OPERATING SYSTEMS Hw 4

Problem 1 (Introduction 10 pts). What is the main difficulty that a programmer must overcome in writing an operating system for a real-time environment?

Problem 2 (Operating System Structures 10 pts). What are the main advantages of the microkernel approach to system design?

Problem 3 (Processes and Interprocess Communication 10 pts). When a process creates a new process using the fork() operation, which of the following state is shared between the parent process and the child process?

a. Stack
b. Heap
c. Shared memory segments

Problem 4 (Threads 10 pts). Provide two programming examples in which multithreading provides better performance than a single-threaded solution.

Problem 5 (Process Scheduling 30 pts). Suppose that the following processes arrive for execution at the times indicated. Each process will run the listed amount of time. In answering the questions, use nonpreemptive scheduling and base all decisions on the information you have at the time the decision must be made.

Process	Arrival Time	Burst Time	Priority
P1	0.0	8	4
P2	0.4	4	1
P3	1.0	1	0

a. Draw the timeline for FCFS, SJF, preemptive SJF, priority based scheduling.

b. What is the average turnaround time for these processes with the FCFS scheduling algorithm?

c. What is the average turnaround time for these processes with the SJF scheduling algorithm (non-preemptive)?

d. The SJF algorithm is supposed to improve performance, but notice that we chose to run process P1 at time 0 because we did not know that two shorter processes would arrive soon. Compute what the average turnaround time will be if the CPU is left idle for the first 1 unit and then SJF scheduling is used. Remember that processes P1 and P2 are waiting during this idle time, so their waiting time may increase. This algorithm could be known as future-knowledge scheduling.

Problem 6 (Process Synchronization 30 pts). The Cigarette-Smokers Problem. Consider a system with three smoker processes and one agent process. Each smoker continuously rolls a cigarette and then smokes it. But to roll and smoke a cigarette, the smoker needs three ingredients: tobacco, paper, and matches. One of the smoker processes has paper, another has tobacco, and the third has matches. The agent has an infinite supply of all three materials. The agent places two of the ingredients on the table. The smoker who has the remaining ingredient then makes and smokes a cigarette, signaling the agent on completion. The agent then puts out another two of the three ingredients, and the

cycle repeats. Write an algorithm to synchronize the agent and the smokers using semaphores. Please show sample traces of your algorithm unless it will not be accepted.
Hint: You may use 4 semaphores:
semaphore tobacco_paper, semaphore tobacco_match, semaphore match_paper, semaphore done.

Homework Policies:

1. Please do not copy-paste similar content from Internet. Cheating is strongly discouraged.
2. Each student should do his homework seperately. Group work is not allowed.
3. Late homeworks will be graded as 0.
4. Please comment your source codes.
5. Please bring your PRINTED homework until 11.April.2011

Note: Please obey these grading policies, unless your grade will be decreased.

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