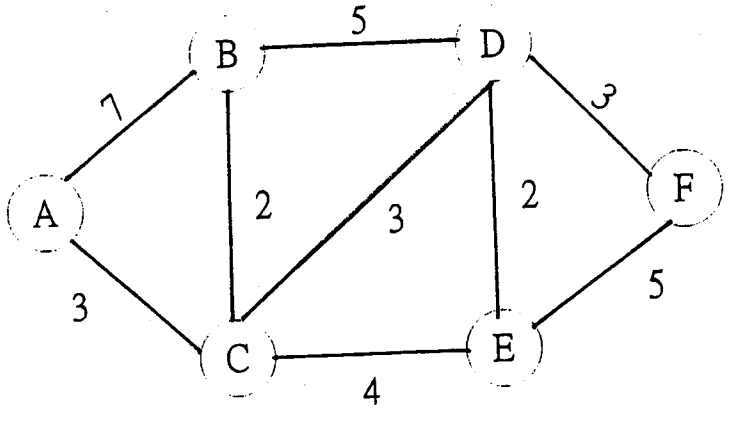
1. A specific retailer has established a database to contain the sales record of its stores, through the daily inputs from its POS system. A software engineer is requested to write an algorithm to find the sales volume of hot items in a weekly basis. Do you suggest the engineer to apply a sequential search algorithm or a binary search algorithm? Why one of them maybe more efficient than the other? (10%)

2. Given the graph below:



(1) Find the minimum spanning tree of the graph. (5%)

(2) What is the shortest path between vertices A and F. (5%)

3. Suppose that the postorder sequence is CFABGDE and the inorder sequence is CBFAEGD for the same binary tree:

(1) Draw the binary tree. (5%)

(2) Write out the preorder sequence for the binary tree. (5%)

4. Show the tree representation of the following parenthetical notation:
(A(B(E(K,L),F),C(G),D(H(M)))). (10%)

5. Explain the meaning of AVL tree and 2-3 tree. Why the concept is so important? (10%)

(背面仍有題目,請繼續作答)

6、Two kinds of program *performance analysis* will be used to evaluate the quality of the program named "time complexity" and "space complexity". Please explain these two complexity meanings? (4%) Please use the program in ***Box 1*** to evaluate the *program step* by using tabular method with steps/execution, frequency, total steps. (6%) Please use Big O to show the complexity of the program steps. (5%)

7. Please show the following two infix equations to postfix with the memory changing situations (10%)

(1) **a * b + c * d**

(2) **e / (f + a * d) + c**

	(	)	+	-	*	/	%	eos
isp	0	19	12	12	13	13	13	0
icp	20	19	12	12	13	13	13	0

※isp: in-stack precedence ; icp: incoming precedence
eos: end of stack

Box1

```
float sum(float list[ ], int n)
{
   float tempsum = 0;
   int i;
   for (i = 0; i<n; i++)
        tempsum += list [i];
   return tempsum;
}
```

8、Please define a **self-referential structure** to represent the planets in the solar system. Each planet has fields for its name, its distance from the sun (in miles), and the number of moons it has. (3%) Please use this structure to write a pseudo code to form a 5-node circular queue structure (8%)

9、Suppose you are now writing a program to transfer the architecture in ***Box 2*** to that in ***Box 3***. Please discuss what data types you will use and why? (6%) Please design a pseudo code by using the data types you list to implement the transformation. (8%)

Box 2

```
pattern2-1 = yes: cluster_2
pattern2-1 = no
|   pattern10-2 = yes: cluster_10
|   pattern10-2 = no
|   |   pattern3-9 = yes
|   |   |   pattern3-1 = yes
|   |   |   |   pattern4-5 = yes: cluster_4
|   |   |   |   pattern4-5 = no: cluster_3
|   |   |   pattern3-1 = no
|   |   |   |   pattern4-4 = yes: cluster_4
|   |   |   |   pattern4-4 = no: cluster_5
|   |   pattern3-9 = no
|   |   |   pattern3-4 = yes: cluster_5
|   |   |   pattern3-4 = no: cluster_8
```

Box 3

```
if (/pattern2-1/){cluster_2}
else{   if (/pattern10-2/){cluster_10}
        else{   if (/pattern3-9/){
                    if (/pattern3-1/){
                        if (/pattern4-5/){cluster_4}
                        else {cluster3}
                    }
                    else{   if (/pattern4-4/){cluster_4}
                            else{cluster_3}
                    }
                }
                else{   if (/pattern3-4/){cluster_5}
                        else{cluster_8}
                }
        }
}
```