Operating Systems, Spring 2013

Midterm

2:10pm ∼ 3:50pm, Tuesday, April 23, 2013

INSTRUCTIONS:

1. This is a *closed-book* exam.

2. Try to solve all of the problems.

3. Try to give short answers. (Hint: An answer need not always be longer than the question.)

4. No cheating.

5. Please hand in both the exam sheet and the answer sheet.

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1. (10%) A computer has 1 GB of RAM allocated in units of 64 KB. How many KB are needed if a bit map is used to keep track of free memory?

2. (20%) Now revisit the previous question using a hole list. How much memory is needed for the list in the best case and in the worst case? Assume the operating system occupies the bottom 512 KB of memory.

3. Using the page mapping depicted below,
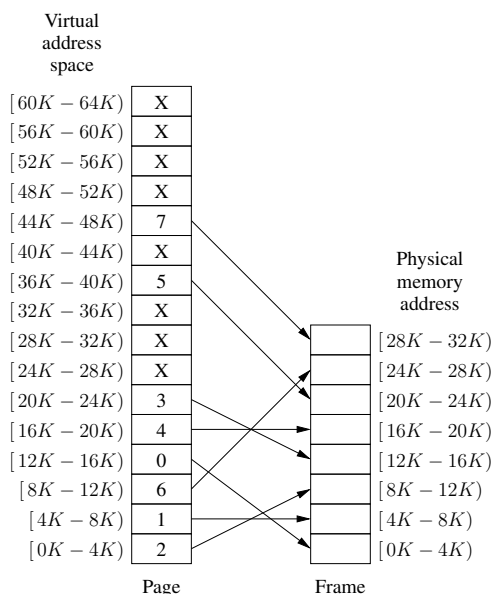
give the physical address corresponding to each of the following virtual addresses:

   (a) (10%) 20

   (b) (10%) 4100

   (c) (10%) 8300

4. (10%) A machine has 48-bit virtual addresses and 32-bit physical addresses. Pages are 8 KB. How many entries are needed for the page table?

5. (20%) Suppose that a 32-bit virtual address is broken up into four fields, a, b, c, and d. The first three are used for a three-level page table system. The fourth field, d, is the offset. Does the number of pages depend on the sizes of all four fields? If not, which ones matter and which ones do not?

6. (10%) A computer whose processes have 1024 pages in their address spaces keeps its page tables in memory. The overhead required for reading a word from the page table is 500 nsec. To reduce this overhead, the computer has a TLB, which holds 32 (page, frame) pairs and can do a lookup in 100 nsec. What hit rate is needed to reduce the mean overhead to 200 nsec?