

# THE UNIVERSITY OF AUCKLAND

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**FIRST SEMESTER, 2013**

**Campus: CITY**

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**Computer Science**

**TEST**

**Fundamentals of Database Systems**

**(Time Allowed: 50 minutes)**

Note:

- The use of calculators is NOT permitted.
- Compare the exam version number on the Teleform sheet supplied with the version number above. If they do not match, ask the supervisor for a new sheet.
- Enter your name and student ID on the Teleform sheet. Your name should be entered left aligned. If your name is longer than the number of boxes provided, truncate it.
- Answer all **Multiple-choice** questions on the Teleform answer sheet provided. Answer Section **B** in the space provided in this booklet. Attempt all questions.
- Use a dark pencil to mark your answers in the multiple choice answer boxes on the Teleform sheet. Check that the question number on the sheet corresponds to the question number in this question/answer book. If you spoil your sheet, ask the supervisor for a replacement.
- Write your answers in the space provided in the short answer section. Write as clearly as possible. The space provided will generally be sufficient but is not necessarily an indication of the expected length. Extra space is provided at the end of this exam book.

<b>Surname:</b>	
<b>First Name(s):</b>	
<b>Student ID:</b>	
<b>Login Name(UPI):</b>	

**MARKERS ONLY**

Question	Marks	Out Of
18		4
19		8

CONTINUED

For the following four questions use the following set of transactions and the indicated timing of when the operations are issued.

TA1:     r1[x],             w1[x],                     c1  
TA2:             r2[x],                     w2[x],             c2  
TA3:                             r3[x], c3

**Question 1**

[2 marks] If we use the simple scheduler, which operation gets blocked first?

- (a) w1[x],
- (b) w2[x],
- (c) r2[x],
- (d) r3[x],
- (e) None of the above

**Question 2**

[2 marks] If we use the common scheduler, which operation gets blocked first?

- (a) r2[x],
- (b) w1[x],
- (c) w2[x],
- (d) r3[x],
- (e) None of the above

**Question 3**

[2 marks] If we run all transactions on the isolation level READ COMMITTED, i.e. they ignore each other's read locks, which operation gets blocked first?

- (a) r3[x],
- (b) w1[x],
- (c) w2[x],
- (d) r2[x],
- (e) None of the above

**Question 4**

[2 marks] If we run TA1, TA2 on the Isolation level READ COMMITTED, and TA3 on isolation level READ UNCOMMITTED, which operation gets blocked first?

- (a) w1[x],
- (b) r2[x],
- (c) w2[x],
- (d) r3[x],
- (e) None of the above

For the following three questions use the following schedule  
s1: r1[z], w2[x], r3[z], r1[x], w3[z], c3, r1[z], r1[y], w1[y], c1, c2

**Question 5**

[3 marks] What is the worst phenomenon in schedule s1?

- (a) Lost update
- (b) Fuzzy read
- (c) Dirty write
- (d) Dirty read
- (e) None of the above

**Question 6**

[2 marks] Name the first object on which the locking rules of the common scheduler are not observed?

- (a) x
- (b) z
- (c) y
- (d) None of the above.

**Question 7**

[2 marks] Which transaction is the first to not observe the locks on an object?

- (a) TA3
- (b) TA2
- (c) TA1
- (d) None of the above.

For the following three questions use the following schedule  
s2: r1[z], w2[x], r3[z], c2, r1[x], w3[z], c3, r1[y], w1[y], c1

**Question 8**

[3 marks] What is the worst phenomenon in schedule s2?

- (a) Dirty read
- (b) Lost update
- (c) Fuzzy read
- (d) Dirty write
- (e) None of the above

**Question 9**

[2 marks] Name the first object on which the locking rules of the common scheduler are not observed?

- (a) y
- (b) z
- (c) x
- (d) None of the above

**Question 10**

[2 marks] Which transaction is the first to not observe the locks on an object?

- (a) TA3
- (b) TA1
- (c) TA2
- (d) None of the above

For the following three questions use the following set of transactions. We use the **common** scheduler.

TA1: r1[x], w1[x], w1[y], r1[y], c1

TA2: r2[y], r2[k], r2[z], c2

TA3: r3[z], w3[x], r3[x], c3

**Question 11**

[3 marks] Can **TA1** become part of a deadlock, and if yes, which operation would be blocked?

- (a) Yes, r1[y] would be blocked.
- (b) Yes, w1[x] would be blocked.
- (c) Yes, r1[x] would be blocked.
- (d) Yes, w1[y] would be blocked.
- (e) None of the above

**Question 12**

[2 marks] Can **TA2** become part of a deadlock, and if yes, which operation would be blocked?

- (a) Yes, r2[y] would be blocked.
- (b) Yes, r2[k] would be blocked.
- (c) Yes, r2[z] would be blocked.
- (d) None of the above

**Question 13**

[2 marks] Can **TA3** become part of a deadlock, and if yes, which operation would be blocked?

- (a) Yes, w3[x] would be blocked.
- (b) Yes, r3[x] would be blocked.
- (c) Yes, r3[z] would be blocked.
- (d) None of the above

For the following three questions, consider the following scenario:

The stable database has at time t the following pages, objects on these pages and values:

Page 1:

x = 54

y = 37

Page 2:

z = 23

k = 95

The following is the list of the stable log records at time t. The database uses the steal, no-force policy. The database encounters a system crash at time t. You are supposed to **perform crash recovery**.

[nr: 161, ta: 81, obj: z, b: 12, a: 23]

[nr: 162, ta: 82, obj: k, b: 87, a: 95]

[nr: 163, ta: 82, obj: x, b: 52, a: 54]

[nr: 164, ta: 82, commit ]

[nr: 165, ta: 83, obj: y, b: 61, a: 37]

[nr: 166, ta: 81, obj: x, b: 54, a: 78]

[nr: 167, ta: 81, commit]

[nr: 168, ta: 84, obj: x, b: 78, a: 21]

[nr: 169, ta: 84, obj: z, b: 23, a: 34]

[nr: 170, checkpoint: redo: 161, undo: 165]

[nr: 171, ta: 83, obj: k, b: 95, a: 73]

**Question 14**

[2 marks] What is the content of page 1 of the stable database after the crash recovery?

- (a) x= 54, y=37
- (b) x= 78, y=37
- (c) x= 52, y=61
- (d) x= 78, y=61
- (e) None of the above

**Question 15**

[2 marks] What is the content of page 2 of the stable database after the crash recovery?

- (a) z= 12, k=87
- (b) z= 23, k=95
- (c) z= 34, k=73
- (d) z= 12, k=95
- (e) None of the above

**Question 16**

[2 marks] Was a database buffer page written to the stable database applying the steal policy, i.e. containing a then uncommitted write? If Yes, for which page and between which two log entries was this page written to the stable database?

- (a) Yes, Page2 between log entry 169 and 170
- (b) Yes, Page2 between log entry 162 and 163
- (c) Yes, Page1 between log entry 163 and 164
- (d) Yes, Page1 between log entry 165 and 166
- (e) None of the above

**Question 17**

[3 marks] Consider the following set of transactions, with the indicated timing of when the operations are issued. They will run into a deadlock in the common scheduler.

TA1: w1[y], R1[x], w1[x], c1

TA2: r2[x], w2[x], c2

What is the best strategy for resolving the deadlock:

- (a) Abort TA1
- (b) Grant TA1 the exclusive lock on x; TA1 can continue, TA2 waits for TA1
- (c) Grant TA2 the exclusive lock on x, TA2 can continue, TA1 waits for TA2
- (d) Abort TA2
- (e) None of the above

**SECTION B**

Answer all questions in this section in the space provided. If you run out of space then please use the Overflow Sheet and indicate in the allotted space that you have used the Overflow Sheet.

**Question 18**

**[4 marks]**

Give reasons for your answer to Question 17



**Question 19**

**[8 marks]**

- a) Explain which operations should be performed in a transactional dequeue, how should the transaction demarcation be set?



- b) What does the transactional dequeue pattern achieve? What does it prevent?







**Rough Working – This page will not be marked**

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