

Programs and Libraries

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08120 Programming 2

Simple C# Programs

```
class MyClass
{
    static data members
    static method members
    static void Main ()
    {
    }
}
```

- The first programs that we wrote were simple
- They contained a single class and static data
- They did not make any instances of any classes

Multi-Class C# Programs

```
class Account
{
}

class MyClass
{
    static void Main ()
    {
        Account a = new Account();
    }
}
```

- More advanced programs create instances of different classes
- We have seen this with Bank Accounts and WPF

Class instances in your programs

- A class instance (also called an *object*) will contain data and methods that let it do something for you
 - Bank Account
 - Alien Sprite
 - WPF Window
- The class itself will be described in a C# source file
- The class will be compiled to produce an output file that can be run on the target computer

Creating Forms

C# Programs

```
csc MyProg.cs
```

- When we wrote our first program we put the entire program in a single source file
- The program was also made up of a single class which we could compile and run
- The output of the compiler in this situation is an *executable* file
- It has the language extension `.exe`

Compiled Programs

- In Microsoft .NET the output of a compilation is called an *assembly* file
- This contains a collection of classes and the resources that they use
 - An assembly file can contain images and sounds as well
- There are two kinds of assembly file
 - Executable assemblies contain a Main method that is used to start the program
 - Library assemblies just contain object descriptions and the compiled code for them

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Library Assemblies

- Some parts of a program do not have a Main method
- They are simply objects that are created and used by the program when it runs
- It is often useful to be able to share such objects amongst a number of different programs
- We can do this by creating a library assembly
- This cannot be run as a program, but it can be used as an ingredient in other programs

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An Account class

```
class Account
{
    private decimal accountBalance;

    public void PayInFunds (decimal amount)
    {
        accountBalance = accountBalance + amount;
    }
}
```

- This source file contains part of a class that could be used to manage a bank account
 - There will be lots of other members in the finished on
- There will not be a Main method though, since this is not a program

Compiling a Library Class

```
csc AccountClass.cs
error CS5001: Program 'c:\AccountClass.exe'
does not contain a static 'Main' method
suitable for an entry point
```

- If we try to compile this class we get an error because there is no Main method to run when the program starts
- The compiler is trying to make an executable assembly and will complain because it has no entry point

Compiling a Library Class

```
csc /target:library accountclass.cs
```

- We can tell the compiler to create a library assembly rather than an executable one
 - It does not have to be typed in red
- The /target:library part of the command does this
 - It does not have to be typed in red
- The output from this compilation is a different file type
 - The file that is created is a *dynamic link library*
 - It has the language extension .dll
- This must **not** contain a Main method, since it is not a program

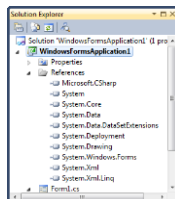
Using a Library Class

```
csc /reference:AccountClass.dll Bank.cs
```

- The C# compiler can be given a list of references to use when it creates a program
- This would make it possible for code in the Bank.cs file to make use of the Account object declared in the library file
- The classes in the Account library would be loaded and used when the program runs
- The run-time of the program is now spread over two different files
- But only one of them contains the Main method

Libraries in Visual Studio

- Visual Studio will manage library references for us
- The Solution Explorer has a References tab which holds all the libraries that a program is using
- WPF Applications contain lots of references

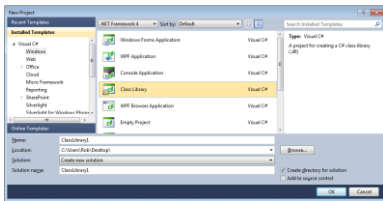


System Libraries

- Some libraries are stored as part of the System
- This means that a single, central, version of that library can be used by all the programs on a particular computer
- All Forms applications share the same set of library files
- Visual Studio will link to these files and they will also be picked up when the program runs

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User Libraries



- You can create “user” libraries in Visual Studio
- These produce a dll output that can be added to other projects

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Namespaces

Identifiers

- Whenever we make something in our program we have to think of a name for it
- We should try to ensure that the name we select is meaningful:
 - `windowHeightInMetres`
 - `PayInFunds`
- These names exist in our program and they have to be unique

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Identifier Clashes

- We have a problem when we are working with other people, or when we try to use code from a library
- We might have picked the same names as they have, leading to confusion
- There needs to be a way in which we can resolve this problem and make sure names don't clash

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C# Namespaces

- C# provides a solution to this problem, it is called a *namespace*
- This is exactly what the name implies, a space for names, or more specifically, a place where particular names have meaning
- We can create our own namespaces for the programs that we write

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Creating a namespace

```
namespace BankClasses  
{  
    class Account  
    {  
    }  
    class Address  
    {  
    }  
}
```

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Using items in namespaces

- Items in the same namespace can just refer to each other directly
- Outside the namespace you have to use the "fully qualified name":

```
BankClasses.Account myAccount =  
    new BankClasses.Account ();
```

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Using using

- If you want to get things from a particular namespace you can put a using statement at the top of your program:

```
using AccountClasses;  
...  
Account a = new Account();
```

- Note that we have been adding "using System" to all our programs so we can use items in the System namespace

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Sensible using

- If you add too many using directives it is hard to tell where something comes from when you use it in your program
- I therefore tend to use the fully qualified name a lot of the time
- It makes the code easier to follow

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Name Clashes

- You can add as many using statements as you like at the top of your code
- If two namespaces contain an item with the same name you must use the fully qualified name to access that item so the compiler can tell which one to use
- Otherwise you will get an error

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Nesting Namespaces

- A namespace can contain other namespaces
- This way you can build up a hierarchy of names
- The C# system does this, System.IO is the namespace which contains all the input/output classes

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Namespaces and Libraries

- If you are using code from other libraries you have to make sure that the library is incorporated into the program when it is actually built
- The System library is always present, but if you make your own libraries you will have to make sure these are included when the program is built

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Namespaces and source files

- A namespace can be spread over several source files
- A source file can contain some items in different namespaces
- To manage this you need to build a project to keep track of the different items
- Visual Studio is very good for this

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Libraries and Namespaces Summary

- Libraries help you break a program into a number of smaller chunks
- It also allows you to reuse elements in multiple projects
- Namespaces allow you to manage the names of the objects in your programs so that they can be partitioned

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