

# CS4500/5500, Operating Systems

## Spring 2019, Assignment 1

*Due date: midnight, Saturday March 16*

Please read the following:

- 1) Assignments are to be completed individually, no teamwork.
- 2) Total points possible: 100 pts.
- 3) If not otherwise stated, each problem is 5 pts.
- 4) Please add the following statement in the beginning of your submission.

*I have neither given or received unauthorized assistance on this work*

*Name:*

*Date:*

### **Chapter 1:**

1. What are the differences between a trap and an interrupt?
2. What are the main structures of contemporary operating systems, and their advantages and disadvantages?
3. How can I/O devices notify an OS of the completion of jobs? List three ways.
4. Describe the actions an OS must take to process an interrupt.
5. What is a system call? How is the transition between the user-mode and the kernel-mode performed?

### **Chapter 2:**

1. What is a process? How is a process different from a program?
2. Given the five-state process model, explain how does a process transit among these states and on what events?
3. What are the differences of threads and processes?
4. What is multiprogramming and why it is needed?
5. Discuss the advantages and disadvantages of user-level threads and kernel-level threads.
6. Discuss the goals of CPU scheduling on different computer systems.
7. Assume that the following processes are to be executed on a uniprocessor system. Based on their arrival time and CPU burst, calculate the average turnaround time and response time of these processes under the following scheduling policies (10 pts in total):

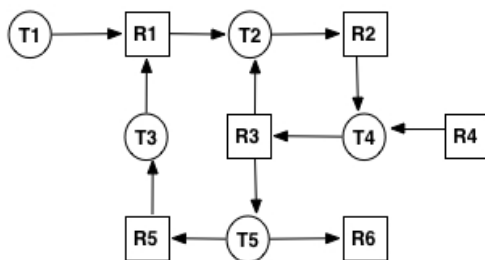
- a. FCFS (2pts)
- b. Round Robin (quantum = 3 and 6, 4pts)
- c. Shortest Job First (both preemptive and non-preemptive, 4pts)

Process	Arrival Time	CPU burst
P1	0	8
P2	1	3
P3	2	6
P4	3	4

8. What are the additional requirements of multiprocessor scheduling compared with uniprocessor scheduling? What are the possible issues?
9. List different ways to ensure mutual exclusion.
10. What are the advantages and disadvantages of busy-waiting and sleep-and-wake approaches for mutual exclusion?
11. Why semaphore is needed? What are the commonalities and differences between semaphore and mutex.
12. In the readers/writers problem (Page 171, Figure 2-48), explain what semaphores **mutex** and **db** do, and how they work in reader's and writer's processes, respectively.

### Chapter 6:

1. Given the following resource graph, please show how deadlock detection works, by finding out which processes and resources are deadlocked.



2. Problem 26 in Chapter 6, 4th edition.

**NOTE:** Change the row of process B as Allocated: 20111 Maximum: 22211 and the row of C as Allocated: 11110 Maximum: 21510