國立嘉義大學九十七學年度

資訊工程學系碩士班招生考試試題

科目:數學

- 1. Given a 2-dimensional array A[i,j] with the size of 256x256, show how to calculate the relative address of the element A[i,j] while representing the array in column-major order. (10%)
- 2. Draw the equation (A+B)*D+E/(F+A*D)+C as a binary tree, then write down its postfix and prefix representations. (10%)
- 3. Show a recursive algorithm of merge sort and show the processes of analyzing its time complexity. (10%)
- 4. Briefly explain the following questions:
 - (a) the definition of asymptotic notation θ . (5%)
 - (b) the purpose to introduce threaded tree. (5%)
 - (c) the advantages and disadvantages of interpolation search (over simple binary search). (5%)
- 5. Suppose the symbols to be coded by Huffman coding are the characters in the word "HELLO". A simple list data structure is used.
 - (a) show the coding tree. (3%)
 - (b) compute the total of bits needed to encode the string. (2%)
- 6. Observe that

$$1 = 1$$

$$1 - 4 = -(1+2)$$

$$1 - 4 + 9 = 1 + 2 + 3$$

$$1 - 4 + 9 - 16 = -(1+2+3+4)$$

$$1 - 4 + 9 - 16 + 25 = 1 + 2 + 3 + 4 + 5$$

Guess a general formula and prove it by mathematical induction. (10%)

- 7. Explain the following questions:
 - (a) How many integers from 1 to 1000 do not have any repeated digits (e.g., both 999 and 858 have repeated digits.)? (5%)
 - (b) What is the probability that an integer chosen at random from 1 through 1000 has at least one repeated digit? (5%)
- 8. Design a finite-state automaton to accept the set of all strings of 0's and 1's that end 011.(10%)
- 9. Let $A = \{1, 2, 3, 4, 5, 6, 7, 8\}$.
 - (a) If five integers are selected from A, must at least one pair of the integers have a sum of 9? Justify your answer. (5%)
 - (b) If four integers are selected from A, must at least one pair of the integers have a sum of 9? Justify your answer. (5%)
- 10. For each positive integer n, let a_n be the number of iterations of the while loop in the following code segment:

- (a) Find a recurrence relation for a_n . (5%)
- (b) Solve the recurrence relation. (5%)