

八十五學年度國立台灣工業技術學院研究所碩士班招生考試

所別：電子工程技術研究所

組別：計算機組

科目：計算機組織

1. IC Technology for Computer

(a) The cost of an integrated circuit can be expressed in three simple equations:

$$\text{cost per die} = (\text{cost per wafer}) / (\text{dies per wafer} * \text{yield}) \quad (1)$$

$$\text{dies per wafer} = \text{wafer area} / \text{die area} \quad (2)$$

$$\text{yield} = (1 + \text{defects per area} * \text{die area} / 2)^{-2} \quad (3)$$

Combine the three equations above to determine the cost per die in terms of die area. If you ignore constants, what is the approximate relationship between cost and die area? (10%)

(b) The capacities of DRAM and IC increase four times every 3 years. About half of the increase comes from die size. The other half comes from transistor density. If 0.6 micron technology is used today and the technology trend continues, how many micron will be used 6 years later? (10%)

2. CPU Instruction Set

On a register-to-register machine, CPU's instructions can be classified into three categories: operation, data transfer, and control. An instruction set has the following instructions: ADD, SUB, AND, OR, LOAD. If you are asked to add three more instructions to the instruction set to make it more complete, What kind of instructions will you add? Why? (20%)

3. Memory Management

(a) To map a virtual address to a physical address usually a computer system has a *page table*. Where is page table stored? Why? (5%)

(b) What is a TLB? What is it for? (5%)

(c) A computer system uses a CPU which has no on-chip TLB and cache. If it uses SRAM to implement its TLB and unified cache (i.e. for both data and instruction). The access of SRAM takes 10ns. What is the minimum execution time for a LOAD instruction (You can assume it takes no time to do anything in CPU)? Why? (10%)

4. Pipelined Computation

A pipelined CPU may have data hazard, branch hazard, and exception hazard.

(a) Which of the above hazards can be solved using software techniques? How? (12%)

(b) Give two hardware methods for solving data hazard. (8%)

5. Supporting Procedure Calls

(a) Explain the meanings of *caller save* and *callee save*. (8%)

(b) What kind of data structure is used to support procedure calls? Why? (6%)

(c) Who determines caller save or callee save will be used? (e.g. programmer, software company, compiler developer, ...) Why? (6%)

