Lecture One - Introduction

The .NET Framework

The Microsoft .NET platform provides all of the tools and technologies that you need to build distributed Web applications. It exposes a language independent, consistent programming model across all tiers of an application while providing seamless interoperability with, and easy migration from, existing technologies. The .NET platform fully supports the Internet's platform neutral, standards-based technologies, including HTTP, Extensible Markup Language (XML), and Simple Object Access Protocol (SOAP).

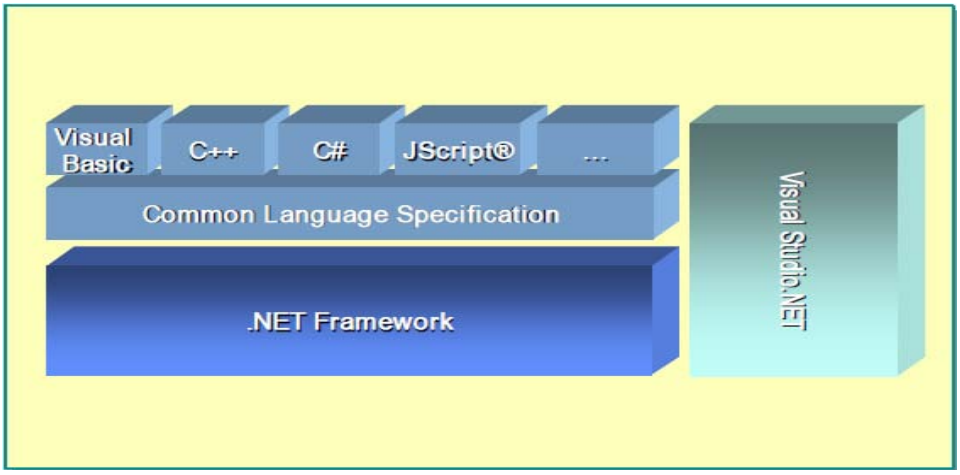
C# is a new language specifically designed for building applications in the .NET environment. As a developer, you will find it useful to understand the rationale and features that provide the foundation for the .NET platform before you start writing C# code.

The .NET Framework is based on a new Common Language Runtime. The Common Language Runtime provides a common set of services for projects built in Microsoft Visual Studio.NET, regardless of the language. These services provide key building blocks for applications of any type, across all application tiers.

Microsoft Visual Basic ®, Microsoft Visual C++®, and other Microsoft programming languages have been enhanced to take advantage of these services. Third-party languages that are written for the .NET platform also have access to the same services.

Visual Studio.NET

Visual Studio.NET provides a high-level development environment for building applications on the .NET Framework. It provides key enabling technologies to simplify the creation, deployment, and ongoing evolution of secure, scalable, highly available Web applications and Web Services.



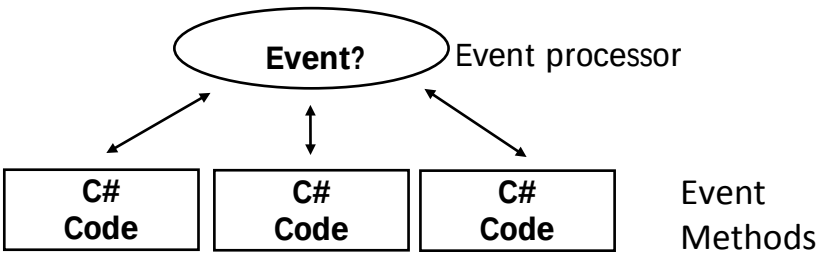
What is Visual C#?

Microsoft Visual C# is Microsoft's powerful component-oriented language. C# plays an important role in the architecture of the Microsoft .NET Framework, and some people have compared it to the role that C played in the development of UNIX. If you already know a language such as C, C++, or Java, you'll find the syntax of C# reassuringly familiar. If you are used to programming in other languages, you should soon be able to pick up the syntax and feel of C#; you just need to learn to put the braces and semicolons in the right place.

Visual C# is part of a grand new initiative by Microsoft. It is a complete re-engineering of Visual C# for the Microsoft .NET framework. With Visual C#, you are able to quickly build Windows-based applications (the emphasis in this course), web-based applications and software for other devices.

Windows applications built using Visual C# feature a Graphical User Interface (GUI). Users interact with a set of visual tools (buttons, text boxes, tool bars, menu items) to make an application do its required tasks. The applications have a familiar appearance to the user. As you develop as a Visual C# programmer, you will begin to look at Windows applications in a different light. You will recognize and understand how various elements of Word, Excel, Access and other applications work. You will develop a new vocabulary to describe the elements of Windows applications.

Visual C# Windows applications are **event-driven**, meaning nothing happens until an application is called upon to respond to some event (button pressing, menu selection, ...). Visual C# is governed by an event processor. As mentioned, nothing happens until an event is detected. Once an event is detected, a corresponding event method is located and the instructions provided by that method are executed. Those instructions are the actual code written by the programmer. In Visual C#, that code is written using the C# programming language. Once an event method is completed, program control is then returned to the event processor.



All Windows applications are event-driven. For example, nothing happens in Word until you click on a button, select a menu option, or type some text. Each of these actions is an event.

The event-driven nature of applications developed with Visual C# makes it very easy to work with. As you develop a Visual C# application, event methods can be built and tested individually, saving development time. And, often event methods are similar in their coding, allowing re-use (and lots of copy and paste).

A Brief Look at Object-Oriented Programming (OOP)

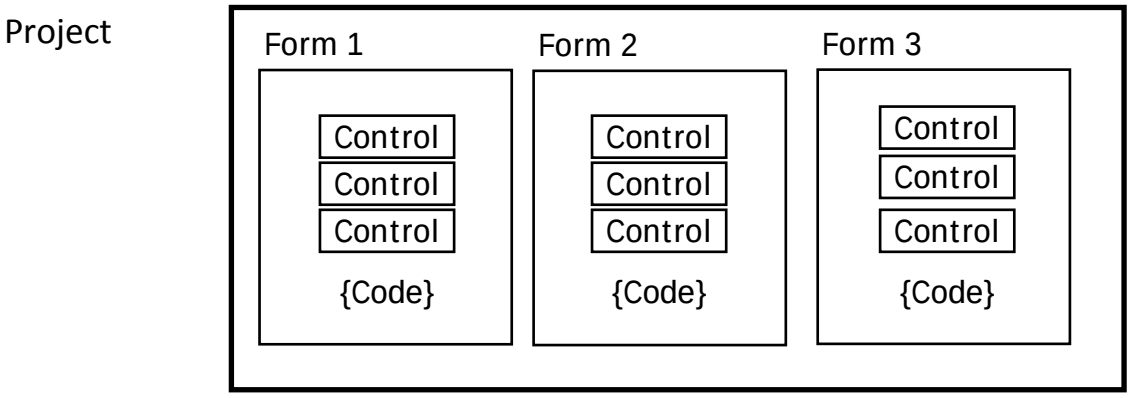
Visual C# is fully **object-oriented**. For this particular course, we don't have to worry much about just what that means (many sizeable tomes have been written about OOP). What we need to know is that each application we write will be made up of **objects**. Just what is an object? It can be many things: a variable, a font, a graphics region, a rectangle, a printed document. The key thing to remember is that these objects represent reusable entities that are used to develop an application. This 'reusability' makes our job much easier as a programmer.

In Visual C#, there are three terms we need to be familiar with in working with object-oriented programming: **Namespace**, **Class** and **Object**. **Objects** are what are used to build our application. We will learn about many objects throughout this course. Objects are derived from **classes**. Think of classes as general descriptions of objects, which are then specific implementations of a class. For example, a class could be a general description of a car, where an object from that class would be a specific car, say a red 1965 Ford Mustang convertible (a nice object!). Lastly, a **namespace** is a grouping of different classes used in the .NET world. One namespace might have graphics classes, while another would have math functions. We will see several namespaces in our work.

Structure of a Visual C# Windows Application

We want to get started building our first Visual C# Windows application. But, first we need to define some of the terminology we will be using. In Visual C#, a Windows **application** is defined as a **solution**. A solution is made up of one or more **projects**. Projects are groups of forms and code that make up some application. In most of our work in this course, our applications (solutions) will be made up of a single project. Because of this, we will usually use the terms application, solution and project synonymously.

As mentioned, a project (application) is made up of forms and code. Pictorially, this is:



Application (Project) is made up of:

1. **Forms** - Windows that you create for user interface
2. **Controls** - Graphical features drawn on forms to allow user interaction (text boxes, labels, scroll bars, buttons, etc.) (Forms and Controls are **objects**.)
3. **Properties** - Every characteristic of a form or control is specified by a property. Example properties include names, captions, size, color, position, and contents. Visual C# applies default properties. You can change properties when designing the application or even when an application is executing.
4. **Methods** - Built-in methods that can be invoked to impart some action to a particular control or object.
5. **Event Methods** - Code related to some object or control. This is the code that is executed when a certain event occurs. In our applications, this code will be written in the C# language (covered in detail in Chapter 2 of these notes).
6. **General Methods** - Code not related to objects. This code must be invoked or called in the application.

The application displayed above has three forms. Visual C# uses a very specific directory structure for saving all of the components for a particular application. When you save a new project (solution), you will be asked for a **Name** and **Location** (directory). A folder named **Name** will be established in the selected **Location**. That folder will be used to store all solution files, project files, form files (**cs** extension) and other files needed by the project. Two subfolders will be established within the Name folder: **Bin** and **Obj**. The **Obj** folder contains files used for debugging your application as it is being developed. The **Bin\Debug** folder contains your compiled application (the actual executable code or **exe** file). Later, you will see that this folder is considered the 'application path' when ancillary data, graphics and sound files are needed by an application.

In a project folder, you will see these files (and possibly more):

1. **AssemblyInfo.cs** Information on how things fit together
2. **SolutionName.sln** Solution file for solution named SolutionName
3. **SolutionName.suo** Solution options file
4. **ProjectName.csproj** Project file – one for each project in solution
5. **ProjectName.csproj.user** Another Project file – one for each project in solution
6. **FormName.resx** Form resources file – one for each form
7. **FormName.cs** Form code file – one for each form
8. **App.ico** Icon used to represent the application

Steps in Developing a Windows Application

The Visual C# Integrated Development Environment (IDE) makes building an application a straightforward process. There are three primary steps involved in building a Visual C# application:

1. **Draw** the user **interface** by placing controls on a Windows form
2. **Assign properties** to controls
3. **Write code** for control events (and perhaps write other methods)

These same steps are followed whether you are building a very simple application or one involving many controls and many lines of code.

The event-driven nature of Visual C# applications allows you to build your application in stages and test it at each stage. You can build one method, or part of a method, at a time and try it until it works as desired. This minimizes errors and gives you, the programmer, confidence as your application takes shape.

As you progress in your programming skills, always remember to take this sequential approach to building a Visual C# application. Build a little, test a little, modify a little and test again. You'll quickly have a completed application. This ability to quickly build something and try it makes working with Visual C# fun – not a quality found in some programming environments! Now, we'll start Visual C# and look at each step in the application development process.

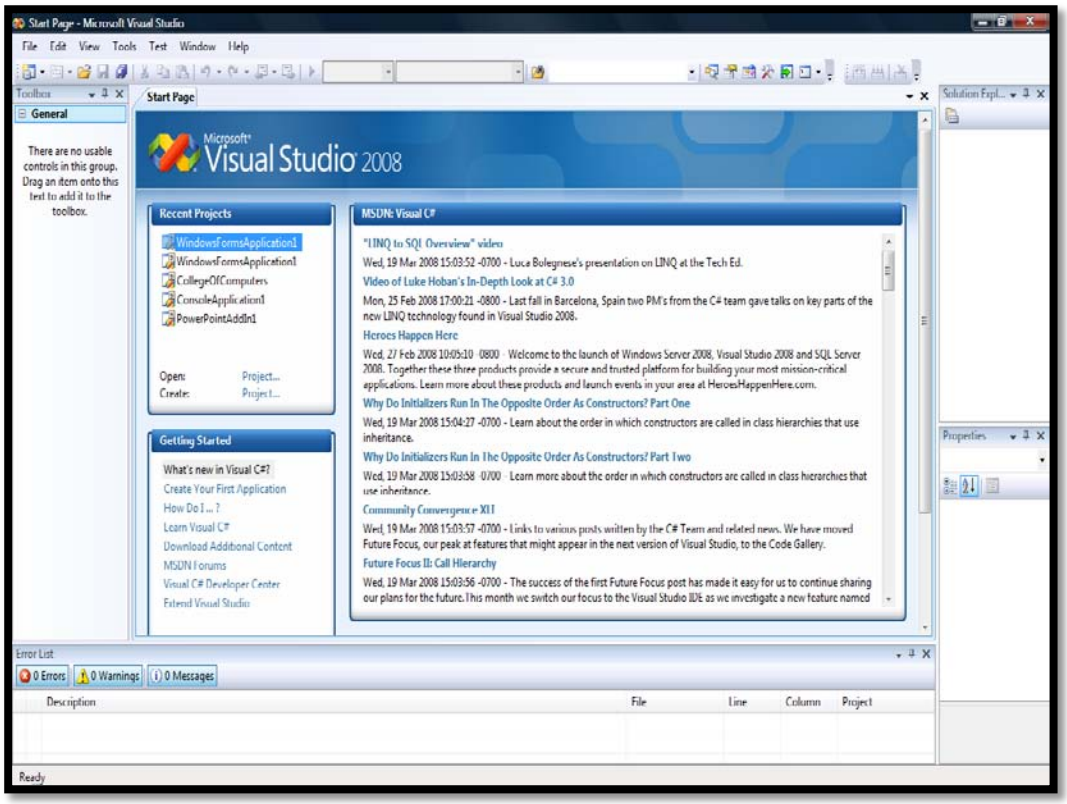
Starting Visual C#

We assume you have Visual C# installed and operational on your computer. In these notes, we use a version of **Visual C#** included as a part of **Microsoft Visual Studio**. Visual Studio includes not only Visual C#, but also Visual C++ and Visual Basic. All three languages use the same Integrated Development Environment (IDE). If you

are using the stand-alone Visual C# product, some of the instructions and screens shown for starting a project may differ slightly. To start Visual C#:

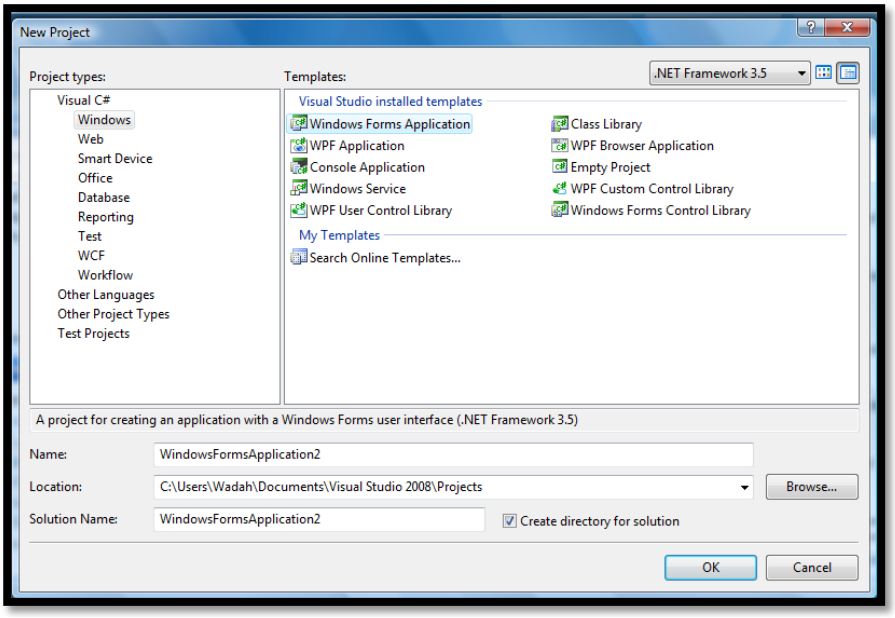
1. Click on the **Start** button on the Windows task bar.
2. Select Programs, then Microsoft Visual Studio.
3. Click on Microsoft Visual Studio.

(Some of the headings given here may differ slightly on your computer, but you should have no trouble finding the correct ones.) Visual Studio will start and (among other things) a start page similar to this will appear:



There is lots of useful information on this page. There are links to resources to help with Visual C#, as well as lots of news on what's happening in the Visual C# (and Visual Studio) world. At some point, you might like to investigate some of these links.

For now, we want to start a project. Under the **Recent Projects** heading, there is a sub-heading **Create:**, and another sub-heading **Project ...**. Click that heading and the following dialog box should appear:



Recall this screen is from Visual Studio, so we have selected **Visual C# Projects** under **Project types**. We want to build a **Windows Application**, so make that choice under **Templates**.

Assign a **Name** to your project (mine is named **TestProject**). Once done, click **OK** and the Visual C# development environment will appear. Your project will consist of a single Windows form.

Visual C# Integrated Development Environment (IDE)

The **Visual C# IDE** is where we build and test our application via implementation of the three steps of application development (draw controls, assign properties, write code). As you progress through this course, you will learn how easy-to-use and helpful the IDE is. There are many features in the IDE and many ways to use these features. Here, we will introduce the IDE and some of its features. You must realize, however, that its true utility will become apparent as you use it yourself to build your own applications.

Several windows appear when you start Visual C#. Each window can be viewed (made visible or active) by selecting menu options, depressing function keys or using the displayed toolbar. As you use the IDE, you will find the method you feel most comfortable with

The title bar area shows you the name of your project. When running your project you will also see one of two words in brackets: **Running** or **Debugging**. This shows the mode Visual C# is operating in. Visual C# operates in three modes.

1. **Design** mode - used to build application (the mode if not **Running** or **Debugging**)
2. **Running** mode - used to run the application
3. **Debugging** mode - application halted and debugger is available; also referred to as **Break** mode

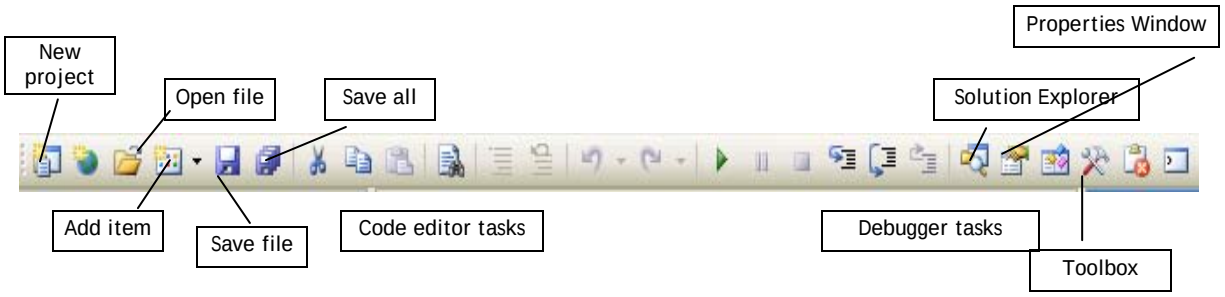
We focus here on the **design** mode. You should, however, always be aware of what mode you are working in.

Under the title bar is the **Menu**. This menu is dynamic, changing as you try to do different things in Visual C#. When you start working on a project, it should look like this:

You will become familiar with each menu topic as you work through the course. Briefly, they are:

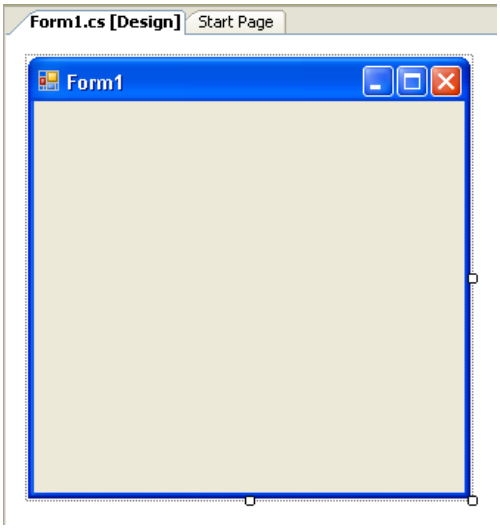
File	Use to open/close projects and files. Use to exit Visual C#
Edit	Used when writing code to do the usual editing tasks of cutting, pasting, copying and deleting text
View	Provides access to most of the windows in the IDE
Project	Allows adding files and objects to your application
Build	Allows you to compile and run your completed application (go to Run mode)
Debug	Comes in handy to help track down errors in your code (works when Visual C# is in **Break** mode)
Data	Used when building database applications (not covered in this course)
Format	Useful for manipulating controls placed on your forms
Tools	Allows custom configuration of the IDE. Be particularly aware of the **Options** choice under this menu item. This choice allows you to modify the IDE to meet any personal requirements.
Window	Lets you change the layout of windows in the IDE
Community	Provides links to the Visual Studio community
Help	Perhaps, the most important item in the Menu. Provides access to the Visual C# on-line documentation via help contents, index or search. Get used to this item!

The View menu also allows you to choose from a myriad of toolbars available in the Visual C# IDE. Toolbars provide quick access to many features. The **Standard** (default) toolbar appears below the Menu:

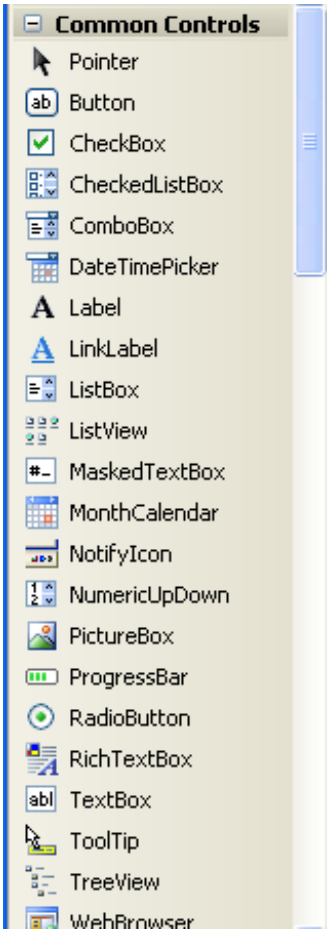


If you forget what a toolbar button does, hover your mouse cursor over the button until a descriptive tooltip appears. We will discuss most of these toolbar functions in the remainder of the IDE information.

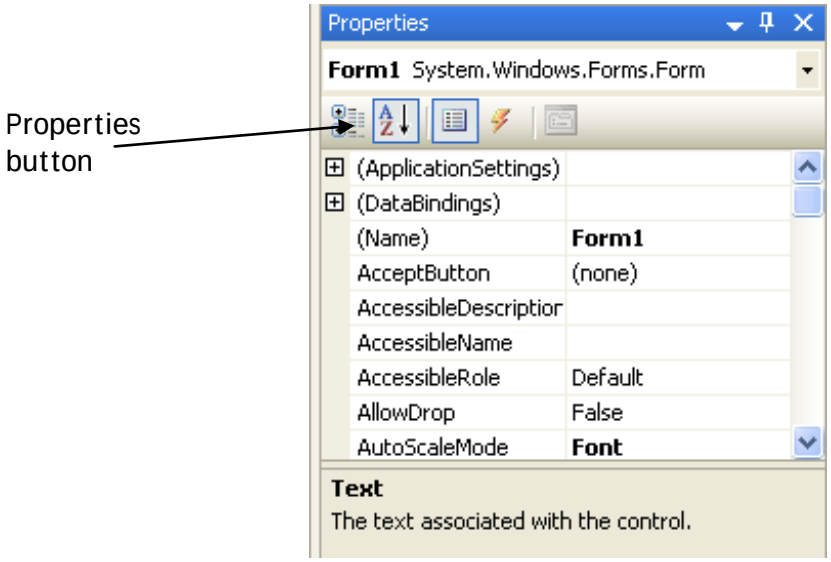
In the middle of the Visual C# IDE is the Design Window. This window is central to developing Visual C# applications. Various items are available by selecting tabs at the top of the window. The primary use is to draw your application on a form and, later, to write code. Forms are selected using the tab named **FormName.cs [Design]**:



The corresponding code for a form is found using the **FormName.cs** tab. The design window will also display help topics and other information you may choose. The **Toolbox** is the selection menu for controls used in your application. It is active when a form is shown in the design window:



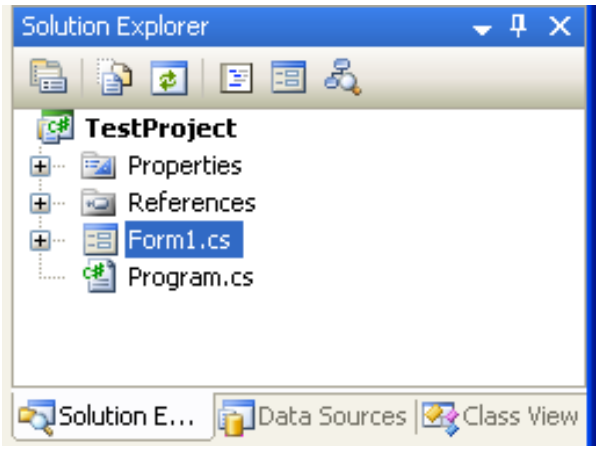
The **Properties Window** serves <u>two</u> purposes. Its primary purpose is to establish design mode (initial) property values for objects (controls). It can also be used to establish event methods for controls. Here, we just look at how to work with properties. To do this, click the **Properties** button in the task bar:



The drop-down box at the top of the window lists all objects in the current form. Under this box are the available properties for the active (currently selected) object. Two property views are available: **Alphabetic** and **Categorized** (selection is made

using menu bar under drop-down box). Help with any property can be obtained by highlighting the property of interest and pressing **<F1>**. We will examine how to assign properties after placing some controls on a form.

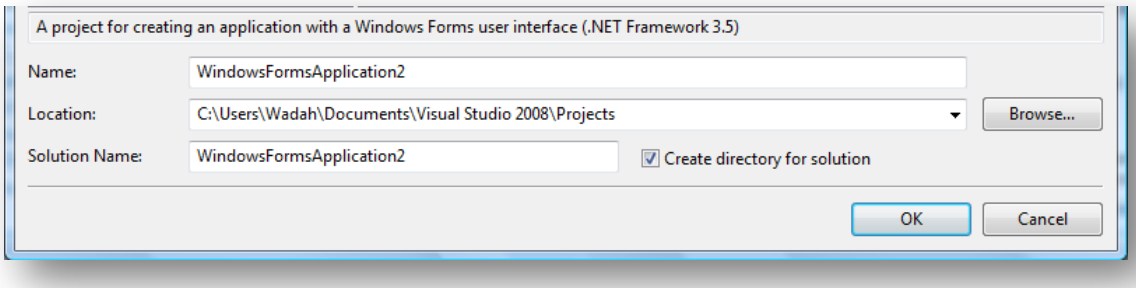
The **Solution Explorer Window** displays a list of all forms and other files making up your application. To view a form in this window, simply double-click the file name. Or, highlight the file and press **<Shift>-<F7>**. Or, you can obtain a view of the form (**View Designer**) or code (**View Code**) windows (window containing the actual C# coding) from the Project window, using the toolbar near the top of the window. As we mentioned, there are many ways to do things using the Visual C# IDE.



Saving a Visual C# Project

We recommend the first thing you do upon creating a new project is to save it. This makes sure all the files and folders are in locations you have specified. To save a Visual C# project, click the **Save All** button (looks like several floppy disks) in the IDE toolbar. Clicking on this button will have different results, depending on when you click it.

If you are working on a project that has never been saved, the following window will appear:



This window asks where you want to save your project. In the **Name** box, enter the name of the folder to save your project in. **Location** should show the directory your project folder will be in. You can **Browse** to an existing location or create a new directory by checking the indicated box. For this course, we suggest saving each of your project folders in the same directory.

If you are working on a project that has been saved previously and you click on the **Save All** button, Visual C# saves all your files in the same location without asking any questions. Sometimes, you may want to 'force' a save. For example, if you are making lots of changes, you might occasionally like to save your work prior to running the project. Do this by clicking the **Save All** button at any time. And, always make sure to save your project before running it or before leaving Visual C#.