

CSci 402 - Operating Systems
Quiz 9
Fall 2023

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*(This exam is open book and open notes.
Remember what you have promised when you signed your
Academic Integrity Honor Code Pledge.)*

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Time: (N/A) minutes

Name (please print)

Total: 10 points

Signature

Instructions

1. This is the first page of your exam. The previous page is a title page and does not have a page number. Since this is a take-home exam, no need to sign above since you won't submit this file.
2. Read problem descriptions carefully. You may not receive any credit if you answer the wrong question. Furthermore, if a problem says "*in N words or less*", use that as a hint that N words or less are expected in the answer (your answer can be longer if you want). Please note that points may get *deducted* if you put in wrong stuff in your answer.
3. If a question doesn't say `weenix`, please do not give `weenix`-specific answers.
4. Write answers to all problems in the **answers text file**.
5. For non-multiple-choice and non-fill-in-the blank questions, please show all work (if applicable and appropriate). If you cannot finish a problem, your written work may help us to give you partial credit. We may not give full credit for answers only (i.e., for answers that do not show any work). Grading can only be based on what you wrote and cannot be based on what's on your mind when you wrote your answers.
6. Please do *not* just draw pictures to answer questions (unless you are specifically asked to draw pictures). Pictures will not be considered for grading unless they are clearly explained with words, equations, and/or formulas. It's very difficult to draw pictures in a text file and you are not permitted to submit additional files other than the answers text file.
7. For problems that have multiple parts, please clearly *label* which part you are providing answers for.
8. Please ignore minor spelling and grammatical errors. They do not make an answer invalid or incorrect.
9. During the exam, please only ask questions to *clarify* problems. Questions such as "would it be okay if I answer it this way" will not be answered (unless it can be answered to the whole class). Also, you are suppose to know the definitions and abbreviations/acronyms of *all technical terms*. We cannot "clarify" them for you. We also will **not** answer any clarification-type question for multiple choice problems since that would often give answers away.
10. Unless otherwise specified and stated explicitly, multiple choice questions have one or more correct answers. You will get points for selecting correct ones and you will lose points for selecting wrong ones.
11. When we grade your exam, we must assume that you wrote what you meant and you meant what you wrote. So, please write your answers accordingly.

(Q1) (2 points) Which of the following statements are correct about **Kernel 3**?

- (1) page frames for a memory segments are managed directly by the corresponding vmarea data structure
- (2) if an mmobj manages N page frames, the “pagenums” for these page frames must be numbered from 0 through N-1
- (3) if an mmobj manages N page frames, all these page frames must be present (i.e., “memory resident”) at all times or the user program will not function correctly
- (4) a hash table is used in weenix to keep track of page frames
- (5) none of the above is a correct answer

Answer (just give numbers): _____

(Q2) (2 points) Which of the following statements are correct about the **pageout daemon**?

- (1) FIFO is a good page replacement policy
- (2) the LRU page replacement policy uses the “validity” bit inside page table entries to determine if a page is recently used or not
- (3) Linux uses a clock algorithm to implement the LRU page replacement policy
- (4) two-handed clock algorithm is preferred over one-handed clock algorithm
- (5) none of the above is a correct answer

Answer (just give numbers): _____

(Q3) (2 points) Which of the following statements are correct about the implementation of **virtual memory in weenix**?

- (1) in weenix, every physical address has a user space virtual address that maps to it and a kernel space virtual address that maps to it
- (2) in weenix, the bottom 1/4 of the page table are identically mapped for all processes
- (3) in weenix, the vmmap data structure contains one vmarea to represent the user space text segment and one vmarea to represent the kernel space text segment
- (4) in weenix, a page table entry contains a bit to indicate whether that page table entry is used to map user space virtual addresses or kernel space virtual addresses to physical addresses
- (5) none of the above is a correct answer

Answer (just give numbers): _____

(Q4) (2 points) Which of the following statements are correct about the implementation of **virtual memory in Linux**?

- (1) in Linux, if a page frame is “busy”, it means that the corresponding page is being accessed by a kernel thread
- (2) in Linux, the size of the “normal zone” is 1 GB
- (3) in Linux, if kernel data structures cannot fit inside the “normal zone”, they will be moved into the “highmem zone”
- (4) in Linux, if a page is allocated but not recently used, it can be found in the active page list
- (5) none of the above is a correct answer

Answer (just give numbers): _____

(Q5) (2 points) Which of the following statements are correct about the implementation of **virtual memory in weenix**?

- (1) anonymous objects and shadow objects are examples of “memory management objects” in weenix
- (2) in weenix, a vmarea contains a memory management object pointer (called vma_obj) that must point to either an anonymous object or a shadow object
- (3) if a page is originally copy-on-write but have been modified, that page can be found inside a shadow object in weenix
- (4) in weenix, the swap space is the backing store for pages that are managed by a shadow object
- (5) none of the above is a correct answer

Answer (just give numbers): _____