1. Please explain the purposes/functionalities for the following items, respectively. (10%)

   (a) Domain Name Server (DNS)

   (b) Secure Socket Layer (SSL)

   (c) L1 and L2 cache memory

   (d) Cyclic Redundancy Code (CRC)

   (e) Single Sign-On (SSO)

2. In a multiprogramming environment, several programs are placed in memory at the same time, and they are executed by the CPU switching between these programs. Please present the concepts or principles for the following memory management approaches? (Note: You can use pictorial representation or text to describe them.) (10%)

   (a) Paging

   (b) Segmentation

   (c) Demand paging

3. Please present the executing result for the following C recursive program: (10%)

```c
#include <stdio.h>
main()
{
    int a;
    int b=1;
    for (a=0;a<5;a++){
        switch(a){
            case 1: b++;
            case 2: b+=2;
                break;
            case 3: b+=3;
            case 4: b+=4;
                break;
            default: b++;
        }
    printf("a=%d, b=%d\n", a, b);
    }
}
```

4. Please order the following time complexity <u>from the best to the worst</u>, suppose n is sufficiently large. (10%)

$$O(1); O(n); O(\log n); O(n\log n) ; O(n^2) ; O(n^3) ; O(2^n) ; O(n!)$$

5. The simplest way to implement a queue is using a one dimensional array and two variables, *front* and *rear*. The two variables are used to record the front and rear of a queue. Please answer the following problems.　(10%)

(a) What is the drawback of this simplest implementation?

(b) What data structure can be used to solve the problem in question (a) ?

6. You are asked to design a program to store the data of employee in your company. The stored data of an employee includes age, salary, phone, sex, and seniority. You decide to store all employees' data by a binary tree in your program.　(10%)

(a) Assumed that the employees are rarely changed in your company, how would you implement this binary tree in your program?

(b) Assumed that the employment and resignation occur frequently in your company, how would you implement this binary tree in your program?

7. Write the traversal result of the following binary tree: (a) preorder; (b) inorder; (c) postorder　(15%)
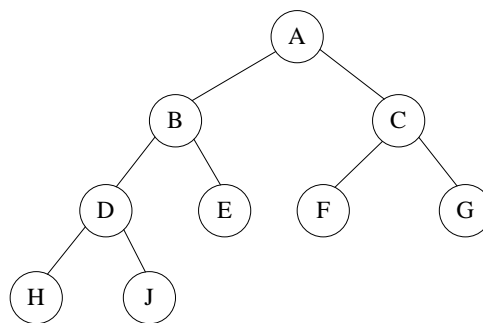
8. Suppose that we have the following key values: 7, 16, 49, 82, 5, 31, 6, 2, 44 and we want to use max(min) heap implemented by an array to store these values.　(10%)

(a) Write out the content in the array after each value is inserted into the max heap.

(b) Write out the content in the array after each value is inserted into the min heap.

9. Find the minimum-cost spanning tree of the following graph by using　(15%)

(a) Kruskal's algorithm

(b) Prim's algorithm

(c) Sollin's algorithm.

(Note: You have to draw the immediate steps or briefly explain your reason for (a), (b) and (c). Answers without explanation get only 2 points.)