

# CS 245 Database Systems Principles – Summer 2001

## Assignment 5

- Due Date: Monday August 6<sup>th</sup> 2001, 5 pm.
  - Submission through
    - Box Placed outside Gates 412.
    - Email solution to [masood@cs.stanford.edu](mailto:masood@cs.stanford.edu) (only pdf, ps or plain text files).
    - SITN homework delivery.
  - The deadline is hard, No Late days.
  - Do not forget to write your Leland Ids at the start of your solution.
  - State all assumptions.
  - Email questions to [cs245-staff@lists.stanford.edu](mailto:cs245-staff@lists.stanford.edu)
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### Problem 1 (20 points)

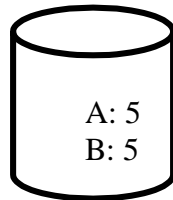
Suppose we have a transaction T1 that performs the following two actions:

A := A + 5

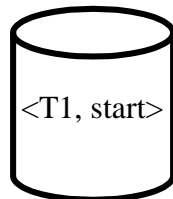
B := B + 5

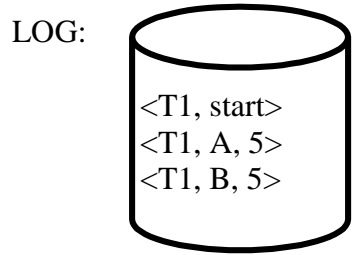
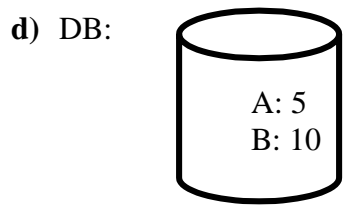
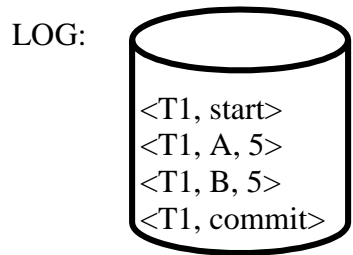
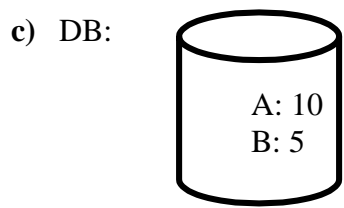
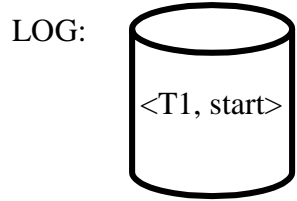
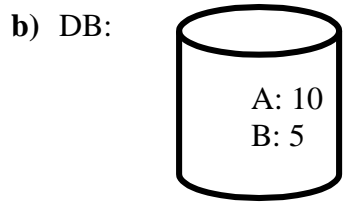
Say that UNDO logging is in use, and that initially, A = 5 and B = 5. For each hypothetical disk state shown below, state whether it is a legal state for UNDO logging. If it is not a legal state, explain why not.

a) DB:



LOG:



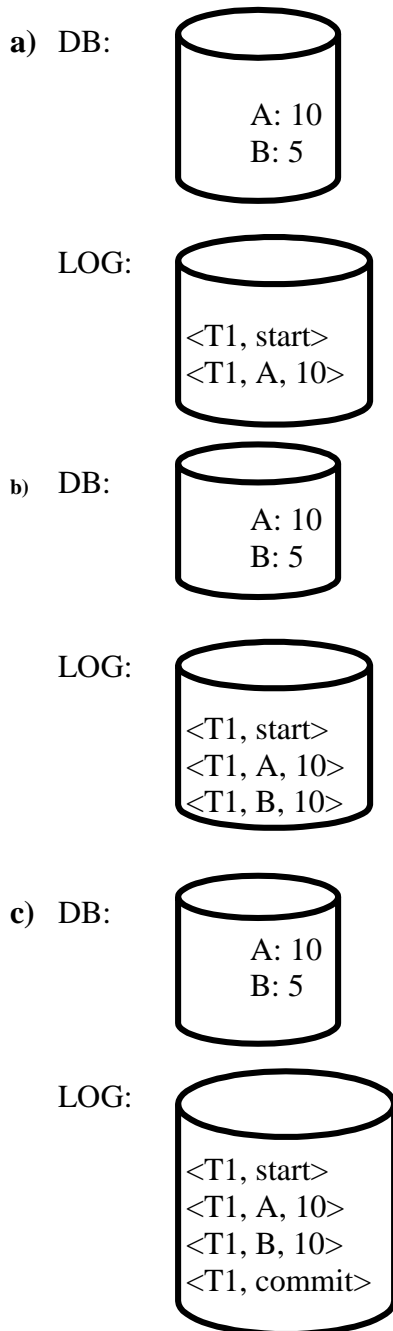


## Problem 2 (15 points)

Suppose we have a transaction T1 that performs the following two actions:

$A := A + 5$ ;  $B := B + 5$

Say that REDO logging is in use, and that initially,  $A = 5$  and  $B = 5$ . For each hypothetical disk state shown below, state whether it is a legal state for REDO logging. If it is not a legal state, explain why not.



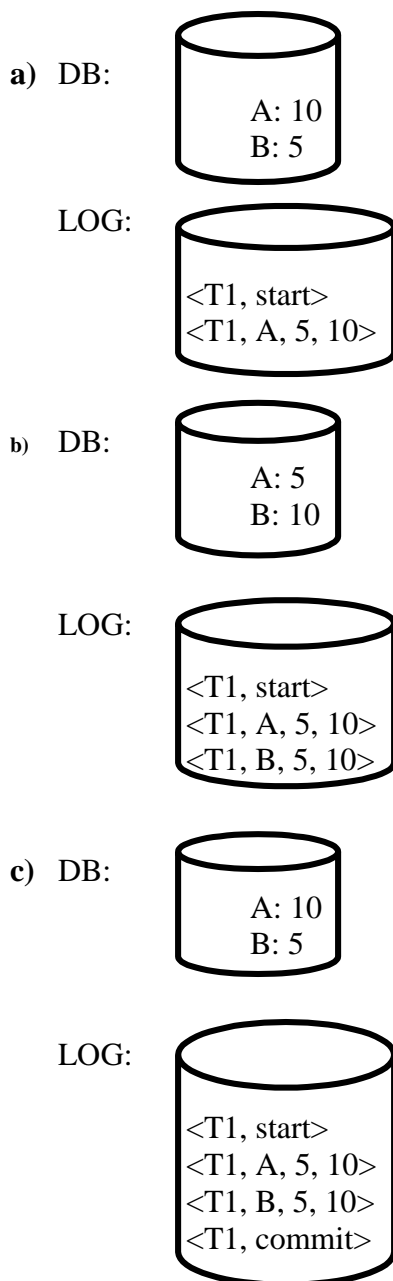
### Problem 3 (15 points)

Suppose we have a transaction T1 that performs the following two actions:

$A := A + 5$ ;  $B := B + 5$

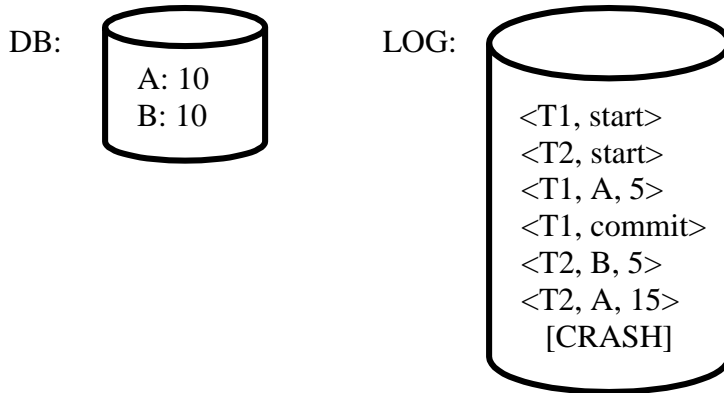
Say that UNDO/REDO logging is in use, and that initially,  $A = 5$  and  $B = 5$ . For each hypothetical disk state shown below, state whether it is a legal state for UNDO/REDO logging. If it is not a legal state, explain why not.

Assume the log entries are in the format  
<Tid, Variable, Old value, New value>



## Problem 4 (20 points)

Say the system reboots after a crash and finds the following disk state:



- a) If the system is using UNDO logging, give the initial state of the database before T1 and T2 began executing (i.e., what were the initial values of A and B on the disk?).
- b) If the system is using UNDO logging, what will be the final state of the database after recovery (i.e., what will be the values of A and B on the disk after the recovery process has finished?).
- c) If the system is using REDO logging, give the initial state of the database before T1 and T2 began executing (i.e., what were the initial values of A and B on the disk?).
- d) If the system is using REDO logging, what will be the final state of the database after recovery (i.e., what will be the values of A and B on the disk after the recovery process has finished?).

## Problem 5 (30 points)

Consider the following transaction log from the start of the run of a database system that is capable of running undo/redo logging with checkpointing:

- 1) <T1 Start>
- 2) <T1, A, 45, 10>
- 3) <T2 Start>
- 4) <T2, B, 5, 15>
- 5) <T2, C, 35, 10>
- 6) <T1, D, 15, 5>
- 7) <T1 Commit>
- 8) <T3 Start>
- 9) <T3, A, 10, 15>
- 10) <BEGIN CHKPT (T2, T3)>
- 11) <T2, D, 5, 20>
- 12) <T2 Commit>
- 13) <END CHKPT>
- 14) <T4 Start>
- 15) <T4, D, 20, 30>
- 16) <T3, C, 10, 15>
- 17) <T3 Commit>
- 18) <T4 Commit>

Assume the log entries are in the format

<Tid, Variable, Old value, New value>

What is the value of the data items *A*, *B*, *C*, and *D* on disk after recovery:

- a) if the system crashes just before line 6 is written to disk?
- b) if the system crashes just before line 10 is written to disk?
- c) if the system crashes just before line 12 is written to disk?
- d) if the system crashes just before line 13 is written to disk?
- e) if the system crashes just before line 16 is written to disk?
- f) if the system crashes just before line 18 is written to disk?