國立政治大學 110 學年度碩士班暨碩士在職專班招生考試試題

考試科目	計算機概論	系所別	資訊科學系碩士在職專班/一般組	考試時間	2月6日(六)第2節

1. (10 points) The decimal number 5_{10} can be written as a binary number with 101_2. Please sort the following five numbers in ascending order: 100110011_2, 101110_3, 1523_7, 183_{13}, and 140_{15}.
2. Given a function `foo()` written in the C programming language as follows.

```
int foo(int array[], int lo, int hi) {
    int i = lo, j = hi - 1, k = array[lo];
    while (1) {
        while (array[j] > k) --j;
        while (array[i] < k) ++i;
        if (i >= j) return i;
        swap(&array[i++], &array[j--]);
    }
}
```

   a. (10 points) What is the purpose of `foo()`?
   b. (5 points) What is the time complexity of `foo()` for the array containing n = (`hi-lo`) elements?
   c. (10 points) The `swap()` function is used to exchange the values of two variables via their addresses. Please implement the `swap()` function in C.
3. Common storage devices include dynamic random access memory (DRAM), static random access memory (SRAM), hard disk drive (HDD), and solid-state drive (SSD).
   a. (5 points) Sort these four storage devices by their speeds.
   b. (5 points) Which of them is/are non-volatile storage device(s)?
4. Hash table and binary search tree (BST) are two fundamental data structures for search.
   a. (10 points) Give the time complexities of hash table and BST in search and insertion.
   b. (10 points) Give two advantages of BST over hash table.
5. In a multiprocessing environment, no two processes are executing in their critical sections at the same time.
   a. (10 points) Please give a solution to the critical-section problem. Specifically, design the acquire() and the release() functions for the following code.

```
acquire();
// critical section
release();
// remain section
```

   b. (10 points) Describe the situation of deadlocks with an example.
6. Do you consider regular expression is a programming language (5 points)? Please give a way to decide if a language is a programming language (10 points).

備註	一、作答於試題上者，不予計分。 二、試題請隨卷繳交。