**For class practice**

**CS4352 Operating Systems**

*Question 1:* Storage needed to keep track of free memory using a bitmap versus using a linked list.

Assume the 64-MB memory is allocated in units of *1*KB.

For the linked list, assume that memory consists of an alternating sequence of segments and holes, each 64 KB. Also assume that each node in the linked list needs a 32 bits (for containing node information).

How many bytes of storage is required for each method?

**How about when bit map has** allocated in units of *2* byte, 4 bytes

**Draw example of the actual memory**

*Question 2:* Consider a swapping system in which memory consists of the following hole sizes in memory order: 10MB, 4MB, 20MB, 18MB, 7MB, 9MB, 12MB, and 15MB. Which hole is taken for successive segment requests of 12 MB, 10 MB, and then 9 MB

for **first fit**? Now repeat the question for **best fit**, **worst fit**, and **next fit**.

*Question 3:* A computer has four page frames. The time of loading, time of last access, and the *R* and *M* bits for each page are as shown below (the times are in clock ticks):

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Page | Loaded | Last ref. | R | M |
| 0 | 126 | 290 | 1 | 0 |
| 1 | 230 | 265 | 0 | 1 |
| 2 | 140 | 270 | 1 | 0 |
| 3 | 110 | 285 | 1 | 1 |

(a) Which page will NRU replace?  
(b) Which page will FIFO replace?  
(c) Which page will LRU replace?  
(d) Which page will second chance replace?

**Please briefly show the steps how you obtain your result.**

*Question 4:* A computer has 32-bit virtual addresses and 128-KB pages.

1. How many entries are needed in the page table if traditional (one-level) paging is used?
2. If the physical memory is half size of virtual memory, many page frames are there in the physical memory?
3. How many bits is the physical memory?

*Question 5:*Can a page be in two working sets at the same time? Please explain.