

Department of Computing and Information Systems

Comp90050 Advanced Database Systems

Exam Duration: Two hours

Reading Time: 15 minutes

This paper has 4 pages

Authorised materials:

No materials are authorised including calculators.

Instruction to Invigilators:

The students need script books. The examination paper should not leave the examination hall.

Instruction to Students:

Instructions. No need to simplify computations.

Do read my instructions for preparation.

The exam requires you all understand the subject. Please read notes + preparation guidelines.

continued . . .

Q1.

- a) What computer hardware aspects influence the performance of a database system? **[5 Marks]**
- b) An electronic fund transfer application had a function that can transfer an amount of X from account A to account B. The updates in the function are written as a single transaction. However, the function was modified by a newly employed programmer with the view of improving the performance of the function by dividing the updates into two sequential transactions. What can go wrong with such a decision? **[5 Marks]**

Q2.

- a) What are sufficient conditions to achieve the ACID properties? Do not give details of ACID properties to answer the question. **[5 Marks]**

continued . . .

- b) What are the problems in the following history generated by the execution of transactions T1 and T2? Give its dependency relation.

Note: the following is not complete history and you will be given complete history if such a question is asked.

<(T1,Slock A), (T1,Xlock B), (T2, Slock A), (T2, Read A),
(T2, Xlock B), (T2, Write B),,
(T2, Unlock B), (T1, Read A), (T1, Write B), (T1,unlock A),
(T1, Unlock B)>

Provide a correct history for the above to rectify the problems.

[5 Marks]

Q3.

- a) Describe The need for nested transaction model. What commit rules are followed in the Nested Transaction model and why?

[5 Marks]

- b) Describe how one can modify the contents of a disk page (block) atomically. How this is done in the case of writing log pages?

[5 Marks]

- Q4.** Describe locking protocols used for various degrees of isolation. What are the benefits of various degrees of isolation?

[10 Marks]

Q5.

- a) Why (CLRs) in are written and when?

[5 Marks]

- b) why log does not have to be flushed on Abort Transaction but on Commit Transaction?

[5 Marks]

continued . . .

COMP90050

page 4 of 5

Q6. The following is a log after a crash. Describe the steps that are performed to recover the system after a crash if ARIES is used for recovery. Your answer should clearly show the construction of Transaction Table and Dirty Page table during the recovery. The format of a log record is (LSN, TYPE, TID, Previous LSN)

Log:

(00, begin checkpoint,-, -)

(05, end checkpoint,-, -)

(10, writes to page 5, T1, -)

.

. This missing part will be provided in the exam.

.

(100, End, T4, 90)

(110, write page 2, T3, 50)

(120, write page 8, T2, 60)

[10 Marks]

Q7.

a) Compute probability of a deadlock? What are the assumptions made with such simplistic model?

[5 Marks]

continued . . .

- b)** A company uses k -way disk mirroring for its storage system and has decided to reconfigure the system to m -way mirroring to increase its storage capacity. You will be given necessary parameters if such a question is asked. What is the ratio of change in MTTF of the new storage system over the old system? You do not need a calculator to solve this problem.

[5 Marks]

End of exam