

## 國立臺灣科技大學 104 學年度碩士班招生試題

系所組別：電子工程系碩士班甲組  
科目：計算機系統

(總分為 100 分)

1. (10%) Please explain the following terms:
  - (a) Compulsory misses (3%)
  - (b) Capacity misses (3%)
  - (c) Conflict misses (4%)
  
2. (15%) Pipeline
  - (a) Please explain how a MIPS processor can exploit the instruction-level parallelism (ILP)? (5%)
  - (b) Please draw the datapath of the MIPS processor with the control unit. (10%)
  
3. (10%) Assume that the miss rate of an instruction cache is 3% and the miss rate of the data cache is 5%. If a processor has a CPI of 3 without any memory stalls and the miss penalty is 100 cycles for all misses. How much faster the processor can run with a perfect cache that never missed? Assume the frequency of all loads and stores is 30%.
  
4. (5%) Please explain branch prediction buffer and use 2-bit prediction scheme as an example.
  
5. (10%) Virtual Memory
  - (a) Please explain TLB, cache, and page table. (5%)
  - (b) How to integrate TLB, cache, and page table together. (5%)



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6. (8%)

(a) Sort the following functions based on their orders from high to low. (3%)

$$f_1(n) = n^2 \log n + \log n$$

$$f_2(n) = n/100 + 100/n^2$$

$$f_3(n) = n^3 + 2n^2 + 1$$

$$f_4(n) = \log n^2$$

$$f_5(n) = 2^n + 3$$

(b) Write a recursive function to calculate  $\sum_{i=1}^n i^2$ . (5%)

7. (6%)

If the height of a binary tree is  $k$ , what is the maximum number of nodes in this tree? Prove it. (6%)

8. (10%)

(a) If the postorder traversal of a binary tree is CBEGFDA and the inorder traversal of the tree is BCAEDGF, draw this binary tree. (5%)

(b) Draw the binary expression tree for  $(a+b*c)/(d-e)$ . (5%)

9. (16%)

Briefly explain the following terms:

(a) Dequeue (4%)

(b) Depth-first search (4%)

(c) Spanning Tree (4%)

(d) Hash Collision Resolution (4%)

10. (10%)

(a) Is QuickSort stable? Explain your answer briefly. (4%)

(b) If one  $n$ -element list is sorted by QuickSort, what is its computation complexity for the average case? What is its computation complexity for the worst case? Demonstrate one  $n$ -element list, where the worst case happens if we use QuickSort to sort. (6%)

