

國 立 清 華 大 學 命 題 紙

九十二學年度 資訊工程學系 (所) \_\_\_\_\_ 組碩士班研究生招生考試

科目 計算機系統 科號 2702 共 2 頁第 1 頁 \*請在試卷【答案卷】內作答

1. (9pt) (a) Give the flow diagram of the procedures for multiplying two binary floating-point numbers.  
 (b) Multiply the two decimal numbers  $0.75_{ten}$  and  $-0.375_{ten}$  by using the steps from your answer in (a). Show the step-by-step intermediate results in your answer.
  
2. (10pt) (a) What are the five steps required for the normal MIPS instructions? Briefly describe each step in one sentence.  
 (b) Consider the following two contiguous MIPS instructions.  
     add \$s0, \$t0, \$t1  
     sub \$t2, \$s0, \$t3  
 What solution can be used to resolve the data hazard problem in these two instructions? Give a graphical instruction-pipeline representation of your solution.
  
3. (6pt) Suppose we have a processor with a base CPI of 1.0, assuming all reference hit in the primary cache, and a clock rate of 800MHz. Assume a main memory access time of 125ns, including all the miss handling. Suppose the miss rate per instruction at the primary cache is 4%. What is the total CPI for this machine with one level of caching? Now we add a secondary cache that has a 20ns access time for either a hit or a miss and is large enough to reduce the miss rate to main memory to 2%. What is the total CPI for this machine with a two-level cache?
  
4. (20pt) a. What is the ideal performance improvement for an n-stage pipeline machine?  
 b. Write two reasons that the pipeline machine cannot achieve the ideal performance except data hazard.  
 c. What are the methods to remove the data hazard?  
 d. Describe what is a carry save adder tree.
  
5. (10pt) Explain the differences between *interrupts*, *system calls*, and *traps* briefly.
  
6. (10pt) Consider an operating system which avoids deadlock by using banker's algorithm. There are four types of resources A, B, C, and D. The following is a snapshot of the system-state.

	<u>Allocation</u>				<u>Max</u>				<u>Available</u>			
	A	B	C	D	A	B	C	D	A	B	C	D
P <sub>0</sub>	1	3	5	4	2	3	5	6	1	5	2	0
P <sub>1</sub>	0	0	1	4	0	6	5	6				
P <sub>2</sub>	0	0	1	2	0	0	1	2				
P <sub>3</sub>	1	0	0	0	1	7	5	0				
P <sub>4</sub>	0	6	3	2	0	6	5	2				

If P<sub>3</sub> makes a request of (0, 4, 2, 0), can the request be granted immediately? Why?

7. (4pt) RAID (Redundant Arrays of Inexpensive Disks) have been widely used to speed up the disk access time. Several levels of RAID are supported. Please make the right binding between the following RAID levels and explanations.

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|------------|--|
| (a) RAID-0 | (A) block-interleaved parity             |
| (b) RAID-1 | (B) non-redundant striping               |
| (c) RAID-4 | (C) mirrored disks                       |
| (d) RAID-5 | (D) block-interleaved distributed parity |

8. (16pt) Consider a 32-bit operating system that runs on a machine with 64 MB of physical memory. The operating system divides the 32-bit logical address space into pages. Each page is sized of 4 KB. There are 4 methods for translating a virtual address to a physical address: (a) one-level page table, (b) two-level page table, (c) hashed paged table, and (d) inverted page table. Please calculate the memory space required for a process's page table in each method under the following assumptions:

- 甲、each entry in the page table is sized of 4 bytes,
- 乙、in the two-level page table, the outer (first-level) page table has 256 entries, and
- 丙、in the hashed paged table, the range of the value returned by the hash function is between 0 and 27.

9. (10pt) Explain the operating system techniques to perform power-aware (energy-aware) scheduling to optimize systems for energy consumptions.

10. (5pt) DSP processors are increasingly employed in embedded systems for supporting audio and video applications. Explain the key features of DSP processors (different) from conventional general-purpose processors.