考试科目：数据结构和程序设计（PASCAL、C任送）

题号：0702
页数：4

答题须知：凡程序设计题，必须先进行设计思想的描述，可以用框图或结构化汉语进行说明，然后再编程，在程序中用到的数据结构和变量必须加以说明，过程也应适当加以注释，卷面要求书写整齐，字迹清晰，本卷共九题。

一、（10分）请写出遍历下面的二叉树的三种结果

```
        A
      B   C
   F    D    E
```
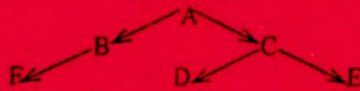
二、（10分）请写出下面图的二种存储结构。
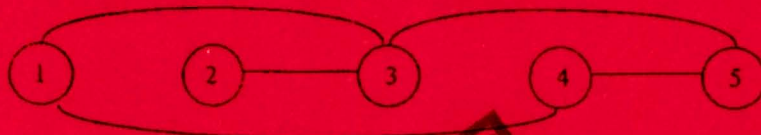
三、（10分）举例说明拓扑排序的方法。

四、（10分）如果用链表作为栈的存储结构，请写出相应的运算过程
　　（1）初始化　（2）进栈　（3）退栈

五、（10分）举例说明堆排序的方法

六、（10分）已知等式 $1+3+5+\cdots+(2n-1)=n^2$，仅利用加法操作，可以设计出如下程序，它能计算出平方值不超过给定的非负整数 A（A≤10000）的最大整数，即求出 Root(A)，使满足 $Root^2(A) \le A < (Root(A)+1)^2$，其中 $0 \le A \le 10000$。试填空完成此程序。（Pascal 或 C 语言任选一题，共五空）

```pascal
program RootDemo;
var
    A: Integer;

function RootN(W: Integer): Integer;
var
    X, Y, Z: Integer;

begin
    X := 0;
    Y := _____①_____
    Z := _____②_____
    while (Y <= W) do
    begin
        X := _____③_____
        Z := _____④_____
        Y := _____⑤_____
    end;
    RootN := X;
end;
```

```c
#include <stdio.h>
int a;

int rootn(w)
int w;
{
    int x,y,z;

    x=0;
    y= _____①_____ ;
    z= _____②_____ ;
    while (y<=w) {
        x= _____③_____ ;
        z= _____④_____ ;
        y= _____⑤_____ ;
    }
    return(x);
}

main()
```

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```pascal
begin
    WriteLn;
    WriteLn;
    WriteLn(' This is a example: ');
    WriteLn('Please input integer A:');
    Write('( 0 <= A <= 10000 ) A := ');
    Read(A);
    if (A >= 0) and (A <= 10000) then
        WriteLn(' Input = ',A,' Root = ',RootN(A));
end.
```

```c
{
    printf("\n\n");
    printf(" This is a example \n");
    printf("Please input integer A \n");
    printf("( 0 <= A <= 10000 ) A  = ");
    scanf("%d",&a);
    if ((a>=0)&&(a<=10000))
        printf(" Input = %d Root = %d",a,rootn(a));
}
```

七．(12分) 下面的程序是一个改进的冒泡排序程序，其主要改进是每次扫描都要排好两个元素．假定初始被排序的元素个数永远是奇数个，试填空完成下面的程序．(Pascal 或 C 语言任选一题，共六空)

```pascal
program SortDemo;
const
    Max = 9;
var
    A: Array[1..Max] of Integer;
    M: Integer;

procedure SortN;
var
    I, J, K, STemp, LTemp: Integer;

begin
    for I := 1 to (Max - 1) DIV 2 do
    begin
        if A[I+I] <= A[I+I+1] then
        begin
            STemp := A[I+I];
            LTemp := A[I+I+1];
        end else
        begin
            STemp := A[I+I+1];
            LTemp := A[I+I];
        end;
        J = I + I - 1;
        while _____①_____ do
        begin
            A[__②__] = _____③_____;
            J = J - 1;
        end;
        A[J+2] = LTemp;
        K = J;
```

```c
#include <stdio.h>
#define Max 9
int a[Max+1];

void sortn()
{
    int  i,j,k,stemp,ltemp;

    for (i=1; i<=(Max-1)/2; i++) {
        if (a[i+i]<=a[i+i+1]) {
            stemp=a[i+i];
            ltemp=a[i+i+1];
        }
        else {
            stemp=a[i+i+1];
            ltemp=a[i+i];
        }
        j=i+i-1;
        while _____①_____ {
            a[ __②__ ] = _____③_____;
            j--;
        }
        a[j+2]=ltemp;
        k=j;
        while _____④_____ {
            a[ __⑤__ ] = _____⑥_____;
            k--;
        }
        a[k+1]=stemp;
    }
```

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```pascal
    while ____④____ do
    begin
        A[ ⑤ ] := ____⑥____;
        K := K - 1;
    end;
    A[K+1] := STemp;
end;

begin
    WriteLn;
    WriteLn(' This is a example: ');
    WriteLn(' Please initialize A array: ');
    for  M := 1 to Max do
    begin
        Write(' A[',M,'] = ');
        Read(A[M]);
    end;
    SortN;
    WriteLn(' The sort result is: ');
    for  M := 1 to Max do
    begin
        Write(' A[',M,'] = ');
        Write(A[M]);
    end;
    WriteLn;
end.
```

```c
    ;
main()
{
    int m;

    printf("\n This is a example: ");
    printf("\n Please initialize A array: \n");
    for (m=1; m<=Max; m++) {
        printf(" a[%d] = ",m);
        scanf("%d",&a[m]);
    }
    sortn();
    printf("\n The sort result is: \n");
    for (m=1; m<=Max; m++) {
        printf(" A[%d] = ",m);
        printf("%d",a[m]);
    }
    printf("\n");
}
```

八．（16分）下面的程序是一个打印出在A[1],A[2],……A[n]共n个元素中
取出m个元素的所有组合情况的程序（1）试填空完成下面的程序（2）写
出当n=5，m=3时该程序的运行结果（Pascal或C语言任选一题，共六空）

```pascal
program CombinDemo;
const
    N = 5;
    M = 3;
var
    A: Array[1..N] of Integer;
    K, Count: Integer;

procedure Combin(Start,Endn,Total,Take:Integer);
var
    I, J: Integer;

begin
    if Take <= 0 then
    begin
```

```c
#include <stdio.h>
#define N  5
#define M  3
int a[N+1], count;

void combin(start, endn, total, take)
int start, endn, total, take;
{
    int i, j;

    if (take <= 0) {
        count++;
        printf("\n");
    }
    else {
```

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Left column (Pascal):

```
        Count := Count + 1;
        WriteLn;
    end else
    begin
        for I := 1 to _____①_____ do
        begin
            if I <> 1 then
                for J := 1 to N-Total do
                    Write(' ');
            Write(A[ ___②___ ], ' ');
            Combin( _③_ , _④_ , _⑤_ , _⑥_ );
        end;
    end;
end;

begin
    for K := 1 to N do
        A[K] := K;
    Count := 0;
    WriteLn;
    WriteLn('This is a example');
    Combin(1, N, N, M);
    WriteLn(' Total ', Count);
end.
```

Right column (C):

```
    for (i=1; i<= _____①_____ ; ++i) {
        if (i != 1)
            for (j=1; j<=N-total; j++)
                printf(" ");
        printf("%d ",a[ ___②___ ] );
        combin( _③_ , _④_ , _⑤_ , _⑥_ );
    }
}

main()
{
    int k;
    for (k=1; k<=N; ++k)
        a[k] = k;
    count = 0;
    printf("\n");
    printf("This is a example:\n");
    combin(1,N, N, M);
    printf(" total = %d\n",count);
}
```

九．（12分）假定排序二叉树 t 的每个节点的存储结构如下图所示，其中 Left 为指向左子树的指针，Right 为指向右子树的指针，试编写一程序，完成从排序二叉树上删除键值为 x（即 Key = x，并假定值 x 在排序二叉树 t 上最多只出现一次）的节点的功能，注意：删除后仍需保持排序二叉树的固有排列．

Left	Key	Right