CS608 Lecture Notes

Visual Basic.NET Programming

Object-Oriented Programming

Custom Classes & Objects – Advanced Topics

(Part II of III)

(Lecture Notes 2B)

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Chapter 6 Classes & Objects -Advanced Concepts

6.1 Advanced Methods - Method Overloading

6.1.1 Introduction to Method Overloading

- As we know, you cannot have two variables or methods with the same name within a block of code say Module, Form, and Class etc.
- Names are unique and cannot be duplicated.
- Also, on a related topic, not only does a ***Method's*** name must be unique, but when you call a method you must call it with the same NUMBER of arguments and DATA TYPE as the NUMBER parameters and DATA TYPE of the declaration. For example:

  - If you declare a method named

    ```
    Public Sub CalculateTotal (ByRef decTotal As Decimal, ByVal decTax As Deciaml)

            decTotal = decSubTotal + (decSubTotal * decTax)

    End Sub
    ```

  - When you call this Method you must call it with the same NUMBER of arguments & DATA TYPE as follows:

    ```
    objInvoice.CalculateTotal(decTotalCharges, decSalesTax)
    ```

  - Any of the following statements will result in Compiler Errors:

    ```
    objInvoice.CalculateTotal(decTotalCharges)    'Error only one argument

    objInvoice.CalculateTotal(decTotalCharges, decSalesTax, decAmount)  'Error to many
    argu.


    objInvoice.CalculateTotal(intTotalCharges, decSalesTax)   'Error wrong data type

    objInvoice.CalculateTotal(decTotalCharges, strSalesTax)   'Error wrong data type
    ```

- Ok now we have reviewed the basic rules for naming and methods, lets take a look at what Method overloading does for us.
- Method Overloading allows you to do the following:

  - Create Methods with the Same Name
  - Each one accepting different NUMBERS of parameters
  - Each one accepting different DATA TYPE

- In short Method Overloading allows us to create those statements which generated errors in the above examples
- The rules to Method overloading is as follows:

  1. **You can create multiple methods with the same name, but the NUMBER of Parameters OR the data type must be different for each one.**

  2. **YOU CANNOT have two methods that are identical!!!! Same # of Parameters & Data Type**

  3. **Each Method can perform what ever functionality you code it to do.**

- So pretty much the rules have not changes, since each methods parameter or data type must be different for each method with the same name.
- The only rule that has been broken is having methods with the same name, but their number of parameters and data type must be different.

6.1.2 Overloading Regular Methods

- OK now what we understand what Method overloading is lets look at how to overload regular methods and an application of the rules
- The rules states that you can have two or more methods with the same name, but they cannot have the same number of parameters or data type.
- As an example lets look at the various valid declarations of the method ***CalculateTotal()***:

  - Using Method Overloading we can declare the following Methods inside a Class:

```
'No parameters version
Public Sub CalculateTotal ()

        'Code in what ever you desire here!
        decTotal = decSubTotal + (decSubTotal * decTax)
End Sub

'Two parameters version with data type: dec & dec
Public Sub CalculateTotal (ByRef decTotal As Decimal, ByVal decTax As Deciaml)

        decTotal = decSubTotal + (decSubTotal * decTax)
End Sub

'One parameters version with data type: dec
Public Sub CalculateTotal ( decTotal As Decimal)

        decTotal = decSubTotal  * decTax
End Sub

'One parameters version with data type: int
Public Sub CalculateTotal (ByVal intTotal As Integer)

        intTotal = intValue
End Sub

'Two parameters version with data type: int & int
Public Sub CalculateTotal (intTotal As Integer, charName As String)

        intTotal = intValue

        charNamel = charValue
End Sub
```

    - Note that not one of these methods are identical..**ONLY THE NAME!!!!!!**

  - From these declarations, we can make the following calls:

```
objInvoice.CalculateTotal(decTotalCharges)    'Will call the one-paremeter dec version

objInvoice.CalculateTotal(decTotalCharges, decSalesTax)  '2-parameter, 2-dec data types

objInvoice.CalculateTotal()   'No argument version

objInvoice.CalculateTotal(intTotalValue,  charClientName)    '2-par,  int  &  char  data
types

objInvoice.CalculateTotal(intValue)   '1-par, int data type version
```

  - Each of these calls will call the corresponding method that matches its number of parameter & data type

6.1.3 Overloading Constructor Methods

- One good place to use Method overloading is in the Constructor Method
- As you recall, we can create default (no argument) Constructor or Parameterize (arguments) constructors.
- But there was one draw back to using only a Parameterize Constructors was that once you crate one, you must always create the Object with those parameters, you cannot create Objects with no parameters. In order to do so you needed to explicitly also add a Default Constructor.
- For example, in the ***clsPerson*** class examples we covered, we needed to create both the default & the parameterized in order to be able to declare empty objects and those populated. This is our only option, we can only create objects with no parameters or three parameters ONLY!

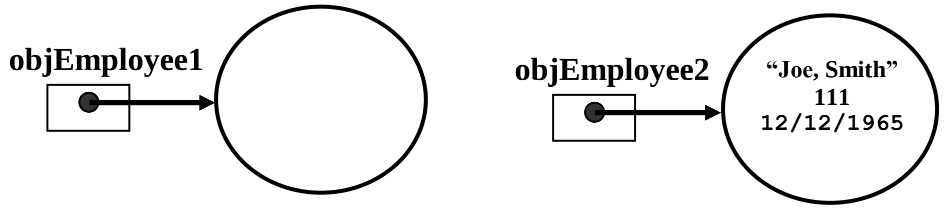
Example 1:

- Declaring a default and three parameters Constructors:

```
Public Class clsPerson
        Private strName As String
        Private intIDNumber As Integer
        Private dBirthDate As Date

        Public Sub New ()
                strName = “”
                intIDNumber = 0
                dBirthDate = #1/1/1900#
        End Sub


        Public Sub New (ByVal strNn As String, ByVal intID As Integer, ByVal dBDate As Date)
                strName = strNn
                intIDNumber = intID
                dBirthDate = dBDate
        End Sub

End Class
```

- Now we can create objects of the ***clsPerson*** Class using both the default or the 3 parameter constructor:

```
'Creating Objects with no Parameters and with Parameters:
Dim objEmployee1 As clsPerson = New clsPerson()
Dim objEmployee2 As clsPerson = New clsPerson(“Joe Smith”, 111, #12/12/1965#)
```



- **Note that these is our only options, to create a default or 3 parameter Objects**

- But supposed we wanted to also be able to create objects using only on parameter, or two or with different data types.
- In order to do this then we need to apply the rules to **Method Overloading**. Since a Constructor only has one name ***New***, we simply just need to create constructor with the number of parameters and data type we wish.
- For example using method overloading we can create the following Constructors for the ***clsPerson*** Class:

    - The Overloaded Constructor Methods inside the ***clsPerson*** Class:

Example 2:

- Declaring various Constructor Overloaded Methods:

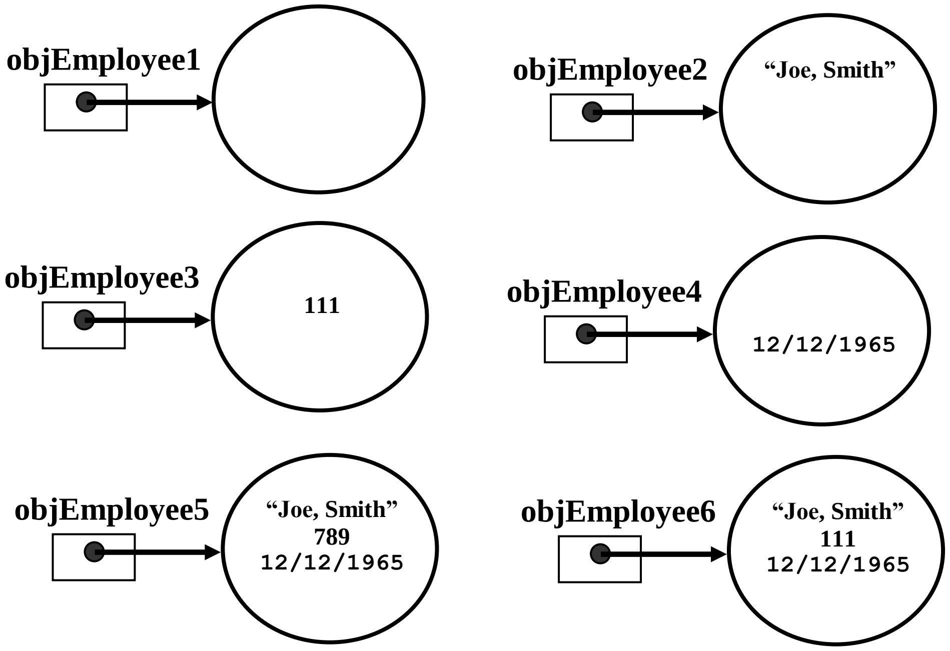
```
Public Class clsPerson
        Private strName As String
        Private intIDNumber As Integer
        Private dBirthDate As Date

        Public Sub New ()
                strName = “”
                intIDNumber = 0
                dBirthDate = #1/1/1900#
        End Sub

        Public Sub New (ByVal strNn As String)
                strName = strNn
                intIDNumber = 0
                dBirthDate = #1/1/1900#
        End Sub

        Public Sub New (ByVal intID As Integer)
                strName = “”
                intIDNumber = intID
                dBirthDate = #1/1/1900#
        End Sub

        Public Sub New (ByVal dBDate As Date)
                strName = “”
                intIDNumber = 0
                dBirthDate = dBDate
        End Sub

        Public Sub New (ByVal strNn As String, ByVal dBDate As Date)
                strName = strNn
                intIDNumber = CInt(Int((999 * Rnd()) + 111))  ‘Generates a random number between 999 and 111
                dBirthDate = dBDate
        End Sub


        Public Sub New (ByVal strNn As String, ByVal intID As Integer, ByVal dBDate As Date)
                strName = strNn
                intIDNumber = intID
                dBirthDate = dBDate
        End Sub



End Class
```

- In the calling program, we can create the various versions of ***clsPerson*** Objects:

Example 1 (Continue):

- In this example we created various Objects of the Class *clsPerson*, using the Overloaded constructors:

```
'Creating Objects with using the Overloaded Constructors:
Dim objEmployee1 As clsPerson = New clsPerson()
Dim objEmployee2 As clsPerson = New clsPerson("Joe Smith")
Dim objEmployee3 As clsPerson = New clsPerson(111)
Dim objEmployee4 As clsPerson = New clsPerson(#12/12/1965#)
Dim objEmployee5 As clsPerson = New clsPerson("Joe Smith", #12/12/1965#)
Dim objEmployee6 As clsPerson = New clsPerson("Joe Smith", 111, #12/12/1965#)
```



6.1.4 Sample Program 1 – Method Overloading

Module-Driven Windows Application – Adding Method Overloading Constructors to the Person Class

Problem statement:

- ❑ Using a Module-Driven Application (Startup Object = Sub Main()) we will demonstrate method overloading in the Person Class we created in previous examples.
- ❑ This example is test program to test the clsPerson Class, but instead of using a *Console Application*, we will use a *No-Form Module driven Windows Application*.
- ❑ We will reuse and keep all the features of the ***clsPerson*** Class from previous example, but we will overload the Constructor.
- ❑ In addition enhance the clsPerson Class by adding a new private data member named TotalItemsPurchased, which represents the total items a person Object has purchased.
- ❑ In addition we will add a new method named Shop(), which makes a Person Object shop. This method will simply sum the total number of items that the Person has purchased.
- ❑ This project will contain NO forms, only a Module. In the module we will create various Objects to test each of the Overloaded Constructors. In Sub Main() we will print each object to verify that the constructor worked.
- ❑ In addition to the other topics covered in previous examples, this Example will demonstrate the following topics:

  - ▪ Using a No-Form Module Driven Windows Application Test Program
  - ▪ Method Overloading

Class Requirements

- ❑ The class contains the following data, properties & methods members

(See UML Diagram)

Class Person Member Data:

▪ Name:	Type String
▪ IDNumber:	Type Integer.
▪ BirthDate:	Date
▪ Address:	Type String
▪ Phone:	Type String
▪ TotalItemsPurchased:	Type Integer

Class Member Overloaded Constructors Methods:

- ▪ New()
- ▪ New(Name)
- ▪ New(IDNumber)
- ▪ New(BirthDate)
- ▪ New(Name, BirthDate)
- ▪ New(Name, IDNumber, BirthDate, Address, Phone).

Class Member Properties & Methods:

- ▪ Properties for each data member.
- ▪ The Method PrintPerson(), which displays the Persons data
- ▪ Method Shop(), which sums the total items purchased

UML Class Diagram

clsEmployee
Name IDNumber BirthDate Address Phone TotalItemsPurchased

New()
New(N)
New(ID)
New(B)
New(N, B)
New(N, ID, B, A, P)
PrintPerson()
Shop()

Module Requirements

- ❑ The application will contains the following module and functionality:

  - ▪ ***modMainModule***: Create several objects to test each of the Overloaded Constructor methods.

  - ▪ In Sub Main() we will call the PrintPerson Method of each object to verify that the overloaded constructors worked.

HOW IT'S DONE:

Part I – Create The Class:

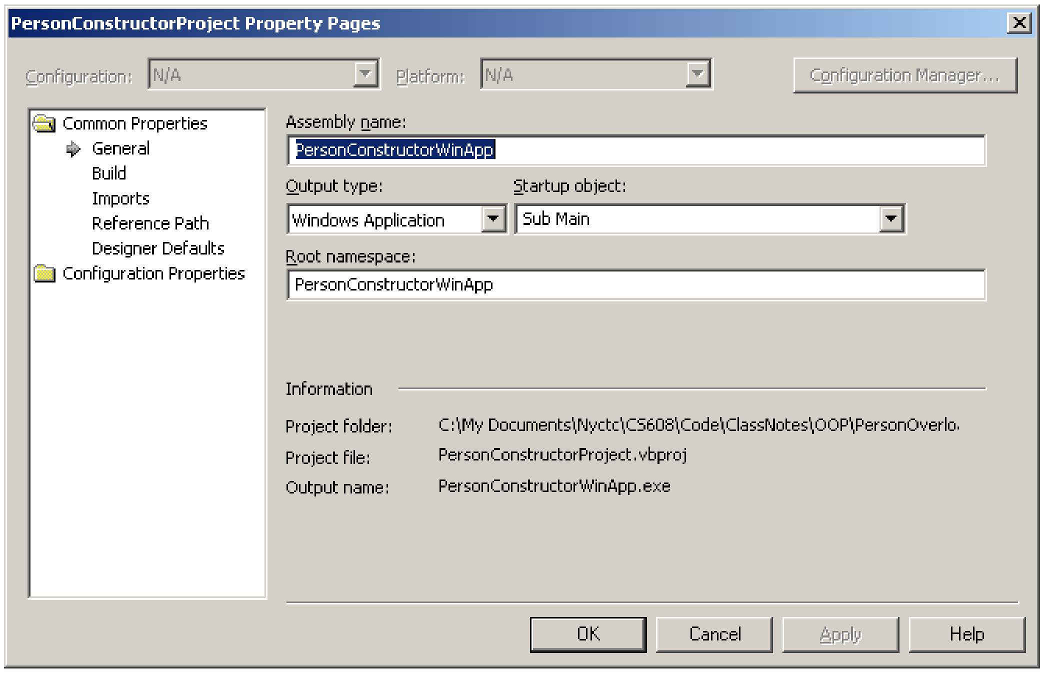
Step 1: Start a new Windows Application project:

Step 2: Add a Module to the project and set its properties as shown in the table:

Object	Property	Value
Module	File Name	**modMainModule**

Step 3: Set the Project's properties and set the Startup Object to Sub Main():

Object	Property	Value
Project	Name Startup Object	**CustomerFormWinApp** **frmCustomerForm**



Configuration: N/A
Platform: N/A

Assembly name: PersonConstructorWinApp
Output type: Windows Application
Startup object: Sub Main
Root namespace: PersonConstructorWinApp

Project folder: C:\My Documents\Nyctc\CS608\Code\ClassNotes\OOP\PersonOverlo
Project file: PersonConstructorProject.vbproj
Output name: PersonConstructorWinApp.exe

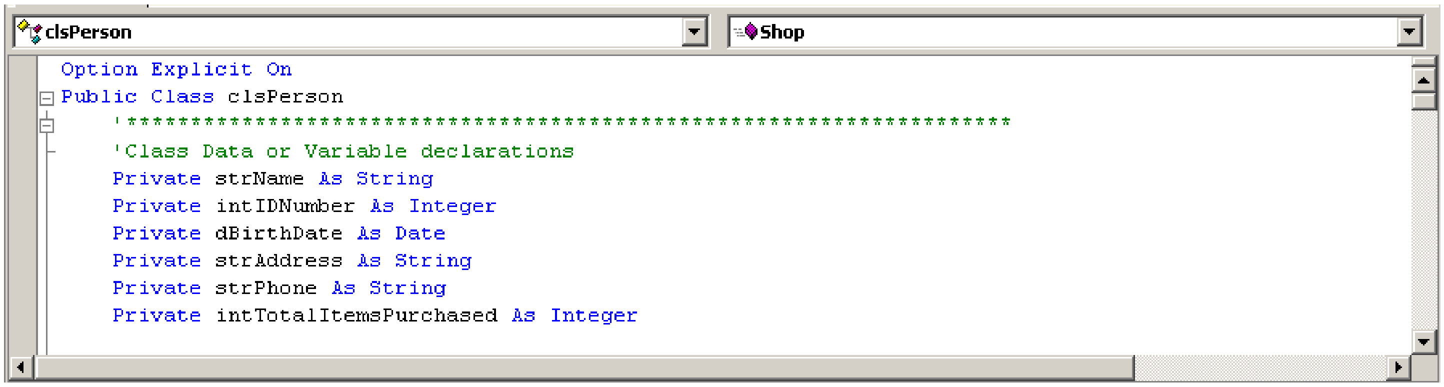
Step 4: Prepare to Reuse the Person Class from Previous Console Application, by Copying the File from previous Application Folder to the Folder of this Windows Application Project

1. Using Windows Explorer, navigate to the Console Application folder of the previous example.
2. Copy/Paste the file clsPerson.vb to this Project folder

Step 5: Add the Class to the Project

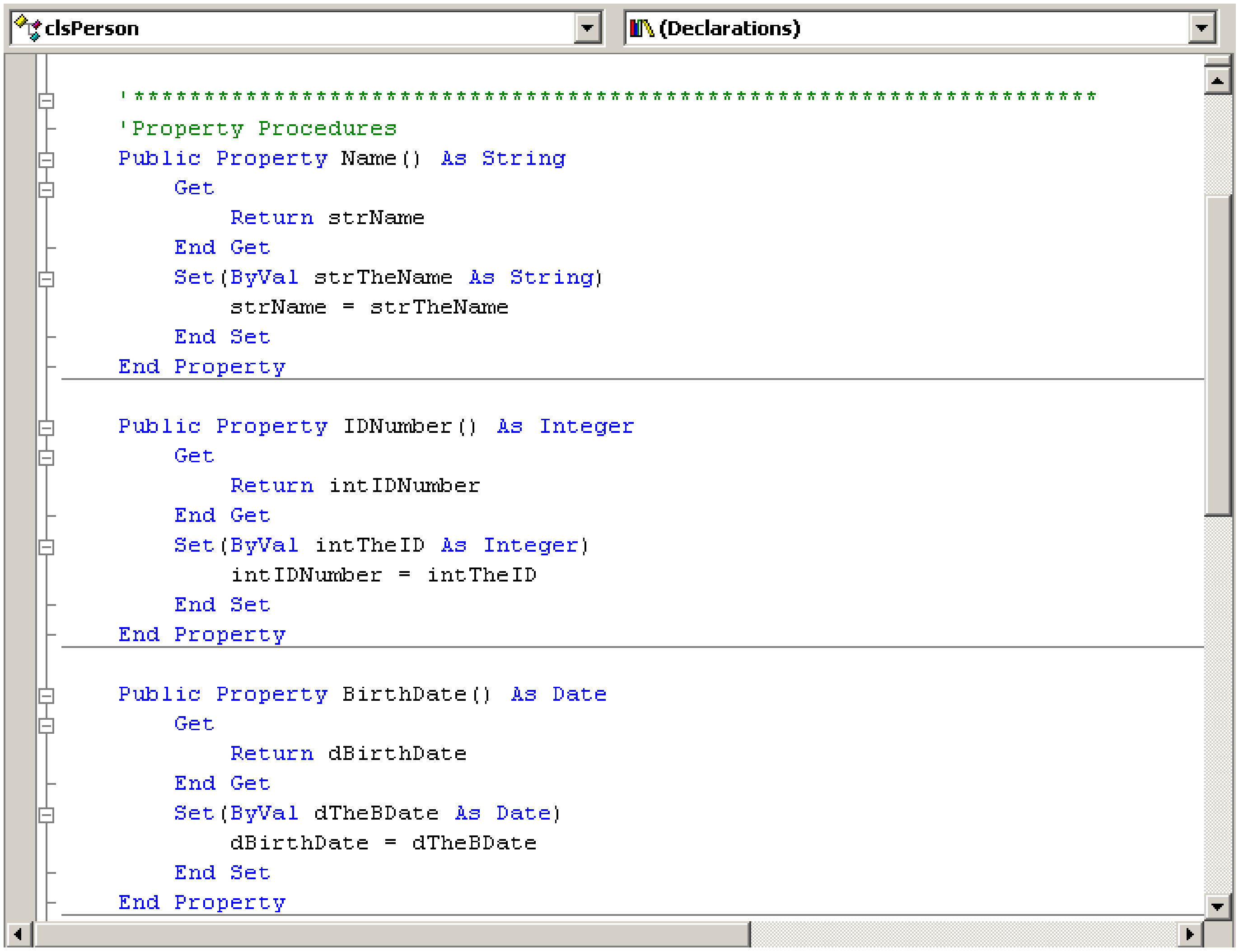
1. In the Project Menu, select Add Existing Item… and navigate to the project folder
2. Select the ***clsPerson.vb*** File and click OK
3. The class is now part of the project and ready to be reused!

Step 6: In the Class Module add an additional data member intTotalItemsPurchased:

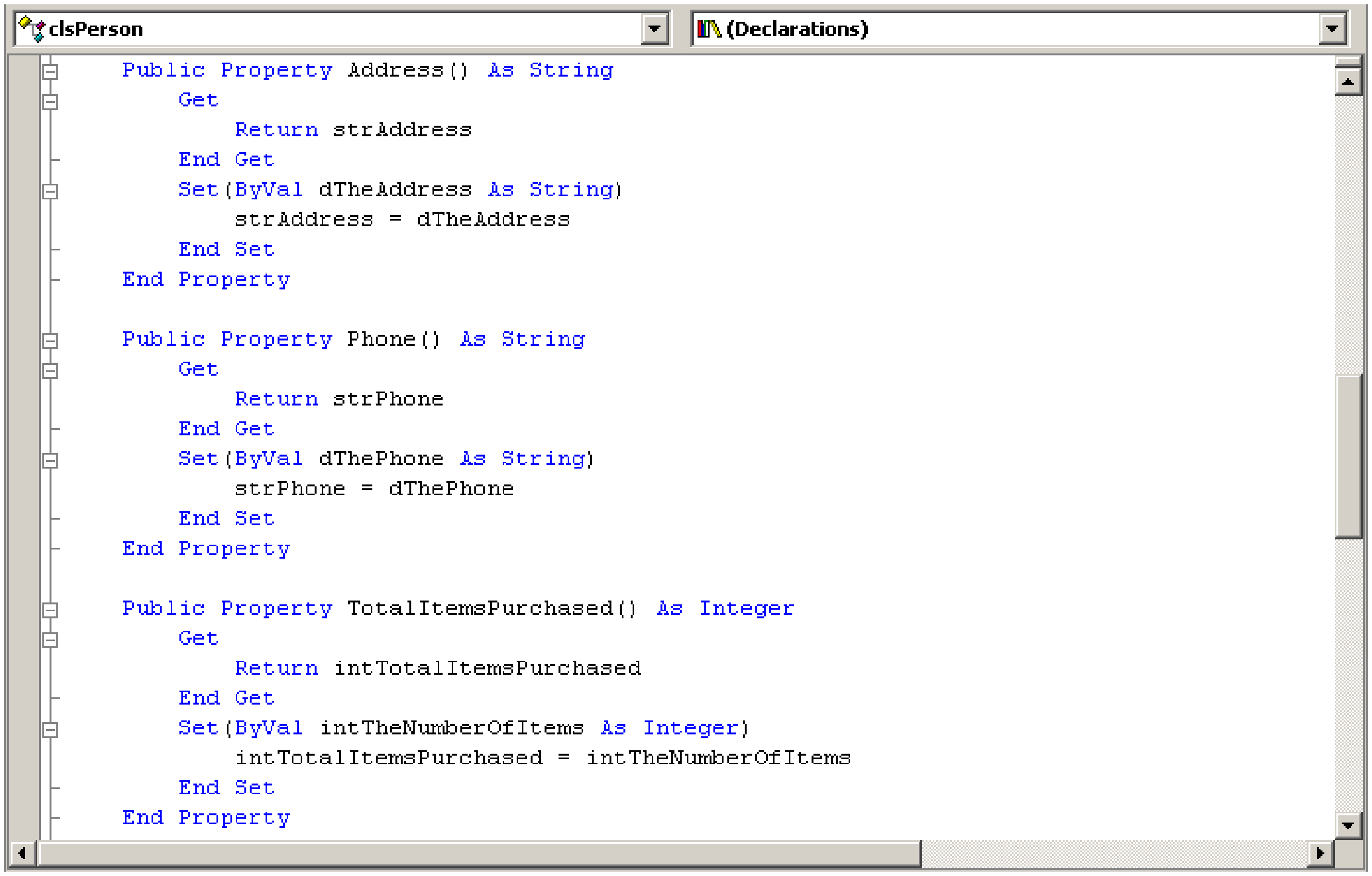


```
Option Explicit On
Public Class clsPerson
    '**********************************************************************
    'Class Data or Variable declarations
    Private strName As String
    Private intIDNumber As Integer
    Private dBirthDate As Date
    Private strAddress As String
    Private strPhone As String
    Private intTotalItemsPurchased As Integer
```

Step 7: In the Property Procedure section, add a Property for the intTotalItemsPurchased private data:

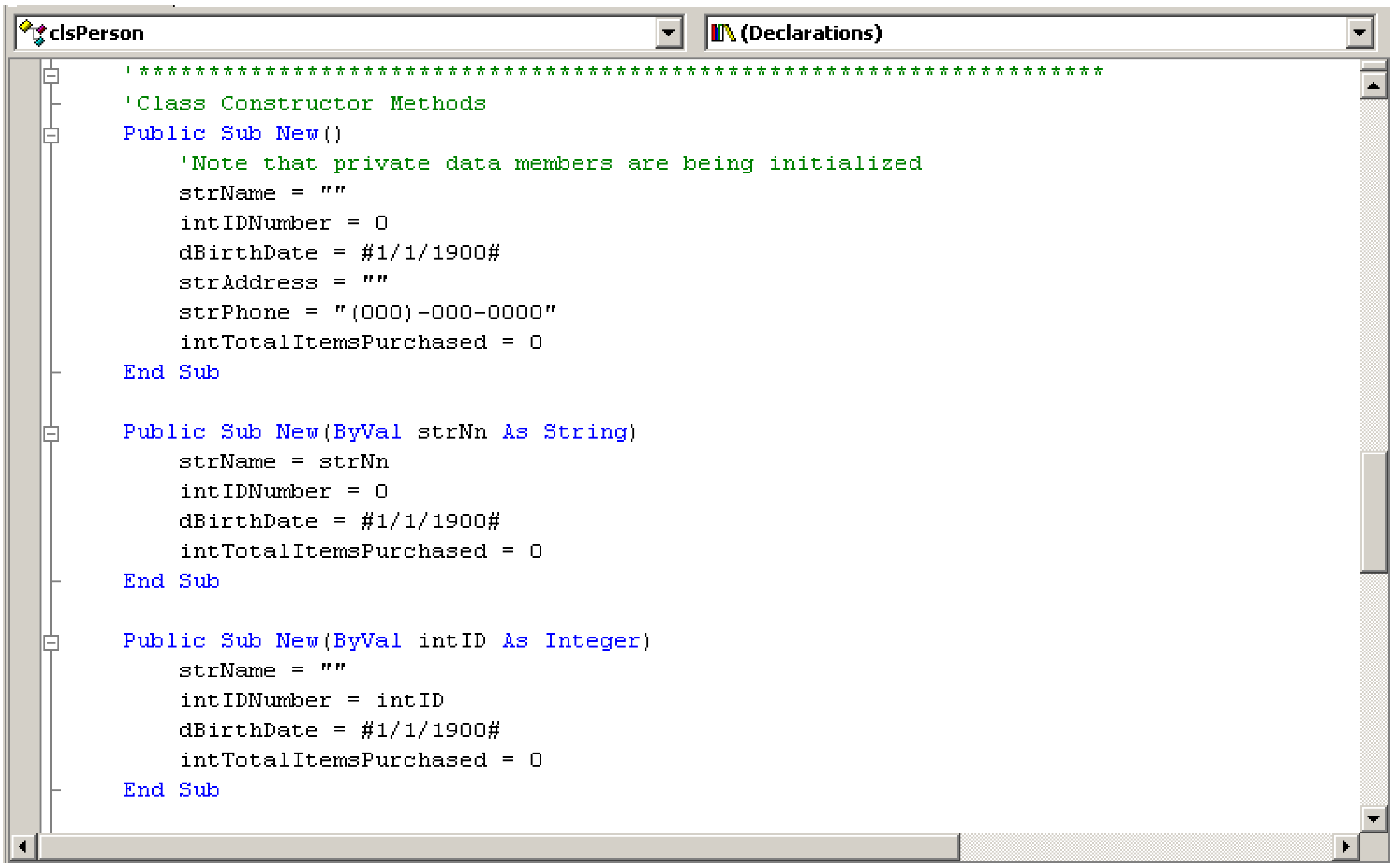


```
    '**********************************************************************
    'Property Procedures
    Public Property Name() As String
        Get
            Return strName
        End Get
        Set(ByVal strTheName As String)
            strName = strTheName
        End Set
    End Property

    Public Property IDNumber() As Integer
        Get
            Return intIDNumber
        End Get
        Set(ByVal intTheID As Integer)
            intIDNumber = intTheID
        End Set
    End Property

    Public Property BirthDate() As Date
        Get
            Return dBirthDate
        End Get
        Set(ByVal dTheBDate As Date)
            dBirthDate = dTheBDate
        End Set
    End Property
```

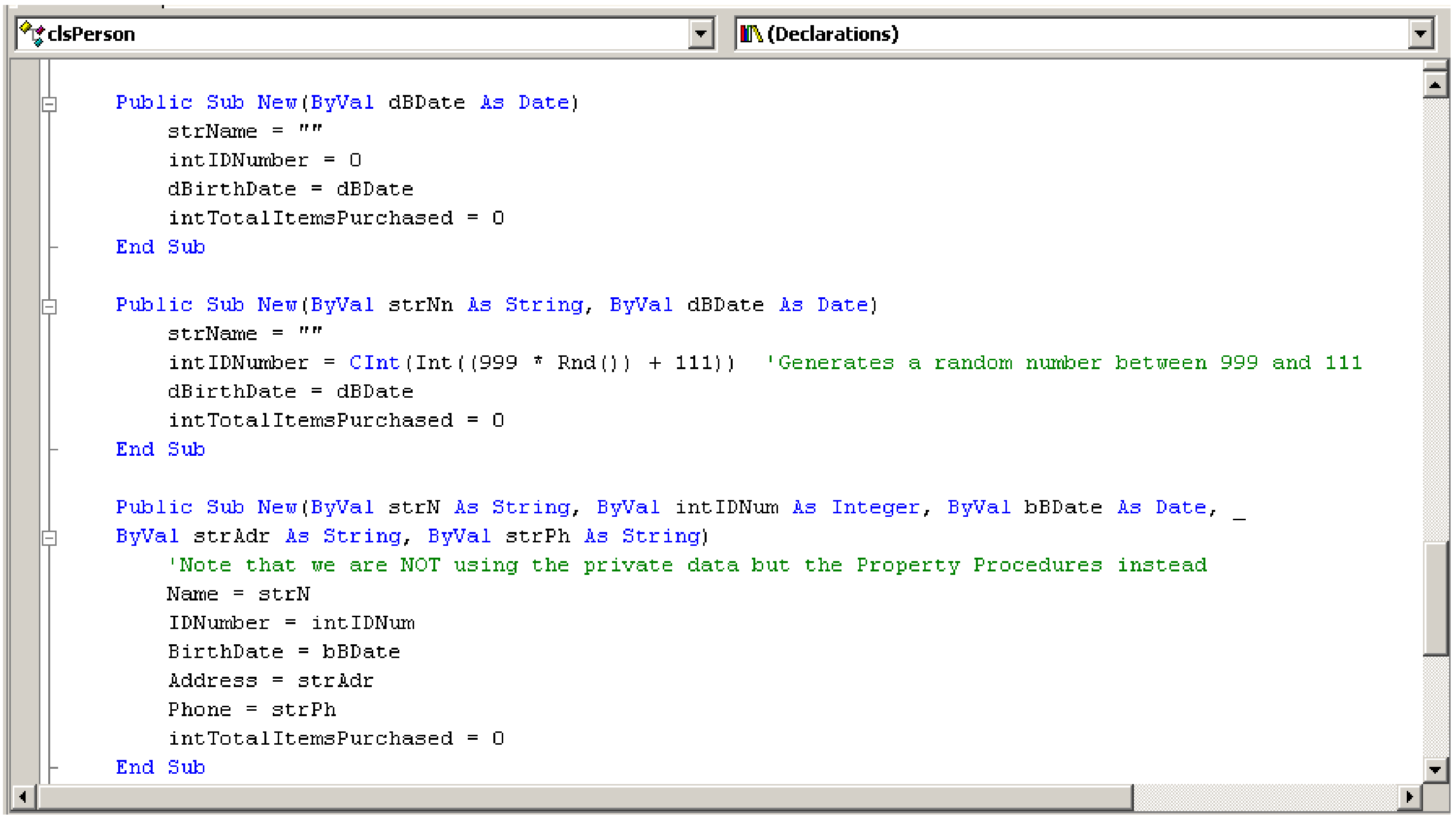


```
    Public Property Address() As String
        Get
            Return strAddress
        End Get
        Set(ByVal dTheAddress As String)
            strAddress = dTheAddress
        End Set
    End Property

    Public Property Phone() As String
        Get
            Return strPhone
        End Get
        Set(ByVal dThePhone As String)
            strPhone = dThePhone
        End Set
    End Property

    Public Property TotalItemsPurchased() As Integer
        Get
            Return intTotalItemsPurchased
        End Get
        Set(ByVal intTheNumberOfItems As Integer)
            intTotalItemsPurchased = intTheNumberOfItems
        End Set
    End Property
```

Step 8: In the Class Module code window Add the following Overloaded Constructor Methods:

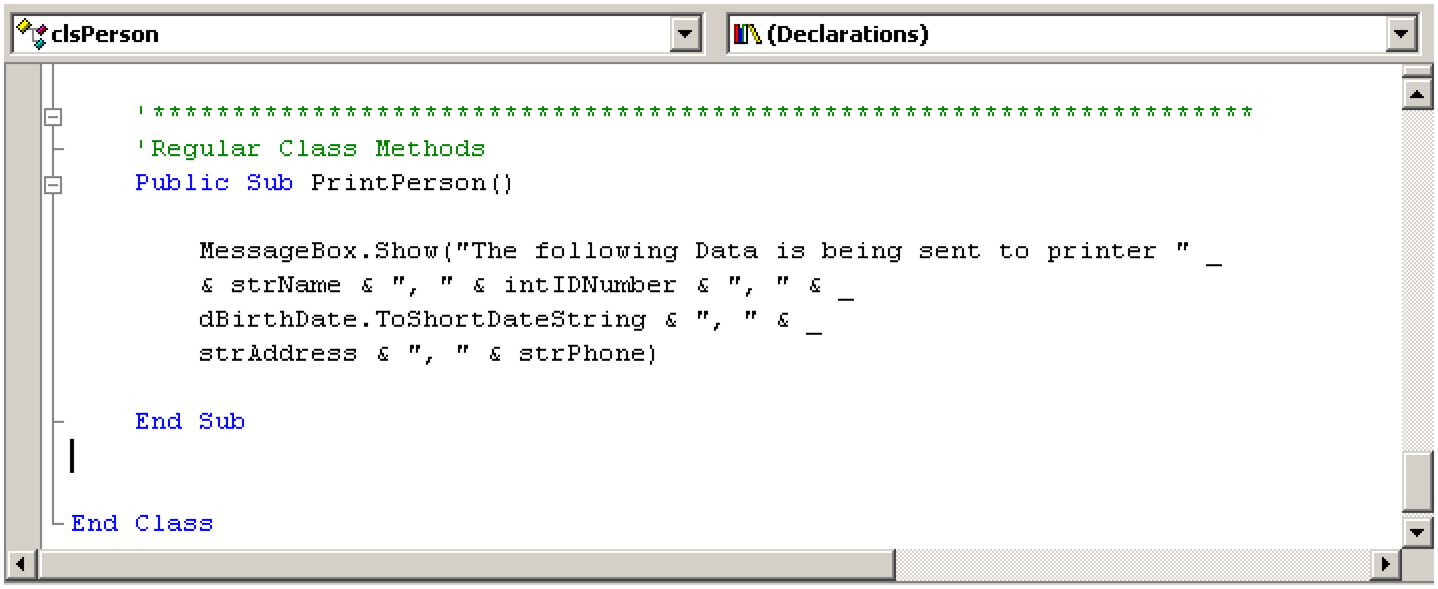

clsPerson (Declarations)

```
'*******************************************************************
'Class Constructor Methods
Public Sub New()
    'Note that private data members are being initialized
    strName = ""
    intIDNumber = 0
    dBirthDate = #1/1/1900#
    strAddress = ""
    strPhone = "(000)-000-0000"
    intTotalItemsPurchased = 0
End Sub

Public Sub New(ByVal strNn As String)
    strName = strNn
    intIDNumber = 0
    dBirthDate = #1/1/1900#
    intTotalItemsPurchased = 0
End Sub

Public Sub New(ByVal intID As Integer)
    strName = ""
    intIDNumber = intID
    dBirthDate = #1/1/1900#
    intTotalItemsPurchased = 0
End Sub
```



```
Public Sub New(ByVal dBDate As Date)
    strName = ""
    intIDNumber = 0
    dBirthDate = dBDate
    intTotalItemsPurchased = 0
End Sub

Public Sub New(ByVal strNn As String, ByVal dBDate As Date)
    strName = ""
    intIDNumber = CInt(Int((999 * Rnd()) + 111))  'Generates a random number between 999 and 111
    dBirthDate = dBDate
    intTotalItemsPurchased = 0
End Sub

Public Sub New(ByVal strN As String, ByVal intIDNum As Integer, ByVal bBDate As Date, _
ByVal strAdr As String, ByVal strPh As String)
    'Note that we are NOT using the private data but the Property Procedures instead
    Name = strN
    IDNumber = intIDNum
    BirthDate = bBDate
    Address = strAdr
    Phone = strPh
    intTotalItemsPurchased = 0
End Sub
```

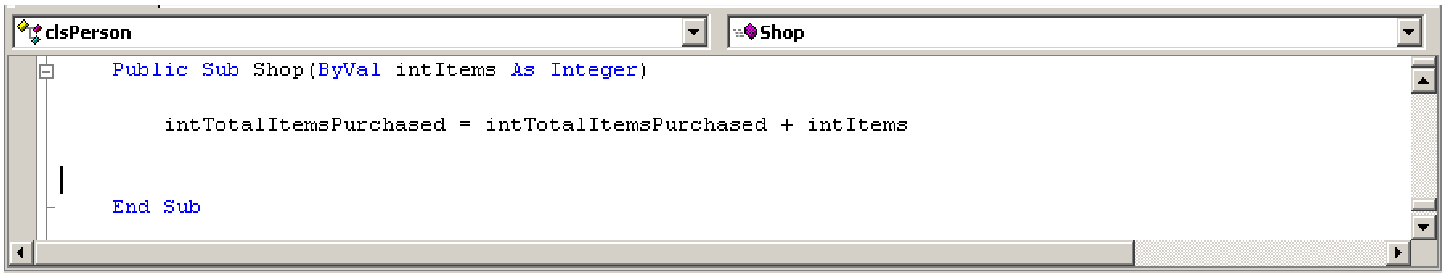
Step 9: In the Class Module keep the PrintPerson() Method as is:



```
    '*************************************************************************
    'Regular Class Methods
    Public Sub PrintPerson()

        MessageBox.Show("The following Data is being sent to printer " _
        & strName & ", " & intIDNumber & ", " & _
        dBirthDate.ToShortDateString & ", " & _
        strAddress & ", " & strPhone)

    End Sub

End Class
```

- ❖ **Remember that it is bad practice to display any forms or messages from within a Class. I do this only for teaching purposes to demonstrate a topic.**

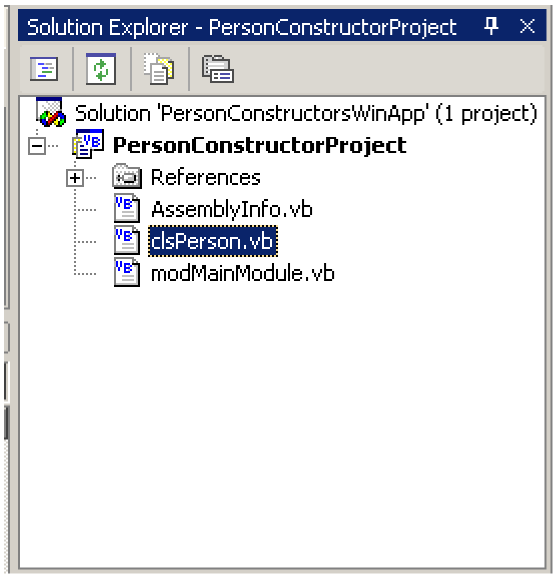
Step 10: In the Class Module Add the Shop() Method:



clsPerson | Shop

```
Public Sub Shop(ByVal intItems As Integer)

    intTotalItemsPurchased = intTotalItemsPurchased + intItems


End Sub
```

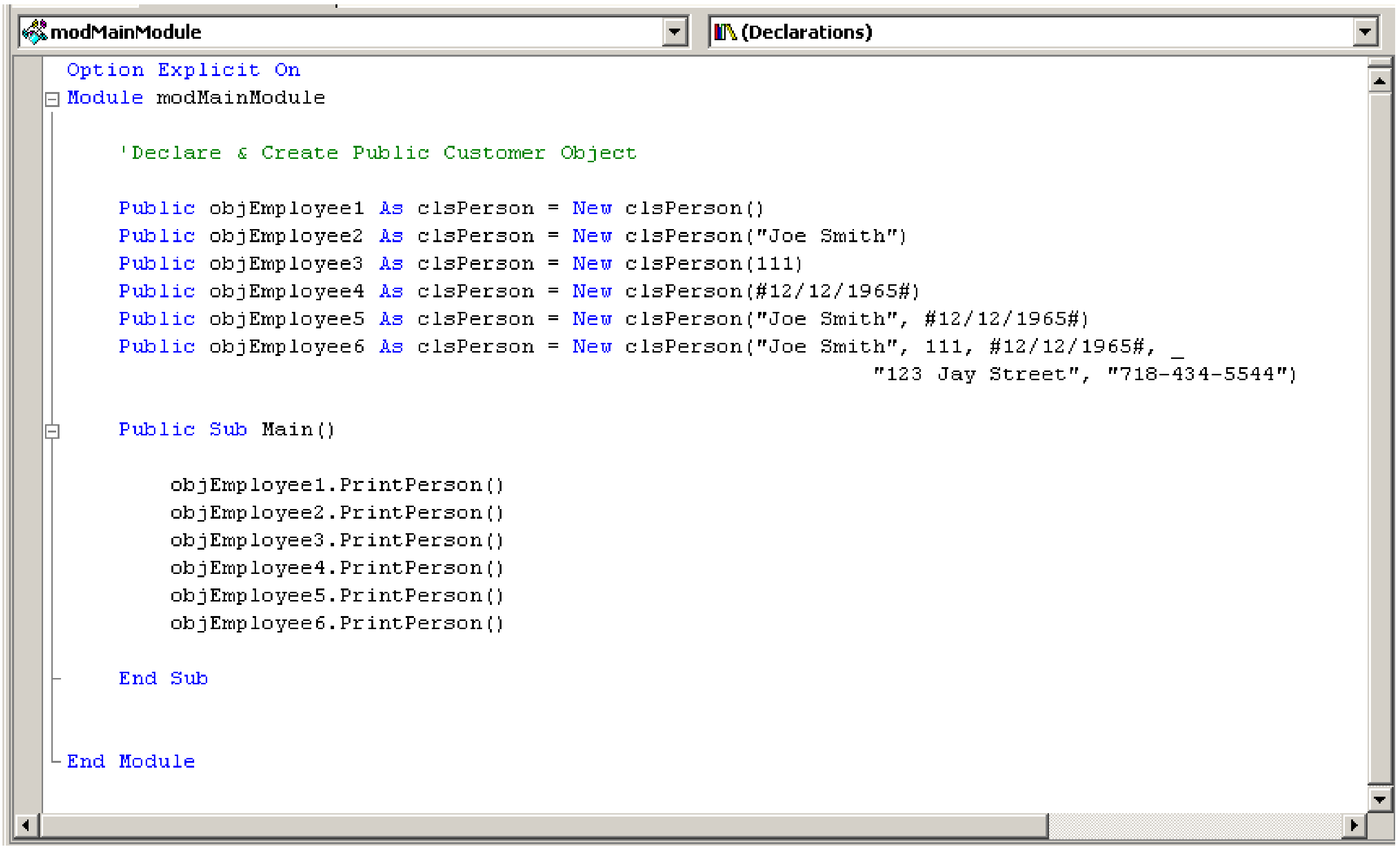
Step 11: At this Point the Project should look as follows:



```
Solution Explorer - PersonConstructorProject
Solution 'PersonConstructorsWinApp' (1 project)
  PersonConstructorProject
    References
    AssemblyInfo.vb
    clsPerson.vb
    modMainModule.vb
```

Part II & III – Create The Object and Use it (The User Interface)

Step 12: Add the following Code in the Module:

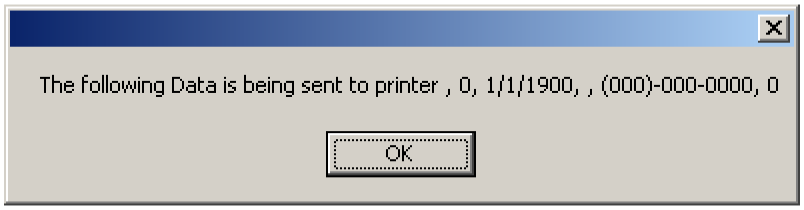


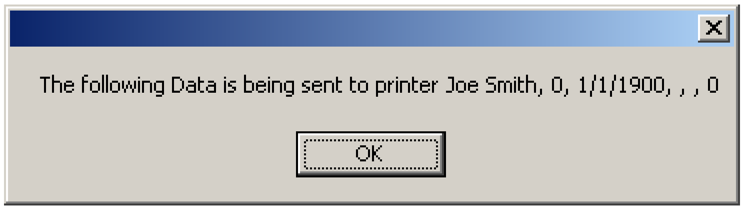
modMainModule

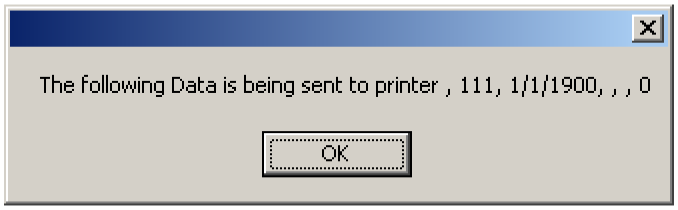
(Declarations)

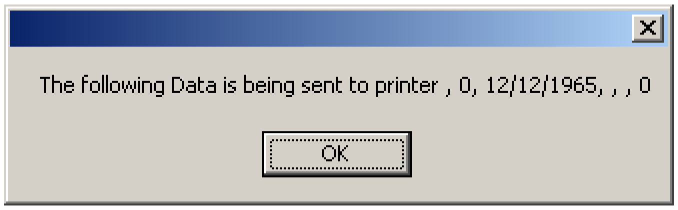
```
Option Explicit On
Module modMainModule

    'Declare & Create Public Customer Object

    Public objEmployee1 As clsPerson = New clsPerson()
    Public objEmployee2 As clsPerson = New clsPerson("Joe Smith")
    Public objEmployee3 As clsPerson = New clsPerson(111)
    Public objEmployee4 As clsPerson = New clsPerson(#12/12/1965#)
    Public objEmployee5 As clsPerson = New clsPerson("Joe Smith", #12/12/1965#)
    Public objEmployee6 As clsPerson = New clsPerson("Joe Smith", 111, #12/12/1965#, _
                                                      "123 Jay Street", "718-434-5544")


    Public Sub Main()

        objEmployee1.PrintPerson()
        objEmployee2.PrintPerson()
        objEmployee3.PrintPerson()
        objEmployee4.PrintPerson()
        objEmployee5.PrintPerson()
        objEmployee6.PrintPerson()

    End Sub


End Module
```

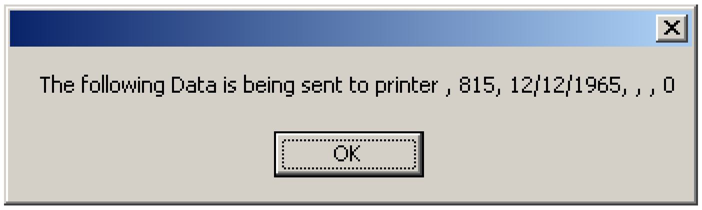
Step 13: Compile & Run the program:

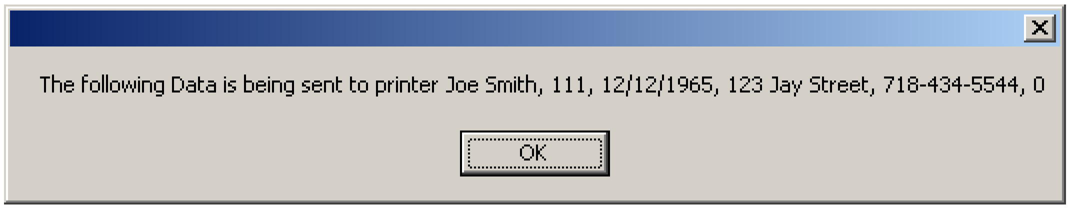

```
The following Data is being sent to printer , 0, 1/1/1900, , (000)-000-0000, 0
```


```
The following Data is being sent to printer Joe Smith, 0, 1/1/1900, , , 0
```


```
The following Data is being sent to printer , 111, 1/1/1900, , , 0
```


```
The following Data is being sent to printer , 0, 12/12/1965, , , 0
```


```
The following Data is being sent to printer , 815, 12/12/1965, , , 0
```


```
The following Data is being sent to printer Joe Smith, 111, 12/12/1965, 123 Jay Street, 718-434-5544, 0
```

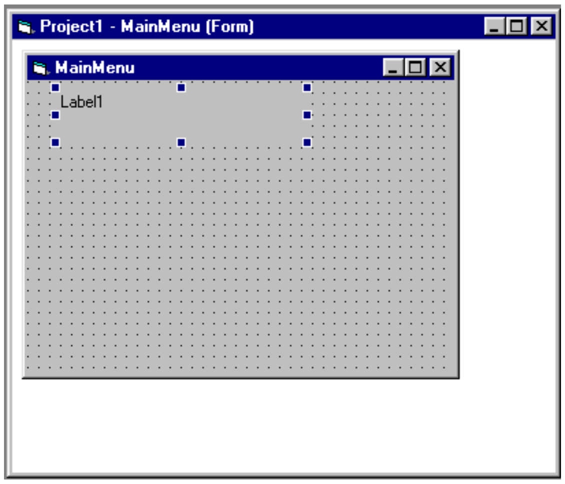
6.2 Creating Custom Events inside Our Custom Classes

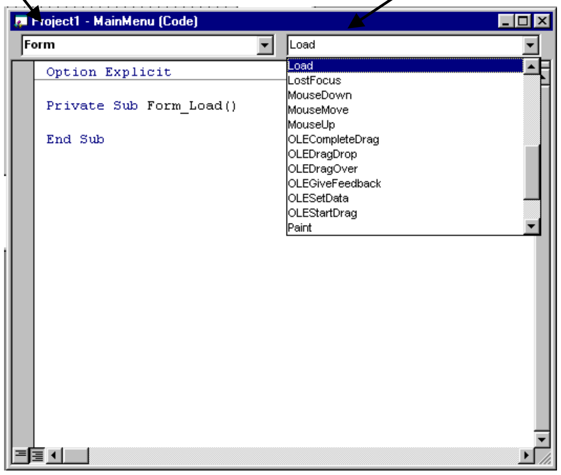
6.2.1 Events in Visual Basics.NET

- **Events** are <u>actions</u> taken upon the object by an outside force (User, Program code etc).
- **Events** or actions upon the object will automatically trigger **<u>Outside of the Object</u>** a specialized Methods known as ***Event-Handlers***.
- The key points here are *<u>automatically</u>* execution of the ***Event-Handler*** & that this ***Event-Handler*** is <u>automatically</u> ***<u>created Outside</u>*** the Object in a ***Form***, ***Module*** or another ***Object***.
- Using Events is a way of Objects communicating or sending notification of an activity or event inside the Object.

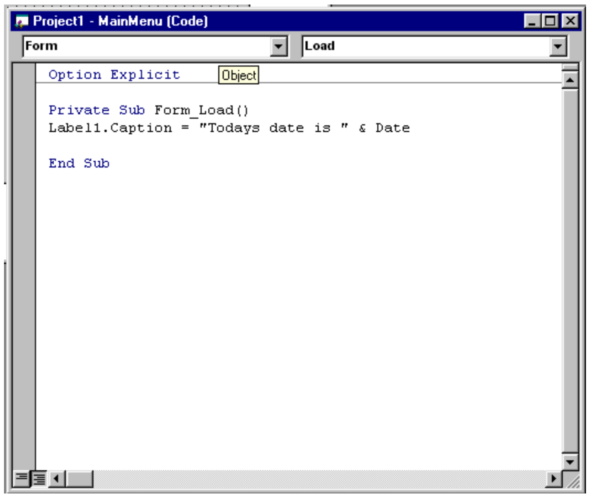
- VB.NET comes with a variety of *<u>predefined</u>* **Event-Handlers** in the Controls & Forms already created and ready for you to use. This was how you programmed in CS101 & 508 coding these Event-Handlers. Such programming is known as ***Event-Driven Programming***.
- VB Controls and forms can respond to hundreds of different <u>predefined</u> events, but you don't have to write any code to an event unless you want to. You only need to write event code, when you want something to happen in response to an event.
- ***Event-Handlers*** are found in the invisible aspect of a form or control, which can be accessed by double-clicking on the form or control. This will invoke the ***Object's Code Window***.
- In the Object's Code Window select the ***Object Combo-box*** and the list of available Events will appear in the ***Event Combo-box***.
- Now all you need to do is to enter the code you wish to execute when the event is triggered inside the Event-Handler. Again, that is if you want to, you don't have to add any code to react to the event if you don't want to.

Object selected ***Available events***





```
Option Explicit

Private Sub Form_Load()

End Sub
```



```
Option Explicit

Private Sub Form_Load()
Label1.Caption = "Todays date is " & Date

End Sub
```

6.2.2 Creating your own Events inside Objects

- One of the most powerful features of VB 6.0 is the ability to define our own ***Events*** in ***Class Objects***.
- Creating our own Events involves defining the event itself and generating ***Event- Handler*** procedure that will be available for us to enter code whenever the event is triggered inside the class.
- Note that there are two types of Events:
  1. **Regular Event Procedure -** Event which does NOT send out information to the outside word
  2. **Parameterized Event Procedure -** Event that DOES send information to the outside world, if this is the case then the event procedure will need parameters to store such information. ads

- There are two parts and several steps required to create you own event:

Part I – Inside the Class Module

a) In the declaration section of the Class Module declare the Event as Public

Part II – Inside the Class Module

a) In some desired location inside the class, Raise or Trigger the Event

Part III – Outside the Class

a) In the declaration section of the Form, Class or Module *Create* the Object with the Keyword ***WithEvents***.

Part IV – Outside the Class

a) In the Editor Code Window using the *drop-down list box* select the Event-Handler

b) If is required enter the code you want executed automatically when the event is fired!

- Lets go through the steps in more detail:

Step I – Declare the Event

- In the *declaration section* of the class declare the ***Event*** using the ***Public Event*** keyword and the name of the procedure.
  - At this point you need to decide if your event will send information from the Object to the outside world. If so, then you will need variables.

- The Syntax for declaring the Regular Event or Parameterized Event is as follows:

'Syntax for Declaring Event:
Public Event *EventName* ()

'Syntax for Declaring Event:
Public Event *EventName* (ByVal *variable* As *Type*, ByVal *variable* As *Type*…..)

Example 1:

- Assuming you needed to create an event named ***OnShopping()***, and this Event will NOT send any information out to the outside world, in the declaration section of the Class module declare the following Public Event:

Public Class *clsPerson*
```
        Private strName As String
        Private intIDNumber As Integer
        Private dBirthDate As Date
        Private intTotalItemsPurchased As Integer

        Public Event OnShopping()

        'Other Class Code...
        ..................
        ............
```

Example 2:

- Assuming you needed to create an event named ***OnShopping()*** but this time you want it to send the Total Number of Items purchased to the outside world. To implement you will need a Parameter or variable to store this value. In the declaration section of the Class module declare the following Public Event:

Public Class *clsPerson*

```
      Private strName As String
      Private intIDNumber As Integer
      Private dBirthDate As Date

      Public Event OnShopping(ByVal intTotalItems)


      'Other Class Code...
      ..................
      ............
```

End Class

Step II – Raise or Trigger Event

- At the location inside the class module either in a Property, Sub Procedure or Function, where ever you want the event to trigger, use the ***RaiseEvent*** keyword using the following syntax:

'Syntax for Declaring Event:
RaiseEvent *EventName* ()

'Syntax for Declaring Event:
Public Event *EventName* (*Argument1*, *Argument2*…..)

Example 3:

- Suppose you want to trigger the ***OnShopping*** Event when the Person shops. Assuming the Person Object contains a method named Shop() and you want to this event to fire every time the Shop() method is executed, the declaration is as follows:

```
Public Class clsPerson
      Private strName As String
      Private intIDNumber As Integer
      Private dBirthDate As Date

      Public Event OnShopping()

      'Other Class Code...
      ..................
      Public Sub Shop(ByVal intItems As Integer)
        intTotalItemsPurchased = intTotalItemsPurchased + intItems

        'Raise or trigger event & send information with the event
        RaiseEvent OnShopping()

      End Sub

End Class
```

Example 4:

- Now, suppose you want to trigger the ***OnShopping*** Event when the Person shops, but you also want to send the Total Number of Items Purchased with the event. Assuming the Person Object contains a method named Shop() and you want to this event to fire every time the Shop() method is executed and send the information as well, the declaration is as follows:

```
Public Class clsPerson
      Private strName As String
      Private intIDNumber As Integer
      Private dBirthDate As Date

      Public Event OnShopping(ByVal intTotalItems)

      'Other Class Code...
      ..................
      Public Sub Shop(ByVal intItems As Integer)
        intTotalItemsPurchased = intTotalItemsPurchased + intItems

        'Raise or trigger event & send information with the event
        RaiseEvent OnShopping(intTotalItemsPurchased)

      End Sub

End Class
```

Step III – (Outside the Class) Create Objects Using Keyword WithEvents

- In the Declaration Section of a Form or Class Module you need to create the Objects with the ability to trigger events

- Use any of the methods shown in previous lectures to create object. Use ***Dim***, ***Private***, or ***Public*** but use the keyword ***WithEvents***. The syntax are as follows:

Public WithEvents *ObjectName* **As** *ClassName* **= New** *ClassName***()**

Public WithEvents *ObjectName* **As New** *ClassName***()**

Public WithEvents *ObjectName* **As** *ClassName*

'Inside a Method Procedure enter the following statement to create the object:
ObjectName = **New** *ClassName***()**

❖ **Note only when you create an Object with the Keyword WithEvents will the Event Feature work. If you create an Object using the regular methods as shown in previous sections, the object's events will NOT WORK!**

Example 5:

- Suppose you want to create Objects of the ***clsPerson*** Class, but you want these objects to trigger the events create in the class. Assuming you create this Object inside a Form, the declaration is as follows:

```
Public Class frmEditForm

    'Declaration of Object WithEvents using default constructor
    Private WithEvents objPerson1 As clsPerson = New clsPerson()

    'Declaration of Object WithEvents using parameterized constructor
    Private WithEvents objPerson2 As clsPerson = New clsPerson("Joe Smith", _
                  111, #12/12/1965#, "192 East 8th, Brooklyn", "718-434-6677")



      'Other Form Code...
      ..................
      ............

End Class
```

Step IV (a,b) – (Optional & Outside the Class) a) Generate the Event-Handler and b) Enter Code in the Event-Handler

- **Step a)** – Once you create the Object using the Keyword *WithEvents*, either in a Form, Module or Class, you now have the ability to generate the ***Event-handler*** procedure that will execute **automatically** when the event is raised inside the object. This done as follows:
    1. In the Form Code Window using the Drop-Down List Box on the top left select the *WithEvent* Object.
    2. On the Drop-Down List Box on the top Right select the Event.
    3. The Event-handler will be AUTOMATICALLY GENERATED IN THE SAME LOCATION where the OBJECT resides.

- You now have the option to code in the ***Event handler*** in the same way that you would code and event handler from a Form or Control. To do this, simply select the object from the ***Object Combo box*** & then the Event handler from the ***Event Combo Box*** once you do this, the Event-Handler will appear inside the Form, Class or Module where the Object was created using *WithEvents*.

- The syntax for the Event-handlers that Do Not pass information from the Object:

```
'Syntax for Event_handler Procedure with no arguments. Note that the Handles Keyword states that the object is handling the event:
Private Sub objObject_Event () Handles objObject.Event

      'Body Code goes here!
End Sub
```

- The syntax for the Event-handlers that pass information from the Object:

```
'Syntax for Event_handler Procedure with arguments:
Private Sub objObject_Event (ByVal variable As Object) Handles objObject.Event

      'Body Code goes here!
End Sub
```

❖ **Note you that you DON'T have to memorize this Syntax, the method is generated AUTOMATICALLY!**

Example 6:

- We continuing the example of the ***clsPerson*** Class Object that contains the OnShopping Event, which is triggered in the method named Shop(). We will create two Objects of this class using *WithEvents*, this will make available the two Event-Handler in which we can enter what ever code we wish to execute when the Person Shops. Assuming you create this Object inside a Form, the declaration is as follows:

```
Public Class frmEditForm

      Public WithEvents objCustomer As New clsPerson()

          'Declare & Create Puclic Customer Object Initialized with Data
      Public WithEvents objManager As clsPerson = New clsPerson("Angel", 222, _
                          #12/12/1965#,"192 East 8th, Brooklyn", "718-434-6677")
      'Other Form Code...
      ..................

      Public Sub objCustomer_OnShopping(ByVal intTotalItems As Object) Handles
      objCustomer.OnShopping

      MessageBox.Show("Customer Event total is  " & intTotalItems)

      End Sub

      Public Sub objManager_OnShopping(ByVal intTotalItems As Object) Handles
      objManager.OnShopping

      MessageBox.Show("Manager Event total is  " & intTotalItems)
      End Sub
```

6.2.3 Sample Program 2 – Creating Custom Events

Form Driven Application – Adding Events to the Person Class

Problem statement:

- Using a Form Driven Application (Startup Object = Form) we will demonstrate adding events to the Person Class we created in Sample Program 2.
- We will reuse and keep all the features of the ***clsPeson*** Class from previous example.
- Also, we will add to the class, an Event named ***OnShopping*** and we will Raise this event in the ***Shop()*** Method of the ***clsPerson*** Class.
- We will drive this class using a Form that will allow us to display the object created and its data, and in addition allow us to click a button to purchase a number of items.
- In addition to the other topics covered in previous examples, this Example will demonstrate the following topics:

  - Creating our own Events

Class Requirements

- The class contains the following data, properties & methods members (See UML Diagram):

Class Person Member Data:

Name:	Type String
IDNumber:	Type Integer.
BirthDate:	Date
Address:	Type String
Phone:	Type String
TotalItemsPurchased:	Type Integer

Class Person Event Declaration:

- Public Event OnShopping(NumberOfItems):
- Event takes one argument representing total number of items purchase

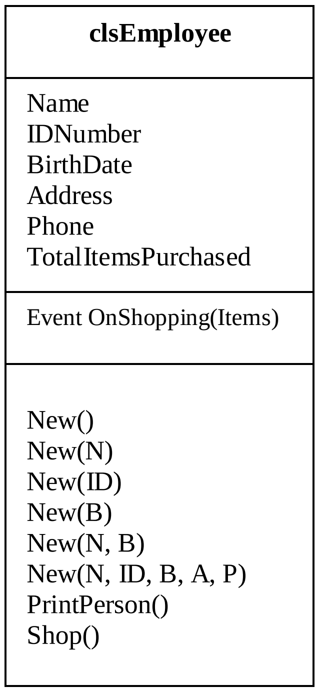
Class Member Overloaded Constructors Methods:

- New()
- New(Name)
- New(IDNumber)
- New(BirthDate)
- New(Name, BirthDate)
- New(Name, IDNumber, BirthDate, Address, Phone).

Class Member Properties & Methods:

- Properties for each data member.
- The Method PrintPerson(), which displays the Persons data
- Method Shop(), which sums the total items purchased and raises the *OnShopping* Event

UML Class Diagram



Form Requirements

- The application will contains the following Form and functionality:

  - ***frmCustomerForm***: Form to display the Customer information and allow customer to shop a number of items

  - The form will create one Objects of the Person Class ***WithEvents***

  - The Form will add code to the Event-Handler generated by the ***WithEvents*** Object.

HOW IT'S DONE:

Part I – Create The Class:

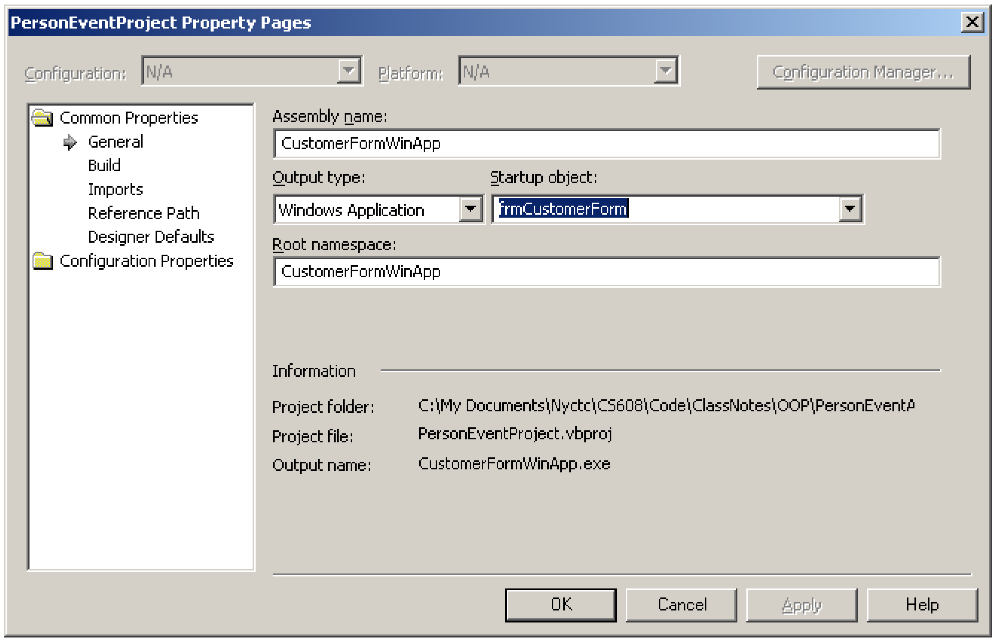
Step 1: Start a new Windows Application project:

Step 2: Add a Form to the project and set its properties as shown in the table:

Object	Property	Value
Form1	Name Text	**frmCustomerForm** **Customer Form**

Step 3: Set the Project's properties to behave as a Form Driven Application:

Object	Property	Value
Project	Name Startup Object	**CustomerFormWinApp** **frmCustomerForm**



Assembly name: CustomerFormWinApp
Output type: Windows Application
Startup object: frmCustomerForm
Root namespace: CustomerFormWinApp

Information
Project folder: C:\My Documents\Nyctc\CS608\Code\ClassNotes\OOP\PersonEventA
Project file: PersonEventProject.vbproj
Output name: CustomerFormWinApp.exe

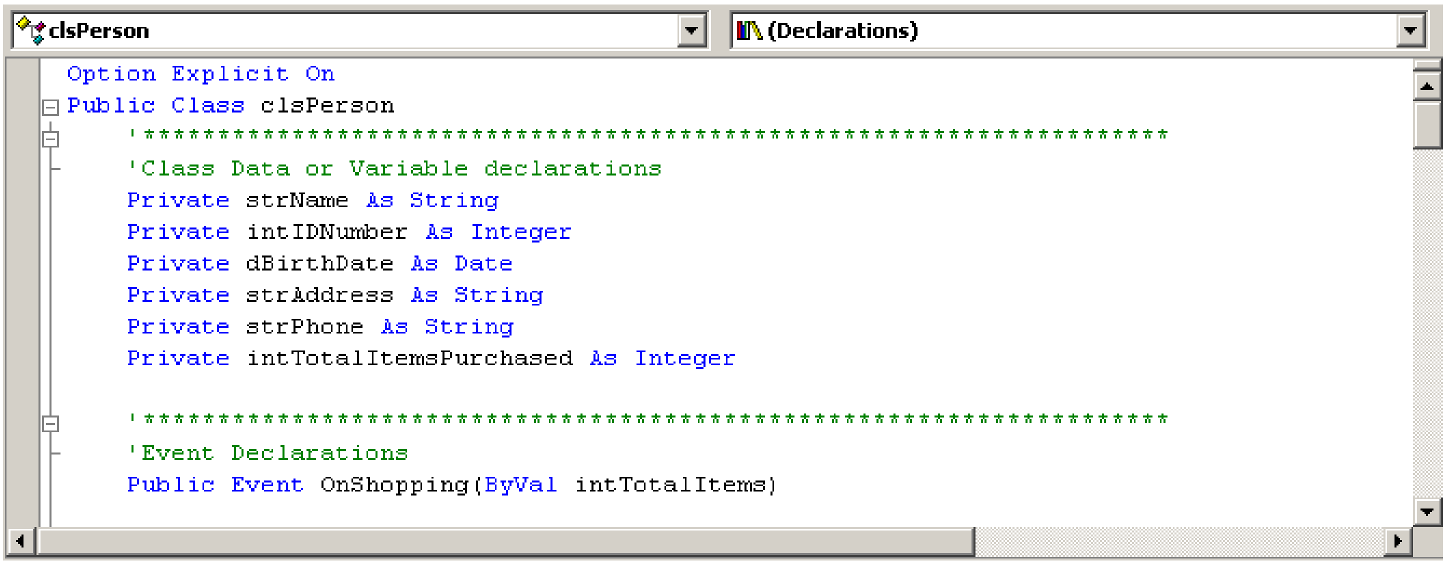
Step 4: Prepare to Reuse the Person Class from Previous Console Application, by Copying the File from previous Application Folder to the Folder of this Windows Application Project

1. Using Windows Explorer, navigate to the Console Application folder of the previous example.
2. Copy/Paste the file clsPerson.vb to this Project folder

Step 5: Add the Class to the Project

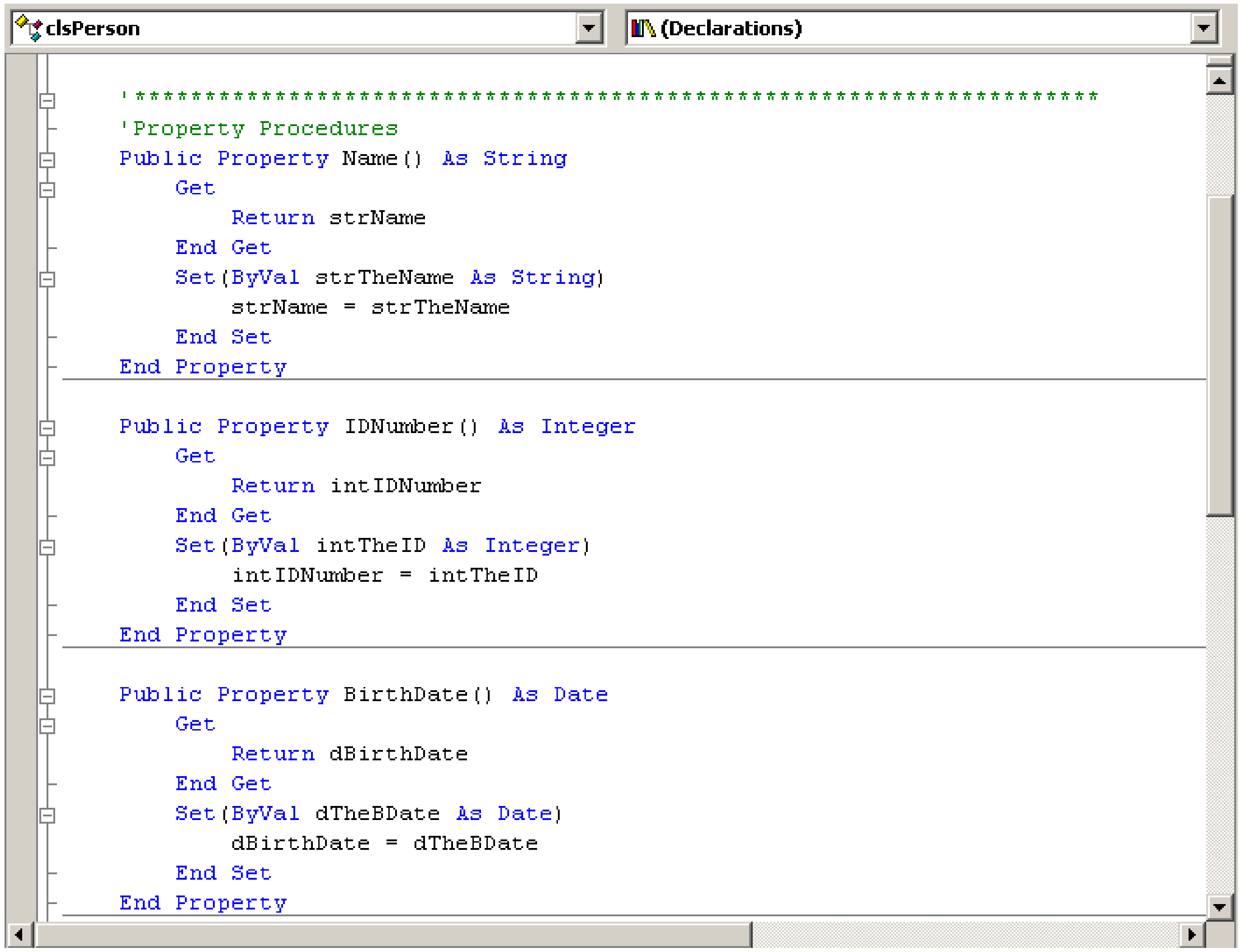
1. In the Project Menu, select Add Existing Item… and navigate to the project folder
2. Select the ***clsPerson.vb*** File and click OK
3. The class is now part of the project and ready to be reused!

Step 4: In the Class Module Declare the OnShopping Event:

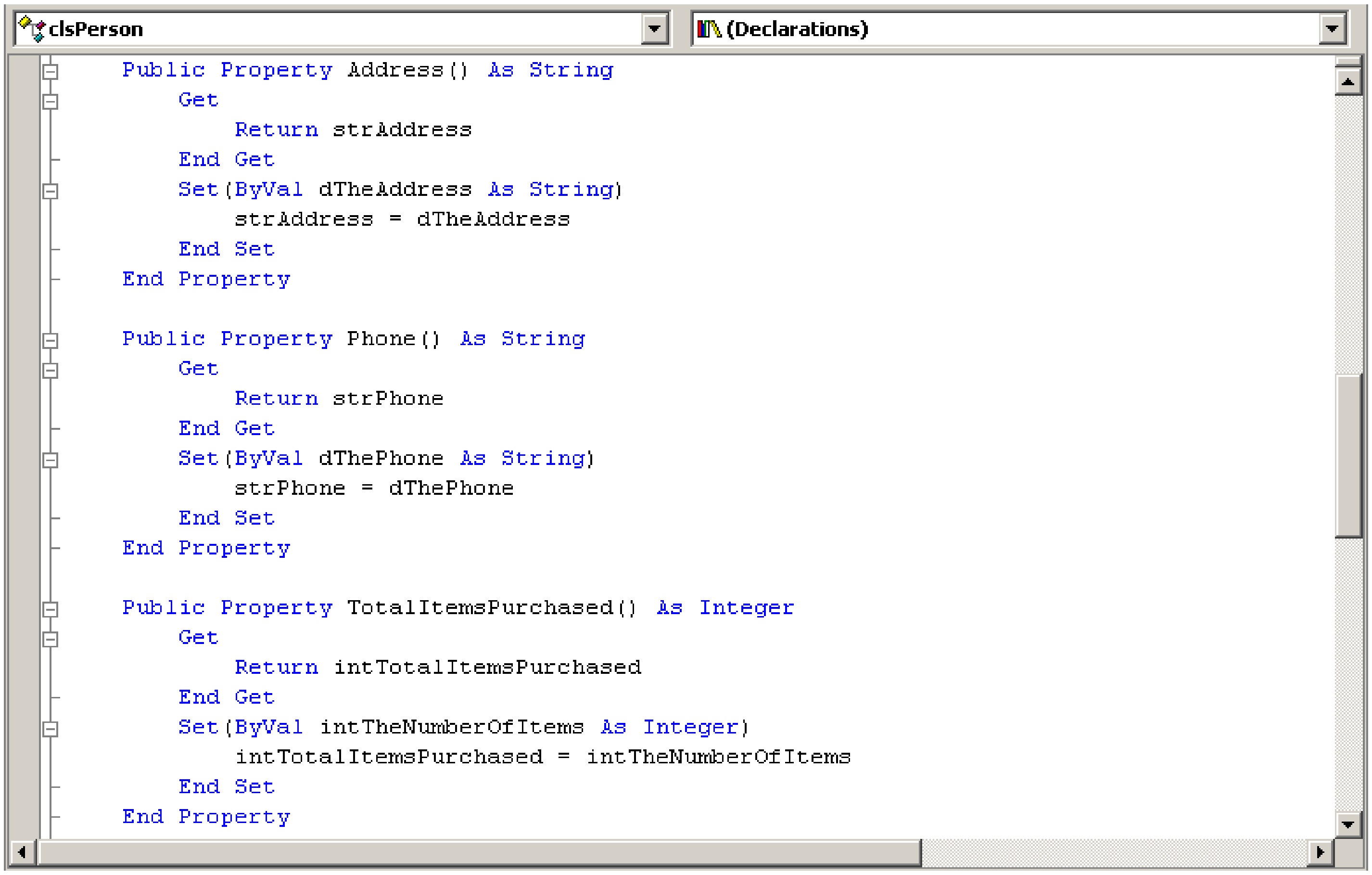


```
Option Explicit On
Public Class clsPerson
    '*********************************************************************
    'Class Data or Variable declarations
    Private strName As String
    Private intIDNumber As Integer
    Private dBirthDate As Date
    Private strAddress As String
    Private strPhone As String
    Private intTotalItemsPurchased As Integer

    '*********************************************************************
    'Event Declarations
    Public Event OnShopping(ByVal intTotalItems)
```

Step 5: Leave the Property Procedure as is:

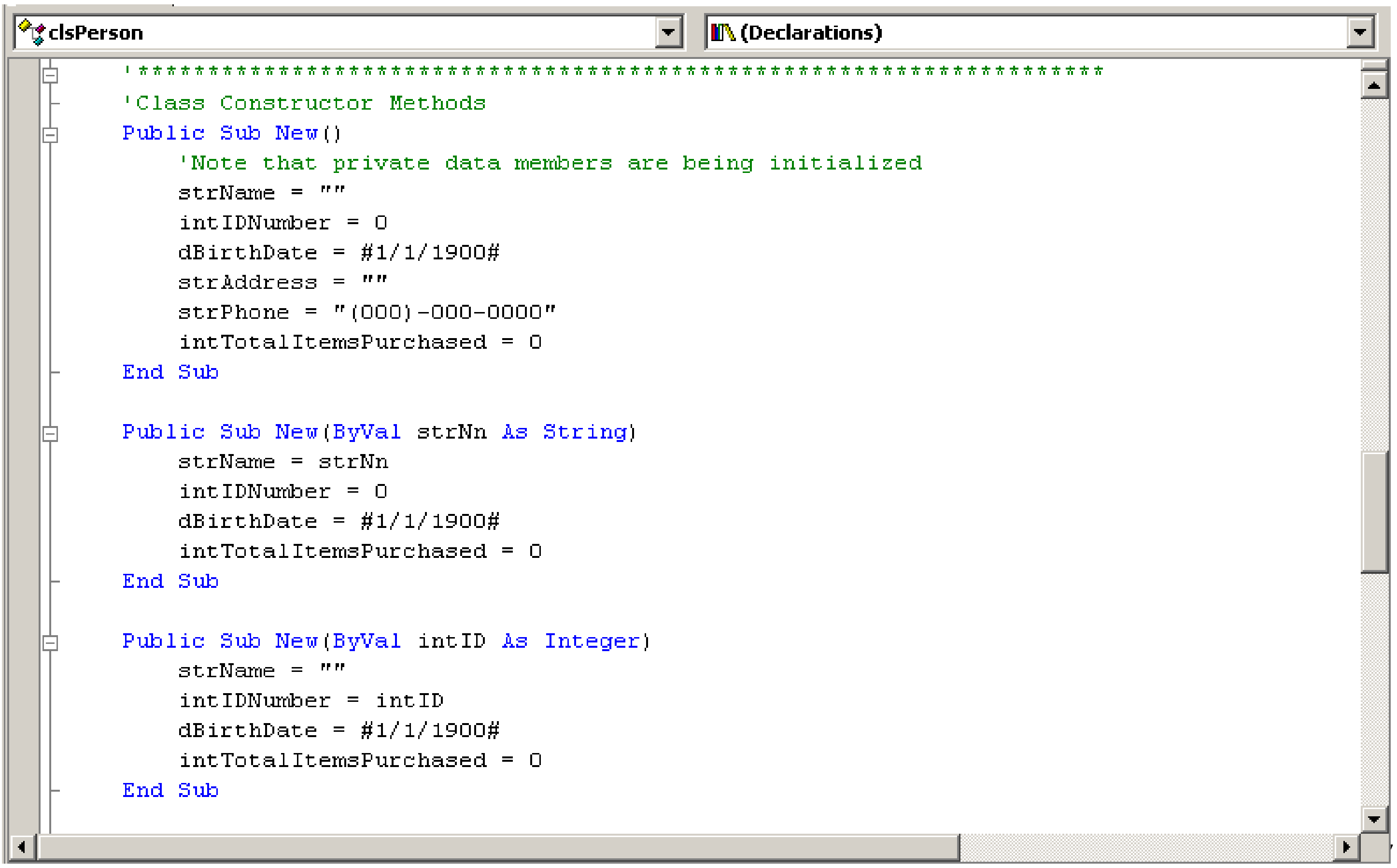


```
    '*********************************************************************
    'Property Procedures
    Public Property Name() As String
        Get
            Return strName
        End Get
        Set(ByVal strTheName As String)
            strName = strTheName
        End Set
    End Property

    Public Property IDNumber() As Integer
        Get
            Return intIDNumber
        End Get
        Set(ByVal intTheID As Integer)
            intIDNumber = intTheID
        End Set
    End Property

    Public Property BirthDate() As Date
        Get
            Return dBirthDate
        End Get
        Set(ByVal dTheBDate As Date)
            dBirthDate = dTheBDate
        End Set
    End Property
```

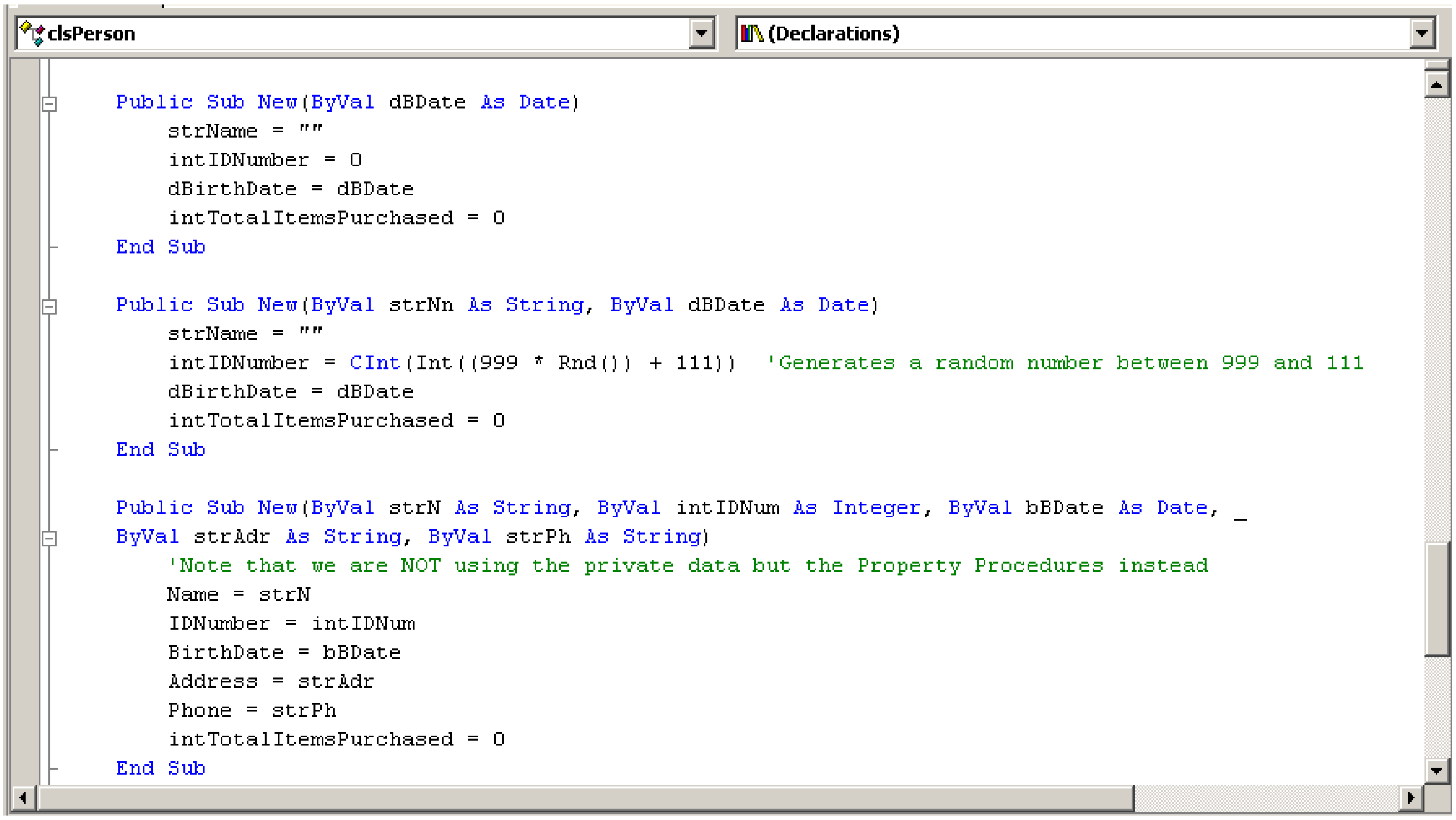


```
Public Property Address() As String
    Get
        Return strAddress
    End Get
    Set(ByVal dTheAddress As String)
        strAddress = dTheAddress
    End Set
End Property

Public Property Phone() As String
    Get
        Return strPhone
    End Get
    Set(ByVal dThePhone As String)
        strPhone = dThePhone
    End Set
End Property

Public Property TotalItemsPurchased() As Integer
    Get
        Return intTotalItemsPurchased
    End Get
    Set(ByVal intTheNumberOfItems As Integer)
        intTotalItemsPurchased = intTheNumberOfItems
    End Set
End Property
```

Step 6: In the Class Module code window keep the code for the Constructor Methods:

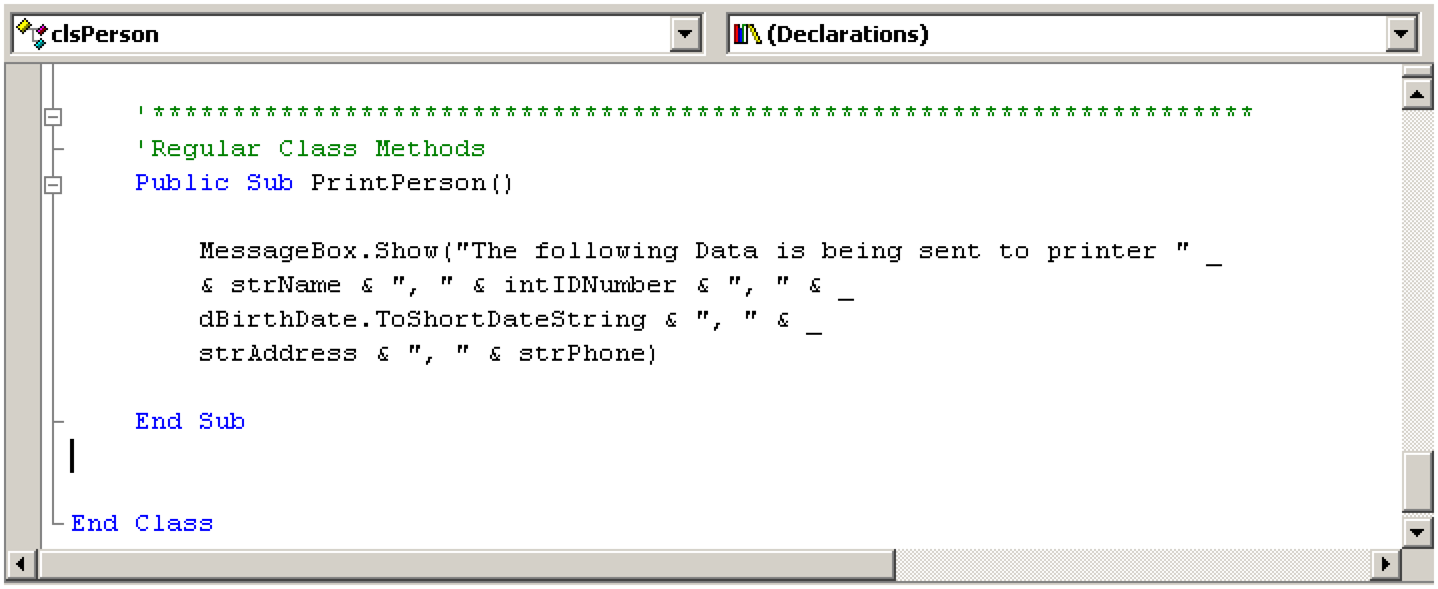


```
'**********************************************************************
'Class Constructor Methods
Public Sub New()
    'Note that private data members are being initialized
    strName = ""
    intIDNumber = 0
    dBirthDate = #1/1/1900#
    strAddress = ""
    strPhone = "(000)-000-0000"
    intTotalItemsPurchased = 0
End Sub

Public Sub New(ByVal strNn As String)
    strName = strNn
    intIDNumber = 0
    dBirthDate = #1/1/1900#
    intTotalItemsPurchased = 0
End Sub

Public Sub New(ByVal intID As Integer)
    strName = ""
    intIDNumber = intID
    dBirthDate = #1/1/1900#
    intTotalItemsPurchased = 0
End Sub
```



```
    Public Sub New(ByVal dBDate As Date)
        strName = ""
        intIDNumber = 0
        dBirthDate = dBDate
        intTotalItemsPurchased = 0
    End Sub

    Public Sub New(ByVal strNn As String, ByVal dBDate As Date)
        strName = ""
        intIDNumber = CInt(Int((999 * Rnd()) + 111))  'Generates a random number between 999 and 111
        dBirthDate = dBDate
        intTotalItemsPurchased = 0
    End Sub

    Public Sub New(ByVal strN As String, ByVal intIDNum As Integer, ByVal bBDate As Date, _
    ByVal strAdr As String, ByVal strPh As String)
        'Note that we are NOT using the private data but the Property Procedures instead
        Name = strN
        IDNumber = intIDNum
        BirthDate = bBDate
        Address = strAdr
        Phone = strPh
        intTotalItemsPurchased = 0
    End Sub
```

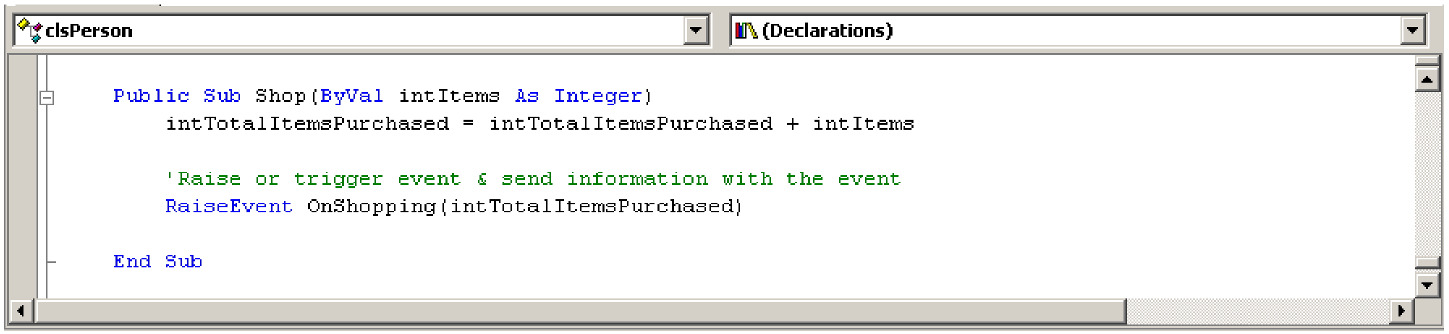
Step 7: In the Class Module keep the PrintPerson() Method as is:



```
    '**********************************************************************
    'Regular Class Methods
    Public Sub PrintPerson()

        MessageBox.Show("The following Data is being sent to printer " _
        & strName & ", " & intIDNumber & ", " & _
        dBirthDate.ToShortDateString & ", " & _
        strAddress & ", " & strPhone)

    End Sub

End Class
```

- ❖ **Remember that it is bad practice to display any forms or messages from within a Class. I do this only for teaching purposes to demonstrate a topic.**

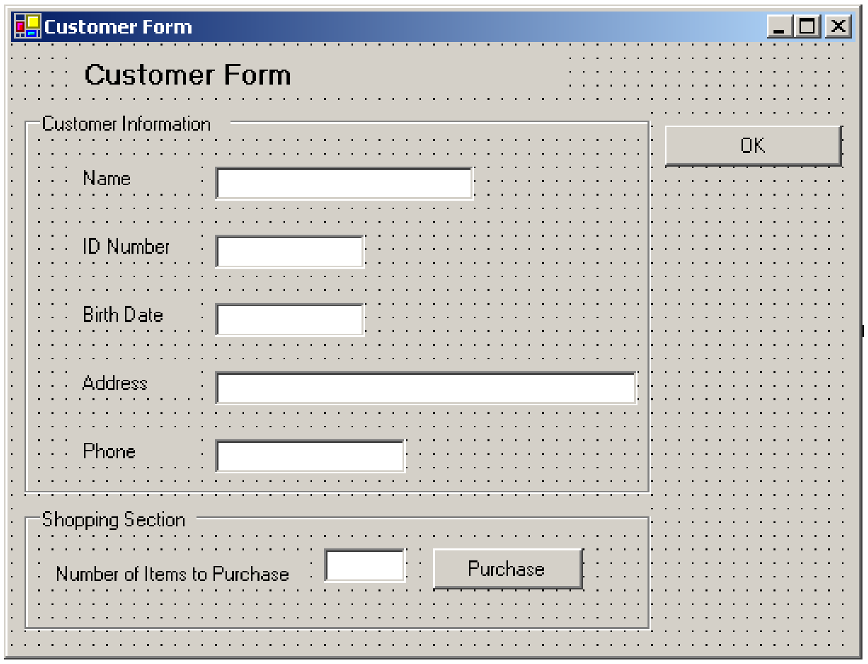
Step 8: In the Class Module Shop() Method Raise the OnShopping Event as follows:



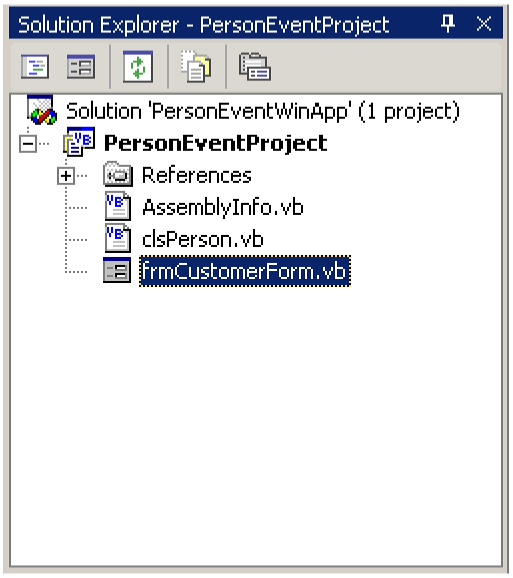
```
Public Sub Shop(ByVal intItems As Integer)
    intTotalItemsPurchased = intTotalItemsPurchased + intItems

    'Raise or trigger event & send information with the event
    RaiseEvent OnShopping(intTotalItemsPurchased)

End Sub
```

Step 9: Add the following indicated Controls to the frmCustomerForm. Set their properties accordingly:

Object	Property	Value
Form1	Name Text	**frmCustomerForm** **Customer Form**

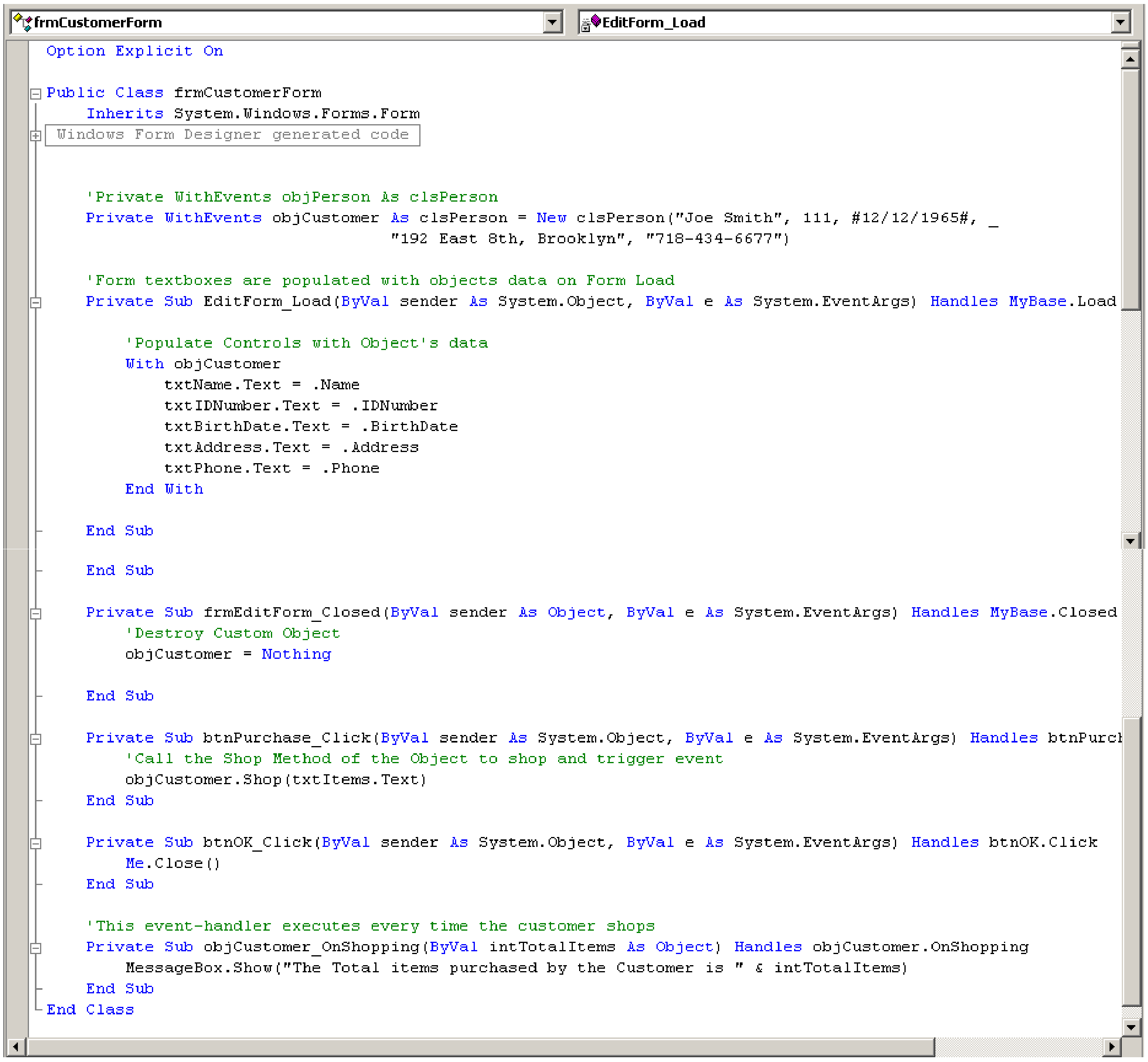


Step 10: At this Point the Project should look as follows:



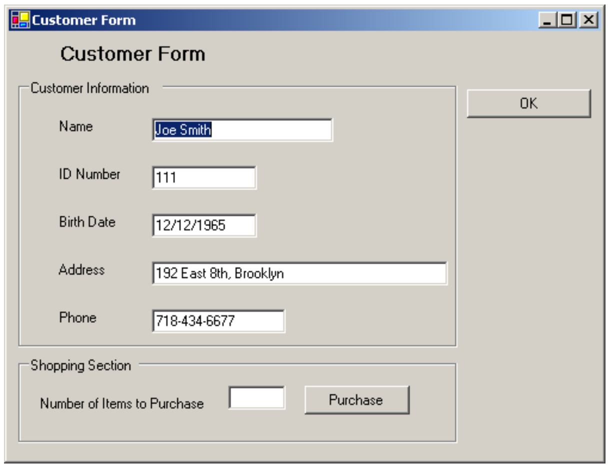
Solution 'PersonEventWinApp' (1 project)
PersonEventProject
References
AssemblyInfo.vb
clsPerson.vb
frmCustomerForm.vb

Step 11: In the Form frmCustomerForm Add the Following Code. Note that the Event-Handler is automatically generated by the WithEvent Object:

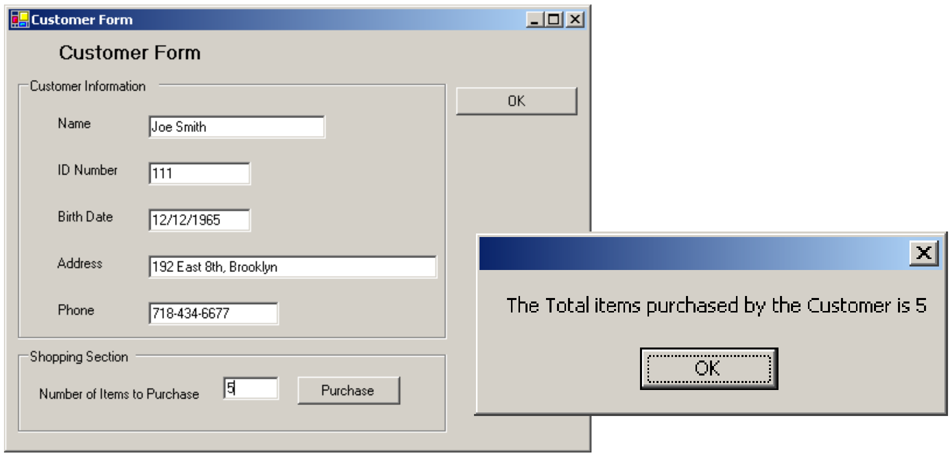


```
Option Explicit On

Public Class frmCustomerForm
    Inherits System.Windows.Forms.Form
 Windows Form Designer generated code


    'Private WithEvents objPerson As clsPerson
    Private WithEvents objCustomer As clsPerson = New clsPerson("Joe Smith", 111, #12/12/1965#, _
                               "192 East 8th, Brooklyn", "718-434-6677")

    'Form textboxes are populated with objects data on Form Load
    Private Sub EditForm_Load(ByVal sender As System.Object, ByVal e As System.EventArgs) Handles MyBase.Load

        'Populate Controls with Object's data
        With objCustomer
            txtName.Text = .Name
            txtIDNumber.Text = .IDNumber
            txtBirthDate.Text = .BirthDate
            txtAddress.Text = .Address
            txtPhone.Text = .Phone
        End With

    End Sub

    End Sub

    Private Sub frmEditForm_Closed(ByVal sender As Object, ByVal e As System.EventArgs) Handles MyBase.Closed
        'Destroy Custom Object
        objCustomer = Nothing

    End Sub

    Private Sub btnPurchase_Click(ByVal sender As System.Object, ByVal e As System.EventArgs) Handles btnPurch
        'Call the Shop Method of the Object to shop and trigger event
        objCustomer.Shop(txtItems.Text)
    End Sub

    Private Sub btnOK_Click(ByVal sender As System.Object, ByVal e As System.EventArgs) Handles btnOK.Click
        Me.Close()
    End Sub

    'This event-handler executes every time the customer shops
    Private Sub objCustomer_OnShopping(ByVal intTotalItems As Object) Handles objCustomer.OnShopping
        MessageBox.Show("The Total items purchased by the Customer is " & intTotalItems)
    End Sub
End Class
```

Step 12: Compile & Run the program:

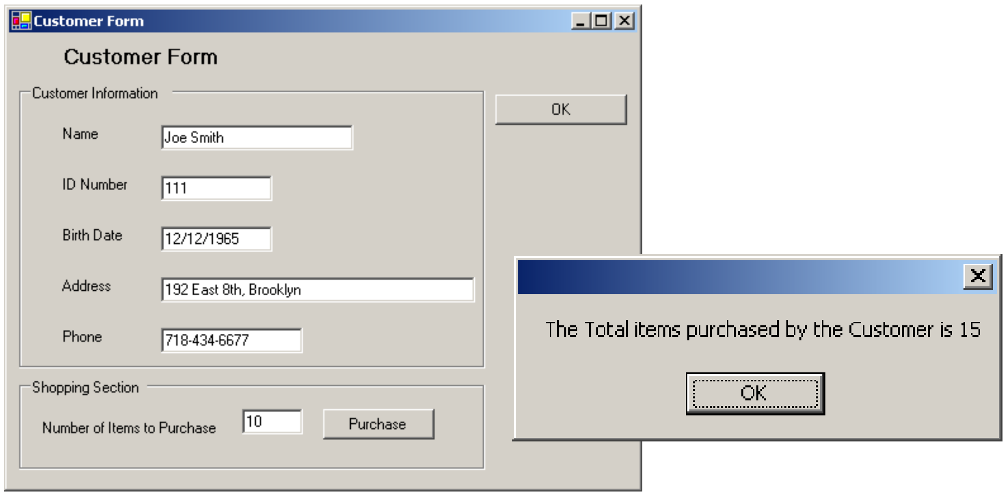


Name: Joe Smith
ID Number: 111
Birth Date: 12/12/1965
Address: 192 East 8th, Brooklyn
Phone: 718-434-6677
Number of Items to Purchase:



Name: Joe Smith
ID Number: 111
Birth Date: 12/12/1965
Address: 192 East 8th, Brooklyn
Phone: 718-434-6677
Number of Items to Purchase: 5

The Total items purchased by the Customer is 5



Name: Joe Smith
ID Number: 111
Birth Date: 12/12/1965
Address: 192 East 8th, Brooklyn
Phone: 718-434-6677
Number of Items to Purchase: 10

The Total items purchased by the Customer is 15

6.3 Working with Arrays and Objects

6.3.1 The Array Class Revisited

Overview of Arrays

- In VB.NET the Array Class is defined in the System Namespace.
- In previous lectures we defined an Arrays Class as follows:
  - **Array:** An Array is a list of data of a single data type

- We have also learned that when creating an object of a class we are creating a reference. Therefore when we create an array, we create an array object in which the name of the array is the reference pointing to the object. Syntax:

Creating Arrays

- We also learned that the syntax to declaring objects of the Array Class is:

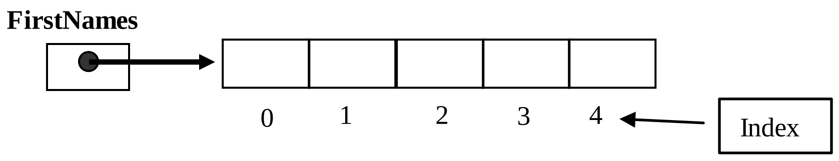
'General Array Syntax:
Accessibility *ArrayName(Size)* **As** *Type*

Where Accessibility:
-*Dim*
-*Public*
-*Private*

Where Size: Size of the array starting from 0 & each value representing the Size is know as the Index
Where Type: Data type of array

- For Example if we needed to keep a list of the first names for the 5 employees of a company, we would declare an array of *FirstNames* with 5 elements of type string. The syntax is as follows:

```
Dim FirstNames(5) As String
```



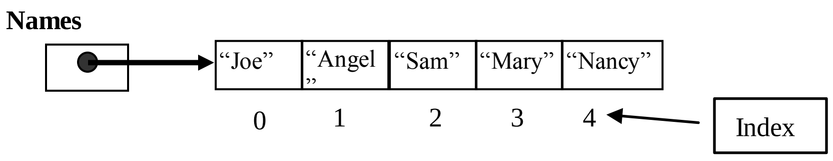
Initializing Arrays upon Creation

- We can populate arrays with data upon creation using the following syntax:

'Initialization Array Syntax:
Accessibility *ArrayName()* **As** *Type = {value1, value2, value3….}*

- For Example if we needed to keep a list of the first names for the 10 employees of a company and populate the arrays with first names upon creation of the array, we would declare it as follows:

```
Dim Names() As String = {"joe", "Angel", "Sam", "Mary", "Nancy"}
```



Populating Array Elements

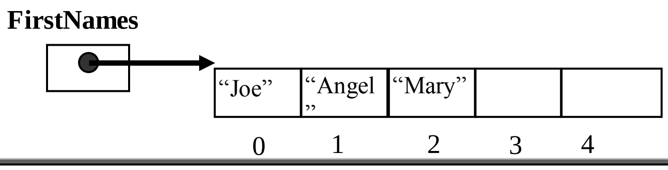
- ❑ When you populate data to an array you do via the name of the array and the index. Syntax:

```
ArrayName(index) = value
```

  - For example if we wished to populate the first, second and third element of the empty array just created, the statements would look as follows:

```
FirstNames(0) = "Joe"
FirstNames (1) = "Angel"
FirstNames (2) = "Mary"
```

  - The array would now look as follows:



Accessing Array Elements

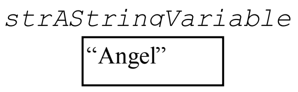
- ❑ When you access or retrieve data from an array you do via the name of the array and the index. Syntax:

```
value = ArrayName(index)
```

  - For example if we wished to retrieve the second element of the array just created, assuming we have a string variable to store this value, the statement would be:

```
strAStringVariable = FirstNames(1)
```

  - The variable will now contain the element retrieved from index(1) or the second element:



Populating All the Array Elements

- ❑ To populate all values of an array in one pass, you need to assign the values in each element consecutively.
- ❑ The For..Next Loop is a excellent mechanism to use with arrays since we know the number of iterations or size of array:

```
For i = 0 to SIZE

     FirstNames(i) = strNames

Next
```

Accessing All Array Elements

- ❑ You can extract or access all elements of array also using the For..Next loop as follows:

```
For i = 0 to SIZE

     strNames = FirstNames(i)

Next
```

6.3.2 Arrays handling of Objects

Custom Objects and Arrays

- In this section we look into how to use an array that stores our custom objects.
- Working with arrays and the objects we create can be confusion, but it is not really very difficult, after all an Array is an Object.
- Also, in the array examples we reviewed in previous lectures we were actually working with Arrays of Objects since the String Data type is also an Object. So we were really storing objects in the arrays.
- If you remember that the when we create a Class, we are actually introducing a new Data Type into our program.
- Therefore, if an array is defined as: **"arrays are a list of data of a same data type"** and we know that when we create an Object the name is really a reference or pointer to the object, then an array of Object is simply:
  - **Array of Object:** A list of *references* to Objects of the same data type or Class.

Creating Arrays of Objects

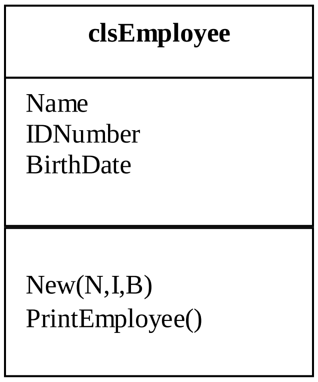
- Syntax to declaring an Array of objects:

'General Array Syntax:
Accessibility *ArrayName(Size)* **As** *ClassName*

Where Accessibility:
 -*Dim*
 -*Public*
 -*Private*

Where Size: Size of the array starting from 0 & each value representing the Size is know as the Index
Where Type: Data type of array

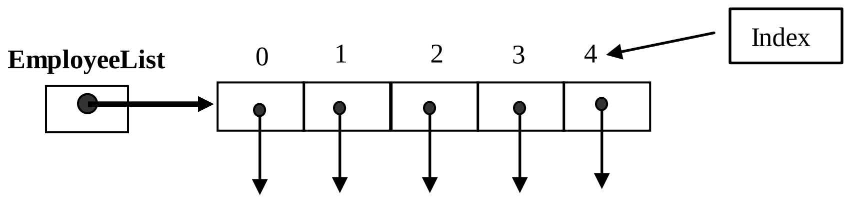
- Note that when we create an array of objects, we are really creating an array of references to objects. Not until you being to add Items or Objects to the array will the array really store Objects.
- Lets look at the following example:
  - For Example, assuming we have a class clsEmployee with the following UML Class diagram describing the properties and methods:



- Now we wish to create an array to store objects for the 5 employees of a company, we would declare the array as follows:

```
Dim EmployeeList(4) As clsEmployee
```

- After the declaration what we have is an array of reference pointers, that only point to Objects of the Class *clsEmployee*:



- This concept can be a little confusing. What is stored in each array element is a reference or pointer. So when you manipulate the array using the Array(index) the value being manipulated is a reference or pointer.

Populating Array Elements with Objects

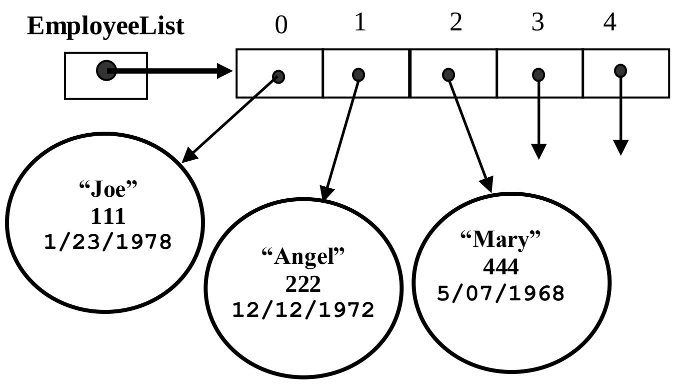
- When you populate Objects to the array you are simply assigning the reference stored in a cell to the reference of the Object you would like to add to the array.
- The syntax is identical as before, but the value is a reference to an object:

```
ArrayName(index) = ReferenceVariable
```

- For example if we wished to populate the first, second and third element of the empty array just created with objects. Assuming we have the following Object declarations:

```
'Object Declarations, creation & Populated via Constructor
Dim objEmployee1 As clsEmployees = New clsEmployees("Joe",111,#1/23/1978#)
Dim objEmployee2 As clsEmployees = New clsEmployees("Angel",222,#12/12/1972#)
Dim objEmployee3 As clsEmployees = New clsEmployees("Mary",444,#5/07/1968#)


'Populate Array with Object by
'Performing a reference assignment
EmployeeList(0) = objEmployee1
EmployeeList(1) = objEmployee1
EmployeeList(2) = objEmployee1
```

- After the assignment statements, the array would now look as follows:



Accessing Object Elements

Accessing the Object's Properties From The Array

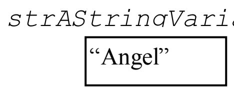
- When you access or retrieve data from an array of Objects, you do via the array(index) but in addition you also need to use the dot (.) Operator to access the Properties & Methods of the Object.

```
Variable = ArrayName(index).Property
```

  - For example if we wished to retrieve the Name of the Object residing on the second element of the array, assuming we have a string variable to store this value, the statement would be:

```
strAStringVariable = EmployeeList(1).Name
```

  - The variable will now contain the element retrieved from index(1) or the second element:



Setting the Object's Properties in the Array

- Supposed we want to set or overwrite the property of an Object in the array, the syntax is as follows using the index and dot (.) Operator:

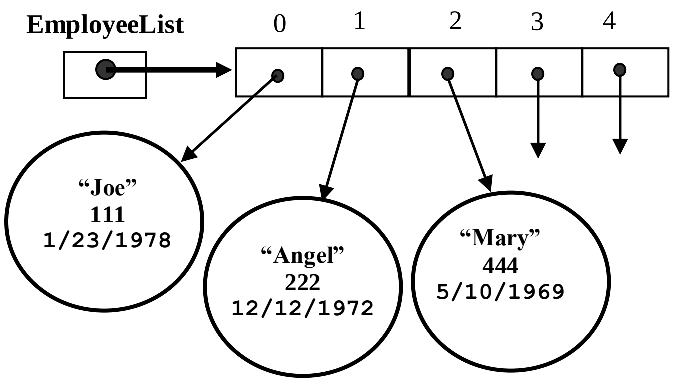
- Syntax for setting an Object Property

```
ArrayName(index).Property = strAStringVariable
```

  - For example if we wished to change or overwrite the BirthDate property of the Object residing on the third element of the array, with the value #5/10/1969# the statement would be:

```
EmployeeList(2).BirthDate = #5/10/1975#
```

  - After the statement the third Object in the list will be modified:



Executing an Object's Method in the Array

- If we wanted to execute an method in the array, the syntax is as follows using the index and dot (.) Operator:

```
ArrayName(index).Method()
```

  - For example if we wished to execute the PrintEmployee() Method of the first element of the array the statement is:

```
EmployeeList(0).PrintEmployee()
```

Searching and Setting Properties of all Objects in array

- To set the properties of all the objects in the array in one pass, you need to assign the values in each property consecutively.
- You can use the **For..Next** Loop, the size of the array and the dot(.) operator:

```
For i = 0 to SIZE

      EmployeeList(i).Name = strName

Next
```

Searching the Array Elements

- You can extract or access all elements of array also using the ***For..Next*** loop and the dot(.) Operator as follows:

```
For i = 0 to SIZE

      strName = EmployeeList(i).Name

Next
```

6.3.4 Sample Program 3 – Working With Arrays & Objects

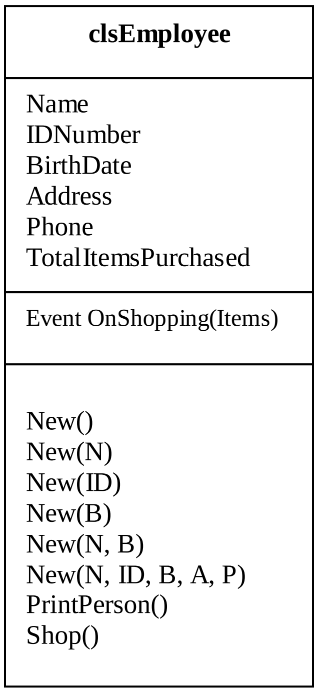
Module-Driven Window Application – Arrays & Person Class

Problem statement:

- ❑ Using a Module-Driven Windows Application (Startup Object = Sub Main()) we will demonstrate how to store and retrieve objects stored inside arrays.
- ❑ We will reuse and keep all the features of the ***clsPeson*** Class from previous example.
- ❑ We will drive this class using a Module via Sub Main(). The Main() method will control the flow of the program and display the a main Form
- ❑ The Form will allow us to search for a Person Object stored in the array by ID and display the object's information on the Form.
- ❑ In addition, the Form will contain a text box to display the number of previously purchased items. The idea is that we will attempt to demonstrate that we are keeping a running total and that the array is storing the objects with the correct data. In this example this feature will NOT work! And we will see why and how references play an important part. In the next example we will see this feature work.
- ❑ In addition to the other topics covered in previous examples, this Example will demonstrate the following topics:

  - Storing Objects in arrays
  - Searching arrays of objects
  - Displaying objects in arrays
  - Returning Objects from Functions
  - Returning a copy of the object stored in Array and it's implications.

UML Class Diagram



Class Requirements (Same as Previous Example 2)

- ❑ The class contains the following data, properties & methods members (See UML Diagram):

  Class Person Member Data:

  - Name: Type String
  - IDNumber: Type Integer.
  - BirthDate: Date
  - Address: Type String
  - Phone: Type String
  - TotalItemsPurchased: Type Integer

  Class Person Event Declaration:

  - Public Event OnShopping(NumberOfItems):
  - Event takes one argument representing total number of items purchase

  Class Member Overloaded Constructors Methods:

  - New(), New(Name), New(IDNumber), New(BirthDate), New(Name, BirthDate)
  - New(Name, IDNumber, BirthDate, Address, Phone).

  Class Member Properties & Methods:

  - Properties for each data member.
  - The Method PrintPerson(), which displays the Persons data
  - Method Shop(), which sums the total items purchased and raises the *OnShopping* Event

Form Requirements

- ❑ The application will contains the following Form and functionality:

  - ***frmCustomerForm***: Form to Search for a Customer, display the Customer information and allow customer to shop a number of items

  - The form will create one Objects of the Person Class ***WithEvents***

  - The Form will add code to the Event-Handler generated by the ***WithEvents*** Object.

HOW IT'S DONE:

Part I – Create The Class:

Step 1: Start a new Windows Application project:

Step 2: Add a Form to the project and set its properties as shown in the table:

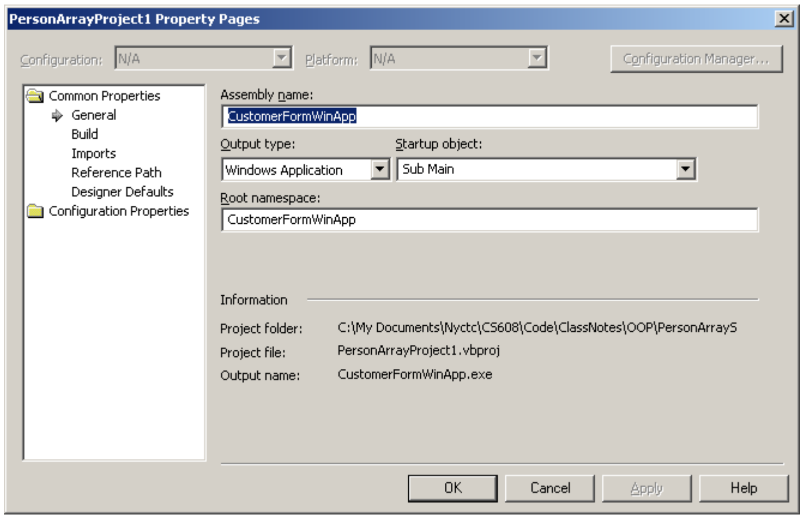
Object	Property	Value
Form1	Name Text	**frmCustomerForm** **Customer Form**

Step 3: Add a Standard Module set its properties as shown in the table:

Object	Property	Value
Module1	Name	**modMainModule**

Step 4: Set the Project's properties to behave as a Module-Driven Windows Application:

Object	Property	Value
Project	Name Startup Object	**CustomerFormWinApp** **Sub Main()**



Assembly name: CustomerFormWinApp
Output type: Windows Application
Startup object: Sub Main
Root namespace: CustomerFormWinApp

Information
Project folder: C:\My Documents\Nyctc\CS608\Code\ClassNotes\OOP\PersonArrayS
Project file: PersonArrayProject1.vbproj
Output name: CustomerFormWinApp.exe

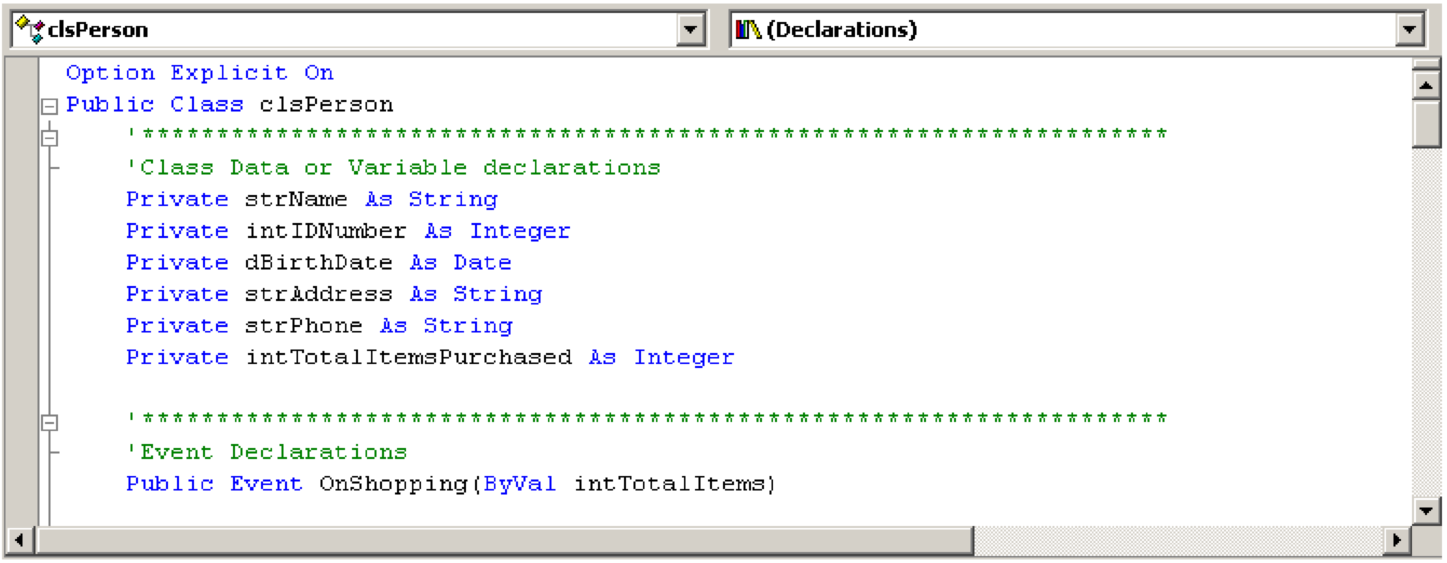
Step 5: Prepare to Reuse the Person Class from Previous Console Application, by Copying the File from previous Application Folder to the Folder of this Windows Application Project

1. Using Windows Explorer, navigate to the Console Application folder of the previous example.
2. Copy/Paste the file clsPerson.vb to this Project folder

Step 6: Add the Class to the Project

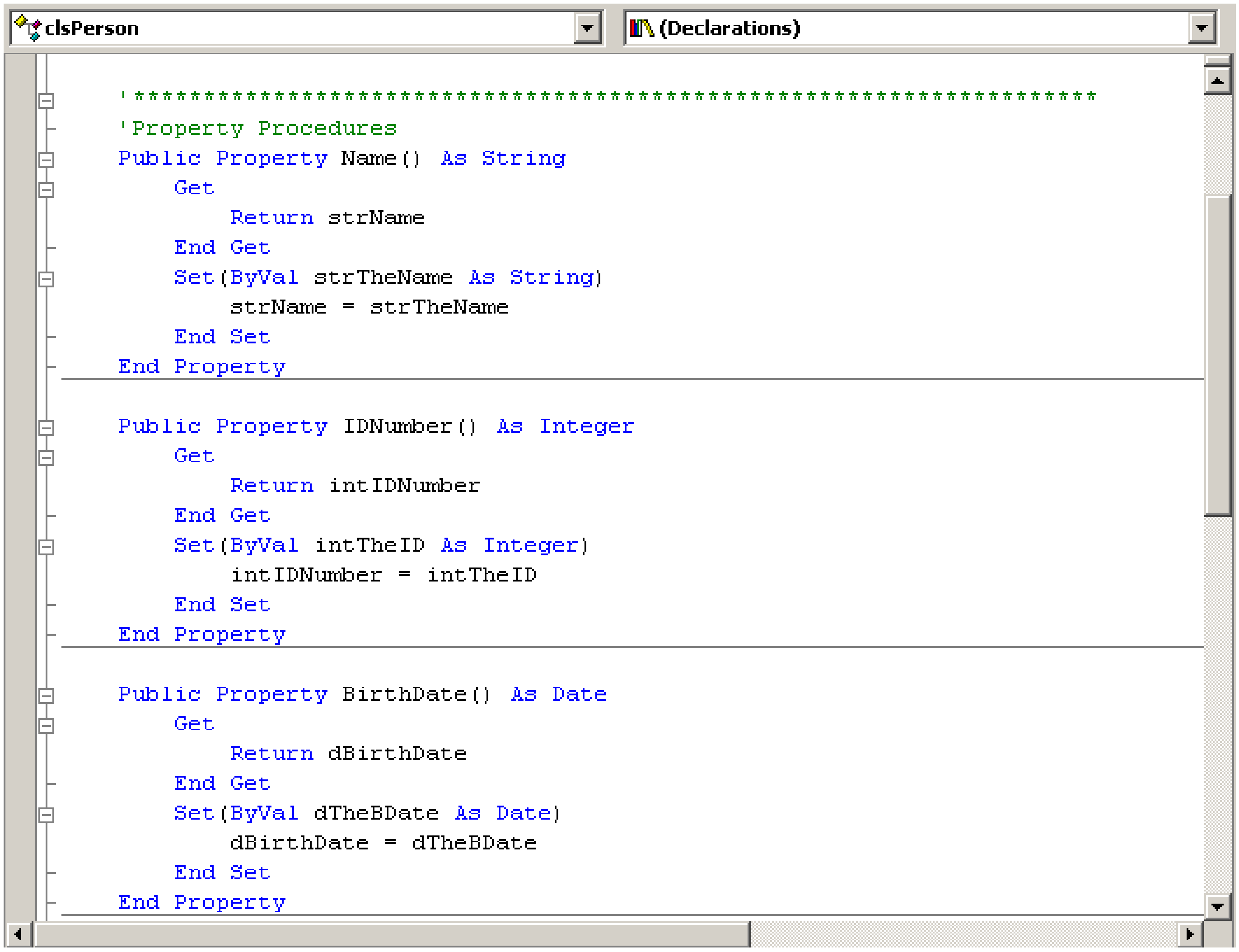
1. In the Project Menu, select Add Existing Item… and navigate to the project folder
2. Select the ***clsPerson.vb*** File and click OK
3. The class is now part of the project and ready to be reused!

Step 7: In the Class Module keep private data section as is:

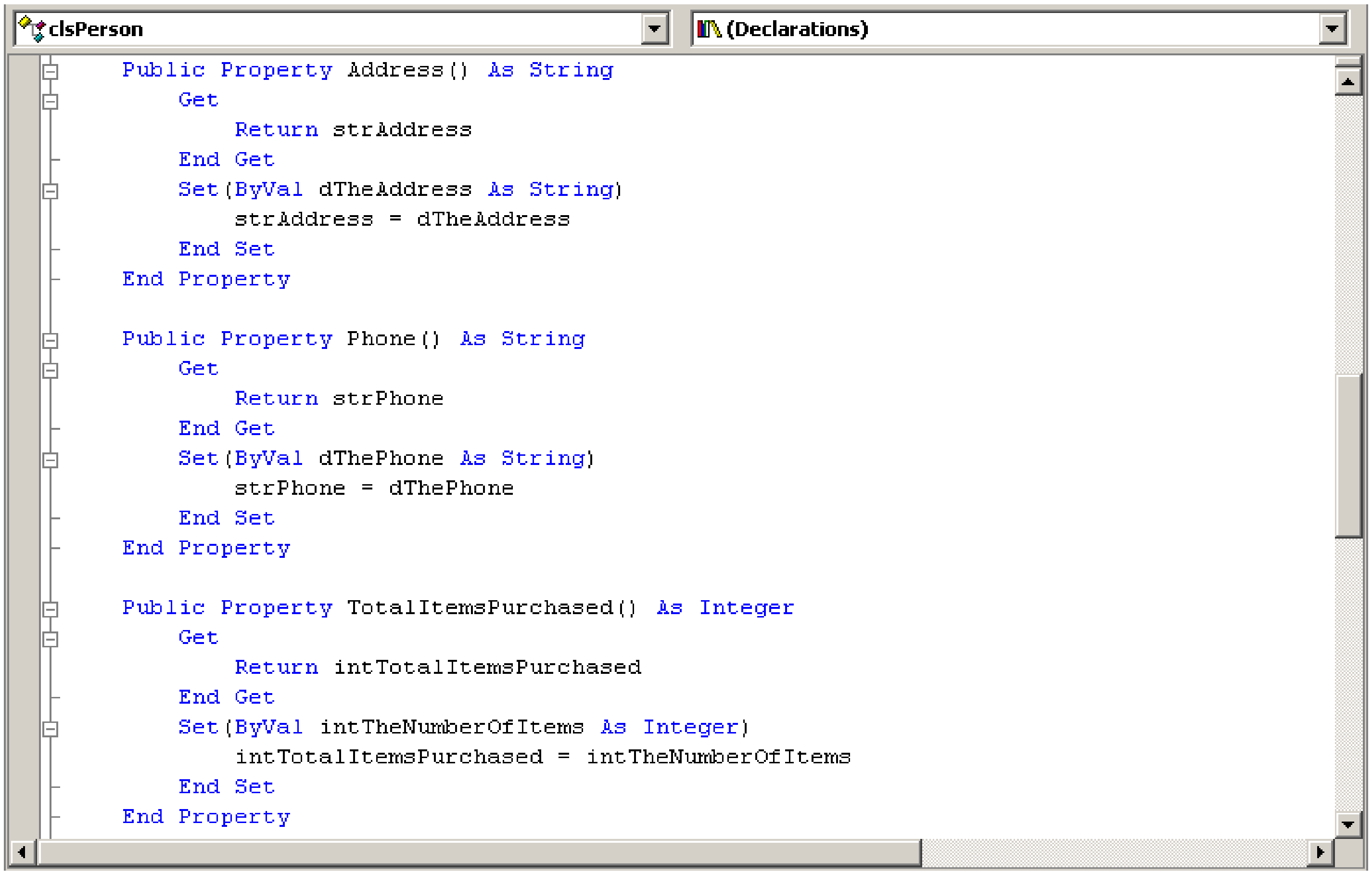


```
Option Explicit On
Public Class clsPerson
    '*********************************************************************
    'Class Data or Variable declarations
    Private strName As String
    Private intIDNumber As Integer
    Private dBirthDate As Date
    Private strAddress As String
    Private strPhone As String
    Private intTotalItemsPurchased As Integer

    '*********************************************************************
    'Event Declarations
    Public Event OnShopping(ByVal intTotalItems)
```

Step 8: Leave the Property Procedure as is:

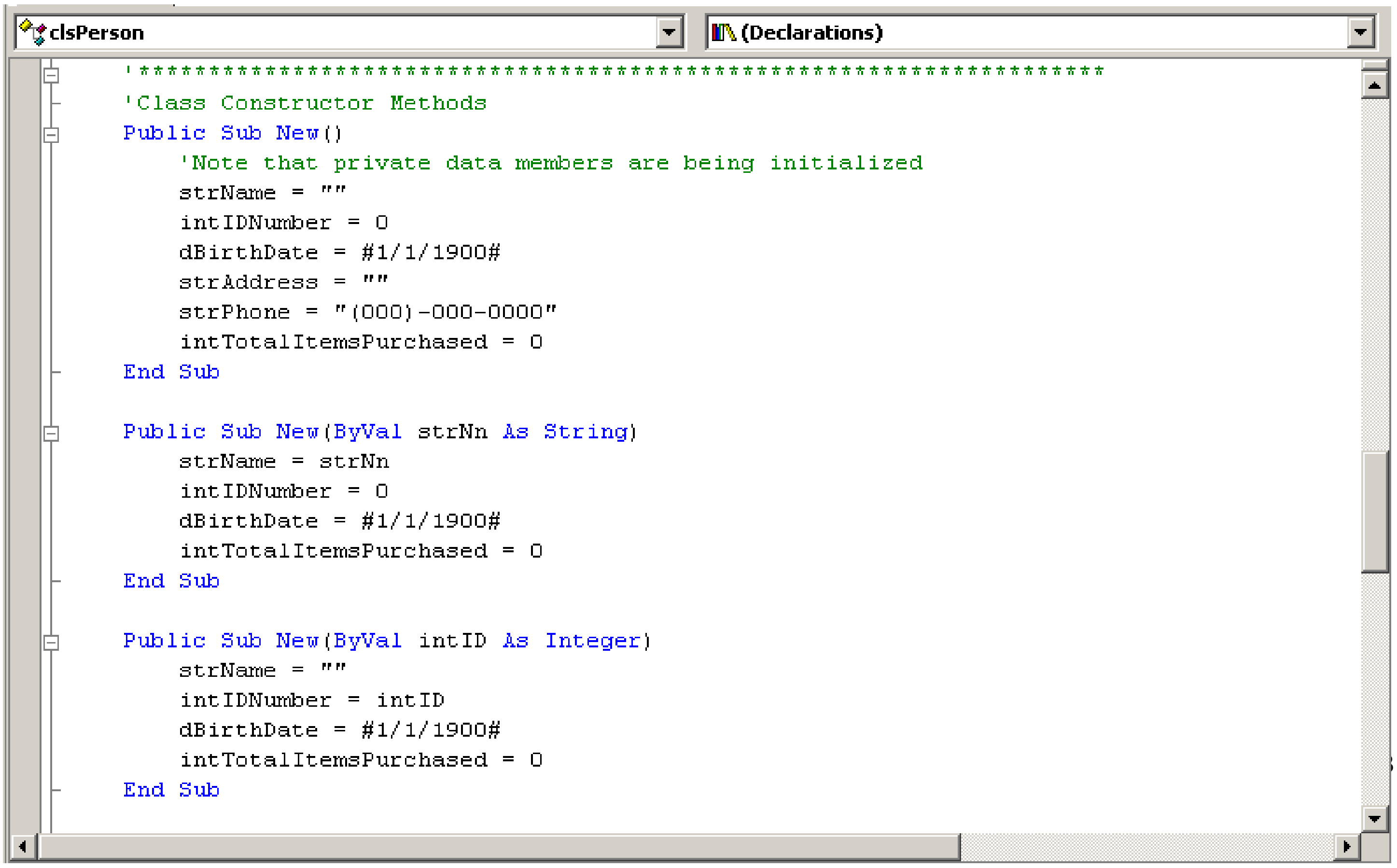


```
    '*********************************************************************
    'Property Procedures
    Public Property Name() As String
        Get
            Return strName
        End Get
        Set(ByVal strTheName As String)
            strName = strTheName
        End Set
    End Property

    Public Property IDNumber() As Integer
        Get
            Return intIDNumber
        End Get
        Set(ByVal intTheID As Integer)
            intIDNumber = intTheID
        End Set
    End Property

    Public Property BirthDate() As Date
        Get
            Return dBirthDate
        End Get
        Set(ByVal dTheBDate As Date)
            dBirthDate = dTheBDate
        End Set
    End Property
```

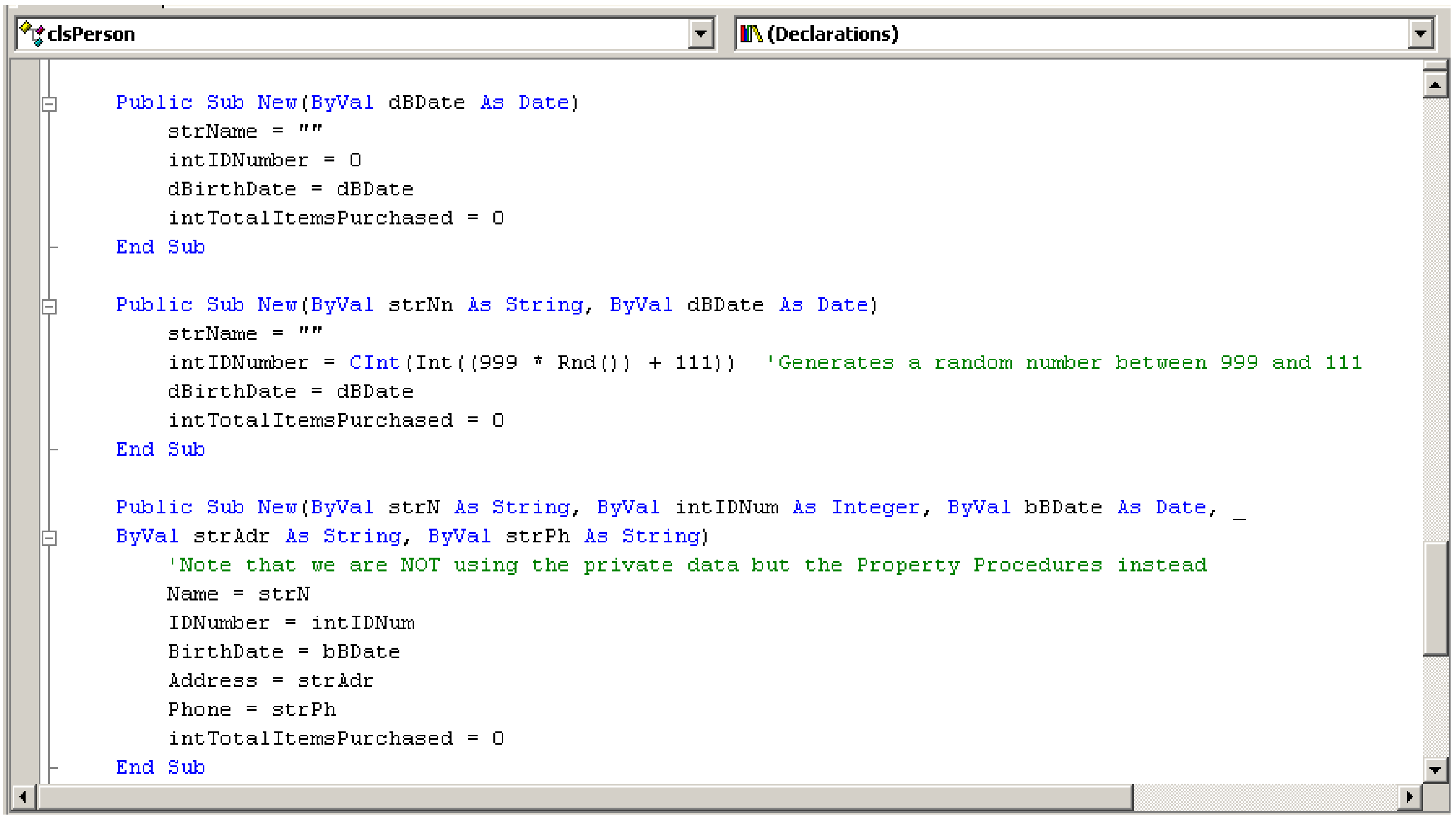


```
Public Property Address() As String
    Get
        Return strAddress
    End Get
    Set(ByVal dTheAddress As String)
        strAddress = dTheAddress
    End Set
End Property

Public Property Phone() As String
    Get
        Return strPhone
    End Get
    Set(ByVal dThePhone As String)
        strPhone = dThePhone
    End Set
End Property

Public Property TotalItemsPurchased() As Integer
    Get
        Return intTotalItemsPurchased
    End Get
    Set(ByVal intTheNumberOfItems As Integer)
        intTotalItemsPurchased = intTheNumberOfItems
    End Set
End Property
```

Step 9: In the Class Module code window keep the code for the Constructor Methods:

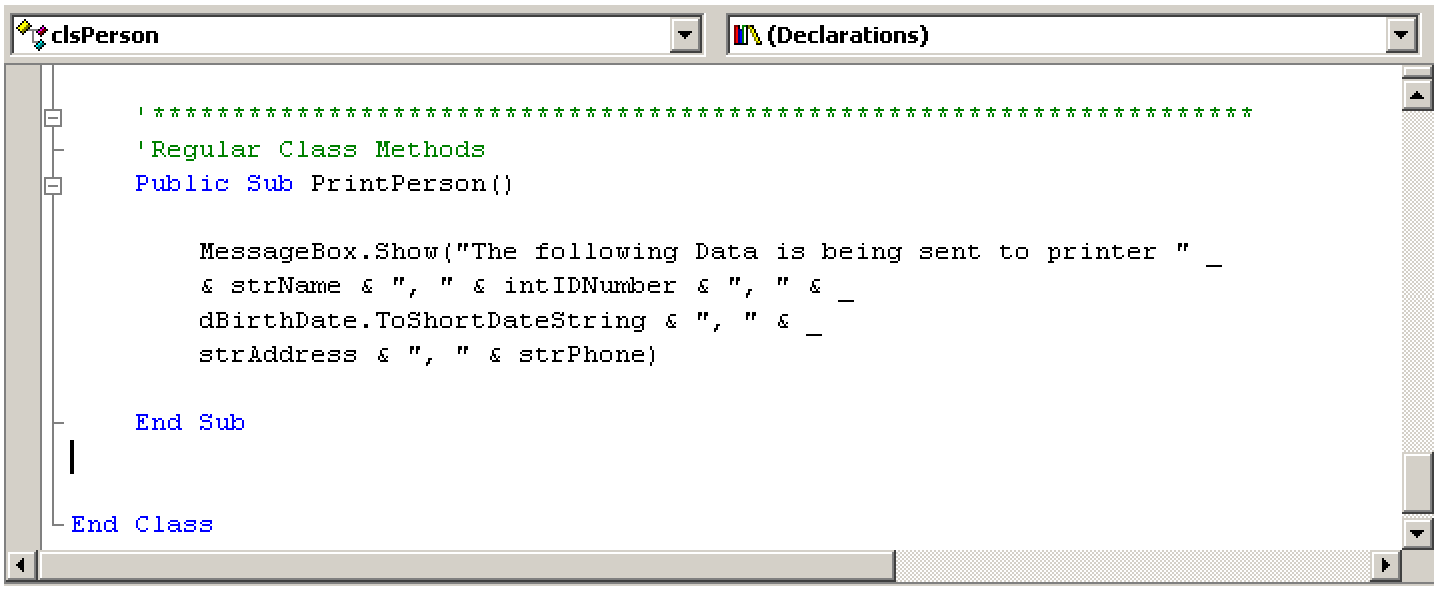


```
'**********************************************************************
'Class Constructor Methods
Public Sub New()
    'Note that private data members are being initialized
    strName = ""
    intIDNumber = 0
    dBirthDate = #1/1/1900#
    strAddress = ""
    strPhone = "(000)-000-0000"
    intTotalItemsPurchased = 0
End Sub

Public Sub New(ByVal strNn As String)
    strName = strNn
    intIDNumber = 0
    dBirthDate = #1/1/1900#
    intTotalItemsPurchased = 0
End Sub

Public Sub New(ByVal intID As Integer)
    strName = ""
    intIDNumber = intID
    dBirthDate = #1/1/1900#
    intTotalItemsPurchased = 0
End Sub
```


clsPerson | (Declarations)

```
Public Sub New(ByVal dBDate As Date)
    strName = ""
    intIDNumber = 0
    dBirthDate = dBDate
    intTotalItemsPurchased = 0
End Sub

Public Sub New(ByVal strNn As String, ByVal dBDate As Date)
    strName = ""
    intIDNumber = CInt(Int((999 * Rnd()) + 111))  'Generates a random number between 999 and 111
    dBirthDate = dBDate
    intTotalItemsPurchased = 0
End Sub

Public Sub New(ByVal strN As String, ByVal intIDNum As Integer, ByVal bBDate As Date, _
ByVal strAdr As String, ByVal strPh As String)
    'Note that we are NOT using the private data but the Property Procedures instead
    Name = strN
    IDNumber = intIDNum
    BirthDate = bBDate
    Address = strAdr
    Phone = strPh
    intTotalItemsPurchased = 0
End Sub
```

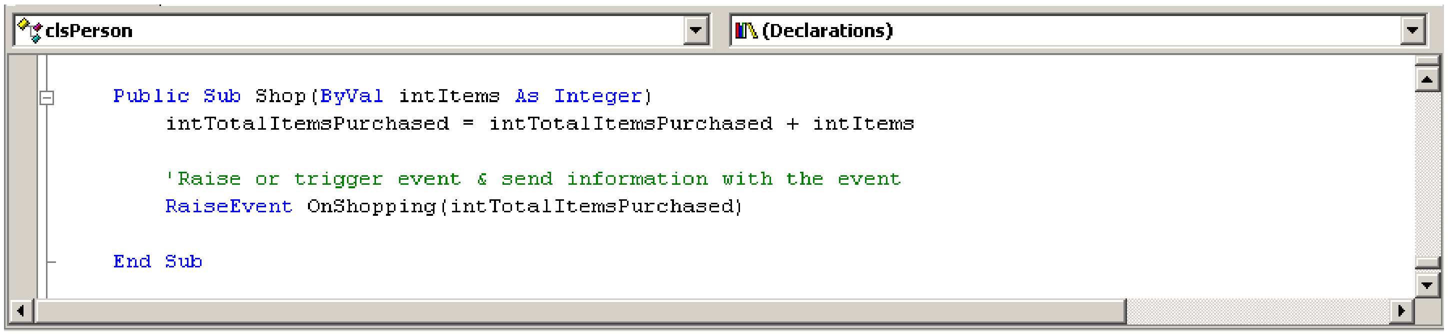
Step 10: In the Class Module keep the PrintPerson() Method as is:



```
    '**********************************************************************
    'Regular Class Methods
    Public Sub PrintPerson()

        MessageBox.Show("The following Data is being sent to printer " _
        & strName & ", " & intIDNumber & ", " & _
        dBirthDate.ToShortDateString & ", " & _
        strAddress & ", " & strPhone)

    End Sub

End Class
```

- ❖ **Remember that it is bad practice to display any forms or messages from within a Class. I do this only for teaching purposes to demonstrate a topic.**

Step 11: In the Class Module Keep Shop() Method as is:



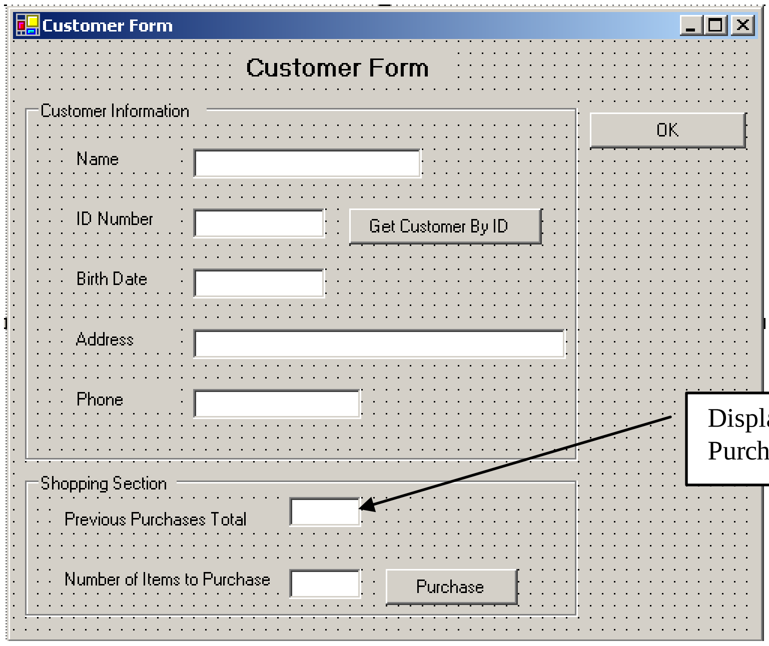
```
Public Sub Shop(ByVal intItems As Integer)
    intTotalItemsPurchased = intTotalItemsPurchased + intItems

    'Raise or trigger event & send information with the event
    RaiseEvent OnShopping(intTotalItemsPurchased)

End Sub
```

Part II & III – Create The Object and Use it (The User Interface)

Step 12: Add the following indicated Controls to the frmCustomerForm. Set their properties accordingly:

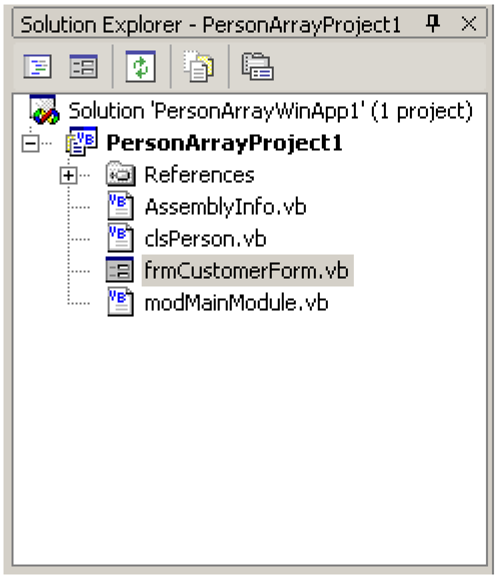
Object	Property	Value
Form1	Name Text	**frmCustomerForm** **Customer Form**

- Note that the Form now includes a button to initiate a search of the customer by the ID entered in the ID Number Text Box.



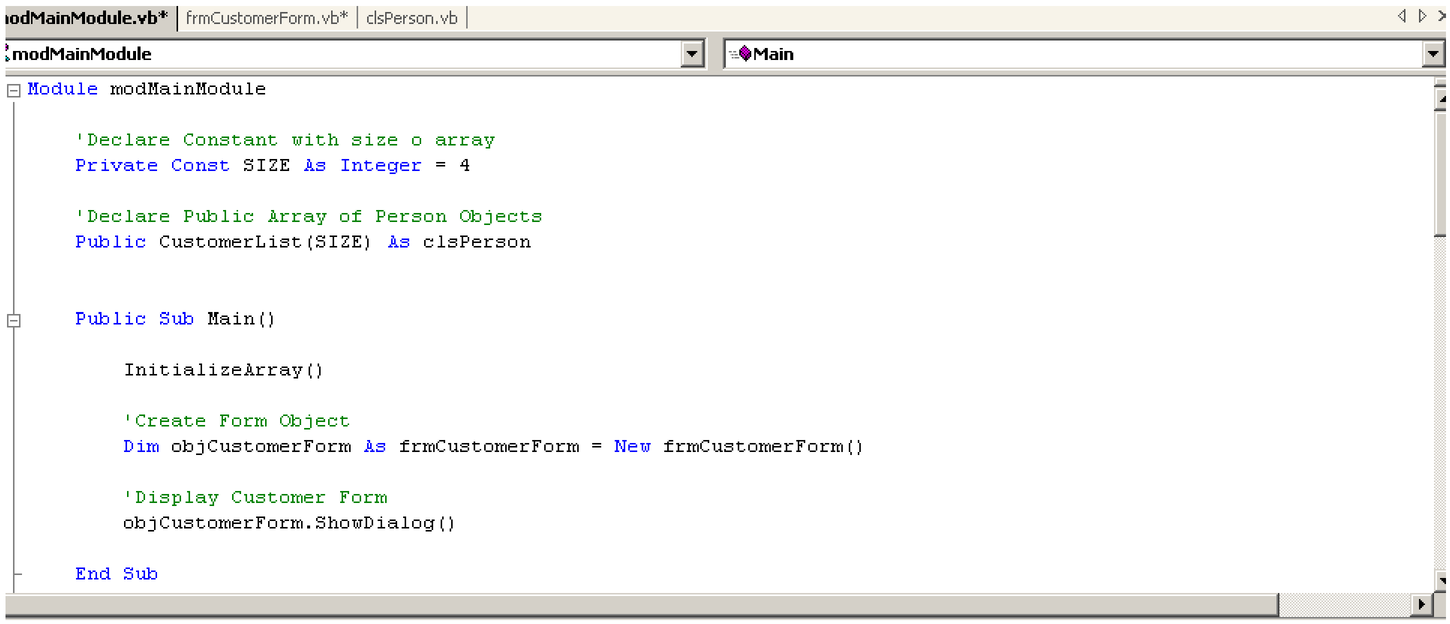
Displays Previous Number of Items Purchased or running total

Step 13: At this Point the Project should look as follows:



Step 14: In the Module Add the Following Code:

- Code any Global & Private Variable declarations and Sub Main()
  1. A Constant Variable created and initialized defining the SIZE of the array
  2. We declare an Array of Objects of type clsPerson
  3. In Sub Main() we Call the InitializeArray method to populate the arrays with objects
  4. We then create an Object of the Form and Display the Form



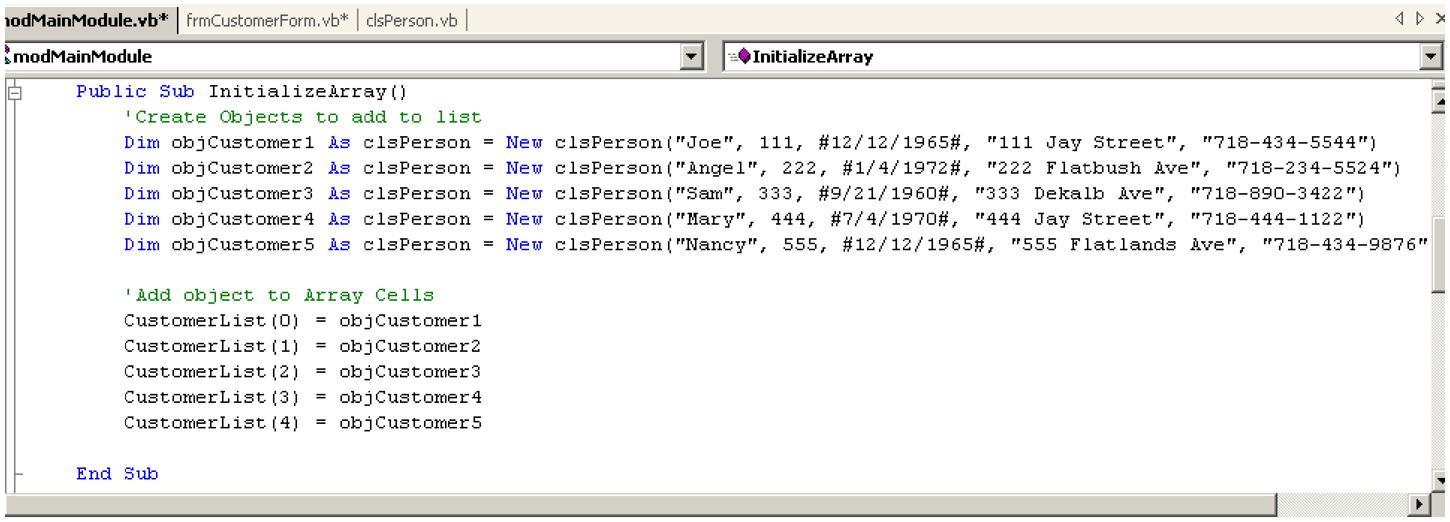
odMainModule.vb* | frmCustomerForm.vb* | clsPerson.vb

modMainModule | Main

```
Module modMainModule

    'Declare Constant with size o array
    Private Const SIZE As Integer = 4

    'Declare Public Array of Person Objects
    Public CustomerList(SIZE) As clsPerson


    Public Sub Main()

        InitializeArray()

        'Create Form Object
        Dim objCustomerForm As frmCustomerForm = New frmCustomerForm()

        'Display Customer Form
        objCustomerForm.ShowDialog()

    End Sub
```

- Add code for the InitializeArray()method:

  1. The InitializeArray() Method creates 5 objects of the clsPerson Class using the parameterized Constructor to initialize the objects with values.
  2. Each clsPerson Object is added to an element of the array.



odMainModule.vb* | frmCustomerForm.vb* | clsPerson.vb

modMainModule | InitializeArray

```
    Public Sub InitializeArray()
        'Create Objects to add to list
        Dim objCustomer1 As clsPerson = New clsPerson("Joe", 111, #12/12/1965#, "111 Jay Street", "718-434-5544")
        Dim objCustomer2 As clsPerson = New clsPerson("Angel", 222, #1/4/1972#, "222 Flatbush Ave", "718-234-5524")
        Dim objCustomer3 As clsPerson = New clsPerson("Sam", 333, #9/21/1960#, "333 Dekalb Ave", "718-890-3422")
        Dim objCustomer4 As clsPerson = New clsPerson("Mary", 444, #7/4/1970#, "444 Jay Street", "718-444-1122")
        Dim objCustomer5 As clsPerson = New clsPerson("Nancy", 555, #12/12/1965#, "555 Flatlands Ave", "718-434-9876"

        'Add object to Array Cells
        CustomerList(0) = objCustomer1
        CustomerList(1) = objCustomer2
        CustomerList(2) = objCustomer3
        CustomerList(3) = objCustomer4
        CustomerList(4) = objCustomer5

    End Sub
```

- Add the Function Search():

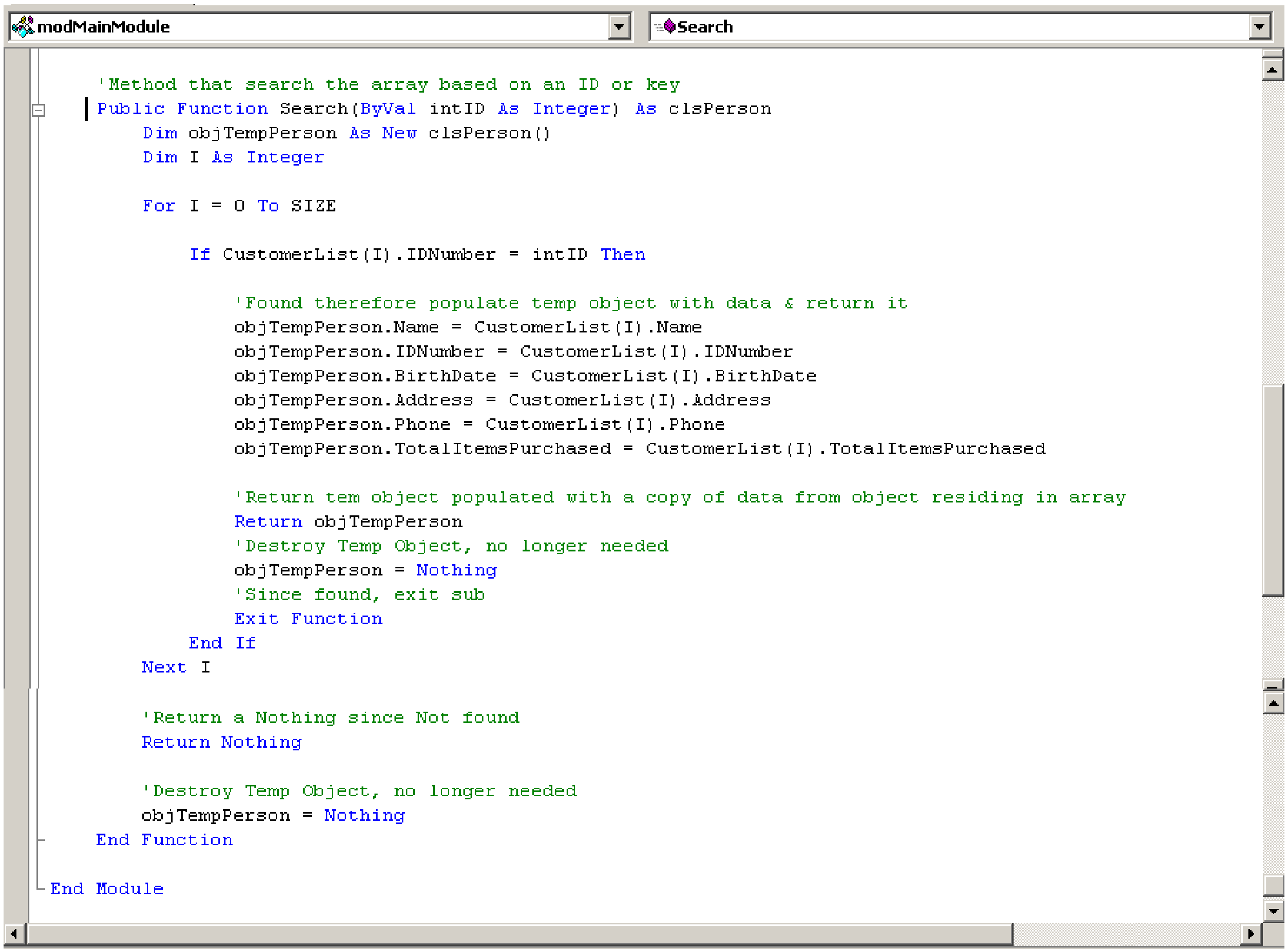
  1. This function takes as a parameter an integer value representing the ID of the customer.
  2. In addition, the Function **returns** an ***Object*** of the *clsPerson* class:

     - You may think this concept of returning an object from a function is new, but is NOT. You have been doing it all along when you returned string data types. Remember that a string is an object.
     - In this case we are returning the objects that we created.

  3. A temporary Person Object is created to be used as the Object that will be returned by the Function. Note that if the Object we are searching for is NOT FOUND, we will return the keyword **Nothing** to the calling program.
  4. We use a *For Loop* to iterate through the array by index as follows:

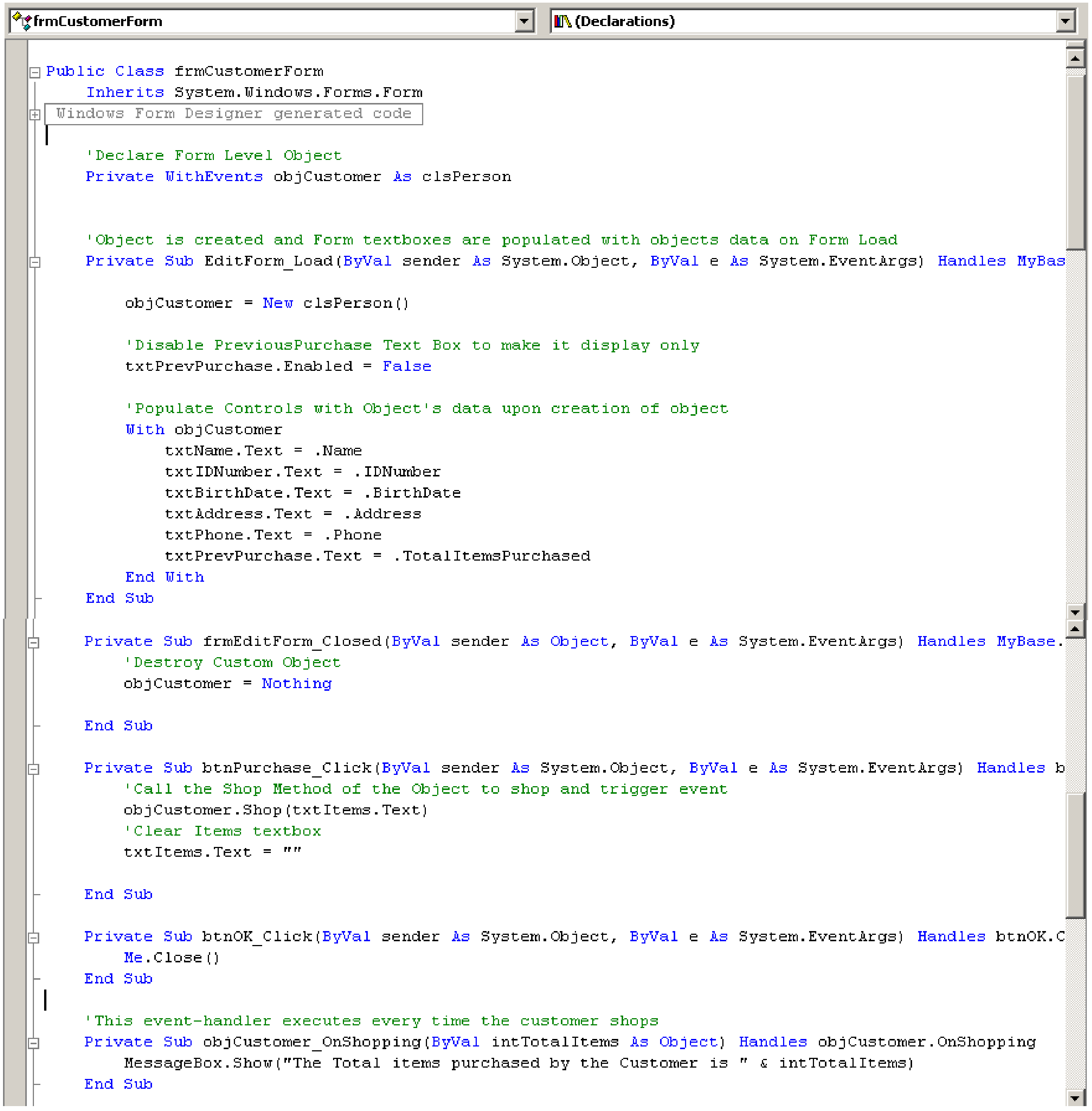
     - A test of the ID number argument to the ID of every Object in the array is made.
     - If the ID matches:
       i. The content of the Object residing in that array index is copied to the temporary Person Object data.
       ii. The Temp Object is returned to the calling program
       iii. The temp object is destroyed
       iv. The Function Exits
     - If none of the ID matches:

       i. The loops completes to the end of the size of the array.
       ii. The Function Returns a **Nothing**!
       iii. The temp object is destroyed
       iv. The Function Ends



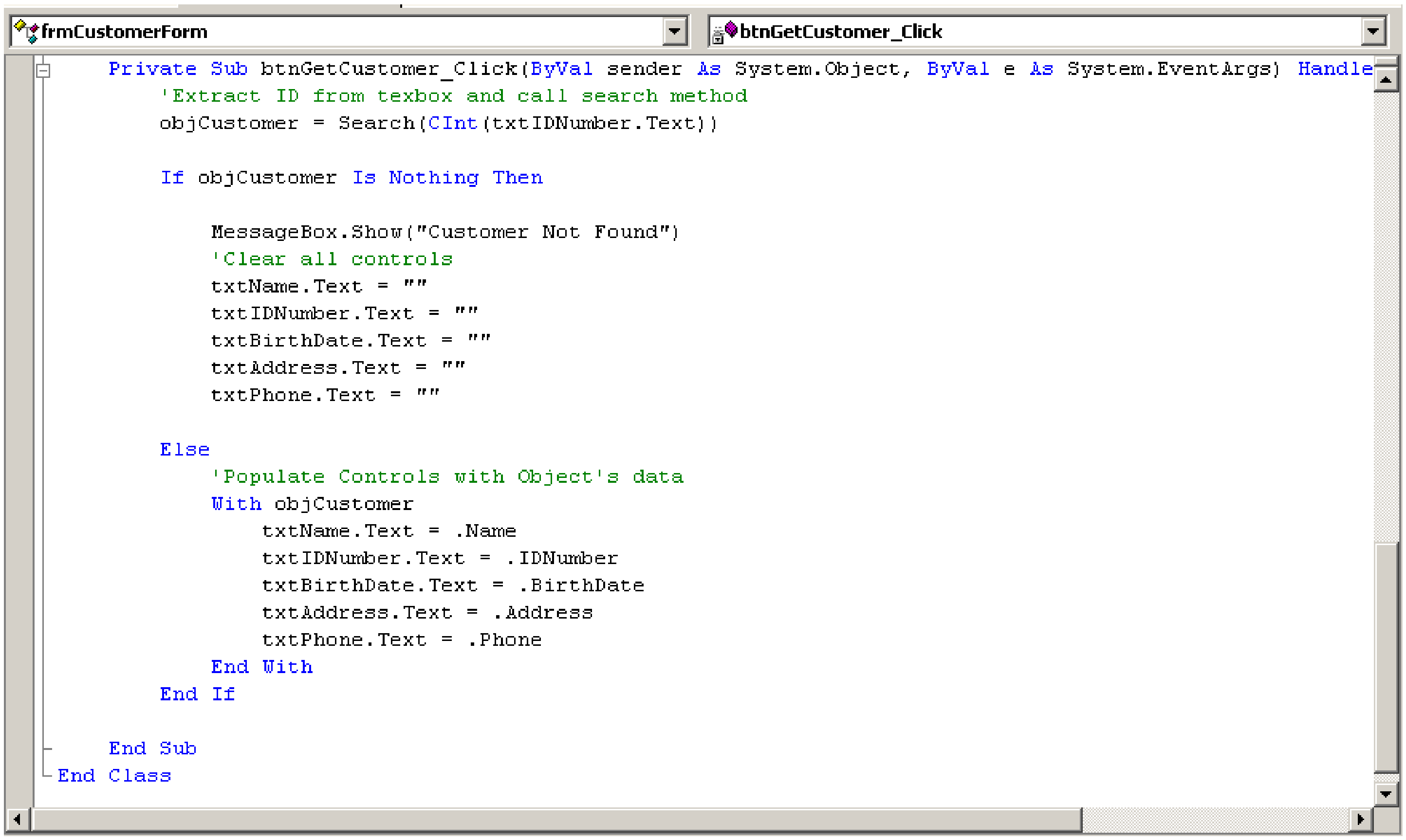
```
    'Method that search the array based on an ID or key
    Public Function Search(ByVal intID As Integer) As clsPerson
        Dim objTempPerson As New clsPerson()
        Dim I As Integer

        For I = 0 To SIZE

            If CustomerList(I).IDNumber = intID Then

                'Found therefore populate temp object with data & return it
                objTempPerson.Name = CustomerList(I).Name
                objTempPerson.IDNumber = CustomerList(I).IDNumber
                objTempPerson.BirthDate = CustomerList(I).BirthDate
                objTempPerson.Address = CustomerList(I).Address
                objTempPerson.Phone = CustomerList(I).Phone
                objTempPerson.TotalItemsPurchased = CustomerList(I).TotalItemsPurchased

                'Return tem object populated with a copy of data from object residing in array
                Return objTempPerson
                'Destroy Temp Object, no longer needed
                objTempPerson = Nothing
                'Since found, exit sub
                Exit Function
            End If
        Next I

        'Return a Nothing since Not found
        Return Nothing

        'Destroy Temp Object, no longer needed
        objTempPerson = Nothing
    End Function

End Module
```

Step 15: In the Form frmCustomerForm Add the Following Code:



```
Public Class frmCustomerForm
    Inherits System.Windows.Forms.Form
 Windows Form Designer generated code

    'Declare Form Level Object
    Private WithEvents objCustomer As clsPerson


    'Object is created and Form textboxes are populated with objects data on Form Load
    Private Sub EditForm_Load(ByVal sender As System.Object, ByVal e As System.EventArgs) Handles MyBas

        objCustomer = New clsPerson()

        'Disable PreviousPurchase Text Box to make it display only
        txtPrevPurchase.Enabled = False

        'Populate Controls with Object's data upon creation of object
        With objCustomer
            txtName.Text = .Name
            txtIDNumber.Text = .IDNumber
            txtBirthDate.Text = .BirthDate
            txtAddress.Text = .Address
            txtPhone.Text = .Phone
            txtPrevPurchase.Text = .TotalItemsPurchased
        End With
    End Sub

    Private Sub frmEditForm_Closed(ByVal sender As Object, ByVal e As System.EventArgs) Handles MyBase.
        'Destroy Custom Object
        objCustomer = Nothing

    End Sub

    Private Sub btnPurchase_Click(ByVal sender As System.Object, ByVal e As System.EventArgs) Handles b
        'Call the Shop Method of the Object to shop and trigger event
        objCustomer.Shop(txtItems.Text)
        'Clear Items textbox
        txtItems.Text = ""

    End Sub

    Private Sub btnOK_Click(ByVal sender As System.Object, ByVal e As System.EventArgs) Handles btnOK.C
        Me.Close()
    End Sub

    'This event-handler executes every time the customer shops
    Private Sub objCustomer_OnShopping(ByVal intTotalItems As Object) Handles objCustomer.OnShopping
        MessageBox.Show("The Total items purchased by the Customer is " & intTotalItems)
    End Sub
```

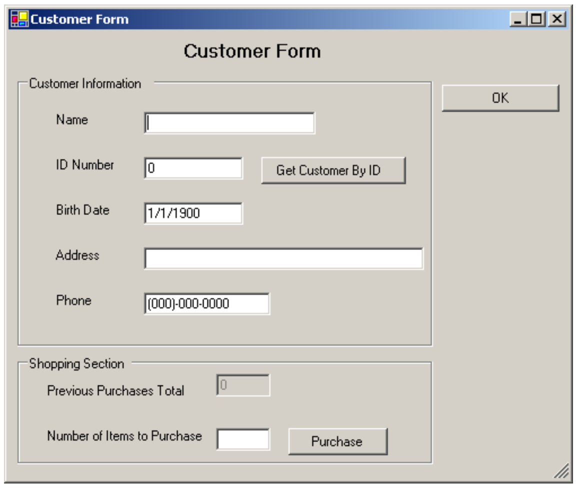
- *The GetCustomer* Click Event:
  - In this Event-Handler we will call the search method of the module to search for the customer object in the array by ID
  - Note that the Search() method returns an Object reference and we assign this reference to the Object Create in this Form.
  - Also note that the result of the Search() can return a Nothing, therefore we Test the object returned to verify if is Nothing or is a valid reference.
  - From the results of the test, we either populate the text boxes with the customer data or display to the user that the Customer was not found.



```
    Private Sub btnGetCustomer_Click(ByVal sender As System.Object, ByVal e As System.EventArgs) Handle
        'Extract ID from texbox and call search method
        objCustomer = Search(CInt(txtIDNumber.Text))

        If objCustomer Is Nothing Then

            MessageBox.Show("Customer Not Found")
            'Clear all controls
            txtName.Text = ""
            txtIDNumber.Text = ""
            txtBirthDate.Text = ""
            txtAddress.Text = ""
            txtPhone.Text = ""

        Else
            'Populate Controls with Object's data
            With objCustomer
                txtName.Text = .Name
                txtIDNumber.Text = .IDNumber
                txtBirthDate.Text = .BirthDate
                txtAddress.Text = .Address
                txtPhone.Text = .Phone
            End With
        End If

    End Sub
End Class
```

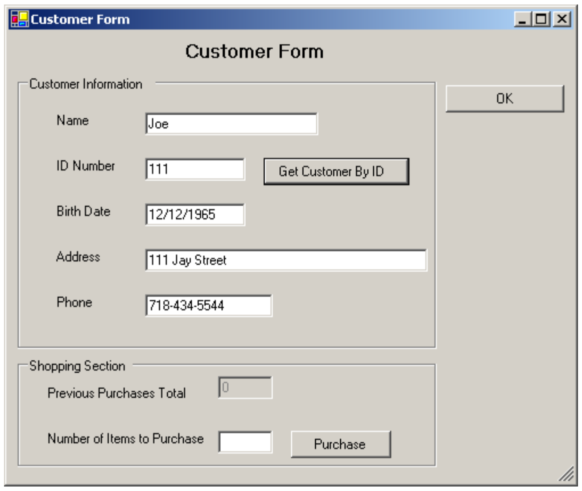
Step 16: Compile & Run the program:

Steps 1 – the Form is displayed with default



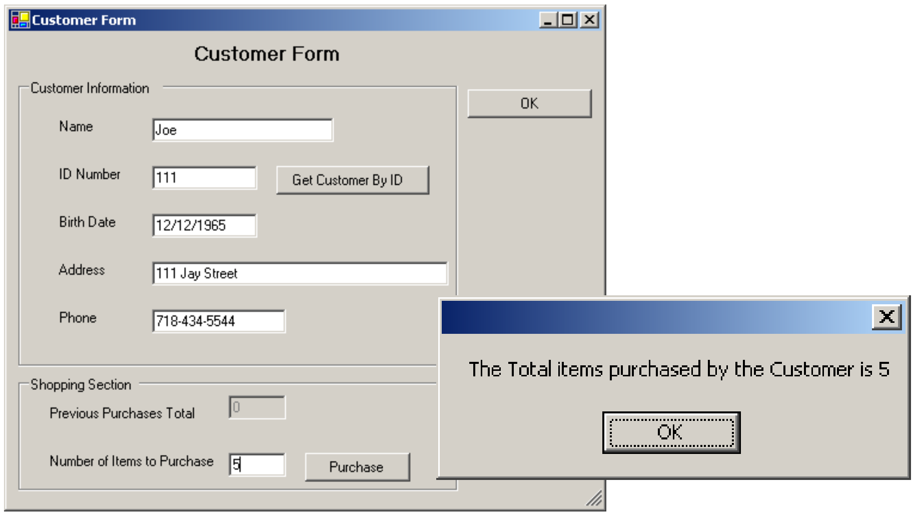
Name:
ID Number: 0
Birth Date: 1/1/1900
Address:
Phone: (000)-000-0000
Previous Purchases Total: 0
Number of Items to Purchase:

Steps 2 – Enter 111 in the ID text box and click the Get Customer Button. Customer 111 data is displayed.



Name: Joe
ID Number: 111
Birth Date: 12/12/1965
Address: 111 Jay Street
Phone: 718-434-5544
Previous Purchases Total: 0
Number of Items to Purchase:

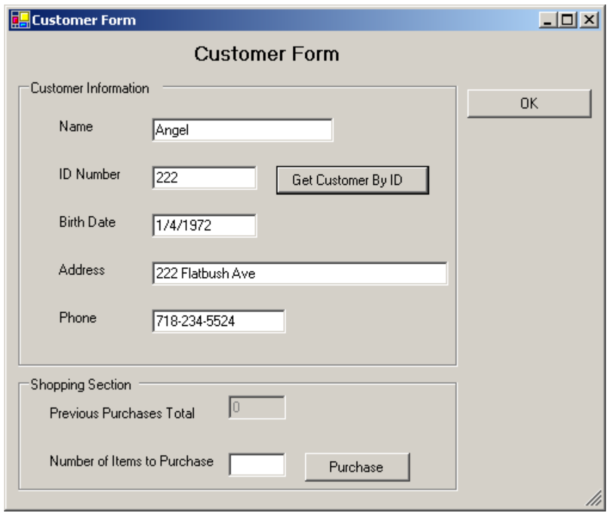
Steps 3 – Now purchase 5 Items. The event-handler will inform you of the purchase
Step 4 – Click OK



Name: Joe
ID Number: 111
Birth Date: 12/12/1965
Address: 111 Jay Street
Phone: 718-434-5544
Previous Purchases Total: 0
Number of Items to Purchase: 5

The Total items purchased by the Customer is 5

Steps 5 – Enter 222 in the ID text box and click the Customer Button to get another customer. Customer 222 data is displayed.


Customer Form

Customer Form

Customer Information

Name: Angel

ID Number: 222

Birth Date: 1/4/1972

Address: 222 Flatbush Ave

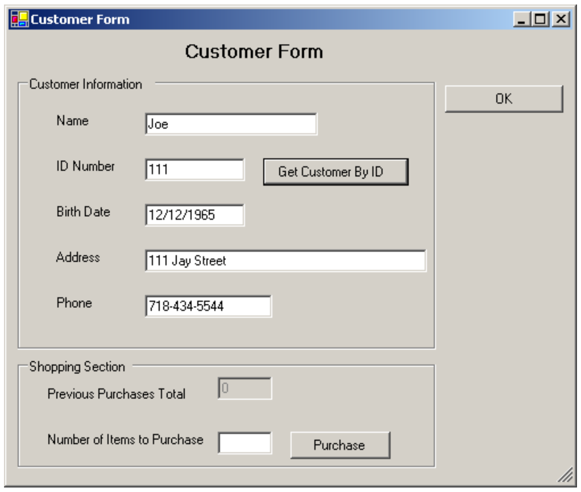
Phone: 718-234-5524

Shopping Section

Previous Purchases Total: 0

Number of Items to Purchase:

Steps 6 – Now Enter 111 again in the ID text box and click the Get Customer Button. Customer 111 data is displayed BUT the Previous Purchased Total is blank. No data for this variable was stored.


Customer Form

Customer Form

Customer Information

Name: Joe

ID Number: 111

Birth Date: 12/12/1965

Address: 111 Jay Street

Phone: 718-434-5544

Shopping Section

Previous Purchases Total: 0

Number of Items to Purchase:

- ❖ The reason we were not able to store any data back to the array is because what is returned to the Form by the Search() method is a copy of the reference, therefore we don't know the index or location of the object just retrieved so we can modify it.
- ❖ The next example will show us an alternative.

6.3.5 Sample Program 4 – Working With Arrays & Objects (Part II)

Module-Driven Window Application – Arrays & Person Class

Problem statement:

- This example has the same requirements as the previous Example 3.
- The difference will be in the Search() method in the Module. This time, search will return a *Reference* or a direct link (Pointer) to the Object in the Array. Therefore any modifications we make to the *Reference* by the calling program will actually modify the element stored in the array.
- In the last example the Previously Purchased Total text box was NOT empty, indicating that there was no storage of the number of items purchased by the Customer.
- In this example this feature will work since we have a direct link to the Object being stored in the array and we can modify it.
- In addition to the other topics covered in previous examples, this Example will demonstrate the following topics:

  - Storing Objects in arrays
  - Searching arrays of objects
  - Displaying objects in arrays
  - Returning Objects from Functions
  - Returning a Reference of the object stored in Array.
  - Modifying the object stored in the array via the reference.

Class Requirements (Same as Previous Example 3)

- The class contains the following data, properties & methods members (See UML Diagram):

  Class Person Member Data, Property, Methods & Events:

  - Same as Previous Example

Form Requirements

- The application will contains the following Form and functionality:

  - Same as previous Example 3

UML Class Diagram

clsEmployee
Name IDNumber BirthDate Address Phone TotalItemsPurchased
Event OnShopping(Items)

New()
New(N)
New(ID)
New(B)
New(N, B)
New(N, ID, B, A, P)
PrintPerson()
Shop()

HOW IT'S DONE:

Part I – Create The Class:

Step 1: Start a new Windows Application project:

Step 2: Add a Form to the project and set its properties as shown in the table:

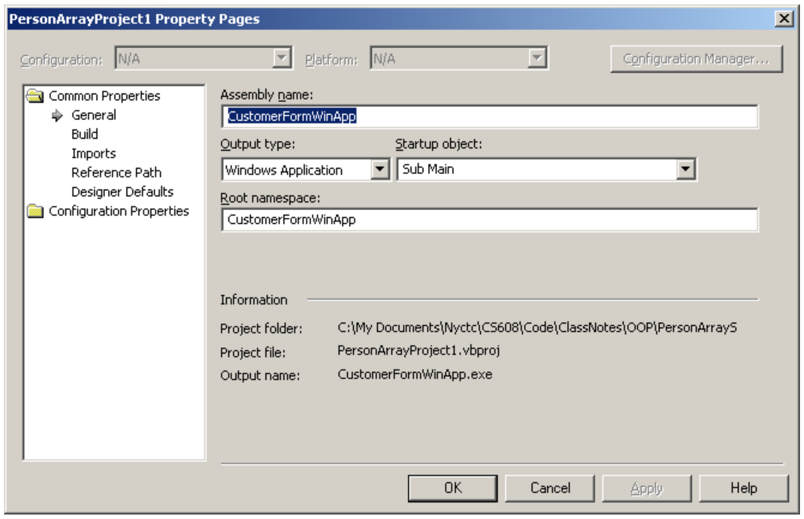
Object	Property	Value
Form1	Name Text	**frmCustomerForm** **Customer Form**

Step 3: Add a Standard Module set its properties as shown in the table:

Object	Property	Value
Module1	Name	**modMainModule**

Step 4: Set the Project's properties to behave as a Module-Driven Windows Application:

Object	Property	Value
Project	Name Startup Object	**CustomerFormWinApp** **Sub Main()**



Assembly name: CustomerFormWinApp
Output type: Windows Application
Startup object: Sub Main
Root namespace: CustomerFormWinApp

Information
Project folder: C:\My Documents\Nyctc\CS608\Code\ClassNotes\OOP\PersonArrayS
Project file: PersonArrayProject1.vbproj
Output name: CustomerFormWinApp.exe

Step 5: Prepare to Reuse the Person Class from Previous Console Application, by Copying the File from previous Application Folder to the Folder of this Windows Application Project

1. Using Windows Explorer, navigate to the Console Application folder of the previous example.
2. Copy/Paste the file clsPerson.vb to this Project folder

Step 6: Add the Class to the Project

1. In the Project Menu, select Add Existing Item… and navigate to the project folder
2. Select the ***clsPerson.vb*** File and click OK
3. The class is now part of the project and ready to be reused!

Step 7: In the Class Module keep private data section as is:

- ❑ Same as before

Step 8: Leave the Property Procedure as is:

- ❑ Same as before

Step 9: In the Class Module code window keep the code for the Constructor Methods:

- ❑ Same as before

Step 10: In the Class Module keep the PrintPerson() Method as is:

- ❑ Same as before

Step 11: In the Class Module Keep Shop() Method as is:

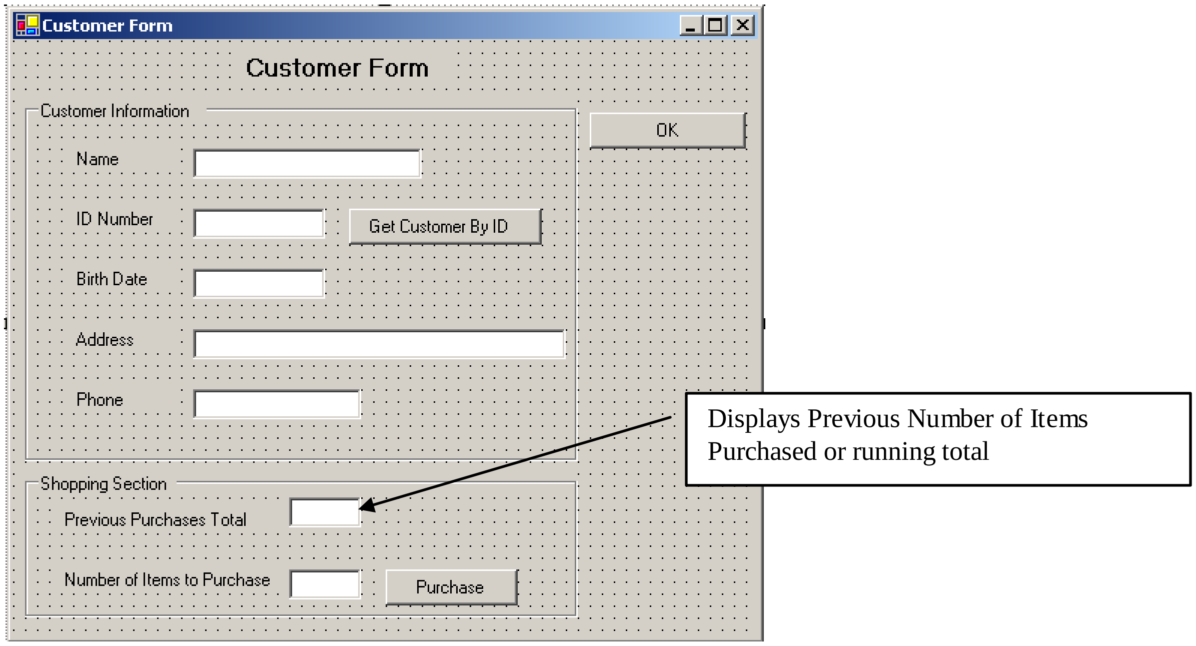
- ❑ Same as before

Part II & III – Create The Object and Use it (The User Interface)

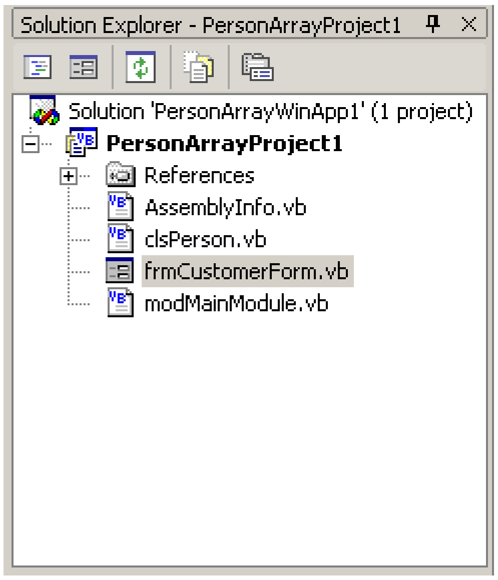
Step 12: Add the following indicated Controls to the frmCustomerForm. Set their properties accordingly:

Object	Property	Value
Form1	Name Text	**frmCustomerForm** **Customer Form**

- Note that the Form now includes a button to initiate a search of the customer by the ID entered in the ID Number Text Box.

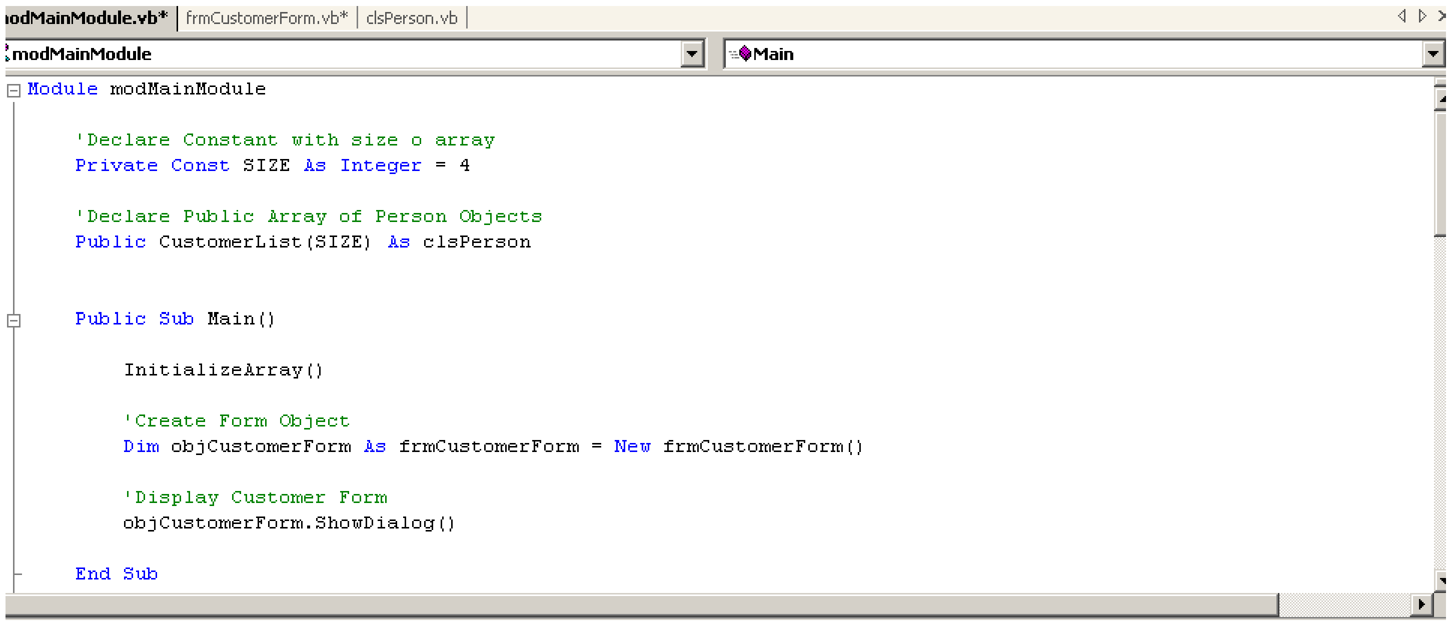


Step 13: At this Point the Project should look as follows:



Step 14: In the Module Add the Following Code:

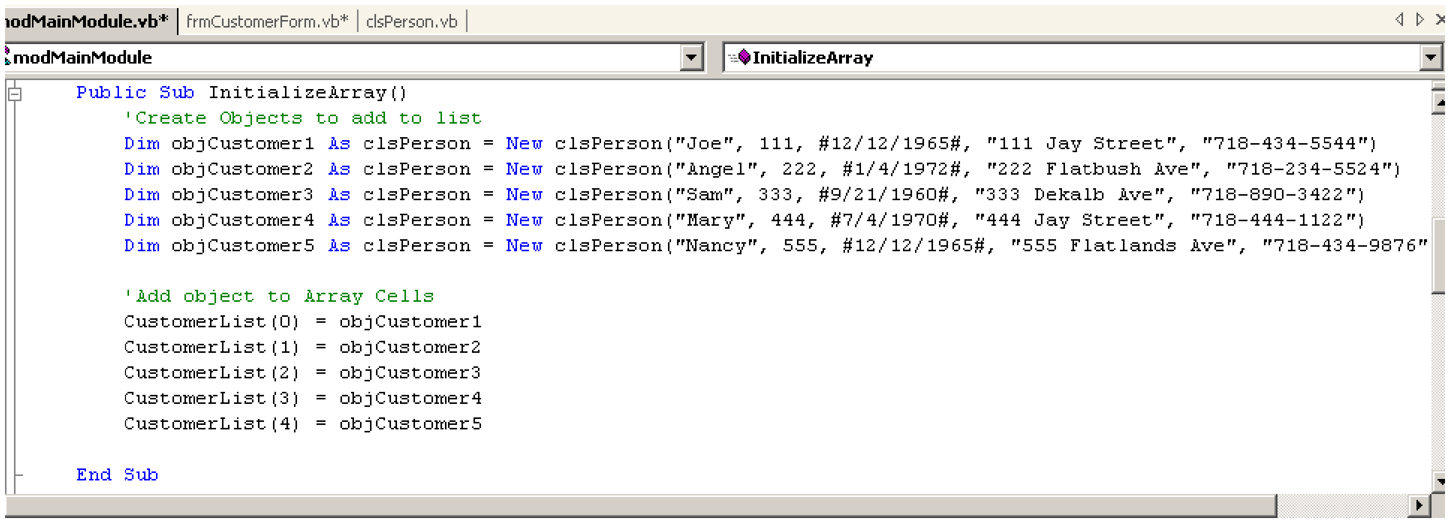
- Code any Global & Private Variable declarations and Sub Main() **(Same as Before!!)**
  1. A Constant Variable created and initialized defining the SIZE of the array
  2. We declare an Array of Objects of type clsPerson
  3. In Sub Main() we Call the InitializeArray method to populate the arrays with objects
  4. We then create an Object of the Form and Display the Form



```vb
Module modMainModule

    'Declare Constant with size o array
    Private Const SIZE As Integer = 4

    'Declare Public Array of Person Objects
    Public CustomerList(SIZE) As clsPerson


    Public Sub Main()

        InitializeArray()

        'Create Form Object
        Dim objCustomerForm As frmCustomerForm = New frmCustomerForm()

        'Display Customer Form
        objCustomerForm.ShowDialog()

    End Sub
```

- Add code for the InitializeArray()method **(Same as Before!!)**:

  3. The InitializeArray() Method creates 5 objects of the clsPerson Class using the parameterized Constructor to initialize the objects with values.
  4. Each clsPerson Object is added to an element of the array.

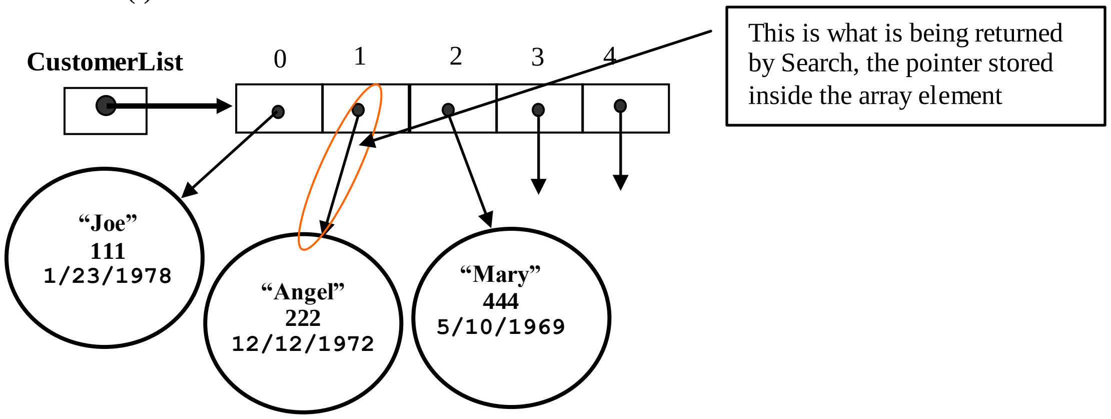


```vb
    Public Sub InitializeArray()
        'Create Objects to add to list
        Dim objCustomer1 As clsPerson = New clsPerson("Joe", 111, #12/12/1965#, "111 Jay Street", "718-434-5544")
        Dim objCustomer2 As clsPerson = New clsPerson("Angel", 222, #1/4/1972#, "222 Flatbush Ave", "718-234-5524")
        Dim objCustomer3 As clsPerson = New clsPerson("Sam", 333, #9/21/1960#, "333 Dekalb Ave", "718-890-3422")
        Dim objCustomer4 As clsPerson = New clsPerson("Mary", 444, #7/4/1970#, "444 Jay Street", "718-444-1122")
        Dim objCustomer5 As clsPerson = New clsPerson("Nancy", 555, #12/12/1965#, "555 Flatlands Ave", "718-434-9876"

        'Add object to Array Cells
        CustomerList(0) = objCustomer1
        CustomerList(1) = objCustomer2
        CustomerList(2) = objCustomer3
        CustomerList(3) = objCustomer4
        CustomerList(4) = objCustomer5

    End Sub
```

- Add the Function *Search()*. Here things are different. Let's look at the algorithm:

  1. This function takes as a parameter an integer value representing the ID of the customer.
  2. In addition, the Function **returns** a Reference to the ***Object*** **<u>stored inside</u>** the Array. If the Object is NOT Found, then a **Nothing** is returned to the calling program.
  3. We use a *For Loop* to iterate through the array by index as follows:

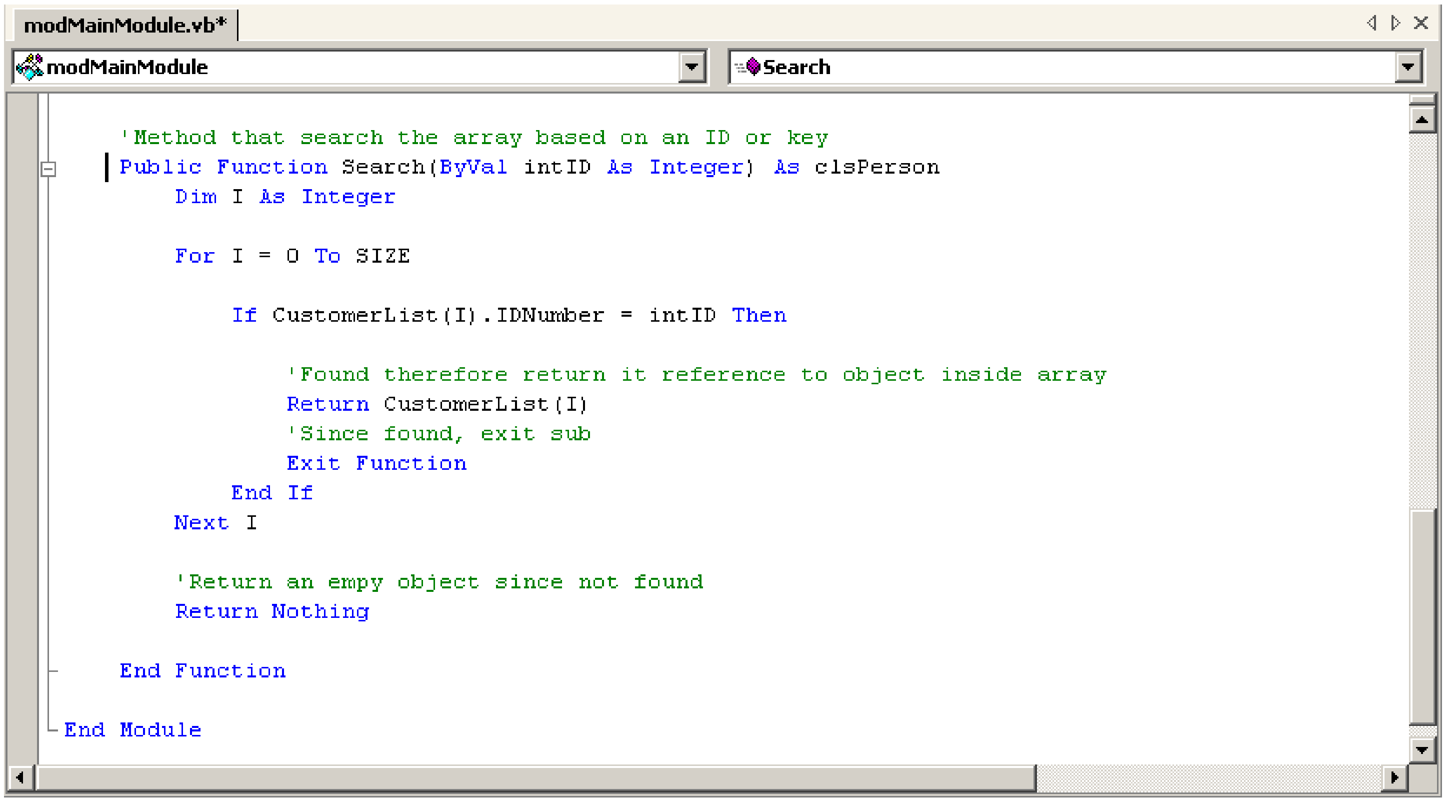
     - A test of the ID number argument to the ID of every Object in the array is made.
     - If the ID matches:
        i. Return the Reference or Pointer Element. Remember that what is being stored in the arrays are pointers, so if we make the following statement: *CustomerList(I)* we are returning the pointer stored in the (I) index.



CustomerList
0
1
2
3
4
This is what is being returned by Search, the pointer stored inside the array element
"Joe"
111
1/23/1978
"Angel"
222
12/12/1972
"Mary"
444
5/10/1969

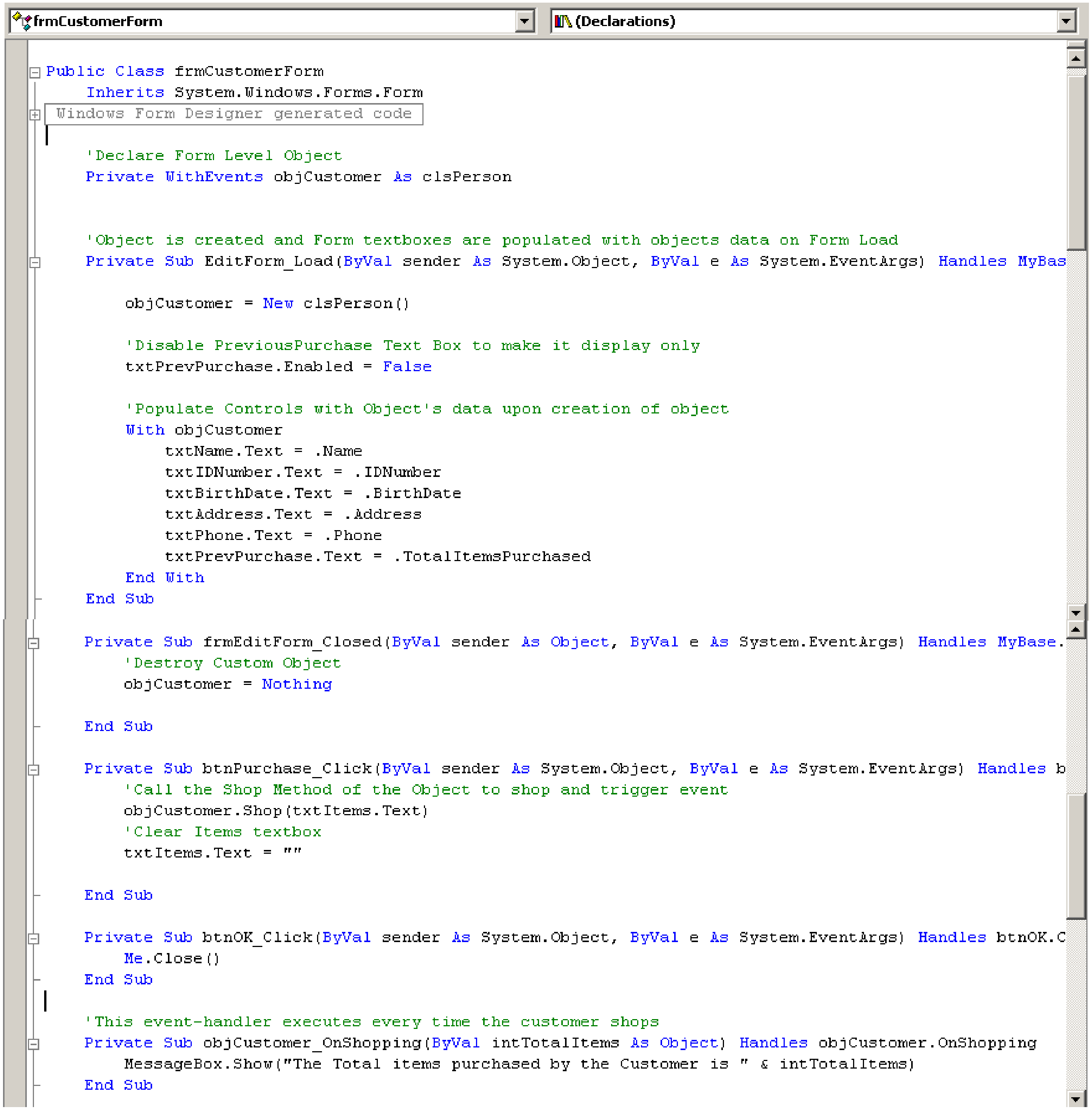
        ii. The Function Exits
     - If none of the ID matches:

        i. The loops completes to the end of the size of the array.
        ii. The Function Returns a **Nothing**!
        iii. The Function Ends



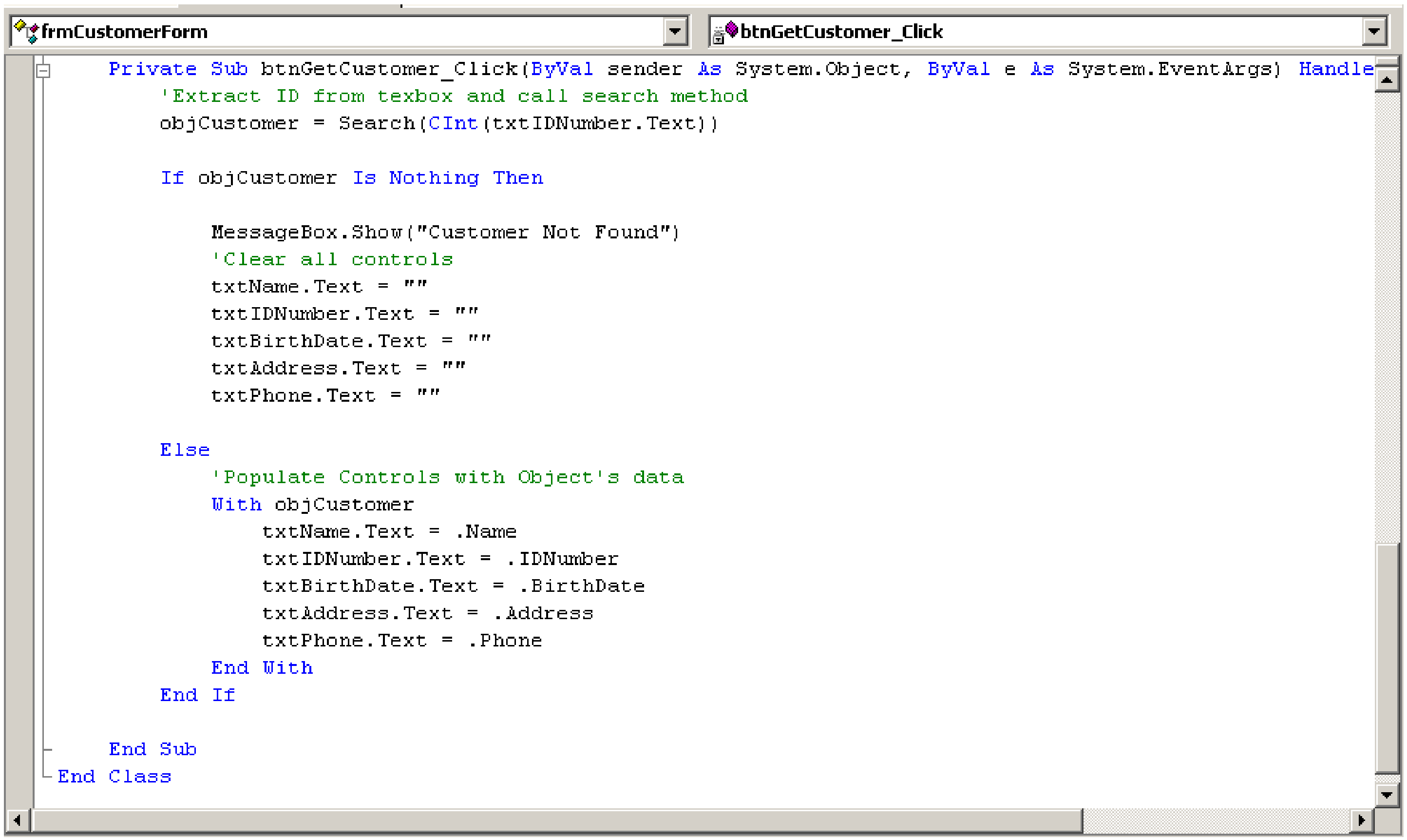
```
    'Method that search the array based on an ID or key
    Public Function Search(ByVal intID As Integer) As clsPerson
        Dim I As Integer

        For I = 0 To SIZE

            If CustomerList(I).IDNumber = intID Then

                'Found therefore return it reference to object inside array
                Return CustomerList(I)
                'Since found, exit sub
                Exit Function
            End If
        Next I

        'Return an empty object since not found
        Return Nothing

    End Function

End Module
```

Step 15: In the Form frmCustomerForm Add the Following Code:



```
Public Class frmCustomerForm
    Inherits System.Windows.Forms.Form
 Windows Form Designer generated code

    'Declare Form Level Object
    Private WithEvents objCustomer As clsPerson


    'Object is created and Form textboxes are populated with objects data on Form Load
    Private Sub EditForm_Load(ByVal sender As System.Object, ByVal e As System.EventArgs) Handles MyBas

        objCustomer = New clsPerson()

        'Disable PreviousPurchase Text Box to make it display only
        txtPrevPurchase.Enabled = False

        'Populate Controls with Object's data upon creation of object
        With objCustomer
            txtName.Text = .Name
            txtIDNumber.Text = .IDNumber
            txtBirthDate.Text = .BirthDate
            txtAddress.Text = .Address
            txtPhone.Text = .Phone
            txtPrevPurchase.Text = .TotalItemsPurchased
        End With
    End Sub

    Private Sub frmEditForm_Closed(ByVal sender As Object, ByVal e As System.EventArgs) Handles MyBase.
        'Destroy Custom Object
        objCustomer = Nothing

    End Sub

    Private Sub btnPurchase_Click(ByVal sender As System.Object, ByVal e As System.EventArgs) Handles b
        'Call the Shop Method of the Object to shop and trigger event
        objCustomer.Shop(txtItems.Text)
        'Clear Items textbox
        txtItems.Text = ""

    End Sub

    Private Sub btnOK_Click(ByVal sender As System.Object, ByVal e As System.EventArgs) Handles btnOK.C
        Me.Close()
    End Sub

    'This event-handler executes every time the customer shops
    Private Sub objCustomer_OnShopping(ByVal intTotalItems As Object) Handles objCustomer.OnShopping
        MessageBox.Show("The Total items purchased by the Customer is " & intTotalItems)
    End Sub
```

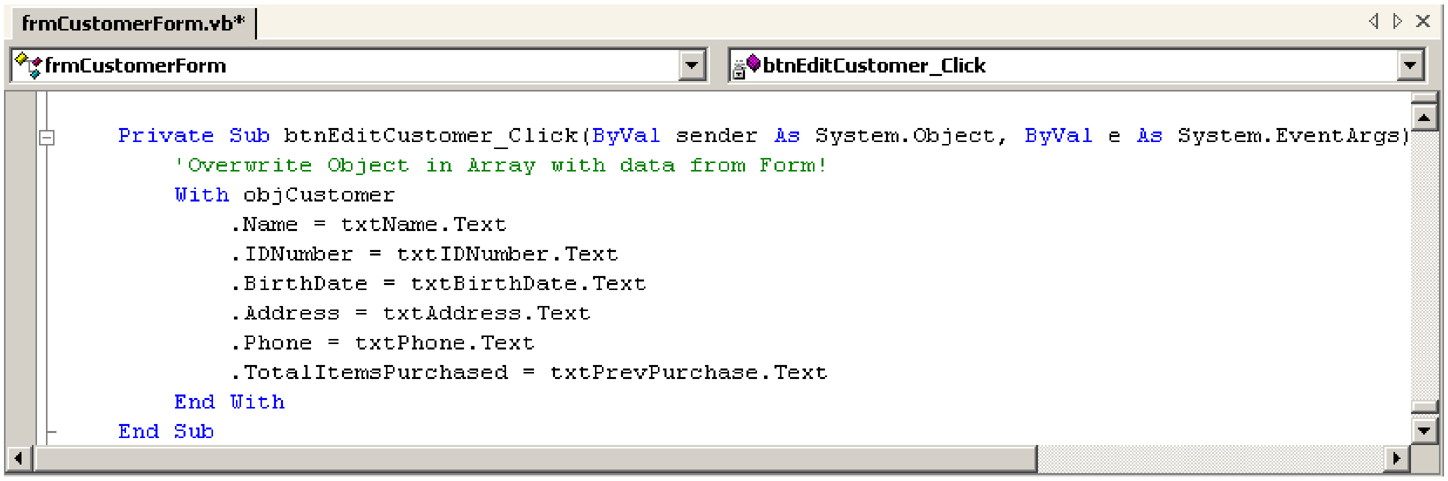
- *The GetCustomer* Click Event:
  - In this example the code in this Event_Handler does not change
    - The search method is called to perform the search by customer ID
    - Note that the Search() method returns a Reference to the original Object in the Array
    - We then assign this reference to the Customer Object inside the Form.
    - **The point here is that what ever we do to the objCustomer Object in the Form, we are doing to the actual Object stored in the array!**
    - We populate the text boxes with the values from objCustomer
    - If Search() return a Nothing, we notify the user.



frmCustomerForm | btnGetCustomer_Click

```
    Private Sub btnGetCustomer_Click(ByVal sender As System.Object, ByVal e As System.EventArgs) Handle
        'Extract ID from texbox and call search method
        objCustomer = Search(CInt(txtIDNumber.Text))

        If objCustomer Is Nothing Then

            MessageBox.Show("Customer Not Found")
            'Clear all controls
            txtName.Text = ""
            txtIDNumber.Text = ""
            txtBirthDate.Text = ""
            txtAddress.Text = ""
            txtPhone.Text = ""

        Else
            'Populate Controls with Object's data
            With objCustomer
                txtName.Text = .Name
                txtIDNumber.Text = .IDNumber
                txtBirthDate.Text = .BirthDate
                txtAddress.Text = .Address
                txtPhone.Text = .Phone
            End With
        End If

    End Sub
End Class
```

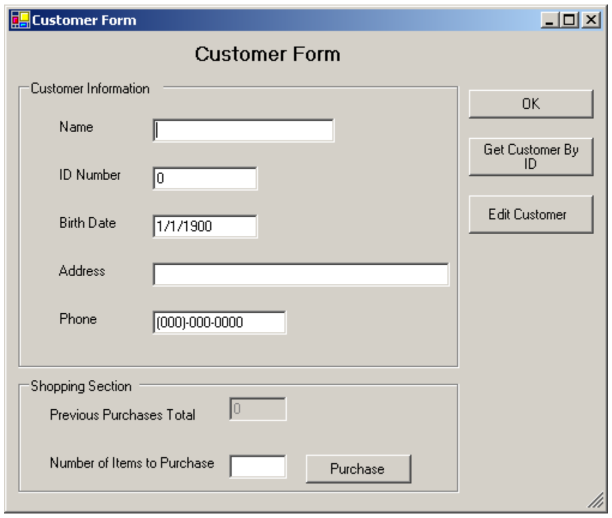
- *The EditCustomer_Click* Event:
  - In order to further demonstrate that we are actually modifying the object stored in the array, I added an Edit Customer button to the Form that will allow us to write the content of the text boxes to the Object residing inside the Array.
  - In other words we now can edit any of the Customer's Information Text Boxes and save them to the Array:



```
    Private Sub btnEditCustomer_Click(ByVal sender As System.Object, ByVal e As System.EventArgs)
        'Overwrite Object in Array with data from Form!
        With objCustomer
            .Name = txtName.Text
            .IDNumber = txtIDNumber.Text
            .BirthDate = txtBirthDate.Text
            .Address = txtAddress.Text
            .Phone = txtPhone.Text
            .TotalItemsPurchased = txtPrevPurchase.Text
        End With
    End Sub
```

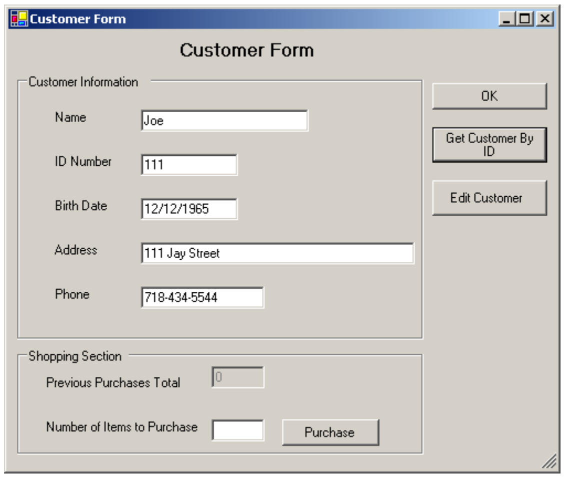
Step 16: Compile & Run the program:

Steps 1 – the Form is displayed with default



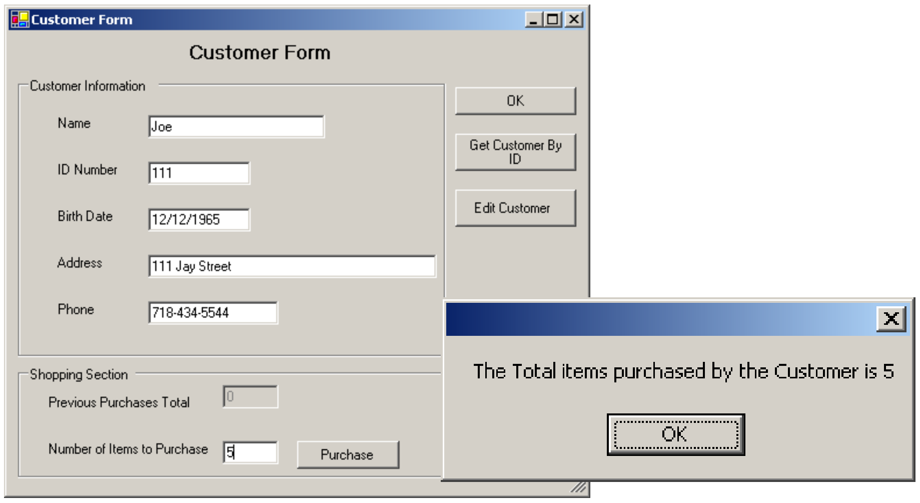
Name	
ID Number	0
Birth Date	1/1/1900
Address	
Phone	(000)-000-0000
Previous Purchases Total	0
Number of Items to Purchase	

Steps 2 – Enter 111 in the ID text box and click the Get Customer Button. Customer 111 data is displayed.



Name	Joe
ID Number	111
Birth Date	12/12/1965
Address	111 Jay Street
Phone	718-434-5544
Previous Purchases Total	0
Number of Items to Purchase	

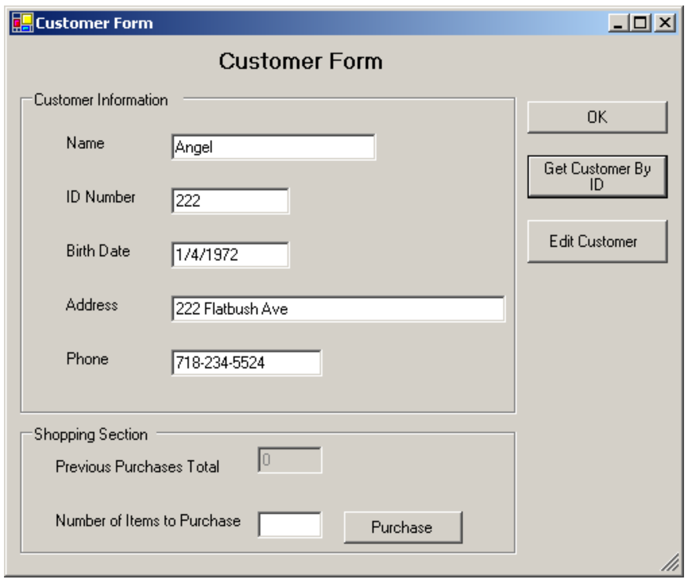
Steps 3 – Now purchase 5 Items. The event-handler will inform you of the purchase
Step 4 – Click OK



Name	Joe
ID Number	111
Birth Date	12/12/1965
Address	111 Jay Street
Phone	718-434-5544
Previous Purchases Total	0
Number of Items to Purchase	5

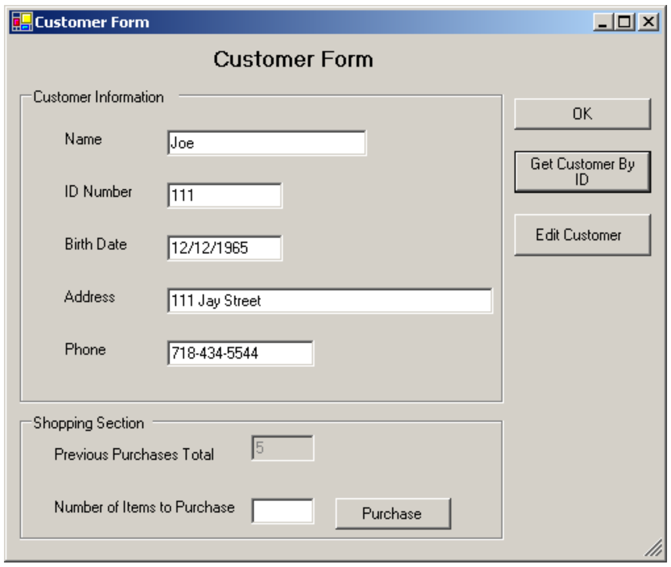
The Total items purchased by the Customer is 5

Steps 5 – Enter 222 in the ID text box and click the Customer Button to get another customer. Customer 222 data is displayed.



Name: Angel
ID Number: 222
Birth Date: 1/4/1972
Address: 222 Flatbush Ave
Phone: 718-234-5524
Previous Purchases Total: 0
Number of Items to Purchase:

Steps 6 – Now Enter 111 again in the ID text box and click the Get Customer Button. Customer 111 data is displayed INCLUDING the Previous Purchased Total. Data was stored in the array.



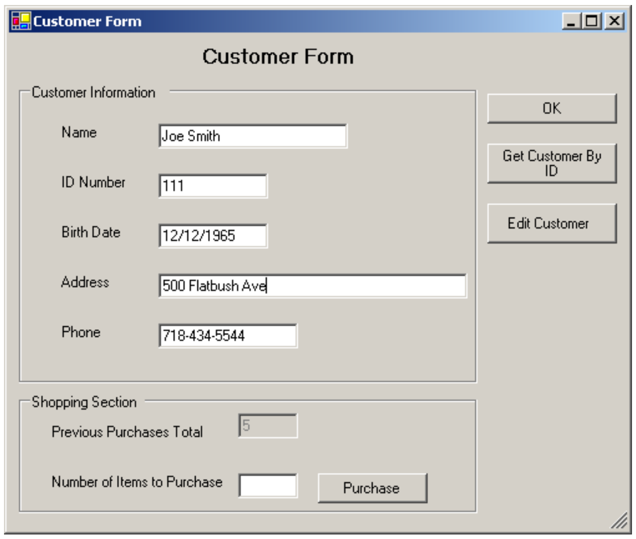
Name: Joe
ID Number: 111
Birth Date: 12/12/1965
Address: 111 Jay Street
Phone: 718-434-5544
Previous Purchases Total: 5
Number of Items to Purchase:

- ❖ Notice that now the stored value appears in the Previous Purchased Total text box.

Now let's test the Modify or Edit Customer Feature:

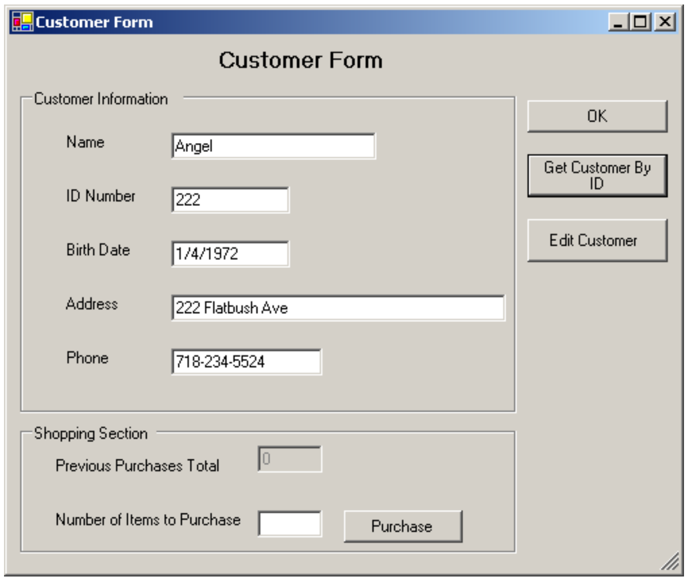
Steps 7 – Now Enter 111 again in the ID text box and click the Get Customer Button. Customer 111 data is displayed.

Step 8 – Now Modify the Customer Information and Click the Edit Customer Button



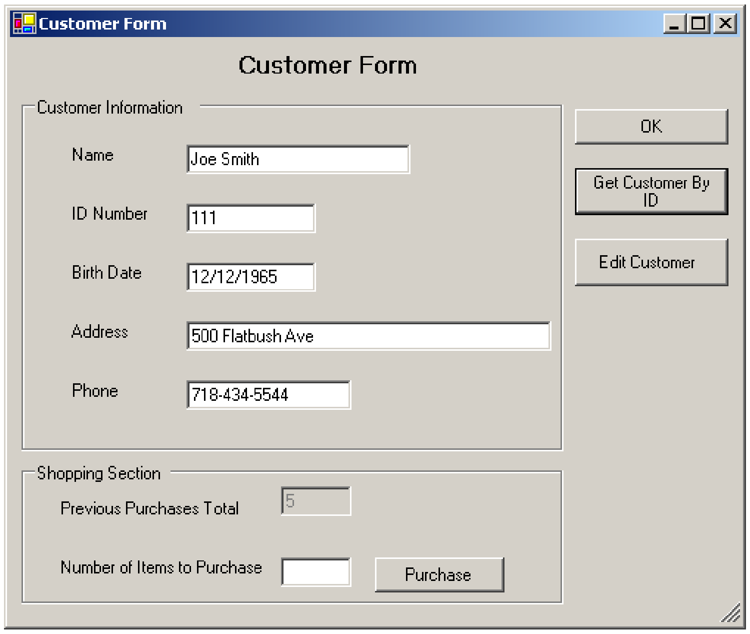
Name: Joe Smith
ID Number: 111
Birth Date: 12/12/1965
Address: 500 Flatbush Ave
Phone: 718-434-5544
Previous Purchases Total: 5
Number of Items to Purchase:

Steps 9 – Enter 222 in the ID text box and click the Customer Button to get another customer. Customer 222 data is displayed.



Name: Angel
ID Number: 222
Birth Date: 1/4/1972
Address: 222 Flatbush Ave
Phone: 718-234-5524
Previous Purchases Total: 0
Number of Items to Purchase:

Steps 10 – Now Enter 111 again in the ID text box and click the Get Customer Button. Customer 111 data is displayed INCLUDING the changes made when we clicked the Edit Customer Button.



Name: Joe Smith
ID Number: 111
Birth Date: 12/12/1965
Address: 500 Flatbush Ave
Phone: 718-434-5544
Previous Purchases Total: 5
Number of Items to Purchase:

5.3.5 Sample Program 5 – Small Business Application Example

Windows Driven Application – Customer & Retail Management

Problem statement:

- Use a Windows-Driven Application (Startup Object = Sub Main) to create a customer/retail management system for a small business. The objectives of the application is to allow employees of the retail business to use the application for the following tasks:

    - Sell products to customers – Customers can shop and purchase items by quantity. Example 5 items, 10 items etc.
    - Manage Customers – Search for customer records and do the following: **Search for Customer**, **Add new Customer**, **Edit Customer**, **Remove Customer**, **Print Customer** and **Print All Customers**.

- The application is to have the following FORM OR USER-INTERFACE to allow employees to manage the system:

    - **Main Form** – Main Portal for users to navigate to other forms for customer management and shopping
    - **CUSTOMER MANAGEMENT** – User-interface for managing customers
    - **RETAIL MANAGEMENT FORM** – User-interface for cashiers to sell the products to each customer.

- NOTE that we will implement this application ONLY USING THE VB.NET LANGUAGE COMPONENTS WE HAVE LEARNED UP TO THIS POINT. A realistic Business Application will use more appropriate technology to implement such application. Nevertheless, this example will truly test our understanding of OBJECTS AND CLASSES up to this point.

Application Architecture Introduction (Separating Interface from Implementation)

- We will continue to implement proper application programming ARCHITECTURE and FORMATS adhering to BEST PRACTICE by making all attempts to SEPARATE INTERFACE from IMPLEMENTATION.
- In other words SEPARATE USER-INTERFACE CODE with PROCESSING. This is done as follows:

    - Forms or User-interface code or the code in the FORMS will contain NO PROCESSING CODE!
    - FORMS will only contain User-Interface code or code to interact with USER ONLY!
    - FORM code includes MESSAGE BOXES, UI CONTROLS manipulation, getting data from user, displaying data to user.
    - All PROCESSING CODE will reside in the MODULE INSIDE PROCESSING METHODS!
    - PROCESSING METHODS IN MODULE will be CALLED BY THE FORMS TO DO THE WORK!
    - PROCESSING MODULE will contain LITTLE or NO FORM CODE! SUCH AS CALLS to FORMS OR FORM CONTROLS
    - FORM CODE WILL INTERACT WITH USER AND CALL PROCESSING METHODS IN MODULE TO DO THE WORK!

Re-using Objects

- We will also review the OOP concept of **Reusability** by reusing the Person Class from the previous examples and modifying the class for this project.

Database Requirements

- We will NOT use a real database but SIMMULATE the database using an ARRAY OF CUSTOMER OBJECTS.

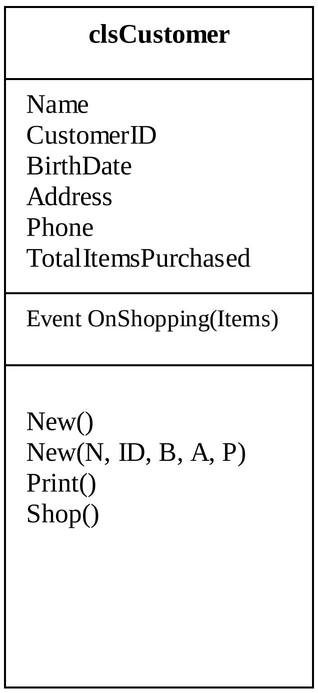
Form, & Module Requirements

- The main or driver program will utilize several forms. A Main Form as a startup point to invoke the Customer Management & Retail Management Forms. Each one of these Forms will perform their function and manage the objects created in the program.
- In addition the program will contain a Module where several global public Objects will reside that represent a SIMMULATED DATABASE OF CUSTOMER OBJECTS.

Additional Requirements

- This Example will demonstrate the following topics:
  - Windows Module-Driven Application Example
  - Creating Classes & reusing Classes from previous programs
  - Creating, initializing ARRAY OF Objects
  - Using Objects as follows:
    - (Set, Get, Calling methods, triggering Form Object event-handlers, & programming Form objects event-handlers)
    - Working with Objects & Forms
    - Global Objects in a Module
    - Assigning Object Reference to one another (Object to Object Interaction)

UML Class Diagram



Class Requirements

- Create a class named **clsCustomer**. The class contains the following data, properties & methods:

  Class clsCustomer Member Data:

Name:	Type String
CustomerID:	Type String.
BirthDate:	Date
Address:	Type String
Phone:	Type String
TotalItemsPurchased:	Type String

  Class Member Properties & Methods:
  - Set & Get Properties for each data member.

  Class Member Methods:
  - Print(): Displays the Persons data
  - Shop(Items): Allows customer objects to purchase items

Form Requirements

- The application will contains the following Forms:

frmMainForm:	Portal to navigate to other Forms
frmCustomerManagement:	Form contains controls to Search, Add, Edit, Delete, Print and & Print all Customers
frmRetailManagement:	Form to perform the retail shopping process and also displays Customer's information

- Note that the Forms will create any necessary FORM-LEVEL ***Objects*** & Form ***Event-Handlers*** that respond to user interactions.

Module Requirements

- The application will contains one Module with the following requirements:

  - ***MainModule***: Module to contain the following components:
    - ***Global*** **ARRAY** of CUSTOMER OBJECT **POINTERS** which represent the Customer DATABASE.
    - ***Sub Main()*** – Main method which controls program flow.
    - The following PROCESSING METHODS:
      - ***Sub Initialize()*** – Populate the ARRAY of POINTERS with CUSTOMER OBJECTS. Creates 5 CUSTOMER OBJECTS with data and assigns them to the ARRAY of POINTERS.
      - ***Function SearchCustomer(ID)*** – Search ARRAY of Objects for the object whose ID is the parameter. RETURNS a POINTER to the object found or returns a NOTHING if not found.
      - ***Function AddCustomer (OBJECT POINTER)*** – Search ARRAY of Objects for a NULL POINTER and has it POINT to the Object Pointer pass as Parameter. Returns a TRUE if empty pointer found and objects added, else FALSE if no room found in ARRAY.
      - ***Function AddCustomer (parameter1, parameter2, parameter3 etc….)*** – OVERLOADED ADD method. Creates a NEW EMPTY OBJECT, populates object with properties passed as parameters. Search ARRAY of Objects for a NULL POINTER and has it POINT to the NEW OBJECT. Returns a TRUE if empty pointer found and object added, else FALSE if no room found in ARRAY

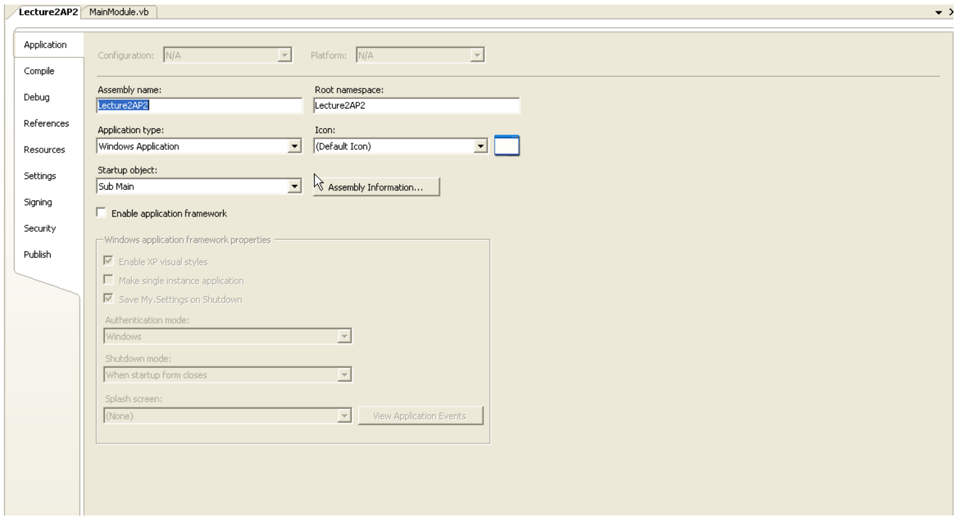
- ***Function EditCustomer (ID, OBJECT POINTER)*** – Search ARRAY for OBJECT whose ID is passed as parameter. If found in ARRAY, object is REPLACED WITH OBJECT passed as parameter. Returns a TRUE if object found and REPLACED. Returns FALSE if object not found in ARRAY.
- ***Function EditCustomer (parameter1, parameter2, parameter3 etc….)*** – OVERLOADED EDIT method. Search ARRAY for OBJECT whose ID is passed as parameter. If found in ARRAY, object is MODIFIED by SETTING ITS PROPERTIES ON THE OBJECT IN THE ARRAY. Returns a TRUE if object found and MODIFIED. Returns FALSE if object not found in ARRAY
- ***Function RemoveCustomer(ID)*** – Search ARRAY for the object whose ID is the parameter. REMOVES OBJECT from ARRAY by setting ARRAY(i) POINTER to NOTHING. RETURNS a TRUE if found and REMOVED or returns FALSE otherwise.
- ***Function PrintCustomer(ID)*** – Search ARRAY for the object whose ID is the parameter. Calls PRINT() method of object. RETURNS a TRUE if found or returns FALSE otherwise.
- ***Sub PrintALLCustomers()*** – Search ARRAY and calls PRINT() method of EACH OBJECT in ARRAY.

HOW IT'S DONE:

Part I – Create The Class:

Step 1: Start a new Windows Application. Set PROJECT PROPERTIES so that we have a Module-Driven Application:

Object	Property	Value
Project	Name Startup Object	**CustomerFormWinApp** **Sub Main**



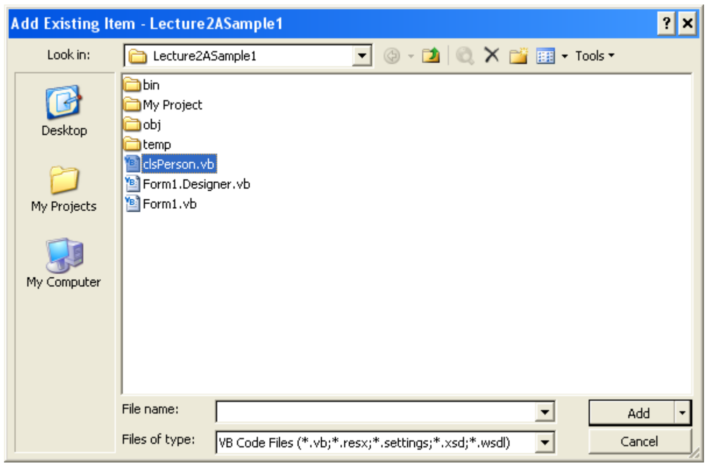
Configuration: N/A
Platform: N/A
Assembly name: Lecture2AP2
Root namespace: Lecture2AP2
Application type: Windows Application
Icon: (Default Icon)
Startup object: Sub Main
☐ Enable application framework
Windows application framework properties
☑ Enable XP visual styles
☐ Make single instance application
☑ Save My.Settings on Shutdown
Authentication mode: Windows
Shutdown mode: When startup form closes
Splash screen: (None)

Step 2: Prepare to Reuse the Person Class from Previous Example, by Copying the File from previous Application Folder to the Folder of this Windows Application Project

3. Using Windows Explorer, navigate to the Folder of the previous example Console Application Sample Program 1.
4. Copy/Paste the file **clsPerson.vb** to this Project folder

Step 3: Add the Class to the Project

4. In the Project Menu, select ***Add***| ***Existing Item…*** and navigate to the project folder



Look in: Lecture2ASample1
bin
My Project
obj
temp
clsPerson.vb
Form1.Designer.vb
Form1.vb
File name:
Files of type: VB Code Files (*.vb;*.resx;*.settings;*.xsd;*.wsdl)

5. Select the ***clsPerson.vb*** File and click OK
6. The class is now part of the project and ready to be Reused!

Step 4: In the SOLUTION EXPLORE, RENAME the clsPerson Class to clsCustomer

Step 5: In the Class Module code window MODIFY the code for the private data as follows:

```
Option Explicit On
Option Strict On
Public Class clsCustomer
    '*********************************************************************
    'Class Data or Variable declarations
    Private m_Name As String
    Private m_CustomerID As String
    Private m_BirthDate As Date
    Private m_Address As String
    Private m_Phone As String
    Private m_TotalItemsPurchased As Integer
```

Step 6: In the Class Module Declare OnShopping Event:

```
    '*********************************************************************
    'Event Declarations
    Public Event OnShopping(ByVal intTotalItems As Integer)
```

Step 7: In the Class Module code window enter the code for public Properties:

```
    'Property Procedures
    Public Property Name() As String
        Get
            Return m_Name
        End Get
        Set(ByVal Value As String)
            m_Name = Value
        End Set
    End Property

    Public Property CustomerID() As String
        Get
            Return m_CustomerID
        End Get
        Set(ByVal Value As String)
            m_CustomerID = Value
        End Set
    End Property

    Public Property BirthDate() As Date
        Get
            Return m_BirthDate
        End Get
        Set(ByVal Value As Date)
            m_BirthDate = Value
        End Set
    End Property
    'Property Procedures
    Public Property Address() As String
        Get
            Return m_Address
        End Get
        Set(ByVal Value As String)
            m_Address = Value
        End Set
    End Property

    Public Property Phone() As String
        Get
            Return m_Phone
        End Get
        Set(ByVal Value As String)
            m_Phone = Value
        End Set
    End Property

    Public Property TotalItemsPurchased() As Integer
        Get
            Return m_TotalItemsPurchased
        End Get
        Set(ByVal Value As Integer)
            m_TotalItemsPurchased = Value
        End Set
    End Property
```

Step 8: In the Class Module code window enter the code for Constructor Methods (Non-Parameter and/or Parameterized):

```
    '*********************************************************************
    'Class Constructor Methods

    'Default Constructor
    Public Sub New()
        'Note that private data members are being initialized
        m_Name = ""
        m_CustomerID = ""
        m_BirthDate = #1/1/1900#
        m_Address = ""
        m_Phone = "(000)-000-0000"
        m_TotalItemsPurchased = 0
    End Sub

    'Parameterized Constructor
    Public Sub New(ByVal Name As String, ByVal IDNum As String, ByVal BDate As Date, _
    ByVal Address As String, ByVal Phone As String)
        'Note that as example we are NOT using the private data but
        'the Property Procedures instead when setting the data via the constructor
        Me.Name = Name
        Me.CustomerID = IDNum
        Me.BirthDate = BDate
        Me.Address = Address
        Me.Phone = Phone

        'Not included in parameters, so we intialize it
        Me.TotalItemsPurchased = 0
    End Sub
```

Step 9: MODIFY the Print() method as required:

```
    '*********************************************************************
    '*********************************************************************
    'Class Methods
    '*********************************************************************

    ''' <summary>
    ''' Method that diplays Customer's data
    ''' </summary>
    ''' <remarks></remarks>
    Public Sub Print()

        'Display object Content
        MessageBox.Show(m_Name & ", " & m_CustomerID & ", " & _
        m_BirthDate & ", " & m_Address & ", " & m_Phone & ", " & m_TotalItemsPurchased)

    End Sub
```

- **NOTE THAT THIS CLASS CONTAINS A USER-INTERFACE CODE VIA A MESSAGE BOX. THIS IS ONLY FOR TEACHING PURPOSE!!**
- **YOU SHOULD NOT DISPLAY ANY MESSAGE BOXEX OR USER-INTERFACE CODE FROM WITHIN A CLASS IN HWS AND PROJECTS UNLESS OTHERWISE INSTRUCTED!!**

Step 10: Create Shop(*Item*) method:

```
    '*********************************************************************
    ''' <summary>
    ''' Shops by addign items to be purchased to running total items.
    ''' Triggers On Shopping Event
    ''' </summary>
    ''' <param name="intItems"></param>
    ''' <remarks></remarks>
    Public Sub Shop(ByVal intItems As Integer)
        m_TotalItemsPurchased = m_TotalItemsPurchased + intItems

        'Raise or trigger event & send information with the event
        RaiseEvent OnShopping(m_TotalItemsPurchased)

    End Sub


End Class
```

Part II & III – Create & Use The Objects (The User Interface Code)

Standard Module:

Step 11: Add a Module to the Project and set its properties as show in table below:

Object	Property	Value
Module	Name Text	**MainModule** **MainModule**

Step 12: Add Module GLOBAL declarations:

- In the module, we will ARRAY OF OBJECT POINTERS. These POINTERS will eventually point to objects which will represent our simulated DATABASE OF CUSTOMERS!
- In addition we create an object for the MAIN FORM..

```
Option Explicit On
Option Strict On

Module MainModule

'*****************************************************************************
' GLOBAL VARIABLES & OBJECT DECLARATIONS SECTION
'*****************************************************************************

    'Declare Constant with size o array
    Private Const SIZE As Integer = 9

    'Declare Public Array of Person Objects
    Public arrCustomerList(SIZE) As clsCustomer

    'Declare & Create Public FORM Object
    Dim objMainForm As frmMainForm = New frmMainForm()
```

Step 13: Add Sub Main() method:

- Sub main executes and call Initialize method to populate ARRAY, then Displays the MAIN FORM..

```
    '*****************************************************************************
    ' MAIN METHOD DECLARATION
    '*****************************************************************************
    ''' <summary>
    ''' Main program simply populates array with test objects
    ''' Display Customer Management Form to manage Customers
    ''' </summary>
    ''' <remarks></remarks>
    Public Sub Main()
        'Initialize Array
        Initialize()

        'Display Main Form
        objMainForm.ShowDialog()

    End Sub
```

Step 14: Add Module INITIALIZE() Method declarations:

- Mow we begin to add PROCESSING METHODS TO THE MODULE that will do the work for the FORMS.
- The first method we implement is the INITIALIZE() method. This sub procedure creates 5 OBJECTS of the PERSON CLASS and assigns them to the 5 GLOBAL POINTERS.
- At this point the simulated DATABASE OF CUSTOMERS is not POPULATED WITH OBJECTS!

```
    '*****************************************************************************
    ' METHOD DECLARATIONS
    '*****************************************************************************
    ''' <summary>
    ''' Intended to execute at the start of the program. Can be used to perform
    ''' any initialization. In this case, Create 5 OBJECT populated objects and
    ''' ADD objects to ARRAY.
    ''' </summary>
    ''' <remarks></remarks>
    Public Sub Initialize()
        'Declare  5 POINTERS to Customer Object
Dim objCustomer1, objCustomer2, objCustomer3, objCustomer4, objCustomer5 As clsCustomer

        'Create objects and initialize with data via paremterized constructor
        objCustomer1 = New clsCustomer("Joe", "111", #12/12/1965#, _
                                "111 Jay Street", "718-434-5544")
        objCustomer2 = New clsCustomer("Angel", "222", #1/4/1972#, _
                                "222 Flatbush Ave", "718-234-5524")
        objCustomer3 = New clsCustomer("Sam", "333", #9/21/1960#, _
                                "333 Dekalb Ave", "718-890-3422")
        objCustomer4 = New clsCustomer("Mary", "444", #7/4/1970#, _
                               "444 Jay Street", "718-444-1122")
        objCustomer5 = New clsCustomer("Nancy", "555", #12/12/1965#, _
                                "555 Flatlands Ave", "718-434-9876")

        arrCustomerList(0) = objCustomer1
        arrCustomerList(1) = objCustomer2
        arrCustomerList(2) = objCustomer3
        arrCustomerList(3) = objCustomer4
        arrCustomerList(4) = objCustomer5

    End Sub
```

Step 15: Create SEARCHCUSTOMER(ID) FUNCTION declarations:

- Purpose of this method is to search the database (ARRAY) for the object whose ID is parameter and return a POINTER to the object
- How it works:
  - **FOR LOOP** is used to search array. THIS SEARCH ALGORITHM IS COMMON FOR CODE WHICH SEARCH ARRAYS FOR OBJECTS.
  - In a nut shell, this algorithm does the following:
    1. Iterate ARRAY using FOR LOOP.
    2. Skips each EMPTY POINTER OR A NOTHING.
    3. Interrogates each OBJECT for its ID using ARRAY(INDEX).ID_PROPERTY
    4. Takes an action after interrogation (RETURN POINTER TO OBJECT, SET'S PROPERTY, OR CALL METHOD etc.)
    5. In this case, we RETURN POINTER TO OBJECT OR ARRAY POINTER ARRAY(INDEX).. REMEMBER, THE RETURN KEYWORD ALSO EXITS THE METHOD
    6. If a match (PROPERTY = ID?) is NOT FOUND then we reach the END OF FOR LOOP. At this point method RETURNS A NOTHING

```
'*******************************************************************************
''' <summary>
''' Function Searches the database for POINTER to object whose ID is a parameter
''' Skips the empty or NULL pointers before interrogating the object for the ID.
''' Returns POINTER to OBJECT and EXITS!
''' </summary>
''' <param name="IDNum"></param>
''' <returns></returns>
''' <remarks></remarks>
Public Function SearchCustomer(ByVal IDNum As String) As clsCustomer

    'Step 1-Search Array for ID Number
    For i As Integer = 0 To SIZE
        'Step 2-Skip the Empty Cells
        If Not (arrCustomerList(i) Is Nothing) Then
            'Step 3-Interrogate Object
            If arrCustomerList(i).CustomerID = IDNum Then
                'Step 4-Found ID, Return POINTER to OBJECT IN ARRAY & Exit
                Return arrCustomerList(i)
            End If
        End If
    Next

    'Step 5-Did not find object in search return a nothing
    Return Nothing
End Function
```

Step 16: Create ADDCUSTOMER(OBJECT) FUNCTION declarations:

- ❑ Purpose of this method is to ADD a new Customer to the ARRAY. True is returned if successful, False if no EMPTY OR NULL POINTERS ARE AVAILABLE.
- ❑ How it works:
  - **FOR LOOP** is used to search array for EMPTY POINTER.
  - This algorithm does the following:
    1. Iterate ARRAY using FOR LOOP.
    2. Interrogate each ARRAY(i) POINTER if is an EMPTY POINTER OR A NOTHING.
    3. SET ARRAY(i) POINTER to point to OBJECT POINTER passed as argument
    4. RETURN a TRUE indicating object was added
    5. If NO EMPTY POINTER IS FOUND, then we RETURN A FALSE indicating no room was found in array.

- ❑ One important point here to note is that this ADD method ADDS A NEW OBJECT PASSED AS ARGUMENT TO THE METHOD! Point here is that the FORM OR USER-INTERFACE NEEDS TO CREATE AND POPULATE THIS OBJECT AND PASS IT TO THE METHOD.

```
'******************************************************************************
''' <summary>
''' Function Adds NEW objects passed as parameter to database.
''' Searches for the FIRST nothing or empty POINTER and adds object to that POINTER.
''' Returns a TRUE When OBJECT added OR FALSE when no more empty POINTERS and EXITS!!
''' THIS METHOD REQUIRES THAT WE CREATE AN OBJECT IN THE FORM OR USER-INTERFACE
''' OBJECT IS PASSED AS ARGUMENT TO METHOD CALL.
''' </summary>
''' <param name="objNewCustomer"></param>
''' <returns></returns>
''' <remarks></remarks>
Public Function AddCustomer(ByVal objNewCustomer As clsCustomer) As Boolean

    'Step 1-Search Array for ID Number. Skip the Empty Cells
    For i As Integer = 0 To SIZE
        If arrCustomerList(i) Is Nothing Then
            'Step 2-Add object to Array
            arrCustomerList(i) = objNewCustomer
            'Step 2-Return TRUE & Exit
            Return True
        End If
    Next

    'Step 3-Did not find EMPTY CELL in search return FALSE
    Return False


End Function
```

Step 17: Create ADDCUSTOMER(parameter1, parameter2, parameter3, etc..) FUNCTION declarations:

- This is an OVERLOADED VERSION of the previous ADD METHOD. Again, purpose of this method is to ADD a new Customer to the ARRAY. True is returned if successful, False if no EMPTY OR NULL POINTERS ARE AVAILABLE.
- How it works:
  - **FOR LOOP** is used to search array for empty POINTER.
  - This algorithm does the following:
    1. Create a NEW OBJECT
    2. POPULATES OBJECT BY SETTING PROPERTIES WITH DATA PASSED AS PARAMTERS TO METHOD
    3. Iterate ARRAY using FOR LOOP.
    4. Interrogate each ARRAY(i) POINTER if is an EMPTY POINTER OR A NOTHING.
    5. SET ARRAY(i) POINTER to point to OBJECT CREATED INSIDE METHOD
    6. RETURN a TRUE indicating object was added
    7. If NO EMPTY POINTER IS FOUND, then we RETURN A FALSE indicating no room was found in array.
- DIFFERENCE between this ADD method and the previous is that this method CREATES AND POPULATES THE OBJECT TO ADD TO THE ARRAY INSIDE THE METHOD. This is IMPORTANT, because the FORM OR USER-INTERFACE DOES NOT NEED TO CREATE AND POPULATE THIS OBJECT IN THE FORM. IT CAN SIMPLY PASS THE TEXT BOXES OF THE DATA. THE FORM IS KEPT LIGHT WITH VERY LITTLE CODE!!

```
    '******************************************************************************
    ''' <summary>
    ''' OVERLOADED ADD Function. Adds NEW object to array.
    ''' Object Properties are passed as arguments and new object is created and
    ''' Populated inside the method.
    ''' Searches for the FIRST nothing or empty POINTER and adds object to that POINTER.
    ''' Returns a TRUE When OBJECT added OR FALSE when no more empty POINTERS and EXITS!!
    ''' THIS VERSION OF ADD HAS THE ADVANTAGE THAT WE DON'T NEED TO CREATE AN OBJECT
    ''' IN THE FORM! SIMPLY SEND THE FORM CONTROLS AS ARGUMENTS TO THE METHOD CALL!
    ''' IN SHORT, LESS CODE IN THE FORMS OR USER INTERFACE
    ''' </summary>
    Public Function AddCustomer(ByVal Name As String, ByVal IDNum As String, ByVal BDate
As Date, _
    ByVal Address As String, ByVal Phone As String) As Boolean

        'Step 1-Create object
        Dim objNewCustomer As New clsCustomer

        'Step 2-Populate object with Parameter data
        With objNewCustomer
            .Name = Name
            .CustomerID = IDNum
            .BirthDate = BDate
            .Address = Address
            .Phone = Phone
        End With

        'Step 3-Search Array for EMPTY CELL
        For i As Integer = 0 To SIZE
            If arrCustomerList(i) Is Nothing Then
                'Step 4-Add object to Array
                arrCustomerList(i) = objNewCustomer
                'Step 5-Return TRUE & Exit
                Return True
            End If
        Next

        'Step 6-Did not find EMPTY CELL in search return FALSE
        Return False

    End Function
```

Step 18: Create EDITCUSTOMER(OBJECT) FUNCTION declarations:

- Purpose of this method is to EDIT OR MODIFY a Customer OBJECT in the ARRAY. True is returned if successful, False if OBJECT NOT FOUND.
- This method like the others use the same algorithm used in SEARCH METHOD
- How it works:
  - **FOR LOOP** is used to search array for OBJECT IN ARRAY.
  - This algorithm does the following:
    1. Iterate ARRAY using FOR LOOP.
    2. Skips each EMPTY POINTER OR A NOTHING.
    3. Interrogates each OBJECT for its ID using ARRAY(INDEX).ID_PROPERTY
    4. If a match (PROPERTY = ID?) is FOUND, EDIT IS DONE BY SETTING ARRAY(i) POINTER to point to OBJECT POINTER passed as argument
    5. RETURN True
    6. If you reach the end of the FOR LOOP and a match (PROPERTY = ID?) is NOT FOUND RETURN A FALSE.

- One important point here to note is that this EDIT method REPLACES THE ORIGINAL OBJECT IN THE ARRAY WITH A NEW ONE. Point here is that A REPLACEMENT IS MADE. ALSO NOTE that the FORM OR USER-INTERFACE NEEDS TO CREATE the OBJECT AND POPULATE THIS OBJECT AND PASS IT TO THE METHOD AS ARGUMENT.

```
    '******************************************************************************
    ''' <summary>
    ''' Function EDITS BY REPLACING the exiting OBJECT WITH A NEW OBJECT.
    ''' Function takes ID Number and NEW OBJECT TO REPLACE as parameters.
    ''' Function Searches the database for POINTER to object whose ID is a parameter
    ''' Skips the empty or NULL pointers before interrogating the object for the ID.
    ''' When found it performs the REPLACEMENT. Returns TRUE if found, FALSE otherwise
    ''' THIS METHOD REQUIRES THAT WE CREATE AN OBJECT IN THE FORM OR USER-INTERFACE
    ''' OBJECT and ID NUMBER are PASSED AS ARGUMENT TO METHOD CALL.
    ''' </summary>
    ''' <param name="IDNum"></param>
    ''' <param name="objCustomer"></param>
    ''' <returns></returns>
    ''' <remarks></remarks>
    Public Function EditCustomer(ByVal IDNum As String, ByVal objCustomer As clsCustomer)
As Boolean
        'Step 1-Search Array for ID Number
        For i As Integer = 0 To SIZE
            'Step 2-Skip the Empty Cells
            If Not (arrCustomerList(i) Is Nothing) Then
                'Step 3-Interrogate Object
                If arrCustomerList(i).CustomerID = IDNum Then
                    'Step 4-REPLACE object in Array
                    arrCustomerList(i) = objCustomer
                    'Step 5-Return TRUE & Exit
                    Return True
                End If
            End If
        Next

        'Step 6-Did not find object in search return FALSE
        Return False


    End Function
```

Step 18: Create EDITCUSTOMER(parameter1, parameter2, parameter3, etc..) FUNCTION declarations:

- This is an OVERLOADED VERSION of the previous EDIT METHOD. Again, purpose of this method is to EDIT OR MODIFY a Customer in the ARRAY. True is returned if successful, False if OBJECT IS NOT FOUND IN ARRAY.
- How it works:
  - **FOR LOOP** is used to search array for OBJECT.
  - This algorithm does the following:
    1. Create a NEW OBJECT
    2. Iterate ARRAY using FOR LOOP.
    3. Skips each EMPTY POINTER OR A NOTHING.
    4. Interrogates each OBJECT for its ID using ARRAY(INDEX).ID_PROPERTY
    5. If a match (PROPERTY = ID?) is FOUND, EDIT IS DONE BY SETTING EACH OF THE PROPERTIES OF THE OBJECT RESIDING INSIDE THE ARRAY with parameters passed as arguments
    6. RETURNS a True
    7. If you reach the end of the FOR LOOP and a match (PROPERTY = ID?) is NOT FOUND RETURN A FALSE

- DIFFERENCE between this EDIT method and the previous is that this method MODIFIES THE ORIGINAL OBJECT INSIDE THE ARRAY. NO REPLACEMENT IS DONE! THE ORIGINAL IS MODIFIED!

```
    '*****************************************************************************
    ''' <summary>
    ''' OVERLOADED EDIT Function. MODIFIES Exiting object in array.
    ''' Object Properties are passed as arguments and ORIGINAL OBJECT IN ARRAY
    ''' is MODIFIED inside the method.
    ''' Searches for the FIRST nothing or empty POINTER and adds object to that POINTER.
    ''' Returns a TRUE When OBJECT added OR FALSE when no more empty POINTERS and EXITS!!
    ''' THIS VERSION OF EDIT HAS THE ADVANTAGE THAT WE DON'T REPLACE THE OBJECT
    ''' IN THE ARRAY, BUT MODIFY EXITING ONE. ALSO IN THE FORM OR USER-INTERFACE
    ''' WE SIMPLY SEND THE FORM CONTROLS AS ARGUMENTS TO THE METHOD CALL!
    ''' </summary>
    Public Function EditCustomer(ByVal Name As String, ByVal IDNum As String, ByVal BDate
As Date, _
    ByVal Address As String, ByVal Phone As String) As Boolean

        'Step 1-Search Array for ID Number
        For i As Integer = 0 To SIZE
            'Step 2-Skip the Empty Cells
            If Not (arrCustomerList(i) Is Nothing) Then
                'Step 3-Interrogate Object
                If arrCustomerList(i).CustomerID = IDNum Then
                    'Step 4-MODIFY PROPERTIES of object in Array
                    'NOTE WE DON'T MODIFY THE ID NUMBER. THIS IS THE KEY!
                    arrCustomerList(i).Name = Name
                    arrCustomerList(i).BirthDate = BDate
                    arrCustomerList(i).Address = Address
                    arrCustomerList(i).Phone = Phone

                    'Step 5-Return TRUE & Exit
                    Return True
                End If
            End If
        Next

        'Step 6-Did not find object in search return False
        Return False
    End Function
```

Step 19: Create REMOVECUSTOMER(ID) FUNCTION declarations:

- This method REMOVES THE OBJECT by searching the ARRAY for the object whose ID is parameter. Once found it removes object from the database. Returns a TRUE if successful and FALSE if object is NOT FOUND.
- How it works:

1. Create a NEW OBJECT
2. Iterate ARRAY using FOR LOOP.
3. Skips each EMPTY POINTER OR A NOTHING.
4. Interrogates each OBJECT for its ID using ARRAY(INDEX).ID_PROPERTY
5. If a match (PROPERTY = ID?) is FOUND, REMOVE OBJEC BY SETTING THE ARRAY POINTER ARRAY(i) to NOTHING.
6. RETURNS a True
7. If you reach the end of the FOR LOOP and a match (PROPERTY = ID?) is NOT FOUND RETURN A FALSE

```
'*****************************************************************************
''' <summary>
''' Function Removes object from database by searching for OBJECT whose ID
''' is a parameter. Skips the empty pointers before interrogating the
''' object for the ID. When found, Removes object by setting POINTER TO NOTHING
''' Returns a TRUE When removed OR FALSE when OBJECT not found and EXITS!
''' </summary>
''' <param name="IDNum"></param>
''' <returns></returns>
''' <remarks></remarks>
Public Function RemoveCustomer(ByVal IDNum As String) As Boolean

    'Step 1-Search Array for ID Number
    For i As Integer = 0 To SIZE
        'Step 2-Skip the Empty Cells
        If Not (arrCustomerList(i) Is Nothing) Then
            'Step 3-Interrogate Object
            If arrCustomerList(i).CustomerID = IDNum Then
                'Step 4-Set Array POINTER to Nothing
                arrCustomerList(i) = Nothing
                'Step 5-Found ID and Deleted, Return TRUE & Exit
                Return True
            End If
        End If
    Next

    'Step 6-Did not find object in search return False
    Return False

End Function
```

Step 20: Create PRINTCUSTOMER(ID) FUNCTION declarations:

- Purpose of this method is to search the database (5 Customer OBJECTS) for the object whose ID is parameter. Once found it CALLS PRINT() METHOD of OBJECT. Returns a TRUE if successful and FALSE if object is NOT FOUND.
- How it works:

1. Create a NEW OBJECT
2. Iterate ARRAY using FOR LOOP.
3. Skips each EMPTY POINTER OR A NOTHING.
4. Interrogates each OBJECT for its ID using ARRAY(INDEX).ID_PROPERTY
5. If a match (PROPERTY = ID?) is FOUND, PRINTS OBJECT BY CALLING PRINT() METHOD OF OBJECT
6. RETURNS a True
7. If you reach the end of the FOR LOOP and a match (PROPERTY = ID?) is NOT FOUND RETURN A FALSE

```
'*****************************************************************************
''' <summary>
''' Function Prints object by searching for OBJECT whose ID is a parameter
''' Skips the empty pointers before interrogating the object for the ID.
''' When found, CALLS the PRINT() METHOD in the object
''' Returns a TRUE When printed OR FALSE when OBJECT not found and EXITS!
''' </summary>
''' <param name="IDNum"></param>
''' <returns></returns>
''' <remarks></remarks>
Public Function PrintCustomer(ByVal IDNum As String) As Boolean

    'Step 1-Search Array for ID Number
    For i As Integer = 0 To SIZE
        'Step 2-Skip the Empty Cells
        If Not (arrCustomerList(i) Is Nothing) Then
            'Step 3-Interrogate Object
            If arrCustomerList(i).CustomerID = IDNum Then
                'Step 4-CALL METHOD
                arrCustomerList(i).Print()
                'Step 5-Found ID, Return TRUE & Exit
                Return True
            End If
        End If
    Next

    'Step 6-Did not find object in search return False
    Return False

End Function
```

Step 21: Create PRINTALLCUSTOMERS() SUB declarations:

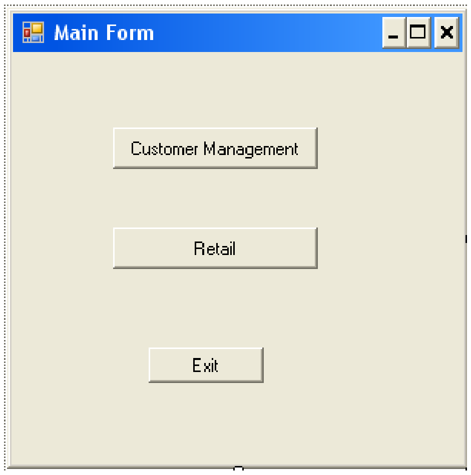
- Purpose of this SUB method is to ITERATE through ARRAY and call PRINT() method of each OBJECT IN ARRAY.
- How it works:

1. Create a NEW OBJECT
2. Iterate ARRAY using FOR LOOP.
3. Skips each EMPTY POINTER OR A NOTHING.
4. PRINTS OBJECT BY CALLING PRINT() METHOD OF OBJECT
5. RETURNS a True
6. If you reach the end of the FOR LOOP and a match (PROPERTY = ID?) is NOT FOUND RETURN A FALSE

```
    '******************************************************************************
    ''' <summary>
    ''' Sub Prints all objects in database by CALLING each object's PRINT() METHOD
    ''' Skips the empty pointers before CALLING the METHOD.
    ''' </summary>
    ''' <remarks></remarks>
    Public Sub PrintAllCustomers()

        'Step 1-Search evert object in Array
        For i As Integer = 0 To SIZE
            'Step 2-Skip the Empty Cells
            If Not (arrCustomerList(i) Is Nothing) Then
                'Step 3-CALL METHOD
                arrCustomerList(i).Print()
            End If
        Next

    End Sub

End Module
```

Step 22: RENAME Form1 to frmMainForm. Set the controls as shown in figure below:

Object	Property	Value
Form1	Name Text	**frmMainForm** **Main Form**



Step 23: Main Form CustomerManagement_Click Event:

```
    '*****************************************************************************
    ''' <summary>
    ''' Click Event creates object of Customer Management Form
    ''' Calls METHOD in Form OBJECT so object can show itself
    ''' </summary>
    ''' <param name="sender"></param>
    ''' <param name="e"></param>
    ''' <remarks></remarks>
Private Sub btnCustomerManagement_Click(ByVal sender As System.Object, ByVal e As
System.EventArgs) Handles btnCustomerManagement.Click
        'Step 1-Create object of Customer Management Form
        Dim objCustomerManagementForm As New frmCustomerManagement


        'Step 2-Display Customer Management Form
        objCustomerManagementForm.ShowDialog()

End Sub
```

Step 24: Main Form RETAIL BUTTON CLICK EVENT:

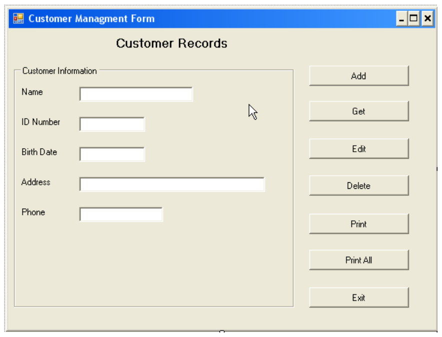
```
    '******************************************************************************
    ''' <summary>
    ''' Click Event to creates object of the Retail Management Form
    ''' Calls METHOD in Form OBJECT so form can show itself
    ''' </summary>
    ''' <param name="sender"></param>
    ''' <param name="e"></param>
    ''' <remarks></remarks>
    Private Sub btnRetail_Click(ByVal sender As System.Object, ByVal e As
System.EventArgs) Handles btnRetail.Click

        'Step 1-Create object of Retail Management Form
        Dim objRetailManagementForm As New frmRetailManagement


        'Step 2-Display Employee Management Form
        objRetailManagementForm.ShowDialog()

    End Sub
```

Step 25: Main Form Exit_Click Event:

```
    '******************************************************************************
    ''' <summary>
    ''' Event-handler calls Form Close() method to close the Form.
    ''' </summary>
    ''' <param name="sender"></param>
    ''' <param name="e"></param>
    ''' <remarks></remarks>
Private Sub btnExit_Click(ByVal sender As System.Object, ByVal e As System.EventArgs)
Handles btnExit.Click
        'Step 1-Close yourself
        Me.Close()

End Sub


End Class
```

Step 26: Create the Customer Management Form and add the controls shown below:

Object	Property	Value
Form2	Name	**frmCustomerManagement**
	Text	**Customer Management**



Step 27 FORM-LEVEL DECLARATIONS & OBJECT POINTER:

```
Option Explicit On
Option Strict On

Public Class frmCustomerManagement
    '*****************************************************************************
    ' FORM-LEVEL VARIABLES & OBJECT DECLARATIONS SECTION
    '*****************************************************************************
    'Module-level Object POINTER Declaration
    Private objCustomer As clsPerson
```

Step 28 FORM LOAD EVENT:

```
    '*****************************************************************************
    ''' <summary>
    ''' Form_Load event. Calls Initialize() method to populate Customer List.
    ''' Creates object and popoulate Form controls with object's default values
    ''' </summary>
    ''' <param name="sender"></param>
    ''' <param name="e"></param>
    ''' <remarks></remarks>
    Private Sub frmCustomerManagement_Load(ByVal sender As System.Object, ByVal e As
System.EventArgs) Handles MyBase.Load

        'Step 1-Perform initialization by calling Module.Initialize() method
        Initialize()

        'Step 2-Create EMPTY Form-Level Object
        objCustomer = New clsCustomer

        'Step 3-Populate Form Controls with Object's data
        With objCustomer
            txtName.Text = .Name
            txtIDNumber.Text = .CustomerID
            txtBirthDate.Text = CStr(.BirthDate)
            txtAddress.Text = .Address
            txtPhone.Text = .Phone
        End With

    End Sub
```

Step 29 Add code to the GET CLICK EVENT:

```
    '******************************************************************************
    ''' <summary>
    ''' Calls Search method of module to search database for object
    ''' whose ID is passed as argument. Returns a pointer to the object
    ''' found, else returns a Nothing.
    ''' </summary>
    ''' <param name="sender"></param>
    ''' <param name="e"></param>
    ''' <remarks></remarks>
    Private Sub btnGet_Click(ByVal sender As System.Object, ByVal e As System.EventArgs)
Handles btnGet.Click

        'Step 1-Call Overloaded Search(ID) to search for object that match ID
        'Return pointer to object found.
        objCustomer = SearchCustomer(txtIDNumber.Text.Trim)

        'Step 2-If result of search is Nothing, then display customer is not found
        If objCustomer Is Nothing Then
            MessageBox.Show("Customer Not Found")

            'Step 3-Clear all controls
            txtName.Text = ""
            txtIDNumber.Text = ""
            txtBirthDate.Text = ""
            txtAddress.Text = ""
            txtPhone.Text = ""

        Else
            'Step 4-Then Data is extracted from customer object & placed on textboxes
            With objCustomer
                txtName.Text = .Name
                txtIDNumber.Text = .CustomerID
                txtBirthDate.Text = CStr(.BirthDate)
                txtAddress.Text = .Address
                txtPhone.Text = .Phone
            End With
        End If
    End Sub
```

Step 30 ADD code for the ADD CLICK EVENT:

```
    '*****************************************************************************
    ''' <summary>
    ''' Calls Module Add method to Add a new object to the object database
    ''' We use the OVERLOADED ADD(x,y,z..) which takes paramters. In this case
    ''' we pass text boxes directly. Note how lite the form code is in this case
    ''' </summary>
    ''' <param name="sender"></param>
    ''' <param name="e"></param>
    ''' <remarks></remarks>
    Private Sub btnAdd_Click(ByVal sender As System.Object, ByVal e As System.EventArgs)
Handles btnAdd.Click

        'Step 1-Call Add method to add with Customer Properties as arguments
        'to ADD new Customer to database
        Dim result As Boolean = AddCustomer(txtName.Text.Trim, txtIDNumber.Text.Trim, _
                                            CDate(txtBirthDate.Text.Trim), _
                                            txtAddress.Text.Trim, txtPhone.Text.Trim)

        'Step 2-Test results & prompt user
        If result Then
            MessageBox.Show("Customer Added Successfully")
        Else
            MessageBox.Show("Database Full")
        End If

    End Sub
```

Step 31 Add code to the EDIT CLICK EVENT:

```
    '*****************************************************************************
    ''' <summary>
    ''' Calls Module EDIT(x,y,z..) method to modify object in list whose ID
    ''' is passed as argument. Note that OVERLOADED EDIT method is used and
    ''' form controls are passed as argument thus Form code is kept light.
    ''' Returns True or False
    ''' </summary>
    ''' <param name="sender"></param>
    ''' <param name="e"></param>
    ''' <remarks></remarks>
    Private Sub btnEdit_Click(ByVal sender As System.Object, ByVal e As System.EventArgs)
Handles btnEdit.Click

        'Step 1-Call Add method to add with Customer Properties as arguments
        'to ADD new Customer to database
        Dim result As Boolean = EditCustomer(txtName.Text.Trim, txtIDNumber.Text.Trim, _
                                            CDate(txtBirthDate.Text.Trim), _
                                            txtAddress.Text.Trim, txtPhone.Text.Trim)

        'Step 2-Test results & prompt user
        If result = False Then
            MessageBox.Show("Customer Not Found")
        End If

    End Sub
```

Step 32 Add code for the DELETE CLICK EVENT:

```
    '*****************************************************************************
    ''' <summary>
    ''' Calls Module Remove method to delete the object from the database
    ''' based on ID or key
    ''' </summary>
    ''' <param name="sender"></param>
    ''' <param name="e"></param>
    ''' <remarks></remarks>
    Private Sub btnDelete_Click(ByVal sender As System.Object, ByVal e As
System.EventArgs) Handles btnDelete.Click

        'Step 1-Call Add method to add new Customer to database
        Dim result As Boolean = RemoveCustomer(txtIDNumber.Text.Trim)

        'Step 2-Test results & promt user
        If result Then
            MessageBox.Show("Customer Deleted")
        Else
            MessageBox.Show("Customer Not Found!")
        End If

    End Sub
```

Step 33 Add code for the PRINT CLICK EVENT:

```
    '*****************************************************************************
    ''' <summary>
    ''' Calls module Print method to print the object's properties
    ''' </summary>
    ''' <param name="sender"></param>
    ''' <param name="e"></param>
    ''' <remarks></remarks>
    Private Sub btnPrint_Click(ByVal sender As System.Object, ByVal e As System.EventArgs)
Handles btnPrint.Click

        'Step 1-Call Add method to add new Customer to database
        Dim result As Boolean = PrintCustomer(txtIDNumber.Text.Trim)

        'Step 2-Test results & promt user
        If result <> True Then
            MessageBox.Show("Customer Not Found!")
        End If

    End Sub
```

Step 34 Add code for the PRINT ALL CLICK EVENT:

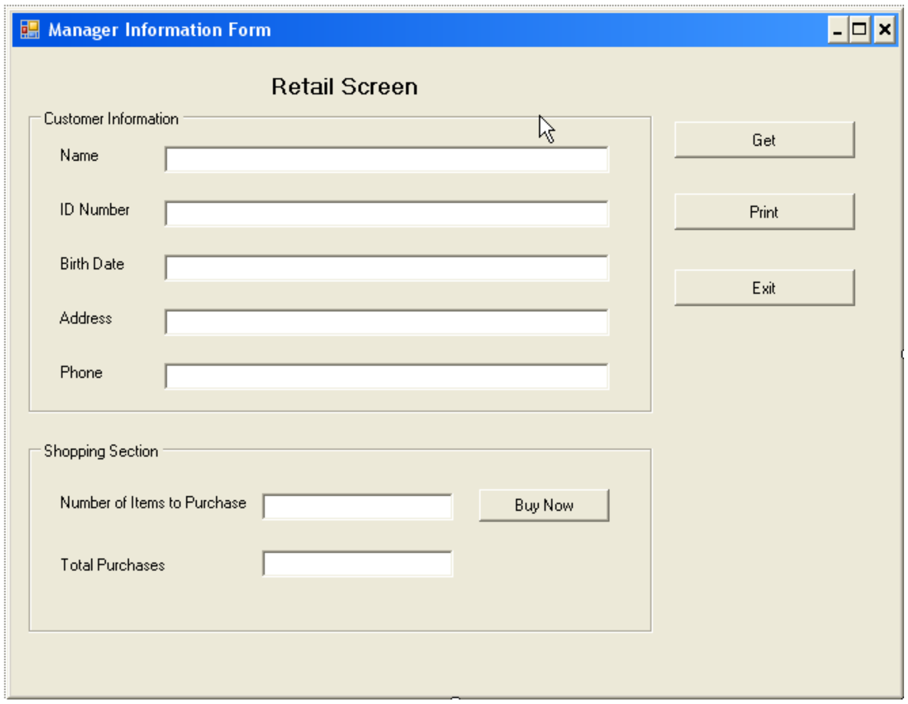
```
    '*****************************************************************************
    ''' <summary>
    ''' Calls Module PrintAll method to print all the objects in database
    ''' </summary>
    ''' <param name="sender"></param>
    ''' <param name="e"></param>
    ''' <remarks></remarks>
Private Sub btnPrintAll_Click(ByVal sender As System.Object, ByVal e As System.EventArgs)
Handles btnPrintAll.Click

        'Step 1-Call PrintAll method in module
        PrintAllCustomers()

End Sub
```

Step 35 Add code for the EXIT CLICK EVENT:

```
    '*****************************************************************************
    ''' <summary>
    ''' Closes the Form
    ''' </summary>
    ''' <param name="sender"></param>
    ''' <param name="e"></param>
    ''' <remarks></remarks>
Private Sub btnExit_Click(ByVal sender As System.Object, ByVal e As System.EventArgs)
Handles btnExit.Click

        Me.Close()

End Sub
```

Step 36 Create the RETAIL MANAGEMENT FORM and add the controls shown below:

Object	Property	Value
Form4	Name Text	**frmManagerInformationForm** **Manager Information Form**



Step 37 FORM-LEVEL DECLARATIONS & OBJECT POINTER:

```
Option Explicit On
Option Strict On

Public Class frmRetailManagement
    '*****************************************************************************
    ' FORM-LEVEL VARIABLES & OBJECT DECLARATIONS SECTION
    '*****************************************************************************

   'Module-level Object POINTER Declaration
    Private WithEvents objCustomer As clsCustomer
```

Step 38 FORM LOAD EVENT:

```
    '*************************************************************************
    ' EVENT-HANDLER DECLARATIONS SECTION
    '*************************************************************************

    '*************************************************************************
    ''' <summary>
    ''' Form_Load event. Create object and popoulate Form controls
    ''' With object's default values. Also Sets text box to Read-only
    ''' in MODULE
    ''' </summary>
    ''' <param name="sender"></param>
    ''' <param name="e"></param>
    ''' <remarks></remarks>
    Private Sub frmRetailManagement_Load(ByVal sender As System.Object, ByVal e As
System.EventArgs) Handles MyBase.Load
        'Step 1-Create EMPTY Form-Level Object
        objCustomer = New clsCustomer

        'Step 2-Populate Form Controls with Object's data
        With objCustomer
            txtName.Text = .Name
            txtIDNumber.Text = .CustomerID
            txtBirthDate.Text = CStr(.BirthDate)
            txtAddress.Text = .Address
            txtPhone.Text = .Phone
        End With

        'Step 3-Disable txtTotalPurchases Text Box to make it Read-only
        txtTotalPurchases.Enabled = False

    End Sub
```

Step 39 Add code to the PRINT CLICK EVENT:

```
    '*************************************************************************
    ''' <summary>
    ''' Event-handler call PRINT() METHOD of Form-Level object.
    ''' </summary>
    ''' <param name="sender"></param>
    ''' <param name="e"></param>
    ''' <remarks></remarks>
Private Sub btnPrint_Click(ByVal sender As System.Object, ByVal e As System.EventArgs)
Handles btnPrint.Click

       'Step 1-Tell object to print itself
        objCustomer.Print()

    End Sub
```

Step 40 Add code to the GET CLICK EVENT:

```
    '*****************************************************************************
    ''' <summary>
    ''' Calls Search method of module to search database for object
    ''' whose ID is passed as argument. Returns a pointer to the object
    ''' found, else returns a Nothing.
    ''' </summary>
    ''' <param name="sender"></param>
    ''' <param name="e"></param>
    ''' <remarks></remarks>
Private Sub btnGet_Click(ByVal sender As System.Object, ByVal e As System.EventArgs)
Handles btnGet.Click
        'Step 1-Call Overloaded Search(ID) to search for object that match ID
        'Return pointer to object found.
        objCustomer = SearchCustomer(txtIDNumber.Text.Trim)

        'Step 2-If result of search is Nothing, then display customer is not found
        If objCustomer Is Nothing Then
            MessageBox.Show("Customer Not Found")

            'Step 3-Clear all controls
            txtName.Text = ""
            txtIDNumber.Text = ""
            txtBirthDate.Text = ""
            txtAddress.Text = ""
            txtPhone.Text = ""

        Else
            'Step 4-Then Data is extracted from customer object & placed on textboxes
            With objCustomer
                txtName.Text = .Name
                txtIDNumber.Text = .CustomerID
                txtBirthDate.Text = CStr(.BirthDate)
                txtAddress.Text = .Address
                txtPhone.Text = .Phone

                'Set total purchases
                txtTotalPurchases.Text = CStr(.TotalItemsPurchased)
            End With
        End If

    End Sub
```

Step 41 Add code to the SHOP CLICK EVENT:

```
    '******************************************************************************
    ''' <summary>
    ''' Calls customer object Shop() method to purchase items and cleas the text box.
    ''' Also displays total purchases of customer
    ''' </summary>
    ''' <param name="sender"></param>
    ''' <param name="e"></param>
    ''' <remarks></remarks>
Private Sub btnShop_Click(ByVal sender As System.Object, ByVal e As System.EventArgs)
Handles btnShop.Click

        'Step 1-Call the Shop Method of the Object to shop and trigger event
        objCustomer.Shop(CInt(txtItems.Text.Trim))

        'Step 2-Clear Items textbox
        txtItems.Text = ""

        'Step 3-Set total purchases
        txtTotalPurchases.Text = CStr(objCustomer.TotalItemsPurchased)

    End Sub
```

Step 42 Add code to the ONSHOPPING EVENT HANDLER:

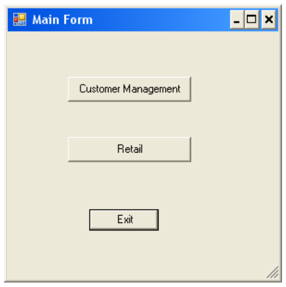
```
    '******************************************************************************
    ''' <summary>
    ''' Event-handler of Customer Objects. Triggered when Shop() method is called.
    ''' Displays a message every time customer shops.
    ''' </summary>
    ''' <param name="intTotalItems"></param>
    ''' <remarks></remarks>
    Private Sub objCustomer_OnShopping(ByVal intTotalItems As Integer) Handles
objCustomer.OnShopping

        MessageBox.Show("The Total items purchased by the Customer is " & intTotalItems)

    End Sub
```

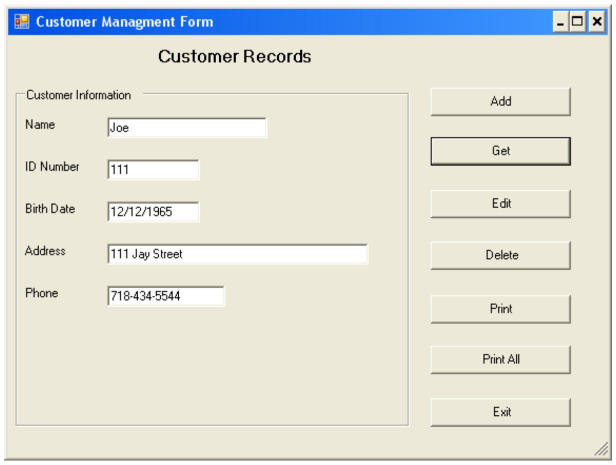
Step 43 Add code to the EXIT CLICK EVENT:

```
    '****************************************************************************
    ''' <summary>
    ''' Event-handler calls Form Close() method to close the Form.
    ''' </summary>
    ''' <param name="sender"></param>
    ''' <param name="e"></param>
    ''' <remarks></remarks>
Private Sub btnExit_Click(ByVal sender As System.Object, ByVal e As System.EventArgs)
Handles btnExit.Click

        'Close yourself (Form)
        Me.Close()

End Sub


End Class
```

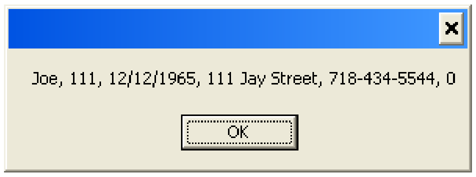
Step 44: BUILD & RUN APPLICATION

Test 1, 2 & 3 – Displaying Main & Customer Management Form. Also Clicking PRINT BUTTON:



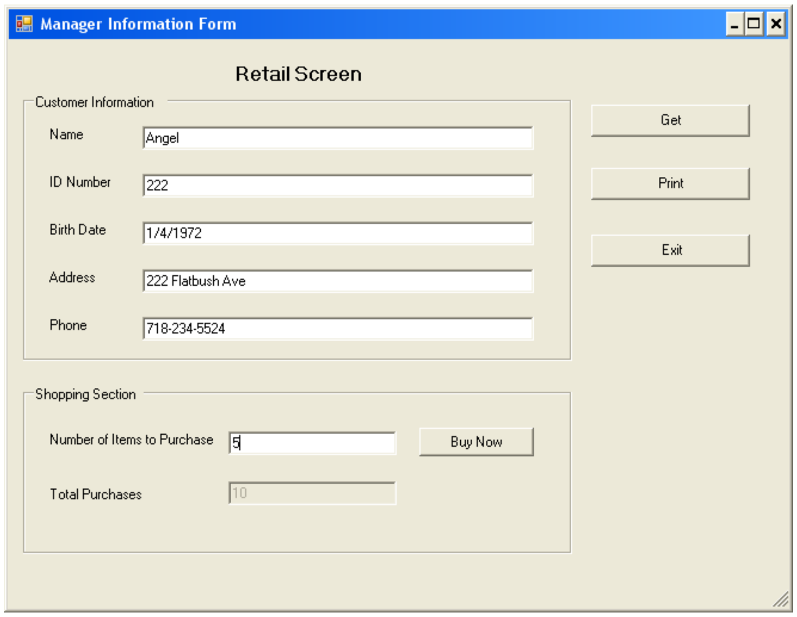


Name	Joe
ID Number	111
Birth Date	12/12/1965
Address	111 Jay Street
Phone	718-434-5544

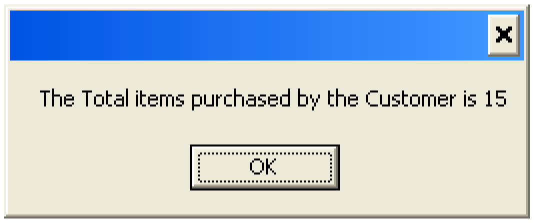


Joe, 111, 12/12/1965, 111 Jay Street, 718-434-5544, 0

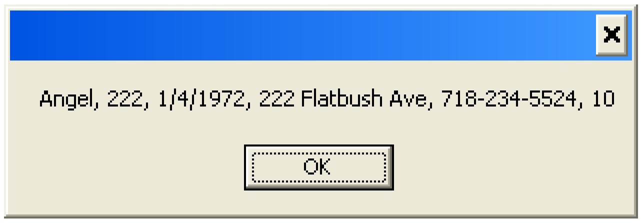
Test 4 – Displaying Retail Management Form & Purchasing Items by Clicking Buy Now Button:



Name	Angel
ID Number	222
Birth Date	1/4/1972
Address	222 Flatbush Ave
Phone	718-234-5524
Number of Items to Purchase	5
Total Purchases	10



The Total items purchased by the Customer is 15



Angel, 222, 1/4/1972, 222 Flatbush Ave, 718-234-5524, 10

Homework Assignment 4

- ❑ This program is an upgrade to Homework Assignment 3. Read and follow each of the following requirements.
- ❑ Copy HW3 to another Folder call it what ever you want, HW4 etc.
- ❑ Open the project; Rename the Solution and Project to HW4.
- ❑ You will be graded based on all requirements being met. Add the following Class requirements:

I. **Upgrade** the Employee Class as follows:

1) **NEW REQUIREMENTS:** Create the following event in this class:
   - Event named ***SecurityAlert(UserName, Password)***
   - <u>*Trigger*</u> or <u>***raise***</u> this event ONLY inside the *Authenticate()* method <u>**prior**</u> to the verification of the username & password.

II. (**OPTIONAL BUT HIGHLY RECOMENDED**)Write a simple test driver program to test this class. Same requirements as HW# 3.

III. Keeping and **re-using the <u>code from HW #3</u>** modify the Form and Module as follows:

Standard Module (NEW REQUIREMENTS):

1) **DELETE** the 5 Objects from HW # 3 and replace it with a Public ***Array of Objects***.
2) This array is now the database of employees and will store via *Load()*, the 5 objects of the ***clsEmployees*** Class.
3) Create a Method named **Load()** that will populate the objects to the Array as follows: (Joe,111, Manager), (Angel, 222, Director), (Sam,333,Office Assistant), (Mary,444,Vice President), (Nancy,555,Secretary)

Public Sub Main:

4) You should not have to make too many changes to Sub Main(), ONLY a call to *Load()* to populate the array before displaying the Login Form.

Public Function Authenticate:

5) Integrate this assignment with the previous Login Screen HW# 3. This time the module Authenticate Method is to <u>**SEARCH**</u> the Array of Objects and <u>**CALLING**</u> <u>**EACH**</u> Object's ***Object.Authenticate()*** to verify authenticity.
6) Most of the modifications will take place inside the Main **Authenticate()** Method which is replaced the old code with NEW code to SEARCH the array. You need to Search the Array and interrogate each Object in array!
7) In addition, Authenticate needs to Trigger ***SecurityAlert()*** Event on the <u>*Object*</u> in the Login Form in order to execute the **Object_SecurityAlert(U, P)** *Event-Handler* to trap for fired employees. This is explained in the Login Form requirements below.
8) In the Sub Main() procedure we continue to use the code from HW# 3 to control the program: loop, message box etc.

Login Form:

1) The login form should keep all functionality from HW # 3 but add the following requirements
2) **NEW REQUIREMENTS:** Create an Object of the *clsEmployee* Class inside the declaration section of the Form.
   - Declare & Create this Object so that via the *Drop-down List Boxes* in the *Code Window* of the Form it will GENERATE the ***Object_SecurityAlert(U,P)*** Event-handler on the Form.
   - Note that this Event-Handler ***Object_SecurityAlert(U,P)*** should execute EVERTIME the Login Form ***Object.Authenticate(u,p)*** Method is executed since we *RaiseEvent* this event inside this method of the class!
   - Inside the Event-Handler ***Object_SecurityAlert(U,P)*** enter code in a trap for the following user:
     - o When username = Sam and Password = 333 is authenticated in the Module, inside this Event-Handler do the following:
     - o *Display* a message box stating this is a security breach! This employee has been fired!
     - o End the Program IMEDIATLY!!!

   - Remember that it is the ***Authentication()*** Method of the Module that authenticates each of the Objects in the Array of Objects and must also handle the triggering of the Security_Alert Event Handler in Login Form. It is your job to figure out how to get the ***Object*** <u>Created on the Form</u> to react and trigger the Object***_SecurityAlert(U,P)*** Event-handler on the Login Form from the Authenticate method of the MODULE!

- ❑ Due <u>in</u> one week!