

Object Oriented Programming

Lecture 7

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Static variables





- Lifetime of static variable is **throughout the program life**
- They are declared and initialized **only once**
- If static variables are not explicitly initialized then they are **initialized to 0** of appropriate type



Example

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

void func1(int i)
{
    static int staticInt = i;
    cout << staticInt << endl;
}

int main()
{
    func1(1);
    func1(2);
}
```

Output:

1

1



Example (Default Values)

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

void func1(int i)
{
    static int staticInt;
    cout << staticInt << endl;
}

int main()
{
    func1(1);
    func1(2);
}
```

Output:

0

0



Example (Static vs Const)

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

void func1(int i)
{
    static int staticInt;
    staticInt = i;
    cout << staticInt << endl;
}

int main()
{
    func1(1);
    func1(2);
}
```

Static variable is **not a constant variable**. There values can be changed

Output:

1
2



Example (Life vs Access)

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

void func1(int i)
{
    static int staticInt;
    staticInt = i;
    cout << staticInt << endl;
}

int main()
{
    func1(1);
    func1(2);
    cout << staticInt;
}
```

Output:
Error

Lifetime is throughout the program life.
But access is limited to function where they are defined

Definition

“A variable that is part of a class, yet is not part of an object of that class, **is called static data member**”

Also known as ***Class Variable***

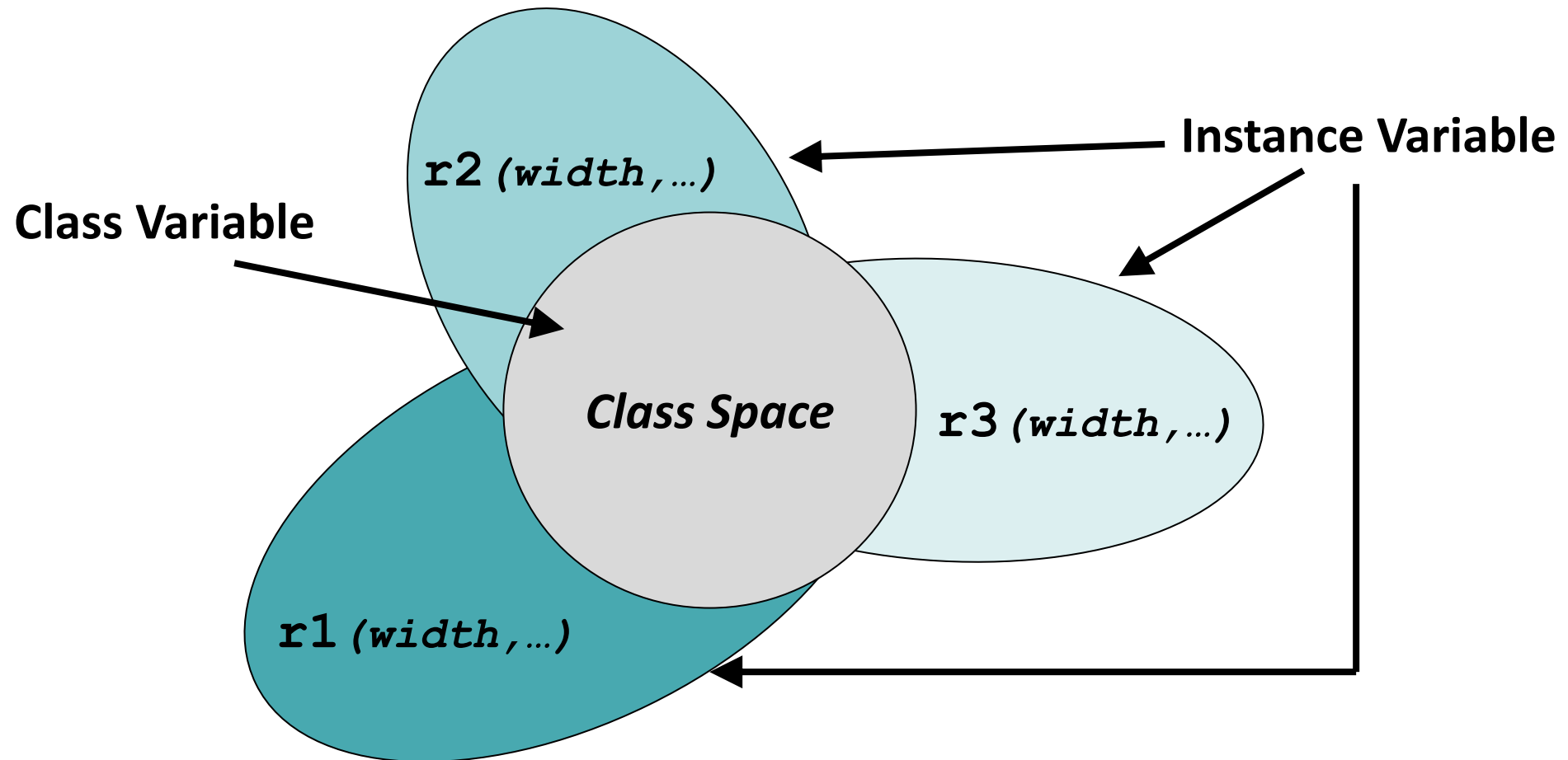


- They are shared by all instances of the class
- They do not belong to any particular instance of a class



Class Variable vs. Instance Variable

- `Rectangle r1, r2, r3;`



- Keyword **static** is used to make a data member static

```
class ClassName{  
...  
static DataType VariableName;  
};
```



Defining Static Data Member

- Static data member is declared inside the class
- But they are defined outside the class



Example

```
class Rectangle{  
private:  
    static int noOfRectangles;  
public:  
    ...  
};  
  
int Rectangle::noOfRectangles = 0;  
  
/*private static member cannot be accessed  
outside the class except for initialization*/
```

- If static data members are not explicitly initialized at the time of definition then they are initialized to 0



Example

```
int Rectangle::noOfRectangles ;
```

is equivalent to

```
int Rectangle::noOfRectangles =0 ;
```

- To access a static data member there are two ways
 - Access like a normal data member
 - Access using a scope resolution operator '::'



Example

```
class Rectangle
{
    int width, height;
public:
    static int NoOfRectangles;
    Rectangle();
};

int Rectangle::NoOfRectangles=0;

int main()
{
    cout << Rectangle::NoOfRectangles;    Access Method 1

    Rectangle r1;
    cout << r1.NoOfRectangles;            Access Method 2
}
```



Life of Static Data Member

- They are created even when there is no object of a class
- They remain in memory even when all objects of a class are destroyed



Example

```
class Rectangle
{
    int width, height;
public:
    static int NoOfRectangles;
    Rectangle();
};

int Rectangle::NoOfRectangles=0;

int main()
{
    cout << Rectangle::NoOfRectangles;
}
```



- They can be used to store information that is required by all objects, like global variables



Exercise

- Modify the class ***Rectangle*** such that one can know the number of rectangles created in a system



Example

```
class Rectangle
{
    int width, height;
public:
    static int NoOfRectangles;
    Rectangle();
    ~Rectangle();

};
```

```
Rectangle::Rectangle()
{
    NoOfRectangles++;
}
```

```
Rectangle::~~Rectangle()
{
    NoOfRectangles--;
}
```



Example

```
int main()
{
    cout << Rectangle::NoOfRectangles;

    Rectangle r1;

    cout << Rectangle::NoOfRectangles;

    Rectangle r2;

    cout << Rectangle::NoOfRectangles;

}
```

Output:

0
1
2



Problem

- ***noOfRectangles*** is accessible outside the class
- Bad design as the local data member is kept public



Definition:

“The function that needs access to the members of a class, yet does not need to be invoked by a particular object, is called **static member function**”



Static Member Function

- They are used to **access** static data members
- Access mechanism for static member functions is same as that of static data members
- They **cannot** access any non-static members



Example

```
class Rectangle
{
    int width, height;
    static int NoOfRectangles;
public:

    Rectangle(){};
    ~Rectangle(){};

    static int getTotalRectangles()
    {
        return NoOfRectangles;
    }

};
int Rectangle::NoOfRectangles;
```

```
int main()
{
    cout << Rectangle::getTotalStudent();
    Rectangle r1;
    cout << Rectangle::getTotalStudent();
}
```



Accessing non static data members

```
class Rectangle
{
    int width, height;
    static int NoOfRectangles;
public:

    Rectangle(){};
    ~Rectangle(){};

    static int getTotalRectangles()
    {
        return width;
    }

};
int Rectangle::NoOfRectangles;
```

Error: Can **ONLY**
access static data

```
int main()
{
    cout << Rectangle::getTotalStudent();
    Rectangle r1;
    cout << Rectangle::getTotalStudent();
}
```



this Pointer

- *this* pointer is passed implicitly to member functions
- *this* pointer is **not passed** to static member functions
- Reason is static member functions cannot access non static data members



Global Variable vs. Static Members

- Alternative to static member is to use global variable
- Global variables are accessible to all entities of the program
 - Against information hiding

Thanks a lot



If you are taking a Nap, **wake up**.....Lecture Over