CS 4760	**Operating Systems**	**Test 2**
Name:	Spring 2008	Max Pts: 57

Important: This is an open book test. You can use any books, notes, or paper but no electronic device. *Do not log into the computer during the test, or use any electronic or communications device. Switch off your cell phones*. 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. [6 pt] For most of the commands, a shell `fork`s and then, `exec`s the command. Are there any exceptions to this rule?

2. [10 pt] You are given the following set of processes.

Process	Memory	Burst time	Arrival time
p_0	200M	3	3
p_1	400M	1	1
p_2	500M	7	7
p_3	900M	6	7
p_4	500M	7	5

   Using first fit strategy, show the placement of processes at time 0, 5, 10, 15, and 20. The total available memory is 1G.

3. [6 pt] Explain the operating systems' view of memory. How does it differ from physical view and logical view?

4. [10 pt] Consider a system with the following set of processes and states:

$$P = \{p_0, p_1\},\ S = \{s_0, s_1, s_2, s_3\}$$

State changes due to processes are:

$$\begin{array}{ll} p_0(s_0) = \{s_1, s_3\} & p_1(s_0) = \{s_1, s_2\} \\ p_0(s_1) = \Omega & p_1(s_1) = \{s_0, s_2\} \\ p_0(s_2) = \{s_1, s_3\} & p_1(s_2) = \{s_0, s_1, s_3\} \\ p_0(s_3) = \{s_1, s_2\} & p_1(s_3) = \Omega \end{array}$$

Draw the corresponding state change diagram. Is the system safe? Is it deadlocked? Is there a knot in the system?

5. [10 pt] Assume a system with four resource types, $C = \langle 9, 7, 6, 6 \rangle$ (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	1	5	4
p_1	4	1	1	3
p_2	2	1	2	2
p_3	2	2	2	1
p_4	0	2	2	2

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

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

Run the safety algorithm on this system to determine if this state is safe. If it is safe, give the sequence in which processes can be run. If it is unsafe, enumerate the processes that may get involved in a deadlock.

6. [15pt] Assume that you have the following jobs to be executed with one processor:

Process	Burst time	Arrival time
p_0	6	3
p_1	9	4
p_2	5	8
p_3	8	0
p_4	6	6

Give the average wait time and average turnaround time for each process using the following algorithms. Is the CPU idle at any time in the given algorithms?

(a) First in first out

(b) Shortest job next (no preemption)

(c) Shortest remaining time next

(d) Round robin, with a quantum of 4

(e) Round robin, with a quantum of 4 plus context switch time of 1