M.TECH DISTRIBUTED AND MOBILE COMPUTING FIRST YEAR SECOND SEMESTER 2024

DISTRIBUTED OPERATING SYSTEMS

Time: Three hours **Full Marks:** 100

Answer any ***five*** from the following questions. Each question carries twenty marks.
Make your answer brief and to-the-point.

1. a) What is ***distributed operating system*** **(DOS)?** Name various kinds of **DOS** that exist in literature and compare them with respect to **degree of transparency, underlying hardware** (homogeneous or heterogeneous), **number of OS, basis for communication** and **scalability**.
b) Write down the advantages and disadvantages of ***distributed systems*** **(DS)** over the **centralized systems**. What is the difference between a ***multiprocessor*** and a ***multicomputer***?

(2+8) + (6+4)

2.
a) What is ***mutual exclusion***? State the ***necessary & sufficient conditions*** for achieving mutual exclusion in a **DS**.
b) Describe the **Ricart and Agrawala's** algorithm for achieving mutual exclusion in a **DS**.
b) A **DS** may have multiple, independent ***critical regions*** **(CR)**. Imagine that *process 0* wants to enter **CR** *A* and *process 1* wants to enter **CR** *B*. Can **Ricart and Agrawala's** algorithm lead to deadlocks? Explain your answer.

(2+3) + 10 + 5

3. a) How a transaction is represented and executed in a distributed system?
b) Define ***well-formed*** transaction and ***two-phase*** transaction. Consider the following transaction T1 and define it in well-formed two-phase form.

```
T1:begin transaction
        read(x); read(y); write(x-5); write(y+5);
   end transaction.
```

c) Prove that if { T1, T2, ..., Tm} is a set of well-formed and two-phase transactions, then any legal schedule is equivalent to a serial schedule.

3 + (2+3) + 12

4. a) Describe a distributed periodic deadlock detection algorithm. Prove that global deadlock will be detected by some site if that distributed periodic deadlock detection is followed.
b) What is ***phantom deadlock***? Illustrate it with an example.

(10+5) + 5

5. a) Specify one major limitation of bus-based **multiprocessor**? What alternative system design has been proposed in literature to overcome it?
b) Describe the cache consistency protocol adopted by ***Dash***. A **Dash** system has ***B*** bytes of memory divided over ***m*** clusters. Each cluster has ***n*** processors in it. The cache block size is ***c*** bytes. Give a formula for the total amount of memory devoted to directories (excluding the two state bits per directory entry).

(2+4) + (10+4)

6. a) What are the advantages of a ***distributed shared memory*** (**DSM**) system over a **distributed system**? Write down the basic design principle of page-based **DSM**.
b) Although use of **replicated pages** among the processors can improve the performances of the page-based **DSMs**, but if a process attempts to write on a **replicated page**, a potential consistency problem arises - explain it. Describe a suitable **protocol** to overcome this consistency problem.

(3+5) + (4+8)