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Invigilator's Signature :	

2012 ADVANCED OPERATING SYSTEM

Time Allotted : 3 Hours

Full Marks: 70

The figures in the margin indicate full marks. Candidates are required to give their answers in their own words as far as practicable.

Answer Question No. 1 and any *four* questions from the rest.

- a) Explain the concept of logical clocks and their importance in distributed systems. A clock of a computer system must never run backward. Explain how this issue can be handled in an implementation of the logical clock concept.
 - b) There is one distributed mutual exclusion algorithm, which gives the impression that, the message complexity of a distributed mutual exclusion can be O (\sqrt{N}) instead of O (N). Why does the algorithm need $3\sqrt{N}$ messages per CS execution and each request need \sqrt{N} messages ? 4
 - c) Explain the concept of semaphore for solving critical section problem with the help of the flowchart. Describe the drawbacks of semaphore.

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2. a) Figure below shows events of three processes P1, P2 and and P3. Let e_{ij} denotes the *j*th event of process p_i .

Arrows indicate transmission of messages.



Assume that the processes use Lamport's logical clocks where c_i denotes the logical clock at process p_i . The initial value of $c_i = 0$ for every process p_i . Assume that the increment value of d = 1 for all processes.

- i) To each event shown in the figure assign the correct clock value.
- ii) In Lamport's logical clock if the increment value d is different in each process. Explain your answer.

3 + 3

- b) Explain the limitation of Lamport's logical clock with the help of diagram. "Vector clock concept can overcome the limitation of Lamport's logical clock." Justify. 3 + 5
- a) What are the different approaches for maintaining cache consistency of the data cached at clients ? If the cache consistency scheme does not address the sequential write sharing issue then what sort of problem can arise ?

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- b) "A distributed operating system makes collection of networked machines to act like a virtual uniprocessor." What are the main advantages of this virtual machine architecture for a user ? What design issues are required in distributed operating system to achieve this goal ?
- 4. a) What is race condition ? Show with an example. 3
 - b) "In Ricart-Agrawal's mutual exclusion algorithm a process will get all N-1 REPLY messages only if it is eligible to enter in the critical section so the extra RELEASE message is not required in this algorithm." Justify the statement by discussing the Ricart-Agrawala's mutual exclusion algorithm in detail. 2
 - c) "In a simple solution to distributed mutual exclusion a control site is assigned the task of granting permission for the CS execution. The request the CS, a site sends a REQUEST message to the contol site. The control site queues up the request for the CS and grants them permission, one by one. This method to achieve mutual exclusion in distributed systems requires only 3 messages per CS execution. Discuss what promoted Lamport to develop mutual execution also, even it requires more messages [3(N-1)] per CS innovation. 4 + 5
- a) "In distributed deadlock detection, in some algorithm for accessing a remote resources a process site sends the request message to a designed control site, but in some algorithm the process site sends the request message to the receiver site where the resources is locked." Between these two approaches which one is better ? Explain your answer. Between these two approaches in which approach phantom deadlock can be detected ? Show with an example. 3 + 3

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b) Show the iteration (up to 3rd) for deadlock detection for Obermark's algorithm for the following figure : 5



- c) Why does some distributed application use stateless servers to stateless server in spite of the fact that stateful servers provide an easier programming paradiagram and are typically more effected than stateless servers ?
- a) Write the edge chasing distributed deadlock detection algorithm and show the probe message propagation along each edge for the following example and then determine any deadlock exists there or not. 3 + 3



- b) Explain the migration algorithm and the read replication algorithm for implementing DSM system. 5
- c) What is false sharing ? Can this problem may lead to any other problem in a DAM system ? 1 + 2

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