Abstract Classes and Shape calculator

By

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Week 6&7 lab

Milwaukee School of Engineering

Submitted to:

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Objective

The objective of this lab is to create a class hierarchy of shapes objects. Where we can let the user pick any number of shapes he wants and after the user is done input the program calculates the volume and surface area or area and perimeter of the objects. We created rectangles, circle, box, and spheres as concrete objects (hierarchy level 3).

Description

In my program I created 3 abstract class and 4 concrete files for my objects(rectangle, circle, box ,and sphere). Each object is then divided into to base class of TwoDShape or ThreeDShape that is abstract meaning cannot be created in the program but can be defined. Afterwards there is an arching abstract class named “Shape”. In my program I create a vector of shape pointers. And then depending on what player decided will create a a dynamic memory of the object chosen. This will allow me to call the shape later on when the user is done inputted information and also allow me to read the information (History Tab) when the user wants to revert back on the inputted info.

Conclusions

The lab was successful and was able to implement all the required classes and proper object relationship using polymorphism. The toughest challenge for me was on how to implement to_string() function for each class and printing out the area/perimeter or volume/surface area for each object. I later found out I can print out the values by calling the TwoDShape to_string() or ThreeDShape to_string() in my concrete classes. Another problem I had during this lab was deciding how to keep an object if within a different scope. This because in my menu process I allow the user four process which are (1) Insert, (2) Help, (3) Start, (4) History and (5) Exit. The insert option lets the user insert any options and its information only. Help gives a small text about the program, (3) calculates and output results, (4) prints the shape name, and (5) exit deletes dynamic memory and exits program. A lot of times whenever I am in insert or calling the history the information of the object’s variables would not exist because the object would have been deleted after the if scope was done. Therefor dynamic memory was needed. Recognizing the need of to use dynamic memory is something I must work on. What I did love about this lab was learning a refresh on pointers and how to use polymorphism. Overall, the lab was a success.

Console Result:

```
//////////////////////////////////////////
1 - Insert.
2 - Help.
3 - Start.
4 - History.
5 - Exit.
Please enter your choice and press enter:1
//////////////////////////////////////////
Please select Shape choice.
1 - Rectangle.
2 - Circle.
3 - Box.
4 - Sphere.
Choice: 1
length: 1
width: 5
//////////////////////////////////////////
1 - Insert.
2 - Help.
3 - Start.
4 - History.
5 - Exit.
Please enter your choice and press enter:1
//////////////////////////////////////////
Please select Shape choice.
1 - Rectangle.
2 - Circle.
3 - Box.
```

4 - Sphere.

Choice: 2

radius: 5.34

//

1 - Insert.

2 - Help.

3 - Start.

4 - History.

5 - Exit.

Please enter your choice and press enter:1

//

Please select Shape choice.

1 - Rectangle.

2 - Circle.

3 - Box.

4 - Sphere.

Choice: 3

length: 5

width: 6

height: 50

//

1 - Insert.

2 - Help.

3 - Start.

4 - History.

5 - Exit.

Please enter your choice and press enter:1

//

Please select Shape choice.

1 - Rectangle.

2 - Circle.

3 - Box.

4 - Sphere.

Choice: 4

radius: 3.14

//

1 - Insert.

2 - Help.

3 - Start.

4 - History.

5 - Exit.

Please enter your choice and press enter:2

//

This program wil allow the user to create any number of circles,rectnagle,boxes, and spheres.All of the data will be stored and once the user us ready.

Insert allows the user to insert a shape as data.

Start will not let the user input any new data and will start the process.

History will tell the user all the shapes he has chosen.

Exit will close the problem out.

Thank you playing.

//

1 - Insert.

2 - Help.

3 - Start.

4 - History.

5 - Exit.

Please enter your choice and press enter:4

//

Rectangle

Circle

Box

Sphere

//

1 - Insert.

2 - Help.

3 - Start.

4 - History.

5 - Exit.

Please enter your choice and press enter:1

//

Please select Shape choice.

1 - Rectangle.

2 - Circle.

3 - Box.

4 - Sphere.

Choice: 1

length: -10

width: -5

cannot have negative length

cannot have negative width

//

1 - Insert.

2 - Help.

3 - Start.

4 - History.

5 - Exit.

Please enter your choice and press enter:1

//

Please select Shape choice.

1 - Rectangle.

2 - Circle.

3 - Box.

4 - Sphere.

Choice: 2

radius: 7.2

//

1 - Insert.

2 - Help.

3 - Start.

4 - History.

5 - Exit.

Please enter your choice and press enter:4

//

Rectangle

Circle

Box

Sphere

Rectangle

Circle

//

1 - Insert.

2 - Help.

3 - Start.

4 - History.

5 - Exit.

Please enter your choice and press enter:4

//

Rectangle

Circle

Box

Sphere

Rectangle

Circle

//

1 - Insert.

2 - Help.

3 - Start.

4 - History.

5 - Exit.

Please enter your choice and press enter:3

//

Calculating Shapes...

Done.

Outputting information.

Rectangle[1,5] TwoDShape||Area: 5 Perimeter: 12

Circle[5.34] TwoDShape||Area: 89.5818 Perimeter: 33.5512

Box[5,6,50] ThreeDShape||Volume: 1500 SurfaceArea: 1160

Sphere[3.14] ThreeDShape||Volume: 97.2582 SurfaceArea: 123.896

Rectangle[0,0] TwoDShape||Area: 0 Perimeter: 0

Circle[7.2] TwoDShape||Area: 162.855 Perimeter: 45.2376

//

1 - Insert.

2 - Help.

3 - Start.

4 - History.

5 - Exit.

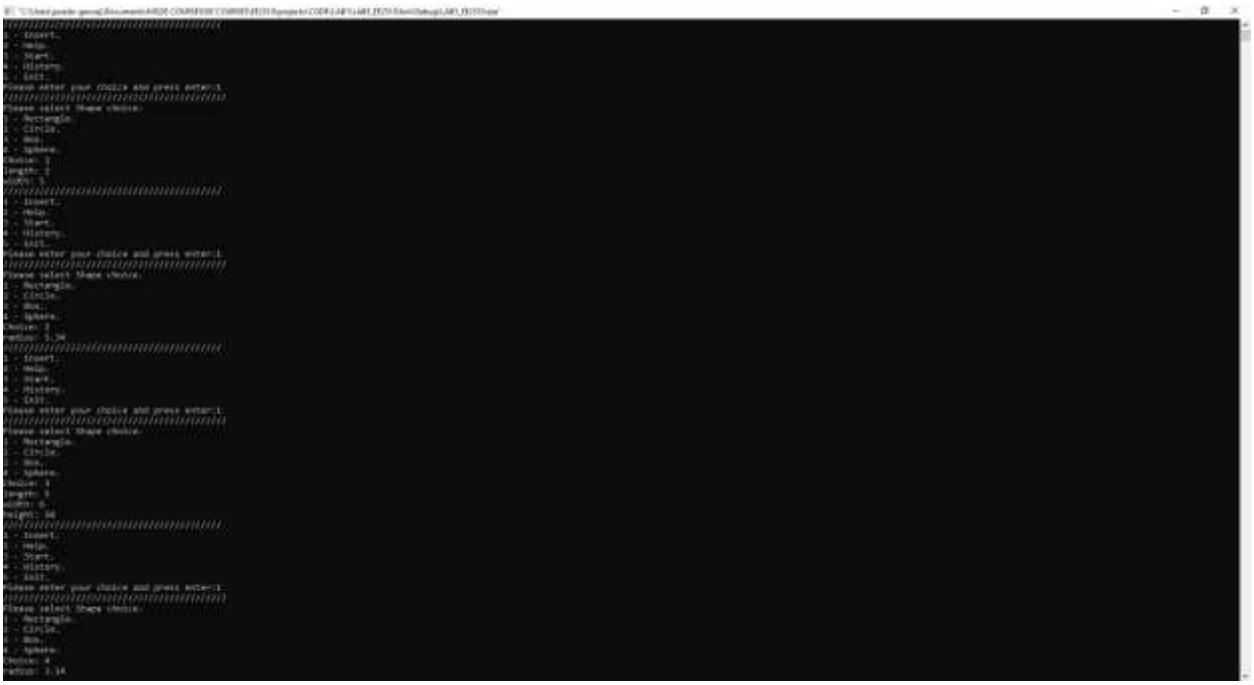
Please enter your choice and press enter:5

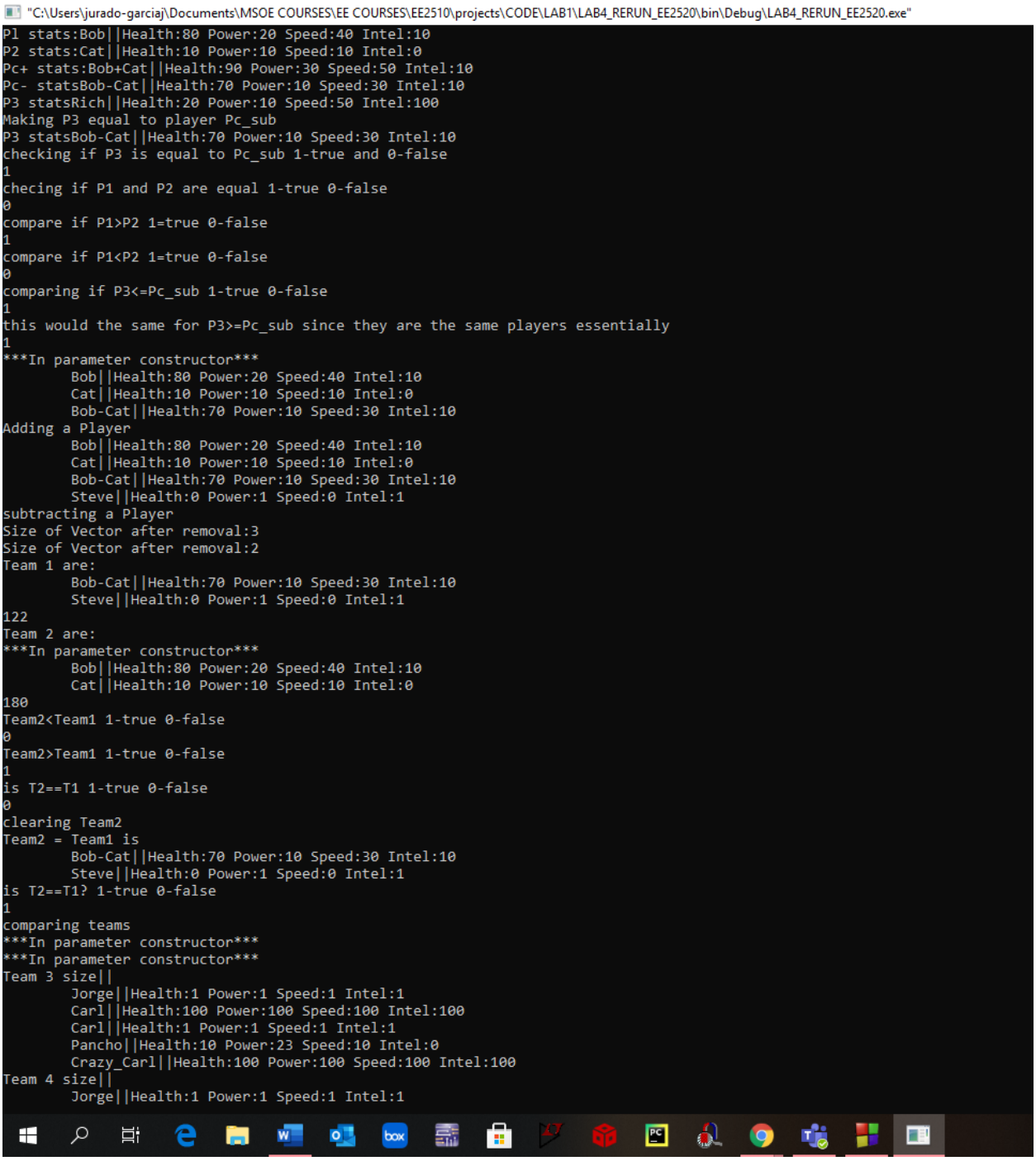
//

game is done

Process returned 0 (0x0)   execution time : 97.007 s

Press any key to continue.




"C:\Users\jurado-garciaj\Documents\MSOE COURSES\EE COURSES\EE2510\projects\CODE\LAB1\LAB4_RERUN_EE2520\bin\Debug\LAB4_RERUN_EE2520.exe"
P1 stats:Bob||Health:80 Power:20 Speed:40 Intel:10
P2 stats:Cat||Health:10 Power:10 Speed:10 Intel:0
Pc+ stats:Bob+Cat||Health:90 Power:30 Speed:50 Intel:10
Pc- statsBob-Cat||Health:70 Power:10 Speed:30 Intel:10
P3 statsRich||Health:20 Power:10 Speed:50 Intel:100
Making P3 equal to player Pc_sub
P3 statsBob-Cat||Health:70 Power:10 Speed:30 Intel:10
checking if P3 is equal to Pc_sub 1-true and 0-false
1
checing if P1 and P2 are equal 1-true 0-false
0
compare if P1>P2 1=true 0-false
1
compare if P1<P2 1=true 0-false
0
comparing if P3<=Pc_sub 1-true 0-false
1
this would the same for P3>=Pc_sub since they are the same players essentially
1
In parameter constructor
Bob||Health:80 Power:20 Speed:40 Intel:10
Cat||Health:10 Power:10 Speed:10 Intel:0
Bob-Cat||Health:70 Power:10 Speed:30 Intel:10
Adding a Player
Bob||Health:80 Power:20 Speed:40 Intel:10
Cat||Health:10 Power:10 Speed:10 Intel:0
Bob-Cat||Health:70 Power:10 Speed:30 Intel:10
Steve||Health:0 Power:1 Speed:0 Intel:1
subtracting a Player
Size of Vector after removal:3
Size of Vector after removal:2
Team 1 are:
Bob-Cat||Health:70 Power:10 Speed:30 Intel:10
Steve||Health:0 Power:1 Speed:0 Intel:1
122
Team 2 are:
In parameter constructor
Bob||Health:80 Power:20 Speed:40 Intel:10
Cat||Health:10 Power:10 Speed:10 Intel:0
180
Team2<Team1 1-true 0-false
0
Team2>Team1 1-true 0-false
1
is T2==T1 1-true 0-false
0
clearing Team2
Team2 = Team1 is
Bob-Cat||Health:70 Power:10 Speed:30 Intel:10
Steve||Health:0 Power:1 Speed:0 Intel:1
is T2==T1? 1-true 0-false
1
comparing teams
In parameter constructor
In parameter constructor
Team 3 size||
Jorge||Health:1 Power:1 Speed:1 Intel:1
Carl||Health:100 Power:100 Speed:100 Intel:100
Carl||Health:1 Power:1 Speed:1 Intel:1
Pancho||Health:10 Power:23 Speed:10 Intel:0
Crazy_Carl||Health:100 Power:100 Speed:100 Intel:100
Team 4 size||
Jorge||Health:1 Power:1 Speed:1 Intel:1

Main File

```
/*
 * main.ccp
 *
 *  Created on: April 17, 2021
 *      Author: Jorge Jurado-Garcia
 *  Markups: 4/19 create dynamic memory
 *                for shapes objects and for choice 3
 *
 */
#include <string>
#include "Shape.h"
#include "TwoDShape.h"
#include "ThreeDShape.h"
#include "Rectangle.h"
#include "Circle.h"
#include "Box.h"
#include "Sphere.h"
#include <vector>

using namespace std;

int main()
{
//creating dynamic memory for rectnagle, circle, box, and square
int choice; //variable for first menu
bool gameon = true;
vector<Shape*> shape; //vector of base shapes pointers
Shape* shape_ptr;
//user is playing the game
while( gameon != false){
cout<<"////////////////////////////////////////\n";
cout<<"1 - Insert.\n";
cout<<"2 - Help.\n";
cout<<"3 - Start.\n";
cout<<"4 - History.\n";
cout<<"5 - Exit.\n";
cout<<"Please enter your choice and press enter:";
cin>>choice;
cout<<"////////////////////////////////////////\n";
if(choice == 1){
//coding for selecting objects
//calles the shape the user is going to input
int shape_choice;
cout<<"Please select Shape choice.\n";
cout<<"1 - Rectangle.\n";
cout<<"2 - Circle.\n";
cout<<"3 - Box.\n";
cout<<"4 - Sphere.\n";
cout<<"Choice: ";
cin>>shape_choice;
if(shape_choice==1){
float length;
float width;
cout<<"length: ";
cin>>length;
```

```
cout<<"width: ";
cin>>width;
Rectangle *R = new Rectangle(0,0,"Rectangle");
R->set_length(length);
R->set_width(width);
shape_ptr = R; //shape pointer points to the address of R;
shape.push_back(shape_ptr);
}
else if(shape_choice==2){
float radius;
cout<<"radius: ";
cin>>radius;
Circle *C = new Circle(0,"Circle");
C->set_radius(radius);
shape_ptr = C; //shape pointer points to the address of C;
shape.push_back(shape_ptr);
}
else if(shape_choice==3){
float length;
float width;
float height;
cout<<"length: ";
cin>>length;
cout<<"width: ";
cin>>width;
cout<<"height: ";
cin>>height;
Box *B = new Box(0,0,0,"Box");
B->set_length(length);
B->set_width(width);
B->set_height(height);
shape_ptr = B; //shape pointer points to the address of B;
shape.push_back(shape_ptr);
}
else if(shape_choice==4){
float radius;
cout<<"radius: ";
cin>>radius;
Sphere *S = new Sphere(radius,"Sphere");
shape_ptr = S; //shape pointer points to the address of S;
shape.push_back(shape_ptr);
}
}
if(choice == 2){
    cout<<"This program wil allow the user to create any number of
circles,rectnagle,boxes, and spheres.";
    cout<<"All of the data will be stored and once the user us ready.\n";
    cout<<"Insert allows the user to insert a shape as data.\n";
    cout<<"Start will not let the user input any new data and will start the
process.\n";
    cout<<"History will tell the user all the shapes he has chosen.\n";
    cout<<"Exit will close the problem out.\n";
    cout<<"Thank you playing."<<endl;
}
if(choice == 3){
    cout<<"Calculating Shapes..."<<endl;
```

```
    for(int j=0; j<shape.size(); j++){
       shape[j]->calculateAll();
    }
    cout<<"Done.\n";
    cout<<"Outputting information.\n";
    for(int j=0; j<shape.size();j++){
        cout<<shape[j]->to_string()<<endl;
        }
    }
if(choice == 4){
//conduct a for loop of the array
       for(int j=0; j< shape.size();j++){
        cout<<shape[j]->Shape::to_string()<<endl;
       }

}
if(choice == 5){
    gameon = false;
}//end if
}//end while
    cout<<"game is done\n";
    for(int j=0; j< shape.size();j++){
     delete shape[j];
    }
//vectors are always deleted afterwards

//user stops the game does nothing
/*
A virtual destructor
- it enables a dynamic dispatch mechanism that makes sure destruction works
fix this by creating shape destructor as a virtual
*/
}
```

Shape Header File

```
/*
Created: Jorge Jurado-Garcia
Date: 4/16/21
modifications:
4/16 creation of virtual class
4/19 adding set/get declaration
    adding virtual destructors
*/
#ifndef SHAPE_H_INCLUDED
#define SHAPE_H_INCLUDED

#include <stdio.h>
#include <string>
#include <iostream>

using namespace std;

class Shape{
private:
    string name;
public:
    Shape(); //default constructor
    Shape(string n); //parameter constructor
    virtual ~Shape();

    set_name(string n);
    string get_name();

    virtual string to_string();  //virtual function
    //pure virtual function that uses for all subclass
    virtual void calculateAll()=0;
};


#endif // SHAPE_H_INCLUDED
```

Shape source file

```
/*
 * Shape.ccp
 *
 *  Created on: April 16, 2021
 *      Author: Jorge Jurado-Garcia
 *
 * Defines the functions for abstract class Shape
 * 4/19/21 Creating set and get functions
 *
 */

 #include "Shape.h"
 #include <stdio.h>
 #include <string>
 #include <iostream>
 #include <sstream>

 using namespace std;

Shape::Shape(){
    name = "no name";
 }
Shape::Shape(string n){
    set_name(n);
}
Shape:: ~Shape(){
}
Shape::set_name(string n){
    name = n;
    return 0;
}
string Shape:: get_name(){
    return name;
}
string Shape:: to_string(){
 return name;
}
```

TwoDShape Header File

```
/*
Created: TwoDShape
Author: Jorge Jurado-Garcia
Date: 4/16/21
modifications:
4/16 creation of base sub class
4/19 adding virtual constructor
     fixing parameter functions for twoDshape
*/

#ifndef TWODSHAPE_H_INCLUDED
#define TWODSHAPE_H_INCLUDED

#include <stdio.h>
#include <string>
#include <iostream>
#include "Shape.h"

using namespace std;

class TwoDShape: public Shape{
protected:
    float area;
    float perimeter;
public:
    TwoDShape();
    TwoDShape(string name);
    virtual ~TwoDShape();

    float get_area();
    float get_perimeter();

    virtual string to_string();
    virtual void calculateAll();

    virtual void calculateArea()=0;
    virtual void calculatePerimeter()=0;
};

#endif // TWODSHAPE_H_INCLUDED
```

TwoDShape Source File

```
/*
 * TwoDShape.ccp
 *
 *  Created on: April 16, 2021
 *      Author: Jorge Jurado-Garcia
 *
 * Defines the functions for abstract class TwoDShape
 *
 */

 #include "TwoDShape.h"
 #include <stdio.h>
 #include <string>
 #include <iostream>
 #include <sstream>

 using namespace std;

TwoDShape::TwoDShape(){ //will call the Shape class automatically
    area = 0;
    perimeter = 0;
    //cannot acces name for base class Shape
}
TwoDShape::TwoDShape(string name)
:Shape(name){
//well have to call the shape parameter constructor
//because the default constructor is automatically called
 area = 0;
 perimeter = 0;
}
TwoDShape:: ~TwoDShape(){
}
float TwoDShape::get_area(){
    return area;
}
float TwoDShape::get_perimeter(){
    return perimeter;
}
string TwoDShape::to_string(){
ostringstream out1;
ostringstream out2;
out1<<area;
out2<<perimeter;
string ret;
ret = "TwoDShape||";
ret = ret + "Area: " + out1.str() + " Perimeter: " + out2.str();
return ret;
}
void TwoDShape::calculateAll(){
    calculateArea();
    calculatePerimeter();
}
```

ThreeDShape Header File

```
/*
Created: ThreeDShape
 Author Jorge Jurado-Garcia
Date: 4/16/21
modifications:
4/16 creation of base sub class
*/
#ifndef THREEDSHAPE_H_INCLUDED
#define THREEDSHAPE_H_INCLUDED

#include <stdio.h>
#include <string>
#include <iostream>
#include "Shape.h"

using namespace std;

class ThreeDShape: public Shape{
protected:
    float volume;
    float surfaceArea;
public:
    ThreeDShape();
    ThreeDShape(string name);
    virtual ~ThreeDShape();

    float get_volume();
    float get_surfaceArea();

    virtual string to_string();
    virtual void calculateAll();

    virtual void calculate_Volume()=0;
    virtual void calculate_SurfaceArea()=0;
};


#endif // THREEDSHAPE_H_INCLUDED
```

ThreeDShape Source File

```
/*
 * ThreeDShape.ccp
 *
 *  Created on: April 20, 2021
 *      Author: Jorge Jurado-Garcia
 *
 * Defines the functions for abstract class TwoDShape
 *
 */

 #include "ThreeDShape.h"
 #include <stdio.h>
 #include <string>
 #include <iostream>
 #include <sstream>

 using namespace std;

ThreeDShape::ThreeDShape(){ //will call the Shape class automatically
    volume = 0;
    surfaceArea = 0;
    //cannot access name for base class Shape
}
ThreeDShape::ThreeDShape(string name)
:Shape(name){
//well have to call the shape parameter constructor
//because the default constructor is automatically called
 volume = 0;
 surfaceArea = 0;
}
ThreeDShape:: ~ThreeDShape(){
}
float ThreeDShape::get_volume(){
    return volume;
}
float ThreeDShape::get_surfaceArea(){
    return surfaceArea;
}
string ThreeDShape::to_string(){
ostringstream out1;
ostringstream out2;
out1<<volume;
out2<<surfaceArea;
string ret;
ret = "ThreeDShape||";
ret = ret + "Volume: " + out1.str() + " SurfaceArea: " + out2.str();
return ret;
}
void ThreeDShape::calculateAll(){
    calculate_Volume();
    calculate_SurfaceArea();
}
```

Sphere Header file

```
/*
Created: Sphere.h
Author: Jorge Jurado-Garcia
Date: 4/20/21
modifications:
*/
#ifndef SPHERE_H_INCLUDED
#define SPHERE_H_INCLUDED

#include "ThreeDShape.h"
#include <iostream>
#include <sstream>

 using namespace std;

class Sphere: public ThreeDShape {
private:
    float radius;
public:
    Sphere();
    Sphere(float r, string name);
    virtual ~Sphere();
    void calculate_Volume();
    void calculate_SurfaceArea();
    virtual string to_string();
};


#endif // SPHERE_H_INCLUDED
```

Sphere Source File

```
/*
Created: Sphere.ccp
Author: Jorge Jurado-Garcia
Date: 4/20/21
modifications:
*/

#include "Sphere.h"
#include <iostream>
#include <sstream>
#include <string>

using namespace std;

Sphere::Sphere()
    :ThreeDShape("no name")
//only need to initalize in constructors
{
    radius = 0;
}
Sphere:: Sphere(float r, string name)
   //only need to initalize in constructors
    :ThreeDShape(name)
{
    if(r>=0){
    radius = r;
    }
    else{
    radius = 0;
    }
}
Sphere:: ~Sphere(){
}

void Sphere:: calculate_Volume(){
    //area in this case is inherit from TwoDshape
    volume = 3.1415*radius*radius*radius*(4/3);
}
void Sphere:: calculate_SurfaceArea(){
    //perimeter in this case is inherit from TwoDShape
    surfaceArea = 4*radius*radius*3.1415;
}
string Sphere:: to_string(){
    string ret;
    ostringstream r;
    r<<radius;
    ret = Shape::to_string() +"["+ r.str() + "] " + ThreeDShape::to_string();
    return ret;
}
```

Box header file

```
/*
Created: Box.h
Author: Jorge Jurado-Garcia
Date: 4/20/21
modifications:
*/
#ifndef BOX_H_INCLUDED
#define BOX_H_INCLUDED

#include <stdio.h>
#include "ThreeDShape.h"
#include <string>
#include <iostream>

using namespace std;

class Box: public ThreeDShape {
private:
    float length;
    float width;
    float height;
public:
    Box();
    Box(float len, float w, float h, string name);
    virtual ~Box();

    set_length(float len);
    set_width(float w);
    set_height(float h);

    void calculate_Volume();
    void calculate_SurfaceArea();
    virtual string to_string();
};
#endif // BOX_H_INCLUDED
```

Box Source File

```
/*
Created: Box.ccp
Author: Jorge Jurado-Garcia
Date: 4/20/21
modifications:
*/

#include "Box.h"
#include <iostream>
#include <sstream>
using namespace std;

Box::Box()
    :ThreeDShape("no name")
//only need to initalize in constructors
{
    length = 0;
    width = 0;
    height = 0;
}
Box:: Box(float len, float w, float h, string name)
   //only need to initalize in constructors
    :ThreeDShape(name)
{
    length = set_length(len);
    width = set_width(w);
    height = set_height(h);
}
Box:: ~Box(){
}
Box:: set_length(float len){
    if(len >= 0){
    length = len;
    }
    else{
    length = 0;
    cout<<"cannot have negative length"<<endl;
    }
    return 0;
}
Box:: set_width(float w){
    if(w >=0){
    width = w;
    }
    else{
    width = 0;
    cout<<"cannot have negative width"<<endl;
    }
    return 0;
}
Box:: set_height(float h){
    if(h >=0){
    height = h;
    }
    else{
```

```
    height = 0;
    cout<<"cannot have negative width"<<endl;
    }
    return 0;
}
void Box:: calculate_Volume(){
    //area in this case is inherit from TwoDshape
    volume = length * width * height;
}
void Box:: calculate_SurfaceArea(){
    //perimeter in this case is inherit from TwoDShape
    surfaceArea = 2*( width*length + height*length + height*width);
}
string Box:: to_string(){
    string ret;
    ostringstream l;
    ostringstream w;
    ostringstream h;
    l<<length;
    w<<width;
    h<<height;
    ret = Shape::to_string() +"["+ l.str() + "," + w.str() + "," + h.str() +
"] " + ThreeDShape::to_string();
    return ret;
}
```

Rectangle Header file

```
/*
Created: Jorge Jurado-Garcia
Date: 4/16/21
modifications:
4/16 creation of virtual class
4/19 add set/get adding ~Rectangle
*/
#ifndef RECTANGLE_H_INCLUDED
#define RECTANGLE_H_INCLUDED

#include <stdio.h>
#include "TwoDShape.h"
#include <string>
#include <iostream>

using namespace std;

class Rectangle: public TwoDShape {
private:
    float length;
    float width;
public:
    Rectangle();
    Rectangle(float len, float w, string name);
    virtual ~Rectangle();

    set_length(float len);
    set_width(float w);

    void calculateArea();
    void calculatePerimeter();
    virtual string to_string();
};
#endif // RECTANGLE_H_INCLUDED
```

Rectangle Source File

```
/*
 * Rectangle.ccp
 *
 *  Created on: April 16, 2021
 *      Author: Jorge Jurado-Garcia
 *
 * Defines the functions for abstract class TwoDShape
 * 4/19 adding set definitions and changing float area to area
 * 4/20 changing code to set_lengt and set_width
 */

 #include "Rectangle.h"
 #include <iostream>
 #include <sstream>

 using namespace std;
Rectangle::Rectangle()
    :TwoDShape("no name")
//only need to initalize in constructors
{
    length = 0.0;
    width = 0.0;
}
Rectangle:: Rectangle(float len, float w, string name)
   //only need to initalize in constructors
    :TwoDShape(name)
{
    length = set_length(len);
    width = set_width(w);
}
Rectangle:: ~Rectangle(){
}
Rectangle:: set_length(float len){
    if(len >= 0){
    length = len;
    }
    else{
    length = 0;
    cout<<"cannot have negative length"<<endl;
    }
    return 0;
}
Rectangle:: set_width(float w){
    if(w >=0){
    width = w;
    }
    else{
    width = 0;
    cout<<"cannot have negative width"<<endl;
    }
    return 0;
}
void Rectangle:: calculateArea(){
    //area in this case is inherit from TwoDshape
    area = length * width;
```

```
}
void Rectangle:: calculatePerimeter(){
    //perimeter in this case is inherit from TwoDShape
    perimeter = (2*length)+(2*width);
}
string Rectangle:: to_string(){
    string ret;
    ostringstream l;
    ostringstream w;
    l<<length;
    w<<width;
    ret = Shape::to_string() +"["+ l.str() + "," + w.str() + "] " +
TwoDShape::to_string();
    return ret;
}
```

Circle Header File

```
/*
 * Circle.h
 *
 *  Created on: April 19, 2021
 *      Author: Jorge Jurado-Garcia
 *
 * Defines the functions for abstract class TwoDShape
 *
 */

#ifndef CIRCLE_H_INCLUDED
#define CIRCLE_H_INCLUDED

#include "TwoDShape.h"
#include <iostream>
#include <sstream>

 using namespace std;

class Circle: public TwoDShape {
private:
    float radius;
public:
    Circle();
    Circle(float r, string name);
    virtual ~Circle();

    set_radius(float r);

    void calculateArea();
    void calculatePerimeter();
    virtual string to_string();
};

#endif // CIRCLE_H_INCLUDED
```

Circle Source File

```
/*
 * Circle.h
 *
 *  Created on: April 19, 2021
 *      Author: Jorge Jurado-Garcia
 *
 * Defines the functions for abstract class TwoDShape
 *
 */

  #include "Circle.h"
 #include <iostream>
 #include <sstream>

 using namespace std;
Circle::Circle()
    :TwoDShape("no name")
//only need to initalize in constructors
{
    radius = 0;
}
Circle:: Circle(float r, string name)
   //only need to initalize in constructors
    :TwoDShape(name)
{
    radius = set_radius(r);
}
Circle:: ~Circle(){
}
Circle:: set_radius(float r){
    if(r >= 0){
    radius = r;
    }
    else{
    radius = 0;
    cout<<"cannot have negative length"<<endl;
    }
    return 0;
}
void Circle:: calculateArea(){
    //area in this case is inherit from TwoDshape
    area = 3.1415*radius*radius;
}
void Circle:: calculatePerimeter(){
    //perimeter in this case is inherit from TwoDShape
    perimeter = (2*radius)*3.1415;
}
string Circle:: to_string(){
    string ret;
    ostringstream r;
    r<<radius;
    ret = Shape::to_string() +"["+ r.str() + "] " + TwoDShape::to_string();
    return ret;
}
```