TUTORIAL SEVEN

Memory Organization (Part 1)

1. A particular computer system provides a total memory of 4800 words to users. It supports multiprogramming with multiple-partition. At a given moment in time, the memory is occupied by four processes:

Starting Address of Process	Length (words)
1000	1200
3100	700
4000	400
4400	200

When a new process requests memory, the following method is employed:

STEP 1: Use the Best-fit algorithm to allocate memory for this new process. Do Step 2 only if there is no hole which fits the memory request.

STEP 2: Do memory compaction by moving occupied partitions toward lower memory addresses. Compaction stops when a sufficiently large hole is formed for the new memory request. If, at the end of compaction, there is still insufficient space, the process requesting for more memory is blocked.

The Operating System receives three new memory requirements from processes: 600, 250 and 1050 words (requested in this order).

a) Show the memory allocation after all three requests have been serviced.

b) If the algorithm in Step 1 had been First-fit, show the memory allocation after all three requests have been serviced.

c) In this particular case, which algorithm yields a lower overhead in terms of total relocation of occupied partitions?

2. a) Identify memory allocation schemes that suffer from internal fragmentation.

b) Explain why memory compaction cannot be performed if absolute address format is used in the code.

3. Consider a paging system with the page table stored in memory.

a) If a memory reference takes 200 nanoseconds, how long does a paged memory reference take?

b) If we add associative registers, and 75 percent of all page-table references are found in the associative registers, what is the effective memory reference time? (Assume that finding a page-table entry in the associative registers takes zero time, if the entry is there.)

4. Considering a computer system with a 10-bit logical address. Translate the logical address 1000011011 to the corresponding physical address for the following two cases:

   a) Assuming paging is used, the page size is 128 bytes and the page table is as given in Figure Q4a.

   b) Assuming segmentation is used, the maximum segment size that the system can support is 256 bytes, and the segment table is as given in Figure Q4b.

0	01011
1	00010
2	00010
3	10101
4	01001
5	01100
6	11010
7	00110

Figure Q4a

0	00010000	010000000000
1	00001000	100000000000
2	00100000	010011010000
3	00011000	100001100000

Figure Q4b