CS471: Operating System Concepts
Spring 2016
Homework #5
Solution
Points: 20

Question 1 [Points 4] Assuming a 2-KB page size (2048 bytes), what are the page numbers and offsets for the following address references (provided as decimal numbers):
a. 3085
b. 42095
c. 215201
d. 650000

Ans: (a) 3085/2048 = 1; <1,1037> (b) 42095/2048=20; <20,1135> (c) 215201/2048=105; <105,161> (d) 650000/2048=317; <317,784>

Question 2 [Points 8] Consider the following segment table:

Segment	Base	Length
0	219	600
1	2300	14
2	90	100
3	1327	580
4	1952	96

What are the physical addresses for the following logical addresses?
a. 0,430
b. 1,10
c. 2,500
d. 3,400
e. 4,112

Ans:

  (a) <0,430> ➔ 219+430=649
  (b) <1,10> ➔ 2300+10=2310
  (c) <2,500> ➔ Illegal address since 55>segment length of 100
  (d) <3,400> ➔ 1327+400=1727
  (e) <4,112> ➔ Illegal address since 112 > segment length of 96

Question 3 [Points 4] The BTV operating system has a 21-bit virtual address, yet on certain embedded devices, it has only a 16-bit physical address. It also has a 2-KB page size. How many entries are there in each of the following?
a. A conventional, single-level page table
b. An inverted page table

Ans:
  a. **Page table will have as many entries as there are number of pages in the virtual address➔ $2^{21}/2^{11} = 2^{10} = 1024$ entries**
  b. **Inverted page table will have as many entries as there are frames. The physical address has 16 bits and frame size is 2KB; so number of frames is $2^{16}/2^{11}= 2^5$ entries or 32 entries**

Question 4 [Points 4] Consider a logical address space of 256 pages with a 4-KB page size, mapped onto a physical memory of 64 frames.
a. How many bits are required in the logical address?
b. How many bits are required in the physical address?

Ans:
(a) For page# we need $\log_2 256 = 8$ bits; For offset, we need $\log_2 4096 = 12$ bits; So logical address requires 20 bits

(b) For physical address we need a frame address of $\log_2 64 = 6$ bits; and offset of 12 bits; a total of 18 bits for physical address.