EX/PG/DMC/T/115A

M. TECH. IN DISTRIBUTED & MOBILE COMPUTING 1ST SEM. EXAM.-2024

Subject: Distributed Systems **Time: 3 hours** **Full Marks: 100**

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 1 and **any four** from the rest

1. Answer the following questions: [10x2]

   a) A service returns inconsistent values, each time it is invoked. What is the type of failure present in the service? Justify your answer.

   b) What kind of inter-process communication should be adopted for distributed computing systems and parallel computing systems?

   c) What are the different ring structures in a x86-based computer?

   d) What are the functions of a middleware in a distributed system?

   e) What do you mean by a replication transparency?

   f) Give a scenario when flat transaction out performs nested transaction.

   g) "Call by references is not possible to implement in a distributed system" – critically comment on the statement.

   h) Why do distributed systems need naming services? Give one example of a naming service.

   i) Differentiate between client-server and peer-to-peer systems.

   j) What are stub and skeleton and why are they needed in remote procedure calls?

2. a) List the various steps to implement remote procedure call. Remote objects are usually registered in a so-called "registry" - Why? Prove that exactly once call semantic is not feasible in remote procedure calls.

   b) Define global state of a distributed system. Write an algorithm for determining the global state of a distributed system. What is its message complexity? Prove the correctness of your algorithm.

   [(3+2+5)+(2+4+1+3)]

3. a) Explain distributed computing systems and state the architecture of distributed computing systems. Also, compare and contrast between Distributed Operating Systems and Network Operating Systems with suitable examples.

   b) Explain the Election Algorithm. State and explain why the Ring Algorithm is better than the Bully Algorithm for Leader Election in a Distributed System. [(5+5)+(3+7)]

[Turn over

4. a) Explain Network Time Protocol (NTP) for external clock synchronization. "External Synchronization ensures Internal Synchronization but not the vice versa" – Justify the statement.

   b) Explain Lamport's averaging Algorithm in brief. Prove that it guarantees synchronization even in the presence of Byzantine node failure. A system is designed to support a clock skew of 65s, and maximum drift rate of 0.5s in 1s The system resynchronized regularly at an interval of 10s What is the maximum number of byzantine node the system can support? [(5+2)+(3+5+5)]

5. a) Describe different virtualization technologies used in cloud computing. Discuss their relative merit and demerits.

   b) What are the differences and similarities between Distributed Computing and Cloud Computing?

   c) Write the pseudocode of Map and Reduce processes to find the maximum edge weight in a large graph. [10+4+6]

6. Write short notes on the following topics

   a) Hadoop Architecture and the corresponding Read and Write operations.
   b) Distributed transaction Models and the commit protocol.

[10+10]