Name: _____

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**CS 4/53201**           # Exam #1          **Operating Systems**

**Friday 30 September 1998**

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1.  (10 points)  Explain what is meant by the term "multiprogramming".

2.  (10 points)  In what way is memory-mapped I/O "better" than interrupt-based asynchronous I/O?

3.  (15 points)  Most modern CPUs and operating systems support two modes of operation: user mode and kernel mode.

    a.  What can a process / thread do in kernel mode that it can not do in user mode?

    b.  Briefly explain how a process / thread can get into kernel mode.

4.  (10 points)  What is the difference between a "program" and a "process"?

5.  (15 points)  In the 5 state process model, processes in both the "ready" and "blocked" states are waiting on something before they can move into the "running" state.

    a.  What are the processes waiting on in the "ready" and "blocked" states?

    b.  In the entire system, how many processes can be in each of these three states at any point in time?

6.  (15 points)  Briefly explain the major differences between a client communicating with a server via message-passing and via remote procedure calls (RPCs).

7.  (10 points)  Why is a context switch between threads faster than a context switch between processes?

8.  (15 points)  Explain how a server (e.g., a file server) can be structured to make effective use of threads.