

國立中正大學  
110 學年度碩士班招生考試  
試題

[第 4 節]

科目名稱	計算機系統
系所組別	資訊工程學系-甲組

—作答注意事項—

※作答前請先核對「試題」、「試卷」與「准考證」之系所組別、科目名稱是否相符。

1. 預備鈴響時即可入場，但至考試開始鈴響前，不得翻閱試題，並不得書寫、畫記、作答。
2. 考試開始鈴響時，即可開始作答；考試結束鈴響畢，應即停止作答。
3. 入場後於考試開始 40 分鐘內不得離場。
4. 全部答題均須在試卷（答案卷）作答區內完成。
5. 試卷作答限用藍色或黑色筆（含鉛筆）書寫。
6. 試題須隨試卷繳還。



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1. 選擇題(單選) (2 pts each):

(1). Which of the following statements is false?

- A. Mobile devices must be concerned with power consumption.
- B. Mobile devices can provide features that are unavailable on desktop or laptop computers.
- C. The difference in storage capacity between a mobile device and laptop is shrinking.
- D. Mobile devices usually have fewer processing cores than a standard desktop computer.

(2). When the exclusive lock is applied to a file then \_\_\_\_\_

- A. only one process can use this file
- B. only one process can write to this file, but many processes can read it concurrently
- C. many processes can read and write to this file concurrently
- D. processes can write to this file only

(3). Unified virtual memory uses \_\_\_\_\_ to cache both process page and file data

- A. disk block caching
- B. double caching
- C. buffer caching
- D. page caching

(4). In memory-mapped I/O

- A. main memory of the computing device is used for communicating with the I/O devices using the standard I/O instructions.
- B. main memory of the computing device is used for communicating with the I/O devices using the special I/O instructions.
- C. address space of the computing device is used for communicating with the I/O devices using the standard I/O instructions.
- D. address space of the computing device is used for communicating with the I/O devices using the special I/O instructions.

(5). Disk scheduling algorithms in the OS consider only seek distances, because

- A. rotational latency is insignificant compared to the average seek time.
- B. modern disks do not disclose the physical location of logical blocks.
- C. the operating systems may have other constraints such as writes may be more urgent than reads.
- D. it is difficult to optimize seek time in disk hardware.

(6). Which of the following statement about device formatting is FALSE?

- A. Device manufacturers store the initial file-system data structures in the device.
- B. Operating system can create multiple partitions with in a single device.
- C. Volume creation is implicit when a file system is placed directly within a partition.
- D. Not every partition contains a copy of the operating systems.

(7). Which of the following statements is not true about spinlocks in Linux?

- A. Spinlocks cannot be used on single processor machines.
- B. A thread may disable kernel preemption on Symmetric Multi-Processing machines

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instead of acquiring spinlocks.

- C. A thread that acquires a spinlock cannot acquire the same lock a second time without first releasing the lock.
- D. The Linux kernel is designed so that the spinlock is held only for only short durations.

A (8). A thread using POSIX condition variables, a thread

- A. must lock the associated mutex lock before calling `pthread_cond_wait()` and unlock it after calling `pthread_cond_signal()`.
- B. must lock the associated mutex lock before calling `pthread_cond_wait()`, but doesn't need to unlock it after calling `pthread_cond_signal()`.
- C. doesn't need to lock the associated mutex lock before calling `pthread_cond_wait()`, but must unlock it after calling `pthread_cond_signal()`.
- D. doesn't need to lock the associated mutex lock before calling `pthread_cond_wait()` and doesn't need to unlock it after calling `pthread_cond_signal()`

B (9). Which of the following is true for the solutions to critical-section problems?

- A. No deadlock implies progress, and progress implies bounded waiting
- B. Bounded waiting implies progress, and progress implies no deadlock
- C. Progress implies no deadlock, and no deadlock implies bounded waiting
- D. Bounded waiting implies no deadlock, and no deadlock implies progress.

A (10). Which of the following statements regarding threads is false?

- A. Sharing is automatically provided in Java threads.
- B. Both Pthreads and Win32 threads share global data.
- C. The `start()` method actually creates a thread in the Java virtual machine.
- D. The Java method `join()` provides similar functionality as the `WaitForSingleObject` in Win32.

2. (10 pts) Suppose there are three real-time processes in the system, as shown in the table. Please answer the following questions:

Process	Processing Time	Period
P1	20	50
P2	30	100
P3	90	300

- a. (5 pts) Suppose the Rate Monotonic Scheduling algorithm (RMS) is adopted to schedule the real-time process set, and all the processes are ready at time 0. Assume the deadline for each process equals to its period. Can all the processes be scheduled without missing their deadline requirements?
- b. (5 pts) Suppose that the Earliest Deadline First Scheduling (EDF) is adopted to schedule the real-time process set, and all the processes are ready at time 0. Assume the deadline for each

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process equals to its period. Can all the processes be scheduled without missing their deadline requirements?

3. (10 pts) Given a computer system with a 64-bit virtual address, let the system be only byte-addressable. Assume that every page is of 32KB with 4 bytes per page entry in the page table. Suppose that the frame number needs 3 bytes to store. Please answer the following questions:
  - a. (5 pts) Suppose that we have multi-level paging. How many levels do we have in multi-level paging?
  - b. (5 pts) Suppose that TLB is adopted for paging, where the above multi-level paging is used. Let the memory access time and TLB access time be 100ns and 10ns, respectively. When the TLB hit ratio is 80%, what is the effective memory access time?
4. (5 pts) Given the following snapshot of the system: Please determine whether there exists a safe sequence.

	Allocation				Max				Available			
	A	B	C	D	A	B	C	D	A	B	C	D
P0	2	0	1	1	3	1	1	1	0	1	1	1
P1	1	2	0	1	2	2	1	2				
P2	1	0	0	2	2	0	1	2				
P3	2	1	0	1	2	2	1	2				

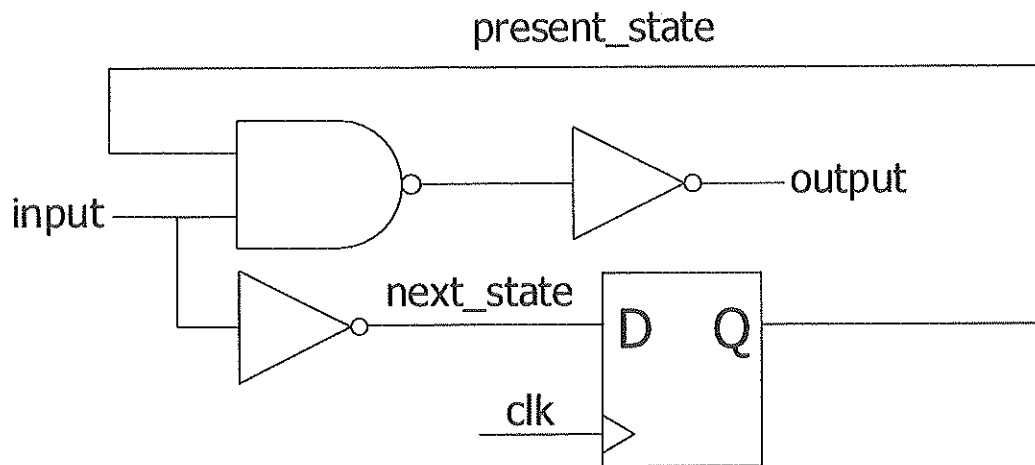
5. (5 pts) Consider a file system that uses inodes to represent files. Disk blocks are 4KB in size and a pointer to a disk block requires 8 bytes. This file system has 12 direct disk blocks, plus single, double, and triple indirect disk blocks. What is the maximum size of a file that can be stored in this file system?
6. (15 pts) The sequential machine shown in the following figure consists of two inverters, one NAND gate, and a D-Flip/Flop.
  - a. (6 pts) Describe the Boolean equation for this sequential machine, including the next\_state function and output function.
  - b. (4 pts) If the input at each cycle is "0", "0", "1", "1", "0", and "1", and initially, the present\_state is at "0", please find the output of the sequential machine.
  - c. (5 pts) Assume that the setup time, clock-to-q delay, and hold time of the D-Flip/Flop are 100ps, 100ps, and 50ps, respectively. The inverter has a 50ps delay, and the NAND gate has a 100ps delay. What is the maximum operating frequency of this circuit?

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7. (8 pts) SRAM and DRAM are used to implement the memory system. Please compare the difference between SRAM and DRAM in terms of density, power, cost, and speed.
8. (8 pts) Suppose that there are two machines, A and B. Machine A uses a dual-port memory, and machine B uses a single port memory. The ideal CPI is 1 for both machines, and machine B has a 1.05 times faster clock rate than machine A. If loads are 40% of executed instructions, which machine is faster? And why?
9. (7 pts) Translate the following C code into MIPS assembly language, and briefly explain the assembly code execution.  
  
C code:  $f = (i == j) ? g + h : g - h;$
10. (6 pts) Based on IEEE 754-2008 standard, half-precision floating-point format (sometimes called FP16 or binary16) occupies 16 bits with one sign bit, 5 exponent bits, and 10 mantissa bits. Please show the representation of -5.0 and +2.5.
11. (6 pts) Hit time, miss rate, and miss penalty are three metrics for cache optimizations. Please provide two cache optimization schemes to increase cache bandwidth.