

Tutorial 6
Chapter 8 – Main Memory – Part I
Operating Systems CS 3SH3 Term 2, Winter 2022
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Tutorials are not mandatory. They are simply a tool for you to understand the course concepts better.

Tutorial Format: The questions will be posted a day before or on the day of the tutorial on the course website. You can choose to solve these problems before hand and come in with your solutions. I or one of the TAs helping me will check your solutions. If you have all of the questions correct you can choose to leave. If you have any of them incorrect, it is recommended that you stay and understand the solutions.

Solutions to the tutorial will not be posted online.

Question 1:

a) Consider a system in which memory protection is achieved using the **Base and Limit registers**. Suppose the value in base register = 1200 and value in limit register = 1000. If the logical address generated by the CPU = 32. To what physical address is this logical address mapped to?

b) Consider a system in which the logical addresses are mapped to physical addresses using relocation registers. Suppose the value of the relocatable register = 14000 and the limit register = 1200. If the CPU generated a logical address = 1300. To what physical address is the logical address mapped to?

Question 2: Explain the difference between internal and external fragmentation.

Question 3:

Given six memory partitions of 300 KB, 600 KB, 350 KB, 200 KB, 750 KB, and 125 KB (in order), how would the first-fit, best-fit, and worst-fit algorithms place processes of size 115 KB, 500 KB, 358 KB, 200 KB, and 375 KB (in order)? Rank the algorithms in terms of how efficiently they use memory.

Question 3:

Consider a physical memory of size 64MB. It is partitioned using the contiguous dynamic partitioning scheme. The operating system uses 8MB of memory space. At a given instance in time, below is the snapshot of memory:

OS = 8MB	P1=16MB	P2=20MB	P3=18MB	2MB
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Process P2 terminates and releases 20MB space and P4 is brought into main memory.

OS = 8MB	P1=16MB	P ₄ =14MB	6MB	P3=18MB	2MB
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- a) Can Process P5 = 8MB be brought into memory? If not, why?
- b) Can Process P6 = 10MB be brought into memory? If not, why?

Question 4:

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

Question 5:

Compare the memory organization schemes of contiguous memory allocation, pure segmentation, and pure paging with respect to the following issues:

- a) External fragmentation
- b) Internal fragmentation

Question 6:

Assuming a 1-KB page size, what are the page numbers and offsets for the following address references (provided as decimal numbers):

- a. 3085
- b. 42095
- c. 215201
- d. 650000
- e. 2000001

Question 7

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?