

CMSC 412 Homework Six

Name: _____

Read Ch 7, 8, 9.

Due Thursday November 5.

Type, please. 10-11 point times (serif) roman (not italic, no bold) or similar, single or 1.5 spaced, 1 inch margins. (I don't mean to define a specific style; missing one or two of these is fine, I won't grade it down.)

As always, if you use sources on-line (e.g., wikipedia, pages found by google, man pages), please cite. This assignment is meant to be done individually.

Point totals are approximate, subject to change.

1. (6 points) Implement a utility program (similar to Unix cp) that copies an input file to one output file. The implementation must use memory-mapped files. Turn in the code (printed).

Guidelines and Hints:

Your program will take as command line arguments the file names of the input and the output files. Fail nicely if the input file does not exist.

Procedure:

- `open ()` both files.
- Call `fstat ()` to obtain the size of the input file. (You need the size of the input file for `mmap` plus is need it to set the size of the output file in `mmap`.)
- Call `lseek ()` and `write` one byte to set the size of the output file. (`scripts/zerofile` uses the same trick in Perl.) If you don't set the size of the output file size, the call to `mmap` will succeed but the first reference to the associated memory area will generate `SIGBUS`.
- Call `mmap ()` for each of the files to map them into memory.
- Use `memcpy ()` to perform the copy.
- `exit ()` (closing and unmapping are implicit).

Consult man pages to find required include files.

2. (2 points) Contrast internal and external fragmentation.
3. Consider a system with a 32-bit logical address and 4-KB pages. The system supports up to 512 MB physical memory. How many entries are there in:
 - i. (1 point) a conventional single-level page table
 - ii. (1 point) an inverted page table
4. (3 points) (a) What is Beladys anomaly? (b) Do FIFO (first-in, first-out), LILO (last-in, last-out), and LRU (least-recently used) suffer from Beladys anomaly? (c) What is the common feature of the page replacement algorithms that do not suffer from Beladys anomaly?
5. (2 points) How large is the page table of a process that can address 2 GB in 4 KB pages. (32 bit addresses; assume only 8 bits are needed for flags.) (This is an ordinary page table, not hierarchical, not inverted, not hash based.)
6. (6 points) (9.8) Consider the following page reference string:
1,2,3,4,2,1,5,6,2,1,2,3,7,6,3,2,1,2,3,6 How many faults would occur for the following three replacement algorithms assuming one, two, three, four, five, six, seven frames.

scheme	1 page	2	3	4	5	6	7
LRU							
FIFO							
OPT							

7. A simplified view of thread states includes only Ready, Running, and Blocked.
 - i. (1 point) Will a thread change state if it incurs a page fault? If so, to what state?

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- ii. (1 point) Will a thread change state if it incurs a TLB miss that is resolved in the page table? If so, to what state?
8. (2 points) What hardware support is required to implement copy-on-write?
9. If you're monitoring the rate at which the pointer in the clock algorithm advances, what can you say about the system if
- i. (1 point) The pointer is moving fast.
 - ii. (1 point) The pointer is moving slow or is still.