Name: _____

CS 4/53201   **Final Exam**   **Operating Systems**

Monday 10 December 2001

1. For the operating system to provide effective protection against accidental or intentional damage by a user program, it must have good support from the CPU architecture.

    a. Explain how the operating system can provide protection if the CPU architecture provides two modes for instruction execution: user mode, and kernel / privileged / monitor mode. (10 points)

    b. Explain how the operating system can provide protection if the CPU architecture provides base and limit registers. (10 points)

2. Besides waiting on an I/O operation to complete, for what other reason might a process or thread be in the blocked state? (Hint — there are 3 other reasons.) (10 points)

3. Shortest-Job-First (SJF) is a non-preemptive algorithm for CPU scheduling.

    a. How effective is this algorithm with respect to scheduling processes with a <u>short</u> CPU burst? (5 points)

    b. How effective is this algorithm with respect to scheduling processes with a <u>long</u> CPU burst? (5 points)

    c. The overhead that is required for the operating system to use this algorithm is high. Explain why this is true. (5 points)

4. This question examines deadlock and deadlock prevention.

    a. List the 4 necessary and sufficient conditions for deadlock. (5 points)

    b. Consider the following proposal: if a process wants to acquire a new resource, it must first release all of its current resources, and then it must make a single request to acquire both the new resource plus those that it just released (all at the same time).

       Is deadlock still possible? If so, explain how it might arise. If not, indicate which of 4 necessary and sufficient conditions does not hold, and briefly explain why. (5 points)

5. In demand paging, Least Recently Used (LRU) is the ideal algorithm. Why is LRU not used in practice? (10 points)

6. The operating system represents each file using a file descriptor (in UNIX terms, an inode).

   a. What information is stored in the file descriptor? (10 points)

   b. Why is the file name not stored in the file descriptor? Be specific. (5 points)

7. Explain the basic idea of multi-level indexing, with respect to file systems. Draw a diagram if that will aid in your explanation. (15 points)

8. Consider the various disk head scheduling algorithms discussed in class.

   a. Briefly describe the LOOK algorithm. (5 points)

   b. What potential problem does the SSTF algorithm have? Explain your answer. (5 points)

   c. Would it be a good idea for SSTF to consider rotational delay as well? Explain your answer. (5 points)

9. What are the major goals of a distributed file system? (10 points)

10. Consider the Central Coordinator algorithm for distributed mutual exclusion.

    a. What does a thread do when it receives a *reply* message? (5 points)

b. What are the major problems with this algorithm? (5 points)

11. Linux represents processes and threads using the same internal representation, but uses the **fork** system call to create new processes and the **clone** system call to create new threads. How do these two system calls differ? Be specific with respect to the Linux process properties. (10 points)

12. A unique feature of Windows NT/2000 is its Environmental Subsystems. Briefly explain the functionality provided by these Environmental Subsystems, and give an example of one such Environmental Subsystem. (10 points)