COMP9311 24T2: Assignment 2
Deadline: Sun 21:59:59 28th July

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

Question 1 (12 marks)

Consider a relation R $(A, B, C, D, E, G, H, I, J)$ and its FD set $F = \{AJ \rightarrow IBE, DEJ \rightarrow IH, E \rightarrow CA, CG \rightarrow DI, AG \rightarrow B, ADI \rightarrow EH\}$.

Regarding the following questions. Give and justify your answers if the question is specified.

1) Check if $EG \rightarrow I$. Justify your answer. (1 mark)

2) Find all the candidate keys for R. (2 mark)

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, does the decomposition R1 = {CGIE}, R2 = {ADEJH}, R3 = {GBEH} of R satisfy the lossless join property? Please justify your answer. (2 marks)

6) Provide a step-by-step lossless decomposition of R into BCNF normal form. (3 marks)

Question 2 (8 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.

	t1	t2	t3	t4	t5	t6	t7	t8	t9	t10	t11	t12	t13	t14	t15	t16
T1	R(X)			R(Y)				W(Y)		W(X)						
T2			R(A)		W(X)											
T3		R(Z)					R(X)						W(Z)	W(X)		
T4									R(Z)						W(A)	W(Z)
T5						W(Y)				R(Z)		W(Z)				

Note: Each transaction begins at the time slot of its first operation and commits right after its last operation (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_{12} and t_{13}. (2 marks)

2) Is the transaction schedule conflict serializable? Give the full 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. (4 marks)

Question 3 (6 marks)

Consider the following query:

P1, P2, P3, P2, P4, P5, P6, P6, P3, P7, P2, P3.

(The user is trying to read page 1 from disk, then page 2, page 3, …)

Assume there are 3 buffers in the buffer pool.

1) Sketch the process of how blocks are replaced in the Least Recently Used (LRU) policy. (1.5 marks)
2) Sketch the process of how blocks are replaced in the Most Recently Used (MRU) policy. (1.5 marks)
3) Sketch the process of how blocks are replaced in the First In First Out (FIFO) policy. (1.5 marks)
4) Among LRU, MRU and FIFO policies, which one performs better in the given query? Why? (1.5 marks)

Assignment Submission

- You are required to submit an electronic version of your answers via **Moodle**. While we accept handwritten submissions, please ensure they are scanned or photographed clearly to ensure legibility.
- We only accept the **.pdf** format. Please name your files in the following format: ass2_**zID**.pdf (e.g., **ass2_z5000000.pdf**).

Note:

1. If you have problems relating to your submission, please email to junhua.zhang@unsw.edu.au.
2. If there are issues with Moodle, send your assignment to the above email with the subject title "<zid> COMP9311 Ass2 Submission".

Late Submission Penalty

- 5% of the total mark (26 marks) will be deducted for each additional day.
- Submissions that are more than five days late will not be marked.

Plagiarism

The work you submit must be your own work. Submission of work partially or completely derived from any other person or jointly written with any other person is not permitted. The penalties for such an offence may include negative marks, automatic failure of the course and possibly other academic discipline.

All submissions will be checked for plagiarism. The university regards plagiarism as a form of academic misconduct and has very strict rules. Not knowing the rules will not be considered *a valid* excuse when you are caught.

- For UNSW policies, penalties, and information to help avoid plagiarism, please see: https://student.unsw.edu.au/plagiarism.
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