Introduction to C# procedural programming

C# Program Structure

- Object oriented
- Everything belongs to a class
  - no global scope
- “Classical” complete C# program – the statements have to be within class, and method Main() is executed at startup
- “New” complete C# program – there can be a top global level statements, which are executed at the start

C# Program Structure

- Namespaces
  - Contain types and other namespaces
- Type declarations
  - Classes, structs, interfaces, enums, and delegates
- Members
  - Constants, fields, methods, properties, events, operators, constructors, destructors
- Organization
  - No header files, code written “in-line”

C# Program Structure

- “Classical” complete C# program:

```
namespace ConsoleTest
{
   class Class1
   {
      static void Main(string[] args)
      {
         System.Console.WriteLine("Hello World!");
      }
   }
}
```

- “New” complete C# program:

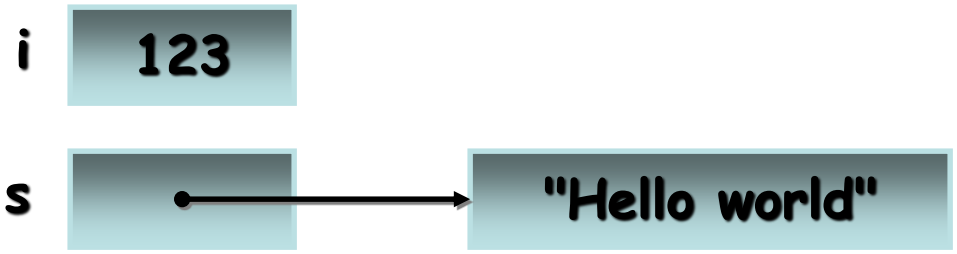
```
System.Console.WriteLine("Hello World!");
```

Value and Reference Types

Definition

- Value types
  - Directly contain data
  - Cannot be null
- Reference types
  - Contain references to objects
  - May be null

```
int i = 123;
string s = "Hello world";
```



Value and Reference Types

Example

- Value types
  - Primitives — `int i;`
  - Enums — `enum State { Off, On }`
  - Structs — `struct Point { int x, y; }`
- Reference types
  - Classes — `class Foo: Bar, IFoo {...}`
  - Interfaces — `interface IFoo: IBar {...}`
  - Arrays — `string[] a = new string[10];`
  - Delegates — `delegate void Empty();`

Simple Types

- Integer Types
  - **byte**, **sbyte** (8bit), **short**, **ushort** (16bit)
  - **int**, **uint** (32bit), **long**, **ulong** (64bit)
- Floating Point Types
  - **float** (precision of 7 digits)
  - **double** (precision of 15–16 digits)
- Exact Numeric Type
  - **decimal** (28 significant digits)
- Character Types
  - **char** (single character)
  - **string** (rich functionality, by-reference type)
- Boolean Type
  - **bool** (distinct type, **not** interchangeable with **int**)

Statements and Comments

- Case sensitive (myVar != MyVar)
- Statement delimiter is semicolon ;
- Block delimiter is curly brackets { }
- Single line comment is //
- Block comment is /* */
  - Save block comments for debugging!

Data

- All data types derived from ***System.Object***
- Declarations:

  datatype varname;

  datatype varname = initvalue;
- C# does not automatically initialize local variables (but will warn you)!

Value Data Types

- Directly contain their data:
  - int (numbers)
  - long (really big numbers)
  - bool (true or false)
  - char (unicode characters)
  - float (7-digit floating point numbers)
  - string (multiple characters together)

Expressions

- Expresions are build of constants, variables and operators

Data Manipulation

=	assignment
+	addition
-	subtraction
*	multiplication
/	division
%	modulus
++	increment by one
--	decrement by one

Conditional Operators

==	equals
!=	not equals
<	less than
<=	less than or equal
>	greater than
>=	greater than or equal
&&	and
||	or

Branches and loops

- Expresions are build of constants, variables and operators

If, Case Statements

```
if (expression)
    { statements; }
else if
    { statements; }
else
    { statements; }
```

```
switch (i) {
    case 1:
        statements;
        break;
    case 2:
        statements;
        break;
    default:
        statements;
        break;
}
```

Loops

for (*initialize-statement; condition; increment-statement*);
{
**   *statements;***
}

while (*condition*)
{
**   *statements*;**
}

Note: can include *break* and *continue* statements

strings

- Immutable sequence of Unicode characters (char)
- Creation:
  - string s = “Bob”;
  - string s = new String(“Bob”);
- Backslash is an escape:
  - Newline: “\n”
  - Tab: “\t”

string/int conversions

- string to numbers:
  - int i = int.Parse(“12345”);
  - float f = float.Parse(“123.45”);
- Numbers to strings:
  - string msg = “Your number is ” + 123;
  - string msg = “It costs ” +
    string.Format(“{0:C}”, 1.23);

Arrays

- (page 21 of quickstart handout)
- Derived from System.Array
- Use square brackets [ ]
- Zero-based
- Static size
- Initialization:
  - int [ ] nums;
  - int [ ] nums = new int[3]; // 3 items
  - int [ ] nums = new int[ ] {10, 20, 30};

Arrays

- Built on .NET **System.Array** class
- Declared with type and shape, but no bounds
  - `int [ ] SingleDim;`
  - `int [ , ] TwoDim;`
  - `int [ ][ ] Jagged;`
- Created using **new** with bounds or initializers
  - `SingleDim = new int[20];`
  - `TwoDim = new int[,]{{1,2,3},{4,5,6}};`
  - `Jagged = new int[1][ ];`
    `Jagged[0] = new int[ ]{1,2,3};`

Arrays

- Multidimensional

```
// 3 rows, 2 columns
int [ , ] myMultiIntArray = new int[3,2]

for(int r=0; r<3; r++)
{
        myMultiIntArray[r][0] = 0;
        myMultiIntArray[r][1] = 0;
}
```

Summary

- C# builds on the .NET Framework component model
- New language with familiar structure
  - Easy to adopt for developers of C, C++, Java, and Visual Basic applications
- Fully object oriented
- Optimized for the .NET Framework

Thanks for your attention!