

系所組別： 工程科學系乙組

考試科目： 系統程式

考試日期： 0307，節次： 1

※ 考生請注意：本試題 可 不可 使用計算機

- 1 Consider two different implementation, M1 and M2, of the same instruction set. There are three classes of instructions (A, B, and C) in the instruction set. M1 has a clock rate of 80 MHz and M2 has a clock rate of 100 MHz. The average number of cycles for each instruction class and their frequencies (for a typical program) are as follows:

Instruction Class	Machine M1 - Clock Cycles/Instruction Class	Machine M2 - Clock Cycles/Instruction Class	Frequency
A	1	2	60%
B	2	3	30%
C	4	4	10%

- (a) Calculate the average CPI (i.e., clock cycles per instruction) for machine M1 and M2, respectively. (8%)
- (b) Calculate the average MIPS ratings (i.e., million instructions per second) for machine M1 and M2, respectively. (8%)
- (c) Which machine has a smaller MIPS rating? Which individual instruction class CPI do you need to change, and by how much, to have this machine have the same of better performance as the machine with the higher MIPS rating (you can only change the CPI for one of the instruction classes on the slower machine)? What is the resulting MIPS rating after the change? (8%)
2. Please explain **in details** why there is a trade-off between precision and range when representing a floating point number in computer arithmetic. (16%)
3. Please explain how pipelining enhances hardware utilization. Also, please explain why increasing the depth of pipeline (i.e., number of stages) can **proportionally** improve the overall performance. (20%)

(背面仍有題目,請繼續作答)

系所組別 工程科學系乙組

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4. Suppose that a disk drive has 5000 cylinders, numbered 0 to 4999. The drive is currently serving a request at cylinder 143, and the previous request was at cylinder 125. The queue of pending requests, in FIFO order, is

86, 1470, 913, 1774, 948, 1509, 1022, 1750, 130

Starting from the current head position, what is the total distance (in cylinders) that the disk arm moves to satisfy all the pending requests, for each of the following disk scheduling algorithms? (24%)

- (a) FCFS (first come, first-served)
 (b) SSTF (shortest seek time first)

5. Assume that the variables f , g , h , i , and j are assigned to registers $\$s0$, $\$s1$, $\$s2$, $\$s3$, and $\$s4$, respectively. Also, assume that the base address of the integer arrays A and B are in registers $\$s6$ and $\$s7$, respectively. For the MIPS assembly instructions below, what is the corresponding C statement (**in the simplest form**)?

- (a) `add $s0, $s0, $s1`
`add $s0, $s3, $s2`
`add $s0, $s0, $s3` (4%)
- (b) `addi $s6, $s6, -20`
`add $s6, $s6, $s1`
`lw $s0, 8($s6)` (4%)

- (c) Assume that the registers $\$s0$, $\$s1$, $\$s2$, $\$s3$ contain the values 10, 20, 30, and 40, respectively. Also, assume that register $\$s6$ contains the value 256, and that memory contains the following values:

Address	Value
256	100
260	200
264	300

Find the value of $\$s0$ at the end of the assembly code in (a) and (b), respectively. (8%)