

California State University, Sacramento
CSC 139 Operating System Principles
Final Exam, Fall 2017

Answer the questions in the spaces provided on the question sheets. If you run out of room for an answer, continue on the back of the page.

Name: _____

Section: _____

Multiple Choice (3 points each)

1. In the process state transition diagram, the transition from the READY state to the RUNNING state indicates that
 - A. a process was preempted by another process.
 - B. a process has blocked for a semaphore or other operation.
 - C. a process is done waiting for an I/O operation.
 - D. a process was just created.
2. A critical section is
 - A. the part of a program in which shared data is accessed.
 - B. the most important part of a program.
 - C. the part of the kernel that interfaces directly to the device controller.
 - D. the part of a program in which a bug would cause the program to exit.
3. The Banker's Algorithm is an example of a technique for
 - A. deadlock prevention
 - B. deadlock avoidance
 - C. deadlock detection
 - D. deadlock recovery
4. Which of the following is *not* true of virtual memory?
 - A. It allows more efficient use of memory.
 - B. It requires hardware support.
 - C. It reduces the need for relocatable code.
 - D. It requires the use of a disk or other secondary storage.
5. Which of the following is *not* usually stored in a two-level page table?
 - A. Virtual page number
 - B. Physical frame number
 - C. Dirty bit

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- D. Reference bit
6. The purpose of a TLB is
- A. to cache page translation information.
 - B. to cache frequently used data.
 - C. to hold register values while a process is waiting to be run.
 - D. to hold the start and length of the page table.
7. Which of the following is *not* true about segmented memory management?
- A. Segment length must be a multiple of the page size.
 - B. Segmentation allows multiple linear address spaces in one process.
 - C. Segmentation can be used with paging to keep segments partially resident in memory.
 - D. A segment can be read-only for one process and read-write for another.
8. The copy-on-write mechanism provides
- A. an efficient way to create new processes.
 - B. a clever way to share virtual memory page (at least temporarily).
 - C. a way to avoid unnecessary page copying.
 - D. all of the above
 - E. none of the above
9. System calls
- A. provide a rich and flexible API for software developers.
 - B. often change dramatically between different releases of an operating system.
 - C. protect kernel data structures from user code.
 - D. allow the operating system to optimize performance.
10. Buffering is useful because
- A. it makes it seem like there's more memory in the computer.
 - B. it reduces the number of memory copies required.
 - C. it allow all device drivers to use the same code.
 - D. it allows devices and the CPU to operate asynchronously.
11. Which of the following file system types requires the fewest 4KB file blocks to store a 16KB file?
- A. One-level (single indirection) indexed allocation
 - B. Linked allocation

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- C. Contiguous allocation
 - D. They all require the same number of blocks.
12. A piece of code which lies dormant until triggered by some event causing system damage is called _____.
A. logic bomb
B. trap door
C. virus
D. worm

True or False (2 points each)

13. True/False _____ The CPU utilization is always increased as the degree of multiprogramming is increased
14. True/False _____ Paging may suffer from internal fragmentation while segmentation may suffer from external fragmentation.
15. True/False _____ One advantage of employing a bit map to maintain the free-space information of a disk is that it is efficient to find n consecutive free blocks.
16. True/False _____ Let's assume that most files are big. In this case, a large block size for storing files is preferred since it incurs least internal fragmentation.
17. True/False _____ User-level threads are faster to switch among them than kernel-supported threads
18. True/False _____ Non-preemptive scheduling algorithms are better for interactive jobs since they tend to favor jobs that require quick response.
19. True/False _____ One limitation of kernel-supported threads is that when a thread blocks, the kernel cannot schedule another thread from the same process.
20. True/False _____ In general, LOOK disk head scheduling will involve less movement of the disk heads than SCAN disk head scheduling.
21. True/False _____ A 32-bit logical address with 8 KB page size will have 1,000,000 entries in a conventional page table.
22. True/False _____ DMA is a mechanism for allowing an I/O device to transfer data to and from memory without involving the CPU in the transfer.

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Short Answer

23. (6 points) Suppose there are 16 virtual pages and 4 page frames. Determine the number of page faults that will occur with the reference string 0 1 2 3 2 4 1 3 5 6 1 3 2 7 4 8, if the page frames are initially empty, using each of the following page replacement algorithms: (a) FIFO, (b) LRU.
24. (4 points) How does a buddy allocator allocate pages?
25. (6 points) The following letters represent some characteristics of disk allocation methods. Name three methods of disk allocation. Identify the appropriate letters to indicate which characteristics they possess.
- A. Space wasted in index block
 - B. Inefficient for random access
 - C. Single file typically resides on a single cylinder
 - D. Suffers external fragmentation
 - E. Suffers internal fragmentation if initial file size allocation is too big
 - F. Unreliable because single error can cause loss of many blocks of data

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Long Questions

26. (9 points) Calculate the total head movement for serving the following request queue according to the specified disk I/O scheduling algorithms.

Request Queue (cylinder range 0-100): 84 38 15 25 66 11

Assume that the disk head is currently at cylinder 21 and is moving towards cylinder 100. Show steps for partial credit.

Disk Scheduling Algorithm	FCFS	SSTF	C-LOOK
Total Head Movement			

27. (5 points) Assume a system has a TLB hit ratio of 99%. It requires 10 nanoseconds to access the TLB, and 90 nanoseconds to access main memory. What is the effective memory access time in nanoseconds for this system?

28. (3 points) Consider a memory management system that translates 16 bit virtual addresses to 24 bit physical addresses. The system uses a two-level page table, with a 4-bit first level page number, a 4-bit second level page number, and an 8-bit offset within the page. What is the maximum number of physical memory frames that can be addressed by this memory management system?

29. (5 points) A system has a 32-bit logical address space. Each address refers to a byte in memory. If the page size is 16 KB, and main memory size is 256 MB. What is the minimal size (in bytes) of the page table?

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30. (6 points) Consider the following access matrix.

object domain	F_1	F_2	F_3	laser printer	D_1	D_2	D_3	D_4
D_1	read		read			switch		
D_2				print			switch	switch
D_3		read	execute					
D_4	read write		read write		switch			

(a) Is it possible for D_1 to access the laser printer? Explain.

(b) Is it possible for D_1 to access F_2 ? Explain.