

Fall 2017 COMP 3511 Homework Assignment #4

Handout Date: Thursday (16 Nov.) Due Date: Tuesday(30 Nov.)

Name: _____ ID: _____ E-Mail: _____

Please read the following instructions carefully before answering the questions:

- You should finish the homework assignment **individually**.
- There are a total of **3** questions.
- When you write your answers, please try to be precise and concise.
- Fill in your name, student ID, email and Section number at the top of each page.
- Please fill in your answers in the space provided, or you can type your answers in the MS Word file.
- **Homework Collection:** the **hardcopy** is required and the homework is collected in collection box #20. The collection boxes locate outside Room 4210, near lift 21 (there are labels attached on the boxes).

1. (20 points) Multiple choices

- 1) If the size of logical address space is 2 to the power of m , and a page size is 2 to the power of n addressing units, then the high order _____ bits of a logical address designate the page number, and the _____ low order bits designate the page offset.
 - a) m, n
 - b) n, m
 - c) $m - n, m$
 - d) $m - n, n$
- 2) For larger page tables, they are kept in main memory and a _____ points to the page table.
 - a) page table base register
 - b) page table base pointer
 - c) page table register pointer
 - d) page table base
- 3) Time taken in memory access through PTBR is :
 - a) accelerated by a factor of 3
 - b) accelerated by a factor of 2
 - c) slowed by a factor of 3
 - d) slowed by a factor of 2
- 4) Effective access time is directly proportional to
 - a) page-fault rate
 - b) hit ratio
 - c) memory access time
 - d) none of the mentioned
- 5) In the working set model, for:

2 6 1 5 7 7 7 7 5 1 6 2 3 4 1 2 3 4 4 4 3 4 3 4 4 4 1 3 2 3

if $DELTA = 10$, then the working set at time t_1 (...3 4 4 4) is _____.

- a) {1, 2, 4, 5, 6}
 - b) {2, 1, 6, 7, 3}
 - c) {1, 6, 5, 7, 2}
 - d) {3, 4}
- 6) A process is thrashing if
- a) it is spending more time paging than executing
 - b) it is spending less time paging than executing
 - c) page fault occurs
 - d) swapping cannot take place
- 7) What is the mounting of file system?
- a) crating of a filesystem
 - b) deleting a filesystem
 - c) attaching portion of the file system into a directory structure
 - d) removing portion of the file system into a directory structure
- 8) Mapping of file is managed by
- a) file metadata
 - b) page table
 - c) virtual memory
 - d) file system
- 9) The data structure used for file directory is called
- a) mount table
 - b) hash table
 - c) file table
 - d) process table
- 10) When a process closes the file
- a) per-process table entry is not removed
 - b) system wide entry's open count is decremented
 - c) all of the mentioned
 - d) none of the mentioned
2. (30 points) Q&A.
- 1) (5 points) Consider a paging system with the page table stored in memory.
- a. If a memory reference takes 300 nanoseconds, how long does a paged memory reference take?

b. If we add associative registers, and 70 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.)

2) (6 points) On a system with paging, a process cannot access memory that it does not own; why? How could the operating system allow access to other memory? Why should it or should it not?

3) (4 points) Discuss the hardware support required to support demand paging.

4) (5 points) A certain computer provides its users with a virtual-memory space of 2^{32} bytes. The computer has 2^{18} bytes of physical memory. The virtual memory is implemented by paging, and the page size is 4096 bytes. A user process generates the virtual address 11123456. Explain how the system establishes the corresponding physical location. Distinguish between software and hardware operations.

- 5) (5 points) Some file systems allow disk storage to be allocated at different levels of granularity. For instance, a file system could allocate 4 KB of disk space as a single 4-KB block or as eight 512-byte blocks. How could we take advantage of this flexibility to improve performance? What modifications would have to be made to the free- space management scheme in order to support this feature?
- 6) (5 points) Consider a file system that uses inodes to represent files. Disk blocks are 8-KB in size and a pointer to a disk block requires 4 bytes. This file system has 12 direct disk blocks, plus single, double, and triple indirect disk blocks. What is the maximum size of a file that can be stored in this file system?

3. (30 points) Consider the following page reference string:

7, 2, 3, 1, 2, 5, 3, 4, 6, 7, 7, 1, 0, 5, 4, 6, 2, 3, 0, 3

Assuming demand paging with 3. Please illustrate each step that the following replacement algorithms work for this reference string and compute the page faults in each algorithm.

- 1) FIFO replacement
- 2) LRU replacement
- 3) Optimal replacement

4. (20 points) Disk scheduling problem

Suppose that a disk drive has 5,000 cylinders, numbered 0 to 4999. The drive is currently serving a request at cylinder 2150, and the previous request was at cylinder 1280. The queue of pending requests, in FIFO order, is:

2069, 1212, 2296, 2800, 544, 1618, 356, 1523, 4965, 3681

Starting from the current head position (cylinder 2150), what is the total distance (in cylinders) that the disk arm moves to satisfy all the pending requests for each of the following disk-scheduling algorithms?

- a) FCFS
- b) SSTF
- c) SCAN
- d) C-SCAN
- e) LOOK
- f) C-LOOK