I \in F^+$. (2 marks)

2) Find a candidate key for $R$. (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 $F$. (3 marks)

5) Decompose into a set of 3NF relations if it is not in 3NF step by step. Make sure your decomposition is dependency-preserving and lossless-join. (3 marks)

6) Decompose into a set of BCNF relations if it is not in BCNF step by step. Make sure your decomposition is lossless-join. (3 marks)

## Question 2 (10 marks)

Consider the schedule below. Here, R(*) and W(*) stand for 'Read' and 'Write', respectively. $T_1$ , $T_2$ , $T_3$ and $T_4$ represent four transactions and $t_i$ represents a time slot.

| Time | $t_1$ | $t_2$ | $t_3$ | $t_4$ | $t_5$ | $t_6$ | $t_7$ | $t_8$ | $t_9$ | $t_{10}$ | $t_{11}$ | $t_{12}$ | $t_{13}$ | $t_{14}$ |
|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|----------|----------|----------|----------|----------|
| $T_1$ |       |       | R(A)  |       | W(A)  |       |       |       | R(C)  |          |          |          | W(C)     |          |
| $T_2$ | R(A)  |       |       |       |       | W(A)  |       |       |       |          |          |          |          |          |
| $T_3$ |       | R(B)  |       |       |       |       |       | W(B)  |       |          |          | R(A)     |          | W(A)     |
| $T_4$ |       |       |       | R(A)  |       |       | R(B)  |       |       | W(A)     | W(B)     |          |          |          |

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 four transactions when the crash happens between $t_{11}$ and $t_{12}$. (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 four 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 four 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

20% of the value of the submission will be deducted for each day (24 hours). Submissions with more than five days late will not be marked.