## CS 4/53201

## Exam #1

**Operating Systems** 

Friday 5 October 2001

1. What is the difference between synchronous I/O and asynchronous I/O, and in what way is asynchronous I/O "better"? (10 points)

- 2. One of the states in the five-state process model is the "blocked" state (sometimes called the "waiting" state).
  - a. A process or thread may go into the blocked state when it is waiting on an I/O operation to complete. Give an example that illustrates this situation. (5 points)

b. Besides waiting on an I/O operation to complete, why else might a process or thread be in the blocked state? (10 points)

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- 3. Consider the various possible types of message-passing.
  - a. Using direct communication, is it possible for a process to receive messages from more than one sender? Explain. (5 points)

b. What is the major benefit that indirect communication provides over direct communication? (10 points)

- 4. Suppose three threads are all part of the same process.
  - a. What resources do the three threads share? (8 points)

b. What resources are associated with each individual thread? (7 points)

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- 5. Semaphores can be used for both mutual exclusion and synchronization.
  - a. In this context, what is meant by mutual exclusion? (8 points)

b. In this context, what is meant by synchronization? (7 points)

- 6. There are many of similarities between semaphores and condition variables.
  - a. What are the major differences between semaphores used for synchronization and condition variables, with respect to their operation inside a critical section of code? (10 points)

b. When used for synchronization, suppose a semaphore V operation occurs before a semaphore P operation. What happens when the P operation executes, and why? (5 points)

c. Suppose a condition variable signal operation occurs before a condition variable wait operation. What happens when the wait operation executes, and why? (5 points)

7. What is the relationship between monitors, classes, and locks? (10 points)