

考試科目	作業系統	所別	8141 資訊科學系	考試時間	2月25日(六)第二節
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第一題[48%]: 單一選擇題，每小題答對得六分，未答得零分，答錯倒扣兩分。

1.1 Which of the following statements is true regarding the Interprocess communication?

- (A) Shared memory is typically faster than message passing.  
 (B) Message passing is typically faster than shared memory.  
 (C) Message passing is most useful for exchanging large amounts of data.  
 (D) Shared memory is far more common in operating systems than message passing.

1.2 Which one of the followings is true of multilevel queue scheduling?

- (A) Process can move between queues.  
 (B) Each queue has its own scheduling algorithm.  
 (C) A queue cannot have absolute priority over lower-priority queues.  
 (D) It is the most general CPU-scheduling algorithm.

1.3 Suppose that the following processes arrive for execution at the times indicated. Each process will run for the amount of time listed.

Process	Arrival Time	Burst Time
P1	0.0	8
P2	0.4	4
P3	1.0	1

Which one of the followings is correct?

- (A) The average turnaround time with the FCFS scheduling algorithm is 11.  
 (B) The average turnaround time with the non-preemptive SJF scheduling algorithm is 9.53  
 (C) The average turnaround time with the preemptive SJF (shortest remaining time first) scheduling algorithm is 4.33  
 (D) None of the above.

1.4 When using semaphores, a process invokes the *wait()* operation before accessing its critical section, followed by the *signal()* operation upon completion of its critical section. Consider reversing the order of these two operations – first calling *signal()*, then calling *wait()*. What would be a possible outcome of this?

- (A) Starvation is possible  
 (B) Several processes could be active in their critical sections at the same time.  
 (C) Mutual exclusion is still assured.  
 (D) Deadlock is possible.

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1.5 Consider a system with 5 processes  $P_0$  through  $P_4$  and 4 resource types A, B, C, and D. Suppose that the system has the following resource allocation status:

	Allocation				Max				Available			
	A	B	C	D	A	B	C	D	A	B	C	D
$P_0$	0	0	1	2	0	0	1	2	1	5	2	0
$P_1$	1	0	0	0	1	7	5	0				
$P_2$	1	3	5	4	2	3	5	6				
$P_3$	0	6	3	2	0	6	5	2				
$P_4$	0	0	1	4	0	6	5	6				

Using the Banker's algorithm, which one of the following statements is incorrect?

- (A) The matrix *Need* is
- |       | A | B | C | D |
|-------|---|---|---|---|
| $P_0$ | 0 | 0 | 0 | 0 |
| $P_1$ | 0 | 7 | 5 | 0 |
| $P_2$ | 1 | 0 | 0 | 2 |
| $P_3$ | 0 | 0 | 2 | 0 |
| $P_4$ | 0 | 6 | 4 | 2 |
- (B) The system is in a safe state.
- (C) If a request from process  $P_1$  arrives for (0,4,2,0), the request can be granted immediately.
- (D) None of the above.

1.6 Which one of the following statements is correct?

- (A) Consider a logical address space of 64 pages of 1024 words each, mapped onto a physical memory of 32 frames, there are 15 bits in the logical address.
- (B) Consider a logical address space of 64 pages of 1024 words each, mapped onto a physical memory of 32 frames, there are 16 bits in the physical address.
- (C) Consider a computer system with a 32-bit logical address and 4-KB page size. The system supports up to 512MB of physical memory. Using a conventional single-level page table, there are  $2^{19}$  (2 to the power of 19) entries in the page table.
- (D) Consider a computer system with a 32-bit logical address and 4-KB page size. The system supports up to 512MB of physical memory. Using an inverted page table, there are  $2^{17}$  (2 to the power of 17) entries in the page table.

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1.7 Consider a two-level page table scheme. A 32 bit logical address is divided into a 12 bits of outer page number and 12 bits of inner page number and 8 bits of page offset. If we trace a particular process and record the following address sequence with hexadecimal representation:

0x07EF9812, 0x07EF9823, 0x07EF98DE, 0x00000012, 0x00000045, 0x00000089, 0x01AABB99, 0x01AABB54, 0x01AABB77, 0x02989876, 0x00000078, 0x03DFDF89, 0x03DFDF77, 0x00000098, 0x048890FF, 0x048890EE, 0x02989874, 0x03DFDFDE, 0x00000099, 0x03DFDF78, 0x03DFDF24, 0x02989822, 0x02989845, 0x01AABB88, 0x01AABB70, 0x02989899, 0x02989845, 0x00000011, 0x01AABB23, 0x07EF9888, 0x00000099, 0x01AABB34, 0x01AABB87.

Which of the following statements is incorrect?

- (A) The number of page faults for the LRU replacement algorithms, with four page frames is 8.
- (B) The number of page faults for the optimal replacement algorithms, with three page frames is 9.
- (C) If we set working-set window to  $\Delta = 10$  memory references, the working set size at the 10<sup>th</sup> memory references is 5.
- (D) The number of page faults for the FIFO replacement algorithms, with five page frames is 9.

1.8 Consider a disk queue holding requests to the following cylinders in the listed order: 116, 22, 3, 11, 75, 185, 100, 87. Using the SSTF scheduling algorithm, what is the order that the requests are serviced, assuming the disk head is at cylinder 88 and moving upward through the cylinders?

- (A) 116-22-3-11-75-185-100-87
- (B) 100-116-185-87-75-22-11-3
- (C) 87-75-100-116-185-22-11-3
- (D) 100-116-185-3-11-22-75-87

第二題 [12%]

Consider a multiprocessor system and a multithreaded program written using the many-to-many threading model. Let the number of user-level threads in the program be more than the number of processors in the system. Discuss the performance implications of the following scenarios.

- (a) The number of kernel threads allocated to the program is less than the number of processors.
- (b) The number of kernel threads allocated to the program is equal to the number of processors.
- (c) The number of kernel threads allocated to the program is greater than the number of processors but less than the number of user-level threads.

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第三題 [12%]

The following algorithm is proposed for trying to solve the critical-section problem for only 2 processes, P0 and P1. Shared variables flag[2] of Boolean data type are initially set to false; i.e., flag[0]=flag[1]=false. If variable flag[i] is set to true, then process Pi is ready to enter its critical section. The algorithm for Process Pi is as follows: (where i = 0 or 1, and  $j = (i+1) \% 2$ )

```
do {
    flag[i] = true;
    while (flag[j]);
        critical section
    flag[i] = false;
        remainder section
}while(1);
```

Does the above algorithm satisfy all three requirements (mutual exclusion, progress, bounded waiting)? Justify your answer.

第四題 [16%]

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

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

For each of the following, say whether it will (or is likely to) improve CPU utilization. Explain your answers.

- (a) Install a bigger paging disk.
- (b) Increase the degree of multiprogramming.
- (c) Install more main memory.
- (d) Increase the page size.

第五題 [12%]

Consider a file system on a disk that has both logical and physical block size of 512 bytes. Assume that the information about each file is already in memory. For each of the three allocation strategies (contiguous, linked, and indexed),

How is the logical-to-physical address mapping accomplished in this system? (For the indexed allocation, assume that a file is always less than 512 blocks long.)

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