**Written Assignment 3**

**CS4352 Operating Systems**

Fall 2018

**Instructor:** Dr. Tommy Dang

**Office:** EC 306C

**Email:** tommy.dang@ttu.edu

**Instructor office hours**: 10-11am, TR, or by appointment

**TA:** Lino Virgen

**TA office hours**: 10-11am TR, EC 305

**Email**: lino.virgen@ttu.edu

Due Date: **11/17**, 11:59 pm, soft copy via Blackboard.

Late submissions are accepted till 11/20, 11:59 pm, with 10% penalty each day.

No submissions accepted after 11/20, 11:59 pm

*Question 1:* **(20 points)** Storage needed to keep track of free memory using a bitmap versus using a linked list.

Assume that we have **128-MB** memory allocated in units of ***4* bytes**. Memory consists of an alternating sequence of segments and holes, each **64 KB**. Also assume that each node in the linked list needs a **64 bits** (for containing node information).

How many bytes of storage is required for each method? (10 points for each method)

*Question 2:* **(20 points)** Consider a swapping system in which memory consists of the following hole sizes in memory order: 10MB, 6MB, 20MB, 14MB, 9MB, 12MB, and 25MB. 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**. (5 points for each algorithm)

*Question 3:* **(20 points)** 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 | 12 | 30 | 1 | 0 |
| 1 | 22 | 26 | 0 | 1 |
| 2 | 14 | 23 | 1 | 0 |
| 3 | 10 | 29 | 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.** (5 points for each question)

*Question 4:* **(10 points)** A computer has 30-bit virtual addresses and 8-KB pages.

1. How many entries are needed in the page table if traditional (one-level) paging is used? *(5 points)*
2. If the physical memory is half size of virtual memory, many page frames are there in the physical memory? *(5 points)*

*Question 5:* **(20 points)** A computer provides each process with 65,536 bytes of address space divided into pages of 4096 bytes. A particular program has a text size of 32,768 bytes, a data size of 16,386 bytes, and a stack size of 15,870 bytes.

Will this program fit in the address space? (10 points)

If the page size were 512 bytes, would it fit? (10 points)

Each page must contain either text, data, or stack, not a mixture of two or three of them.

*Question 6:* **(10 points)** Can a page be in two working sets at the same time? Please explain.

Total points: 20+20+20+10+20+10 = 100 points

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