MASTER OF TELE-COMMUNICATION ENGINEERING EXAMINATION, 2019
(2nd Semester)

DISTRIBUTED PROCESSING & NETWORKING

Time : Three Hours | Full Marks : 100

Answer ***any five*** questions.

1. a) What is distributed in a distributed system? How does it differ from a computer network? List and explain the important characteristics of a distributed system. 2+2+6

b) A multicomputer with 1024 CPUs is organized as a 32x32 grid. What is the worst case delay (in hops) that a message might have to take? 2

c) An experimental file server is up 3/4 of the time and down 1/4 of the time, due to bugs. How many times does this file server have to be replicated to give an availability of at least 99%? 4

d) A multiprocessor has 4096 50-MIPS CPUs connected to memory by an Omega network. How fast do the switches have to be to allow a request to go to memory and back in one instruction time? Total how many nodes will be there in the interconnection network? 4

2. a) Consider a distributed system consisting of 3 processors and 9 processes. Non-zero traffic between pair of processes is given below. Apply graph theoretic algorithm to obtain three different processor allocations and choose the best one. Assume that no machine can run more than four processes. 10

Pair of processes	Traffic	Pair of processes	Traffic
A-B	3	C-I	5
A-E	2	D-I	4
A-G	6	E-G	3
B-C	2	E-H	4
B-E	2	F-H	1
B-F	1	F-I	5
C-D	3	G-H	4
C-F	8	H-I	2

b) Discuss with an example, a sender initiated distributed heuristic algorithm for processor allocation in a distributed system. 10

3. a) What is a logical clock? What is its limitation? Calculate the logical clock times of the ten events **a – j** shown in Fig. 1 and hence give the total ordering of those events. 10

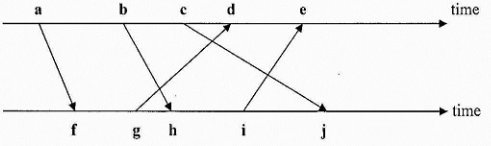

Fig. 1

b) What do you mean by a physical clock? What is UTC? What is resynchronization interval? Obtain an expression for resynchronization interval. 2+2+2+4

4. a) What is a real-time system? Write the characteristics of different types of real-time systems. 3+7

b) Discuss the Rate Monotonic Scheduling (RMS) algorithm for real-time systems. Schedule the following processes using RMS algorithm. 10

Process	Execution Time	Period (Deadline)
P1	1	3
P2	1	4
P3	1	12

5. a) Discuss a centralized algorithm for implementation of critical sections in a distributed system. 10

b) Discuss the Ring algorithm for coordinator election in a distributed system. 10

6. a) A conversation in a wireless ad-hoc network is severely disturbed by interference signals according to a Poisson process of rate $\lambda = 0.1$ per minute. i) What is the probability that no interference signals occur within the first two minutes of the conversation? ii) Given that the first two minutes are free of disturbing effects, what is the probability that in the next minute precisely one interfering signal disturbs the conversation? 5+5

b) Given the transition probability matrix P,

$$P = \begin{bmatrix} 0.8 & 0.2 & 0.0 \\ 0.8 & 0.0 & 0.2 \\ 0.0 & 0.8 & 0.2 \end{bmatrix}$$

Draw the Markov chain and compute the steady-state vector. 2+8