

國立交通大學九十一學年度碩士班入學考試試題

科目名稱：系統程式(096)

考試日期：91 年 4 月 20 日 第 1 節

系所班別：資訊科學系

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*作答前, 請先核對試題、答案卷(試卷)與准考證上之所組別與考試科目是否相符!!

Operating Systems
MS Entrance Exam, April 2002

Total: 100 points (4x25)

共有 25 題, 全部為單選, 每題 4 分, 答錯每題倒扣 1 分

1. Consider hardware and software interrupts. Suppose X is for Y and triggered by Z. Which of the following combination is correct?
 - a. (hardware interrupt, to issue I/O request, device controller)
 - b. (hardware interrupt, to signal I/O completion, device controller)
 - c. (hardware interrupt, to issue I/O request, device driver)
 - d. (software interrupt, to request OS services, device driver)
 - e. (software interrupt, to signal I/O completion, application program)
2. Consider two CD ROM device controllers, one with Direct Memory Access (DMA) and the other one without DMA. For the one without DMA, each transfer of one byte from the controller into the memory needs an interrupt to finish it. Each interrupt handling requires 5 μ s CPU time and the CD ROM can pump one byte every 10 μ s. For the one with DMA, the device controller interrupts after it puts one block (1K bytes) into the memory. What is the overhead due to interrupts from the CDROM controller with DMA?
 - a. 1%
 - b. 0.5%
 - c. 0.05%
 - d. 0.005%
 - e. None of the above
3. Modern CPUs have a dual-mode flag bit. X is in charged to set the bit from kernel mode to user mode, and Y is in charged for vice versa. What is (X, Y)?
 - a. (kernel, driver)
 - b. (kernel, hardware)
 - c. (hardware, kernel)
 - d. (hardware, driver)
 - e. (driver, hardware)
4. Which of the following inter-process communication mechanism does not go through the kernel?
 - a. Remote procedure call
 - b. Socket
 - c. Remote Method Invocation
 - d. Shared memory
 - e. Semaphore
5. Among the multithreading models mapping the user threads to the kernel threads, which one is used when the number of kernel threads per process is limited?
 - a. one-to-one
 - b. one-to-many

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- c. many-to-one
 - d. many-to-many
 - e. none of the above
6. When creating a thread, what resources cannot be shared with other threads?
- a. code and data
 - b. open files and registers
 - c. PCB (process control block)
 - d. registers and stack
 - e. stack and open files
7. In Solaris 2, an intermediate level of threads called light weight process (LWP) between the user threads and the kernel threads is created for the user thread library multiplexes user threads of a process onto a pool of LWPs for the process. Which statement is incorrect?
- a. Scheduling and context switching between user threads is done by the thread library without kernel intervention.
 - b. Each LWP is connected to exactly one kernel thread.
 - c. The kernel schedules only kernel threads.
 - d. Each LWP has a register set for the user thread it is running.
 - e. User threads and LWPs are user space data structures, while kernel threads are kernel space resources.
8. Which of the following will not be in a process control block (PCB)?
- a. Stack
 - b. Program counter
 - c. Registers
 - d. Memory map
 - e. List of open files
9. Consider a round robin scheduler with quantum of 20 and 3 processes (P1, P2, P3) with job burst time of 53, 17, 24, respectively. Suppose that these 3 processes arrive at about the same time but in the order of P1, P2, and then P3. What is the average turn-around time? (Choose the closest number.)
- a. 90
 - b. 80
 - c. 70
 - d. 60
 - e. 50
10. Which scheduling algorithm gives the minimum turn-around time?
- a. Preemptive shortest job first
 - b. Non-preemptive shortest job first
 - c. Round robin
 - d. Multilevel feedback queue scheduling
 - e. It depends on workload.

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11. Which of the following statement about process synchronization is incorrect?
 - a. It is possible to solve the critical section problem without any kernel support.
 - b. All shared memory solutions, without the kernel support, to the critical section problem require busy waiting.
 - c. Semaphore solves the critical section problem while avoiding busy waiting.
 - d. The wait and signal operations on a semaphore need to be atomic.
 - e. None of the above.
12. A computer has 11 tape drives, with n processes competing for them. Each process may need at most 3 drives at the same time. What is the maximum value of n that keeps the system deadlock free?
 - a. 3
 - b. 4
 - c. 5
 - d. 6
 - e. 7
13. Which of the following systems has the loosest coupling between processors?
 - a. Network system
 - b. Distributed system
 - c. Clustered system
 - d. Parallel system
 - e. It depends.
14. Determine the optimal page size of a virtual memory requires balancing some competing factors. The memory overhead of paging consists of the page table (increased as page size gets smaller) and the internal fragmentation waste (increased as page size gets larger). Suppose that the average process size is 512K bytes, page entry size is 4 bytes, the average wasted memory in the last page of each process due to internal fragmentation is a half page. Which of the following numbers is the closest one to the memory overhead, in byte, for a page size of 4096 bytes?
 - a. 1000
 - b. 2000
 - c. 3000
 - d. 4000
 - e. 5000
15. Suppose that a disk drive has 200 cylinders, numbered 0 to 199. The drive is currently serving a request at cylinder 100, and the previous request was at cylinder 80. The queue of pending requests, in FIFO order, is 27, 129, 110, 186, 147, 41, 10, 64, and 120. Starting from the current head position, which of the following disk-scheduling algorithms has the minimum total head movement?

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- a. FCFS
 - b. SSTF
 - c. SCAN
 - d. C-SCAN
 - e. LOOK
16. The reliability of a hard-disk drive is typically described in terms of a quantity called *mean time between failures (MTBF)*. Although this quantity is called a "time," the MTBF actually is measured in drive-hours per failure. If a disk farm contains 3000 drives, each of which has a 500,000 hour MTBF, which of the following best describes how often a drive failure will occur in that disk farm
- a. Once per century
 - b. Once per decade
 - c. Once per year
 - d. Once per month
 - e. Once per week
17. Assume a page size of 8 kilobytes and that a page table entry takes 4 bytes, how many levels of page tables would be required to map a 64-bit address space if the top-level page table fits into a single page?
- a. 2
 - b. 3
 - c. 4
 - d. 5
 - e. none of the above
18. Consider the following page-reference string:
1, 2, 3, 4, 2, 1, 5, 6, 2, 1, 2, 3, 7, 6, 3, 2, 1, 2, 3, 6.
Suppose that X page faults would occur for the *Optimal replacement* algorithm with three frames. Remember that all frames are initially empty, so your first unique pages will all cost one fault each. What is X mod 5?
- a. 0
 - b. 1
 - c. 2
 - d. 3
 - e. 4
19. A machine has 48-bit virtual addresses and 32-bit physical addresses. Pages are 8K. Suppose X entries are needed for a conventional 1-level page table, while Y entries are needed for an inverted page table. What is $\log_2(Y^2/X)$?
- a. 1
 - b. 2
 - c. 3
 - d. 4
 - e. 5

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20. Assume a task is divided into 4 equal-sized segments, and that the system builds an 8-entry page descriptor table for each segment. Thus, the system has a combination of segmentation and paging. Assume also that the page size is 2K bytes. What is the maximum size of each segment (in bytes)?
- 2048
 - 4096
 - 8192
 - 16384
 - 32768
21. Cache is the name generally given to the first level of the memory hierarchy encountered once the address leaves the CPU. A measure of memory-hierarchy performance is the average time to access memory – **Average memory access time** = **Hit time** + **Miss rate** * **Miss penalty**, where **Hit time** is the time to hit in the cache, **Miss rate** is the fraction of cache accesses that result in a miss, and **Miss penalty** is the cost per miss. One way to reduce the miss rate is prefetching – prefetch items into the prefetch buffer before they are requested by the CPU. Assume it takes 1 extra clock cycle if an item misses the cache but is found in the prefetch buffer. What is the **Average memory access time** would be if **Hit time** is 2 clock cycles, **Miss penalty** is 50 clock cycles, **Miss rate** is 1.10%, and **Prefetch hit rate** is 25% (**choose the closest number**)?
- 2.60
 - 2.55
 - 2.50
 - 2.45
 - 2.40
22. Continued from problem 21. what is the effective miss rate to match the average memory access time of problem 21 if prefetching is removed (**choose the closest number**)?
- 0.84%
 - 0.83%
 - 0.82%
 - 0.81%
 - 0.80%
23. Consider the following I/O scenario on a single-user PC: A mouse used with a graphical user interface. You have to make two decisions: (X) use buffering, spooling, caching, or a combination, and (Y) use polled I/O, or interrupt-driven I/O. What is (X, Y)?
- (buffering, interrupt-driven I/O)
 - (caching, polled I/O)
 - (buffering+caching, interrupt-driven I/O)
 - (buffering+spooling, polled I/O)
 - (caching, interrupt-driven I/O)
24. Which of the following memory management mechanism does not suffer from the problem of internal fragmentation?
- Fixed partition

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- b. Buddy system
- c. Virtual memory segmentation
- d. Virtual memory paging
- e. Segmentation with paging

25. Consider a demand-paging system with the following time-measured utilizations:

CPU utilization	20%
Paging disk	97.7%
Other I/O devices	5%

Among the following options, which will (probably) improve CPU utilization?

- (1) Install a faster CPU.
 - (2) Install a bigger paging disk.
 - (3) Install a faster hard disk or multiple controllers with multiple hard disks.
 - (4) Install more main memory.
 - (5) Increase the degree of multiprogramming.
 - (6) Decrease the degree of multiprogramming.
 - (7) Add prepaging to the page fetch algorithms.
 - (8) Increase the page size.
- a. 1, 2, 4, 6
 - b. 2, 4, 6, 8
 - c. 1, 3, 5, 7
 - d. 3, 5, 7, 8
 - e. 3, 4, 6, 7