

**Homework #2**  
**CSC 415-01**

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# CSC415 OPERATING SYSTEM PRINCIPLES

## Homework 2

1. (15 Points) 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

$$219 + 430 = 649$$

- b. 1,10

$$2300 + 10 = 2310$$

- c. 2,500

since  $500 > 100$ , illegal

- d. 3,400

$$1327 + 400 = 1727$$

- e. 4,112

$112 > 96$ , illegal

2. (10 Points) What is internal fragmentation? Give an example of when it occurs.

In fixed-sized partition, the memory allocated to a process may be larger than the requested memory. Unused memory is internal to a partition

The last frame allocated to a process may not be full, page size = 1,000 bytes, process size = 5,500 bytes, 6 pages are allocated to the process, Internal fragmentation = 500 bytes

- | Page  | Frame |
|-------|-------|
| 0 000 | 1 001 |
| 1 001 | 4 100 |
| 2 010 | 7 111 |
| 3 011 | 3 011 |
| 4 100 | 2 010 |
| 5 101 | 5 101 |
| 6 110 | 6 110 |
| 7 111 | 0 000 |

The number of entries in the page table =  $\frac{2^{24}}{2^{21}} = 2^3$ , so number of page = 3.

- 001|0 0011 0100 1000 0000 0000 → 1000 0011 0100 1000 0000 0000  
 0x8 3 4 8 0 0

101|1 1011 0100 0100 0000 0000  $\rightarrow$  101|1 1011 0100 0100 0000 0000

5. (18 Points) Consider the following page reference string: 1, 3, 2, 4, 3, 5, 6, 7, 2, 3, 2, 1, 7, 6, 5, 4, 7, 2, 5, 6. How many page faults would occur for the page replacement algorithms FIFO, Optimal, and LRU, assuming one, four, and seven free frames at the beginning?

- 1 frame: 20, 4 frames: 15, 7 frames: 7

- A process that is spending more time paging than executing; Making little or no progress because of limit of memory or resources.

To eliminate this problem, we can use The Working of Set Model

Strategy: provide as many frame as the program needs to prevent thrashing

7. (18 Points) Suppose that a disk drive has 5,000 cylinders, numbered 0 to 4999, with the read-write head having just finished a request at cylinder 1056. The queue of pending requests, in order of arrival, is:

333, 1200, 922, 4545, 3786, 3605

Starting from the current head position, what is the order in which the requests will be serviced for each of the following disk-scheduling algorithms (assuming no other requests arrive and the head's initial movement is toward higher numbered cylinders for c-f)?

a. FCFS      b. SSTF      c. SCAN      d. LOOK      e. C-SCAN      f. C-LOOK

a. 333, 1200, 922, 4545, 3786, 3605

$$(1056-333) + (1200-333) + (1200-922) + (4545-922) + (4545-3786) + (3786-3605) = 6440$$

b. 922, 1200, 333, 3605, 3786, 4545

$$(1056-922) + (1200-922) + (1200-333) + (3605-333) + (3786-3605) + (4545-3786) = 5491$$

c. 1200, 3605, 3786, 4545, 922, 333

$$(1200-1056) + (3605-1200) + (3786-3605) + (4545-3786) + (4999-4545) + (4999-922) + (922-333) = 8609$$

d. 1200, 3605, 3786, 4545, 922, 333

$$(1200-1056) + (3605-1200) + (3786-3605) + (4545-3786) + (4545-922) + (922-333) = 7701$$

e. 1200, 3605, 3786, 4545, 333, 922

$$(1200-1056) + (3605-1200) + (3786-3605) + (4545-3786) + (4999-4545) + 4999 + 333 + (922-333) = 9864$$

f. 1200, 3605, 3786, 4545, 333, 922

$$(1200-1056) + (3605-1200) + (3786-3605) + (4545-3786) + (4545-333) + (922-333) = 8290$$

8. (15 Points) Describe the procedure for handling the page fault when there is always a free frame in demand paging.

The system will check if the reference is in the memory or not first. If the reference is not in the memory, the system will find a free frame and then inserts the reference into the free frame. After that, the system will update the page table to note that the reference is now in the memory. In the end, the terminated program restarts.