CS 376	**Operating Systems**	Test 3
Name:	Fall 1997	Max Pts: 45

Important: This is an open book test. You can use any books, notes, or paper. *Do not log into the computer during the test.* Any calculations and rough work can be done on the back side of the test pages.

1. [4 pt] Consider a logical address space of eight pages of 1024 words each, mapped onto a physical memory of 32 frames.

   (a) How many bits are there in the logical address?

   (b) How many bits are there in the physical address?

2. [2 pt] Why are page sizes always powers of 2?

3. [6 pt] Consider a paging system with the page table stored in memory.

   (a) If a memory reference takes 200 nanoseconds, how long does a paged memory reference take?

   (b) If we add associative registers, and 75 percent of all page-table references are found in the associative registers, what is the effective memory reference time? (Assume that finding a page table entry in the associative registers takes zero time, if the entry is there, otherwise, the entry is checked from the regular page table in memory).

4. [5 pt] Consider the following segment table:

Segment	Base	Length
0	219	600
1	2300	14
2	90	100
3	1327	580
4	1952	96

What are the physical addresses for the following logical addresses?

(a) 0, 430

(b) 1, 10

(c) 2, 500

(d) 3, 400

(e) 4, 112

5. [5 pt] A certain computer provides its users with a virtual memory space of 2^{32} bytes. The computer has 2^{18} bytes of physical memory. The virtual memory is implemented by paging, and the page size is 4096 bytes. A user process generates the virtual address 11123456. Explain how the system establishes the corresponding physical location.

6. [5 pt] Suppose we have a demand-paged memory. The page table is held in registers. It takes 8 milliseconds to service a page fault if an empty page is available or the replaced page is not modified, and 20 milliseconds if the replaced page is modified. Memory access time is 100 nanoseconds.

   Assume that the page to be replaced is modified 70 percent of the time. What is the maximum acceptable page-fault rate for an effective access time of no more than 200 nanoseconds.

7. [4 pt] Explain the purpose of the `open` and `close` operations on a file and a directory.

8. [4 pt] Why must the bit vector for file allocation be kept on mass storage, rather than in main memory?

9. [10pt] Suppose that the head of a moving-head disk with 200 tracks, numbered 0 to 199, is currently serving a request at track 143 and has just finished a request at track 125. The queue of requests is kept in the FIFO order:

$$86, 147, 91, 177, 94, 150, 102, 175, 130$$

What is the total number of head movements needed to satisfy these requests for the following disk-scheduling algorithms?

(a) FCFS scheduling

(b) SSTF scheduling

(c) SCAN scheduling

(d) LOOK scheduling

(e) C-SCAN scheduling