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National University of Computer and Emerging Sciences, Lahore Campus

	Course:	**Advanced Database Concepts**	**Course Code:**	**CS451**
	Program:	**BS(Computer Science)**	**Semester:**	**Spring 2018**
	Duration:	**60 Minutes**	**Total Marks:**	**34**
	Paper Date:	**27-Feb-18**	**Weight**	**12.5%**
	Section:	**CS**	**Page(s):**	**5**
	Exam:	**Midterm-I**		

Instruction/Notes: Scratch sheet can be used for rough work however, all the questions and steps are to be shown on question paper. You may use backside of paper. ***No extra/rough sheets should be submitted with question paper***. You will not get any credit if you do not show proper working, reasoning and steps as asked in question statements.

Q1. *(3 points)* Given these transactions, find a cascade-free but not strict schedule, if possible.
T1: r1(A), r1(B), w1(B), w1(A), c1.
T2: r2(B), w2(B), c2.
T3: w3(B), c3.

Q2. *(6 points)*
a) Describe how fuzzy checkpointing is used in ARIES.
b) What is the difference between the UNDO/REDO and the UNDO/NO-REDO algorithms for recovery with immediate update?
c) Differentiate between non-repeatable read and phantom problems

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Q3. *(6 points)* Consider the following classes of schedules: conflict-serializable, view-serializable, recoverable, cascadeless, and strict. For each of the following schedules, state which of the preceding classes it belongs to. If you cannot decide whether a schedule belongs in a certain class based on the listed actions, explain briefly. The actions are listed in the order they are scheduled. If a commit or abort is not shown, the schedule is incomplete; assume that abort or commit must follow all the listed actions. Also draw precedence graph for each schedule.

a) S1: r2(X), w3(X), c3, w1(Y), r2(Y), r2(Z), c2, r1(Z), c1.
b) S2: r2(X), w3(X), w1(Y), r2(Y), w2(Z)

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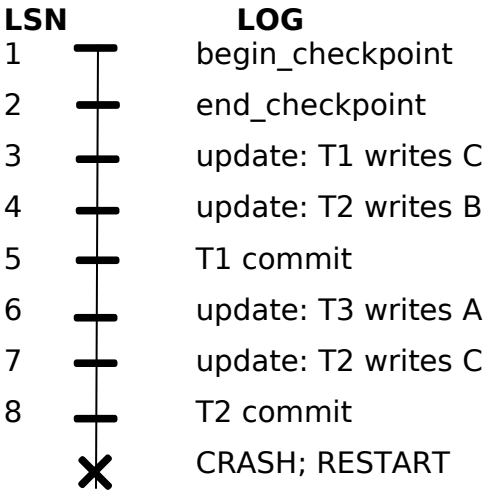
Q4. *(1+4+1+1= 7 points)* Consider the execution shown in below Figure. Assume that the Dirty Page Table and Transaction Table were empty before the start of the log.

a) What is the value of the LSN stored in the master log record?
b) What is done during Analysis? (Be precise about the points at which Analysis begins and ends and show the contents of Dirty Page Table and Transaction Table constructed in this phase.)
c) What is done during Redo? (Be precise about the points at which Redo begins and ends.)
d) What is done during Undo? (Be precise about the points at which Undo begins and ends.)



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Q5. *(12 points)* For the schedule S: r2(X), w3(X), c3, w1(Y), r2(Y), r2(Z), c2, r1(Z), c1. Show that the schedule S will be accepted/rejected in exactly the order shown by the below protocols. Provide proper reason and show your working.

a) Basic 2PL (add locks to the transactions)
b) Basic Timestamp Ordering (Assume T1 < T2 < T3)
c) Strict Timestamp Ordering (Assume T1 < T2 < T3)
d) Optimistic Concurrency Control

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