CS 376	**Operating Systems**	Test 2
Name:	Fall 1997	Max Pts: 43

Important: This is an open book test. You can use any books, notes, or paper. *Do not log into the computer during the test.* Any calculations and rough work can be done on the back side of the test pages. If there is a syntax error in any program segment, just write it down and you will get full credit for the problem. You will lose five points for not writing your name.

1. [5 pt] Show that if the `wait` and `signal` operations in semaphores are not executed atomically, then mutual exclusion may be violated.

2. [8 pt] Given memory partitions of 100K, 500K, 200K, 300K, and 600K (in order), how would each of the first-fit, best-fit, and worst-fit algorithms place processes of 212K, 417K, 112K, and 426K (in order)? Which algorithm makes the most efficient use of memory?

3. [10pt] Consider the following set of processes:

Process Name	Arrival Time	Processing Time
p_0	0	3
p_0	1	5
p_0	3	2
p_0	9	5
p_0	12	5

Compute the average turnaround time and average wait time for the following scheduling algorithms.

(a) FIFO

(b) Shortest job next

(c) Shortest remaining time next

(d) LIFO

(e) Round robin (quantum = 3)

4. [10 pt] Consider the following resource allocation policy. Requests and releases for resources are allowed at any time. If a request for resources cannot be satisfied because the resources are not available, then we check any processes that are blocked, waiting for resources. If they have the desired resources, then these resources are taken away from them and are given to the requesting process. The vector of resources for which the waiting process is waiting is increased to include the resources that were taken away.

   For example, consider a system with three resource types and the vector `Available` initialized to (4,2,2). If process p_0 asks for (2,2,1), it gets them. If p_1 asks for (1,0,1), it gets them. Then, if p_0 asks for (0,0,1), it is blocked (resource not available). If p_2 now asks for (2,0,0), it gets the available one (1,0,0) and one that was allocated to p_0 (since p_0 is blocked. p_0's allocation vector goes down to (1,2,1), and its need vector goes up to (1,0,1).

   (a) Can deadlock occur? If so, give an example. If not, which necessary condition cannot occur?

   (b) Can indefinite blocking occur?

5. [10 pt] Consider the following snapshot of a system:

	Allocation				Max need				Available			
Process	R_0	R_1	R_2	R_3	R_0	R_1	R_2	R_3	R_0	R_1	R_2	R_3
p_0	0	0	1	2	0	0	1	2	1	5	2	0
p_1	1	0	0	0	1	7	5	0				
p_2	1	3	5	4	2	3	5	6				
p_3	0	6	3	2	0	6	5	2				
p_4	0	0	1	4	0	6	5	6				

(a) What is the contents of the request matrix?

(b) Is the system in a safe state?

(c) If a request from process p_1 arrives for (0,4,2,0), can the request be granted immediately?