1. Consider the given C-like tree structure
   
   ```c
   struct tree
   {
     char vertex;
     struct tree *left;
     struct tree *right;
   };
   
   A tree is formed according to this structure.
   
   (a) Write a recursive algorithm to count the number of vertices of this tree. (10%)
   
   (b) Analyze the time complexity of your algorithm. (5%)
   
2. The Internet utilizes the TCP / IP protocol that contains 5 classes of available IP ranges: Class A, Class B, Class C, Class D, and Class E.
   
   (a) Specify the IP ranges of Class B (5%)
   
   (b) An IP address contains two components: the network address and the host address. Specify the network address of a given IP address: 163.17.21.11 with the subnet mask 255.255.255.128. (5%)
   
3. Specify the key characteristics of the following network protocols. (10%)
   
   (a) TCP
   (b) APR
   (c) DHCP
   (d) UDP
   (e) ICMP
   
4. Given a recursive C function
   
   ```c
   Fib(int n)
   {
     if (n<1) return (0);
     else return (2*Fib(n-1)+1 );
   }
   
   (a) An integer variable m is assigned as Fib(3), i.e., m=Fib(3). Compute the value of m. (5%)
   
   (b) Write an iterative function to accomplish the same purpose of the Fib function. (10%)
   
5. (a) Convert the binary representation 100.111 to its equivalent base ten form. (5%)
   
   (b) Convert the two’s complement representation 10000 to its equivalent base ten form. (5%)
6. A right circular shift of two bits on a string of eight bits is equivalent to a left circular shift of how many bits? (5%)  
7. Structure chart is used to represent the procedural organization of a software system. As shown in Fig.1, answer the following questions in relation to the accompanying structure chart:  
(a) To which module does module Y return control? (2%)  
(b) To which module does module Z return control? (2%)  
(c) Are modules W and X linked via control coupling? (2%)  
(d) What data is shared by both module W and module Y? (2%)  
(e) In what way are modules Y and X related? (hint: control coupling or data coupling) (2%)  
8. What are the four necessary conditions? If the four necessary conditions hold simultaneously in a system, a deadlock situation can arise. (10%)  
9. Write down the output of the C program that is shown in Fig. 2. (15%)  

```c  
#include <stdio.h>  
void ans1(int*);  
void ans2(int);  
main()  
{  
    int x=2;  
    ans1(&x);  
    ans2(x);  
    printf("x of main() = %d\n", x+=2);  
}  
void ans1(int *x)  
{  
    *x = (*x)*(*x)*(*x);  
    printf("x of ans1 = %d\n", *x);  
}  
void ans2(int x)  
{  
    x = x*x*x;  
    printf("x of ans2 = %d\n", x);  
}  
```

Fig. 2  C program