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LSU
LOUISIANA STATE UNIVERSITY
DEPARTMENT OF COMPUTER SCIENCE

CSC 4103: Operating Systems
Spring 2022
Written Assignment # 2
Prof. Golden G. Richard III
Due Date: May 4 at class time (NO LATE SUBMISSIONS)

Written Assignment Rules

✓ All work must be your own! No team efforts. You are not to use materials from previous offerings of this course. Do not look online for solutions. Do your own work!

✓ Your solution must be typed or it will not be graded.

(1)   Consider a system with virtual address spaces for processes of 96 pages of 1,024 bytes each. The system has a physical memory of 32 frames.

   (a) How many bits are there in a virtual address? How many bits make up the page number and how many make up the offset?

   (b) How many bits are there in a physical address? How many bits make up the page number and how many make up the offset?

(2)   Assume that a system uses demand paging and has m frames of memory available to processes. Now assume that a page reference string for a process has length p, and n distinct page numbers occur in it.   All of the m frames of available memory are empty.

   (a) What is a lower bound on the number of page faults for **any** page replacement algorithm?

   (b) What is an upper bound on the number of page faults for **any** page replacement algorithm?

(3)   Consider the following page reference string: 2, 3, 1, 2, 5, 3, 4, 6, 7, 7, 1, 0, 5, 4, 6, 2, 3, 0, 1, 7. Assuming demand paging with three frames of memory, how many page faults would occur for the following replacement algorithms?   Show your work!

(a) LRU replacement

(b) FIFO replacement

(c) Optimal replacement

(4)   Assume a filesystem uses inodes with 12 direct block numbers, 1 indirect, 1 double indirect, 1 triple indirect. Assume that blocks hold 4096 bytes and block numbers consume 8 bytes.

(a) What is the maximum size file (in blocks) that can be accommodated?

(b) How many bits are required for offsets into a file of the maximum size?

(5)   Write (in pseudocode) a **STRONG WRITERS** solution to the readers-writers problem **<u>using monitors</u>**. You must indicate if waiting readers must wait until ALL waiting writers have proceeded (STRONG STRONG writers) or not (just STRONG writers).