

國立臺灣科技大學
九十學年度碩士班招生考試試題

系所組別：電子工程系甲組
科目：計算機組織

總分 100 分

I. Basic Questions: Each counts 12%. (60%)

1. An eight-way set-associative cache is used in a computer in which the real memory size is 2^{32} bytes. The line size is 16 bytes, and there are 2^{10} lines per set. Calculate the cache size and tag length.
2. A moving-arm disk-storage device has the following specifications:

Number of tracks per recording surface	200
Disk-rotation speed	2400 rev/min
Track-storage capacity	62,500 bits

Estimate the average latency and the data-transfer rate of this device.

3. What are the basic differences between a branch instruction, a call subroutine instruction, and program interrupt?
4. Define the following: (a) microoperation; (b) microinstruction; (c) microprogram; (d) microcode.
5. What is the difference between a direct and an indirect address instruction? How many references to memory are needed for each type of instruction to bring an operand into a processor register?

II. Design Problems: Each counts 20%. (40%)

1. Design an 8-bit counter using only the following component types: 4-bit D-type registers, half adders, full adders, and two-input NAND gates. The counter's inputs are a CLEAR signal that resets it to the all-0 state and a COUNT signal whose 0-to-1 (positive) edge causes the current count to be incremented by one. Use as few components as you can, assuming for simplicity that each component type has the same cost.
2. A three-port register file that supports simultaneous reads from two ports *A* and *B*, while writing can take place via a third port *C*, is required in a system. Assume that the register file contains four 16-bit registers, denoted as RF_{16} , and is to be built out of four identical 4-bit slices, denoted as RF_4 . (a) Give a register-level diagram showing the internal structure of RF_4 . (b) Show how four copies of RF_4 are interconnected to form RF_{16} .

