

Name:

**Operating Systems
Fall 2013
Test 3
December 04, 2013**

Closed books, notes, cell phones, PDAs, iPods, laptops, etc. No headphones, please. No calculator needed.

You have 75 minutes to solve 7 problems. You get 10 points for writing your name on the top of this page. As with any exam, you should read through the questions first and start with those that you are most comfortable with. If you believe that you cannot answer a question without making some assumptions, state those assumptions in your answer.

Partial credit will be offered only for meaningful progress towards solving the problems.

Please read and sign below if you agree with the following statement:

In recognition of and in the spirit of the academic code of honor, I certify that I will neither give nor receive unpermitted aid on this exam.

Signature:_____

0	/10
1	/10
2	/10
3	/15
4	/15
5	/15
6	/10
7	/15
Total	/100

1. Acronym Bingo [10 points, 2 each]

For each of the following, (1) expand the acronym and (2) briefly explain what it is.

a. SSTF

b. RAID

c. FAT

d. RR

e. LRU

2. True or False? [10 points, 1 each]

- a. In a multiprogramming system the main memory is not generally shared among a number of processes.
- b. A hardware mechanism is needed for translating relative addresses to physical main memory addresses at the time of execution of the instruction that contains the reference.
- c. A physical address is the location of a word relative to the beginning of the program and the processor translates that into a logical address.
- d. A preallocation policy requires that the maximum size of a file be declared at the time of the file creation request.
- e. Indexed allocation supports both sequential and direct access to the file and thus is the most popular form of file allocation.
- f. All segments of all programs must be of the same length.
- g. The principle of locality states that program and data references within a process do not tend to cluster.
- h. The page currently stored in a frame may still be replaced even when the page is locked.
- i. Real-time tasks are not handled any differently than non-real-time tasks in the priority queues.
- j. The SCAN policy favors jobs whose requests are for tracks nearest to both innermost and outermost tracks, and favors the latest arriving jobs.

3. Short Answer [15 points, 3 each]

- a. If a page is shared between two processes, is it possible that the page is read-only for one process and read-write for the other? Why or why not?

- b. What are the components of the time to access (read or write) a disk sector?

- c. The advantage of _____ is that it provides extremely high data availability.
A) RAID 2 B) RAID 4 C) RAID 0 D) RAID 6

- d. What does paging allow to do that was not possible with partitioning?

- e. A _____ is one that must meet its deadline, otherwise it will cause unacceptable damage or a fatal error to the system.
A) periodic task B) soft real-time task
C) hard real-time task D) aperiodic task

4. Virtual Memory [15 points]

A system has an 11-bit virtual address space, and a 13-bit physical address space, with a page size of 32 bytes. Page table entries are 4 bytes each and include a valid bit, permission bits (Read, Write and eXecute), and the physical Page Frame Number (PFN) mapped to that entry. A two-level page table scheme is used for address translation.

i) Indicate on the diagram below how the bits of the virtual address are used:

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ii) How many virtual pages can the process have?

iii) How many physical pages can the system have?

iv) How many physical pages are needed (including space for the page tables) if the entire virtual address space is in physical memory?

v) Assuming no caching, how many memory reads are needed to load a byte from memory into a register?

5. **Disk Scheduling [15 points, 5 each].** Consider the following sequence of disk track requests: 27, 129, 110, 186, 147, 41, 10, 64, 120. Assume that the disk head is initially positioned over track 100 and is moving in the direction of decreasing track number. Analyze the FCFS, SCAN and C-SCAN algorithms in terms of number of tracks traversed. Show your work.

6. File system structure [10 points, 5 each]

- i) Give one advantage of the Unix Inode structure over a File Allocation Table that identifies only the first block of a file and requires files to be allocated contiguously on the disk. Give one advantage of the File Allocation Table over the Inode. Under what circumstances would you prefer the File Allocation Table?
- ii) Assuming Unix Inodes are being used, and that nothing is cached in memory, how many disk accesses are required to read the first byte of the file `"/usr/local/bin/xemacs"`? State what is read on each disk access.

7. File System Structure [15 points]

In class we described three file descriptor structures:

- (a) Indexed files.
- (b) Linked files.
- (c) Contiguous allocation.

Each of the structures has its advantages and disadvantages depending on the goals for the file system and the expected file access pattern.

For each of the following situations, rank the three structures in order of preference. Be sure to include the justification for your rankings.

- i) You have a file system where the most important criterion is the performance of sequential access to very large files.

- ii) You have a file system where the most important criterion is the performance of random access to very large files.

- iii) You have a file system where the most important criterion is the utilization of the disk capacity (i.e. getting the most file bytes on the disk).