COMP 2432 Operating Systems
Tutorial 8

1. Contiguous Memory Allocation.

Consider a memory of total size of 5000K that is managed using IBM MVS ***MVT*** approach. After a sequence of memory requests, there is a list of 4 holes of size 200, 400, 600, and 300K, available in that order. Indicate how the requests of 280, 180, 320, 400, 120, and 160K *arriving in that order* are served using (*a*) **first-fit**, (*b*) **best-fit**, and (*c*) **worst-fit** memory allocation algorithms. Are there any unsatisfied requests using the three algorithms? What is the *utilization* of each of the three allocation algorithms? Utilization is defined to be amount of memory *used* divided by *total* amount of memory. Which is the best and which is the worst?

Using *compaction*, could you satisfy all the requests in the three algorithms?

2. More Contiguous Memory Allocation.

Consider a memory of total size of 1000K managed using IBM MVS ***MVT*** approach. After a sequence of memory requests, there is a list of 3 holes of size 100, 180, and 120K. You are given these 10 requests: 31, 79, 24, 75, 34, 65, 46, 11, 27, and 18K, arriving in that order. Indicate how the requests are satisfied with (*a*) **first-fit** algorithm, (*b*) **best-fit** algorithm, and (*c*) **worst-fit** algorithm. What are the *utilizations* for the three algorithms respectively? Which is the best and which is the worst?

Using *compaction*, could you satisfy all the requests in the three algorithms?

3. Paging.

Consider logical address translation in a paged system, based on byte-addressable memory. The size of the logical address space is 32MB and the size of a page is 512 bytes. The data is stored in a physical main memory of size 256KB.

(*a*) What is the length of the logical or virtual address?
(*b*) What is the length of the physical address?
(*c*) What is the length of the displacement or offset field?
(*d*) What is the length of the page number field?
(*e*) How many frames are there in the main memory?

4. Page Table and Memory Frame.

Consider a process *P* that occupies 5 pages (page 0 to page 4), storing contents *A*, *B*, *C*, *D* and *E* respectively. There are 7 free frames available in the memory, maintained by the operating system in the frame number order 42, 11, 35, 10, 24, 16 and 40. Draw a *diagram* to indicate the content of the frames and the page table after all the 5 pages of *P* are loaded into the physical memory. Assuming that each page is of size 1KB and 6 bits are used to indicate frame number, determine the *physical address* that the logical address 0010011000011 is mapped to. What would be the size of the main memory in this case?

5. Segmentation.

Consider the segment table for process P_1. The segment table contains the following entries.

P_1

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

Determine the physical addresses for the following logical addresses of P_1.

(*a*) (0, 430) (*b*) (1, 200) (*c*) (2, 30) (*d*) (3, 400) (*e*) (4, 112)

6. Segmentation with Sharing.

Suppose that segment 2 of P_1 in **Question 5** is an array for grade information to be *shared* to another process P_2, which has a first segment of size 781 for its program, a second segment of size 483 for its global variables and a final fourth segment of size 425 for its stack. Assume that the computer has a small memory of 4KB, with physical address from 0 to 4095 and that the segment tables are stored at the high memory from 3800 to 4095. Segments for P_2 are to be allocated from the free memory using (*a*) *first-fit algorithm*, (*b*) *best-fit algorithm,* and (*c*) *worst-fit algorithm*. Show the three different segment tables as produced by the three algorithms for P_2. ***Determine*** the physical addresses by performing the five logical address translations as in **Question 5** for the three algorithms, assuming that they are now generated by P_2.