CS708 Lecture Notes

Visual Basic.NET Object-Oriented Programming

Implementing Business Objects

Data Access Code

Part (III of III)

(Lecture Notes 3C)

Professor: A. Rodriguez

Chapter 7 Business Objects Data Access Code

7.1 Business Objects Review & Status

7.1.1 Business Objects Requirements Status

- Ok, let's review and see where we are as far as our Business Object implementation is concerned:

Business Object Requirements	Status
Business Object Represents Real-World Business Entities – Business Objects contain the necessary *attributes* & *methods* to behave like their real-world counterparts.	▪ Done
User Interface Support – The Business Objects should contain the following logic to support the User Interface (UI):	▪ DONE ▪ Business objects RAISE *NotSupported Exception* when business rules are violated. ▪ FORMS/UI can trap & handle
Scalable & Reusable – Business Objects should **<u>evolve</u>** & gain new data, properties & methods to support more functionality	▪ DONE. ▪ Created **Class Library or DLL COMPONENT** to encapsulate our classes,
Business Rules, Validation or Enforcement & Status Tracking – Business Objects should contain the following logic: - Business Objects should VALIDATE that the data being **<u>set</u>** by the user is valid, correct data type, length etc - *Business Objects* should keep track of its status - The *Business Objects* should keep track of the business rules that are broken. - Business Objects should protect itself from unauthorized or unwanted, harmful access	▪ PARTIALLY DONE. ▪ We implemented the NEW & DIRTY object mechanism. ▪ Implemented Field or Property-level validation mechanism for NO-BLANKS, MAX-LENGTH, EXACT-LENGTH, etc.
BO Manage their own *<u>data</u>* & *<u>database access</u>* – Business Objects should contain logic to handle data access. Operations such as *searching, inserting, updating, deleting* the database should be done by the business objects	▪ OPEN REQUIREMENT
Distributed Business Objects – Business Objects should be design base with the following network distribution scheme in mind: - Business Objects should contain the technology to allow them to be distributed across processes, network and applications.	▪ OPEN REQUIREMENT (WILL NOT BE DONE IN THIS COURSE) ▪ Implement ***unanchored objects*** and ***anchored objects***. ▪ Implemented ***Serialization*** ▪ Implemented ***Remoting***

- WE HAVE TWO REQUIREMENTS LEFT. WE WILL ONLY IMPLEMENT ONE IN THIS COURSE, THAT IS THE DATA ACCESS CODE

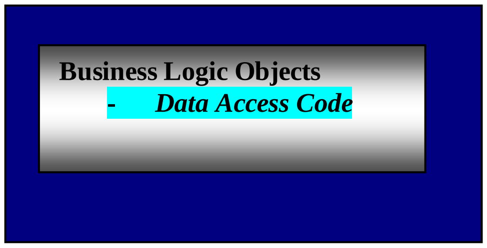
7.2 Business Objects – Data Access Requirements

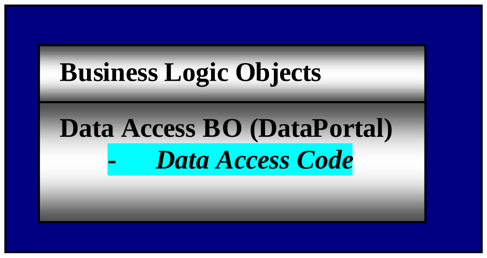
7.2.1 Objectives

- The next requirement we must address is Data Access.
- Since Business Objects need to handle their own Data Access, we will now cover the methods required to do so.

Data Access Objectives:

- Since it is our BUSINESS OBJECTS THAT PERFORM THEIR OWN DATA ACCESS
- Our objectives is to implement the Data Access Code for the 3-tiered and 4-tiered application architectures:





- IN THIS LECTURE, WE WILL IMPLEMENT THE FIRST DIAGRAM OR DATA ACCESS FOR THE 3-TIERED APPLICATION ARCHITECTURE

6.2.2 Implementation Overview

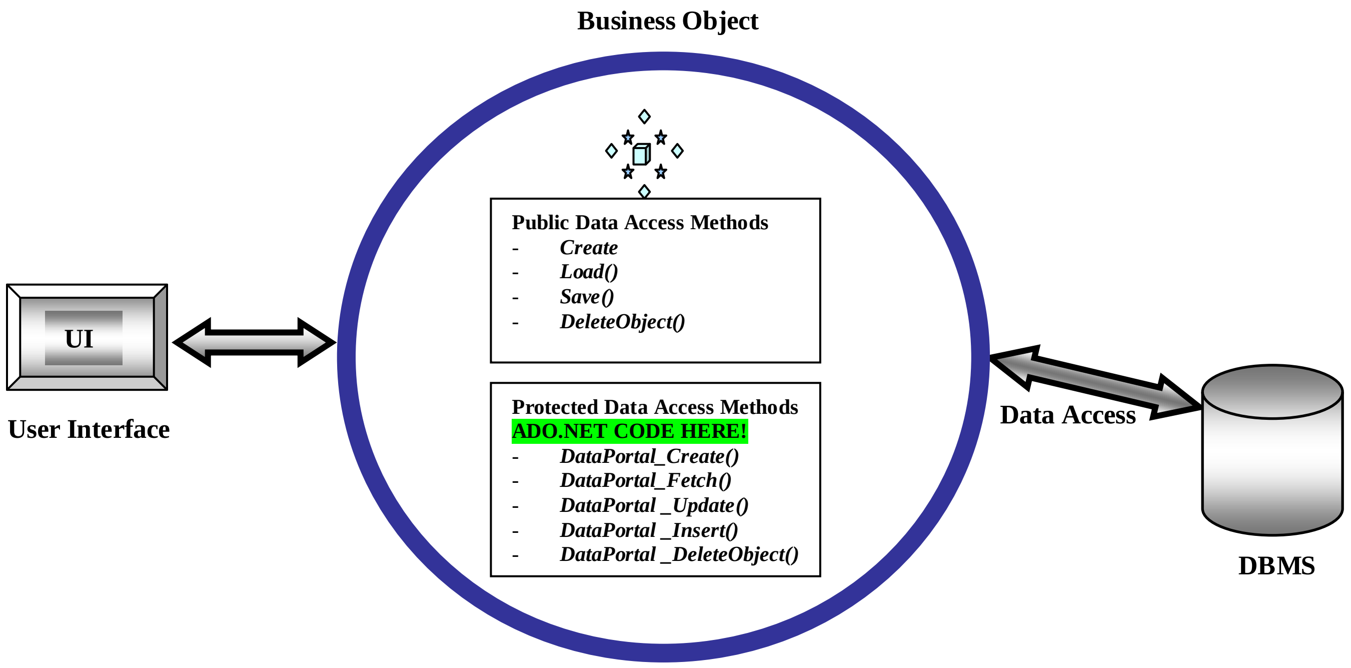
Data Access Methods Details:

- In previous lecture, we divided the data access methods into two sections, PUBLIC DATA ACCESS METHODS and PROTECTED OR PRIVATE DATA ACCESS METHODS:

  - ***Public*** **Data Access Methods** – These methods are Public and assessable to the User-Interface or clients. These methods DO NOT CONTAIN ADO.NET CODE. They call the PROTECTED DATA ACCESS METHODS TO DO THE WORK.

  - ***Protected*****,** ***Private*** **Data Access methods** – These methods can only be accessed internally within the class and its inherited children. These methods will actually perform the data access and contain the ADO.NET CODE with *SQL queries* or *Stored Procedure* calls. These methods are called by the ***Public Data Access Methods***.

- Diagram of our Data Access implementation goals:



7.2.3 Preparing Our Classes for DATA ACCESS (Summary)

- Our BUSINESS CLASSES need to have the proper mechanism to support the Data Access Code.
- We have already done this as follows:

  - Created Public & Protected Data Access Methods
  - We created a BASE CLASS (*BusinessBase*) that will force the Data Access code to our *Business Classes*
  - We created our BUSINESS CLASSES, with ***DIRTY*** & ***NEW*** logic mechanism to work hand-in-hand with the Data Access Methods
  - The ***DIRTY*** & ***NEW*** mechanism in our classes work with the Data Access Methods as follows:

    - **CREATE:**
      - MARKS OBJECT AS ***NEW***, WHEN CREATING A NEW OBJECT WITH DEFAULT DATA FROM DB

    - **SELECT:**
      - MARKS OBJECT AS ***OLD***, AFTER RETRIEVING RECORDS FROM DB

    - **INSERT:**
      - ONLY PERFORMED WHEN OBJECT IS ***DIRTY*** & ***NEW***.
      - MARKS OBJECT AS ***OLD*** AFTER INSERT

    - **UPDATE:**
      - ONLY PERFORMED WHEN OBJECT IS ***DIRTY*** & ***OLD***.
      - MARKS OBJECT AS ***OLD*** AFTER UPDATE

    - **DELETE:**
      - MARKS OBJECT AS ***NEW***, AFTER DELETE SINCE OBJECT DOES NOT EXIST IN DB.

- Our **Business Classes** such as *clsCustomer*, *clsEmployee*, *clsProduct* etc., inherit from ***BUSINESSBASE*** class the proper support for DATA ACCESS methods
- Same is true for our **Business Collection Classes**, such as *clsCustomerList*, *clsEmployeeList*, *clsProductList* etc., which inherit from ***BUSINESSCOLLECTIONBASE*** class the support for DATA ACCESS methods.
- The BASE classes have the following format:

Imports
<Serializable()> _
Class MustInherit clsBusinessBase

Private Business Rules data:
mflgIsDirty, mflgIsNew

Public Business Rules Properties:
IsNew, IsDirty

Public *MustOverride* Data Access Methods:
Create()
Load(Key)
DeleteObject(Key)
Save()

Protected *MustOverride* Data Access Methods:
DataPortal_Create()
DataPortal_Fetch(Key)
DataPortal_Update()
DataPortal_Insert()
DataPortal_DeleteObject(Key)

Public Helper Data Access Methods:
DBConnectionString(DBName)

Imports
Class MustInherit clsBusinessCollectionBase
Inherits DictionaryBase

Public Business Rule Properties:
IsDirty

Public *MustOverride* Data Access Methods:
Create()
Load()
DeleteObject(Key)
Save()

Protected MustOverride Methods:
DataPortal_Create()
DataPortal_Fetch()
DataPortal_Save()
DataPortal_DeleteObject(Key)

Public Helper Data Access Methods:
DBConnectionString(DBName)

- The FORMAT of the Business Classes we create should be based on the following BUSINESS TEMPLATES:

Imports
<Serializable()> _
Class clsBusinessClass
Inherits clsBusinessBase

Private data:
Public Event Declarations:
Public Properties:
Public Constructors:
Public Methods:
Public *Shared* Data Access Methods:
Create()
Load(Key)
DeleteObject(Key)
Save()
Protected *Override* Data Access Methods:
DataPortal_Create()
DataPortal_Fetch(Key)
DataPortal_Update()
DataPortal_Insert()
DataPortal_DeleteObject(Key)

Public Helper Methods:

Imports
<Serializable()> _
Class clsBusinessCollectionClass
Inherits clsBusinessCollectionBase

Public Properties:
Public Wrapper Methods:
Public Regular Methods:
Public *Shared* Data Access Methods:
Create()
Load()
DeleteObject(Key)
Save()

Protected *Override* Data Access Methods:
DataPortal_Create()
DataPortal_Fetch()
DataPortal_Save()
DataPortal_DeleteObject(Key)

Public Helper Methods:

7.3 **Sample Program #1** – Customer Retail Management Program Data Access, Using Microsoft Access Database

7.3.1 Overview

- No we upgrade the *Customer Management Application* from previous lecture (**Lecture 3B, Sample Program #5**), by implementing the DATA ACCESS METHODS using ADO.NET.
- In the previous lecture 3B, we upgraded this application by applying the Business Rules & Logic, Validation, and data access as follows:

  1. Inherited our Business Class ***clsCustomer*** from ***BusinessBase***
  2. Inherited our Business Collection Class ***clsCustomerList*** from ***BusinessCollectionBase***
  3. Modify the Business Class ***clsCustomer*** by following the format provided by the template class ***BusinessClass***
  4. Modify the Business Collection Class ***clsCustomerList*** by following the format provided by the template class ***BusinessCollectionClass***

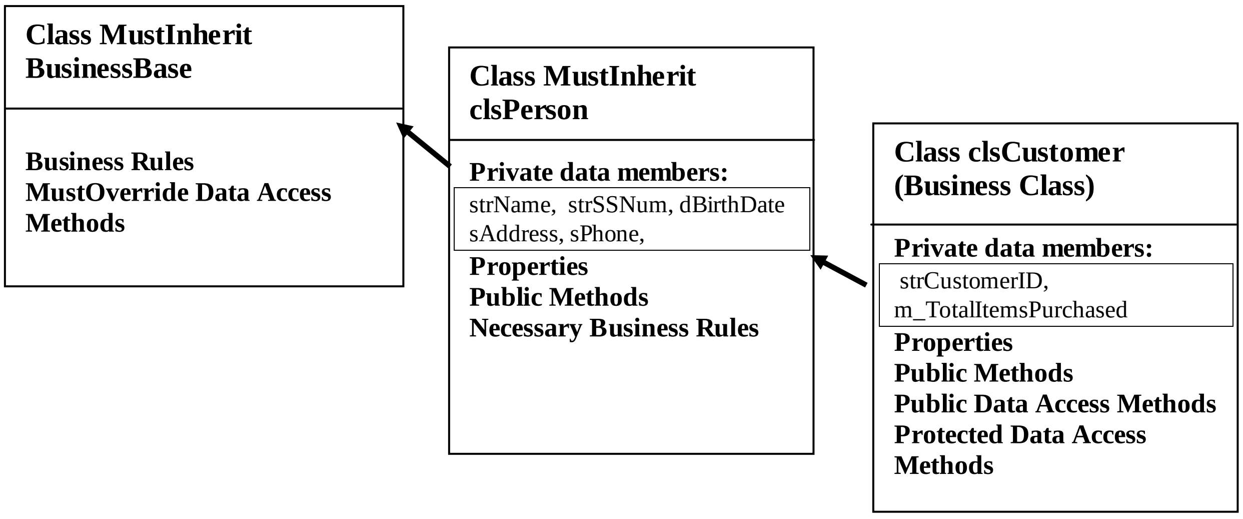
- Using ADO.NET, we will now implement the DATA ACCESS CODE for the four **PROTECTED Data Access Methods**:

  - **Protected Overrides DataPortal_Create()**
  - **Protected Overrides DataPortal_Fetch()**
  - **Protected Overrides DataPortal_Update()**
  - **Protected Overrides DataPortal_Insert()**
  - **Protected Overrides DataPortal_DeleteObject()**

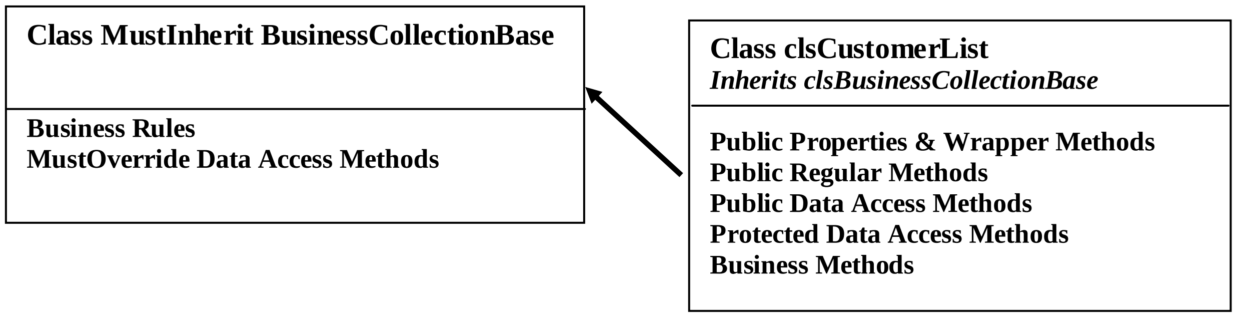
7.3.2 Object Model Requirements

- We will maintain all the Business Objects requirements from Lecture 3B Sample Program #5, these were as follows.

  1. Inherited Business classes from ***BusinessBase*** & modified the Business Classes by applying the format of the ***BusinessClassTemplate***. Object model looks as follows:


Class MustInherit BusinessBase
Business Rules
MustOverride Data Access Methods
Class MustInherit clsPerson
Private data members:
strName, strSSNum, dBirthDate sAddress, sPhone,
Properties
Public Methods
Necessary Business Rules
Class clsCustomer (Business Class)
Private data members:
strCustomerID, m_TotalItemsPurchased
Properties
Public Methods
Public Data Access Methods
Protected Data Access Methods

2. Inherited the Business Collection Classes from ***BussinessCollectionBase***, and modified the Collection Classes based on the template provided by ***BussinessCollectionClass*** templates. Object model looks as follows:



Class MustInherit BusinessCollectionBase
Business Rules
MustOverride Data Access Methods
Class clsCustomerList
Inherits clsBusinessCollectionBase
Public Properties & Wrapper Methods
Public Regular Methods
Public Data Access Methods
Protected Data Access Methods
Business Methods

7.3.3 Business Rules, Logic & Validation Requirements

- We will maintain all the BUSINESS LOGIC AND VALIDATION RULES from Lecture 3B Sample Program #5, with the EXCEPTION OF THE FILE ACCESS CODE, this we will remove
- The requirements are as follows:

1. Maintain the **Dirty Objects** to ALL OUR PROPERTY SET:

   - Customer Name: Call MARK-DIRTY()
   - Social Security & Customer ID Number – Call MARK-DIRTY()
   - Address, & Phone – Call MARK-DIRTY().

2. Maintain the same enforced **Field-Level Validation** to our Properties:

   - Customer Name – NO-BLANK & MAX-LENGTH.
   - Social Security & Customer ID Number – WRITE-ONCE, EXACT LENGTH & NO-BLANK/EMPTY
   - Address, & Phone – NO-BLANK/EMPTY.

3. **REMOVE** THE **FILE ACCESS CODE** from the COLLECTION CLASSES (*clsCustomerList*), which are located in the methods: ***DataPortal_Fetch()*** & ***DataPortal_Save()***, we will be implementing these using ADO.NET.
4. Place Database Connection String as a private data member to each Business Object. More on this below.

7.3.4 Database Requirements for ACCESS DATABASE

- Before we can begin to add the ADO.NET code and test our application, we need to create our database tables with their relationships.
- We will begin this application by first creating the DATA ACCESS LAYER or Database portion first

Database & Client Architecture

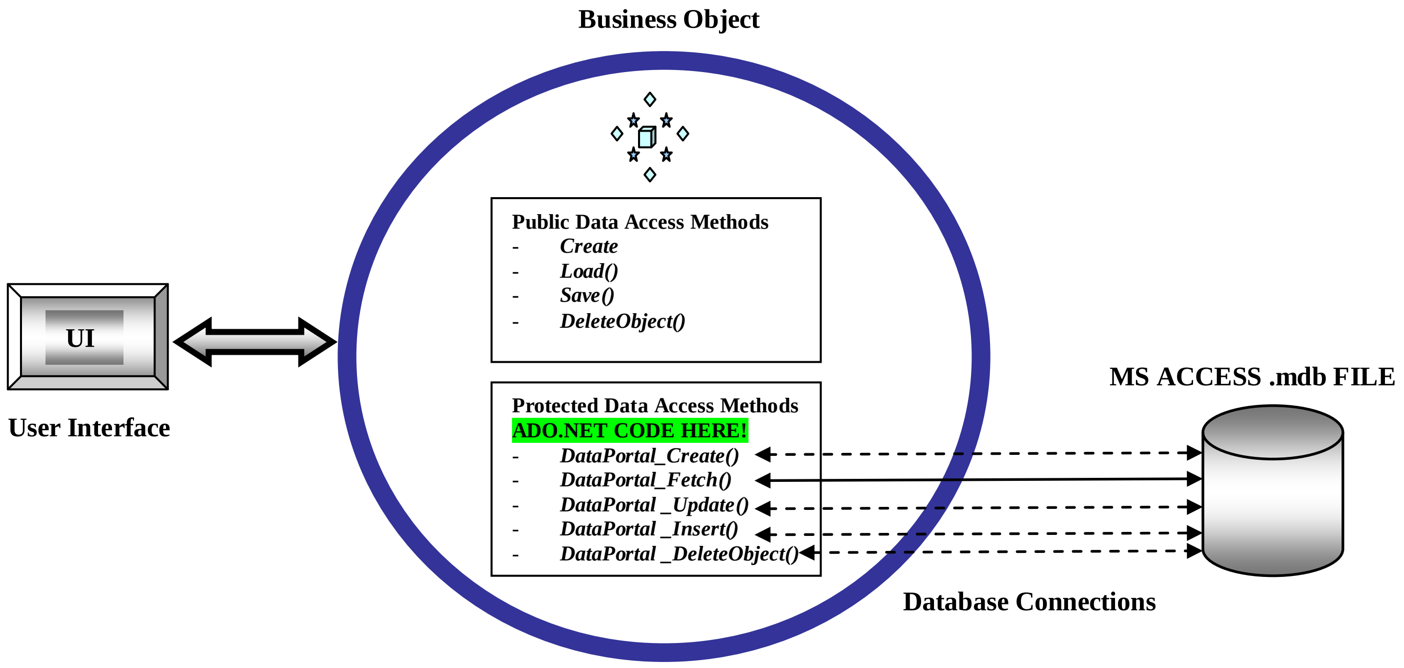
- In this case we will use Microsoft Access Database; therefore our application will continue to be a ***Single-Tier Client/Server Application***. Name the database ***smallbusinessapp***.

Database Schema, Queries & Database Location

- The database needs to reside in the **BIN\DEBUG** FOLDER of the Client program, which is the same location as the CLIENT EXECUTABLE.
- This is done so the ADO.NET Connection String will not require the FULL PATH; it will automatically search for the database file in the location of CLIENT EXECUTABLE.
- Create the database, tables and their relationships, as well as populate the table with data and testing our queries in MS ACCESS.
- Once all our queries are tested we will use them in our ADO.NET code in the application.

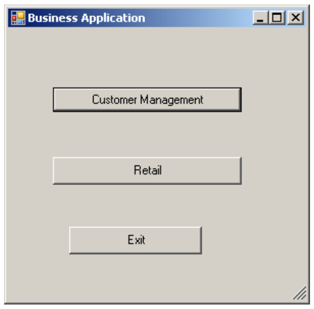
Database Connection String Location

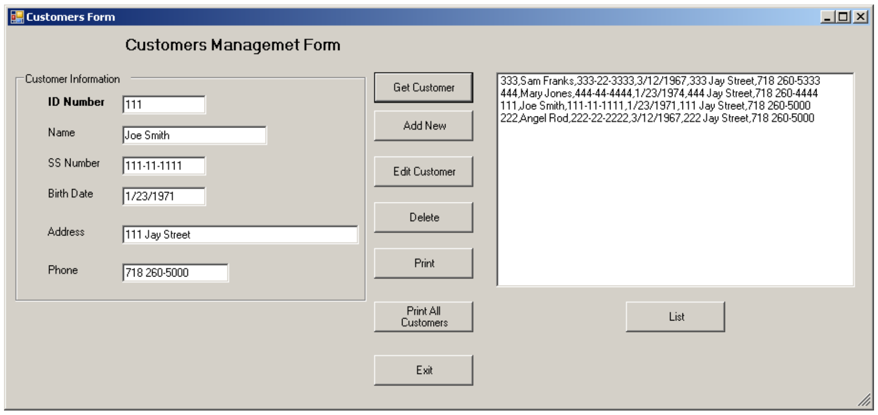
- In this example, we will NOT USE THE BEST PRACTICE MECHANISM PROVIDED BY THE BUSINESS BASE CLASSES (***BusinessBase*** & ***BussinessCollectionBase***). The base classes provide us with a Helper Data Access Method named ***DBConnectionString(Key)*** which allows us to retrieve the connection string from file. In this example we will **CREATE THE CONNECTION STRING IN-LINE WITH OUR CODE INSIDE THE OBJECTS**, as shown in diagram below:



7.3.4 Form Requirements

- The FORM requirements are similar to the previous version of this application. Below is a listing of the three main Forms, ***Main Form***, ***Customer Management*** & ***Retail Management Form***:



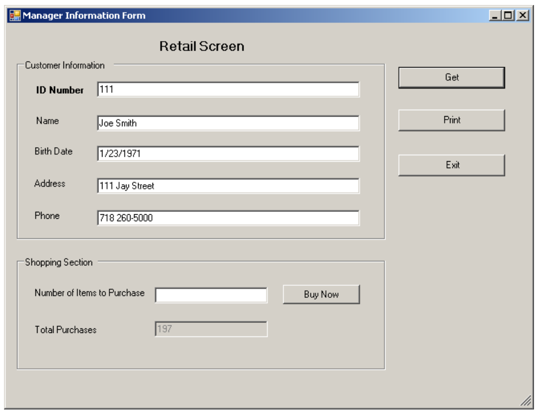


Customers Managemet Form

Customer Information

ID Number	111
Name	Joe Smith
SS Number	111-11-1111
Birth Date	1/23/1971
Address	111 Jay Street
Phone	718 260-5000

```
333,Sam Franks,333-22-3333,3/12/1967,333 Jay Street,718 260-5333
444,Mary Jones,444-44-4444,1/23/1974,444 Jay Street,718 260-4444
111,Joe Smith,111-11-1111,1/23/1971,111 Jay Street,718 260-5000
222,Angel Rod,222-22-2222,3/12/1967,222 Jay Street,718 260-5000
```



Retail Screen

Customer Information

ID Number	111
Name	Joe Smith
Birth Date	1/23/1971
Address	111 Jay Street
Phone	718 260-5000

Shopping Section

Number of Items to Purchase	
Total Purchases	197

New Requirement for Customer Management Form

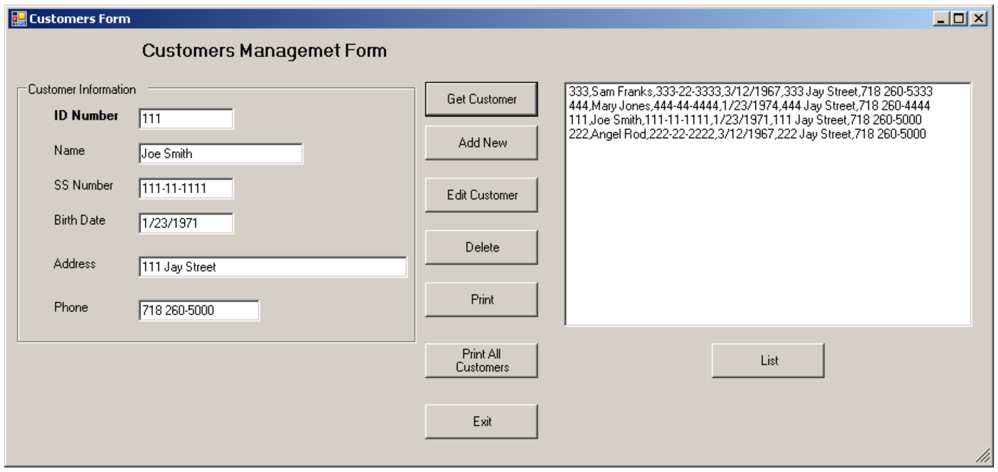
- The current ***Customer Management*** Form requires only ONE MODIFICATION.
- The only issue we have now that we are implementing actual database code, is the following

  - THE DELETE BUTTON simply REMOVES AN ITEM OR CUSTOMER FROM THE COLLECTION ONLY! NOT FROM DATABASE
  - WE NEED TO TELL THE ITEM OR CUSTOMER TO DELETE ITSELF FROM DATABASE BEFORE REMOVING IT FROM THE COLLECTION
  - So, we will need to modify the exiting code in the Delete_Click Event-handler to perform the following steps:

```
'Step 1-Calls DATA ACCESS METHOD TO DELETE OBJECT FROM DB
 objCustomerList.DeleteObject(txtIDNumber.Text.Trim)

 'Step 2-Calls Remove() method to REMOVE OBJECT FROM COLLECTION
    bolResults = objCustomerList.Remove(txtIDNumber.Text.Trim)
```

  - **Note** that we are first DELETING the object from the DATABASE, then DELETING THE OBJECT FROM COLLECTION

- View of Customer Retail Screen. No changes are made in the graphical layout, but inside the DELETE CLICK EVENT, WE MODIFY THE CODE AS SHOWN ABOVE:



ID Number: 111
Name: Joe Smith
SS Number: 111-11-1111
Birth Date: 1/23/1971
Address: 111 Jay Street
Phone: 718 260-5000

```
333,Sam Franks,333-22-3333,3/12/1967,333 Jay Street,718 260-5333
444,Mary Jones,444-44-4444,1/23/1974,444 Jay Street,718 260-4444
111,Joe Smith,111-11-1111,1/23/1971,111 Jay Street,718 260-5000
222,Angel Rod,222-22-2222,3/12/1967,222 Jay Street,718 260-5000
```

New Requirement for Retail Management Form

- The current ***Retail Management*** Form has the following characteristics:

  - Populates text controls with default object data in the Form _Load() event
  - **LOADS** the CustomerList Collection with **ALL** Business Objects from **FILE**
  - Search the CustomerList Collection for customer that is going to shop
  - Allows for Shopping via "By Now" button
  - SAVES the Collection to FILE when closing via the FORM_CLOSE event

- Comments on current Retail Management Form:

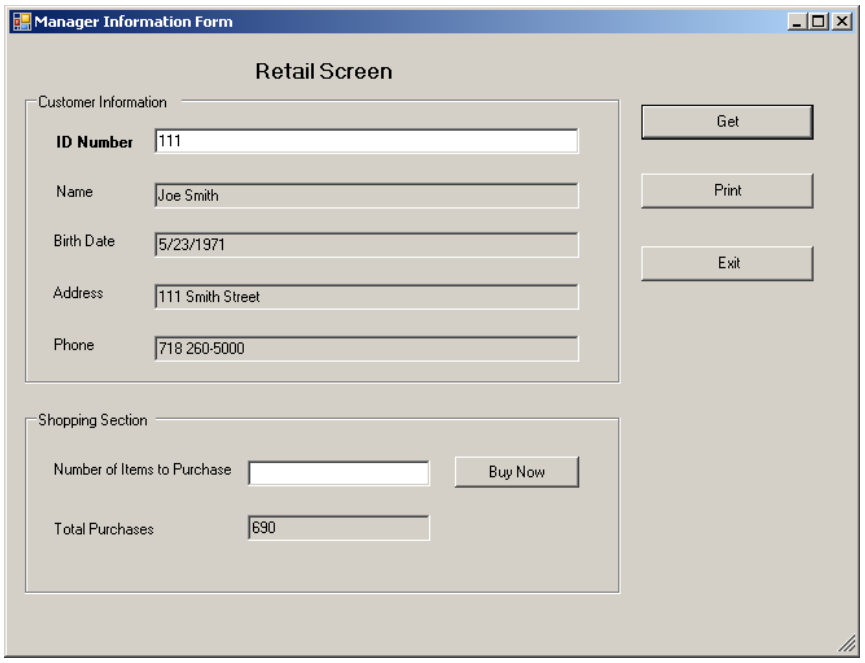
  - Not efficient:
    - Bad performance for Retail or Point-Of-Sales application that handles sales transactions with customers because it loads all customer objects (records) to memory in order to work on ONE CUSTOMER ONLY
    - Loading memory with objects you are not using!

  - Retail User-Interface should really deal with the ONE CUSTOMER OBJECT.
  - THE CUSTOMER OBJECT SHOULD LOAD & SAVE ITSELF TO DATABASE.
  - FOR NEXT CUSTOMER, A NEW OBJECT IS CRATED AND PROCESS REPEATED.

- NEW FORM has the following characteristics:

  - Retail Form ONLY OPERATES ON ONE CUSTOMER OBJECT AT A TIME.
  - The GET or LOAD PROCESS WILL LOAD THE ONE CUSTOMER WITH DATA FROM DATABASE
  - THE ONE CUSTOMER OBJECT SAVE ITSELF TO DATABASE.
  - FOR NEXT CUSTOMER, A NEW OBJECT IS CRATED AND PROCESS REPEATED.
  - FORM HAS USER-INTERFACE LOGIC TO SET the Customer Information UI CONTROLS TEXT BOXES to READ-ONLY. ONLY the CUSTOMER ID TEXT BOX will allow input from the user. The other controls are READ-ONLY.
  - The Purchase ITEM Text Box will only activate when the CUSTOMER RECORD IS LOADED, all other times it is DISABLED.

- View of new Retail Screen:



ID Number	111
Name	Joe Smith
Birth Date	5/23/1971
Address	111 Smith Street
Phone	718 260-5000
Number of Items to Purchase	
Total Purchases	690

7.3.5 Problem Statement

Single-Tier Client/Server

- The requirements for Sample program #1. are as follows:

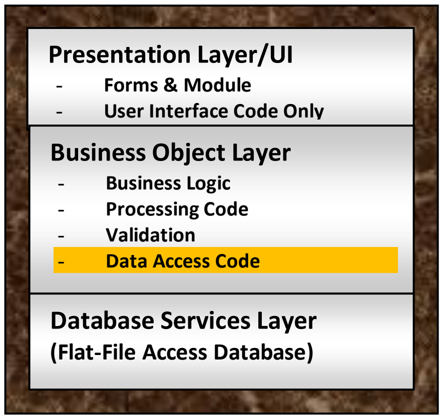
Example #1 – Small Business Customer Retail Management Application Using MS ACCESS

Problem statement:

- Upgrade the Customer Management application from Lecture 3B Sample Program #5 by adding DATA ACCESS CODE using ADO.NET
- The requirements are as follows:

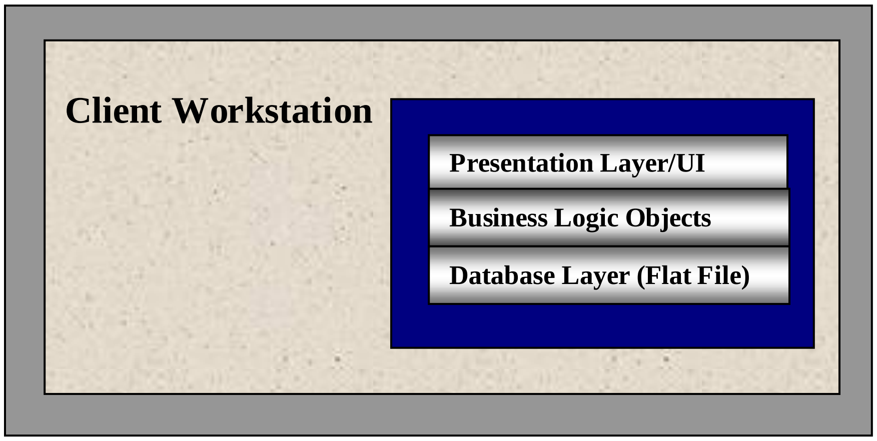
Application Architecture – Programming Methodology

- Continue to implement the 3-tiered layer Application Architecture:



Client/Server Architecture – One-Tier Client/Server

- Maintain the 1-tiered client/server architecture:



Business Object Layer – Business Class & DLL Requirements

- Keep the DLL COMPONENT and Object Model and Business Rules
- Create the DATABASE CONNECTION STRING IN-LINE within THE CLASSES OR OBJECTS
- DELETE the FILE ACCESS CODE from the ***DataPortal_Fetch***() & ***DataPortal_Save()*** methods in *clsCustomerList*

Presentation/UI Layer – Client Process requirements:

- Maintain the same Form/User Interface requirements
- No changes required

Data Service Layer – Database Requirements

- Create an access database to support the application
- Name the database ***smallbusinessapp.mdb***
- Place the ***smallbusinessapp.mdb*** file in the User-Interface Client Application **BIN\DEBUG FOLDER**

HOW IT'S DONE:

Data Service Layer (Microsoft Access Database 2003)

Part I – Create The MS Access Database:

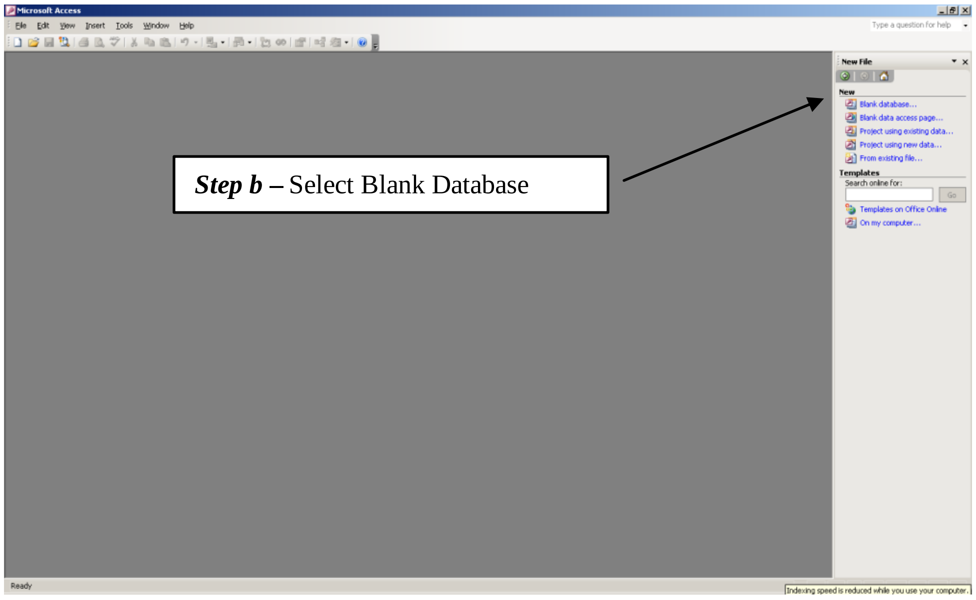
Step 1: Open Microsoft Access 2003 & Create the Database

- Open MS Access 2003 and create a Database named ***SmallBusinessApp***.
- This was done as follows:

Step 1: Create Blank Database in MS Access 2003:

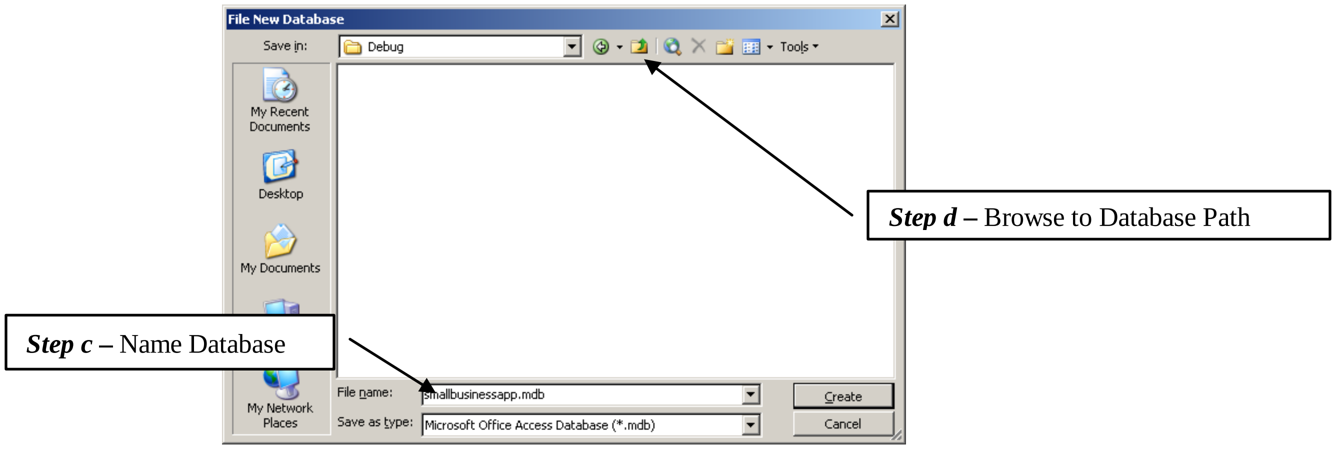
a. Open MS Access 2003

b. Select **File|New…** to invoke the **New File** Window on the right-hand pane of MS Access & Select ***Blank Database..***:

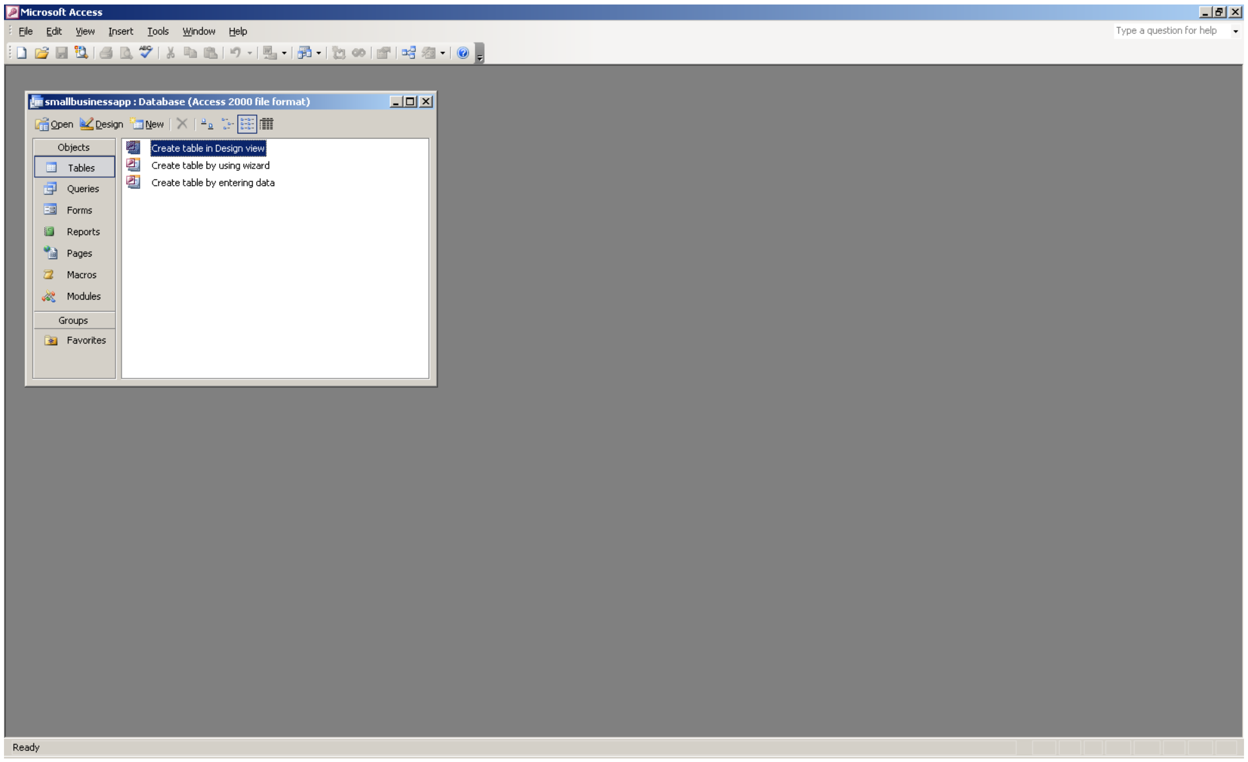

Microsoft Access
File Edit View Insert Tools Window Help
Type a question for help
New File
New
Blank database...
Blank data access page...
Project using existing data...
Project using new data...
From existing file...
Templates
Search online for:
Go
Templates on Office Online
On my computer...
Step b – Select Blank Database
Ready
Indexing speed is reduced while you use your computer.

c. In the ***File New Database*** screen, ***name*** the database

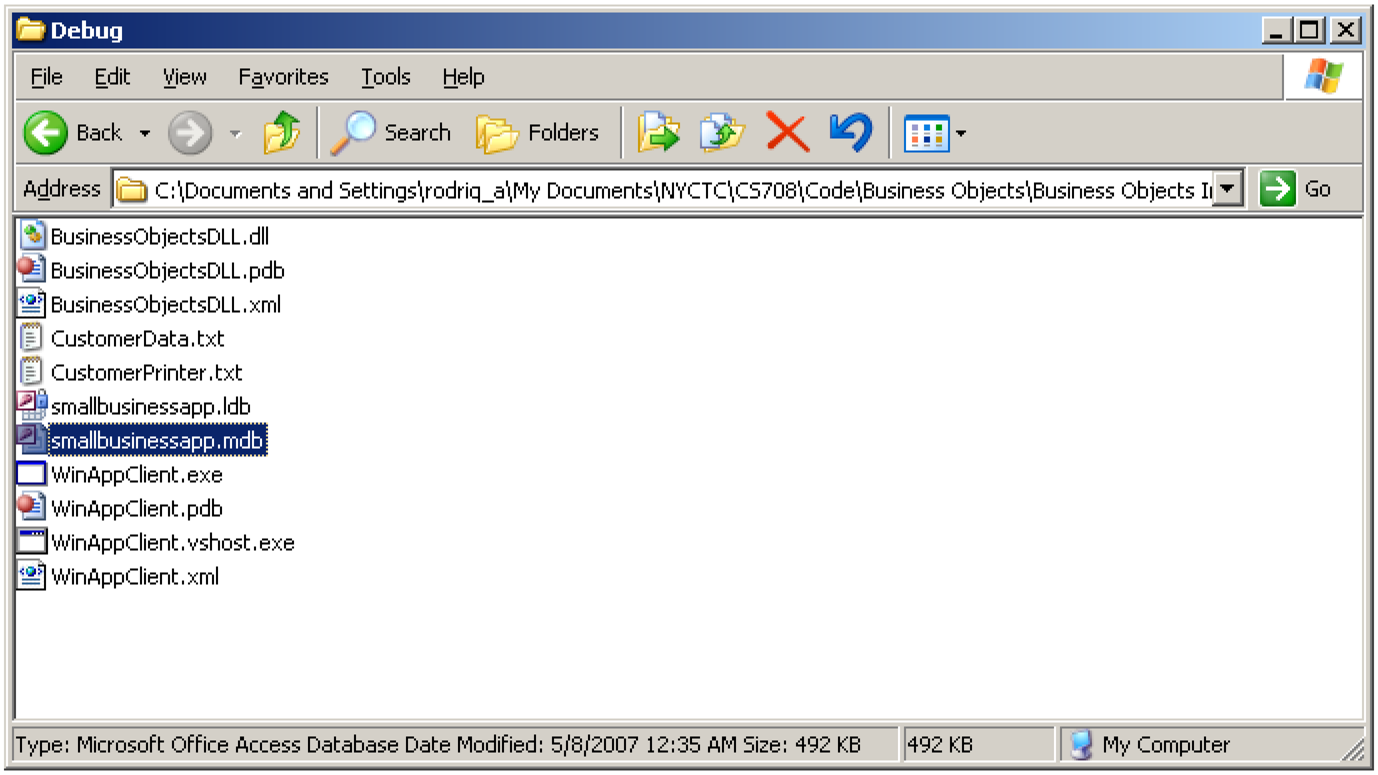
d. Browse to the desire ***path*** & click ***Create***:



e. The SmallBusinessApp.mdb Database is ready:


Microsoft Access
File Edit View Insert Tools Window Help
Type a question for help
smallbusinessapp : Database (Access 2000 file format)
Open Design New
Objects
Tables
Queries
Forms
Reports
Pages
Macros
Modules
Groups
Favorites
Create table in Design view
Create table by using wizard
Create table by entering data
Ready

f. File Structure:



C:\Documents and Settings\rodriq_a\My Documents\NYCTC\CS708\Code\Business Objects\Business Objects I

BusinessObjectsDLL.dll
BusinessObjectsDLL.pdb
BusinessObjectsDLL.xml
CustomerData.txt
CustomerPrinter.txt
smallbusinessapp.ldb
smallbusinessapp.mdb
WinAppClient.exe
WinAppClient.pdb
WinAppClient.vshost.exe
WinAppClient.xml

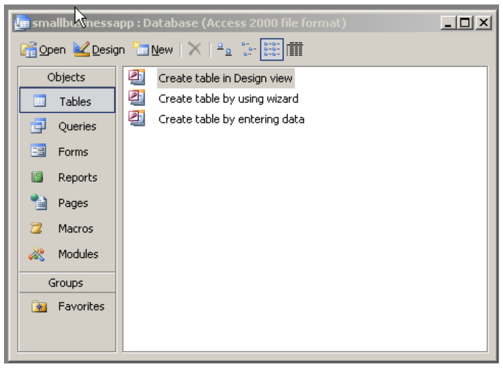
Type: Microsoft Office Access Database Date Modified: 5/8/2007 12:35 AM Size: 492 KB | 492 KB

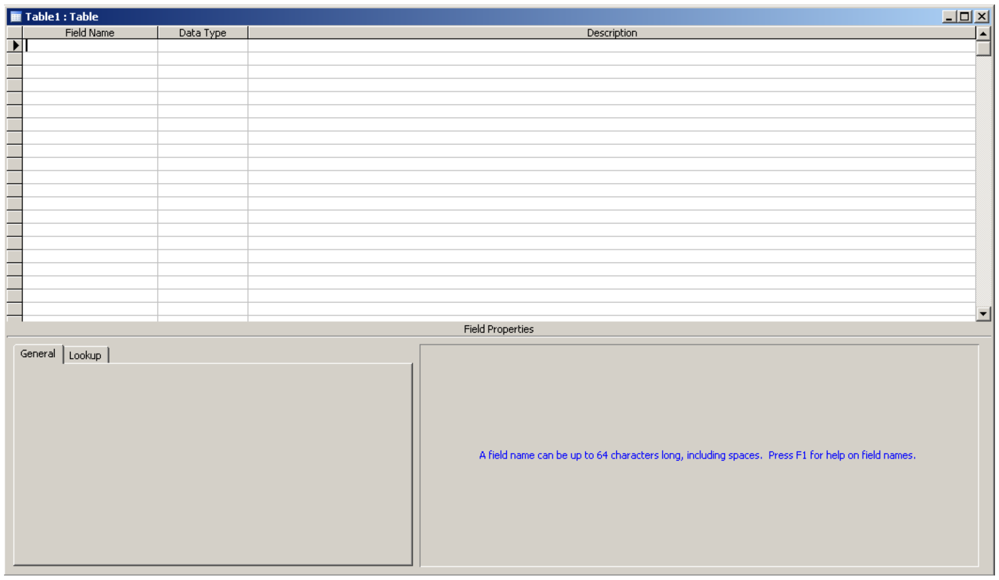
Step 2: Create the Database Table(s) and Enter Data

- In the Object Windows, Create the table(s) and enter test data. This was done as follows:

Step 1: Create the Customer Table:

a. Click the "Table" Objet and double-click the "***Create table in Design View***" icon:


smallbusinessapp : Database (Access 2000 file format)
Open
Design
New
Objects
Tables
Queries
Forms
Reports
Pages
Macros
Modules
Groups
Favorites
Create table in Design view
Create table by using wizard
Create table by entering data

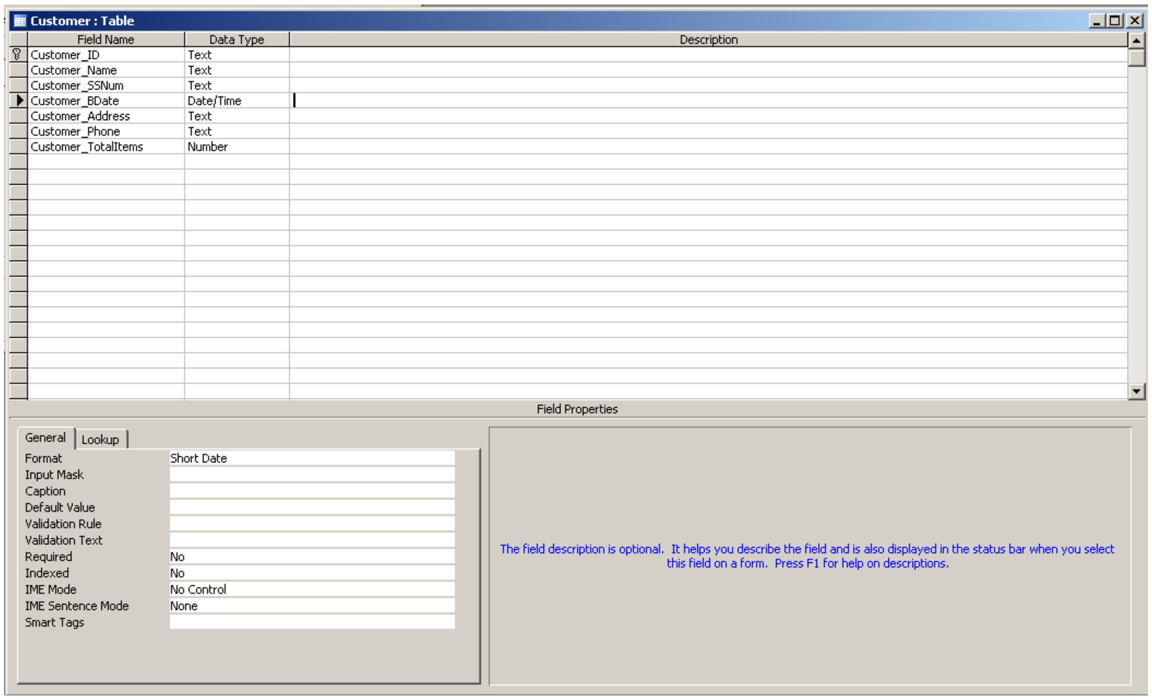


A field name can be up to 64 characters long, including spaces. Press F1 for help on field names.

b. In the Table Design View, enter the following columns & properties:

Column Name	Data Type	Properties	Other Settings/Comments
Customer_ID	Text	Text size =Default = 50	▪ Set as PRIMARY KEY ▪ Steps: 1. Enter the name & data type for the column 2. *Right-Click* on row and in the drop-down menu select **Primary Key**
Customer_Name	Text	Text size =Default = 50	
Customer_SSNum	Text	Text size =Default = 50	
Customer_BDate	Date/Time	Short Date	
Customer_Address	Text	Text size =Default = 50	
Customer_Phone	Text	Text size =Default = 50	
Customer_TotalItems	Integer		

c. The Table Design window should now looks as follows:



Customer : Table

Field Name	Data Type	Description
Customer_ID	Text	
Customer_Name	Text	
Customer_SSNum	Text	
Customer_BDate	Date/Time	
Customer_Address	Text	
Customer_Phone	Text	
Customer_TotalItems	Number	

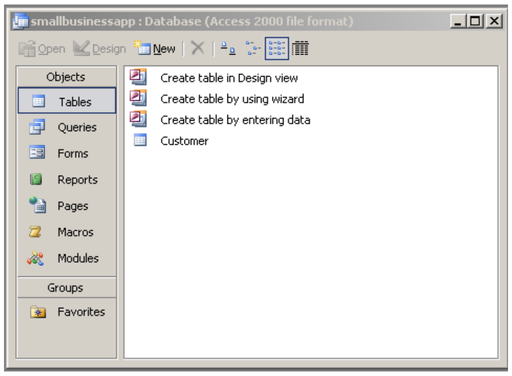
Field Properties

General | Lookup

Format	Short Date
Input Mask	
Caption	
Default Value	
Validation Rule	
Validation Text	
Required	No
Indexed	No
IME Mode	No Control
IME Sentence Mode	None
Smart Tags	

The field description is optional. It helps you describe the field and is also displayed in the status bar when you select this field on a form. Press F1 for help on descriptions.

d. Save and Name the table: "***Customer***". Table now appears in the main object window:

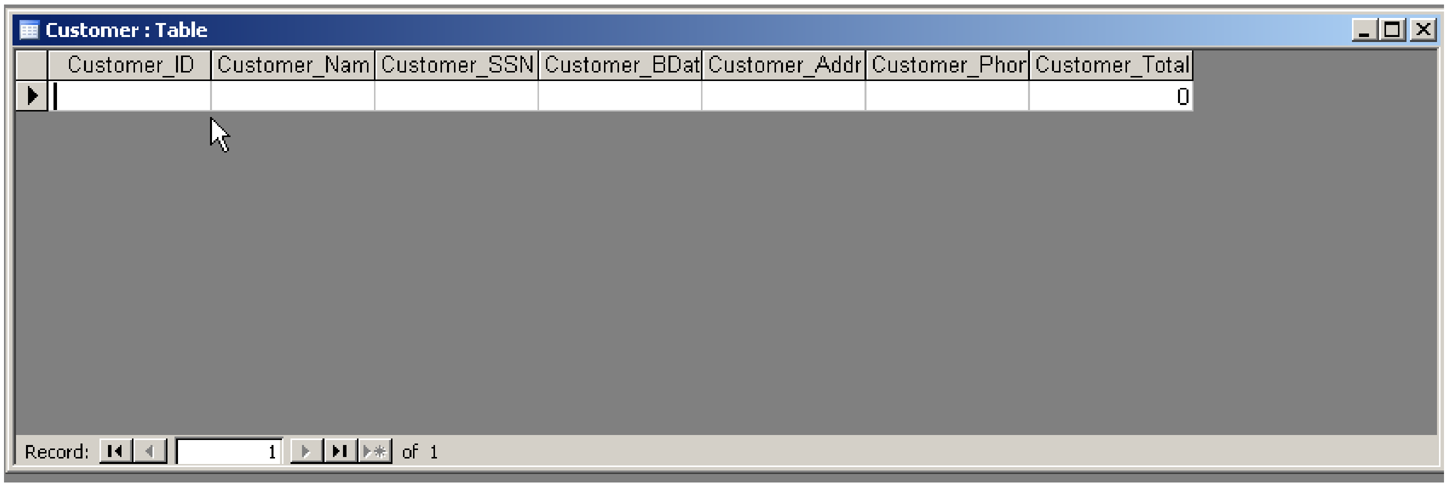


smallbusinessapp : Database (Access 2000 file format)

Create table in Design view
Create table by using wizard
Create table by entering data
Customer

Step 3: Add Test Data to the table:

a. Double-Click on the Customer icon in the object window to invoke the table's "***Data View***":



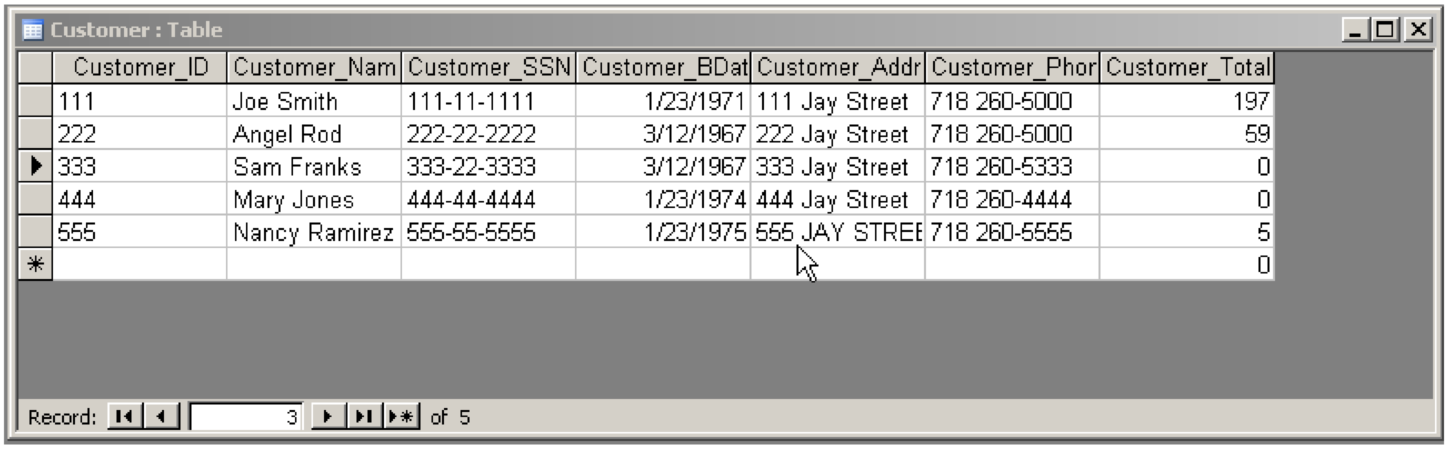
Customer : Table

Customer_ID	Customer_Nam	Customer_SSN	Customer_BDat	Customer_Addr	Customer_Phor	Customer_Total
						0

Record: 1 of 1

b. Insert the cursor in the first row and begin typing in the data from your previous application *CustomerData.txt* file.

c. After all data entry has been completed, the "Data View" should look as follows:



Customer : Table

Customer_ID	Customer_Nam	Customer_SSN	Customer_BDat	Customer_Addr	Customer_Phor	Customer_Total
111	Joe Smith	111-11-1111	1/23/1971	111 Jay Street	718 260-5000	197
222	Angel Rod	222-22-2222	3/12/1967	222 Jay Street	718 260-5000	59
333	Sam Franks	333-22-3333	3/12/1967	333 Jay Street	718 260-5333	0
444	Mary Jones	444-44-4444	1/23/1974	444 Jay Street	718 260-4444	0
555	Nancy Ramirez	555-55-5555	1/23/1975	555 JAY STREE	718 260-5555	5
						0

Record: 3 of 5

d. Save & close the table

Step 3: Create Queries & SQL Statements to test the database

- ❑ Now we create queries to test our database.
- ❑ **NOTE!** In my examples and screen shot, I will use the SQL VIEW of MS Access to simply write the SQL Statements instead of using the GRAPHICAL DESIGNER.
- ❑ We will create the queries and SQL Statements required for the application. Once these queries are tested, we can COPY/PASTE and modify them into our DO.NET code:

Step 1: Create & Test Query to Select a Customer by ID:

- ❑ Create and test the Query to return the record for a Customer by ID.

a. The query should have the following syntax and format:

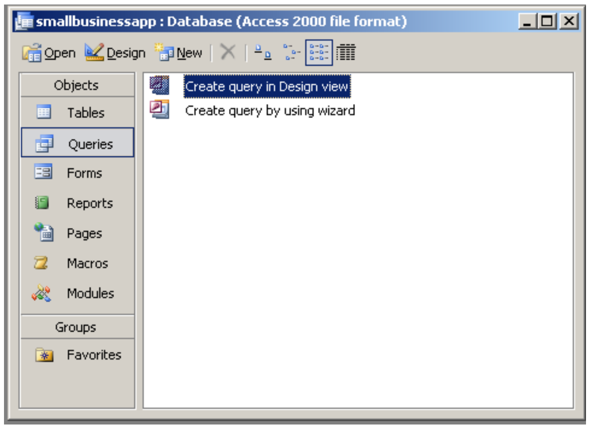
- Syntax:

```
SELECT *
FROM Table
WHERE Column1 = <value>;
```

- Example:
  - String values in Access must be enclosed in single-quotes and end in semicolon ";"
  - Example:

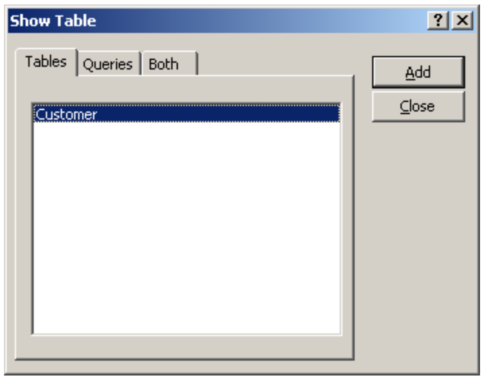
```
SELECT * FROM Customer WHERE Customer_ID = '111';
```

b. In the "***Object Window***" select the "**Queries**" Button:


smallbusinessapp : Database (Access 2000 file format)
Open
Design
New
Objects
Tables
Queries
Forms
Reports
Pages
Macros
Modules
Groups
Favorites
Create query in Design view
Create query by using wizard

c. Double-Click on the "***Create Query in Design View***" icon to invoke the Design View Window

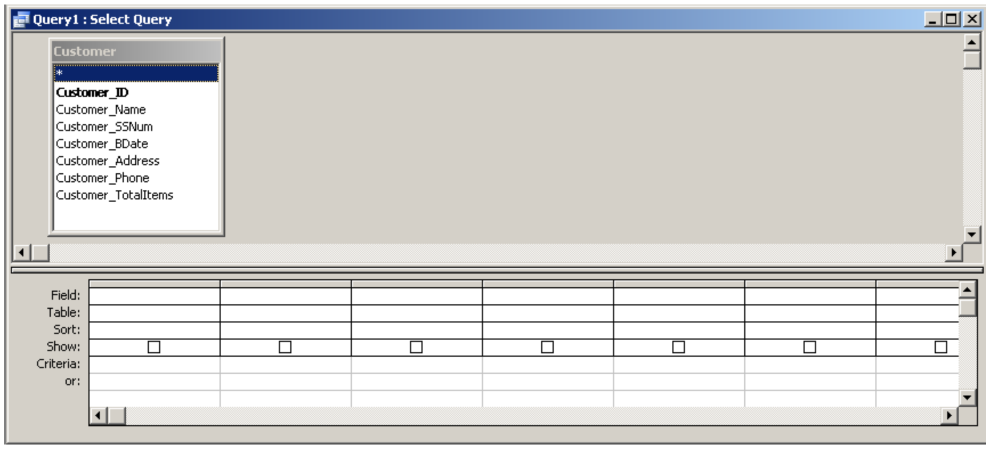
d. The "***Show Table***" screen provides a listing of the available tables for you to select and add to the designer:



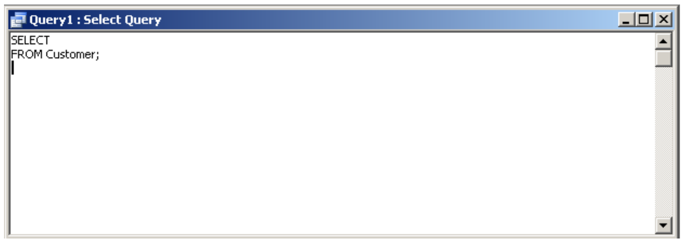
e. *Select* the "***Customer"*** table from the "***Show Table***" screen, and click the "***Add***" button.

f. Repeat this process until all tables you need for the query are entered. Click "***Close***" button to close the "***Show Table***" screen.

g. The designer should now looks as follows:

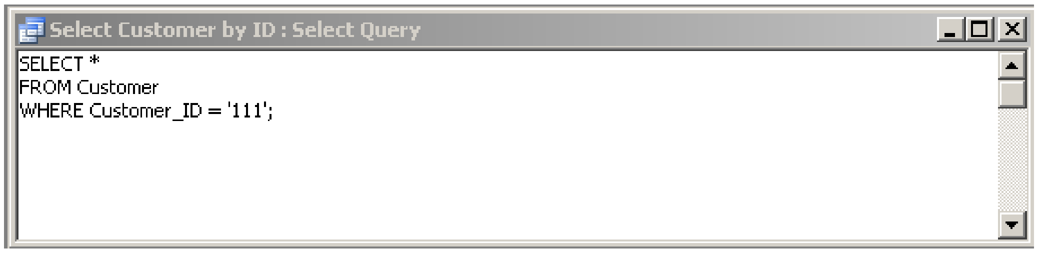


h. Now switch to SQL VIEW. Select the "***Designer***" Windows, then in the menu bar, select "**View|SQL View**", this will invoke the query screen :



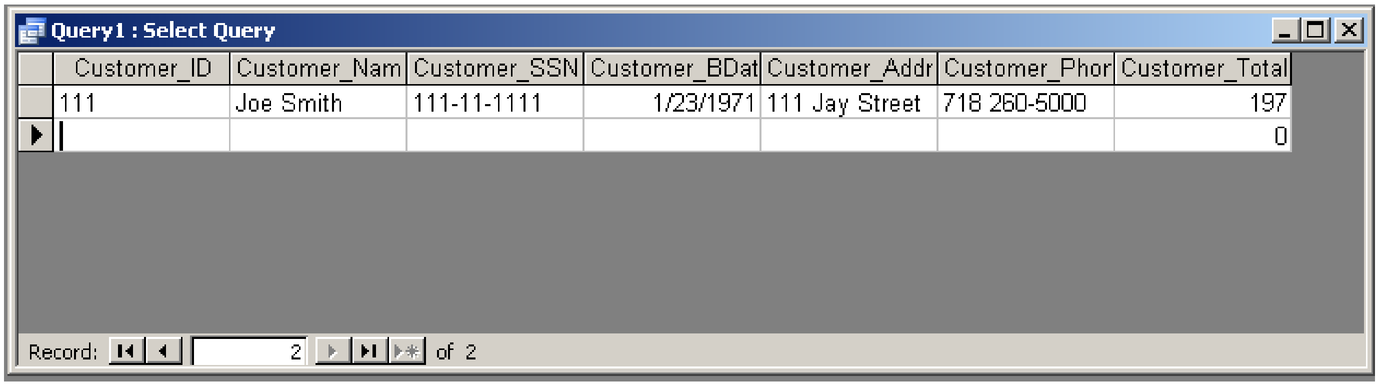
```
SELECT
FROM Customer;
```

i. Now enter the query into the query window:



```
SELECT *
FROM Customer
WHERE Customer_ID = '111';
```

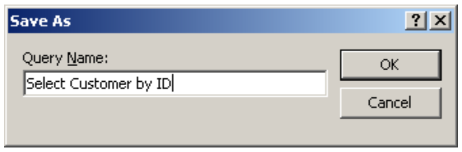
j. Execute, in the menu bar, select "**Query|Run**" or simply click on the run icon :



Customer_ID	Customer_Nam	Customer_SSN	Customer_BDat	Customer_Addr	Customer_Phor	Customer_Total
111	Joe Smith	111-11-1111	1/23/1971	111 Jay Street	718 260-5000	197
						0

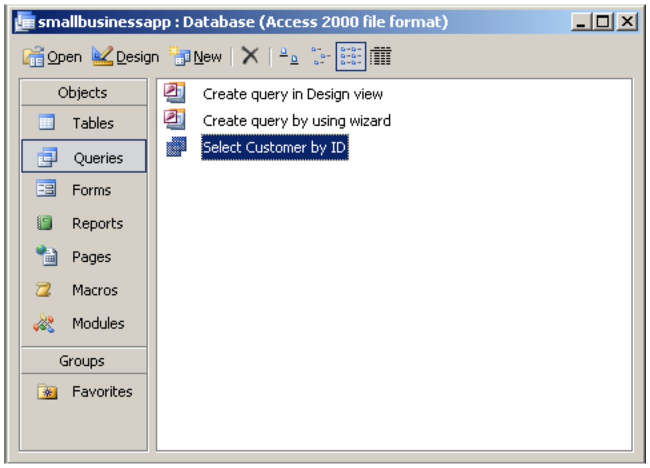
Record: 2 of 2

k. Save and name the query "***Select Customer by ID***":



Select Customer by ID

l. In the "***Object Window***" should now have an icon for the query :


smallbusinessapp : Database (Access 2000 file format)
Open
Design
New
Objects
Tables
Queries
Forms
Reports
Pages
Macros
Modules
Groups
Favorites
Create query in Design view
Create query by using wizard
Select Customer by ID

Step 2: Create & Test the UPDATE SQL Statement:

- Create and test the Query update or modify a Customer's record on the database.
- Repeat the same steps used for the previous query "Select Customer by ID"

a. The query should have the following syntax and format:

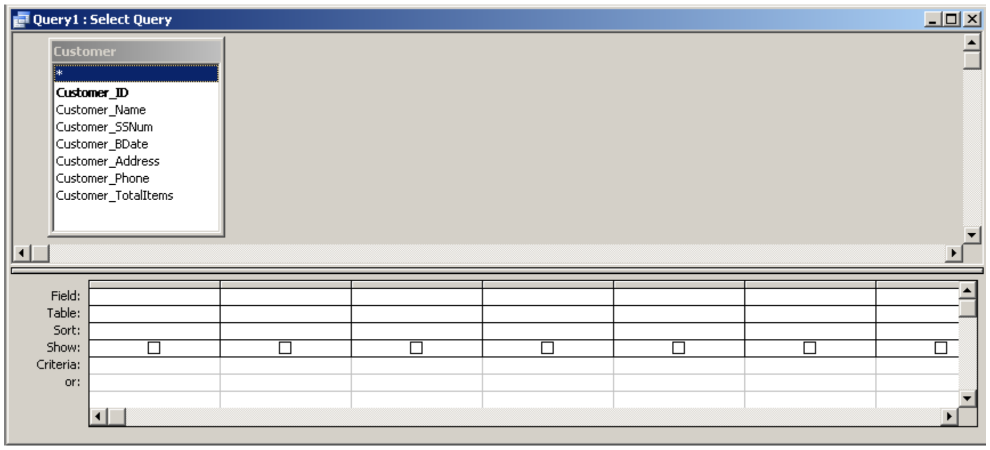
- Syntax:

```
UPDATE Table
SET    Column2=<value2>,
       Column3=<value3>,
       Column4=<value4>,
       Column5=<value5>
       Column6=<value6>,
       Column7=<value7>
WHERE  Column1=<value1>;
```

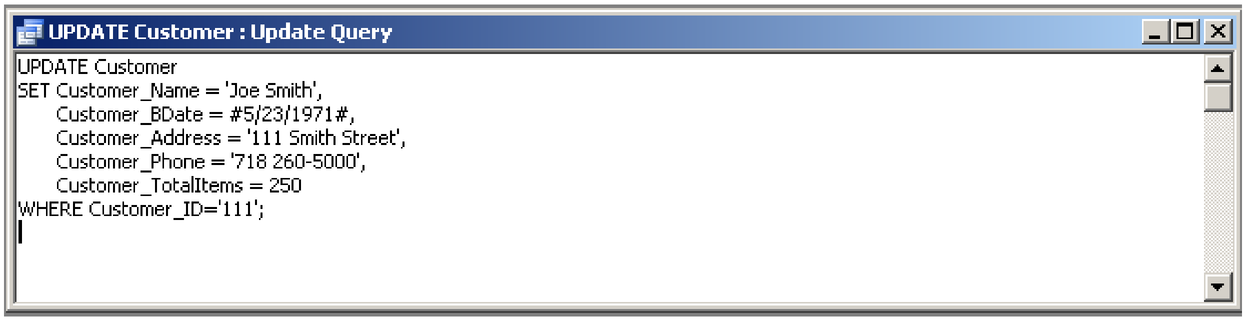
- THE UPDATE QUERY REQUIRED FOR OUR APPLICATION DOES NOT MODIFY THE SOCIAL SECURITY NUMBER COLUMN BECAUSE SSNUM PROPERTY IN THE CUSTOMER HAS A WRITE-ONCE BUSINESS RULE. THIS RULE STATES THAT THE SOCIAL SECURITY CAN ONLY BE WRITTEN ONCE, UPON THE CREATION OF THE NEW CUSTOMER. THEREFORE THE UPDATE STATEMENT CANNOT HAVE AN ENTRY TO MODIFY THE CUSTOMER_SSNUM COLUMN.
- Example:

```
UPDATE Customer
SET    Customer_Name = 'Joe Smith',
       Customer_BDate = #5/23/1971#,
       Customer_Address = '111 Smith Street',
       Customer_Phone = '718 260-5000',
       Customer_TotalItems = 250
WHERE  Customer_ID='111';
```

b. In the "***Object Window***" select the "**Queries**" Button:
c. Double-Click on the "***Create Query in Design View***" icon to invoke the Design View Window
d. The "***Show Table***" screen provides a listing of the available tables for you to select and add to the designer:
e. *Select* the "***Customer"*** table from the "***Show Table***" screen, and click the "***Add***" button.
f. Repeat this process until all tables you need for the query are entered. Click "***Close***" button to close the "***Show Table***" screen.
g. The designer should now looks as follows:

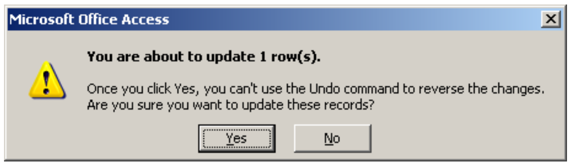


h. Now switch to SQL VIEW. Select the "***Designer***" Windows, then in the menu bar, select "**View|SQL View**"
i. Now enter the query into the query window:



```
UPDATE Customer
SET Customer_Name = 'Joe Smith',
    Customer_BDate = #5/23/1971#,
    Customer_Address = '111 Smith Street',
    Customer_Phone = '718 260-5000',
    Customer_TotalItems = 250
WHERE Customer_ID='111';
```

j. Execute query. You are prompted to modify a record, click yes:

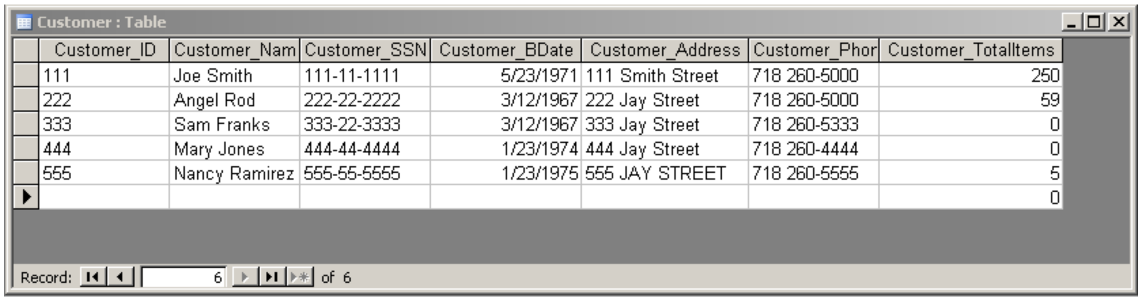


You are about to update 1 row(s).

Once you click Yes, you can't use the Undo command to reverse the changes.
Are you sure you want to update these records?

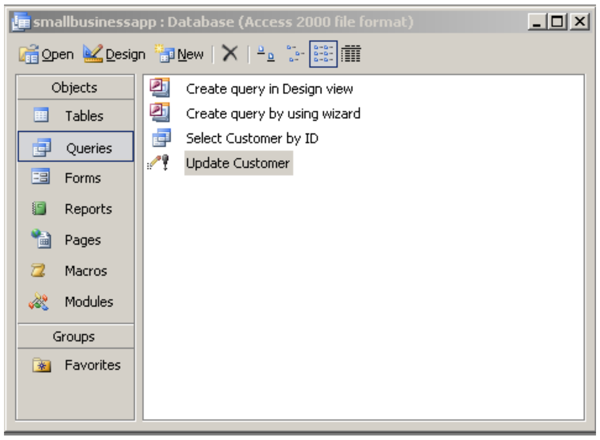
k. Save and name the query "***Update Customer*** ". Exit the "***SQL Design***" view

l. Since Action Queries **DO NOT RETURN RECORDS**, open the Customer Table in "***Data View***" to verify the UPDATE was successfully done:



Customer_ID	Customer_Nam	Customer_SSN	Customer_BDate	Customer_Address	Customer_Phor	Customer_TotalItems
111	Joe Smith	111-11-1111	5/23/1971	111 Smith Street	718 260-5000	250
222	Angel Rod	222-22-2222	3/12/1967	222 Jay Street	718 260-5000	59
333	Sam Franks	333-22-3333	3/12/1967	333 Jay Street	718 260-5333	0
444	Mary Jones	444-44-4444	1/23/1974	444 Jay Street	718 260-4444	0
555	Nancy Ramirez	555-55-5555	1/23/1975	555 JAY STREET	718 260-5555	5
						0

m. In the "***Object Window***" should now have an icon for the UPDATE query :



Step 3: Create & Test the INSERT SQL Statement:

- ❑ Create and test the Query to INSERT a NEW Customer record to the database.
- ❑ Repeat the same steps used for the previous query "UPDATE Customer" query

a. The query should have the following syntax and format:

- Syntax:

```
INSERT INTO Table(Column1, Column2,Column3, Column4, Column5,Column6, Column7)
VALUES(<value1>,<value2>,<value3<value4>,<value5>,<value6>,<value7>);
```

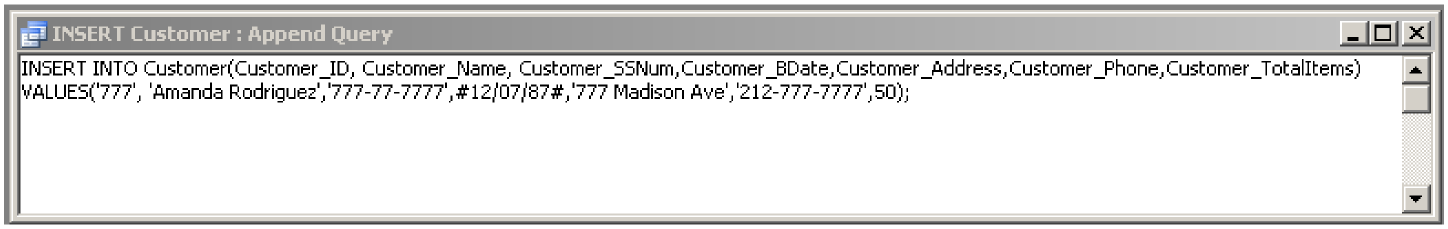
- Example:

```
INSERT INTO Customer(Customer_ID,Customer_Name,
                     Customer_SSNum,
                     Customer_BDate,
                     Customer_Address,
                     Customer_Phone,
                     Customer_TotalItems)

VALUES('777', 'Amanda Rodriguez','777-77-7777',#12/07/87#,'777 Madison Ave',
'212-777-7777',50);
```

b. Follow all the steps from previous query

c. Now switch to SQL VIEW. Select the "***Designer***" Windows, then in the menu bar, select "**View|SQL View**"

d. In "**View|SQL View**" enter the query into the query window:

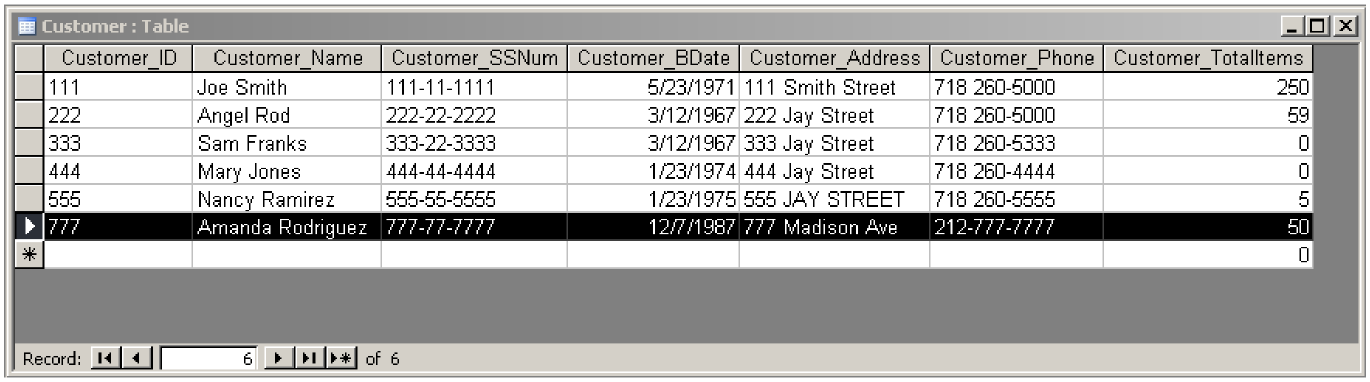

INSERT Customer : Append Query

```
INSERT INTO Customer(Customer_ID, Customer_Name, Customer_SSNum,Customer_BDate,Customer_Address,Customer_Phone,Customer_TotalItems)
VALUES('777', 'Amanda Rodriguez','777-77-7777',#12/07/87#,'777 Madison Ave','212-777-7777',50);
```

e. Execute query. You are prompted to modify a record, click yes:

f. Save and name the query "***INSERT Customer*** ". Exit the "***SQL Design***" view

g. Since Action Queries **DO NOT RETURN RECORDS**, open the Customer Table in "***Data View***" to verify the INSERT was successfully done. Note that a new record has been inserted '777':

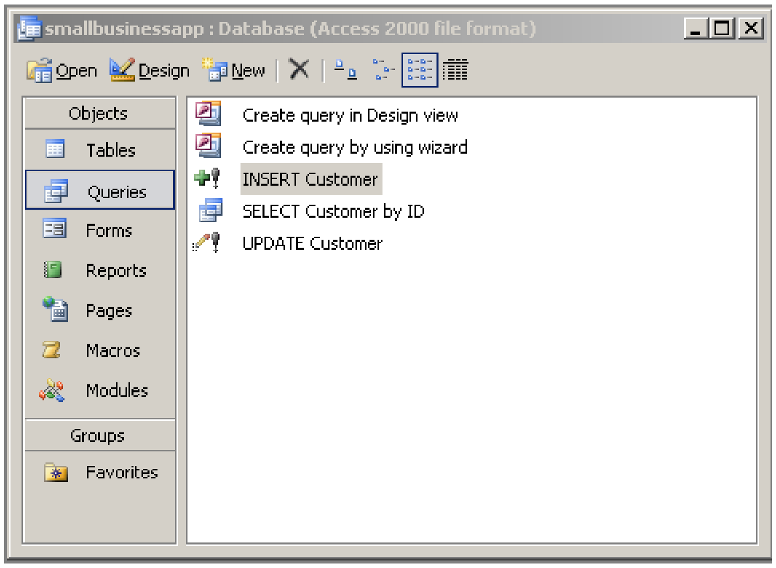


Customer : Table

Customer_ID	Customer_Name	Customer_SSNum	Customer_BDate	Customer_Address	Customer_Phone	Customer_TotalItems
111	Joe Smith	111-11-1111	5/23/1971	111 Smith Street	718 260-5000	250
222	Angel Rod	222-22-2222	3/12/1967	222 Jay Street	718 260-5000	59
333	Sam Franks	333-22-3333	3/12/1967	333 Jay Street	718 260-5333	0
444	Mary Jones	444-44-4444	1/23/1974	444 Jay Street	718 260-4444	0
555	Nancy Ramirez	555-55-5555	1/23/1975	555 JAY STREET	718 260-5555	5
777	Amanda Rodriguez	777-77-7777	12/7/1987	777 Madison Ave	212-777-7777	50
						0

Record: 6 of 6

h. In the "***Object Window***" should now have an icon for the DELETE query :



smallbusinessapp : Database (Access 2000 file format)

Create query in Design view
Create query by using wizard
INSERT Customer
SELECT Customer by ID
UPDATE Customer

Step 4: Create & Test the DELETE SQL Statement:

- Create and test the Query to DELETE a Customer record from the database.
- Repeat the same steps used for the previous query query

a. The query should have the following syntax and format:

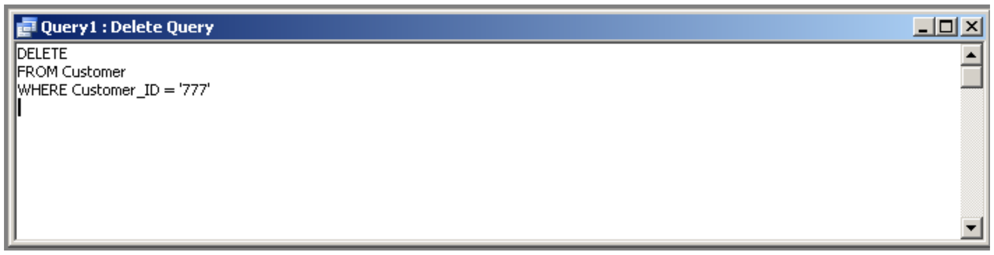
- Syntax:

```
DELETE
FROM Table
WHERE Column1 = <value1>;
```

- Example:

```
DELETE
FROM Customer
WHERE Customer_ID = '777';
```

b. Follow all the steps from previous query
c. Now switch to SQL VIEW. Select the "***Designer***" Windows, then in the menu bar, select "**View|SQL View**"
d. In "**View|SQL View**" enter the query into the query window:

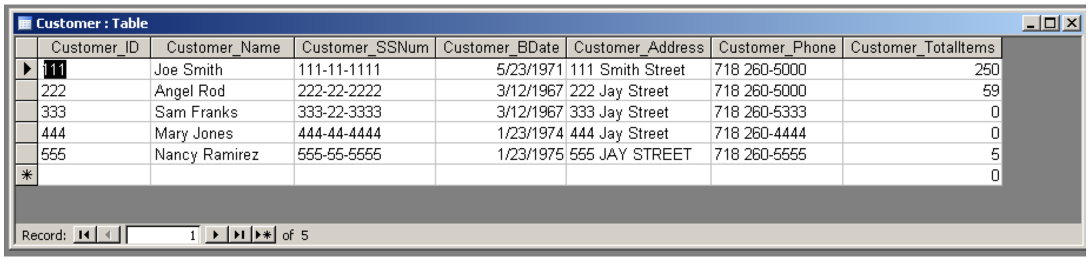


```
DELETE
FROM Customer
WHERE Customer_ID = '777'
```

e. Execute query. You are prompted to modify a record, click yes:

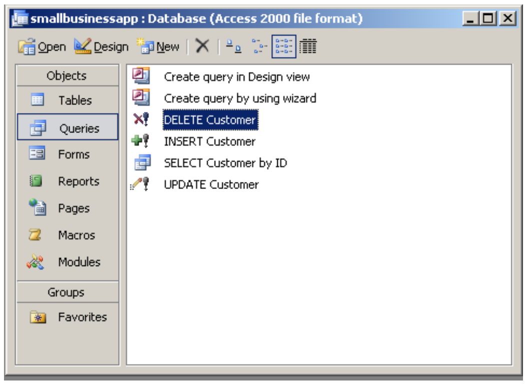
f. Save and name the query "***DELETE Customer*** ". Exit the "***SQL Design***" view

g. Since Action Queries **DO NOT RETURN RECORDS**, open the Customer Table in "***Data View***" to verify the INSERT was successfully done. Note the record whose ID is '777' has been deleted:



Customer_ID	Customer_Name	Customer_SSNum	Customer_BDate	Customer_Address	Customer_Phone	Customer_TotalItems
111	Joe Smith	111-11-1111	5/23/1971	111 Smith Street	718 260-5000	250
222	Angel Rod	222-22-2222	3/12/1967	222 Jay Street	718 260-5000	59
333	Sam Franks	333-22-3333	3/12/1967	333 Jay Street	718 260-5333	0
444	Mary Jones	444-44-4444	1/23/1974	444 Jay Street	718 260-4444	0
555	Nancy Ramirez	555-55-5555	1/23/1975	555 JAY STREET	718 260-5555	5
						0

h. In the "***Object Window***" should now have an icon for the INSERT query :



Step 5: Create & Test the SELECT ALL SQL Statement:

- Create and test the Query to SELECT ALL Customer records from the database.
- Repeat the same steps used for the previous query.

a. The query should have the following syntax and format:

- Syntax:

```
SELECT *
FROM Table
```

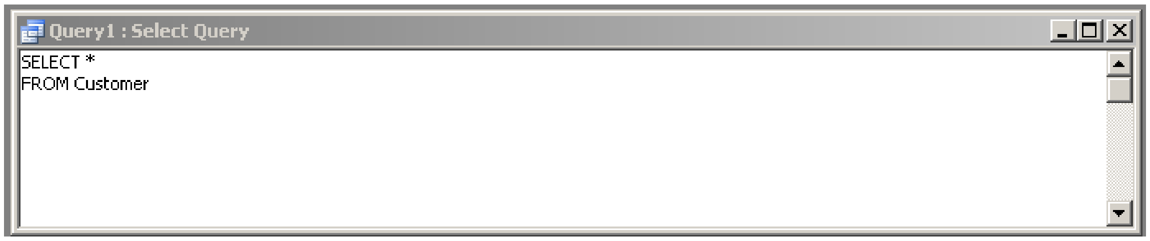
- Example:

```
SELECT *
FROM Customer
```

b. Follow all the steps from previous query

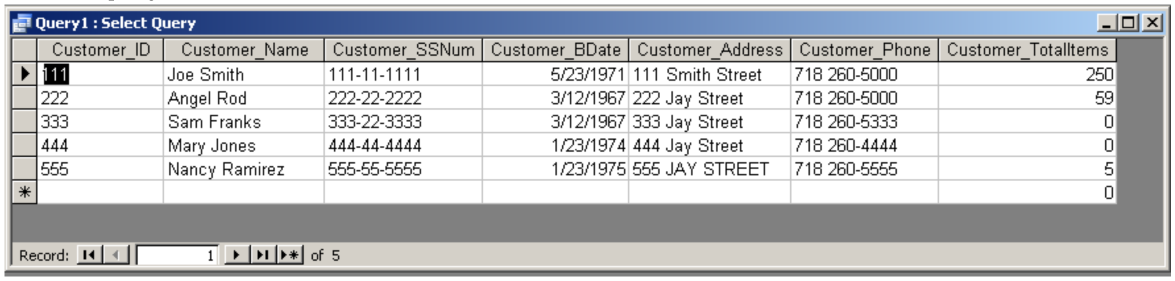
c. Now switch to SQL VIEW. Select the "***Designer***" Windows, then in the menu bar, select "**View|SQL View**"

d. In "**View|SQL View**" enter the query into the query window:



```
SELECT *
FROM Customer
```

e. Execute query:

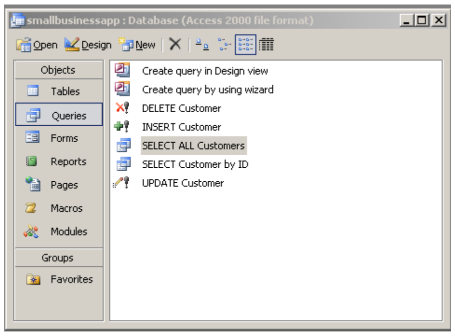


Customer_ID	Customer_Name	Customer_SSNum	Customer_BDate	Customer_Address	Customer_Phone	Customer_TotalItems
111	Joe Smith	111-11-1111	5/23/1971	111 Smith Street	718 260-5000	250
222	Angel Rod	222-22-2222	3/12/1967	222 Jay Street	718 260-5000	59
333	Sam Franks	333-22-3333	3/12/1967	333 Jay Street	718 260-5333	0
444	Mary Jones	444-44-4444	1/23/1974	444 Jay Street	718 260-4444	0
555	Nancy Ramirez	555-55-5555	1/23/1975	555 JAY STREET	718 260-5555	5
						0

Record: 1 of 5

f. Save and name the query "***SELECT ALL Customers*** ". Exit the "***SQL Design***" view

g. In the "***Object Window***" should now have an icon for the SELECT ALL query :



- Create query in Design view
- Create query by using wizard
- DELETE Customer
- INSERT Customer
- SELECT ALL Customers
- SELECT Customer by ID
- UPDATE Customer

- **AT THIS POINT WE HAVE CREATED OUR DATA SERVICE LAYER USING MS ACCESS**
- **AND SUCCESSFULLY TESTED THE POSSIBLE QUERIES THAT WE MAY NEED.**
- **AT THIS POINT WE ARE READY TO PROCEED TO CREATE OUR APPLICATION**

Business Object Layer

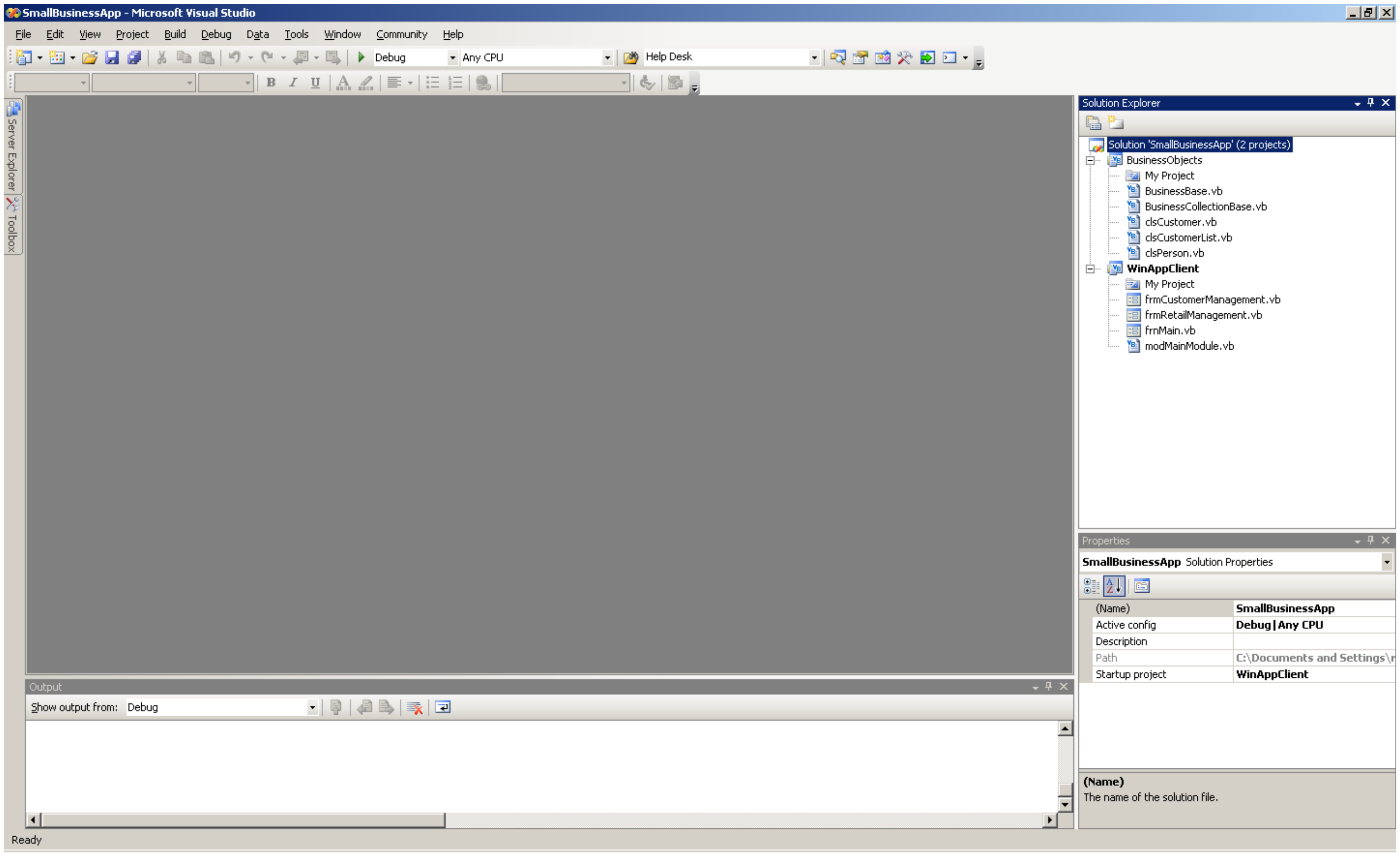
ADD ADO.NET Code to Data Access Methods in Business Objects

- We are now ready to add the ADO.NET CODE TO OUR DATA ACCESS METHODS OF THE BUSINESS OBJECTS.
- At this point, the **Customer Management Application** has been upgraded to contain all the Business Logic, Validation & Data Access methods based on the rules imposed by the ***BusinessBase*** & ***BusinessCollectionBase*** classes.
- Now we need to do the following:

  - Remove the File Access Code from the Collection Class. Going forward we will use the Access Database we just created
  - Add the ADO.NET code inside the Data Access Methods
  - Test the application

Step 1: Open the Customer Management Application with Business Rules & Logic Applied

- Open the last version of the Customer Management Retail Application.
- This version contains all the Business Rules, Validation, Data Access methods, and File Access Code to continue to save and load from a file.
- When you open the application, the application will contain the DLL & Windows Client Projects as follows:


SmallBusinessApp - Microsoft Visual Studio
File Edit View Project Build Debug Data Tools Window Community Help
Debug
Any CPU
Help Desk
Server Explorer
Toolbox
Solution Explorer
Properties
Output
Ready

Solution 'SmallBusinessApp' (2 projects)
- BusinessObjects
  - My Project
  - BusinessBase.vb
  - BusinessCollectionBase.vb
  - clsCustomer.vb
  - clsCustomerList.vb
  - clsPerson.vb
- **WinAppClient**
  - My Project
  - frmCustomerManagement.vb
  - frmRetailManagement.vb
  - frmMain.vb
  - modMainModule.vb

SmallBusinessApp Solution Properties

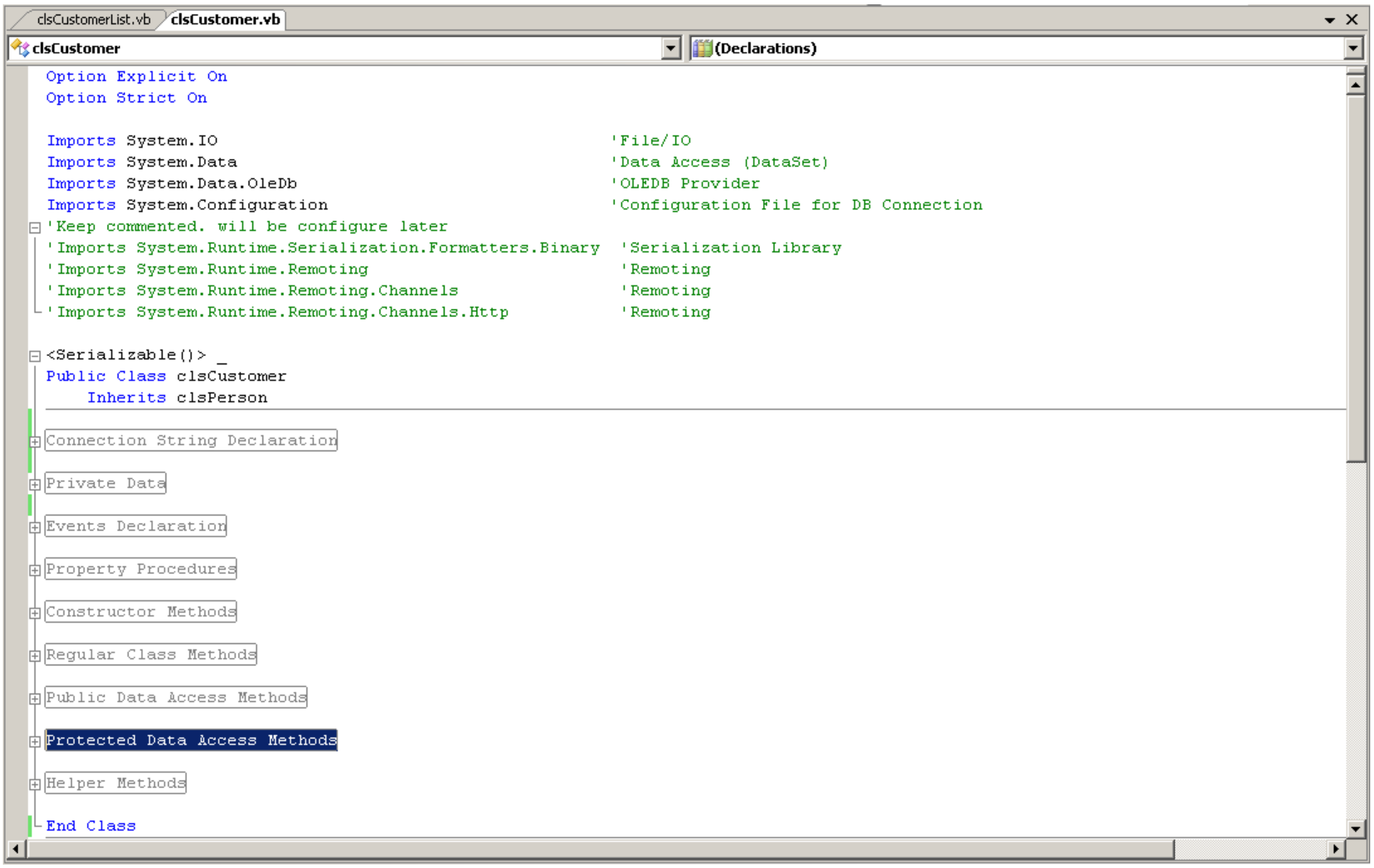
(Name)	**SmallBusinessApp**
Active config	**Debug|Any CPU**
Description	
Path	C:\Documents and Settings\
Startup project	**WinAppClient**

(Name)
The name of the solution file.

Show output from: Debug

Step 2: Add Data Access Code to clsCustomer class

- Now we focus on the *Data Access* code to the ***clsCustomer*** class. We are referring to the **DataPortal_XXX** methods that are intended to carry out the Data Access.
- In the previous example or version, we left these methods empty for the customer class
- Now we will add ADO.NET code to carry out the Data Access.
- Once again, the diagram below illustrates the current structure of the ***clsCustomer*** class. If we designed our Business Class correctly, we should only need to work with the section labeled "**Protected Data Access Code**".
- Nevertheless, we will add a **NEW Private Region** and we will declare the *Connection String* global within the class as a private member therefore the new structure will look as follow with one additional region



```
Option Explicit On
Option Strict On

Imports System.IO                                           'File/IO
Imports System.Data                                         'Data Access (DataSet)
Imports System.Data.OleDb                                   'OLEDB Provider
Imports System.Configuration                                'Configuration File for DB Connection
'Keep commented. will be configure later
'Imports System.Runtime.Serialization.Formatters.Binary      'Serialization Library
'Imports System.Runtime.Remoting                             'Remoting
'Imports System.Runtime.Remoting.Channels                    'Remoting
'Imports System.Runtime.Remoting.Channels.Http               'Remoting

<Serializable()> _
Public Class clsCustomer
    Inherits clsPerson

Connection String Declaration

Private Data

Events Declaration

Property Procedures

Constructor Methods

Regular Class Methods

Public Data Access Methods

Protected Data Access Methods

Helper Methods

End Class
```

Step 1: Add Connection String in the General Class declaration and Private data Section:

- A requirement to the application is that the database Connection String need be embedded to each Business Object.
- Also the decision was made to OPEN & CLOSE the database connection during each DATA ACCESS PROCESS. This means that each DATA ACCESS METHOD WILL OPEN THE CONNECTION, PERFORM THE DATA ACCESS AND THEN CLOSE THE CONNECTION.
- We will create a Class-Level Connection String variable declaration so ALL DATA ACCESS METHOD CAN USE THIS CONNECTION STRING. MORE IMPORTANT WE CAN CHANGE IT ONLY IN ONE LOCATION INSIDE THE BUSINESS OBJECT
- **IMPORTANT! NOTE THAT IF THE PATH OF THE DATABASE IS NOT PROVIDED IN Connection String, THE IT MUST RESIDE IN THE DEBUG\BIN FOLDER**:

```
Option Explicit On
Option Strict On

Imports System.IO                                        'File/IO
Imports System.Data                                      'Data Access (DataSet)
Imports System.Data.OleDb                                'OLEDB Provider
Imports System.Configuration                             'Configuration File for DB
Connection
'Keep commented. will be configure later
'Imports System.Runtime.Serialization.Formatters.Binary  'Serialization Library
'Imports System.Runtime.Remoting                          'Remoting
'Imports System.Runtime.Remoting.Channels                 'Remoting
'Imports System.Runtime.Remoting.Channels.Http            'Remoting

<Serializable()> _
Public Class clsCustomer
    Inherits clsPerson


#Region "Connection String Declaration"
    'Data Access Connection string.  If FULL PATHh is provide, database must
    'Be located in the Bin\Debug folder of application
    Private Const strConn As String = "Provider=Microsoft.Jet.OleDB.4.0;" & _
    "Data Source=SmallBusinessApp.mdb"
#End Region
```

Step 2: ADD ADO.NET code to DataPortal_Create(): (OPTIONAL NOT IMPLEMENTED IN THIS PROGRAM)

- If our Business Objects required DEFAULT DATA from the database we can place that code here.

```
#Region "Protected Data Access Methods"
    '**********************************************************************
    ''' <summary>
    ''' Data Access Code for Creating a New Business Object with
    ''' DEFAULT DATA from database
    ''' </summary>
    ''' <remarks></remarks>
    Protected Overrides Sub DataPortal_Create()
        'Create object and assign default values from database etc.

        'ADD DATA ACCESS CODE HERE USING ADO.NET

        'At the end, set New flag to True a new object is created
        MyBase.MarkNew()
    End Sub
```

Step 3: Open the DataPortal_Fetch(Key) method and add ADO.NET Data Access Code:

- We will use the ADO.NET Connection, Command, Parameters and DataReader objects to carry out the Data Access.

```
'**********************************************************************
Protected Overrides Sub DataPortal_Fetch(ByVal Key As Object)
    'Step 1-Create Connection, assign Connection to string
    Dim objConn As New OleDbConnection(strConn)
    'Step A-Start Error Trapping
    Try
        'Step 2-Open connection
        objConn.Open()

        'Step 3-Create SQL string
        Dim strSQL As String = "SELECT * FROM Customer WHERE Customer_ID = ?"

        'Step 4&5-Create Command object, pass query/connection & Add paramters
        Dim objCmd As New OleDbCommand(strSQL, objConn)
        objCmd.Parameters.Add("@Customer_ID", OleDbType.VarChar).Value = Key

        'Step 6-Create DATAREADER object & Execute Query
        Dim objDR As OleDbDataReader = objCmd.ExecuteReader

        'Step 7-Test to make sure there is data in the DataReader Object
        If objDR.HasRows Then
            'Step 8a-Call Read() Method to point and read the first record
            objDR.Read()
            'Step 8b-Extract data from a row & Populate Yourself.
            Me.CustomerID = CStr(objDR.Item(0))
            Me.Name = CStr(objDR.Item(1))
            Me.SocialSecurity = CStr(objDR.Item(2))
            Me.BirthDate = CDate(objDR.Item(3))
            Me.Address = CStr(objDR.Item(4))
            Me.Phone = CStr(objDR.Item(5))
            Me.TotalItemsPurchased = CInt(objDR.Item(6))
        Else
            'Step 9-No data returned, Record not found!
          Throw New System.ApplicationException("Load Error! Record Not Found")
        End If

        'Step 10-Terminate ADO Objects
        objDR.Close()
        objDR = Nothing
        objCmd.Dispose()
        objCmd = Nothing

        'Step B-Trap for BO, App & General Exceptions
    Catch objBOEx As NotSupportedException
        Throw New System.NotSupportedException(objBOEx.Message)
    Catch objA As ApplicationException
        Throw New System.ApplicationException(objA.Message)
    Catch objEx As Exception
        Throw New System.Exception("Load Error: " & objEx.Message)
    Finally
        'Step 11-Terminate connection
        objConn.Close()
        objConn.Dispose()
        objConn = Nothing
    End Try
    'At the end, set New flag to False.  NOT Dirty since found in database
    MyBase.MarkOld()
End Sub
```

Step 4: Open DataPortal_Update Method and add data access code:

- We will use the ADO.NET Connection, Command, Parameters and DataReader objects to carry out the Data Access.

```
    '*********************************************************************
    Protected Overrides Sub DataPortal_Update()
        'Step 1-Create Connection, assign Connection to string
        Dim objConn As New OleDbConnection(strConn)

        'Step A-Start Error Trapping
        Try

            'Step 2-Open connection
            objConn.Open()

            'Step 3-Create Query, Command Object & initialize
            Dim strSQL As String

            strSQL = "UPDATE(Customer)" _
                    & "SET   Customer_Name = ?," _
                          & "Customer_BDate = ?," _
                          & "Customer_Address = ?," _
                          & "Customer_Phone = ?," _
                          & "Customer_TotalItems = ?" _
                    & "WHERE Customer_ID= ?"

      'Step 4-Create Command object, pass string and connection object as arguments
            Dim objCmd As New OleDbCommand(strSQL, objConn)

            'Step 5-Add Parameter to Collection & Set Value
   objCmd.Parameters.Add("@Customer_Name", OleDbType.VarChar).Value = Me.Name
   objCmd.Parameters.Add("@Customer_BDate", OleDbType.Date).Value = Me.BirthDate
   objCmd.Parameters.Add("@Customer_Address", OleDbType.VarChar).Value = Me.Address
   objCmd.Parameters.Add("@Customer_Phone", OleDbType.VarChar).Value = Me.Phone
   objCmd.Parameters.Add("@Customer_TotalItems", OleDbType.Integer).Value = Me.TotalItemsPurchased
   objCmd.Parameters.Add("@Customer_ID", OleDbType.VarChar).Value = Me.CustomerID

            'Step 6-Execute Non-Row Query Test result and throw exception if failed
            Dim intRecordsAffected As Integer = objCmd.ExecuteNonQuery()
            If intRecordsAffected <> 1 Then
                Throw New System.ApplicationException("UPDATE Query Failed")

            End If

            'Step 7-Terminate Command Object
            objCmd.Dispose()
            objCmd = Nothing

            'Step B-Trap for BO, App & General Exceptions
        Catch objBOEx As NotSupportedException
            Throw New System.NotSupportedException(objBOEx.Message)
        Catch objA As ApplicationException
            Throw New System.ApplicationException(objA.Message)
        Catch objEx As Exception
            Throw New System.Exception("Update Error: " & objEx.Message)
        Finally
            'Step 8-Terminate connection
            objConn.Close()
            objConn.Dispose()
            objConn = Nothing
        End Try

       'Set New flag to False since exist in database/and is Not dirty any longer
        MyBase.MarkOld()
    End Sub
```

Step 5: Open Database DataPortal_Insert() and Add Data Access code to Insert a Record into the Database

```
    '**********************************************************************
    'Data Access Code to insert a new object to database
    Protected Overrides Sub DataPortal_Insert()

            'Step 1-Create Connection, assign Connection to string
        Dim objConn As New OleDbConnection(strConn)

        'Step A-Start Error Trapping
        Try

            'Step 2-Open connection
            objConn.Open()

            'Step 3-Create Command, Query, assing query, and assign connection
            Dim strSQL As String

            strSQL = "INSERT INTO Customer ( Customer_ID,Customer_Name," _
            & "Customer_SSNum,Customer_BDate,Customer_Address," _
            & "Customer_Phone,Customer_TotalItems )" _
            & "VALUES (?, ?, ?, ?, ?, ?, ?)"

            'Step 4-Create Command object, pass connection info as arguments
            Dim objCmd As New OleDbCommand(strSQL, objConn)

            'Step 5-Add Paramter to Pareameters Collection
    objCmd.Parameters.Add("@Customer_ID", OleDbType.VarChar).Value = Me.CustomerID
    objCmd.Parameters.Add("@Name", OleDbType.VarChar).Value = Me.Name
    objCmd.Parameters.Add("@SSNum", OleDbType.VarChar).Value = Me.SocialSecurity
    objCmd.Parameters.Add("@BirthDate", OleDbType.Date).Value = Me.BirthDate
    objCmd.Parameters.Add("@Address", OleDbType.VarChar).Value = Me.Address
    objCmd.Parameters.Add("@PhoneNumber", OleDbType.VarChar).Value = Me.Phone
    objCmd.Parameters.Add("@Customer_TotalItems", OleDbType.Integer).Value = Me.TotalItemsPurchased

            'Step 6-Execute Non-Row Query Test result and throw exception if failed
            Dim intRecordsAffected As Integer = objCmd.ExecuteNonQuery()
            If intRecordsAffected <> 1 Then
                Throw New System.ApplicationException("INSERT Query Failed")
            End If

            'Step 7-Terminate Command Object
            objCmd.Dispose()
            objCmd = Nothing

            'Step B-Trap for BO, App & General Exceptions
        Catch objBO As NotSupportedException
            Throw New System.NotSupportedException(objBO.Message)
        Catch objA As ApplicationException
            Throw New System.ApplicationException(objA.Message)
        Catch objEx As Exception
            Throw New System.Exception("Insert Error:  " & objEx.Message)
        Finally
            'Step 8-Terminate connection
            objConn.Close()
            objConn.Dispose()
            objConn = Nothing
        End Try

        'Set New flag to False since exist in database/and is Not dirty any longer
        MyBase.MarkOld()
    End Sub
```

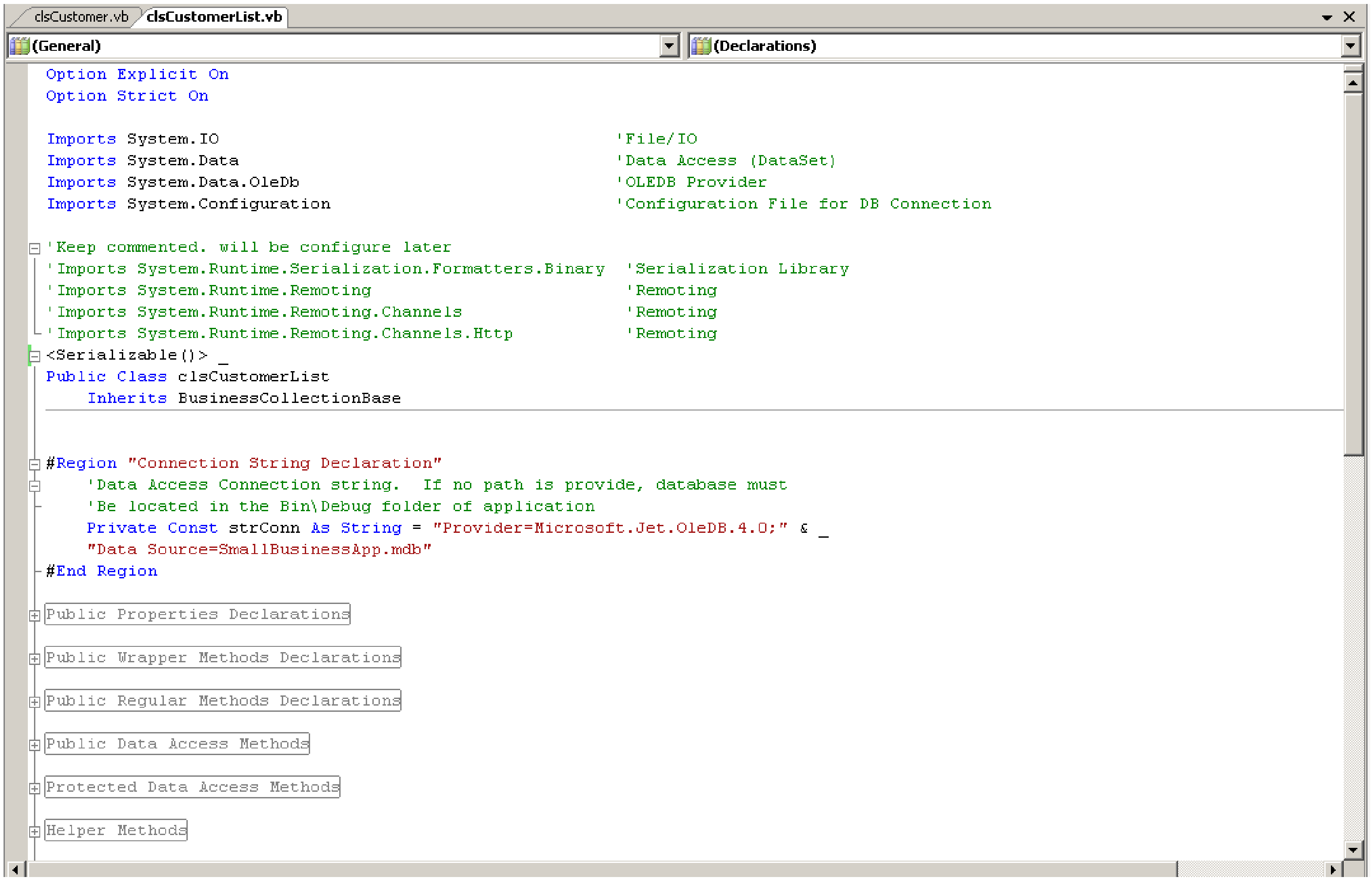
Step 6: Open Database DataPortal_DeleteObject() and Add Data Access code to delete a Record from the Database

```
    '*********************************************************************
    'Data Access Code to immediately delete an object from database.
    Protected Overrides Sub DataPortal_DeleteObject(ByVal Key As Object)
        'ADO.NET Queries for deleting (Delete/From/Where) or Stored Procedures

        'Step 1-Create Connection, assign Connection to string
        Dim objConn As New OleDbConnection(strConn)

        'Step A-Start Error Trapping
        Try

            'Step 2-Open connection
            objConn.Open()

            'Step 3-Create Command, Query, assing query, and assign connection
            Dim strSQL As String = "DELETE FROM Customer WHERE Customer_ID = ?"

      'Step 4-Create Command object, pass string and connection object as arguments
            Dim objCmd As New OleDbCommand(strSQL, objConn)

            'Step 5-Add Parameter to Collection & Set Value
            objCmd.Parameters.Add("@Customer_ID", OleDbType.VarChar).Value = Key

            'Step 6-Execute Non-Row Query Test result and throw exception if failed
            Dim intRecordsAffected As Integer = objCmd.ExecuteNonQuery()
            If intRecordsAffected <> 1 Then
                Throw New System.ApplicationException("DELETE Query Failed")
            End If

            'Step 7-Terminate Command Object
            objCmd.Dispose()
            objCmd = Nothing

            'Step A-Trap for BO, App & General Exceptions
        Catch objBO As NotSupportedException
            Throw New System.NotSupportedException(objBO.Message)
        Catch objA As ApplicationException
            Throw New System.ApplicationException(objA.Message)
        Catch objEx As Exception
            Throw New System.Exception("Delete Error: " & objEx.Message)
        Finally
            'Step 8-Terminate connection
            objConn.Close()
            objConn.Dispose()
            objConn = Nothing
        End Try


        'Object no longer in database, therefore reset our status to be a new object
        MyBase.MarkNew()
    End Sub

#End Region
```

Step 3: Add Data Access Code to the clsCustomerList Collection Class

Data Access Requirements

- Now we focus on the Data Access code to the ***clsCustomerList*** Collection Business Class. We are referring to the **DataPortal_Fetch(), DataPortal_Save()** and **DataPortal_DeleteObject()** methods that are intended to carry out the Data Access.
- In the previous example or version, we used FILE ACCESS CODE to simulate the database, now we will REMOVE THE FILE ACCESS CODE AND ADD ADO.NET code to carry out the true Data Access.
- Once again, the diagram below illustrates the current structure of the ***clsCustomeList*** class. If we designed our Business Class correctly, we should only need to work with the section labeled "**Protected Data Access Code**".
- Nevertheless, we will add a Private Region and we will declare the *Connection String* global within the class as a private member therefore the new structure will look as follow with one additional region:



```
Option Explicit On
Option Strict On

Imports System.IO                                       'File/IO
Imports System.Data                                     'Data Access (DataSet)
Imports System.Data.OleDb                               'OLEDB Provider
Imports System.Configuration                            'Configuration File for DB Connection

'Keep commented. will be configure later
'Imports System.Runtime.Serialization.Formatters.Binary  'Serialization Library
'Imports System.Runtime.Remoting                         'Remoting
'Imports System.Runtime.Remoting.Channels                'Remoting
'Imports System.Runtime.Remoting.Channels.Http           'Remoting
<Serializable()> _
Public Class clsCustomerList
    Inherits BusinessCollectionBase


#Region "Connection String Declaration"
    'Data Access Connection string.  If no path is provide, database must
    'Be located in the Bin\Debug folder of application
    Private Const strConn As String = "Provider=Microsoft.Jet.OleDB.4.0;" & _
    "Data Source=SmallBusinessApp.mdb"
#End Region

Public Properties Declarations

Public Wrapper Methods Declarations

Public Regular Methods Declarations

Public Data Access Methods

Protected Data Access Methods

Helper Methods
```

Step 1: General Class declaration:

- We continue to derive the class from **BusinessCollectionBase** and adding the Data Access Library declarations.
- In addition we add a region and declaration for the connection string.
- **IMPORTANT! NOTE THAT IF THE PATH OF THE DATABASE IS NOT PROVIDED IN Connection String, THE IT MUST RESIDE IN THE DEBUG\BIN FOLDER**

```
Option Explicit On
Option Strict On

Imports System.IO                                       'File/IO
Imports System.Data                                     'Data Access (DataSet)
Imports System.Data.OleDb                               'OLEDB Provider
Imports System.Configuration                            'Configuration File for DB
Connection

'Keep commented. will be configure later
'Imports System.Runtime.Serialization.Formatters.Binary  'Serialization Library
'Imports System.Runtime.Remoting                         'Remoting
'Imports System.Runtime.Remoting.Channels                'Remoting
'Imports System.Runtime.Remoting.Channels.Http           'Remoting
<Serializable()> _
Public Class clsCustomerList
    Inherits BusinessCollectionBase


#Region "Connection String Declaration"
    'Data Access Connection string.  If no path is provide, database must
    'Be located in the Bin\Debug folder of application
    Private Const strConn As String = "Provider=Microsoft.Jet.OleDB.4.0;" & _
    "Data Source=SmallBusinessApp.mdb"
#End Region
```

Step 2: ADD ADO.NET code to DataPortal_Create(): (OPTIONAL NOT IMPLEMENTED IN THIS PROGRAM)

- If our Business Objects required DEFAULT DATA from the database we can place that code here.

```
#Region "Protected Data Access Methods"
    '***************************************************************************
    ''' <summary>
    ''' Data Access or other Code for Creating a New Business COLLECTION Object
    ''' Used when object requires data from db upon creation
    ''' </summary>
    ''' <remarks></remarks>
    Protected Overrides Sub DataPortal_Create()
        'Create COLLECTION object and assign default values from database etc.


    End Sub
```

Explanation of FETCH() Emplementation

- We CANNOT IMPLEMENT the FETCH method in the Collection Class using the same ALGORITHM used in the FILE ACCESS CODE
- In the FILE ACCESS CODE, the algorithm was as follows.

  1. Load or READ a LINE from FILE
  2. CREATE A NEW OBJECT
  3. PARSED LINE (using SPLIT() method)
  4. POPULATE THE OBJECT WITH THE DATA FROM THE PARSED LINE **SETTING ITS PROPERTIES**!!!:
  5. ADD THE OBJECT TO THE COLLECTION
  6. REPEAT

- We CANNOT TAKE THIS APPROACH WITH OUR DATA ACCESS CODE USING THE BUSINESS OBJECTS DUE TO THE FOLLOWING REASONS:

  - CREATING a NEW OBJECT SETS the **NEW FLAG** to **TRUE**
  - IN THE FILE ACCESS CODE, NOTE THAT WE ARE SETTING THE OBJECT VIA THE PROPERTIES which has the following affect to the BUSINESS OBJECT:

    - IN THE BUSINESS OBJECT THIS WILL MAKE THE OBJECT **DIRTY**
    - TRIGGER ANY VALIDATION CODE. This is **NO PROBLEM**, since we simply TRY/CATCH A ***NotSupportedException***

  - So what we have is a NEW & DIRTY OBJECT:

    - LOADING A BUSINESS OBJECT MEANS IT EXISTS IN THE DATABASE AND IS OLD (NOT NEW).
    - SO AN OBJECT AFTER BEING LOADED CANNOT BE DIRTY & NEW, IT SHOULD BE **DIRTY & OLD**!!!!!
    - **THE ONLY METHOD OF MARKING AN OBJECT AS OLD (NEW = FALSE) IS VIA THE DATA ACCESS METHODS, of the BUSINESS OBJECT ITSELF**.

  - In summary, WE CANNOT SIMPLY GET DATA FROM THE DATABASE AND POPULATE THE OBJECT VIA THE PROPERTIES AS WE DID WITH THE FILE ACCESS CODE!
  - WE NEED TO LET THE OBJECT LOAD ITSELF BY CALLING:

```
objCustomer.Load(KEY)
```

  - BUT THE PROBLEM IS THAT WE NEED TO KNOW THE KEY OF EACH OBJECT BEFORE HAND! SO WE NEED TO QUERY THE DATABASE FOR ALL THE KEYS FIRST, THEN CALL LOAD() FOR EACH OF THE KEYS.

- FETCH ALGORITHM:

  1. USING ADO.NET, Query the TABLE for ALL KEYS
  2. LOOP
  3. CREATE a NEW CUSTOMER OBJECT
  4. EXTRACT THE NEXT KEY FROM DATAREADER
  5. Call OBJECT.Load(KEY)
  6. ADD THE OBJECT TO THE COLLECTION
  7. REPEAT

Step 3: Add Data Access code to the Method DataPortal_Fetch()

- We now delete the FILE ACCESS Code and replace with ADO.NET Data Access code.

```
    '************************************************************************
    Protected Overrides Sub DataPortal_Fetch()
        'Step 1-Create Connection, assign Connection to string
        Dim objConn As New OleDbConnection(strConn)

        'Step A-Start Error Trapping
        Try

            'Step 2-Open connection
            objConn.Open()

            'Step 3-Create SQL string to get all Primary Keys of Customers
            Dim strSQL As String = "SELECT Customer_ID FROM Customer"

            'Step 4-Create Command object
            Dim objCmd As New OleDbCommand(strSQL, objConn)

            'Step 5-Create DATAREADER object & Execute Query
            Dim objDR As OleDbDataReader = objCmd.ExecuteReader

            'Step 6-Test to make sure there is data in the DataReader Object
            If objDR.HasRows Then
                'Step 7-Iterate through DataReader one record at a time.
                Do While objDR.Read
                    'Step 8-Create Customer Object
                    Dim objItem As New clsCustomer
                    'Step 9-Get Key from DataReader record
                    Dim strKey As String = objDR.GetString(0)
                    'Step 10-ITEM will load itself based on key.
                    objItem.Load(strKey)
                    'Step 11-Add object to collection
                    Me.Add(objItem.CustomerID, objItem)
                    'Step 12-Terminate new object
                    objItem = Nothing
                Loop
            Else
                'Step 13-No data returned, Record not found.
         Throw New System.ApplicationException("Load Error! Record Not Found")
            End If

            'Step 14-Terminate Command Object
            objCmd.Dispose()
            objCmd = Nothing
            objDR.Close()
            objDR = Nothing

    'Step 15-Trap for Business Object, OleDB, Record not found & general Exceptions
        Catch objBOEx As NotSupportedException
            Throw New System.NotSupportedException(objBOEx.Message)
        Catch objA As ApplicationException
            Throw New System.ApplicationException(objA.Message)
        Catch objEx As Exception
            Throw New System.Exception("Load Error: " & objEx.Message)
        Finally
            'Step 16-Terminate connection
            objConn.Close()
            objConn.Dispose()
            objConn = Nothing
        End Try
    End Sub
```

Step 4: Data Access code for Method DataPortal_Save()

- We now DELETE the FILE ACCESS Code.
- The MAIN logic here is that there is NO DATA ACCESS CODE REQUIRED!
- We simply iterate through the Collection and ask each Object to Save themselves. Thus the ROOT or PARENT collection is simply telling its children to handle their own DATA ACCESS.

```
'***************************************************************************
''' <summary>
''' SAVES all objects from database by Iterating through Collection, and
''' calling Each ITEM object SAVE() method so each Item saves itself
''' </summary>
''' <remarks></remarks>
Protected Overrides Sub DataPortal_Save()

    'Iterates through Collection, Calling Each CHILD object.Save() method
    'CHILD Objects save themselves
    'Step A- Begin Error trapping
    Try
        'Step 1-Step 1-Create Temporary Person and Dictionary object POINTERS
        Dim objDictionaryEntry As DictionaryEntry
        Dim objChild As clsCustomer

        'Step 2-Use For..Each loop to iterate through Collection
        For Each objDictionaryEntry In MyBase.Dictionary
            'Step 3-Convert DictionaryEntry pointer returned to Type Person
            objChild = CType(objDictionaryEntry.Value, clsCustomer)

            'Step 4-Call Child to Save itself
            objChild.Save()

        Next
        'Step B-Traps for general exceptions.
    Catch objE As Exception
        'Step C-Throw an general exceptions
        Throw New System.Exception("Save Error! " & objE.Message)
    End Try

End Sub
```

Step 5: Add Data Access Code to DataPortal_DeleteObject

- This method implements the immediate DELETE of an Object from the Collection and Database.
- The MAIN logic here is that there is NO DATA ACCESS CODE REQUIRED!
- We simply iterate through the Collection, searching for the Object whose key is passed into this method.
- Once the object is found, the method calls it' DeleteObject(KEY) method to carry out the task. The object deletes itself.

```
    '*************************************************************************
    ''' <summary>
    ''' DELETES AN OBJECT BY ID from database by Iterating through Collection
    ''' and calling Each ITEM object DELETE(ID) method so each Item delete itself
    ''' </summary>
    ''' <param name="Key"></param>
    ''' <remarks></remarks>
    Protected Overrides Sub DataPortal_DeleteObject(ByVal Key As Object)
        'Iterates through Collection, Calling Each CHILD object.Delete() method
        'CHILD Objects Delete themselves

        'Step A- Begin Error trapping
        Try
            'Step 1-Step 1-Create Temporary Person and Dictionary object POINTERS
            Dim objDictionaryEntry As DictionaryEntry
            Dim objItem As clsCustomer

            'Step 2-Use For..Each loop to iterate through Collection
            For Each objDictionaryEntry In MyBase.Dictionary
                'Step 3-Convert DictionaryEntry pointer returned to Type Person
                objItem = CType(objDictionaryEntry.Value, clsCustomer)

                'Step 4-Find target object based on key
                'YOU WILL NEED TO SELECT THE CORRECT PROPERTY
                'FOR objItem.Property, ALSO YOU NEED TO CONVERT THE
                'KEY PARAMETER USING CSTR OR CINT ETC. DEPENDING
                'ON THE DATATYPE OF THE objItem.Property
                If objItem.CustomerID = CStr(Key) Then
                    'Step 5-Object deletes itself
                    objItem.DeleteObject(Key)

                    ''Step 6-[OPTIONAL] Remove Object From Collection
                    ''since no longer in DB
                    'MyBase.Dictionary.Remove(Key)
                End If

            Next
            'Step B-Traps for general exceptions.
        Catch objE As Exception
            'Step C-Throw an general exceptions
            Throw New System.Exception("Delete Error! " & objE.Message)
        End Try

    End Sub

#End Region
```

Presentation/User-Interface Layer

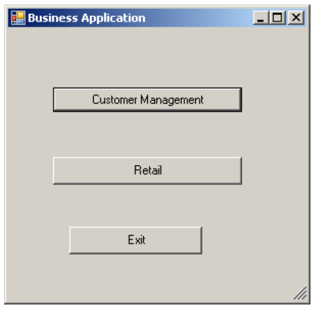
Step 3: Modify the Code in the Module

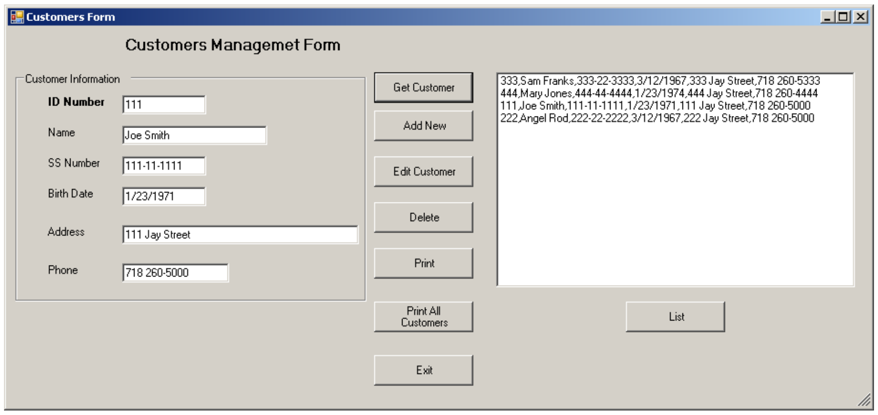
- ❑ NO CHANGES REQUIRED IN THE MODULE.

Step 4: Modify the User-Interface Customer Management Form!

Customer Management Form

- ❑ The ***Customer Management Form*** looks as follows:





ID Number	111
Name	Joe Smith
SS Number	111-11-1111
Birth Date	1/23/1971
Address	111 Jay Street
Phone	718 260-5000

```
333,Sam Franks,333-22-3333,3/12/1967,333 Jay Street,718 260-5333
444,Mary Jones,444-44-4444,1/23/1974,444 Jay Street,718 260-4444
111,Joe Smith,111-11-1111,1/23/1971,111 Jay Street,718 260-5000
222,Angel Rod,222-22-2222,3/12/1967,222 Jay Street,718 260-5000
```

- ❑ The requirements stated that ONLY ONE MODIFICATION IS REQUIRED, and that is MODIFY THE DELETE PROCESSESS TO DELETE THE OBJECT IN THE COLLECTION FROM DATABASE AND THEN THE COLLECTION:

Step 1: Delete_Click() event-handler – ADD CALL TO DELETE OBJECT FROM DATABASE & THEN FROM COLLECTION

- ❑ DELETE BOTH OBJECT FROM DATABASE & THEN COLLECTION.

```
'*********************************************************************************
    ''' <summary>
    ''' Name: Event-Handler for btnDelete button
    ''' Purpose: To delete an object from the collection base 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 A- Begin Error trapping
        Try
            Dim bolResults As Boolean


            'Step 1-Calls DATA ACCESS METHOD TO DELETE OBJECT FROM DB
            objCustomerList.DeleteObject(txtIDNumber.Text.Trim)

            'Step 2-Calls Remove() method to REMOVE OBJECT FROM COLLECTION
            bolResults = objCustomerList.Remove(txtIDNumber.Text.Trim)

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

            'Step 4-If not found display Message & clear all controls
            If bolResults <> True Then
                MessageBox.Show("Customer Not Found")
            End If
            'Step B-Traps for Business Rule violations
        Catch objNSE As NotSupportedException
            MessageBox.Show("Business Rule violation! " & objNSE.Message)
            'Step C-Traps for ArgumentNullException when key is Nothing or null.
        Catch objX As ArgumentNullException
            'Step D-Inform User
            MessageBox.Show(objX.Message)
            'Step E-Traps for general exceptions.
        Catch objE As Exception
            'Step F-Inform User
            MessageBox.Show(objE.Message)
        End Try
    End Sub
```

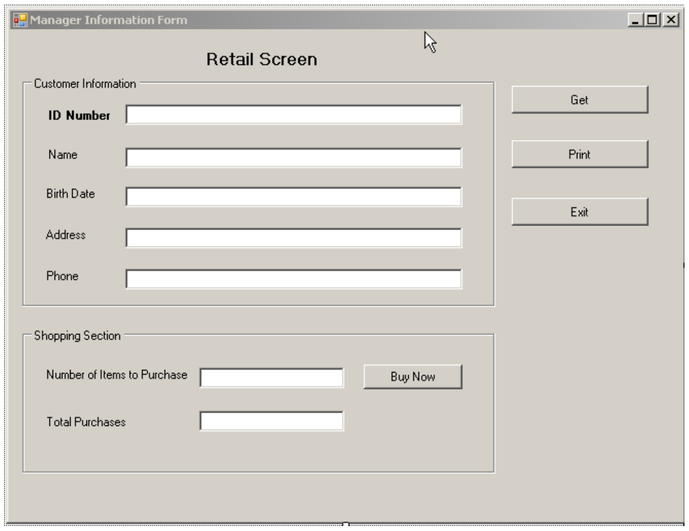
Step 5: Modify the User-Interface Retail Management Form!

Retail Management Form

- As per the requirements we need to do the following:

1. DO NOT LOAD THE COLLECTION ANYMORE. ONLY LOAD THE ONE CUSTOMER WHICH IS SHOPPING
2. DO NOT SAVE THE COLLECTION ANYMORE. ONLY SAVE THE ONE CUSTOMER SHOPPING
3. WITH THE EXCEPTION OF THE CUSTOMER ID TEXTBOX, SET ALL OTHER TEXTBOXES TO READ-ONLY
4. ENABLE THE ***Items*** TEXTBOX ONLY WHEN THE CUSTOMER IS LOADED, OTHER TIMES DISABLE IT

- The ***Retail Management Form*** looks as follows:



- Let's begin the modifications.

Step 1: NO CHANGES IN THE Form Level Object declaration

- NO CHANGES REQUIRED HERE:

```
'*********************************************************************
' FORM-LEVEL VARIABLES & OBJECT DECLARATIONS SECTION
'*********************************************************************
'Module-level Object POINTER Declaration
Private WithEvents objCustomer As BusinessObjectsDLL.clsCustomer
```

Step 2: MODIFY THE FORM_LOAD() event-handler

- The modifications required here are :
  1. WITH THE EXCEPTION OF CUSTOMER ID, DISABLE ALL OTHER TEXT BOXES

```
    '***********************************************************************
    ''' <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 A-Begins Exeception handling.
        Try

            'Step 1-Set Text boxes to Read-only
            txtName.ReadOnly = True
            txtBirthDate.ReadOnly = True
            txtAddress.ReadOnly = True
            txtPhone.ReadOnly = True

            'Step 2-Clear Items textbox
            txtTotalPurchases.ReadOnly = True
            txtItems.Enabled = False

            'Step B-Traps for Business Rule violations
        Catch objNSE As NotSupportedException
            MessageBox.Show("Business Rule violation! " & objNSE.Message)
            'Step C-Traps for general exceptions.
        Catch objE As Exception
            'Step D-Inform User
            MessageBox.Show(objE.Message)
        End Try

    End Sub
```

Step 3: Get_Click() event-handler – Load Customer Record from DB & Populate Form

- Now we NO LONGER LOAD THE COLLECTION, ONLY THE ONE CUSTOMER WHICH IS SHOPPING.
- NOTE! A NEW CUSTOMER OBJECT NEEDS TO BE CREATED EVERY TIME WE LOAD A CUSTOMER

```
    '*******************************************************************************
    ''' <summary>
    ''' Calls CUSTOMER.LOAD method RETRIEVE CUSTOMER RECORD FROM database
    ''' whose ID is passed as argument. EXTRACT THE OBJECT'S DATA AND
    ''' 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 A-Begins Exeception handling.
        Try

            'Step 1-RE-CREATE THE Form-Level Object
            'OBJECT MUST BE NEW EVERY TIME BEFORE WE CAN LOAD()
            objCustomer = New BusinessObjectsDLL.clsCustomer

            'Step 2-Call OBJECT.LOAD() To load object with data from DB
            objCustomer.Load(txtIDNumber.Text.Trim)

            'Step 3-populate text boxes with customer data
            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

            'Step 4-Enable the Items text box
            txtItems.Enabled = True

            'Step B-Traps for ApplicationException generated
            'by Customer.Load() method when record not found
        Catch objAppEx As ApplicationException
            MessageBox.Show("Customer Not Found! " & objAppEx.Message)

            'Step 5-Clear all controls
            txtName.Text = ""
            txtIDNumber.Text = ""
            txtBirthDate.Text = ""
            txtAddress.Text = ""
            txtPhone.Text = ""

            'Step C-Traps for Business Rule violations
        Catch objNSE As NotSupportedException
            MessageBox.Show("Business Rule violation! " & objNSE.Message)
            'Step D-Traps for general exceptions.
        Catch objE As Exception
            'Step E-Inform User
            MessageBox.Show(objE.Message)
        End Try
    End Sub
```

Step 4: SHOP_Click() event-handler – SHOP & SAVE

- Tells Customer to SHOP the number of ITEMS.
- TELLS CUSTOMER OBJECT TO SAVE ITSELF TO DATABASE

```
    '*******************************************************************************
    ''' <summary>
    ''' Calls customer object Shop() method to purchase items and cleas text box.
    ''' Also displays total purchases of customer and SAVES CUSTOMER TO DATABASE
    ''' </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 A-Begins Exeception handling.
        Try
            '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)

            'Step 4-SAVE OBJECT
            objCustomer.Save()

            'Step B-Traps for Business Rule violations
        Catch objNSE As NotSupportedException
            MessageBox.Show("Business Rule violation! " & objNSE.Message)
            'Step C-Traps for general exceptions.
        Catch objE As Exception
            'Step D-Inform User
            MessageBox.Show(objE.Message)
        End Try
    End Sub
```

Step 5: The FORM_CLOSE() event-handler

- IN THIS METHOD SIMPLY DESTROYS THE FORM-LEVEL CUSTOMER OBJECT.
- NO OTHER CODE REQUIRED, WE NO LONGER NEED TO SAVE THE COLLECTION BECAUSE WE DON'T NEED A COLLECTION TO GET OUR OBJECTS. THE OBJECTS LOAD AND SAVE THEMSELVES

```
'*********************************************************************************
    ''' <summary>
    '''Name: Event-Handler Form_Close()
    '''Purpose:Destroys Form-level object pointer when form closes
    '''Saves Collection objects to file and clears the collection
    ''' </summary>
    ''' <param name="sender"></param>
    ''' <param name="e"></param>
    ''' <remarks></remarks>
    Private Sub frmRetailManagement_FormClosed(ByVal sender As Object, ByVal e As
System.Windows.Forms.FormClosedEventArgs) Handles Me.FormClosed
        'Step A-Begins Exeception handling.
        Try
            'Step 1-Destroy Form-Level Objects
            objCustomer = Nothing

            'Step B-Traps for Business Rule violations
        Catch objNSE As NotSupportedException
            MessageBox.Show("Business Rule violation! " & objNSE.Message)
            'Step C-Traps for general exceptions.
        Catch objE As Exception
            'Step D-Inform User
            MessageBox.Show(objE.Message)
        End Try
    End Sub
```

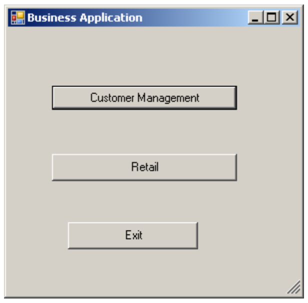
Step 6: EXIT, PRINT & ONSHOPPING event-handler REQUIRE NO MODIFICATIONS

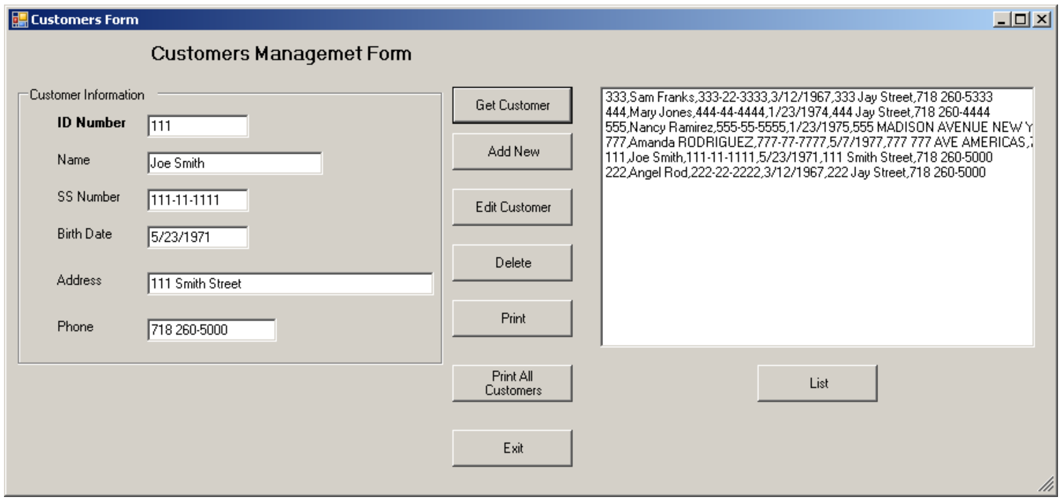
- NO MODIFICATION REQUIRED FOR THE REMAINING EVENT HANDLERS

Step 4: Build & Execute Project

Step 1: Compile and Build the project.

Step 2: Execute the application.





Customers Managemet Form

Customer Information

ID Number: 111

Name: Joe Smith

SS Number: 111-11-1111

Birth Date: 5/23/1971

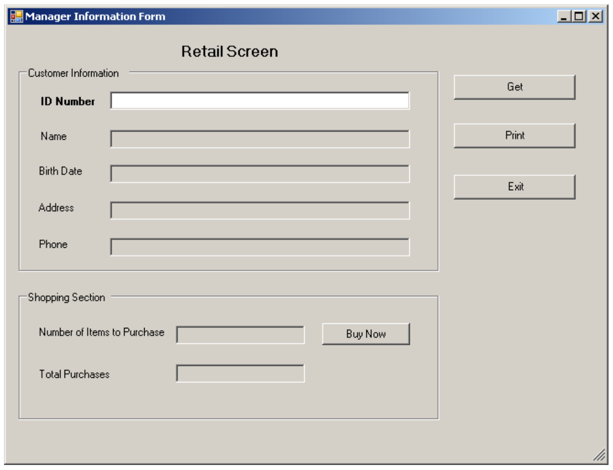
Address: 111 Smith Street

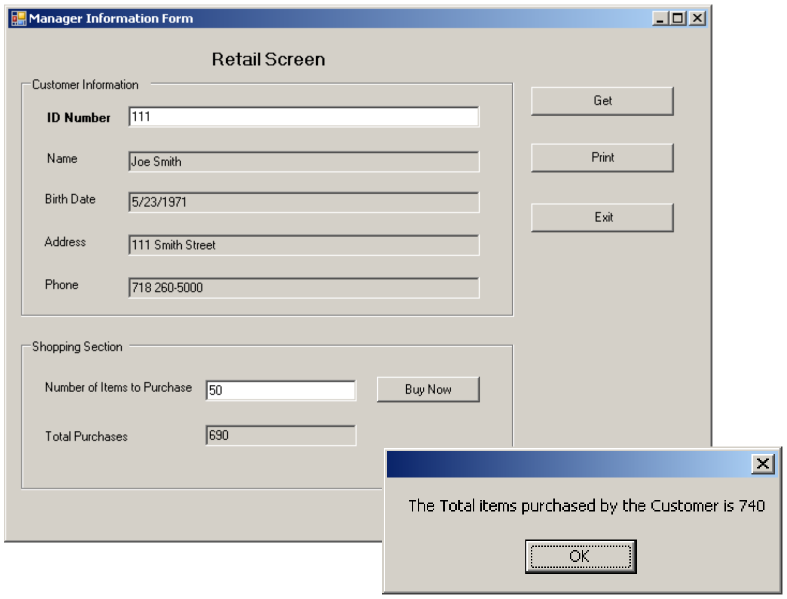
Phone: 718 260-5000

```
333,Sam Franks,333-22-3333,3/12/1967,333 Jay Street,718 260-5333
444,Mary Jones,444-44-4444,1/23/1974,444 Jay Street,718 260-4444
555,Nancy Ramirez,555-55-5555,1/23/1975,555 MADISON AVENUE NEW Y
777,Amanda RODRIGUEZ,777-77-7777,5/7/1977,777 777 AVE AMERICAS,7
111,Joe Smith,111-11-1111,5/23/1971,111 Smith Street,718 260-5000
222,Angel Rod,222-22-2222,3/12/1967,222 Jay Street,718 260-5000
```

Step 3: RETAIL FORM

- Display Retail Form, SHOP for 50 ITEMS & AUTOMATICALLY SAVE CUSTOMER TO DATABASE:





Retail Screen

Customer Information

ID Number: 111

Name: Joe Smith

Birth Date: 5/23/1971

Address: 111 Smith Street

Phone: 718 260-5000

Shopping Section

Number of Items to Purchase: 50

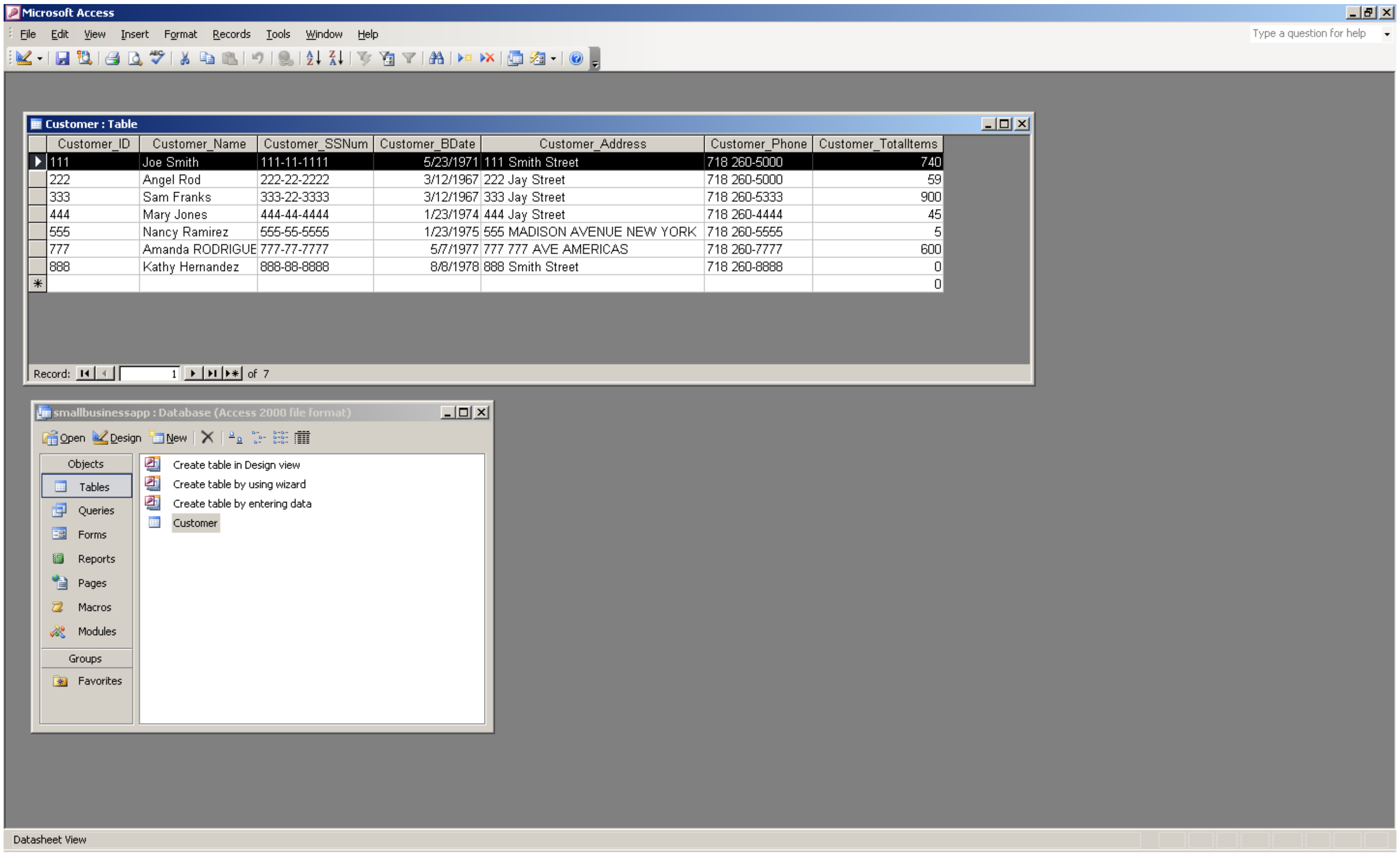
Total Purchases: 690

The Total items purchased by the Customer is 740

Database Layer

VIEW OF FINAL ACCESS DATABASE CUSTOMER TABLE

- The Customer table should reflect the Insertions & updates. Note the

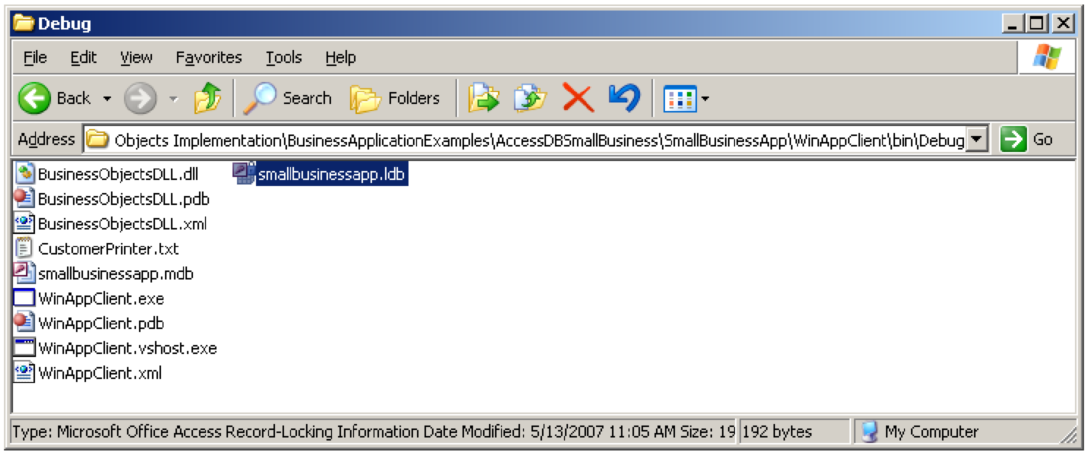


Microsoft Access
File Edit View Insert Format Records Tools Window Help
Type a question for help
Customer : Table
smallbusinessapp : Database (Access 2000 file format)
Open Design New
Objects
Tables
Queries
Forms
Reports
Pages
Macros
Modules
Groups
Favorites
Create table in Design view
Create table by using wizard
Create table by entering data
Customer
Datasheet View

Customer_ID	Customer_Name	Customer_SSNum	Customer_BDate	Customer_Address	Customer_Phone	Customer_TotalItems
111	Joe Smith	111-11-1111	5/23/1971	111 Smith Street	718 260-5000	740
222	Angel Rod	222-22-2222	3/12/1967	222 Jay Street	718 260-5000	59
333	Sam Franks	333-22-3333	3/12/1967	333 Jay Street	718 260-5333	900
444	Mary Jones	444-44-4444	1/23/1974	444 Jay Street	718 260-4444	45
555	Nancy Ramirez	555-55-5555	1/23/1975	555 MADISON AVENUE NEW YORK	718 260-5555	5
777	Amanda RODRIGUE	777-77-7777	5/7/1977	777 777 AVE AMERICAS	718 260-7777	600
888	Kathy Hernandez	888-88-8888	8/8/1978	888 Smith Street	718 260-8888	0
*						0

Record: 1 of 7

- The MS ACCESS database file smallbusinessapp.mdb is located in the BIN\DEBUG folder of the solution
- I DELETED THE CustomerData.txt file since we don't need it any more:



Address: Objects Implementation\BusinessApplicationExamples\AccessDBSmallBusiness\SmallBusinessApp\WinAppClient\bin\Debug

BusinessObjectsDLL.dll
BusinessObjectsDLL.pdb
BusinessObjectsDLL.xml
CustomerPrinter.txt
smallbusinessapp.mdb
WinAppClient.exe
WinAppClient.pdb
WinAppClient.vshost.exe
WinAppClient.xml
smallbusinessapp.ldb

Type: Microsoft Office Access Record-Locking Information Date Modified: 5/13/2007 11:05 AM Size: 19 192 bytes