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**Operating Systems**

**CS 550**

**Final Exam**

**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 The process control block contains a parent process id.
2. T F Disallowing mutual exclusion will prevent deadlock.
3. T F Semaphores provide mutual exclusion at an equal or lower programming level than monitors.
4. T F Denying hold and wait is a deadlock-free solution to the dining philosophers problem.
5. T F NTFS is a journaling file system, in which the journal is a transaction log of file changes.
6. T F The dispatcher swaps threads between the ready and run states.
7. T F Round robin is a non-preemptive scheduling policy.
8. T F With pre-paging, memory is fetched immediately as it is needed.
9. T F The optimal page replacement strategy requires knowledge of the entire set of pages needed.
10. T F Direct memory access allows I/O requests to be processed while the CPU is doing work.

**Part II (80 points).**

Read instructions and questions carefully.

1. What is the difference between a page and a frame? (4 points)
2. Describe the FIFO, LRU and Optimal page replacement algorithms with respect to memory management (6 points).
3. Describe the difference between deadlock avoidance and deadlock recovery (4 points).
4. List and describe three disk scheduling algorithms such as the elevator (SCAN) algorithm (6 points).
5. Draw diagrams showing how non-contiguous memory works, describing and showing segmentation, paging, physical memory, and the address translations between each step (10 points).
6. Explain the difference between internal and external memory fragmentation, using contiguous memory as an example (5 points).
7. Write MPI code to perform a parallel read from a file (10 points).
8. What is Lustre? Explain detailing at least 4 features (5 points).
9. Given 5 processes that start at the same time, having CPU burst times of 15, 10, 20, 75, and 42 milliseconds and a process arriving at time 34ms with a burst time of 23ms, draw a Gantt chart for those processes using the Round Robin scheduling policy with a time slice of 20ms. Compute the average wait time for all processes (10 points).
10. Draw a diagram of the three states in which a process may exist. Describe each of these states (5 points).
11. Explain the differences between journaling and non-journaling file systems (5 points).
12. Explain the difference between a counting and binary semaphore, showing examples of how each may be declared and used in Java (10 points).