Question Paper

Exam Date & Time: 20-Jun-2024 (02:30 PM - 05:30 PM)

MANIPAL ACADEMY OF HIGHER EDUCATION

SIXTH SEMESTER B.TECH. (COMPUTER SCIENCE AND ENGINEERING) DEGREE EXAMINATIONS - JUNE 2024
SUBJECT: CSE 3251/CSE_3251- DISTRIBUTED SYSTEMS

Answer ALL questions.
Missing data may be suitably assumed.

Marks: 50 **Duration: 180 mins.**

1A) To build a distributed system in an efficient manner, it is essential to fulfill certain design goals. One such goal is to make the distribution of processes and resources transparent to end users and applications. Summarize different forms of distribution transparencies in a distributed systems. (4)

1B) The approach of adding, removing, retrieving and modifying resources, which is widely adopted for the Web, is known as Representational State Transfer (REST). The REST has four typical characteristcs. Illustrate the four key characteristics of what are known as RESTful architectures. (3)

1C) Illustrate the hierarchical organization of nodes into a super-peer network with suitable diagram. Interpret the disadvantages of super-peers. (3)

2A) What are the properties of vector clocks? List the steps to be followed with respect to each event for updating the clocks. (4)
Given that 5 messages m1, m2, m3, m4, and m5, are exchanged between 4 processes P1, P2, P3, and P4. Table 1 below shows the send time, receive time, and the sending process. Examine the receiving process for each message.

Table 1

Message	tsnd	Trcv	Sending process	Receiving process
m1	(0,0,0,1)	(0,0,1,1)	P4	
m2	(0,0,0,2)	(0,1,0,2)	P4	
m3	(0,2,0,2)	(0,2,2,2)	P2	
m4	(1,0,0,0)	(1,0,0,3)	P1	
m5	(0,3,0,2)	(1,3,0,4)	P2	

Table 2 below compares send times of messages (i) m2 and m3, (ii) m3 and m4, and (iii) m4 and m5. For each comparison, answer Yes/No.

Table 2

Relation between send times	Yes/No
Is ts(m3) < ts(m2)?	
Is ts(m3) > ts(m2)?	
Is ts(m4) < ts(m3)?	
Is ts(m4) > ts(m3)?	
Is ts(m5) < ts(m4)?	
Is ts(m5) > ts(m4)?	

2B) With an example, demonstrate about the implication of the lack of global time in a distributed system. (3)

2C) With a diagram, Illustrate Network Time Protocol for clock synchronization. (3)

3A) The network shown below (Figure 3A) with a set of five nodes are organized in a simple overlay network with node A forming the root of a multicast tree. Analyze the relative delay penalty or stretch of the given multicast tree, when a message is passed from A to C. Also find the links, whose link stress is greater than one. (4)

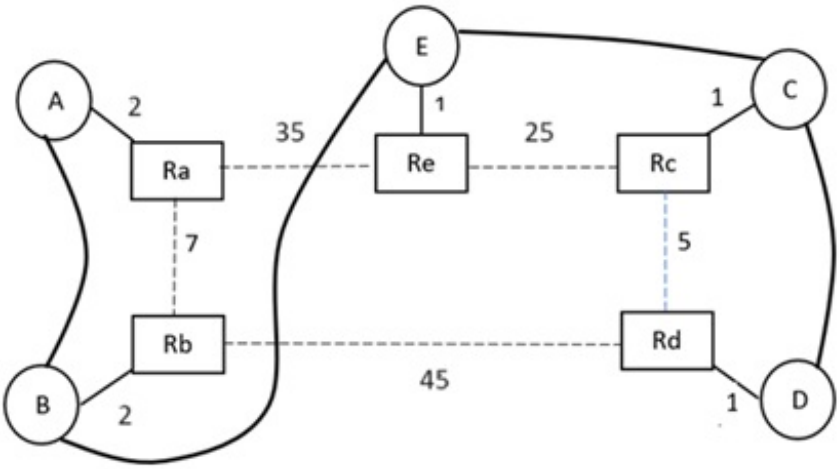
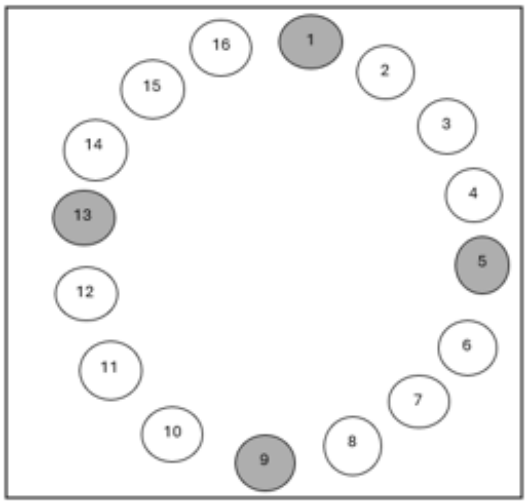


Figure 3A

3B) In zeroMQ, to effectively organize messaging applications and their components, three important messaging patterns are used. What are they? How these patterns provide an easy means of communication b/w 2 processes. (3)

3C) Why is mesh network considered to be more robust and efficient in application-level tree-based multicasting? Assume an application-level tree organized in a simple overlay network. To measure the quality of this network, what are the various metrics used? Discuss in detail with necessary diagram. (3)

4A) Consider chord network of 16 nodes (1,2,3.....,16) arranged in ring fashion, with 4 highlighted nodes 1, 5, 9, and 13 which is shown in the below Figure. Write a finger table for the highlighted nodes. Analyse the given chord and illustrate the procedure of resolving key 8 from key 1 with necessary explanation. (4)



4B) Explain the principle of recursive name resolution. Also list the drawbacks and advantages of recursive name resolution. (3)

4C) What is sequential consistency? Explain how the data store is considered as sequentially consistent and not sequentially consistent with example figures. (3)

5A) Describe *Read your writes* and *Writes follow reads* with example figures. (4)

5B) Interpret Client-initiated replicas in detail. (3)

5C)	Describe the functions of name nodes and data nodes in the HDFS architecture and show a diagram for visual aid.	(3)

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