

Chapter 14

More About Classes

Reading pp. 811-818

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Instance Variables

- Each class object is an instance of a class
- Each class object has its own class member variables
- What does Rectangle cR1, cR2; look like in memory?

Static Members

- **static data members** and **static member functions** do not belong to *any* instance of a class
- An instance of a class does not have to exist to use a static member
- static members belong to the class not an instance of a class

Static Member Example

Tree Interface

```
class Tree
{
    private:
        static unsigned int numberOfTrees;

    public:
        Tree ();
        unsigned int getNumberOfTrees () const;
};
```

Static Member Example

Tree Implementation

```
#include "Tree.h"
```

```
Tree::Tree ()  
{  
    ++numberOfTrees;  
}
```

```
unsigned int Tree::getNumberOfTrees () const  
{  
    return numberOfTrees;  
}
```

```
unsigned int Tree::numberOfTrees = 0;
```

Static Member Variable Specifics

- The static variable assignment must happen outside of the class declaration
- Typically, the initialization happens in the class implementation
- A static integer will be zero unless it is defined otherwise

Static Member Variable Specifics

- The lifetime of a class's static member variables is the lifetime of the program
- Static variables come into existence **BEFORE** any instances of the class are created

Static Member Functions

- A static member function is of the form:

`static returnType functionName (Params);`

Static Member Functions

- A static member function **CANNOT** access any nonstatic member data
- A static member function **CAN** access static member variables before any class instances are defined in memory
- Modifiers such as `const` are not allowed on static member functions

Static Member Functions

- A static member function is accessed by using:
 - `ClassName::`

Problem

- Consider MyMath.h as follows:

```
#ifndef MYMATH_H  
#define MYMATH_H
```

```
class MyMath  
{  
    public:  
        static const double PI;  
        static int gcd (int, int);  
};
```

```
#endif
```

Problem

- Create MyMath.cpp as follows:

```
#include "MyMath.h"
```

```
const double MyMath::PI = 3.14159;
```

```
int MyMath::gcd (int num1, int num2)  
{  
    // write greatest common divisor code  
}
```

Problem

- Create MyMathDriver.cpp as follows:

```
#include <iostream>
#include "MyMath.h"

using namespace std;

int main ()
{
    int int1, int2;
    cout << "PI = " << MyMath::PI << endl;
    cout << "Enter Integer #1: ";
    cin >> int1;
    cout << "Enter Integer #2: ";
    cin >> int2;
    // Write the statement to output the gcd of
    // int1 and int2
    return EXIT_SUCCESS;
}
```