

70-483 : Programming in C#



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Non-primitive Types



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Classes



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Class

Combines related variables (fields) and functions (methods)



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Class

Person	
Fields	Name: string Age: byte Height: float Weight: byte
Methods	Walk() Talk() Eat() Sleep()

Objects

John
Mary
Scott



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Declaring Classes

```
public class Person  
{  
    public string Name;  
    public void Introduce()  
    {  
        Console.WriteLine("Hi, my name is " + Name);  
    }  
}
```



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Declaring Classes

```
public class Calculator
{
    public int Add(int a, int b)
    {
        return a + b;
    }
}
```



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Creating Objects

```
int number;  
  
var person = new Person();  
person.Name = "Mosh";  
person.Introduce();
```



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Static Modifier



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Static Modifier

```
public class Calculator
{
    public static int Add(int a, int b)
    {
        return a + b;
    }
}
```



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Static Modifier

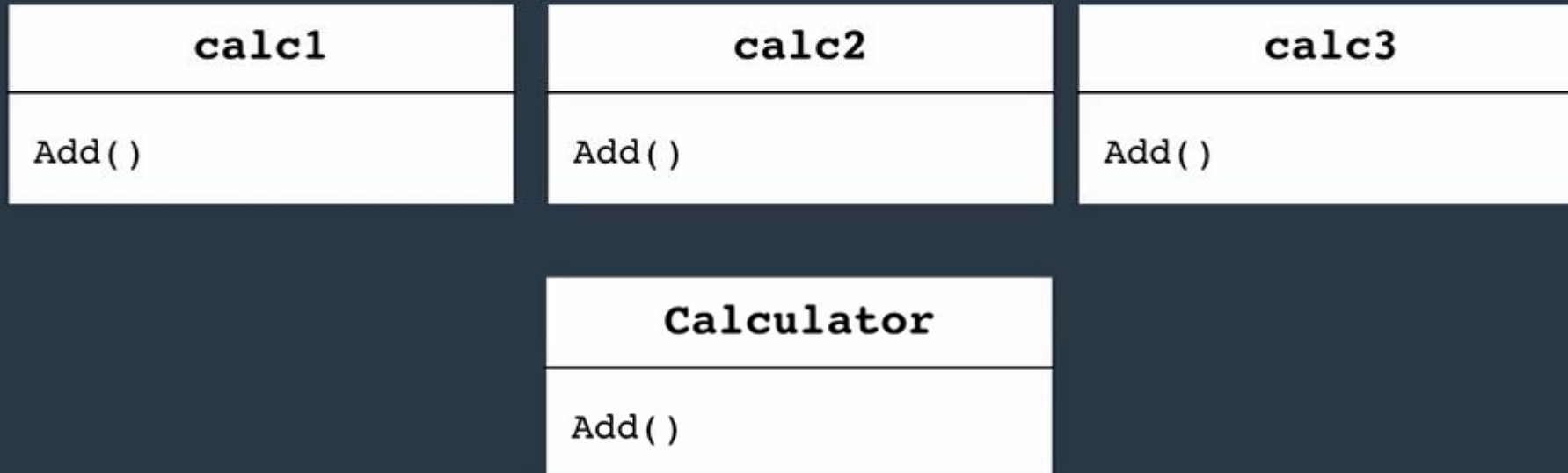
```
int result = Calculator.Add(1, 2);
```



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Static Modifier



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Static Modifier

```
class Program
{
    static void Main()
    {
    }
}
```



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Demo Classes



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Program.cs

CSharpFundamentals.Program

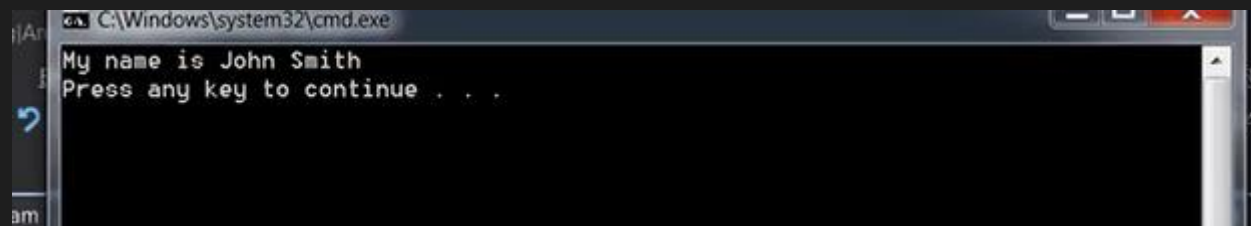
Main(string[] args)

```
using System;

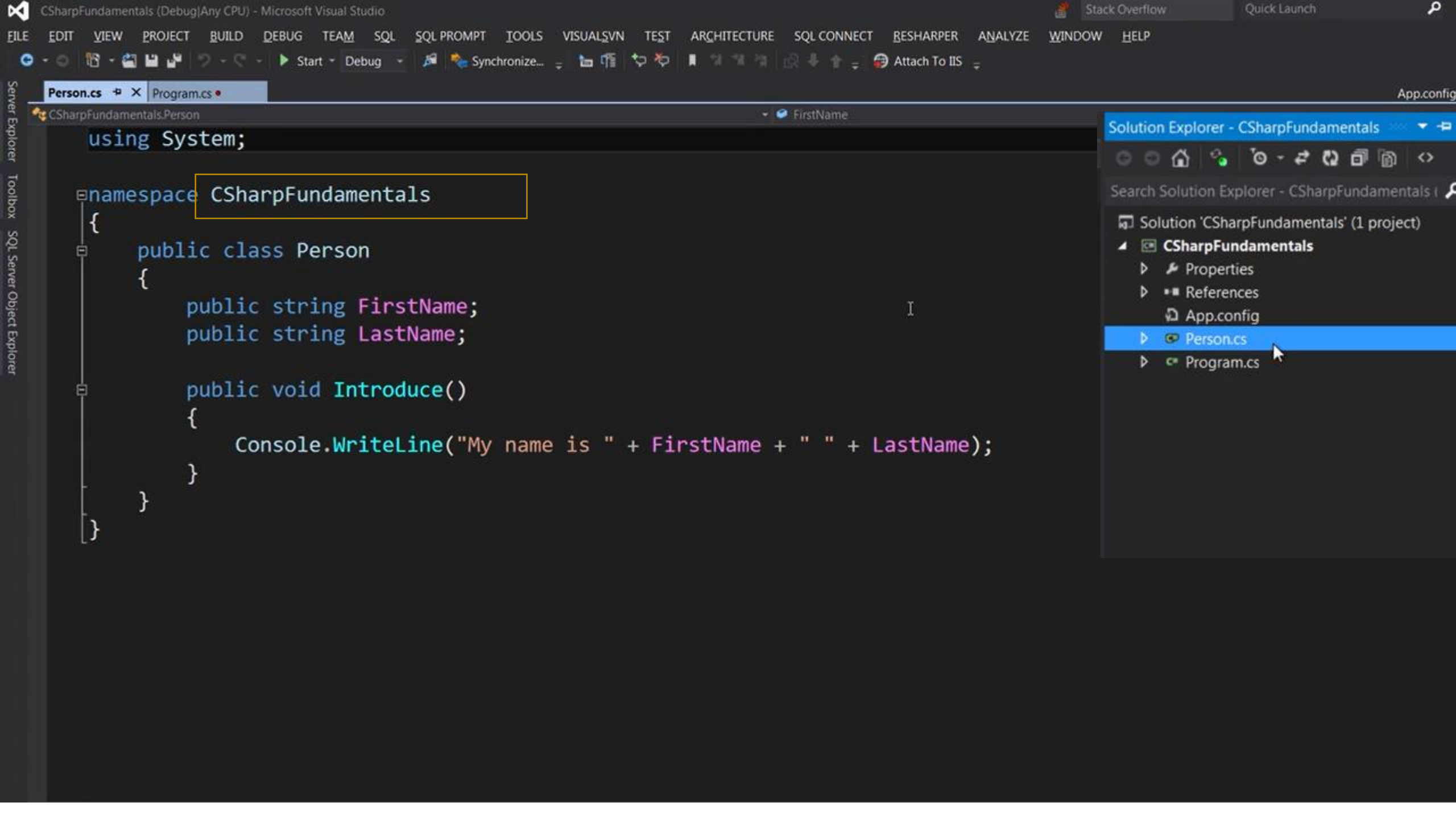
namespace CSharpFundamentals
{
    public class Person
    {
        public string FirstName;
        public string LastName;

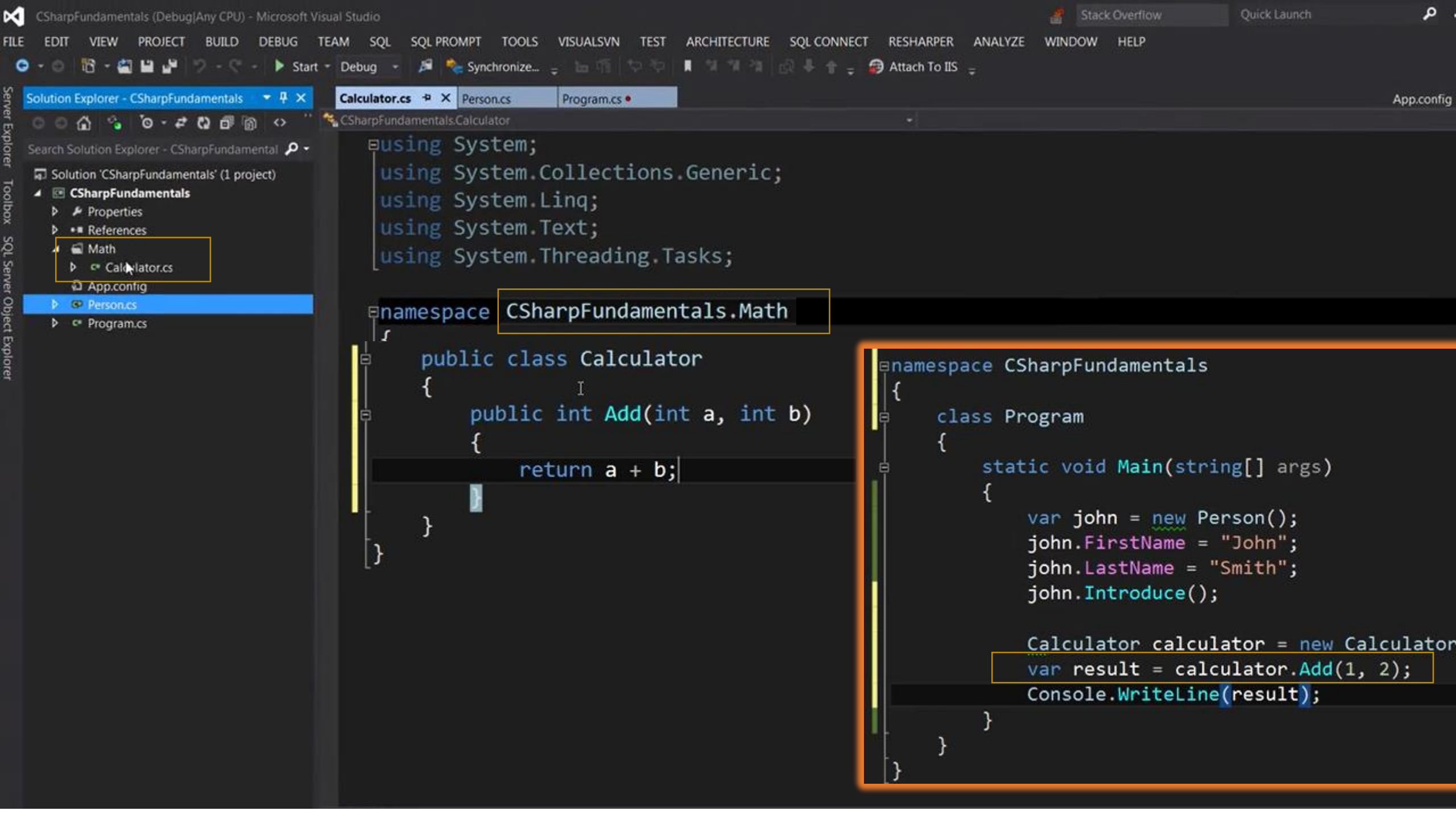
        public void Introduce()
        {
            Console.WriteLine("My name is " + FirstName + " " + LastName);
        }
    }

    class Program
    {
        static void Main(string[] args)
        {
            var john = new Person();
            john.FirstName = "John";
            john.LastName = "Smith";
            john.Introduce();
        }
    }
}
```



A screenshot of a Windows command prompt window titled "C:\Windows\system32\cmd.exe". The window displays the output of the program: "My name is John Smith" followed by "Press any key to continue . . .". The cursor is positioned at the end of the second line, waiting for a key press.





Structs



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Declaring Structs

```
public struct RgbColor  
{  
    public int Red;  
    public int Green;  
    public int Blue;  
}
```



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Arrays



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In this lecture...

- What is an Array
- Declaring Arrays
- Initializing Arrays
- Access Array Elements



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Array

A data structure to store a collection of variables of the same type.



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Declaring Arrays

```
int number1;  
int number2;  
int number3;
```

```
int[] numbers = new int[3];
```



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Accessing Array Elements

```
int[] numbers = new int[3] { 1, 2, 3 };
```

~~numbers[0] = 1;~~

~~numbers[1] = 2;~~

~~numbers[2] = 3;~~



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Demo Arrays



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Program.cs

App.config

Solution Explorer - CSharpFundamentals

CSharpFundamentals.Program

Main(string[] args)

```
namespace CSharpFundamentals
{
    class Program
    {
        static void Main(string[] args)
        {
            var numbers = new int[3];
            numbers[0] = 1;

            Console.WriteLine(numbers[0]);
            Console.WriteLine(numbers[1]);
            Console.WriteLine(numbers[2]);

            var flags = new bool[3];
            Console.WriteLine(flags[0]);
            Console.WriteLine(flags[1]);
            Console.WriteLine(flags[0]);

            var names = new string[3] {"Jack", "John", "Mary"};
        }
    }
}
```

```
Press any key to continue . . .
False
False
Press any key to continue . . .
```

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Solution 'CSharpFundamentals' (1 project)

CSharpFundamentals

Properties

References

App.config

Program.cs

Strings



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In this lecture...

- What is a string
- How to create strings
- Escape characters and verbatim strings



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String

A sequence of characters.
e.g. "Hello World"



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Creating Strings

Using String Literals

```
string firstName = "Mosh";
```



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Creating Strings

Using String Concatenation

```
string name = firstName + " " + lastName;
```



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Creating Strings

Using String Format

```
string name = string.Format("{0} {1}", firstName, lastName);
```



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Creating Strings

Using String Join

```
var numbers = new int[3] { 1, 2, 3 };  
  
string list = string.Join(",", numbers);
```



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String Elements

```
string name = "Mosh";
```

```
char firstChar = name[0];
```



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Strings are Immutable

- Once you create them, you cannot change them.



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String Elements

```
string name = "Mosh";
```

```
char firstChar = name[0];
```

```
name[0] = 'm';
```



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Escape Characters

Char	Description
\n	New Line
\t	Tab
\\	Backslash
\'	Single Quotation Mark
\"	Double Quotation Mark



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Verbatim Strings

```
string path = "c:\\projects\\project1\\folder1";
```

```
string path = @"c:\projects\project1\folder1";
```



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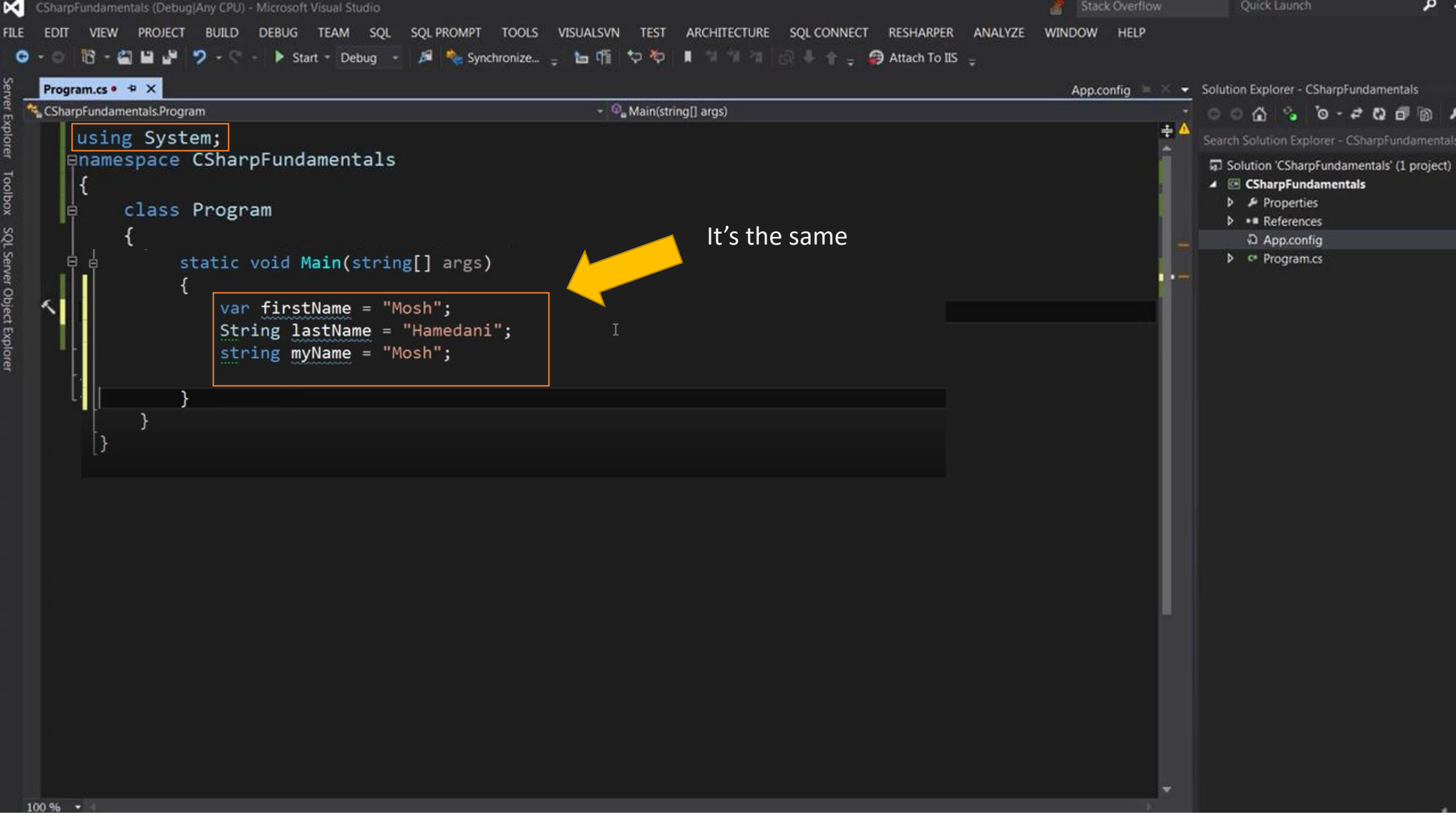
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Demo Strings



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Program.cs

App.config

CSharpFundamentals.Program

Main(string[] args)

```
using System;
```

```
namespace CSharpFundamentals
```

```
{
```

```
    class Program
```

```
    {
```

```
        static void Main(string[] args)
```

```
        {
```

```
            var firstName = "Mosh";
```

```
            var lastName = "Hamedani";
```

```
            var fullName = firstName + " " + lastName;
```

```
            var myFullName = string.Format("My name is {0} {1}", firstName, lastName);
```

```
            var names = new string[] { "John", "Jack", "Mary" };
```

```
            var formattedNames = string.Join(", ", names);
```

```
            Console.WriteLine(formattedNames);
```

```
        }
```

```
    }
```

```
}
```

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CSharpFundamentals

Properties

References

App.config

Program.cs

C:\Windows\system32\cmd.exe

John,Jack,Mary

Press any key to continue . . .

Program.cs

App.config

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CSharpFundamentals.Program

Main(string[] args)

```
using System;
```

```
namespace CSharpFundamentals
```

```
{
```

```
    class Program
```

```
    {
```

```
        static void Main(string[] args)
```

```
        {
```

```
            var firstName = "Mosh";
```

```
            var lastName = "Hamedani";
```

```
            var fullName = firstName + " " + lastName;
```

```
            var myFullName = string.Format("My name is {0} {1}", firstName, lastName);
```

```
            var names = new string[] { "John", "Jack", "Mary" };
```

```
            var formattedNames = string.Join(",", names);
```

```
            var text = @"Hi John
```

```
Look into the following paths
```

```
c:\folder1\folder2
```

```
c:\folder3\folder4";
```

```
            Console.WriteLine(text);
```

```
        }
```

```
    }
```

```
}
```

folde

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CSharpFundamentals

Properties

References

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Program.cs

Enums



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Enum

A set of name/value pairs (constants).



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```
const int RegularAirMail = 1;  
const int RegisteredAirMail = 2;  
const int Express = 3;
```

```
public enum ShippingMethod : byte  
{  
    RegularAirMail = 1,  
    RegisteredAirMail = 2,  
    Express = 3;  
}
```

```
var method = ShippingMethod.Express;
```



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Demo Enums



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Program.cs

CSharpFundamentals.ShippingMethod

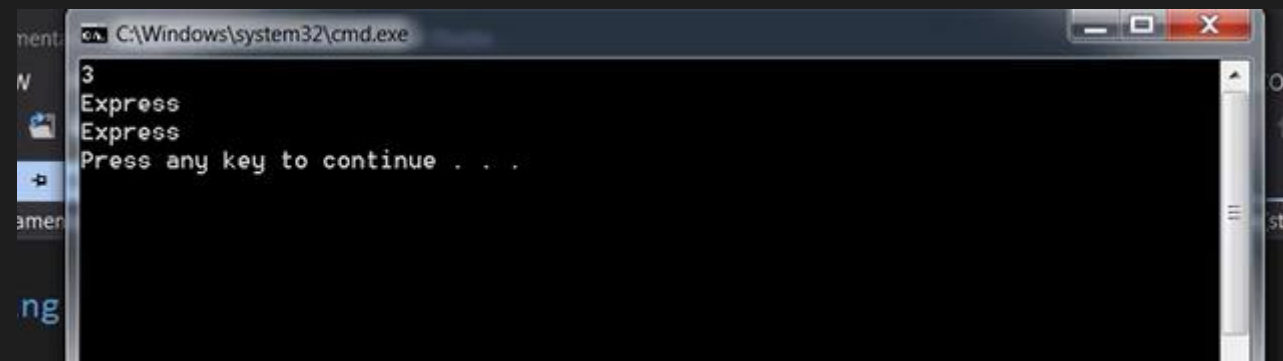
RegularAirMail

```
namespace CSharpFundamentals
{
    public enum ShippingMethod
    {
        RegularAirMail = 1,
        RegisteredAirMail = 2,
        Express = 3
    }

    class Program
    {
        static void Main(string[] args)
        {
            var method = ShippingMethod.Express;
            Console.WriteLine((int)method);

            var methodId = 3;
            Console.WriteLine((ShippingMethod)methodId);

            Console.WriteLine(method.ToString());
        }
    }
}
```



```
C:\Windows\system32\cmd.exe
3
Express
Express
Press any key to continue . . .
```

Program.cs

CSharpFundamentals.ShippingMethod

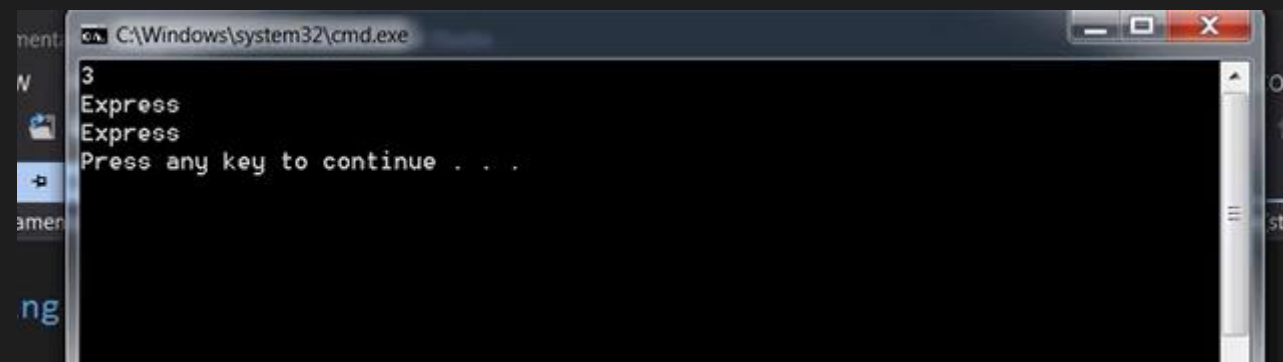
RegularAirMail

```
namespace CSharpFundamentals
{
    public enum ShippingMethod
    {
        RegularAirMail = 1,
        RegisteredAirMail = 2,
        Express = 3
    }

    class Program
    {
        static void Main(string[] args)
        {
            var method = ShippingMethod.Express;
            Console.WriteLine((int)method);

            var methodId = 3;
            Console.WriteLine((ShippingMethod)methodId);

            Console.WriteLine(method.ToString());
        }
    }
}
```



```
C:\Windows\system32\cmd.exe
3
Express
Express
Press any key to continue . . .
```



```
public enum ShippingMethod
```

```
    RegularAirMail = 1,  
    RegisteredAirMail = 2,  
    Express = 3
```

```
class Program
```

```
static void Main(string[] args)  
{
```

```
    var method = ShippingMethod.Express;  
    Console.WriteLine((int)method);
```

```
    var methodId = 3;  
    Console.WriteLine((ShippingMethod)methodId);
```

```
    Console.WriteLine(method.ToString());
```

```
    var methodName = "Express";  
    var shippingMethod = (ShippingMethod) Enum.Parse(typeof (ShippingMethod), methodName);
```

```
enum CSharpFundamentals.ShippingMethod
```

```
}
```

Reference Types and Value Types



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Types

- int
- char
- float
- bool
- classes
- structures
- arrays (`System.Array`)
- strings (`System.String`)



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Types

Structures

- Primitive types
- Custom structures

Classes

- Arrays
- Strings
- Custom classes



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Value Types

Structures

- Allocated on stack
- Memory allocation done automatically
- Immediately removed when out of scope

Reference Types

Classes

- You need to allocate memory
- Memory allocated on heap
- Garbage collected by CLR



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```
var anotherObject = someObject;
```



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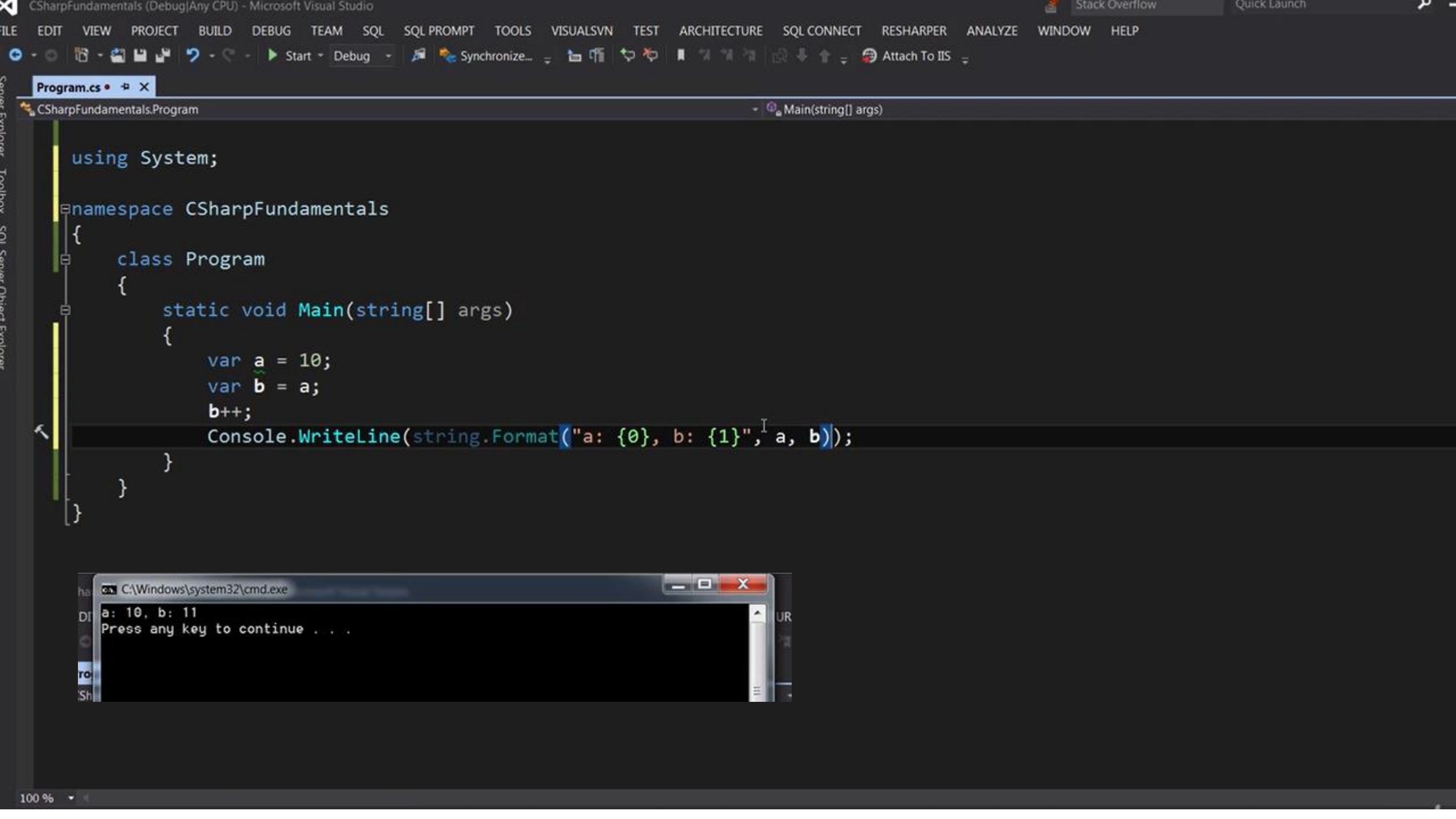
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Demo Reference Types and Value Types



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Stack

a

10

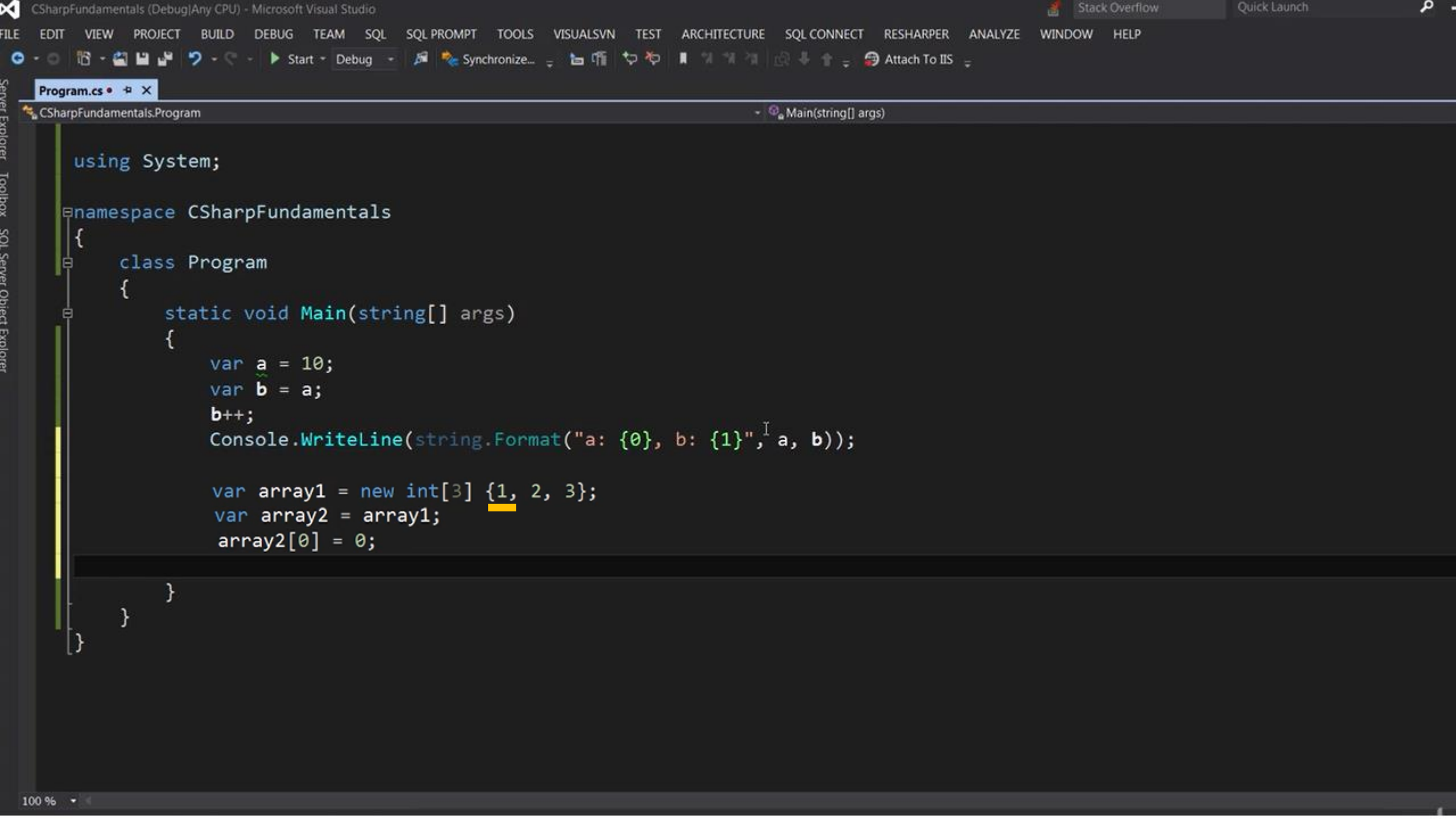
b

10



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Stack

array1

0x00416A

array2

0x00416A

Heap

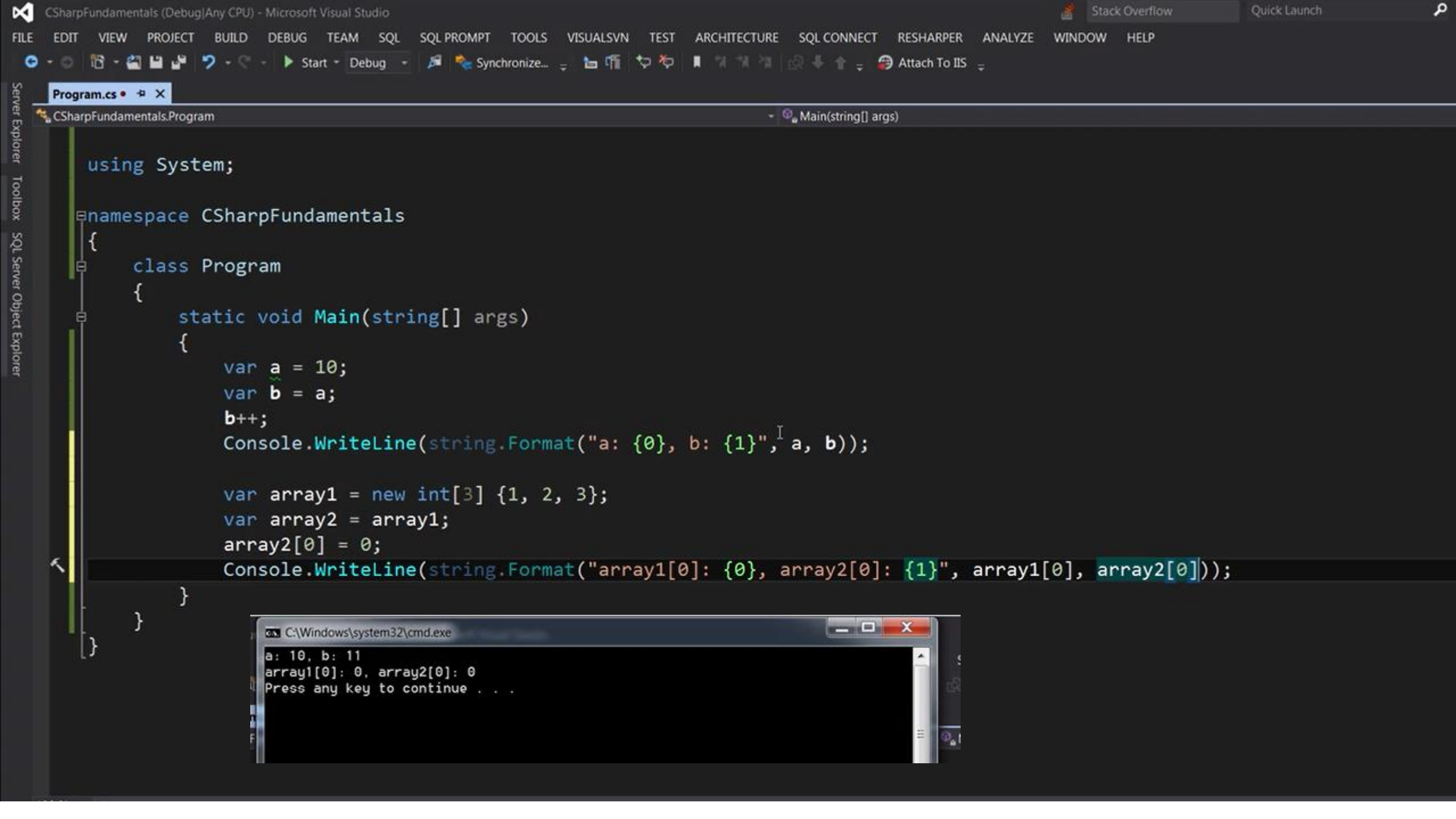
▶ 0x00416A

1 | 2 | 3



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```
CSharpFundamentals (Debug|Any CPU) - Microsoft Visual Studio
FILE EDIT VIEW PROJECT BUILD DEBUG TEAM SQL SQL PROMPT TOOLS VISUALSVN TEST ARCHITECTURE SQL CONNECT RESHARPER ANALYZE WINDOW HELP
CSharpFundamentals.Program Main(string[] args)
using System;
namespace CSharpFundamentals
{
    class Program
    {
        static void Main(string[] args)
        {
            var a = 10;
            var b = a;
            b++;
            Console.WriteLine(string.Format("a: {0}, b: {1}", a, b));

            var array1 = new int[3] {1, 2, 3};
            var array2 = array1;
            array2[0] = 0;
            Console.WriteLine(string.Format("array1[0]: {0}, array2[0]: {1}", array1[0], array2[0]));
        }
    }
}
```

```
C:\Windows\system32\cmd.exe
a: 10, b: 11
array1[0]: 0, array2[0]: 0
Press any key to continue . . .
```

Program.cs

CSharpFundamentals.Program

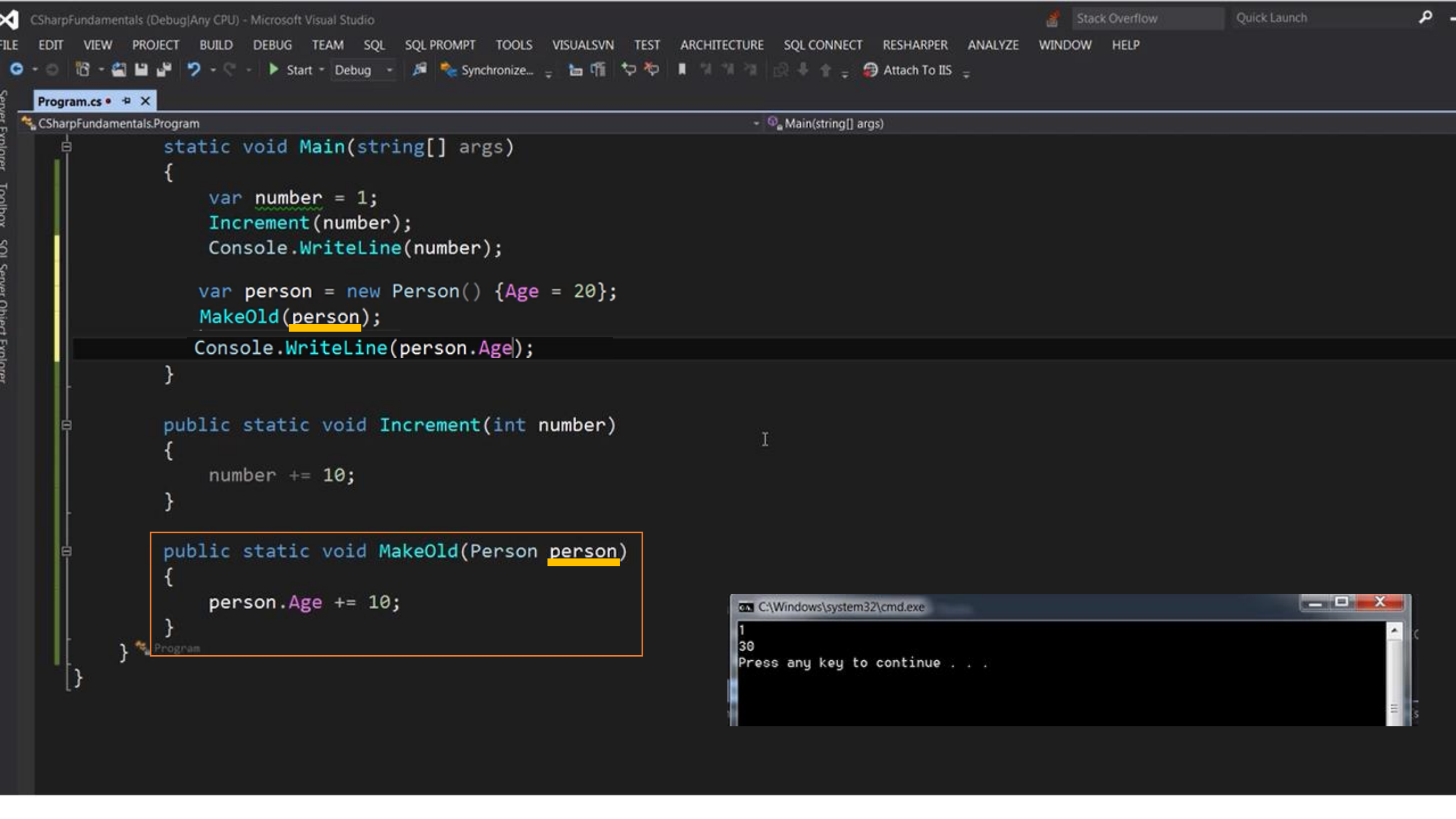
Main(string[] args)

```
namespace CSharpFundamentals
{
    public class Person
    {
        public int Age;
    }

    class Program
    {
        static void Main(string[] args)
        {
        }

        public static void Increment(int number)
        {
            number += 10;
        }

        public static void MakeOld(Person person)
        {
            person.Age += 10;
        }
    }
}
```

Summary



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Classes

Strings
Arrays
Custom Classes

Structures

Primitive Types
Custom Structures



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