CMPSCI 377: Operating Systems

Homework 2: Scheduling and Synchronization

Due: October 14, 1999

VIP Students: Due one week from when you receive the assignment.

1. (10 pts) **Scheduling.** Given the following mix of job, job lengths, and arrival times, assume a time slice of 15 and compute the completion and average response time of each job for the FIFO, RR, and SRTF algorithms. Please use the following table format for your solution.

			Scheduling Algorithms		
Job	length	arrival time	FIFO	RR	SRTF
0	75	0			
1	40	10			
2	25	10			
3	20	80			
4	45	85			
		Avg. RT			

2. (10 pts) **Scheduling.** Given 3 jobs of length 10, 30, and 20 seconds with the same arrival time, schedule them in job number order. The 10 sec job has 1 sec of I/0 every other sec starting at 1 second (assume the I/O happens just before the time slice). The context switch time is 0 sec, and there are 2 queues. The first has 1 sec time slice; the second has a 2 sec time slice. Using the Multilevel Feedback Queues Algorithm, fill in the following tables with the average response, execution, and completion times of these jobs. Use the notation from class: make the superscript on the job number the progress of the job, and the subscript on the job number the system time. For comparison, also compute the job completion and average response times for the RR algorithm.

		Completion Time	
Job	length	RR	MLFB
1	10		
2	30		
3	20		
avg. RT			

Queue	Time Slice	Job
1	1	
2	2	

3. (5 pts) **Scheduling.** What is the effect on the Round Robin Algorithm of increasing the time slice to arbitrarily large values?

4. (10 pts) **Synchronization** What advantages does the test&set instruction have over enabling and disabling interrupts? In which circumstances may we still perfer enabling and disabling interupts?

5. (15 pts) **Semaphores.** Suppose a two-way (north-south), two-lane road contains a long one-lane tunnel. A southbound (or northbound) car can only use the tunnel if there are no oncoming cars in the tunnel. Because of accidents, a signaling system has been installed at the entrances to the tunnel. When a car approaches the tunnel, a sensor notifies the controller computer by calling a function `arrive` with the car's travel direction (north or south). When a car exits the tunnel, the sensor notifies the controller computer by calling `depart` with the car's travel direction. The traffic controller sets the signal lights: green means go, and red means stop. Construct an algorithm for controlling the lights such that they operate correctly even when most cars approach the tunnel from one direction.