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**Operating Systems (CS550)**

**Exam 1**

**Part I (20 points).**

Circle either true or false to indicate that the following statements are true or false. Evaluate “truth” in terms of the material covered in this course. The statements below are intended to have an unambiguous answer.

1. T F Two threads in the same process can share their local variables.

2. T F The process control block (PCB) contains a list of child processes.

3. T F A context switch changes control of the CPU from one process to

another.

4. T F MPI\_Comm\_size retrieves a process’s rank.

5. T F Processes may be in one of three states at any given time.

6. T F A thread may be shared by multiple processes.

7. T F Binary semaphores are often used to allow for mutual exclusion.

8. T F General purpose operating systems are those where a set of jobs is

always submitted in a sequence for processing.

9. T F The memory manager controls the allocation and deallocation of

memory.

10. T F In solving embarrassingly parallel problems, objects and/or variables

may be shared across threads or processes.

Part II (80 points).

Read instructions and questions carefully.

1. List the three states in which a process or thread may be in and briefly describe each (10 points).
2. Write a Java program that has two threads that share a semaphore and a Double variable protected by that semaphore. The Double variable should be initialized to 100.0. The first thread should access the variable 10 times and multiply it by 1.1. The second thread should access the variable 10 times and multiply it by 0.9. The main method must allow this access to occur concurrently (15 points).
3. Explain if the previous program provides mutual exclusion and if a race condition exists (5 points).
4. Explain the parameters of the MPI\_Send function and its purpose (5 points).
5. Explain the producer consumer problem, describing the producer, consumer, shared buffer, and semaphores needed (10 points).
6. Provide pseudocode for both the producer and consumer threads (10 points).
7. List five of the parts of the Process Control Block (PCB) and five of the parts of the thread descriptor (10 points).
8. Explain the difference between processes and threads, and provide an example of when threads would be preferred and when processes would be preferred (5 points).
9. Describe a fixed thread pool. Be sure to list the parts of the thread pool and use diagrams to show how the parts interact (10 points).