



程序设计实习

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更多多态程序实例

几何形体处理程序

几何形体处理程序：输入若干个几何形体的参数，要求按面积排序输出。输出时要指明形状。

Input:

第一行是几何形体数目n（不超过100）。下面有n行，每行以一个字母c开头。

若 c 是 ‘R’，则代表一个矩形，本行后面跟着两个整数，分别是矩形的宽和高；

若 c 是 ‘C’，则代表一个圆，本行后面跟着一个整数代表其半径

若 c 是 ‘T’，则代表一个三角形，本行后面跟着三个整数，代表三条边的长度

几何形体处理程序

Output:

按面积从小到大依次输出每个几何形体的种类及面积。每行一个几何形体，输出格式为：

形体名称：面积



几何形体处理程序

Sample Input:

3

R 3 5

C 9

T 3 4 5

Sample Output

Triangle:6

Rectangle:15

Circle:254.34

```
#include <iostream>
#include <stdlib.h>
#include <math.h>
using namespace std;
class CShape
{
    public:
        virtual double Area() = 0; //纯虚函数
        virtual void PrintInfo() = 0;
};
class CRectangle:public CShape
{
    public:
        int w,h;
        virtual double Area();
        virtual void PrintInfo();
};
```

```
class CCircle:public CShape {
    public:
        int r;
        virtual double Area();
        virtual void PrintInfo();
};
class CTriangle:public CShape {
    public:
        int a,b,c;
        virtual double Area();
        virtual void PrintInfo();
};
```

```
double CRectangle::Area() {  
    return w * h;  
}  
void CRectangle::PrintInfo() {  
    cout << "Rectangle:" << Area() << endl;  
}  
double CCircle::Area() {  
    return 3.14 * r * r ;  
}  
void CCircle::PrintInfo() {  
    cout << "Circle:" << Area() << endl;  
}
```

```
double CTriangle::Area() {  
    double p = ( a + b + c ) / 2.0;  
    return sqrt(p * ( p - a)*(p- b)*(p - c));  
}  
void CTriangle::PrintInfo() {  
    cout << "Triangle:" << Area() << endl;  
}
```

```
CShape * pShapes[100];  
int MyCompare(const void * s1, const void * s2);
```

```
int main()  
{  
    int i; int n;  
    CRectangle * pr; CCircle * pc; CTriangle * pt;  
    cin >> n;  
    for( i = 0; i < n; i ++ ) {  
        char c;  
        cin >> c;  
        switch(c) {  
            case 'R':  
                pr = new CRectangle();  
                cin >> pr->w >> pr->h;  
                pShapes[i] = pr;  
                break;
```



```
    case 'C':  
        pc = new CCircle();  
        cin >> pc->r;  
        pShapes[i] = pc;  
        break;  
    case 'T':  
        pt = new CTriangle();  
        cin >> pt->a >> pt->b >> pt->c;  
        pShapes[i] = pt;  
        break;  
    }  
}  
qsort(pShapes,n,sizeof( CShape*),MyCompare);  
for( i = 0;i <n;i ++)  
    pShapes[i]->PrintInfo();  
return 0;  
}
```

```
int MyCompare(const void * s1, const void * s2)
{
    double a1,a2;
    CShape * * p1 ; // s1,s2 是 void * , 不可写 “* s1” 来取得s1指向的内容
    CShape * * p2;
    p1 = ( CShape * * ) s1; //s1,s2指向pShapes数组中的元素，数组元素的类型是CShape *
    p2 = ( CShape * * ) s2; // 故 p1,p2都是指向指针的指针，类型为 CShape **
    a1 = (*p1)->Area(); // * p1 的类型是 Cshape * ,是基类指针，故此句为多态
    a2 = (*p2)->Area();
    if( a1 < a2 )
        return -1;
    else if ( a2 < a1 )
        return 1;
    else
        return 0;
}
```

```
    case 'C':  
        pc = new CCircle();  
        cin >> pc->r;  
        pShapes[i] = pc;  
        break;  
    case 'T':  
        pt = new CTriangle();  
        cin >> pt->a >> pt->b >> pt->c;  
        pShapes[i] = pt;  
        break;  
    }  
}  
qsort(pShapes,n,sizeof( CShape*),MyCompare);  
for( i = 0;i <n;i ++)  
    pShapes[i]->PrintInfo();  
return 0;  
}
```



如果添加新的几何形体，比如五边形，则只需要从CShape派生出CPentagon, 以及在main中的switch语句中增加一个case，其余部分不变有木有！



用基类指针数组存放指向各种派生类对象的指针，然后遍历该数组，就能对各个派生类对象做各种操作，是很常用的做法

多态的又一例子

```
class Base {  
public:  
    void fun1() { fun2(); }  
    virtual void fun2() { cout << "Base::fun2()" << endl; }  
};  
class Derived:public Base {  
public:  
    virtual void fun2() { cout << "Derived:fun2()" << endl; }  
};  
int main() {  
    Derived d;  
    Base * pBase = & d;  
    pBase->fun1();  
    return 0;  
}
```

输出: Derived:fun2()

多态的又一例子

```
class Base {  
public:  
    void fun1() { this->fun2(); } //this是基类指针，fun2是虚函数，所以是多态  
    virtual void fun2() { cout << "Base::fun2()" << endl; }  
};  
class Derived:public Base {  
public:  
    virtual void fun2() { cout << "Derived:fun2()" << endl; }  
};  
int main() {  
    Derived d;  
    Base * pBase = & d;  
    pBase->fun1();  
    return 0;  
}
```

输出: Derived:fun2()



在非构造函数，非析构函数的成员函数中调用虚函数，是多态!!!

构造函数和析构函数中调用虚函数



在构造函数和析构函数中调用虚函数，不是多态。编译时即可确定，调用的函数是**自己的类或基类**中定义的函数，不会等到运行时才决定调用自己的还是派生类的函数。

```

class myclass {
public:
    virtual void hello(){cout<<"hello from myclass"<<endl; };
    virtual void bye(){cout<<"bye from myclass"<<endl; }
};

class son:public myclass{ public:
    void hello(){ cout<<"hello from son"<<endl;};
    son(){ hello(); };
    ~son(){ bye(); };
};

```

😊 派生类中和基类中虚函数同名同参数表的函数，不加virtual也自动成为虚函数

```

class grandson:public son{ public:
    void hello(){cout<<"hello from grandson"<<endl;};
    void bye() { cout << "bye from grandson"<<endl;}
    grandson(){cout<<"constructing grandson"<<endl;};
    ~grandson(){cout<<"destructing grandson"<<endl;};
};

```

```

int main(){
    grandson gson;
    son *pson;
    pson=&gson;
    pson->hello(); //多态
    return 0;
}

```

结果:
 hello from son
 constructing grandson
 hello from grandson
 destructing grandson
 bye from myclass