OS SAMPLE Final Exam
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ANSWER 4 OF 6 QUESTIONS. Place an X through the question you do not wish me to grade. If you answer more than 5 questions, I will grade the first 4.

WRITE NEATLY!

[Deadlock, 25 points]
1.

(a) State the four necessary conditions for deadlock.

(b) Give a precise definition of a *knot* in a graph. You can assume I know what a cycle is. ☺

[Memory Management, 25 points]
2.

Consider the following stream of page references:

1, 3, 4, 2, 5, 5, 1, 5, 5, 4, 5, 5, 6

(a) If there are 3 frames of real memory, how many page faults occur using an exact LRU page replacement policy?

(b) How many page faults occur under a FIFO (First In First Out) scheme?

(c) What is the optimal number of page faults for the above reference string?

[Process Synchronization, 25 points]
3.

(a) If condition variables are removed from a monitor facility, what advantages does a monitor retain over semaphores for implementing critical sections?

(b) What advantages do semaphores have compared to monitors without condition variables?

[Memory Management: Inverted Page Tables, 25 points]
4.

(a) Assume that a system uses an inverted page table for mapping pages in a process' virtual address space to frames of real memory. Give a concise explanation of the steps necessary to access a location in main memory given a virtual address *n*. Addresses are 32 bits, 12 bits of which define the offset. A diagram will be most helpful. Be thorough, but be concise!

(b) What should the contents of a TLB entry for a system that uses inverted page tables look like? Based on the contents you specify for each entry, is it necessary to flush the TLB when a context switch occurs?

[Unix Filesystems, 25 points]
5.

Suppose that in a UNIX file system the disk block size is 4096 bytes and an inode consumes 128 bytes. Each inode contains 8 direct block numbers, one single indirect, one double indirect and one triple indirect.

How much space is consumed (in total number of blocks, NOT including the inode overhead, but including indirect, double indirect, triple indirect blocks, if needed) by files that are:

(a) One (1) byte long?

(b) 1025 bytes long?

(c) 64KB?

(d) 1MB = 1024 * 1024 bytes?

(e) 1GB = 1024 * 1024 * 1024 bytes?

[Disk Scheduling, 25 points]
6.

Imagine a single-plattered disk with 100 tracks, numbered 1 to 100. The system is currently servicing a request at track 50. The request queue contains the following outstanding requests: [80, 70, 60, 10, 20, 30, 40]. If the disk head is currently at track 50, in what order will the requests above be serviced under each of the following algorithms?

(a) SCAN:

(b) LOOK: