國立臺灣科技大學 109 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：資料結構

(總分為 100 分)

1. In computer systems, the main memory can be regarded as a one-dimensional array B. Using the following two-dimensional array as an example, answer each of the following questions:

$$A = \begin{bmatrix} 43 & 21 & 5 & 7 \\ 24 & 31 & 6 & 9 \\ 21 & 13 & 66 & 87 \\ -12 & 10 & 3 & 1 \\ 2 & 5 & 8 & 4 \end{bmatrix}$$

   (a) Store array A in the one-dimensional array B using the row-major order and show how to access $A[i, j]$, where $0 \le i \le 3$, and $0 \le j \le 4$, from $B[k]$, where $0 \le k \le 19$; that is, represent k as a function of i and j. (10%)

   (b) Store array A in the one-dimensional array B using the column-major order and show how to access $A[i, j]$, where $0 \le i \le 3$, and $0 \le j \le 4$, from $B[k]$, where $0 \le k \le 19$; that is, represent k as a function of i and j. (10%)

2. Heaps are a kind of data structure. Answer each of the following questions:

   (a) Define a heap. (6%)

   (b) Using the following data, construct a heap: (7%)

   43 21 5 7 24 31 6 9 32 12

   (c) Store the above heap in a one-dimensional array. (7%)

3. Queues and stacks are two different kinds of data structures. Answer each of the following questions:

   (a) What is a queue? When is a queue used? (5%)

   (b) What is a stack? When is a stack employed? (5%)

(總分為 100 分)

4.　(10%) Please order the following 5 growth rates in increasing order.
　　　$n!, n^{0.0001n}, n^2, 2^{n\log n}, (1.01)^n$
where log is taken base 2.

5.　(20%) The inorder and preorder sequences of a given binary tree are **"dagehbfic"** and **"badeghcfi"** respectively.
　　(a) Please draw the binary tree. (10%)
　　(b) What is the postorder sequence of this tree? (10%)

6.　(10%) What are the average time and worst time to sort n objects using bubble sort, quick sort, heap sort, merge sort, and radix sort?

7.　(10%) Please explain the relationship among data structure, programming language, and algorithm.