國立嘉義大學九十六學年度
資訊管理學系碩士班招生考試（乙組）試題

科目：資料結構

1. The node of a double linked list is defined as: | llink | data | rlink | , where **llink** is the link which points to its left node and **rlink** points to its right node. Suppose that the pointer **P** points to a node in the double linked list. （That is, **P**'s right node is denoted as "**P->rlink**".）
   (1) If a new node is pointed by the pointer Q. And Q will be inserted at the right side of P. Please show the sequence of modifying links for the insertion. (5 points)
   (2) If we want to delete the node pointed by P, please show the sequence of modifying links for the deletion. (5 points)

2. Assume that two sequences, **A,B,C,D,E,F,G** and **D,C,B,G,F,E,A**, are the preorder and postorder sequences of a binary tree, respectively. Is the binary tree unique? If yes, please construct the binary tree. Otherwise, give two binary trees that have the same sequences. (10 points)

3. (1) What is the benefit of using (static) hashing to do searching? (5 points)
   (2) For a hash function, what are the most important design issues? Please give two issues and briefly discuss them. (5 points)

4. The most popular method for external sorting is the merge sort.
   (1) Why is the external sorting needed? And how does it work via merge sort? (5 points)
   (2) The Huffman code algorithm is usually used to minimize merge times for runs with different size. Given seven sorted runs, their lengths are 2, 3, 4, 7, 8, 9, and 15. Please construct the Huffman tree. (5 points)

5. For the AOE network, the activity a_3 takes 0 time unit. What does it mean? (5 points)
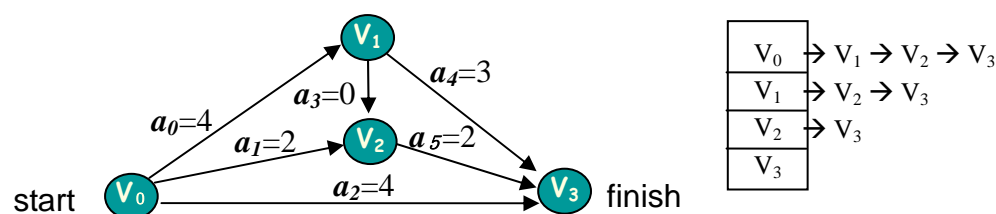
6. The following is a program coded by C language, please write down the output of this program. (8 points)
```c
#include <stdio.h>
int z = 0;
void recursive(int x, int *y)
{
    if (x)
    {
        *y += x;
        recursive(x-1, y);
        printf("x = %d, y = %d, z = %d\n", x, *y, ++z);
    }
}
int main()
{
    int x = 3, y = 0;
    recursive(x, &y);
    printf("x = %d, y = %d, z = %d\n", x, y, z);
}
```

7. Assume there is an inorder (infix) expression $A \times B - (C + E)/F$，please answer the following questions:
   (1) Please represent the inorder expression as a binary tree. (4 points)
   (2) Please translate the inorder expression to a postorder (postfix) one. (4 points)
   (3) Please translate the inorder expression to a preorder (prefix) one. (4 points)
   (4) Please explain the purpose of translating the inorder expression into a preorder or a postorder one. (4 points)

8. Assume a data array is as follows, please answer the following questions:

0	1	2	3	4	5	6	7
12	7	5	33	44	16	8	25

   (1) Please construct a binary search tree using the array data with the input sequence from slot 0 to 7. (5 points)
   (2) Please draw both possible binary trees after deleting 33. (5 points)
   (3) Please exemplify the condition that an array is **not** appropriate to being represented as a binary search tree. (5points)
   (4) Assume we adopt **Bubble Sort** to sort the array data (before deleting 33) **in ascending order**, please write down the sequence of elements in the array after the 3rd round sorting. (4 points)
   (5) In what situation the Bubble Sort will face the worst case that results in the highest time cost when sorting data? (4 points)

9. Assume a two-dimensional array is as follows, please answer the following questions:

	0	1	2	3	4
0	0	1	0	0	0
1	0	0	1	0	0
2	0	0	0	1	0
3	0	0	0	0	1
4	0	0	0	0	0

   (1) Please explain whether it is an appropriate way to represent such data as a two-dimensional array. (2 points)
   (2) Please design and elaborate a method (including the data structure and the data access or searching method) that requires least memory space to record these data and will not sacrifice the data access efficiency. (6 points)