Name:.....
Roll No:.....

MAR ATHANASIUS COLLEGE OF ENGINEERING (AUTONOMOUS),
KOTHAMANGALAM - 686666
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

B.TECH FIRST SERIES EXAMINATION, AUGUST 2026 (S5 CS, DS, AIML)
B24CS3P14- DISTRIBUTED COMPUTING

Max. Marks: 40 Duration: 1.5 Hours

PART A

Answer all questions. Each question carries 3 marks.

1. A university plans to replace its centralized examination server with distributed servers across multiple campuses. Discuss three reasons that justify this transition to a distributed system. **(CO1)**
2. Explain the concept of buffered communication in a distributed system. **(CO1)**
3. Name the three message types used in the Bully Algorithm. **(CO2)**
4. Describe the three basic approaches for implementing distributed mutual exclusion. **(CO3)**

PART B

Answer all questions. Each question carries 14 marks.

5. (a) Discuss the four versions of the Send primitive used in distributed communication.

(CO1)(6 marks)

(b) Consider the following distributed execution with three processes. Let $e = e_3^4$.

$$P_1: \quad e_1^1 -- e_1^2(S1) -- e_1^3 -- e_1^4 -- e_1^5(S3) -- e_1^6(R4)$$

$$P_2: \quad e_2^1 -- e_2^2(R1) -- e_2^3(S2) -- e_2^4 -- e_2^5(R3)$$

$$P_3: \quad e_3^1 -- e_3^2(R2) -- e_3^3 -- e_3^4(e) -- e_3^5(S4)$$

Draw the space-time diagram for the above execution and answer the following:

i. Determine the Past(e_3^4).
ii. Determine the Future(e_3^4).
iii. Identify all events that are concurrent with e_3^4.
iv. Does e_1^5 belong to Past(e_3^4)? Justify your answer using Lamport's happens-before relation.

(CO1)(8 marks)

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6. (a) Consider the following ring:

$$P_{27} \rightarrow P_6 \rightarrow P_{18} \rightarrow P_{10} \rightarrow P_{30} \rightarrow P_{14} \rightarrow P_{21} \rightarrow P_5 \rightarrow P_{27}$$

The coordinator P_{30} crashes.

Process P_{10} starts the election.

Answer the following:

(i) Illustrate the election message at every stage.

(ii) Identify the coordinator.

(iii) Draw the coordinator message path.

(iv) Calculate the total message passes.

(CO2)(10 marks)

(b) Explain why the Bully Algorithm requires every process to know the IDs of all other processes, whereas the Ring Algorithm does not. **(CO2)**(4 marks)

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