

# Operating Systems, Spring 2014

## Homework Assignment #3

Due midnight Monday, May 5, 2014

### Instructions

1. If any question is unclear, please ask for a clarification.
2. You are required to do all the homework assignments on Linux.
3. You are required to give your TA a demo of your program.
4. Unless stated otherwise, you are required to work on the homework assignment individually.
5. Neither late nor copied homework will be accepted.

### Part I (50%)

1. (10%) Explain what memory-mapped I/O is and how it works.
2. (10%) Explain what DMA is and how it works.
3. Consider the following set of processes, with the length of the CPU-burst time given in milliseconds:

<i>Process</i>	<i>Burst Time</i>	<i>Priority</i>
$P_1$	8	4
$P_2$	1	1
$P_3$	2	3
$P_4$	1	5
$P_5$	6	2

The processes are assumed to have arrived in the order  $P_1, P_2, P_3, P_4, P_5$ , all at time 0.

- (a) (5%) Draw four Gantt charts illustrating the execution of these processes using FCFS, SJF, a non-preemptive priority (a smaller priority number implies a higher priority), and RR (quantum = 1) scheduling.
  - (b) (5%) What is the turnaround time of each process for each of the scheduling algorithms in part 3a?
  - (c) (5%) What is the waiting time of each process for each of the scheduling algorithms in part 3a?
  - (d) (5%) Which of the schedulers in part 3a results in the minimal waiting time (over all processes)?
4. (10%) A UNIX process has two parts—the user part and the kernel part. Is the kernel part like a subroutine and a coroutine? Why?

## **Part II (50%)**

Write a monitor in C++ to simulate the dining philosopher problem mentioned in the textbook using the conditional variables provided by the Pthreads API. Make sure that your implementation is able to handle 5 philosophers and is free of the race condition.

## **Grading Policy**

The grading policy for this homework assignment is as follows:

- The points for each problem in Part I are as marked.
- 50 points for Part II.

## **Gentle Reminder**

*Once again, as mentioned in the instructions, neither late nor copied homework will be accepted.*