CS 376	**Operating Systems**	Test 2
Name:	Fall 1999	Max Pts: 48

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. [15 pt] Assume you have the following jobs to execute with one processor:

Process	Burst time	Arrival time
p_0	75	0
p_1	40	10
p_2	25	10
p_3	20	80
p_4	45	85

   Give the average wait time and average turnaround time for each process using the following algorithms:

   (a) First in first out

   (b) Shortest job next (decision to be made when a process is finished)

   (c) Shortest remaining time next

   (d) Round robin, with a quantum of 15

   (e) Round robin, with a quantum of 15 plus context switch time of 5

2. [12 pt] Assume a system with four resource types, $C = \langle 6, 4, 4, 2 \rangle$ (this is the total number of resources in the system, and not what is currently available), and the maximum claim table shown below.

Process	R_0	R_1	R_2	R_3
p_0	3	2	1	1
p_1	1	2	0	2
p_2	1	1	2	0
p_3	3	2	1	0
p_4	2	1	0	1

The resource allocator is considering allocating resources according to the following table:

Process	R_0	R_1	R_2	R_3
p_0	2	0	1	1
p_1	1	1	0	0
p_2	1	1	0	0
p_3	1	0	1	0
p_4	0	1	0	1

(a) Draw a process resource graph to show the state of the system described above.

(b) Run the safety algorithm on this system to determine if this state is safe.

3. [10 pt] A system is composed of four processes $\{p_0, p_1, p_2, p_3\}$ and four types of consumable resources $\{R_0, R_1, R_2, R_3\}$. The total number of resources in the system are: $\langle 2, 3, 2, 2 \rangle$.

   - p_0 requests 2 units of R_2.
   - p_1 has 2 units of R_0 and 1 unit of R_1 while it requests two units of R_3.
   - p_2 has 1 unit of R_1 and requests 1 unit of R_2.
   - p_4 requests one unit each of R_0 and R_2.

   Show the process resource graph to represent this system state.

   Reduce the graph and determine which processes, if any, are deadlocked?

4. [5 pt] What is the effect of increasing the time quantum to an arbitrary large number for round robin scheduling?

5. [6 pt] Given the following information:

Job list		Memory list	
Process	Memory requested	Memory block	Size
p_0	740K	B_0	610K
p_1	500K	B_1	850K
p_2	700K	B_2	700K

Use the best-fit and first-fit algorithms to allocate the memory blocks to the three processes.