

**Homework 2 (due 2/19/2009 at 12:05pm)**  
via email to [ada@cc](mailto:ada@cc) or hardcopy in class

1. Consider the following serializer code:

```
serializer {
    queue a, b, c;
    crowd cr;
    int i = 0; /* initially zero */

    void foo() {
        enqueue(a) until i != 0;
        join_crowd(cr) {
            ... /* critical section */
        }
    }

    void bar() {
        enqueue(b) until a.empty() && i == 0;
        join_crowd(cr) {
            ... /* critical section */
        }
        i = 1;
    }

    void baz() {
        enqueue(c) until i == 1;
        join_crowd(cr) {
            ... /* critical section */
        }
        i = 0;
    }
} // end of serializer
```

Which of the following path expression(s) describe(s) only executions for which the above serializer does not deadlock?

- a) path { foo + bar + baz } + bar end    b) path { bar ; foo ; baz } end    c) path bar ; { foo } ; baz end  
d) path { baz + foo } + bar end    e) path { bar ; baz } ; foo end

2. Consider a system running ten I/O-bound tasks and one CPU-bound task. Assume that the I/O-bound tasks issue an I/O operation once for every millisecond of CPU computing and that each I/O operation takes 10 milliseconds to complete. Also assume that the context switching overhead is 0.1millisecond and that all processes are long-running tasks.

- a) What is the CPU utilization for a round-robin scheduler when the time quantum is 1 millisecond?  
b) What is the CPU utilization for a round-robin scheduler when the time quantum is 10 milliseconds?  
c) Explain how may the following scheduling criteria conflict in certain cases: I/O device utilization and CPU utilization.

**3.** What happens if a user-level thread running on top of the Psyche kernel makes a blocking system call? How does this compare to asynchronous IO calls discussed in class.