Object Oriented Programming

Lecture

Static variables

Static Keyword:

. Static Variables

Variables declared as static in a function are created & initialised once for the lifetime of the program.//in Function

Static variables in a class are created & initialised once. They are shared by all the objects of the class. //in Class

• Static Objects

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

They can be reassigned

Example

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

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

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

Here we are not assigning the static variable we are intializing it so it will not work!!!!

Output:

1

1

Because static variables are declared and initialized only once

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

Here as you can look closely we are not initializing the static variable we are assigning it thats why it works!!!

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

Kun kah functiion kay andr create hua hai agr class main banatay hum aur public kay neechay hota tou we could access it like this classname::staticvaribalename

Lifetime is throughout the program life.

But access is limited to function where they are defined

Static Data Member in Class

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***

Static Data Member

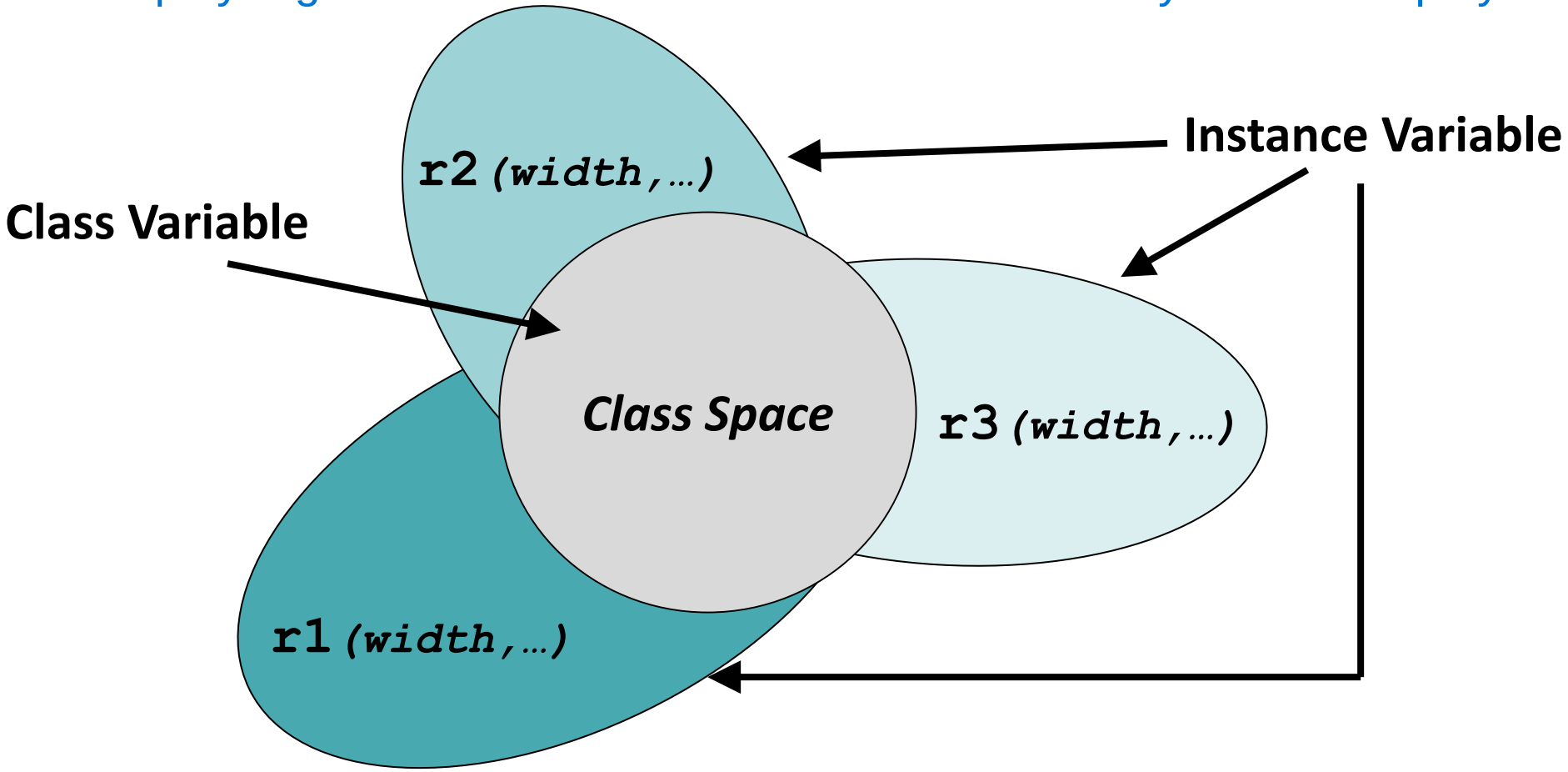
- They are shared by all instances of the class
- They do not belong to any particular instance of a class

Class Variable vs. Instance Variable

- `Rectangle r1, r2, r3;`

For Example:

The score in a muliplayer game the total score should increase if any one of the player scores



Static Data Member (Syntax)

- 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*/
```

Initializing Static Data Member

- 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;
```

Accessing Static Data Member

- 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;

    Rectangle r1;
    cout << r1.NoOfRectangles;

}
```

Access Method 2

Access Method 1

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;


}
```

Uses

- 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

Static Member Function

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::getTotalRectangles();
    Rectangle r1;
    cout << Rectangle::getTotalRectangles();
}
```

Accessing non static data members

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

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

    static int getTotalRectangles()
    {
        return width;
    }


};
int Rectangle::NoOfRectangles;
```

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

Error: Can **ONLY** acess static data

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