題號： 245
科目：計算機概論(A)
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國立臺灣大學 102 學年度碩士班招生考試試題

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請照題號次序作答
Use C, C++ or Java programming language to design your computer programs.

1. (20%)
   a. (16%) Given an array of integers, write an **insertion sort** function
      `insert_sort(array)` which takes the array as the parameter and sorts the array in non-decreasing order?
   b. (2%) What's the time complexity of the average case of insertion sort?
   c. (2%) What's the time complexity of the best case of insertion sort? Give an example array of 10 integers to explain the best case.

2. (15%) Given a string of 16 characters which are either "0" or "1". Assume this string represents a 16-bit sign-magnitude integer, write a program to compute and output the two's complement of input string (or character array). For example, if the input is "0000 0000 0000 0101" which is 16-bit sign-magnitude integer of 5, the output of your program should be "0000 0000 0000 0101". If the input is "1111 1111 1111 1010" which is 16-bit sign-magnitude integer of -5, the output of your program should be "1111 1111 1111 1011"

3. (20%) Given a string consist of "(" and ")" symbols, for every right parenthesis there exists a matching left parenthesis, we said that string is **a balanced parentheses sequence**. For example, "()" , "(())" , "((()))" , "()(())" are balanced parentheses sequence. On the other hand, ")(" , "(())(" and "()(()(" are not balanced parentheses sequence. Please implement a function `balanced_parenthese(seq)` which takes one string `seq` as the parameter. The function will return **true** if the string `seq` is a balanced parentheses sequence or **false** otherwise.

4. (30%) Terminology explanations: explain the terminologies marked and compare them in bold in detail.
   a. **Deman pageing** vs **Demand segmentation**
   b. **Virtual Memory** vs **Virtual Address**
   c. **Isolated IO** vs **Memory Mapped IO**
   d. **Pass by value** vs **Pass by reference**
   e. **Deadlock** vs **Starvation**

5. (15%) The **Armstrong number** is an n digit number that is sum of n-th power of its digits for example: $6 = 6^1$ and $1634 = 1^4 + 6^4 + 3^4 + 4^4$. Please write a program that can list all the **Armstrong number** between 1 and 10000.

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