

405 Operating Systems. Final exam. 2010.

Total XP: 250

1. **CPU Scheduling (15XP)** Suppose 5 jobs arrive nearly simultaneously into an empty ready queue in a system with a single CPU core (The order is P0, P1, P2, P3, P4). The following Gantt chart shows the result from RR scheduling.

P0	P1	P2	P3	P4	P0	P1	P2	P4	P0	P2	P0
10	20	30	38	48	58	60	70	80	90	93	95

The times indicated are associated with the vertical lines on the Gantt chart. (The timeline is not to scale). The last job completes at time 95.

a) (3 points) What is the quantum size (q) for this example? _____

b) (4 points) Calculate the job sizes in this example

P0:

P1:

P2:

P3:

P4:

c) (4 points) Draw the Gantt chart for RR with $q = 20$.

d) (4 points) Draw the Gantt chart for FCFS

2. **Semaphores (35XP)**. There are three types of threads that access a shared linked list: retrievers, adders, and removers. Retrievers walk through the linked list to find a particular item. Since they merely examine the list, there can be multiple retrievers accessing the list concurrently. Adders add new items to the end of the list. Adding an element must be mutually exclusive meaning multiple adders cannot access the list concurrently. However, an add can proceed in parallel with any number or retrievals. Finally, removers remove items from anywhere in the list. At most one remover can

access the list at a time and removing an item must be mutually exclusive with retrievals and additions.

Puzzler: Write code for retrievers, adders, and removers, that enforce this kind of three-way categorical mutual exclusion.

3. System Calls (25XP).

a) (10XP) What is the purpose of a system call in an operating system. (in your own words, be clear, and aim the answer at an undergrad cs major who has not taken OS)

b) (15XP) Describe the steps from executing an API call like printf in a userland program to the execution of the associated system call in the OS.

4. General Question (25XP). This is one you may want to mull over for awhile.

This semester I seem to be flying frequently between my home in Las Cruces and here. I am tired of lugging around my heavy MacBook Pro. I have a desktop here and in Cruces. However, I would like to have the exact same operating system experience regardless of where I am. For example, if I download an episode of Chuck to my desktop in Cruces, I want it to be on my desktop in Fredericksburg. If I download and install an app like VLC in Fredericksburg, I want it to be installed in Cruces. If I set my background picture to some old-skool 8 bit pattern, it should be my background everywhere. Finally, in addition to the two desktops, I want the same experience on my laptop.

I have the following resources: an Altoids tin, a 20GB Dropbox account, nail clippers (sadly I can't get my pocket knife through TSA security), a 32GB USB memory stick. and some old ukulele strings. From the above description you can see that I can install what I want on the physical computers.

How would you accomplish this? Give **specific instructions** that I can follow.

[clarification to avoid confusion: This is a thought experiment. I am not soliciting advice on how to solve a real problem I have]