

國立交通大學九十二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：92年4月20日 第3節

系所班別：資訊科學系 組別：丁組

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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!!

共有 25 題，全部為單選，每題 4 分，答錯每題倒扣 1 分。若無正確答案，請寫“以上皆非”

1. Consider the following snapshot of a system, where P0, P1, P2, P3, P4 are five processes and A, B, C, D are 4 resources. Which of the following sequence is a safe sequence?

- (A) P1, P2, P0, P3, P4
(B) P4, P1, P2, P3, P0
(C) P0, P4, P1, P3, P3
(D) P0, P2, P1, P3, P4
(E) P2, P1, P3, P0, P4

	Allocation				Max				Available			
	A	B	C	D	A	B	C	D	A	B	C	D
P0	0	0	1	3	0	0	1	3	1	3	2	0
P1	1	1	1	0	1	7	5	0				
P2	1	3	5	4	2	3	5	6				
P3	0	5	3	2	0	6	5	2				
P4	0	2	1	4	0	6	5	6				

2. Which of the following statements about processes are incorrect?

- (A) A safe state cannot lead to deadlocks.
(B) The many-to-one multithreading model is suitable when the number of kernel threads per process is limited.
(C) SJF scheduling is used frequently in short-term CPU scheduling.
(D) FCFS is the RR algorithm with an infinite time quantum.
(E) A counting semaphore can be implemented using 2 binary semaphores.

3. Consider a multilevel feedback queue scheduler with three queues, numbered from 0 to 2. The queue 0 is the highest-priority queue and queue 2 is lowest-priority queue. OS schedules a process in a queue only when the higher-priority queues are empty. The queues 0 and 1 use the RR algorithm with time quantum 8 and 16, respectively, and the queue 3 uses SRTF scheduling. When a process in queue 0 (or 1) cannot finish within the time quantum, it is moved to the tail of queue 1 (or 2), respectively. The system snapshot at time 0 is shown as follows. Suppose the system has only one CPU. At time 65, which process is running?

- (A) P0
(B) P1
(C) P2
(D) P3
(E) P4

Processes	Arrival Time	Queue to put a process when that process arrives	CPU Burst
P0	0	0	27
P1	1	0	7
P2	2	1	18
P3	3	1	15
P4	4	2	4

4. Consider the following page-reference strings:

1, 2, 3, 4, 1, 7, 5, 6, 2, 1, 4, 3, 5, 7, 2, 1, 4, 3, 5, 7, 6.

Suppose that X page faults would occur for the least-recently-used (LRU) algorithm with three frames.

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Remember that all frames are initially empty, so your first unique pages will all cost one fault each.
What is $X \bmod 5$?

- (A) 0
- (B) 1
- (C) 2
- (D) 3
- (E) 4

5. Consider the following operations when a page fault occurs:

- (1) Determine the interrupt was a page fault.
- (2) Check that the page reference was legal and determine the location of the page on the disk.
- (3) Correct the page table and other tables to show the desired page is now in memory.
- (4) Trap to OS and save the user registers and process state.
- (5) Interrupt from the disk (I/O completed).
- (6) Issue a read from the disk to a free frame.

Which sequence of operations is correct?

- (A) 4, 1, 2, 6, 5, 3
- (B) 1, 4, 2, 5, 6, 3
- (C) 4, 2, 1, 6, 3, 5
- (D) 1, 2, 4, 3, 6, 5
- (E) 2, 1, 4, 6, 5, 3

6. The following shows the structures of a reader and writer process in the readers-writers problem.

Writer Process	Reader Process
wait(wrt);	wait(mutex);
...	readcount++;
writing is performed	if (readcount == 1) wait(wrt);
...	signal(mutex);
signal(wrt);	...
	reading is preformed
	...
	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) When a writer executes **signal(wrt)**, the scheduler will resume the execution of waiting readers first, and then resume the execution of waiting writers.
 - (C) 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)**.
 - (D) The above program structure is not starvation-free.
7. A machine has 48-bit virtual addresses and 32-bit physical addresses. Pages are 16K. 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

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- (B) 2
(C) 3
(D) 4
(E) 5
8. 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
9. 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
10. The following is a list of instructions that are normally protected.
1. Change to user mode
2. Change to monitor mode
3. Read from monitor memory
4. Write into monitor memory
5. Fetch an instruction from monitor memory
6. Turn on timer interrupt
7. Turn off timer interrupt
What is the minimal set of instructions that must be protected?
(A) 1 2 4 5 6 7
(B) 1 4 5 6 7
(C) 2 4 5 6 7
(D) 1 4 5 7
(E) 2 4 5 7
11. Consider the following set of processes, with the length of the CPU-burst time given in milliseconds. The processes are assumed to have arrived in the order P1, P2, P3, P4, P5, all at time 0.

Processes	Burst Time	Priority
P0	10	1
P1	2	4

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P2	3	5
P3	2	3
P4	5	2

Which of the schedules result in the minimal average waiting time over all processes?

(A) FCFS

(B) A non-preemptive priority (a smaller priority number implies a higher priority)

(C) A non-preemptive priority (a smaller priority number implies a lower priority)

(D) RR (quantum = 1) scheduling

(E) RR (quantum = 2) scheduling

12. Consider the following three transactions, where T0 has already committed, and T1 and T2 are executing concurrently. The four *write* operations in T1 and T2 are marked as w1—w4. *bt* and *et* indicate begin transaction and end transaction, respectively.

Transaction	Transaction Operations
T0	<i>bt</i> Write A=100, Write B=20 <i>et</i>
T1	<i>bt</i> Read A, Read B, <u>w1</u> : Write sum in C, <u>w2</u> : Write diff in D <i>et</i>
T2	<i>bt</i> Read A, Read B, <u>w3</u> : Write diff in C, <u>w4</u> : Write sum in D <i>et</i>

Consider the following possible results of C and D:

1. (C, D) = (80, 80)

2. (C, D) = (120, 80)

3. (C, D) = (120, 120)

4. (C, D) = (80, 120)

Which results are produced by a serial schedule?

A. 1, 2, 3, 4

B. 1, 2

C. 3, 4

D. 1, 3

E. 2, 4

13. Continues from problem 12. Suppose two-phase locking (2PL) is used for ensuring serializability. Consider the following interleaving orders of the four write operations in T1 and T2:

1. w1, w2, w3, w4

2. w1, w3, w2, w4

3. w3, w1, w4, w2

4. w1, w3, w4, w2

5. w3, w4, w1, w2

6. w3, w1, w2, w4

Which interleaving orders are feasible 2PL?

A. 1, 2, 3

B. 2, 4

C. 1, 3

D. 1, 5

E. 4, 5, 6

14. Consider a demand-paged computer system where the degree of multiprogramming is currently fixed at five. The system was recently measured to determine utilization of CPU and the paging disk. The results are one of the following time-measured alternatives:

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S1. CPU utilization: 13%; paging disk utilization: 97%

S2. CPU utilization: 97%; paging disk utilization: 3%

S3. CPU utilization: 13%; paging disk utilization: 3%

The following is a list of possible methods for helping the improvement of CPU utilization

1. For S1, installing a bigger paging disk can help.
2. For S1, installing more main memory can help.
3. For S2, increasing the degree of multiprogramming can help.
4. For S3, increasing the degree of multiprogramming can help.
5. For S2, installing a faster CPU can help.
6. For S1, installing a faster paging disk can help.
7. For S1, decreasing the degree of multiprogramming can help.

Which statements are correct?

- A. 1, 2, 4, 6, 7
 - B. 2, 3, 5, 6, 7
 - C. 1, 3, 5, 6, 7
 - D. 2, 4, 5, 6, 7
 - E. 1, 2, 3, 5, 7
15. 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 64-bit address space if the top-level page table fits into a single page?
- A. 2
 - B. 3
 - C. 4
 - D. 5
 - E. 6
16. Assume a task is divided into 4 equal-size segments, and that the system builds an 8-entry page table for each segment. Thus, the system has a combination of segmentation and paging. Assume also that the page size is 2K Bytes. Suppose that the maximum logical address space for the task is X bytes. What is $\log_2(X)$?
- A. 14
 - B. 15
 - C. 16
 - D. 17
 - E. 18
17. 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 85. The queue of pending requests, in FIFO order, is cylinder 55, 58, 39, 18, 90, 160, 150, 38, 184. Starting from the current head position, which of the following disk-scheduling algorithms has the minimum total head movement?
- A. FCFS
 - B. SSTF
 - C. SCAN
 - D. C-SCAN
 - E. LOOK
18. 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

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the maximum file size supported by this system? (Choose the closest number)

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

19. CPU scheduling decisions may take happen under the following circumstances:

- 1. When a process switches from the running state to the waiting state
- 2. When a process switches from the running state to the ready state
- 3. When a process switches from the waiting state to the ready state
- 4. When a process terminates
- 5. When a process switches from the new state to the ready state
- 6. When a process switches from the suspended state to the ready state

Which circumstances the scheduling scheme taking place is preemptive?

- A. 1, 2, 3, 4
- B. 3, 4, 5, 6
- C. 2, 3, 4, 5, 6
- D. 1, 3, 4, 5, 6
- E. 2, 3, 5, 6

20. The following is a list of memory management schemes:

- 1. Fixed partition
- 2. Dynamic partition
- 3. Simple paging
- 4. Simple segmentation
- 5. Segmentation with paging
- 6. Virtual-memory segmentation
- 7. Buddy system

Which memory management schemes suffer internal fragmentation?

- A. 1, 2, 4, 6
- B. 1, 3, 6, 7
- C. 2, 4, 5, 7
- D. 1, 3, 5, 7
- E. 2, 4, 5, 6

21. A computer has five page frames. The time of loading, time of last access, and the R and M bits for each page are 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	0	1
3	160	280	1	1
4	250	278	0	1

The enhanced second-chance replacement algorithm is implemented by a circular queue. A pointer, next victim, indicates which page is to be replaced next. Suppose the next victim points to page 2, then which page will the enhanced second-chance algorithm replace?

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- A. 0
- B. 1
- C. 2
- D. 3
- E. 4

22. The following shows a list of information:

- 1. Process state
- 2. Program counter
- 3. Memory map
- 4. List of open files
- 5. I/O device queues
- 6. CPU-scheduling information
- 7. Child process information

Which information is included in PCB?

- A. 1, 2, 3, 5, 7
- B. 1, 2, 4, 6
- C. 1, 2, 3, 4, 6
- D. 1, 2, 4, 6, 7
- E. 1, 2, 5, 6, 7

23. Consider a file currently consisting of 100 blocks. Assume that the FCB is already in memory. In the contiguous-allocation case, assume that there is no room to grow in the beginning, but room to grow in the end. Assume that the block information to be added is stored in memory. X and Y is the number of disk I/O operations required to add a block at the 51st block (the newly added block will be the 51st block) for contiguous and linked allocation strategies. What is X and Y?

- A. (50, 50)
- B. (51, 51)
- C. (51, 50)
- D. (50, 51)
- E. (49, 51)

24. The strategy that holds output for a device that cannot accept interleaved data stream

- A. Buffering
- B. Caching
- C. Spooling
- D. DMA
- E. RAID

25. Consider a round robin scheduler with quantum of 50 and 5 processes (P0, P1, P2, P3, P4) with job burst time of 350, 125, 475, 250, 75, respectively. Suppose that these 5 processes arrive at about the same time but in the order of P1, P2, P3, P4, and then P3. Suppose context-switch time is negligible. What is the average turnaround time? (Choose the closest number.)

- A. 850
- B. 870
- C. 890
- D. 910
- E. 930