

# Friends

Last updated 3/31/20

# Friends

- Motivation
  - Normally only functions within a class can access the classes private member variables or private member functions
    - Must use public functions to modify these (setters/getters/...)
  - Suppose we want to grant some other class direct access to private member variables and functions
    - We call these friends
    - The granting Class must declare the friendship

# Friends

- Format

- In the granting Class declarations

```
friend returnType grantedClass::functionName(params)
```

- Example: Grant the Box class the ability to modify the radius of a sphere directly

In Sphere.h

...

```
friend void Box::setSphereR(double r);
```

...

- Forward declare the Sphere Class in the box declarations
  - Allows the compiler to recognize the Sphere variables

In Box.h

```
class Sphere;    // forward declaration for friend functions
```

# Friends

- Example
  - Create a Rectangle class/object that can modify the private member variable of a Circle class/object to set the radius to the largest value that will fit into the rectangle

# Friends

- Example

## CircleF.h

```
/*
 * CircleF.h
 *
 * Created on: Mar 9, 2019
 * Author: johnsontimoj
 */
//
// class declaration for Circle class
// for ee2510 class notes
//
#ifndef CIRCLEF_H_
#define CIRCLEF_H_
#include "RectangleF.h"
class CircleF {
    // member data
    private:
        double radius;

    // member functions
    public:
        CircleF();
        CircleF(double r);
        void setRadius(double r);
        double getRadius(void);
        double calcArea(void);
        double calcCirc(void);

        friend void RectangleF::setRadiusF(CircleF & cir);
}; // end CircleF class
#endif /* CIRCLEF_H_ */
```

private



## CircleF.cpp

```
/*
 * CircleF.cpp
 *
 * Created on: Mar 9, 2019
 * Author: johnsontimoj
 */
#include "CircleF.h"

#define PI 3.14159

CircleF::CircleF() {
    setRadius(1);
    return;
}

CircleF::CircleF(double r){
    setRadius(r);
    return;
}

void CircleF::setRadius(double r){
    radius = r;
    return;
}

double CircleF::getRadius(void){
    return radius;
}

double CircleF::calcArea(void){
    return PI*getRadius()*getRadius();
}

double CircleF::calcCirc(void){
    return 2*PI*getRadius();
}
```

# Friends

- Example

## RectangleF.cpp

```
/*
 * RectangleF.h      RectangleF.h
 *
 * Created on: Nov 30, 2018
 * Author: johnsontimoj
 */

#ifndef RECTANGLEF_H_
#define RECTANGLEF_H_

class CircleF; // Forward declaration for Friendship

class RectangleF{
// member data
private:
    double width;
    double length;
// member functions
public:
    RectangleF(void);
    RectangleF(double w, double l);
    void setWidth(double w);
    void setLength(double l);
    void setRectangleF(double w, double l);
    double getWidth(void);
    double getLength(void);
    double getArea(void);
    void setRadiusF(CircleF &);
};

#endif /* RECTANGLEF_H_ */
```

Accessing the private variable of Circle

```
/*
 * RectangleF.cpp
 *
 * Created on: Nov 30, 2018
 * Author: johnsontimoj
 */

// Implementation of Rectangle class with friend
#include "RectangleF.h"
#include "CircleF.h"

#include <iostream>
#include <cstdlib>
using namespace std;

RectangleF::RectangleF(){
    setRectangleF(1,1);
}

RectangleF::RectangleF(double w, double l){
    setRectangleF(w,l);
}

void RectangleF::setWidth(double w){
    width = w;
    return;
}

void RectangleF::setLength(double l){
    length = l;
    return;
}

void RectangleF::setRectangleF(double w, double l){
    setWidth(w);
    setLength(l);
    return;
}

double RectangleF::getWidth(){
    return width;
}

double RectangleF::getLength(){
    return length;
}

double RectangleF::getArea(){
    return getWidth() * getLength();
}

void RectangleF::setRadiusF(CircleF & cir){
    if(getWidth() > getLength())
        cir.radius = (getLength() / 2);
    else
        cir.radius = (getWidth() / 2);
    return;
}
```

# Friends

- Example

```
/*
 * friends_test.cpp
 *
 * Created on: Apr 3, 2019
 * Author: johnsontimoj
 */
////////////////////////////////////
//
// Test program to show friend concept
//
////////////////////////////////////

#include "RectangleF.h"
#include "CircleF.h"

#include <iostream>
using namespace std;

int main(void){
    // create a circle object with radius 5 and print
    CircleF cir1(5);
    cout << cir1.getRadius() << endl;

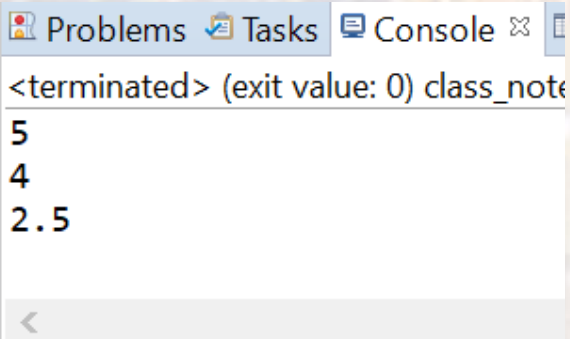
    // create a rectangle object with w/l of 8/12
    RectangleF rect1(8,12);

    // use the setRadiusF function in the rectangle to change the
    // radius of cir1 and print cir1's radius
    rect1.setRadiusF(cir1);
    cout << cir1.getRadius() << endl;

    // change the rectangle dimensions
    rect1.setRectangleF(15, 5);

    // use the setRadiusF function in the rectangle to change the
    // radius of cir1 and print cir1's radius
    rect1.setRadiusF(cir1);
    cout << cir1.getRadius() << endl;

    return 0;
}
```



```
Problems Tasks Console
<terminated> (exit value: 0) class_note
5
4
2.5
<
```