

國立交通大學 93 學年度碩士班入學考試試題

科目名稱：作業系統(136) 考試日期：93 年 4 月 17 日 第 3 節

系所班別：資訊科學系 組別：丁組 第 1 頁, 共 11 頁

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共有 25 題, 全部為單選, 每題 4 分, 答錯每題倒扣 1 分

1. A total of nine process states are recognized by the UNIX SVR4 operating system. These nine states are listed in the following table. The state transition diagram is shown below. What are the states of A, B, C, and D (in this order)?

- (A) Preempted, Zombie, Ready to Run In Memory, Asleep in Memory
- (B) Zombie, Preempted, Sleeping & Swapped, Ready to Run In Memory
- (C) Preempted, Zombie, Ready to Run In Memory, Sleeping & Swapped
- (D) Preempted, Zombie, Ready to Run & Swapped, Asleep in Memory
- (E) Zombie, Preempted, Ready to Run In Memory, Sleeping & Swapped

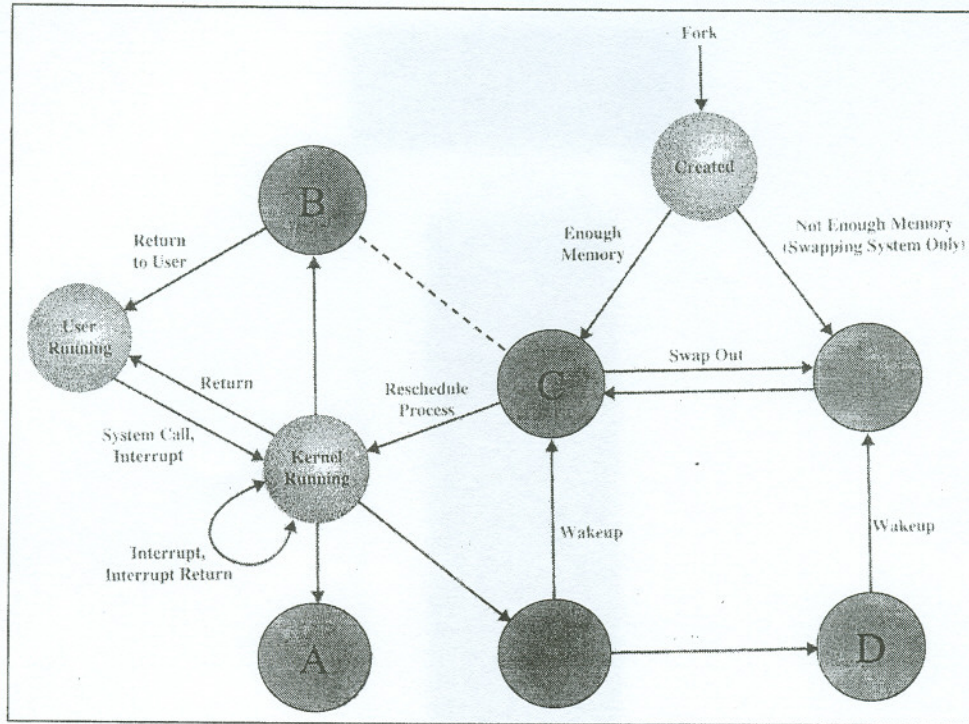
State	Description
User Running	Executing in user mode
Kernel Running	Executing in kernel mode
Ready to run & in memory	Ready to run as soon as the kernel schedules it
Asleep in memory	Unable to execute until an event occurs; process is in memory
Ready to run & swapped	Process is ready to run, but the swapper must swap the process into main memory before the kernel can schedule it to execute
Sleeping & swapped	The process is awaiting an event and has been swapped to secondary storage
Preempted	Process is returning from kernel to user mode, but the kernel preempts it and does a process switch to schedule another process
Created	Process is newly created and not yet ready to run
Zombie	Process no longer exists, but it leaves a record for its parent process to collect

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2. Consider the following statements about real-time systems:

- (1) Major versions of UNIX support soft real-time systems.
- (2) Hard real-time systems can have large secondary storage.
- (3) Soft real-time systems are useful for industrial control.
- (4) Virtual memory is almost never found in hard real-time systems.
- (5) Soft real-time systems guarantee critical tasks be completed on time.

Which of the statements are correct?

- (A) 1, 3, 4, 5
- (B) 2, 3, 4
- (C) 1, 2, 3, 5
- (D) 1, 4
- (E) 4, 5

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3. The following shows the structures of a reader and writer process in the readers-writers problem. The semaphores mutex and wrt are initialized to 1; readcount is initialized to 0.

Writer Process	Reader Process
wait(wrt);	wait(mutex);
...	readcount++;
writing is performed	if (readcount == 1) wait(wrt);
...	signal(mutex);
signal(wrt);	...

	reading is performed
	...
	wait(mutex);
	readcount--;
	if (readcount == 0) signal(wrt);
	signal(mutex);

Which of the following statements is incorrect?

- (A) No reader will be kept waiting unless a writer has already obtained permission to use the shared object.
 - (B) The above program structure allows concurrent readers.
 - (C) When a writer executes signal(wrt), the scheduler will resume the execution of waiting readers first, and then resume the execution of waiting writers.
 - (D) When a writer is performing writing, 10 readers arrive and try to read. Then the first reader will be blocked by wait(wrt) and the other 9 readers will be blocked by wait(mutex).
 - (E) The above program structure is not starvation-free.
4. Which of the following statements about processes are incorrect?
- (A) The many-to-one multithreading model is suitable when the number of kernel threads per process is limited.
 - (B) SJF scheduling is used frequently in long-term CPU scheduling.
 - (C) FCFS is the RR algorithm with an infinite time quantum.
 - (D) A counting semaphore can be implemented using 2 binary semaphores.
 - (E) Semaphores can avoid busy waiting altogether.

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5. Consider the following statements about a facility that is to provide support for mutual exclusion:
- (1) A process can remain inside its critical section for a infinite time.
 - (2) Some assumptions can be made about relative process speeds or number of processors.
 - (3) It must not be possible for a process requiring access to a critical section to be delayed infinitely.
 - (4) A process that halts in its noncritical section must do so without interfering with other processes.
 - (5) When no process is in a critical section, any process that requests entry to its critical section must
be permitted to enter without delay.
- Which of the above statements are correct?
- (A) 1, 2, 3, 4
 - (B) 3, 4, 5
 - (C) 3, 5
 - (D) 2, 3, 4, 5
 - (E) 1, 3, 4
6. Which of the following statements about the I/O system are incorrect?
- (1) Data striping provides high data-transfer rates and improves reliability as well.
 - (2) DMA is good for transferring a large amount of data from/to a disk.
 - (3) RAID 4 uses the block-interleaved parity.
 - (4) Swap space cannot be managed by the normal file system.
 - (5) Caching is the strategy that holds output for a device that cannot accept interleaved data stream.
- (A) 3, 4, 5
 - (B) 1, 3, 4, 5
 - (C) 1, 4, 5
 - (D) 1, 5
 - (E) 4, 5

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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 to multiplex user threads of a process onto a pool of LWPs of 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. Consider the following statements about memory management:

- (1) Overlays do not require any special support from OS.
- (2) Dynamic loading does not require any special support from OS.
- (3) Dynamic linking does not require any special support from OS.
- (4) Swapping is still used in current OS.
- (5) Compaction is one solution to the problem of internal fragmentation.

Which of the statements are correct?

- (A) 1, 3, 4, 5
- (B) 1, 2, 4, 5
- (C) 1, 3, 4
- (D) 1, 2, 4
- (E) 1, 2, 5

9. Consider a paging system with the page table stored in memory, and a memory reference takes 200 nanoseconds. A TLB is used with the page tables and it takes 20 nanoseconds to search the TLB. Suppose the effective memory-access time is X nanoseconds when the hit ratio of TLB is 50%, while the effective memory-access time is Y nanoseconds when the hit ratio of TLB is 80%. What is $\log_2(X-Y)$? (Choose the closest number.)

- (A) 3
- (B) 4
- (C) 5
- (D) 6
- (E) 7

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10. The following is a list of statements about page sizes:

- (1) The trend is toward larger page sizes.
- (2) With a larger page size, total I/O should be reduced, since locality will be improved.
- (3) A large page size is desirable since the size of the page table can be reduced.
- (4) With smaller pages, memory is better utilized in terms of internal fragmentation.
- (5) A desire to minimize I/O time argues for a smaller page size.

Which of the above statements are correct?

- (A) 1 2 3 4 5
- (B) 1 3 4 5
- (C) 1 3 4
- (D) 2 3 4
- (E) 1 2 4 5

11. Consider dynamic partition. The main memory has 896K for user processes and initially is empty. Four processes are ready to run and their sizes are P1(320K), P2(224K), P3(288K), P4(128K). Then the following swap-in(SI)/swap-out(SO) activities are performed: SI(P1), SI(P2), SI(P3), SO(P2), SI(P4), SO(P1), SI(P2). At this moment, what is the size of the biggest hole?

- (A) 192K
- (B) 128K
- (C) 108K
- (D) 96K
- (E) 64K

12. Consider the organization of a UNIX file as represented by the Inode. Assume that there are 10 direct block pointers, and a singly, doubly, and triply indirect pointer in each Inode. Further, assume that the system block size and the disk sector size are both 1K. If the disk block pointer is 4 bytes, then what is the maximum file size supported by this system? (Choose the closest number)

- (A) 12G
- (B) 16G
- (C) 20G
- (D) 24G
- (E) 36G

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13. When an application program issues an asynchronous I/O system call till the I/O is completed, what sequence of operations happen?
- (1) device controller copies data between local buffer and main memory
 - (2) software interrupt
 - (3) hardware interrupt
 - (4) device driver programs the registers in the device controller
 - (5) device driver examines the status of the registers in the device controller
- (A) (2) (1) (4) (3) (5)
- (B) (2) (1) (3) (4) (5)
- (C) (2) (4) (1) (3) (5)
- (D) (2) (4) (3) (1) (5)
- (E) (2) (5) (4) (1) (3)
14. For two processes on the same machine to communicate with each other, which mechanism does not require the kernel intervention?
- (A) socket
 - (B) shared memory
 - (C) message passing
 - (D) remote procedure call
 - (E) RMI (Remote Method Invocation) in Java
15. X could lead a process to leave from the "running" state to the "ready" state and Y could lead a process to leave from the "running" state to the "waiting" state. What is (X, Y)?
- (A) (hardware interrupt, software interrupt)
 - (B) (hardware interrupt, clock interrupt)
 - (C) (software interrupt, clock interrupt)
 - (D) (clock interrupt, hardware interrupt)
 - (E) (clock interrupt, software interrupt)

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16. Among FCFS, preemptive SJF, non-preemptive SJF, and RR, X and Y give the shortest waiting time and the shortest response time, respectively? What is (X, Y)?
- (A) (preemptive SJF, RR)
 - (B) (non-preemptive SJF, RR)
 - (C) (preemptive SJF, FCFS)
 - (D) (non-preemptive SJF, FCFS)
 - (E) (RR, preemptive SJF)

17. In a CPU scheduler with multilevel feedback queues, should the higher priority queue be given larger or smaller quantum compared to the lower priority queue? Will I/O-bound processes stay in the high priority queue or low priority queue?
- (A) (high priority queue: smaller quantum, I/O-bound: low priority queue)
 - (B) (high priority queue: smaller quantum, I/O-bound: high priority queue)
 - (C) (high priority queue: larger quantum, I/O-bound: low priority queue)
 - (D) (high priority queue: larger quantum, I/O-bound: high priority queue)
 - (E) It depends.

18. A computer has four page frames. The time of loading, time of last access, and the R and M bits for each page are as shown below (the times are in clock ticks):

Page	Loaded	Last reference	R	M
0	126	279	0	0
1	230	260	1	0
2	120	272	1	1
3	160	280	1	1

What page will second chance replace?

- (A) 0
 - (B) 1
 - (C) 2
 - (D) 3
 - (E) None of the above.
19. Who shall update and refer the page table of a process, respectively? Is the page table inside the kernel space or the user space?
- (A) (update: MMU, refer: OS, page table: in user space)

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- (B) (update: MMU, refer: OS, page table: in kernel space)
(C) (update: OS, refer: MMU, page table: in user space)
(D) (update: OS, refer: MMU, page table: in kernel space)
(E) None of the above.
20. Although virtual memory and paging work hand-in-hand in most systems, they are designed separately to resolve two issues: X and Y where X is to avoid contiguous physical memory allocation of a process and Y is to allow partially memory resident processes to run CPU. Who handles what?
(A) (virtual memory: X, paging: Y)
(B) (virtual memory: Y, paging: X)
(C) (virtual memory: X, paging: X)
(D) (virtual memory: Y, paging: Y)
(E) All of the above.
21. Determining 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 512 K 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. What is the minimum memory overhead, in bytes, for an average process?
(A) 512
(B) 1024
(C) 2048
(D) 4096
(E) 8192
22. Consider a disk drive whose transfer speed to the memory over the bus is 100 Mbps and the speed to read blocks right under its disk head depends on how fast its disk rotates. Suppose that the rotation speed is 600 rpm, there are 1200 blocks, of 4K bytes each, in each track, and the disk drive cannot transfer and read at the same time. What interleaving factor should be designed, so that the disk head can read blocks of contiguous order without skipping a desired block at the first chance? (Note that an interleaving factor of n means the disk controller reads one block and then skips n blocks under the disk head.)

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(A) 2

(B) 3

(C) 4

(D) 5

(E) 6

23. Suppose that there are 10 copies of a single resource type. The resource allocation state is that process A has 1 copy, process B has 1 copy, process C has 2 copies, and process D has 4 copies. If we know that the maximum numbers of copies that processes A, B, C, D may request are 6, 5, 4, 7, respectively. Now, if we grant process B one more copy, the system enters a X state. If, instead, we grant process D one more copy, the system enters a Y state. What is (X, Y)?

(A) (safe, safe)

(B) (safe, unsafe)

(C) (unsafe, safe)

(D) (unsafe, unsafe)

(E) None of the above.

24. A process' memory access can be characterized by an ordered list of page numbers called *reference string*. A page reference can also be denoted by the distance from the top of the stack where the referenced page was located. A process generates the *distance string* ($\infty, \infty, \infty, \infty, \infty, \infty, \infty, 4, \infty, 4, 2, 3, 1, 5, 1, 2, 6, 1, 1, 4$). If the process uses 4 page frames throughout the reference string, how many page fault will occur?

(A) 10

(B) 11

(C) 12

(D) 13

(E) 14

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25. Since disk arm movement is still slow, compared to disk rotation, it pays to implement track-at-a-time caching to access and cache the whole track once part of it is requested. Which of the following statements regarding how track-at-a-time caching can be implemented are correct?
- (1) It can be implemented in the disk driver, disk controller, or file system.
 - (2) If it is implemented in the disk controller in a disk drive, its associated disk driver should be aware of the cache.
 - (3) If it is implemented in the disk driver, a DMA can be used to transfer data from the cache to the user program.
- (A) None
 - (B) 1
 - (C) 2
 - (D) 3
 - (E) 1, 3