

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 5th, August 5:00 pm**

Question 1 (11 marks)

Consider a relation $R(A, B, C, D, E, G, H, I, J)$ and its FD set $F = \{B \rightarrow DE, CD \rightarrow E, AHI \rightarrow CJ, AJ \rightarrow EHI, G \rightarrow AB\}$

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

- 1) Find all the candidate keys for R . (1 mark)
- 2) Determine the highest normal form of R with respect to F . Justify your answer. (2 marks)
- 3) Find a minimal cover F_m for F . (2 marks)
- 4) Regarding F , is the decomposition $R_1 = \{ABE\}$, $R_2 = \{CDH\}$, $R_3 = \{EGHI\}$ of R dependency-preserving? Please justify your answer. (2 marks)
- 5) Regarding F , does the decomposition $R_1 = \{ABE\}$, $R_2 = \{CDH\}$, $R_3 = \{EGHI\}$ 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. (2 marks)

Question 2 (8 marks)

Consider the schedule below. Here, $R(*)$ and $W(*)$ stand for 'Read' and 'Write', respectively. T_1, T_2, T_3, T_4 and T_5 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}
T_1	$R(X)$			$R(Y)$								$W(X)$				$W(Y)$		
T_2			$W(Z)$										$R(P)$					$R(Y)$
T_3		$R(Y)$					$R(Z)$		$W(Z)$		$W(Y)$							
T_4					$R(X)$									$W(X)$				
T_5						$R(Z)$		$R(X)$		$R(P)$					$W(Z)$		$W(X)$	

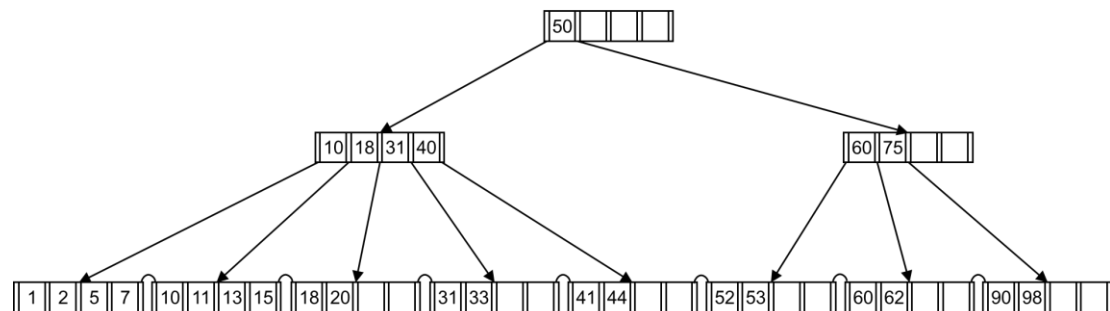
Each transaction begins at the time slot of its first Read and commits right after its last Write (same time slot).

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. (4 marks)

Question 3 (6 marks)

Consider the B+ tree shown in the following as an original tree.



Regarding the following questions. Give and justify your answers.

- 1) Show the B+ tree after inserting a data entry with key 12 into the original tree. (3 marks)
- 2) Show the B+ tree after deleting the data entry with key 90 from the original tree. (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

- 5% of the max assessment 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.