

系所組別：資訊工程學系

考試科目：計算機組織與系統

考試日期：0223，節次：1

※ 考生請注意：本試題不可使用計算機

1. [10%] Please describe the steps involved in developing and executing assembly language programs?
2. [10%] Please write the MIPS code to compute the mathematic formula $a \times b + 3c - 10$.
3. (a) [5%] If processor A has a higher clock rate than processor B, and processor A also has a higher MIPS rating than processor B, explain whether processor A will always execute faster than processor B.
(b) [5%] Computer A has an overall CPI of 1.5 and can be run at a clock rate of 700MHz. Computer B has a CPI of 2.0 and can be run at a clock rate of 650 MHz. We have a particular program to run and this program has exactly 120,000 instructions when compiled for computer A. How many instructions would the program need to have when compiled for Computer B if we want the two computers to have exactly the same execution time for this program?
4. (a) [4%] What are the two characteristics of program memory accesses that caches exploit?
(b) [6%] What are three types of cache misses?
5. [10%] Answer TRUE or FALSE for the following questions.
 - (a) [2%] A virtual cache access time is always faster than that of a physical cache.
 - (b) [2%] Both DRAM and SRAM must be refreshed periodically using a dummy read/write operation.
 - (c) [2%] High associativity in a cache reduces compulsory misses.
 - (d) [2%] A write-through cache typically requires less bus bandwidth than a write-back cache.
 - (e) [2%] Memory interleaving is a technique for reducing memory access time through increased bandwidth utilization of the data bus.
6. [9%] Answer TRUE or FALSE for the following questions. Please justify your answers.
 - (a) [3%] Multithreading is deemed as one of the necessary conditions of a deadlock. If the statement is true, please describe why it is a necessary condition. If it is false, please itemize all necessary conditions of a deadlock.
 - (b) [3%] A transaction is a series of read and write operations upon some data followed by a commit operation. If the series of operations in a transaction cannot be completed, the transaction must be aborted and the operations that did take place must be rolled back. The series of operations in a transaction must be treated as one indivisible operation to ensure the integrity of the data being updated. Is the statement true? If it is true, please specify the name of this requirement. If it is false, please describe why it is wrong.
 - (c) [3%] A RAID Level 1 organization achieves better performance for 'read' requests than a RAID Level 0 organization (with non-redundant striping of data). Is it true? Justify your answer.

(背面仍有題目，請繼續作答)

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7. [6%] Select the correct answers for the following questions.

(a) [3%] Which of the following scheduling algorithms could result in starvation:

1. First-come, first-served
2. Shortest job first
3. Round robin
4. Priority

(b) [3%] Which of the following states are valid states in Linux, i.e., the possible STAT indicated in the ps command:

1. Running or runnable
2. Stopped
3. Interruptible sleep
4. Calling
5. Initialize

8. [10%] The following implementation of a semaphore is risky. Please describe why it could fail in a multithreaded application. What kind of system supports is required to implement a thread-safe semaphore?

```
class Semaphore {
    int available; // in shared memory
public:
    Semaphore() {available=1;}
    int acquire() {
        while (available < 1) {
            sleep(1);
        }
        --available;
    }
    int release() {++available;}
};
```

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9. [10%] Consider the following set of jobs to be scheduled for execution on a single CPU system.

Job	Arrival Time	Size (msec)	Priority
J1	0	10	2 (Silver)
J2	2	8	1 (Gold)
J3	3	3	3 (Bronze)
J4	10	4	2 (Silver)
J5	12	1	3 (Bronze)
J6	15	4	1 (Gold)

(a) [5%] Draw a Gantt chart showing FCFS scheduling for these jobs.

(b) [5%] Consider FCFS, SJF, and non-preemptive PRIORITY scheduling algorithms. Which of the foregoing scheduling policies provides the lowest waiting time for this set of jobs? What is the average waiting time with this policy?

10. [10%] A system has four processes and five resources which can be allocated. The current allocation and maximum needs are given below. To ensure it is a safe state, what is the smallest value of x according to the banker's algorithm? Justify your answer.

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

11. [5%] Consider a demand-paging system with a paging disk that has an average access and transfer time of 20 milliseconds. Addresses are translated through a page table in main memory, with an access time of 1 microsecond per memory access. Thus, each memory reference through the page table takes two accesses. To improve this time, we have added an associative memory that reduces access time to one memory reference, if the page-table entry is in the associative memory. Assume that 70 percent of the accesses are in the associative memory and that, of the remaining, 10 percent (or 3 percent of the total) cause page faults. What is the effective memory access time?