Assignment 3
Due date: Oct. 2nd, 23:59

Each question is worth 1 point.

1. Of these two types of programs:
    a. I/O-bound
    b. CPU-bound

which is more likely to have voluntary context switches, and which is more likely to have non-voluntary context switches? Explain your answer.

2. Given the following mix of tasks, task lengths, and arrival times, compute **the turnaround and waiting time for each task**, along with **the average turnaround time** for the FIFO, RR, and SJF scheduling algorithms. Assume a time slice of 10 milliseconds and that all times are in milliseconds.

Task	Length	Arrival Time
0	85	0
1	30	10
2	35	15
3	20	80
4	50	85

3. What are the three requirements a solution to the critical-section problem must satisfy?

4. Consider the following solution to the critical-section problem involving two processes P0 and P1. Assume that the variable “turn” is initialized to 0. Process P0’s code is presented below.

```
/* Other code */

while (turn != 0) { } /* Do nothing and wait. */
Critical Section /* . . . */
turn = 0;

/* Other code */
```

For process P1, replace 0 by 1 in above code. Determine if the solution meets all the required conditions for a correct critical-section solution.

5. Describe how deadlock is possible with the dining-philosophers problem.

6. There are no guarantees Peterson's solution works correctly on modern computer architectures. True or False?

7. Show that, if the wait() and signal() semaphore operations are not executed atomically, then mutual exclusion may be violated.

8. Linux uses spinlocks for both single and multiple processor systems. True or False? If False, explain why.

9. What are the two general hardware instructions that can be performed atomically?

10. Race conditions are possible in many computer systems. Consider a banking system that maintains an account balance with two functions: deposit(amount) and withdraw(amount). These two functions are passed the amount that is to be deposited or withdrawn from the bank account balance. Assume that a husband and wife share a bank account. Concurrently, the husband calls the withdraw() function, and the wife calls deposit(). Describe how a race condition is possible and what might be done to prevent the race condition from occurring.