CS 4760	Operating Systems	Test 2
Name:	Fall 2013	Max Pts: 45

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. Your cell phones must be on silent mode*. Any other device with an ON-OFF switch should have its switch in the OFF position. Any calculations and rough work can be done on the back side of the test pages. You will lose five points for not writing your name.

1. [6 pt] Assume a multiple level queue system with 10 queues, numbered 0 to 9, with 0 being the highest priority queue. The system has a variable quantum per queue, given by 5×2^ims for queue i. Any incoming job is assigned to queue 0. Consider an incoming job with total burst time requirement of 50ms. How many times will this job be interrupted, if it has all the resources allocated upon initialization and does not have to wait for any resource or signal from another process during execution? In which queue will it finish its execution? How much time will it spend in each queue?

2. [8 pt] Consider a system with 13 dedicated devices of the same type. All jobs currently running on this system require a maximum of three devices to complete their execution. The jobs run for long periods of time with just two devices, requesting the remaining device only at the very end of the run. Assume that the job stream is endless and that your operating system's follows a conservative device allocation policy: *No job will be started unless all the required devices have been allocated to it for the entire duration of its run*.

   (a) What is the maximum number of jobs that can be in progress at any given time? Explain your answer.

   (b) What are the minimum and maximum number of devices that may be idle as a result of this policy? Under what circumstances would an additional job be started?

3. [6 pt] Can you enforce process isolation in memory at compilation time? If yes, how? If not, why not?

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

$$P = \{p_0, p_1, p_2\},\ S = \{s_0, s_1, s_2, s_3\}$$

State changes due to processes are:

$$\begin{array}{lll}
p_0(s_0) = \Omega & p_1(s_0) = \{s_1\} & p_2(s_0) = \{s_1, s_2\} \\
p_0(s_1) = \Omega & p_1(s_1) = \{s_2, s_3\} & p_2(s_1) = \{s_2\} \\
p_0(s_2) = \{s_0, s_3\} & p_1(s_2) = \{s_0, s_3\} & p_2(s_2) = \Omega \\
p_0(s_3) = \{s_0\} & p_1(s_3) = \{s_1\} & p_2(s_3) = \Omega
\end{array}$$

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

5. [15 pt] You have a physical memory of 64MB, starting at address 0. Your operating system requires at least 10MB all the time. Consider the arrival of processes as follows:

Process	Burst time	Arrival time	Memory needed
p_0	5	0	47MB
p_1	18	3	34MB
p_2	4	0	2MB
p_3	12	9	43MB
p_4	10	13	12MB
p_5	17	16	35MB
p_6	18	20	11MB
p_7	18	24	16MB

Show the layout of memory, using first-fit algorithm, at times 10, 20, 30, 40, and 50.