ECS-154A Fall 2009 Quiz 5

Name: _____ Student ID number: _____

Signature: _____

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1. (5) Given a logical 29-bit address and a 512Kbyte physical memory for a byte-addressable machine,

   How big is the physical address space?

   How big is the virtual address space?

   Assuming 8K-byte pages, how many page frames are there? How many pages? How many bits wide is the page table?

   Assuming 1K-byte pages, how many page frames are there? How many pages? How many bits wide is the page table?

2. (4pts) Assume a task is divided into 4 equal-sized segments, and that the system builds an 8-entry page descriptor table for each segment. Thus, the system has a combination of segmentation and paging. Assume also that the page size is 4K bytes

   a. What is the maximum size of each segment?

   b. What is the maximum logical address space for the task?

   c. Assume that an element in physical location 0x1ABC is accessed by this task. What is the format of the logical address that the task generates for it?

3. (6 pts) A virtual memory system for a byte-addressable processor with 8-byte words has a page size of 128 words, sixteen virtual pages, and four physical page frames. The page table is as follows:

Virtual page Number	Page Frame Number
0	1
1	3
2	-
3	0
4	-
5	-
6	-
7	-
8	-
9	-
10	-
11	2
12	-
13	-
14	-
15	-

a. What is the size of the virtual address space? (How many bits in a virtual address?)

b. What is the size of the physical address space? (How many bits in a physical address?)

c. What is the physical address corresponding to the following virtual addresses? (Indicate which, if any, cause page faults).

0x0000, 0xFFFF

4. (8 pts) The following tables contain some of the information about a segmented, paged virtual memory system and certain select memory locations. Total physical memory size is 32K bytes, and the page size is 2048 bytes. All numbers in this table are in decimal unless otherwise noted.

Segment Table

Entry Number	Presence Bit	Page Table
0	1	5
1	0	0
2	1	0
3	1	7
4	1	2
5	1	3
6	1	1
7	1	4

Page Table 0

Entry Number	Present? (1=Yes)	Disk Addr	Frame Number
0	1	1234123	0x4
1	0	0893748	0x7
2	1	2489567	0x1
3	1	9623873	0x5
7	1	B0F6BD3	0x2
10	0	32829AA	0x1
12	1	56D87AC	0x0
15	1	10A876D	0x6

Page Table 2

Entry Number	Present? (1=Yes)	Disk Addr	Frame Number
0	1	1234123	0x1
1	0	0893748	0x3
2	1	2489567	0x5
3	1	9623873	0x7
4	1	BC56BD3	0x9
5	0	832759E	0x2
11	1	46B37AC	0x4
15	1	810476D	0x6

Memory

Address	Contents
0x00A4	0x76
0x01A4	0x73
0x02A4	0x32
0x03A4	0x46
0x04A4	0x30
0x2AA4	0x29
0x05A4	0xa9
0x09A4	0x74
0x0AA4	0x05
0x0CA4	0x23
0x0DA4	0xE3
0x17A4	0xAE
0x22A4	0x92

Page Table 5

Entry Number	Present? (1=Yes)	Disk Addr	Frame Number
0	1	1234123	0x5
1	0	0893748	0x3
5	0	2489567	0x4
7	1	9623873	0x4
11	1	AE76BD3	0x6
13	0	328759A	0x7
14	1	11D87BE	0x2
15	1	91C875D	0x0

Page Table 7

Entry Number	Present? (1=Yes)	Disk Addr	Frame Number
0	1	1234123	0x5
1	0	0893748	0x6
2	1	2489567	0x1
3	1	9623873	0x2
4	1	AE76BD3	0x4
5	1	328759A	0x0
6	1	56D87AC	0x3
7	1	10A876D	0x6

For each of the following convert the virtual address into a physical address (if possible) and write down the value of the memory location corresponding to the address. If it is not possible to do so, explain why.

0x3AA4 (**0 0 1 1 1 0 1 0 1 0 1 0 0 1 0 0** in binary).

0x6CA4 (**0 1 1 0 1 1 0 0 1 0 1 0 0 1 0 0** in binary).

0xD4A4 (**1 1 0 1 0 1 0 0 1 0 1 0 0 1 0 0** in binary).

5. (7 pts) Add the connections to the following diagram necessary to create a 8Kx8 memory. Not all of the hardware shown is required to perform this task.

CS - Chip Select
OE - Output Enable
RD - Read (Read/Write, technically)