Question Paper

Exam Date & Time: 27-May-2023 (02:30 PM - 05:30 PM)

MANIPAL ACADEMY OF HIGHER EDUCATION

SIXTH SEMESTER B.TECH END SEMESTER EXAMINATIONS, JUNE 2023

DISTRIBUTED SYSTEMS [ICT 3254]

Marks: 50 **Duration: 180 mins**

A

Answer all the questions.

Instructions to Candidates: Answer ALL questions Missing data may be suitably assumed

1) The INFO service manages a potentially very large set of resources, each of which can be accessed by the users throughout the Internet by means of a key (a string name). Discuss a design approach for the names of the resources that achieves the minimum loss of performance as the number of resources in the service increases. Draw the suitable fundamental architecture and suggest how the INFO service can be implemented to avoid performance bottlenecks when the number of users becomes very large. Also discuss the failure model for the above-mentioned scenario. (5)

A)

B) Suppose a system wants to transfer a large file whose buffer size is much smaller than the file size, what are the different options can be used to design the server? Assume there are two different clients willing to request two large files and both clients are on slow networks. (3)

C) A request-reply protocol is implemented over a communication service with omission failures to provide at-least-once RMI invocation semantics. In the first case the implementor assumes an asynchronous distributed system. In the second case the implementor assumes that the maximum time for the communication and the execution of a remote method is T. In what way does the latter assumption simplify the implementation? (2)

2) Design a Remote Method Invocation (RMI) application by defining suitable interface which contains basic arithmetic operations and write code using Java to host the same on remote machine. (5)

A)

B) Consider a Storage Manageruses the **nfstimeout** option value to determine how long to wait for an NFS system call to respond before timing out; this setting applies to hard and soft mounts. The default is 0 seconds. This means that the Storage Manager uses the default behavior of NFS system calls. What are the consequences of hard and soft mounts if the mount becomes stale (for example, if the server for the file system is not available). (3)

C) Consider figure Q2C and write the inferences on sequential consistency. (2)

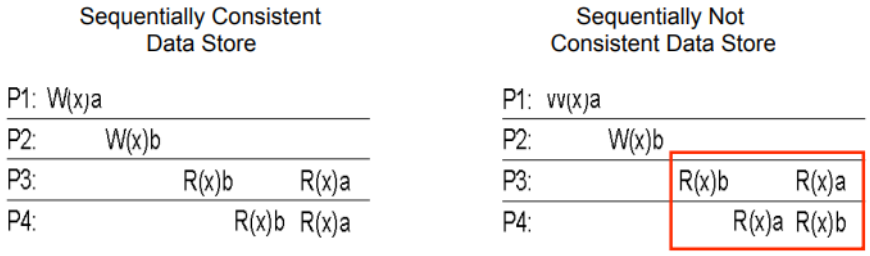

Figure Q2C

3) With a suitable diagram, explain the execution of the token ring algorithm that shows the processes are not necessarily granted entry to the critical section in happened-before order. Compare this algorithm with other algorithms based on delay, number of messages and disadvantages. How this algorithm handles the problems of permission-based algorithms? (5)

A)

B) Compare the update semantics of UNIX when accessing local files with those of NFS and AFS. Under what circumstances might the clients become aware of the differences? (3)

C) "Caching helps in name service's availability". Justify the statement with distributed domain name system. Mention the steps for implementation caching. (2)

4) Consider the object x and y in the figure Q4A transactions T1 and T2 and show the structure of transactions for the following questions. (5)

A) (a) Give an example of a schedule involving transactions T1 and T2 that results in lost update problem.

(b) Add lock and unlock instructions to the transactions T1 and T2 so that they observe two-phase locking protocol. Explain how the lost update problem can be resolved?

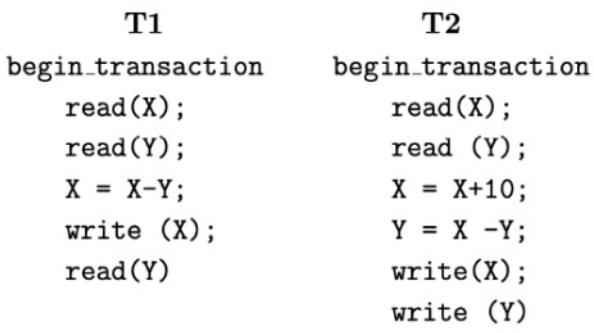

Figure Q4A

B) As shown in figure Q4B, draw event diagram for each Lamport timestamp event using vector timestamps. Use vector ordering and identify which event(s) is/are concurrent with event e. (3)

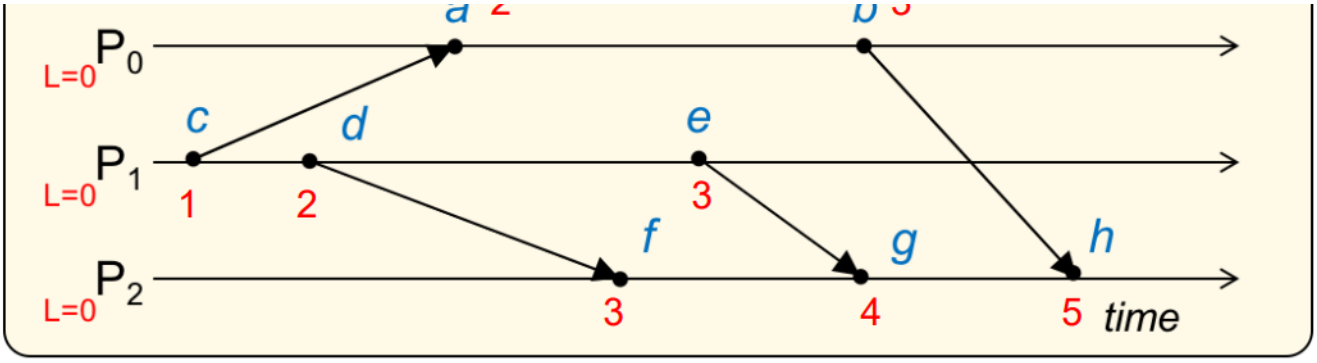

Figure Q4B

C) How to capture consistent global state of any distributed system? What is the significance of a Marker message in sending and receiving the transmission through the communication channel? (2)

5) Distributed processes often have to agree on something. For example, they may have to elect a coordinator, commit a transaction, divide tasks, coordinate a critical section, etc. (5)

Answer the following based on this information:

A)

(i) What happens when a communication channel is reliable but has faulty process and problem in the agreement?

(ii) Illustrate the problem considering four processes where one of them is a faulty process.

(iii) What are the independent variables and dependent variables?

B) If transaction T is before transaction U in their conflicting access to objects at one of the servers, then they must be in that order at all of the servers whose objects are accessed in a conflicting manner by both T and U. How this can be achieved using optimistic concurrency control? (3)

C) Web pages use rows to represent individual web pages, and columns to represent data and metadata associated with that given web page. How table abstraction can be achieved in this application to manage the storage and retrieval? (2)

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