

COMP 28112

Two hours - online

EXAM PAPER MUST NOT BE REMOVED FROM THE EXAM ROOM

**UNIVERSITY OF MANCHESTER
SCHOOL OF COMPUTER SCIENCE**

Distributed Computing

Date: Wednesday 22nd May 2019

Time: 14:00 - 16:00

**This is an online examination. Please answer ALL Questions
The exam contains MULTIPLE CHOICE QUESTIONS**

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This is a CLOSED book examination

The use of electronic calculators is NOT permitted

[PTO]

*Section A contains
multiple choice
questions and is,
therefore, restricted*

SECTION B

Answer all questions from this section.

1. Explain briefly what the four properties commonly denoted by the acronym ACID are when referring to transactions. (3 marks)

2. Why might an implementation of distributed transactions lead to distributed deadlock? Outline one mechanism for attempting to detect distributed deadlock. (2 marks)

3. A service is replicated onto 3 computers.
 - The first computer, A, has a mean time between failures of 1.5 days.
 - The second computer, B, has a mean time between failures of 2 days.
 - The third computer, C, has a mean time between failures of 2.5 days.
 - When a failure occurs, it takes on average 12 hours to fix.
 - (i) What is the availability of the replicated service? (1 mark)
 - (ii) What would the availability of the replicated service be if only computers A and B were used? (1 mark)

4. The following four processes access a shared variable x . Each process accesses a different replica of the store used to hold this variable. Before any process starts executing, the value of x is 0 in all the replicas.

Process 1 $x=1;$ $x=4;$ Process 2 $x=2;$ $x=3;$ Process 3 $while(x==0);$ $y=x;$ $y=5*x+y;$ Process 4 $while(x==0);$ $z=x;$ $z=5*x+z;$

- (i) When all four processes have completed executing the statements given, are 7 and 14 possible values of y and z respectively, if the replication uses the sequential consistency model? Justify your answer. (2 marks)

- (ii) When all four processes have completed executing the statements given, are 7 and 14 possible values of y and z respectively, if the replication uses the causal consistency model? Justify your answer. (2 marks)

[PTO]

5. For the needs of a scientific experiment, ten data collection instruments are deployed at ten different locations of a country, one instrument at each location. These instruments collect data on a continuous basis, which are transmitted to a remote server for storage and processing. To facilitate data storage and processing three servers are going to be placed at three of the ten different locations. Describe a strategy to decide what locations to use to place the servers. (2 marks)
6. In a system containing 6 computers, identified by the integers 1-6, the leader is chosen by the Bully algorithm to be the live one with the highest identifier. Assume for this part that all messages are delivered promptly, and that the computers and the network are entirely reliable. How many messages in total are sent so that the computer with identifier 1 after it is rebooted can learn the identity of the leader by triggering an election? Take care to explain your working! (2 marks)
7. The following questions relate to lab exercise 2.
- (i) What would you do to launch a denial of service attack against the server? (1 marks)
- (ii) What would the consequences of not using ACID transactions be when the server runs the code for: i) obtaining availability; (ii) retrieving bookings; (iii) reserving a slot; (iv) cancelling a slot? State any assumptions you make. (2 marks)
- (iii) Suggest a server configuration to handle the load of incoming messages if, on average, every incoming message requires server processing time of 400 milliseconds and, on average, there are about 16000 messages per hour. State any assumptions you make. (2 marks)

END OF EXAMINATION