

淡江大學九十二學年度碩士班招生考試試題

系別：資訊工程學系

科目：計算機概論(含資料結構、程式語言結構)

准帶項目請打「○」否則打「×」
簡單型計算機
X

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本試題雙面印製

1. Suppose that an array **X** (its base address is 1000) is declared in C language as follows:

```
int X[7][9];
```

Assume that each integer occupies four bytes. What is the address of the array element **X[5][7]**

- (a) if the row-major representation is used? (3 pts)
- (b) if the column-major representation is used? (3 pts)
- (c) Derive a general efficient formula for computing the address of an integer array element **A[i₁][i₂]**...**[i_n]** of the array **A[x₁][x₂]**...**[x_n]**. (4 pts)

2. Consider the following string:

"dogs do not spot hot pots or cats".

- (a) Construct a Huffman tree. (4 pts)
- (b) Generate its Huffman code. (3 pts)
- (c) How many bits are required to encode the above string? (3 pts)

3. Consider the following list of numbers:

45, 23, 15, 72, 68, 87, 35, 59, 7, 81, 12, 65, 39, 28

- (a) Construct a max-heap with linear time. Show each step. (4 pts)
- (b) Show the final result in array representation. (3 pts)
- (c) Justify that the algorithm you use is linear. (3 pts)

4. Consider the following function:

$$g(0) = 1,$$

$$g(1) = 3,$$

$$g(n) = 2 \times g(n-1) + 3 \times g(n-2) \text{ for } n > 1.$$

- (a) Write a tail-recursive function code in C language. (5 pts)
- (b) Show how to eliminate the tail-recursion in your code. (5 pts)

5. (a) Are the following pair of terms unifiable? If they are, find the most general unifier for each pair. (5 pts)

f(a, g(x, y), c), f(t, g(h(d, e), z), z)

(b) Use Lisp or Scheme to define the function **reverse** such that (5 pts)

(reverse '(1 2 3)) ==> (3 2 1)

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6. Show that the following grammar is LR(1) but not LALR(1). (10 pts)

$$S \rightarrow Aa \mid bAc \mid Bc \mid bBa$$

$$A \rightarrow d$$

$$B \rightarrow d$$

7. (a) What are the differences between repeaters, bridges, and switches. (3 pts)

(b) List the five layers of the TCP/IP layering model, and briefly describe the functionality of each layer. (7 pts)

8. (a) What is the full name of CSMA/CD? Describe how this mechanism works in the Ethernet. (5 pts)

(b) List two technologies for each of wireless wide area networks (WWAN), wireless local area networks (WLAN), and wireless personal area networks (WPAN). (5 pts)

9. Simplify the following Boolean expression

$$(A + B)(\bar{A} + C)$$

(a) by using basic identifies of Boolean algebra. (5 pts)

(b) by using K-map simplification. (5 pts)

10. Given a real number $-1756375E-3$ (in C language format), convert it to the floating-point notation of the IEEE Standard 754 using 32-bit single-precision format. Show each step in detail and write the final result in hexadecimal. (10 pts)