MCS378 Midterm Exam

This exam is closed-book and mostly closed-notes. You may, however, use a single 8 1/2 by 11 sheet of paper with *hand-written* notes for reference. (Both sides of the sheet are OK.)

Please write your name only on this page. Do not turn the page until instructed, in order that everyone may have the same time. Then, be sure to look at all problems before deciding which one to do first. Some problems are easier than others, so plan your time accordingly. You have 50 minutes to work.

Write the answer to each problem on the page on which that problem appears. You may also request additional paper, which should be labeled with your test number and the problem number.

If you are stuck, ask for help. At worst, I'll offer to sell you a hint for some points.

Name: _____

Problem	Page	Possible	Score
1	2	12	
2	3	12	
3	4	12	
4	5	12	
Total		48	

1. [**12 Points**]   This problem is about the normal Linux scheduler (on a uniprocessor machine). Assume that no manual adjustments are made to a process's priority, just those that are automatically done. Consider the following four situations the process can be in:

- Not runnable (sleeping, waiting for I/O, etc.)

- Runnable, and in fact the currently running process

- Runnable, but not the currently running process, with counter > 0

- Runnable, but not the currently running process, with counter = 0

For a process that remains for a long enough time in one of the four situations, will the system automatically increase its niceness (+), automatically decrease its niceness (−), or leave its niceness alone (0)? Also, for a process that remains for a long enough time in one of the four situations, will the system automatically increase its goodness (+), automatically decrease its goodness (−), or leave its goodness alone (0)? Indicate your answers by placing the symbol +, −, or 0 into each of the eight cells of the following table.

	niceness	goodness
not runnable		
runnable and running		
runnable, not running, counter > 0		
runnable, not running, counter = 0		

2. [**12 Points**] Suppose a system has 8KB of memory that is allocated to variable-size contiguous partitions using the best-fit strategy. In the following questions, the rectangular boxes represent the system's memory, with each tick mark indicating how big 1KB is.

   (a) Suppose the following sequence of operations occurs:

     i. Partition A, of size 1KB, is allocated.
     ii. Partition B, of size 3KB, is allocated.
     iii. Partition C, of size 2KB, is allocated.
     iv. Partition D, of size 2KB, is allocated.

   Mark in the following diagram the regions that would be occupied by partitions A, B, C, and D:
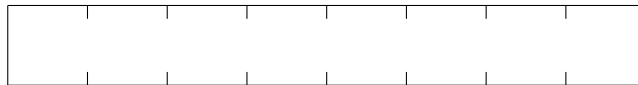
   (b) Suppose that now the following additional operations occur, in the order given, after the above four allocations:

     i. Partition B is deallocated.
     ii. Partition D is deallocated.
     iii. Partition E, of size 1KB, is allocated.
     iv. Partition F, of size 2KB, is allocated.

   Mark in the following diagrams the regions that would be occupied by partitions A, C, E, and F:

   (c) Suppose there is now a request to allocate partition G, of size 2KB. Can this request be satisfied? If so, fill in the following diagram to show the regions that would be occupied by partitions A, C, E, F, and G. If not, instead say which of the following three reasons explain why not: insufficient total memory, internal fragmentation, or external fragmentation.
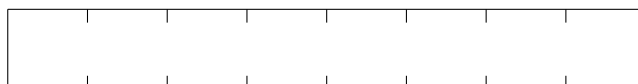
3. [**12 Points**] Suppose a system has three page frames, initially all empty. Construct a reference string for which the FIFO page replacement policy results fewer page faults than the LRU page replacement policy. For each of the two page replacement policies, show for each page number in your reference string whether it is a hit (no page fault) or a miss (page fault), and if a miss, what pages are now in the frames.

4. [**12 Points**]   Write a paragraph briefly summarizing one of the papers that we read. Do not pick a paper for which you led the discussion. Your summary should state what problem the authors were trying to solve, and what the general nature of their solution is.