

JK LAKSHMIPAT UNIVERSITY, JAIPUR

INSTITUTE OF ENGINEERING AND TECHNOLOGY

End Term Examination (Regular/ Backlog), April-May. 2016

M. Tech in Computer Science Engineering, Semester II

Roll No.....

MTCS203: Distributed Computing

Time: 3 hours

Max. Marks: 100

Instructions to students:

1. Do not write anything other than your roll number on question paper.
2. Assume suitable data wherever required and mention it clearly.
3. Writing appropriate units, nomenclature, and drawing neat sketches/schematics/ flow chart wherever, required are an integral part of the answer.

Q.1A Objective type multiple choice questions (10 questions @ 1 mark)

10

- i. 1) The wait-for graph is a deadlock detection algorithm that is applicable when :
 - a) all resources have a single instance
 - b) all resources have multiple instances
 - c) both a and b
 - d) none
- ii. An edge from process P_i to P_j in a wait for graph indicates that :
 - a) P_i is waiting for P_j to release a resource that P_i needs
 - b) P_j is waiting for P_i to release a resource that P_j needs
 - c) P_i is waiting for P_j to leave the system
 - d) P_j is waiting for P_i to leave the system
- iii. In cryptography, what is cipher?
 - a) algorithm for performing encryption and decryption
 - b) encrypted message
 - c) both (a) and (b)
 - d) none of the mentioned
- iv. In asymmetric key cryptography, the private key is kept by
 - a) sender
 - b) receiver
 - c) sender and receiver
 - d) all the connected devices to the network
- v. If deadlocks occur frequently, the detection algorithm must be invoked _____.
 - a) rarely
 - b) frequently
 - c) None of these
 - b) both a & b
- vi. A distributed database has which of the following advantages over a centralized database?
 - A. Software cost
 - B. Software complexity
 - C. Slow Response
 - D. Modular growth



- vii. If the wait for graph contains a cycle :
 - a) then a deadlock does not exist
 - b) then a deadlock exists
 - c) then the system is in a safe state
 - d) either b or c
- viii. A heterogeneous distributed database is which of the following?
 - A. The same DBMS is used at each location and data are not distributed across all nodes.
 - B. The same DBMS is used at each location and data are distributed across all nodes.
 - C. A different DBMS is used at each location and data are distributed across all nodes.
 - D. A different DBMS is used at each location and data are not distributed across all nodes.
- ix. Replication should be used when which of the following exist?
 - A. When transmission speeds and capacity in a network prohibit frequent refreshing of large tables.
 - B. When using many nodes with different operating systems and DBMSs and database designs.
 - C. The application's data can be somewhat out-of-date.
 - D. All of the above.
- x. A distributed database can use which of the following strategies?
 - A. Totally centralized at one location and accessed by many sites
 - B. Partially or totally replicated across sites
 - C. Partitioned into segments at different sites
 - D. All of the above

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|------|---|----|
| Q.2 | Short answer type questions (4 questions @ 2.5 marks) | 10 |
| A | List four ways in which an object-based model of computation is probably a good match for distributed systems. | |
| B | Explain distributed deadlock concept with example. | |
| C | Describe Lamport Logical Clock. | |
| D | Discuss SSL with example. | |
| Q.3A | Identify various types of resources that can usefully be shared in computer networks. Give examples of their sharing as it occurs in distributed systems. | 05 |
| Q.3B | Discuss briefly key challenges that one needs to address in the design and development of distributed applications. | 05 |
| Q.4A | Discuss peer-to-peer architectural model for construction of distributed systems. | 05 |
| Q.4B | Identify main types of security threats that might occur in the Internet with an example. | 05 |
| Q.5A | Discuss important operating systems services that are essential for supporting the development of concurrent and scalable distributed systems. | 05 |
| Q.5B | Discuss fundamental and architectural model of distributed system and its components. | 05 |

- Q.6A Illustrate asymmetric (public/private key pair-based) cryptography technique and how it can be used in supporting security in distributed systems. 05
- Q.6B Define deadlock. Produce a wait-for graph for the following transaction scenario and determine whether a deadlock exists 05

Transaction	Data items locked	Data items waiting for
T1	x2	x1, x3
T2	x3, x10	x7, x8
T3	x8	x4, x5
T4	x7	x1
T5	x1, x5	x3
T6	x4, x9	x6
T7	x6	x5

OR

- Q.6B Consider the following two transactions and schedule (time goes from top to bottom). Draw precedence graph for the same and conclude the state. 05

Transaction T_0	Transaction T_1
$r_0[A]$	
$w_0[A]$	
	$r_1[A]$
	$r_1[B]$
	c_1
$r_0[B]$	
$w_0[B]$	
c_0	



- Q.7A Explain in detail the Bully algorithm for electing a leader. 05
- Q.7B Discuss classification of distributed mutual algorithm. Explain any routing algorithm used in distributed computing. 05

OR

- Q.7B The executions of transactions are strict if read and write operations on an object are delayed until all transactions that previously wrote that object have either committed or aborted. Explain how the locking rules ensure strict executions. 05

- Q.8 (i) The 'transfer' transactions T and U are defined as: 10

T: a.withdraw(4); b.deposit(4);

U: c.withdraw(3); b.deposit(3);

Suppose that they are structured as pairs of nested transactions:

T1: a.withdraw(4); T2: b.deposit(4);

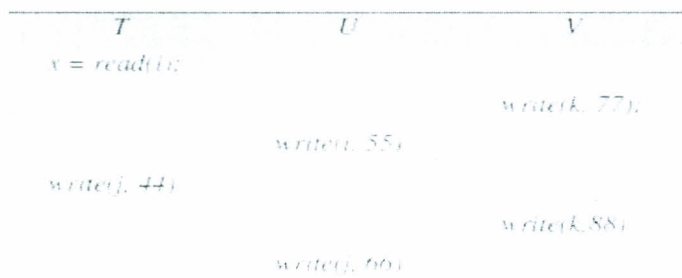
U1: c.withdraw(3); U2: b.deposit(3);

Compare the number of serially equivalent interleavings of T1, T2, U1 and U2 with the number of serially equivalent interleavings of T and U. Explain why the use of these nested transactions generally permits a larger number of serially equivalent interleaving than non-nested ones.

- (ii) Describe various types of distributed file system – Andrew file system, Sun network file system and HDFS.

Q.9A (a) What is strict consistency and why is not possible to achieve in a distributed system? 10

(b) Explain precedence graph and wait for graph. Draw precedence graph of following set of transactions.



Q.9B (i) An alternative definition for a distributed system is that of a collection of independent computers providing the view of being a single system, that is, it is completely hidden from users that there even multiple computers. Give an example where this view would come in very handy. 10

(ii) A server manages the objects $a_1, a_2, \dots, a_n$. The server provides two operations for its clients:

read (i) returns the value of a_i ;

write(i, Value) assigns Value to a_i .

The transactions T and U are defined as follows:

T: $x = \text{read}(j); y = \text{read}(i); \text{write}(j, 44); \text{write}(i, 33);$

U: $x = \text{read}(k); \text{write}(i, 55); y = \text{read}(j); \text{write}(k, 66).$

Give three serially equivalent interleavings of the transactions T and U.

OR

Q.9B (i) In the bully algorithm, a recovering process starts an election and will become the new coordinator if it has a higher identifier than the current incumbent. Is this a necessary feature of the algorithm? Justify. 10

(ii) The TaskBag is a service whose functionality is to provide a repository for 'task descriptions'. It enables clients running in several computers to carry out parts of a computation in parallel. A master process places descriptions of subtasks of a computation in the TaskBag, and worker processes select tasks from the TaskBag and carry them out, returning descriptions of their results to the TaskBag. The master then collects the results and combines them to produce the final result.

The TaskBag service provides the following operations:

setTask allows clients to add task descriptions to the bag;

takeTask allows clients to take task descriptions out of the bag.

A client makes the request takeTask, when a task is not available but may be available soon. Discuss the advantages and drawbacks of the following alternatives:

i) The server can reply immediately, telling the client to try again later.

ii) The server operation (and therefore the client) must wait until a task becomes available.

iii) Callbacks are used.