# Introduction to Windows Forms

This document contains notes pertaining to the Pluralsight course “Introduction to Windows Forms”. Some of the clips of the Pluralsight course are documented. The names of those clips are copied to the section headers in this document and to the table below. Using Microsoft Word, you can use the names in the table as hyperlinks to navigate to any particular clip. But using Apache Open Office, these hyperlinks do not work; instead, they merely serve as a table of contents. You can navigate to the start of any clip via bookmarks; type F5 to bring up the Navigator; then double-click Bookmark1 for 1st clip header, Bookmark 2, for 2nd clip header, etc.

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## Forms

The form displayed when the application starts initially is normally invoked automatically. With regard to secondary forms that are displayed later in the process of application execution, the statements to display such forms are

Show()

or

ShowDialog()

Show() displays the form modelessly, whereas ShowDialog() displays the form modally.

Application start-up also involves the use of the **Application** object. The statement

Application.Run(form)

performs initialization in addition to displaying the start-up form. To end the application one could use

Application.Exit, but this is not really necessary, because closing the start-up form implicitly invokes Application.Exit.

## Demo: Forms

We start by building a code-only project; we will not use template code, and we will not use the **Toolbox**.

* Open Visual Studio. In the right panel click **Create a new project**. Visual Studio displays the **Create a new project** dialog.
* Open the languages drop-down list near the top of the right panel. Choose **Visual Basic**. Type “empty” in the search box at the top of the right panel. Visual Studio reduces the number of candidates in the right-panel list. Select **Empty Project (.NET Framework)** with **Visual Basic** as the language. Click **Next**. Visual Studio displays the **Configure your new project** dialog.

***It is not necessary to have allocated a folder for the solution before creating the solution and 1st project. Visual Studio automatically allocates a new subfolder under the folder selected in the following step, and it copies the solution name as the name of this new subfolder.***

* Type “Simple” into the **Project name** text box. Use the **Location** browser to select a folder into which the solution will reside. Type “CodeOnly” into the **Solution name** text box. Uncheck the check box below the **Solution name** text box. Click **Create**. Visual Studio displays the solution with empty left and center panels. If the **Solution Explorer** is not visible in the right panel, navigate to make it visible.
* Now create the class that contains the windows form. Right click “Simple”; then select **Add -> Class...** from the context menu. Visual Studio displays the dialog **Add New Item**.
* Change the name in the **Name:** text box (bottom left) to “MyForm”. Click **Add**. Visual Studio displays the class MyForm in the center panel.

***By default, classes created in C# are not “public”. It is necessary to type “public” as a prefix to the class name, unless you deliberately want it to be private. The same applies to properties and methods in the class.***

* We want class MyForm to inherit from Systems.Windows.Forms.Form. In order to do that we will have to reference the Systems.Windows.Forms assembly. Right-click “Simple”; then select **Add -> Reference...** from the context menu. Visual Studio displays the dialog **Reference Manager**.
* Expand **Assemblies** in the left panel. Click **Framework** to make it highlighted. Scroll down the list in the center panel to **System.Windows.Forms**, and hover the mouse over this item. Click - to check - the checkbox to the left of this item. Click **OK**. Visual Studio displays **System.Windows.Forms** in the **Solution Explorer** under **References**.
* Navigate back to the body of Class MyForm. Type the line

Inherits Form

Hover the mouse over “Form”, and type <ctrl>.; then accept the invitation “Imports System.Windows.Forms”.

* Add the following code to Class MyForm – a skeleton of the constructor.

Public Sub New() (the VB constructor evidently uses “New” instead of the class’s name)

End Sub

* The constructor can be used to set values for various desired properties. At this point the only property will be the “Text” property, which shows up as the window’s title. In the body of the constructor type

Me.Text = “My Form”

Now we need to supply the “Main” method, the entry point for this application.

* The “Main” method goes inside a module. Right click “Simple”; then select **Add -> Module...** from the context menu. Visual Studio displays the dialog **Add New Item** with **Module** selected (by default) in the center pane. (***In C# we add a new class instead of “module”.***)
* Change the name in the **Name:** text box (bottom left) to “Startup”. Click **Add**. Visual Studio displays the module “Startup” in the center panel.
* Type the following code in the body of Startup.

Public Sub Main()

Dim form as New MyForm

Application

End Sub

***In C# we write “public static void Main()” instead of “Public Sub Main()”.***

* Hover the mouse over “Application”, and type <ctrl>.; then accept the invitation “Imports System.Windows.Forms”.
* Append “.Run(form)” after “Application”. The statement “Application.Run(form)” does 3 things. (1) It starts listening in on the Windows message loop. (2) It sets “form” as the main form for the application. (3) It shows the form.

This completes the construction of the “Simple” application. Build and run the application. The application shows a form whose title is “My Form”. When the C# version of this application runs, the form is displayed, but the console-window is also displayed. To prevent the console window from displaying

* Right-click the project name. Then select **Properties** from the context menu. Visual Studio displays the properties with tab selectors in the left panel.
* With the **Application** tab selected, refer to the **Output type:** dropdown list near the top of the right panel. Use the down-arrow to the right of the dropdown list to change the type to **Windows Application**.
* Close the **Properties** dialog. Rerun the application, and observe that console window is no longer displaying.

## Demo: Controls

We will be adding 3 controls to the Main form: a text box, a button, and a label.

* Navigate to Visual Studio, MyForm.vb.
* To declare the 3 controls, add the following code after “Inherits Form”.

Private MessageTextBox As TextBox

Private MessageLabel As Label

Private ShowMessageButton As Button

* To place these controls into the form, add the following code at the end of the constructor (Sub New()). This code instantiates each of the controls, sets properties of that instance, and then adds that instance to the controls collection of the form.

MessageTextBox = New TextBox()

MessageTextBox.Left = 25

MessageTextBox.Top = 25

MessageTextBox.Width = 200

Me.Controls.Add ( MessageTextBox )

ShowMessageButton = New Button()

ShowMessageButton.Left = 25

ShowMessageButton.Top = 75

ShowMessageButton.Width = 200

ShowMessageButton.Text = “Show Message”

Me.Controls.Add ( ShowMessageButton )

MessageLabel = New Label()

MessageLabel.Left = 25

MessageLabel.Top = 125

MessageLabel.Width = 200

MessageLabel.Text = "[Label]”

Me.Controls.Add ( MessageLabel )

* Build and run the application. The form and its controls display as expected.

## Demo: Event Handlers

The 3 controls – text box, button, and label – are intended to work together. The user types some text into the text box; then he clicks the command button; the application is supposed to respond by copying the text into the label. We start by adding an event handler for the click event of the button. We’ll begin with the static method.

***Do not attempt the following steps in C#. The “static” method is not available in C#.***

* Insert the “WithEvents” keyword into the button’s declaration statement – near the top of the code in MyForm.vb. The result is

Private WithEvents ShowMessageButton As Button

* Add the handler for the button’s click event. All event handlers have a common signature: the 1st parameter is of type **object**, where we normally name the sender of the event; the 2nd parameter – normally named “e” - is of type **EventArgs** (or a class derived from **EventArgs**); e provides information that is specific to the event. In Visual Basic the signature ends with a Handles clause. To get help in coding the event handler signature . . .
  + Refer to the dropdown list at the top of the center panel that contains (by default) the name of the form; click the down arrow, and select the name of the control that we want to work with (ShowMessageButton in this case).
  + Click the rightmost dropdown list at the top of the center panel, and select the name of the event (**Click** in this case). Visual Studio displays a skeleton of the event handler for the selected control.

By default, Visual Studio uses – for the name of the event handler *NameOfControl\_NameOfEvent*. But there is nothing magic about this name; the **Handles** clause at the end of the event signature specifies the name of the control and the name of the event. Just to drive this point home, change “ShowMessageButton\_Click” to “ClickHandler”.

* Type the following statements into the body of ClickHandler().

MessageLabel.Text = MessageTextBox.Text

MsgBox("Button clicked")

Now we’ll repeat the exercise using the dynamic method of adding an event handler.

* Remove the “WithEvents” keyword from the button’s declaration statement.
* Remove the **Handles** clause from the signature of ClickHandler().
* Insert the following statement after “Me.Controls.Add ( ShowMessageButton )”.

AddHandler ShowMessageButton.Click, AddressOf ClickHandler

* Build and run the application. Note that the text is copied successfully after clicking the button.

***Use the following steps to add an event handler in C# (dynamically).***

* Insert the following statements after “this.Controls.Add ( ShowMessageButton )”.

ShowMessageButton.Click += ShowMessageButton\_Click;

Visual Studio responds by creating a skeleton for the mouse-click event handler, and it displays an invitation to rename the event handler. Accept the invitation and rename it to “ClickHandler”.

* Type the following statements into the body of ClickHandler().

MessageLabel.Text = MessageTextBox.Text;

MessageBox.Show ( "Button clicked" );

* Build and run the application. Note that the text is copied successfully after clicking the button.

## Demo: Using The Designer

This project will be similar to the code-only project; but this time we will use template code and the **Toolbox**.

* Open Visual Studio. In the right panel click **Create a new project**. Visual Studio displays the **Create a new project** dialog.
* Open the languages drop-down list near the top of the right panel. Choose **Visual Basic**. Type “windows” in the search box at the top of the right panel. Visual Studio reduces the number of candidates in the right-panel list. Select **Windows Forms App (.NET Framework)** with **Visual Basic** as the language. Click **Next**. Visual Studio displays the **Configure your new project** dialog.

***It is not necessary to have allocated a folder for the solution before creating the solution and 1st project. Visual Studio automatically allocates a new subfolder under the folder selected in the following step, and it copies the solution name as the name of this new subfolder.***

* Type “Designer” into the **Project name** text box. Use the **Location** browser to select a folder into which the solution will reside. Keep “Designer” as the **Solution name** text box. Check the check box titled **Place solution and project in the same directory**. Click **Create**. Visual Studio displays the solution with an empty form titled “Form1”. If the **Solution Explorer** is not visible in the right panel, navigate to make it visible.

The form has two views – the design view and the code view. One can switch between the 2 views by right-clicking *FormName*.vb (in the **Solution Explorer**) and selecting either **View Code** or **View Designer** in the context menu.

* Rename the form in the **Solution Explorer** to “MyForm”. Visual Studio displays a pop-up dialog asking whether to rename all references to the code element ‘Form1’. Click **Yes**. Notice that Visual Studio has renamed the class (design view) to “MyForm”.
* Look at the **Properties** window for MyForm.
* To change MyForm’s title, change the **Text** property to “My Form”.
* Change the **Size** property to “500, 430”.

Now we have enough room to add controls to the form.

* Open the **Toolbox** (in the left-hand panel). Expand the **Common Controls** node.
* Drag/drop a **TextBox** from the **Toolbox** to MyForm. Similarly drop a **Button** and a **Label** to MyForm.
* Play with moving the controls around on the form. Notice vertical snap lines are displayed when the controls are aligned vertically. If the controls have similar sizes, Visual Studio shows a snap line between their right edges when their sizes are the same. Also, when a control is close to an edge of the form, Visual Studio shows a snap line from the center of the control’s edge to the edge of the form - indicating that the control is at the correct distance from the edge of the form in accordance with the standard Windows Forms guidelines. Similarly, when two controls are positioned close to each other the same small snap line is displayed to indicate the correct distance between the controls.
* In this example, we won’t follow the guidelines necessarily, because we are trying to make the controls look the same as in the code-only project.
* Set the TextBox’s **Name** property to “MessageTextBox”.
* Expand the TextBox’s **Location** property; set both **X** and **Y** to 25.
* Expand the TextBox’s **Size** property; set **Width** to 200.
* Set the Button’s **Name** property to “ShowMessageButton”
* Set the Button’s **Location** property to “25, 75”.
* Expand the Button’s **Size** property; set **Width** to 200.
* Set the Button’s **Text** property to “Show Message”.
* Set the Label’s **Name** property to “MessageLabel”.
* Set the Label’s **Location** property to “25, 125”.
* Setting the Label’s **Width** doesn’t work, because the **AutoSize** property is **True** by default. Change **AutoSize** to **False**, and then change **Width** to 200.
* Set the Label’s **Text** property to “[Label]”.
* Click the lightning icon at the top of the Button’s **Properties** window to switch the “events” view.
* Click the **Click** event in the Button’s events view; verify that it is highlighted. Then double-click ShowMessageButton in the form’s designer view. Visual Studio creates a skeleton of the event handler, and displays it in the form’s code view.
* Type the following statements into the body of the event handler.

MessageLabel.Text = MessageTextBox.Text;

Build and run the application. Note that the text is copied successfully after clicking the button.

***I created a similar C# project named “DesignerCS”. I did it quickly, and I deliberately made it look different from the VB version.***

## Generated Code & Demo

The important take-away information from the two Pluralsight clips “Generated Code” and “Demo: Generated Code” are (1) the identity of the files that contain the generated code, and (2) how to navigate to these files. (Since Current Pixel will not be concerned with Visual Basic, I have omitted the answers to these questions for VB from this document.)

In the Solution Explorer expand the node for MyForm.cs, and examine MyForm.Designer.cs. We wrote button event handler in MyForm.cs. Visual Studio automatically generated MyForm.Designer.cs, which contains the method InitializeComponent(). InitializeComponent() contains code that (1) declares and instantiates the classes for the controls, (2) sets the properties of the instances, and (3) adds the instances to the form’s controls collection. Much of this code is hidden by default, but you can see it by expanding the **+** (region) named “Windows Form Designer generated code”.

With regard to the start-up code, execution starts at Main() in Program.cs (which was automatically generated by Visual Studio). In particular “Application.Run()” is the last statement in Main(), and Application.Run() creates an instance of class MyForm. Note that Visual Studio has automatically added MyForm’s constructor (in MyForm.cs). This constructor contains the statement “InitializeComponent();”, which we discussed above.

## Form Lifecycle

The following are the names of event handlers pertaining to a form’s lifecycle events.

**Load** – fires after the form’s constructor is executed, just before a form is shown

**Shown** – fires just after the form shows on the screen

**Activated** – fires when the form gets focus

**Deactivate** – fires when the form loses focus

**FormClosing** – fires just before the form is closed, and closing can be cancelled

**FormClosed** – fires just after the form is closed

A fast way to start coding the **Load** event is to double-click anywhere on the form that does not contain a control; for example, double click the title bar of the form.

## Demo: Form Lifecycle (plus Anchor property)

The 1st part of the clip illustrates using the form’s **Load** event to copy data into a listbox.

The 2nd part of the clip introduces the **Anchor** property for controls on Windows Forms. There are four parts of the anchor: top, right, bottom, and left. Each part of the anchor can be present or missing. For horizontal anchor parts…

If the left part is present and the right part is missing, then

when the form is widened,

the distance between the control and the form’s left edge remains fixed.

If the left part is missing and the right part is present, then

when the form is widened,

the distance between the control and the form’s right edge remains fixed.

If both the left and right parts are present, then

when the form is widened,

the width of the control increases by the same amount.

If both the left and right parts are missing, then

when the form is widened,

the control is moved to the left or right (relative to the form) to maintain the same proportional distance between the left and right edges of the form.

The behavior for vertical anchor parts is the same as for horizontal anchor parts – replacing “left” with “top”, and “right” with “bottom”.

## Demo: Dialogs (MessageBox)

This section shadows the 2nd MessageBox example in the Pluralsight clip “Demo: Dialogs”. This 2nd example deals with the situation where the user has clicked the close-form button (“x” in the upper-right corner); the example uses MessageBox to ask the user whether he really wants to exit. The project that I am using as a vehicle for this example is the same C# project that I wrote for [Demo: Using The Designer.](#_Demo:_Using_The)

* Navigate to the C# Visual Studio project, to the “designer” view of the form. Open the Object Explorer. Click the lightning bolt to get the list of events. Double-click **FormClosing** in the list of events. Visual Studio creates a skeleton of the event handler for **FormClosing**.
* Type the following code into the body of the event handler.

var msg = "Are you sure you want to close?";

if ( MessageBox.Show ( msg, this.Text, MessageBoxButtons.YesNo, MessageBoxIcon.Question,

MessageBoxDefaultButton.Button2 )

{

e.Cancel = true;

}

For this (overloaded) variant of MessageBox.Show()

The 1st argument (msg) is the text to display in the message-box window.

The 2nd argument (this.Text) specifies the text in the window’s title bar (the same text as in the form’s title bar).

The 3rd argument (MessageBoxButtons.YesNo) specifies the style: a box containing 2 buttons – **Yes** and **No**.

The 4th argument (MessageBoxIcon.Question) specifies an icon to display in the dialog: a picture of a question mark.

The 5th argument (MessageBoxDefaultButton.Button2) specifies which of the buttons is highlighted by default: the 2nd button (**No**). If the 1st button were highlighted instead, and if user pressed the **Enter** key carelessly, the form would have closed. But using the default argument in this way forces the user to select the **Yes** button deliberately to close the form.

The return value from MessageBox.Show is an element of an enumerator, **DialogResult**. When the user responds by clicking **No**, DialogResult.No is returned, and the e.Cancel statement is executed.

Build and run the application. Click the “x” in the upper-right corner. The message box will display. Click **No**, or press the **Enter** key. The form does not close. Click “x” again. This time respond to the message box by clicking **Yes**. The form closes, and the application exits.

## Custom Dialogs

The following is – verbatim – what the Pluralsight instructor displayed at the beginning of this clip. It would seem to be a great checklist to use when building a custom dialog.

* Create the form as you would any other
* Set form properties to add dialog look, feel and behavior
  + Set FormBorderStyle to FixedDialog
    - Changes visual style
    - Disables resizing of dialog
  + Set ControlBox property to false
    - Removes minimize, maximize and close buttons from title bar
  + Set AcceptButton and CancelButton properties
    - AcceptButton: pressing Enter is the same as clicking the button
    - CancelButton: pressing Escape is the same as clicking the button
* Set dialog return value on button clicks
  + In event handler, or
  + Using the DialogResult property of the Button

*Important note: Setting the DialogResult property closes the dialog*

## Demo: Custom Dialogs

In this demo we create a custom dialog to perform the same action that we provided in [Demo: Dialogs (MessageBox)](#_Demo:_Dialogs_(MessageBox)) using MessageBox.Show(). But I want to avoid creating a new project, and I don’t want to lose the code used in [Demo: Dialogs (MessageBox.](#_Demo:_Dialogs_(MessageBox)) Therefore, I am going to add - to that project - a new button **Exit** that will have the same functionality as the “x” in the upper-right corner.

* Navigate to the C# Visual Studio project that was written for [Demo: Using The Designer.](#_Demo:_Using_The) Navigate to the “designer” view of the form.
* Add a button named btnExit with “Exit” for its **text** property.
* Double-click btnExit to induce Visual Studio to create the skeleton for btnExit\_Click().
* In the **Solution Explorer** right-click the project name. Click **Add -> Form (Windows Form)…** in the context menu. Visual Studio displays a dialog titled **Add New Item** with **Form (Windows Form)** selected in the center panel.
* Rename the form “ConfirmDialog” via the **Name:** text box at the bottom of the dialog. Click **Add**. Visual Studio responds by adding ConfirmDialog.cs to the solution, and it displays ConfirmDialog.cs in designer mode.
* Resize ConfirmDialog.cs to make it smaller than the main form. Change its **Text** property to “Confirm”.
* Drop a **Panel** (from the **Containers** section of the **Toolbox**) onto ConfirmDialog, Change the **Dock** property of the **Panel** to **Top**. Change the **BackColor** property of the **Panel** to **HighlightText**.
* Add a **Label** to the **Panel**. Change the **Text** property of the **Label** to “Are you sure you want to close?”
* Drop two buttons onto ConfirmDialog, The left-hand button is named “YesButton”, and its **Text** property is “Yes”; the right-hand button is named “NoButton”, and its **Text** property is “No”.
* Following the checklist from [Custom Dialogs](#_Custom_Dialogs) we start by setting the **FormBorderStyle** property of ConfirmDialog; change it to **FixedDialog**; this prevents the user from resizing the dialog.
* Remove the 3 buttons in the upper-right corner; change the **ControlBox** to **False**. (Double-click it to toggle from **True** to **False**.)
* Set YesButton to be the **AcceptButton**; change the **AcceptButton** property to **YesButton**.
* Set NoButton to be the **CancelButton**; change the **CancelButton** property to **NoButton**.
* The Pluralsight instructor’s suggestion was to change the **DialogResult** property of YesButton to be **Yes**. This may work for Visual Basic, but it did seem to work for C#; instead I set the dialog property to **OK.**
* The Pluralsight instructor’s suggestion was to change the **DialogResult** property of NoButton to be **No.** This may work for Visual Basic, but it did seem to work for C#; instead I set the dialog property to **Cancel**.
* Navigate to the handler btnExit\_Click().
* Add the following code to the body of btnExit\_Click().

var confirmDialog = new ConfirmDialog();

var dr = confirmDialog.ShowDialog();

if ( dr == DialogResult.OK )

{

this.Close();

}

You might notice a difference between the **if** statement above and the **if** statement suggested by the Pluralsight instructor. The **if** statement above tests the dialog-result value for the value **DialogResult.OK**, not **DialogResult.Yes**; the reason for this that **ShowDialog**’s return value is either **DialogResult.OK** or **DialogResult.Cancel**. This might be because of the difference between Visual Basic and C#; I did not try this example in Visual Basic.

I tried running the example, and it was successful, except for the use of the **Enter** key. (The **Esc** key worked.) The **Enter** key failed, because the control in ConfirmDialog that had focus (immediately after the dialog was shown) was NoButton, and typing the **Enter** key with this focus is the same as clicking NoButton. I resolved this problem by changing the **TabIndex** properties of YesButton and NoButton to 1 and 2 respectively.

***We do not have to rely on the return value from* ShowDialog() as *the example below illustrates.***

Add a button (btnNote) and a label (lblNote) to the form in [Demo: Dialogs (MessageBox).](#_Demo:_Dialogs_(MessageBox)) Double-click btnNote to create a skeleton event handler (btnNote\_Click()). Add a dialog (frmNote) to the solution - that contains a text box (txtNote) and a button (btnNote). Add the following code to btnNote\_Click().

var dlgNote = new frmNote();

dlgNote.ShowDialog();

var textBoxCtls = dlgNote.Controls.Find ( "txtNote", true );

lblNote.Text = textBoxCtls[0].Text;

The code above instantiates dlgNote from the frmNote class, opens it modally, and copies the text from its text box, when control returns to the main form. btnNote\_Click() in class frmNote contains the single statement

this.Close();

Run the application, and click the “Note” button. When the “Note” dialog displays, type some text into its text box, and then click its “Exit” button. Observe that the application copies its text to lblNote.

## Menu and Toolbars

Menus employ the **MenuStrip** and **ToolStripMenuItem** controls. Menu items are described by text, icons, and shortcut keys. When a character in menu text is preceded by “&”, the user can use <alt> + <that character> to invoke that text (instead of clicking it). The user invokes a shortcut of a menu item by typing <ctrl> + <some letter>. You can display images with menu entries. Images are available from the Visual Studio image library. ***I have downloaded and installed this library on the Windows-10 computer at***

***C:\Program Files (X86)\Microsoft Visual Studio\2019\VS2019 Image Library.zip***

The toolbar employs the **ToolStrip** control. An example of a control on a tool strip is the **ToolStripComboBox**, which is a wrapper around an ordinary combo box. Some, but not all, of the properties and events of wrapped control are accessible directly from the wrapper control; for others, it would be necessary to gain access via the wrapped control.

Windows Forms under .NET Framework, does not provide the ribbon control.

## Demo: Menu and Toolbars

We are going to need some thumbnail images for the following demo. The Pluralsight instructor advised downloading “Visual Studio Image Library”; this is a compressed (.zip) file containing a very large number of subfolders, each of which contains several image files with different extensions. In Windows Forms the “.png” extension is used very often. I selected the 2019 and 2012 versions of “Visual Studio Image Library”, and I downloaded these compressed files onto my Windows-10 computer - into subfolders of

C:\Program Files (X86)\Microsoft Visual Studio

But I found it very difficult to find the appropriate .png files from either of these Image Libraries. Ultimately, I copied a folder from the Pluralsight “Exercise Files” titled “Images” that contains the 9 .png files that we need for this course. I copied this folder to a location that makes it the sister folder to the folders that contain the various Visual Studio solution (.sln) files that shadow this course.

* Create a new solution and application. Name the solution and project “MenuTool”; we’ll use “MenuToolCS” for the C# version.
* Drag a **MenuStrip** from the toolbox to the main form. Visual Studio automatically docks the control at the top of the form.
* Click the **MenuStrip**. Visual Studio opens a place for the designer to type to the name of the leftmost menu. Type “&File”; then **Enter**. Visual Studio displays File; this means that “F” is the “quick” key, and that – instead of clicking File, the user can achieve the same effect typing <alt>F (case insensitive).
* Click under File, and then type “&New”; then **Enter**.
* Click under New, and then type “&Open”; then **Enter**.
* Before adding Save, we want a horizontal separator. Type “-” under Open; then **Enter**.
* What you should see now is File, *indent* New, *indent* Open, *indent* ----------- stacked vertically.
* Click under -----------, and then type “&Save”; then **Enter**.
* Click under Save, and then type “Save &As”; then **Enter**.
* For an example of a second top-level menu item, click in the box to the right of File, type “&Edit”; then **Enter**.
* Then one could add the children of Edit in a manner similar to File’s children.
* Let us return to the File menu; click File, then click New. Visual Studio displays a right-arrow followed by a box inviting a sub-menu under File -> New.
* Open the **Properties** window. Notice that the name of this menu-item control (at the top of **Properties**) is newToolStripMenuItem.
* Similarly examine the names of Open, Save, and Save As in **Properties**.
* Click New again. Click the property **ShortcutKeys**. Click the box to right of **ShortcutKeys**; then click the down-arrow that appears. Visual Studio opens the **Modifiers:** dialog for this menu item.
* Click the **Ctrl** checkbox. Open the **Key:** drop-down list; select “N”. Then click anywhere else. Visual Studio displays Ctrl+N to the right of New.
* Let us associate an image with this “File -> New” menu item. One of the **Properties** of this menu item is **Image**. Click **Image**. Visual Studio responds by displaying a small box containing “...” to the right of **Image**.
* Click “...”. Visual Studio responds by displaying the **Select Resource** dialog.
* Click the **Project Resource** radio button. Then click **Import...** Use the file navigator to go to **Images**; then click DocumentHS.png**.** Click **Open**. Visual Studio displays the name of the image in the box under **Properties\Resources.resx**.
* Click **OK** in the **Select Resource** dialog. Visual Studio displays the image to the left of New.
* Repeat the last 3 steps for File -> Open with openHS.png, and for File -> Save with saveHS.png.

***The first time I tried adding images to the menu items, I may have failed to follow the steps exactly, and the box the box under Properties\Resources.resx showed some strange file names. I saw files named*** DocumentHS1.png, openHS1.png, ***and*** saveHS1.png. ***There is a remedy. Open Resources.resx - via the Solution Explorer; in Visual Basic by double-clicking My Project , and then selecting the Resources tab (in the left panel). You will see these same strange files displayed in Visual Studio’s center pane. To remove one of these files, click the file, and then click RemoveResource in the toolbar at the top of the center pane. But, as a result of removing a resource, when you return to the designer view of the form, Visual Studio – at least in the C# version - might display an error message complaining that the removed resource is needed (e.g. in a menu item). The error message refers to a line of code in Form1.Designer.cs - in the region titled*** “Windows Form Designer Generated Code” - ***where the programmer is warned not to make modifications. The example that I encountered was in a statement that ended with***

= global::MenuToolCS.Properties.Resources.openHS1;

“openHS” ***was the correct name of the image;*** “openHS1” ***was erroneous. In spite of the warning, I deleted “*1*” from the statement, and that resolved the problem.***

* Drag a **ToolStrip** from the toolbox to the main form. Visual Studio automatically docks the control at the top of the form.
* Click the dropdown button at the right edge of the **ToolStrip**. Visual Studio displays a dropdown list showing the various toolbar options. **Button** is very commonly used.
* Select **Button**, and Visual Studio automatically adds it to the horizontal list of tools. This button will be used for “new”.
* Add two more buttons for “open” and “save”. Add a vertical separator. Add three more buttons for “cut”, “copy”, and “paste”.
* Click the leftmost button, and open the **Properties**  window. Rename the toolbar button to “NewToolStripButton”.
* Next to change its image, click **Image** property. Visual Studio responds by displaying a small box containing “...” to the right of **Image**.
* Click “...”. Visual Studio responds by displaying the **Select Resource** dialog.
* Click the **Project Resource** radio button. Visual Studio enables the list of resources below the **Project Resource** radio button.
* Select DocumentHS from the list of resources. Then click **OK**. Visual Studio changes NewToolStripButton’s image to the DocumentHS image.
* Click the **ToolTip Text** property; then type “New” to set its property. This text is shown when the mouse hovers over a control.
* Rename tool-strip buttons, add images, and supply tool-tip text for the remaining tool-strip buttons. You will need to import images for “cut”, “copy”, and “paste”.
* Select the File -> New menu item. Click the lightning icon at the top of the item’s **Properties** window to switch the “events” view.
* Select **Click** in the list of events. Double-click the menu item. Visual Studio creates a skeleton of the event handler. Repeat this for File -> Open and File -> Save.
* In the body of the File -> New’s **Click** event handler, type

MsgBox("You have clicked New")

* Put similar code into the event handlers for File -> Open and File -> Save.
* Select the “new” toolstrip button. Click the lightning icon at the top of the item’s **Properties** window to switch the “events” view.
* Select **Click** in the list of events. Click the down-arrow at the right edge of the “value” for this event. Visual studio displays a candidate list of events. Select the event handler for the File -> New menu item. (We are letting the menu item share an event handler with the toolstrip item.)
* Repeat the last two steps for the “open” and “save” toolstrip buttons.
* The “cut”, “copy”, and “paste” toolstrip buttons could also have event handlers, but for now they would be new event handlers; we don’t yet have “cut”, “copy”, and “paste” menu items.

You can repeat all of the steps in this section for MenuToolCS, the C# version of this project. To make it possible to use this application without the mouse, I have made the following enhancements.

* Change the **TabStop** property to **True** for the Menu Strip and for the Tool Strip.
* Set the **TabIndex** property to 1 for the Menu Strip and to 2 for the Tab Strip.

The **TabStop** **True** value makes it possible for the user to navigate to the Menu Strip and to the Tool Strip by typing the **Tab** key on the keyboard. When the cursor is at the Menu Strip, the user employ use all 4 arrow keys on the keyboard to navigate through the menu. When the cursor is at the Tool Strip, the user can employ the right and left arrow keys to navigate.