CS 350: First Midterm (Spring 02) - 3/21/2002

Answer all questions. Be Concise or you will run out of time. If necessary, feel free to make assumptions (clearly state them) if they do not trivialize the problem

**Problem 1:** (12 points; 10 minutes) Briefly explain any 3 of the following concepts

- Mode switch
- Mutual Exclusion
- Livelock
- Swapping

**Problem 2:** (17 pts; 15 minutes)
(a) (4 points) What is an element of a Process Control Block that does not appear in a Thread Control Block. What is an element that appears in both?
(b) (5 points) Discuss a side effect that may happen if synchronization is too liberal. Discuss one that may happen if it is too conservative.
(c) (8 points) Someone in your company suggests a new system call “compound”. This system call allows a user to request multiple operations from the OS in a single system call. The user provides a list of system calls that they want executed, then call “compound”. The OS then executes the required operations. Is this a good or bad idea? Explain

**Problem 3:** (16 points; 15 minutes) Explain the following potentially wrong statements.

1. Maximizing CPU utilization should be the aim of the short term scheduler
2. Monitors allow more effective synchronization than do semaphores
3. Kernel Level threads are not visible to the user
4. Progress and Fairness are related requirements for the critical section problem

**Problem 4:** (30 points; 20 minutes) An OS uses a multiple level feedback scheduler with 3 round-robin levels. The quantum for the 3 levels are 1, 2, and 4 time units respectively. Assume that we have 6 jobs that arrive at time 0 with burst lengths of 8, 2, 1, 3, 10, 4. The jobs are listed in the order they arrive (the one with length 8 arrived first).

(a) (15 points) Show the Gantt chart for these processes. What is the response time and the normalized turnaround time?
(b) (4 points) What are the advantages/disadvantages of this scheduler vs. Round Robin scheduling?
(c) (6 points) It appears that this scheduler does the opposite of what selfish round robin scheduling does (Recall, SRR delays newly arrived processes until they catch up in priority to existing processes). Can you explain this apparent paradox?
(d) (5 points) What are the advantages of Multiple Level Feedback relative to Shortest Job First scheduling; are there any given that SJF minimizes the average wait time?

**Problem 5:** (15 pts; 15 minutes) A traffic policeman is in charge of controlling traffic at a busy intersection. Cars arrive from 4 directions (North, East, South and West). The policeman goes through the directions in the order they are listed above (N, E, S, W then back to N). When he starts a new direction, he allows at most 5 cars to go; if there are less than 5 he changes to the next direction after the last car passes through. Show the pseudo-code for the policeman and the cars to simulate this problem.

**Problem 6:** (10 pts; 10 minutes) This problem is concerned with the bakery algorithm solution for the critical section problem.

(a) (3 points) Why was the concept of obtaining ticket numbers needed?
(b) (7 bonus) Because the process of obtaining a ticket is inefficient, the following replacement was suggested. Every process keeps track of the number of times it entered the critical section. This number is used in place of the ticket (with the process id used as tie break). Comment on this idea.