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 16, Apr 5:00 pm

Question 1 (16 marks)

Consider a relation $R(A, B, C, D, E, G, H, I, J)$ and its FD set $F = \{AB \rightarrow CD, C \rightarrow IJ, J \rightarrow DH, DI \rightarrow AE, DJ \rightarrow GH\}$.

1) Check if $D \rightarrow A \in F^+$. Justify your answer. (2 mark)

2) List all the candidate keys for R. (2 marks)

3) How many super keys can be found for R? Compute the total number of super keys and list 5 of them. (2 marks)

4) Find a minimal cover F_m for F. (2 marks)

5) Determine the highest normal form of R with respect to F. Justify your answer. (2 marks)

6) Regarding F, is the decomposition $R_1 = \{ACE\}$, $R_2 = \{BCDE\}$, $R_3 = \{DJGHI\}$ of R dependency-preserving? Please justify your answer. (2 marks)

7) Regarding F, is the decomposition $R_1 = \{ACE\}$, $R_2 = \{BCDE\}$, $R_3 = \{DJGHI\}$ of R lossless-join? Please justify your answer. (2 marks)

8) Decompose it into a collection of BCNF relations if it is not in BCNF. Make sure your decomposition is lossless-join and briefly justify your answers. (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 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_1	R(B)						R(A)	W(B)		W(A)		
T_2		R(B)	R(A)	W(B)		R(A)			W(A)			
T_3											R(B)	W(B)
T_4	R(A)	W(A)			R(B)	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_6 and t_7, what should be done to the four transactions when the crash happens between t_9 and t_{10}. (2 marks)

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

3) Give a serial schedule of these four transactions (there can be more than 12 time slots). (2 marks)

4) Construct a schedule (which is different from above) of these four transactions which causes deadlock when using two-phase locking protocol. If no such schedule exists, explain why. (2 marks)

Question 3 (6 marks)
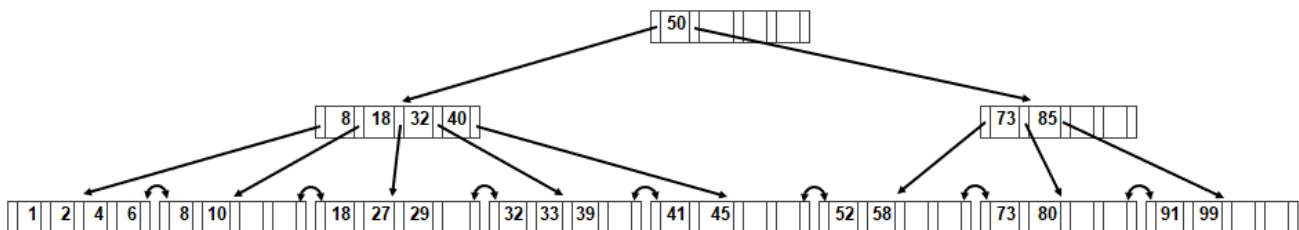
1) There are currently 20 records in this tree. How many additional records could be added to this tree without changing its height (give the maximum possible number)? Justify your answers. (2 marks)

2) Show the B+ tree after adding the data entry with key 5 into the original tree. (2 marks)

3) Show the B+ tree after deleting the data entry with key 80 from the original tree. (2 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 ass1_**studentID**.doc or ass1_**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.

Warning: Before submission, please keep a copy in your university account or other reliable cloud servers (such as dropbox or google drive). If you are not sure how, please have a look at taggi. Usually, the submission should be successful. In case it fails, we do **not** accept backups from your own computers as the modification time can be edited.

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Late Submission Penalty

0 mark.