CSHARP CLASS 11
DATABASE CONNECTIONS

KEVIN.LI@GEORGIANCOLLEGE.CA

OUTLINE

- ADO.net
- WinForm sample
- MVC sample

.NET DATA PROVIDER CORE OBJECTS

Object	Description
Connection	Establishes a connection to a database.
Command	Represents an individual SQL statement that can be executed against the database.
Data reader	Provides read-only, forward-only access to the data in a database.
Data adapter	Provides the link between the command and connection objects and a dataset object.

DATA PROVIDERS INCLUDED WITH THE .NET FRAMEWORK

Provider	Namespace	Lets you access…
SQL Server	`System.Data.SqlClient`	SQL Server databases
OLE DB	`System.Data.OleDb`	Any database that supports OLE DB
ODBC	`System.Data.Odbc`	Any database that supports ODBC

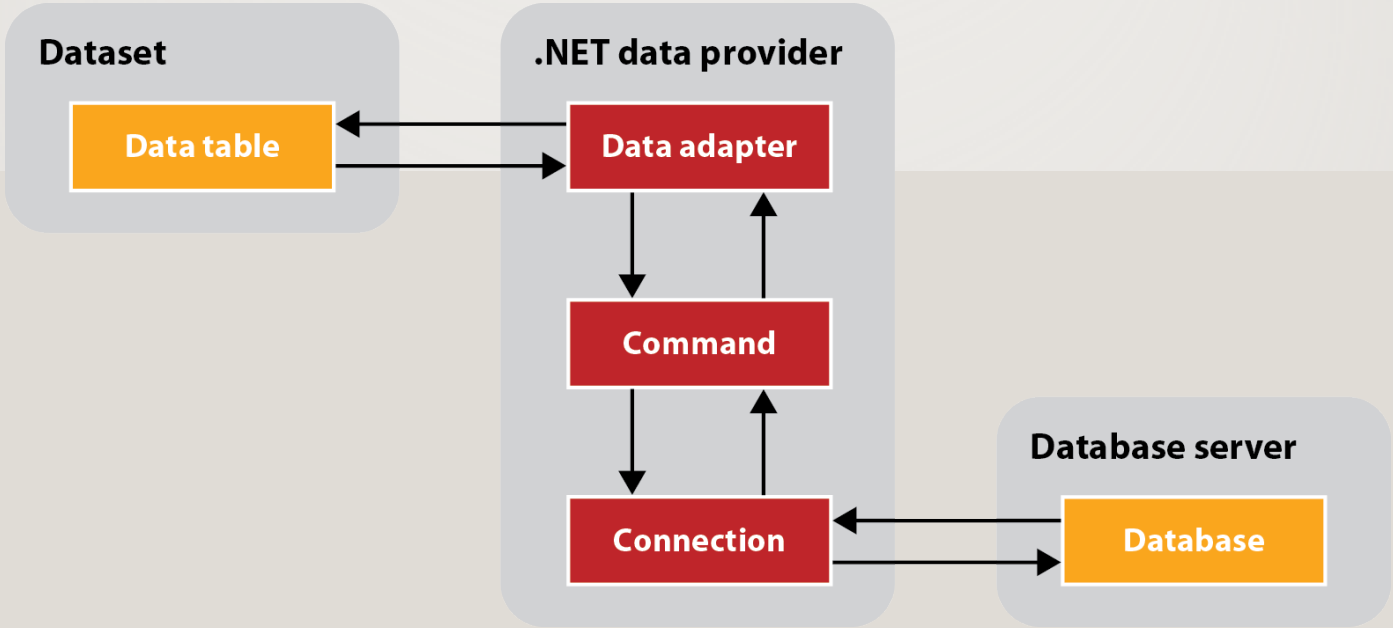
CLASS NAMES FOR THE DATA PROVIDERS

Object	SQL Server	OLE DB	ODBC
Connection	`SqlConnection`	`OleDbConnection`	`OdbcConnection`
Command	`SqlCommand`	`OleDbCommand`	`OdbcCommand`
Data reader	`SqlDataReader`	`OleDbDataReader`	`OdbcDataReader`
Data adapter	`SqlDataAdapter`	`OleDbDataAdapter`	`OdbcDataAdapter`

A using directive for the SQL Server data provider namespace

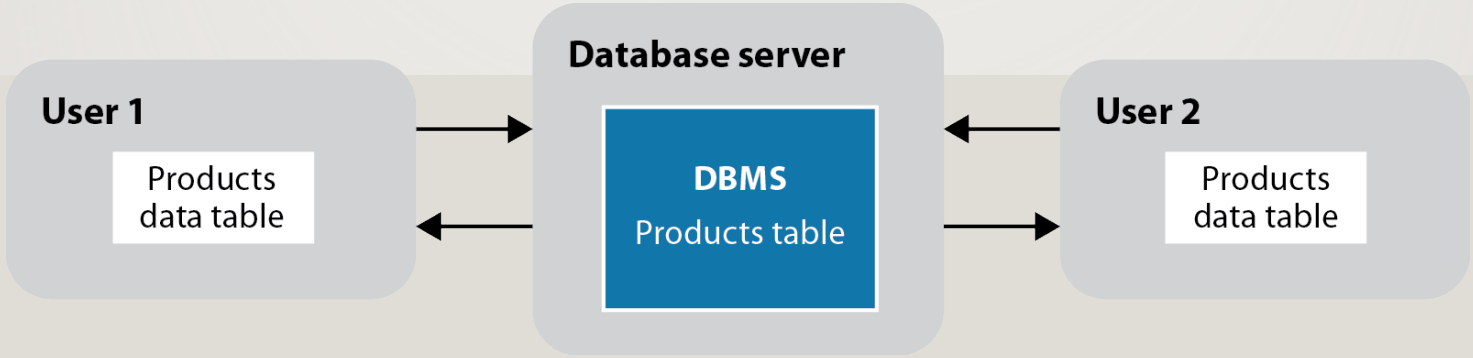
```
using System.Data.SqlClient;
```

BASIC ADO.NET COMPONENTS



ADO stands for ActiveX Data Objects.
ADO.NET is a database technology of .**NET** Framework used to connect application system and database server.

TWO USERS WHO ARE WORKING WITH COPIES OF THE SAME DATA



CONCURRENCY CONCEPTS

- When two or more users retrieve the data in the same row of a database table at the same time, it is called *concurrency*. Because ADO.NET uses a disconnected data architecture, the database management system can't prevent this from happening.
- If two users try to update the same row in a database table at the same time, the second user's changes could overwrite the changes made by the first user. Whether or not that happens, though, depends on the *concurrency control* that the programs use.
- By default, ADO.NET uses *optimistic concurrency*. This means that the program checks to see whether the database row that's going to be updated or deleted has been changed since it was retrieved. If it has, a ***concurrency exception*** occurs and the update or deletion is refused. Then, the program should handle the exception.

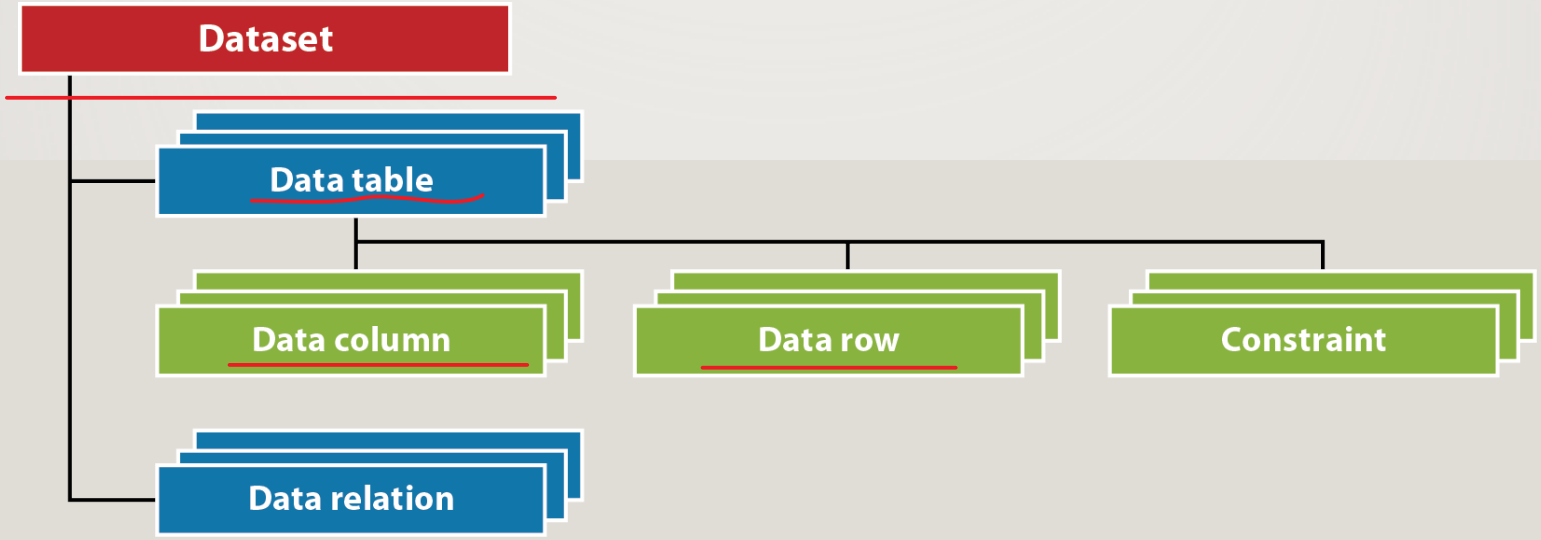
CONCURRENCY CONCEPTS (CONT.)

- If optimistic concurrency isn't in effect, the program doesn't check to see whether a row has been changed before an update or deletion takes place. Instead, the operation proceeds without throwing an exception. This is referred to as "***last in wins***" because the last update overwrites any previous update. And this can lead to errors in the database.

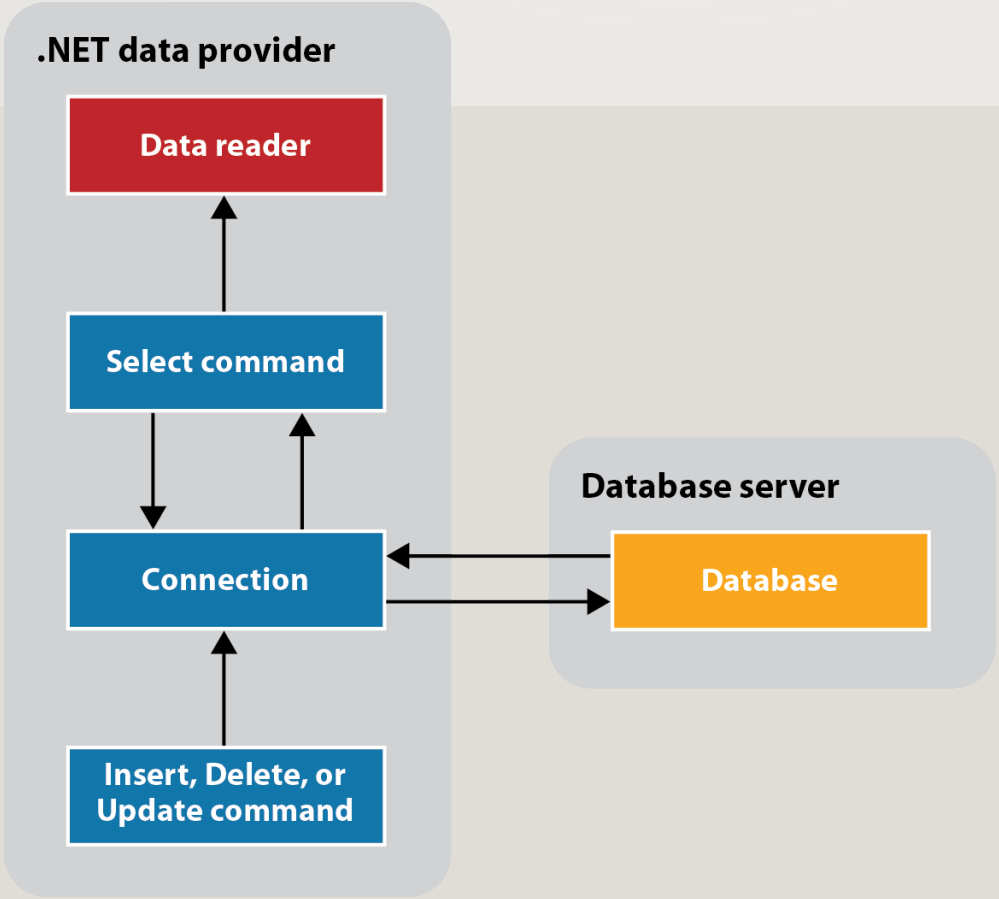
HOW TO AVOID CONCURRENCY ERRORS

- For many applications, concurrency errors **rarely occur**. As a result, optimistic concurrency is adequate.
- If concurrency is likely to be a problem, a program that uses a dataset can be designed so it **updates the database and refreshes the dataset frequently.** That way, concurrency errors are less likely to occur.
- Another alternative is to design a program so it retrieves and **updates just one row at a time**. That way, there's less chance that two users will retrieve and update the same row at the same time.

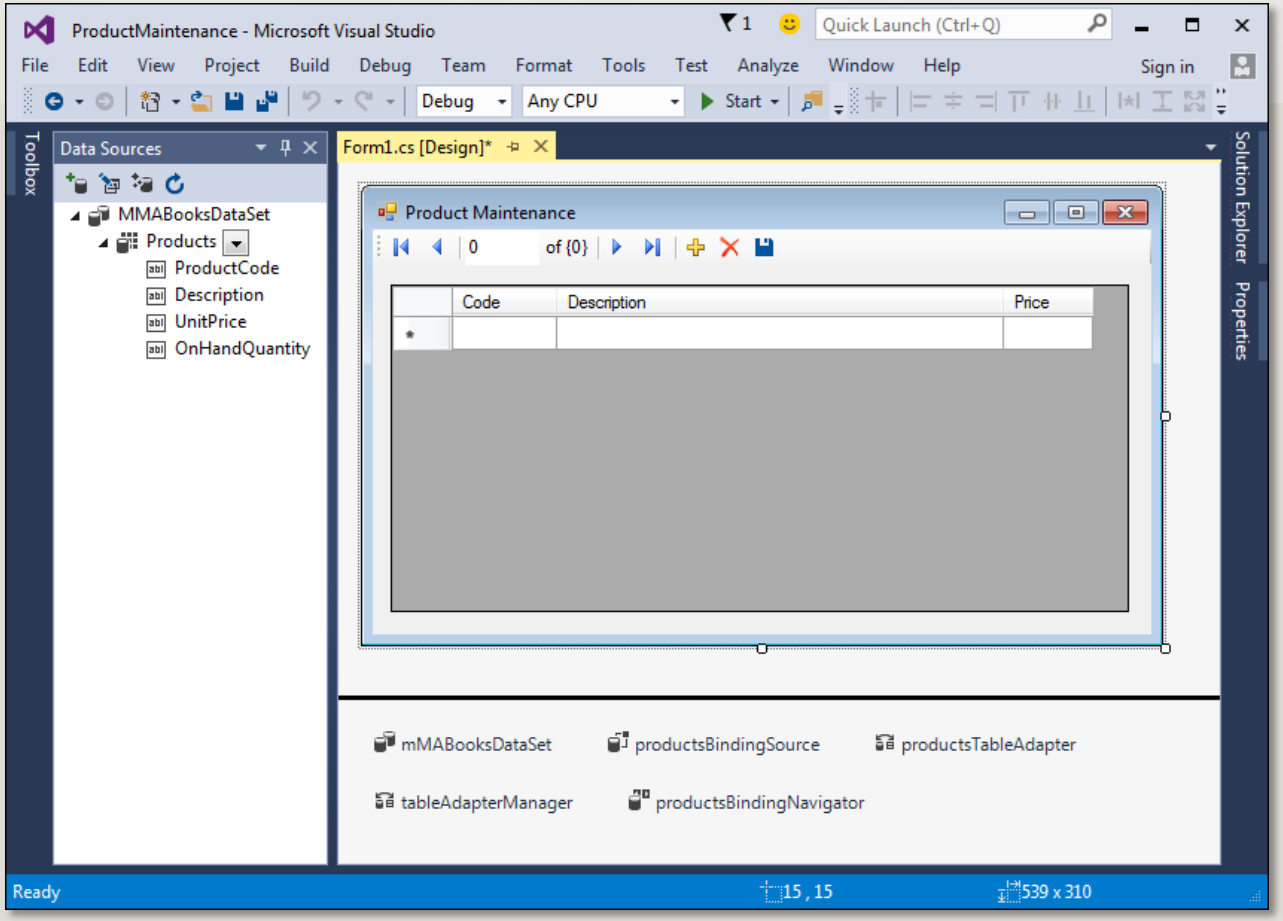
THE BASIC DATASET OBJECT HIERARCHY



ADO.NET COMPONENTS FOR ACCESSING A DATABASE DIRECTLY



ADO.NET OBJECTS CREATED USING THE DATA SOURCES WINDOW

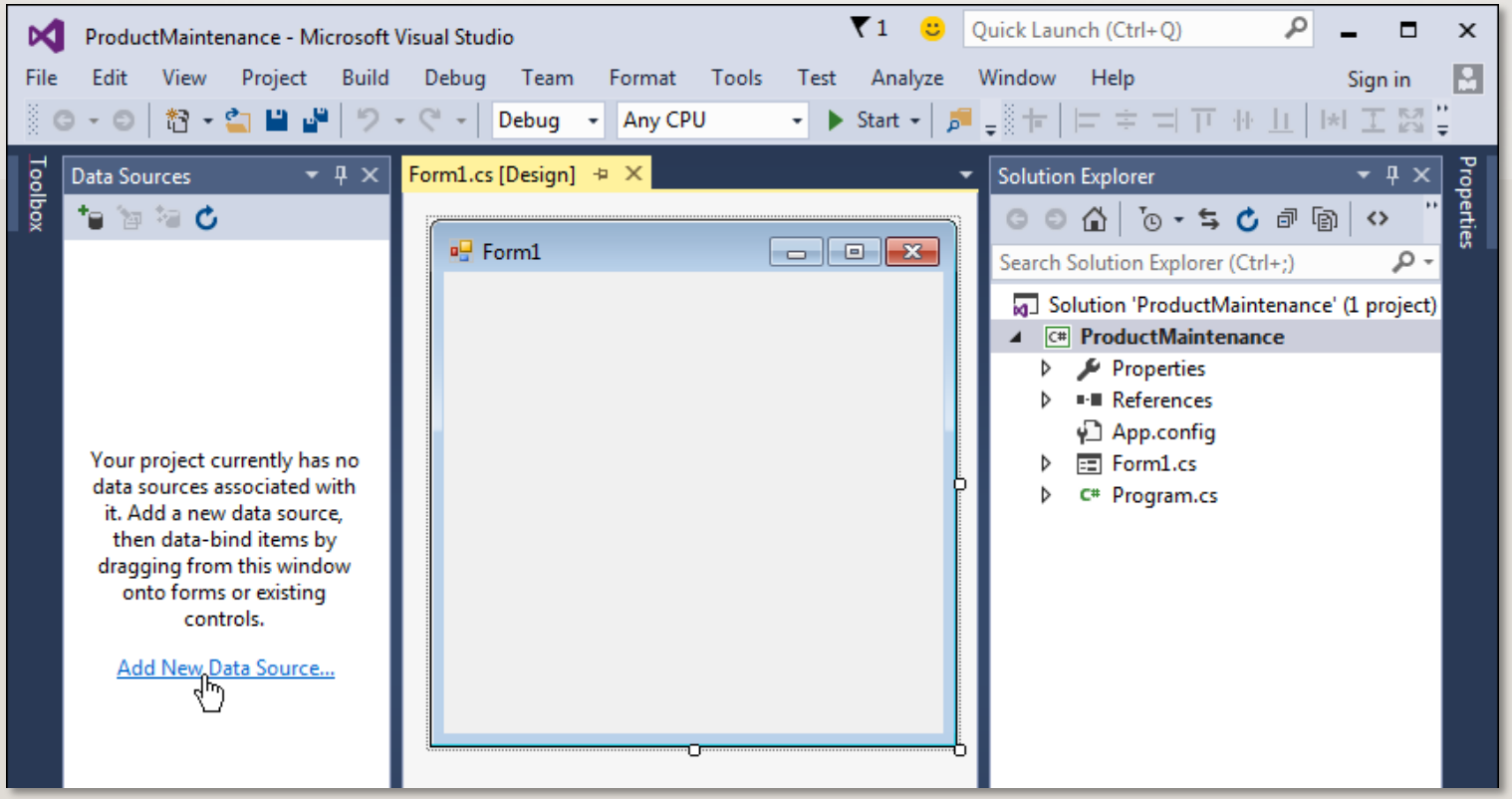


ADO.NET OBJECTS CREATED USING CODE

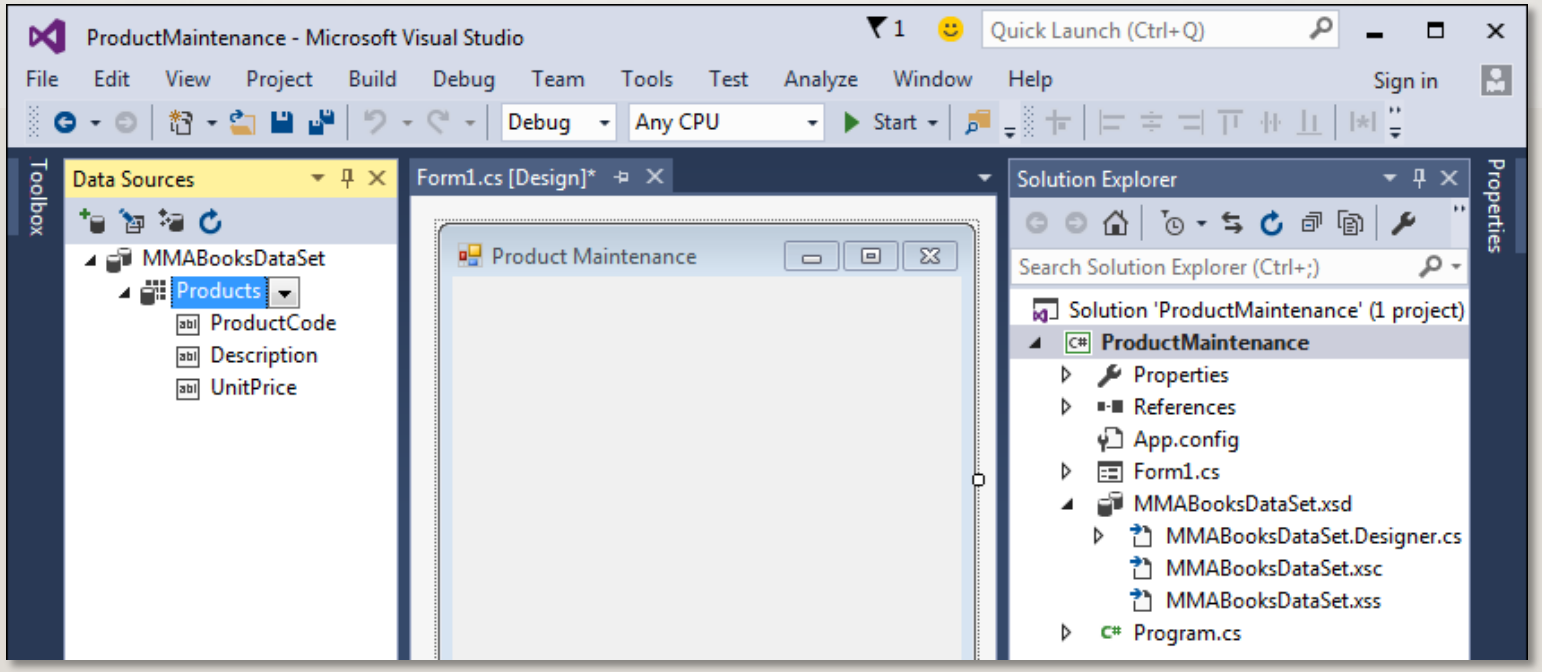

```
string connectionString =
    "Data Source=localhost\\SqlExpress;Initial Catalog=MMABooks;" +
    "Integrated Security=True";
SqlConnection connection = new SqlConnection(connectionString);

string selectStatement =
    "SELECT * FROM Products ORDER BY ProductCode";
SqlCommand selectCommand =
    new SqlCommand(selectStatement, connection);

SqlDataAdapter productsDataAdapter =
    new SqlDataAdapter(selectCommand);

DataSet productsDataSet = new DataSet();
```

productsDataSet = productDataAdapter.Fill()

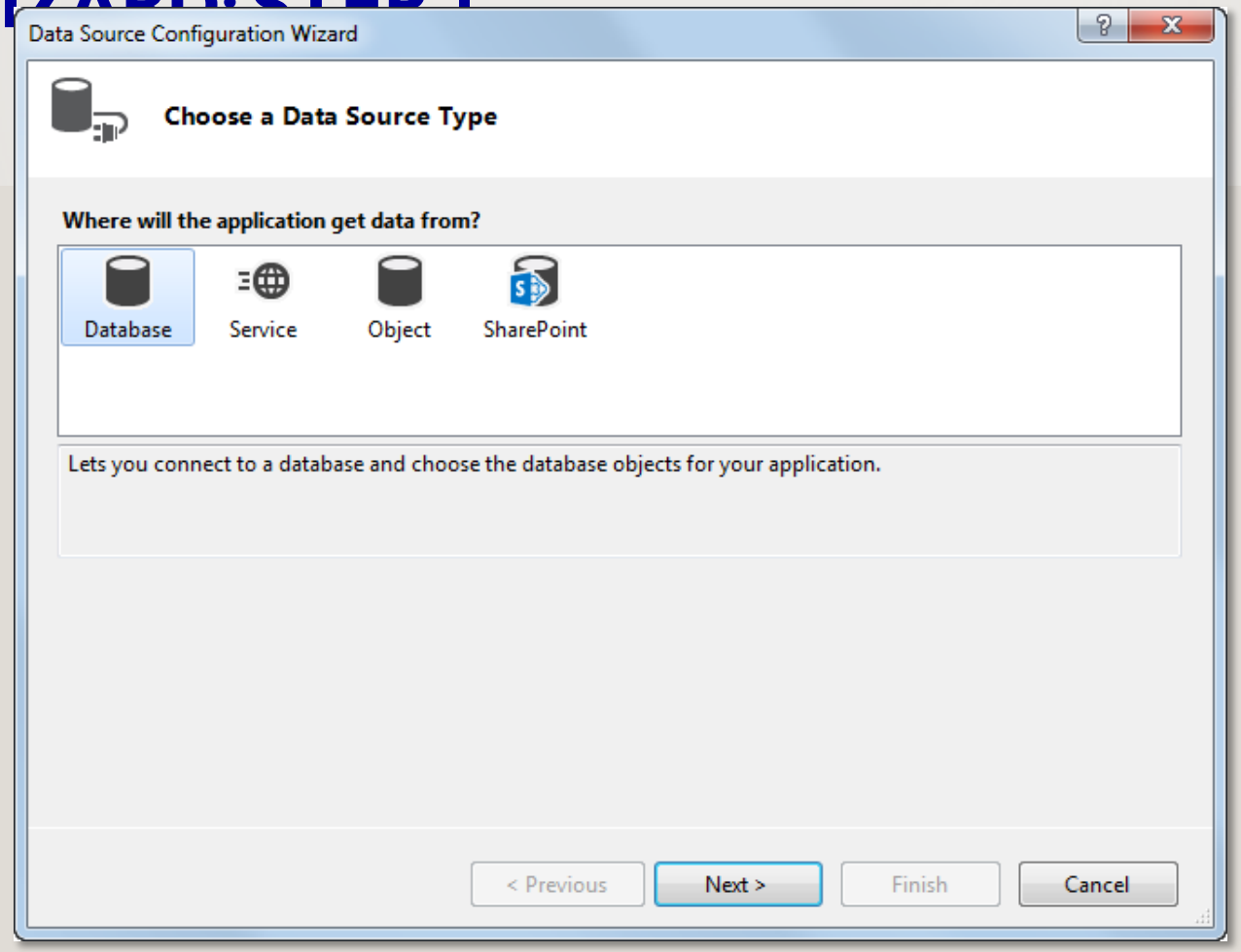
AN EMPTY DATA SOURCES WINDOW



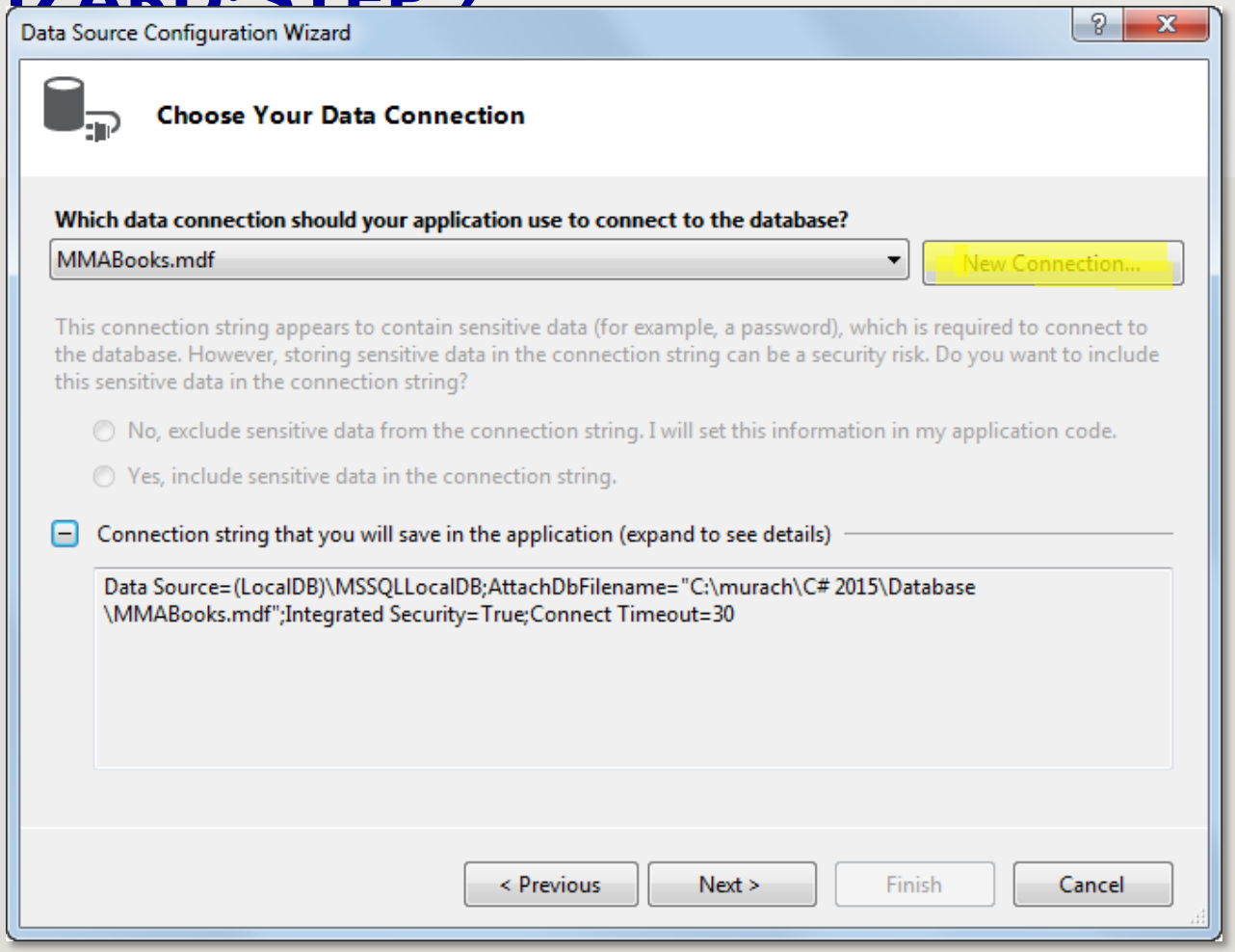
A DATA SOURCES WINDOW AFTER A DATA SOURCE HAS BEEN ADDED



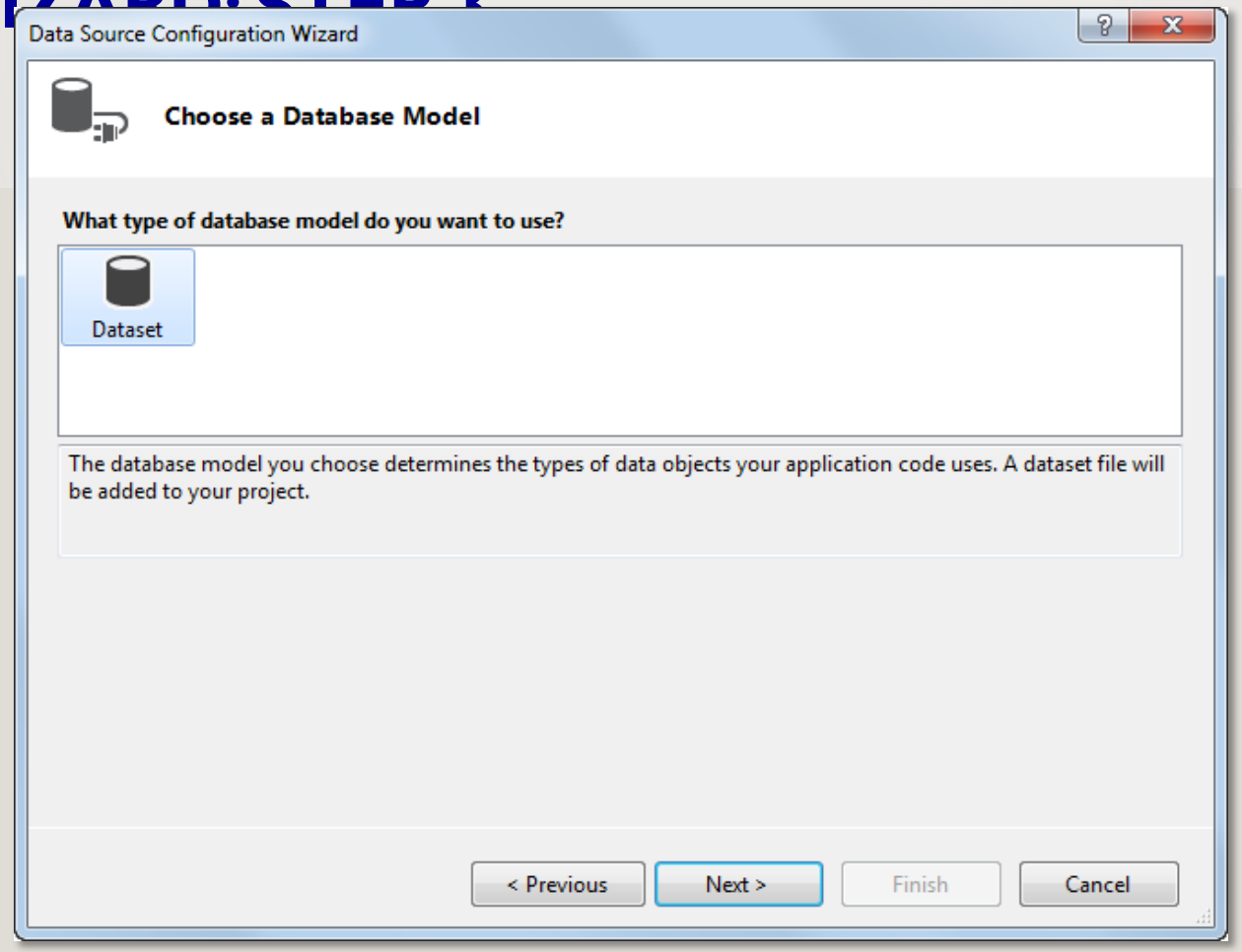
THE DATA SOURCE CONFIGURATION WIZARD: STEP 1



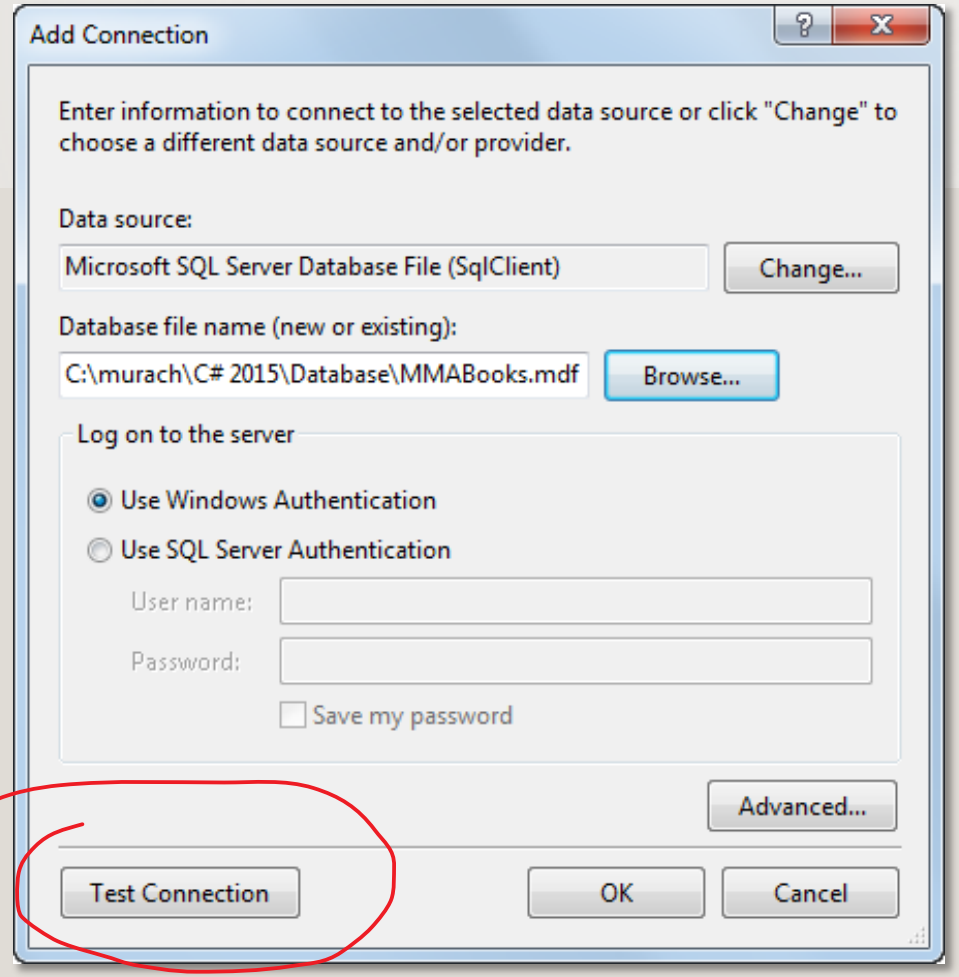
THE DATA SOURCE CONFIGURATION WIZARD: STEP 2



THE DATA SOURCE CONFIGURATION WIZARD: STEP 3

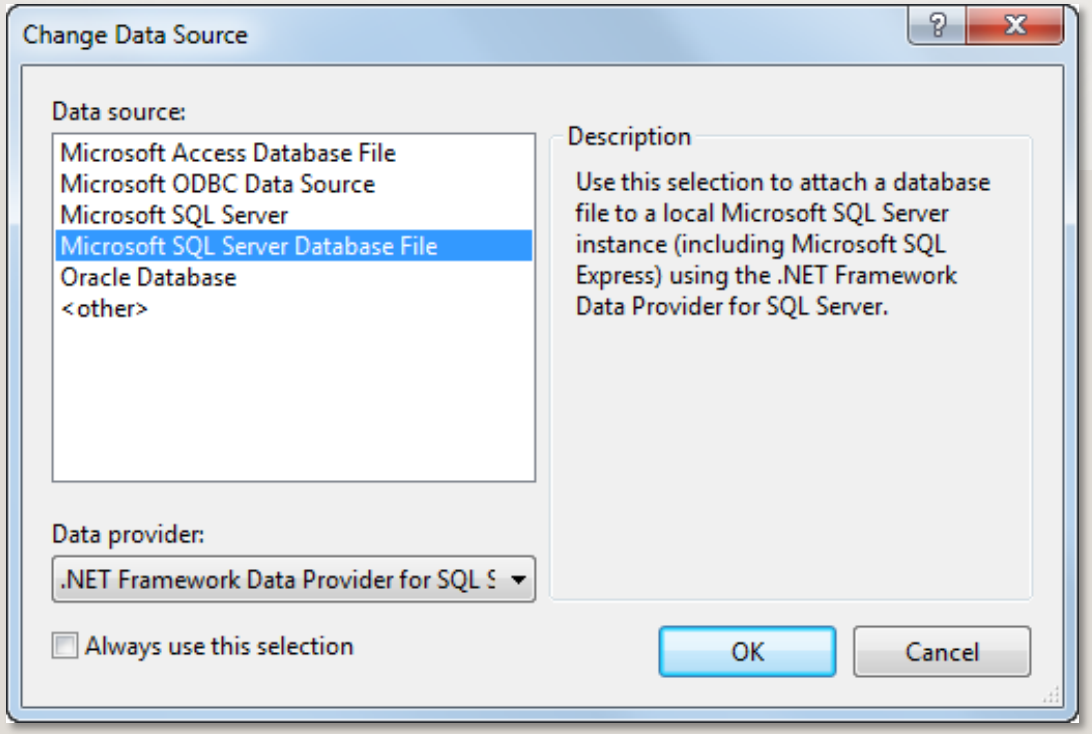


THE ADD CONNECTION DIALOG BOX

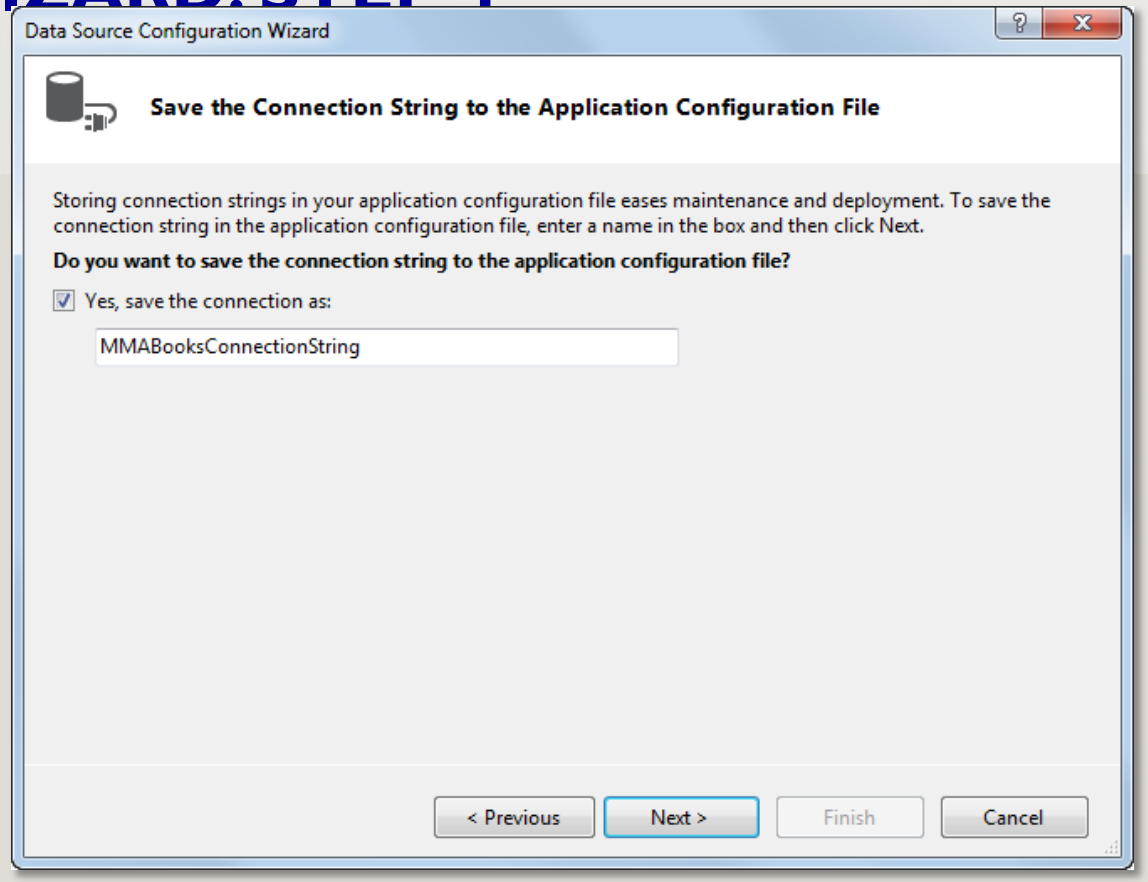


Test firstly in SQL management studio if failed.

THE CHANGE DATA SOURCE DIALOG BOX



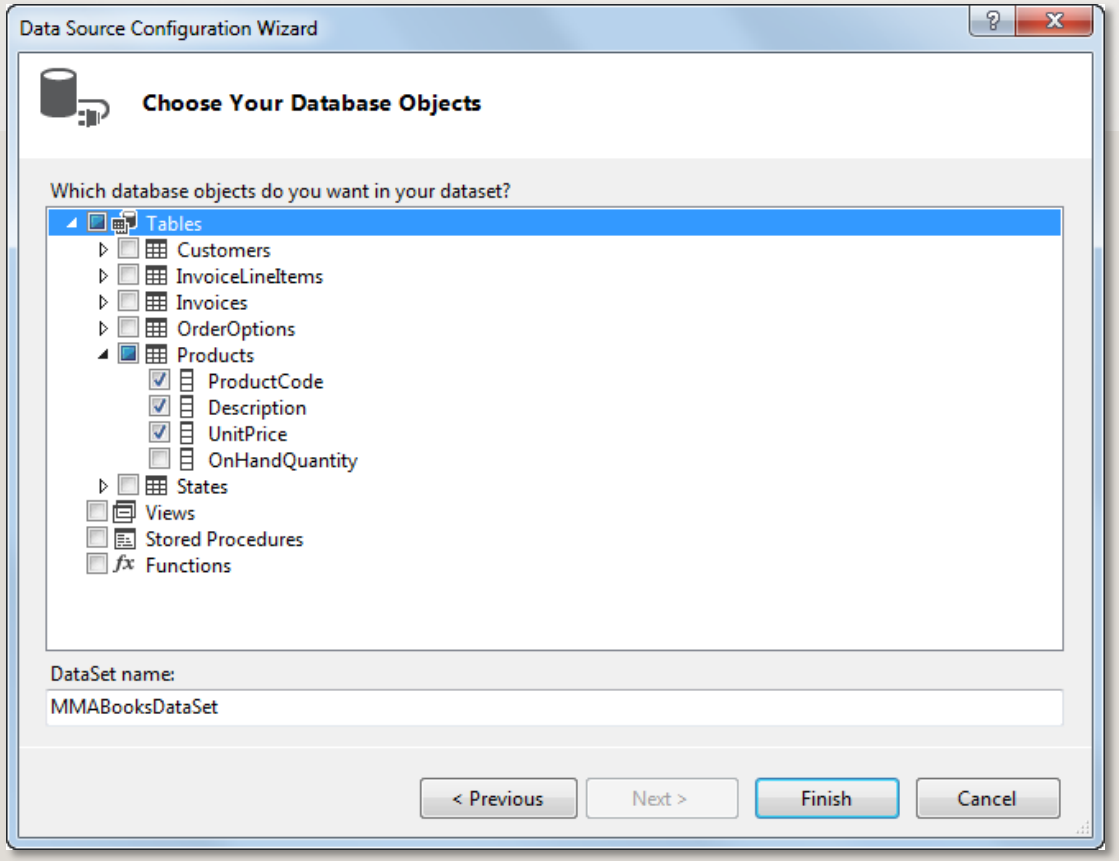
THE DATA SOURCE CONFIGURATION WIZARD: STEP 4



THE INFORMATION THAT'S STORED IN THE APP.CONFIG FILE

```
<connectionStrings>
    <add name="ProductMaintenance.Properties.Settings.MMABooksConnectionString"
        connectionString="Data Source=(LocalDB)\MSSQLLocalDB;
                          AttachDbFilename=|DataDirectory|\MMABooks.mdf;
                          Integrated Security=True;
                          Connect Timeout=30"
        providerName="System.Data.SqlClient" />
</connectionStrings>
```

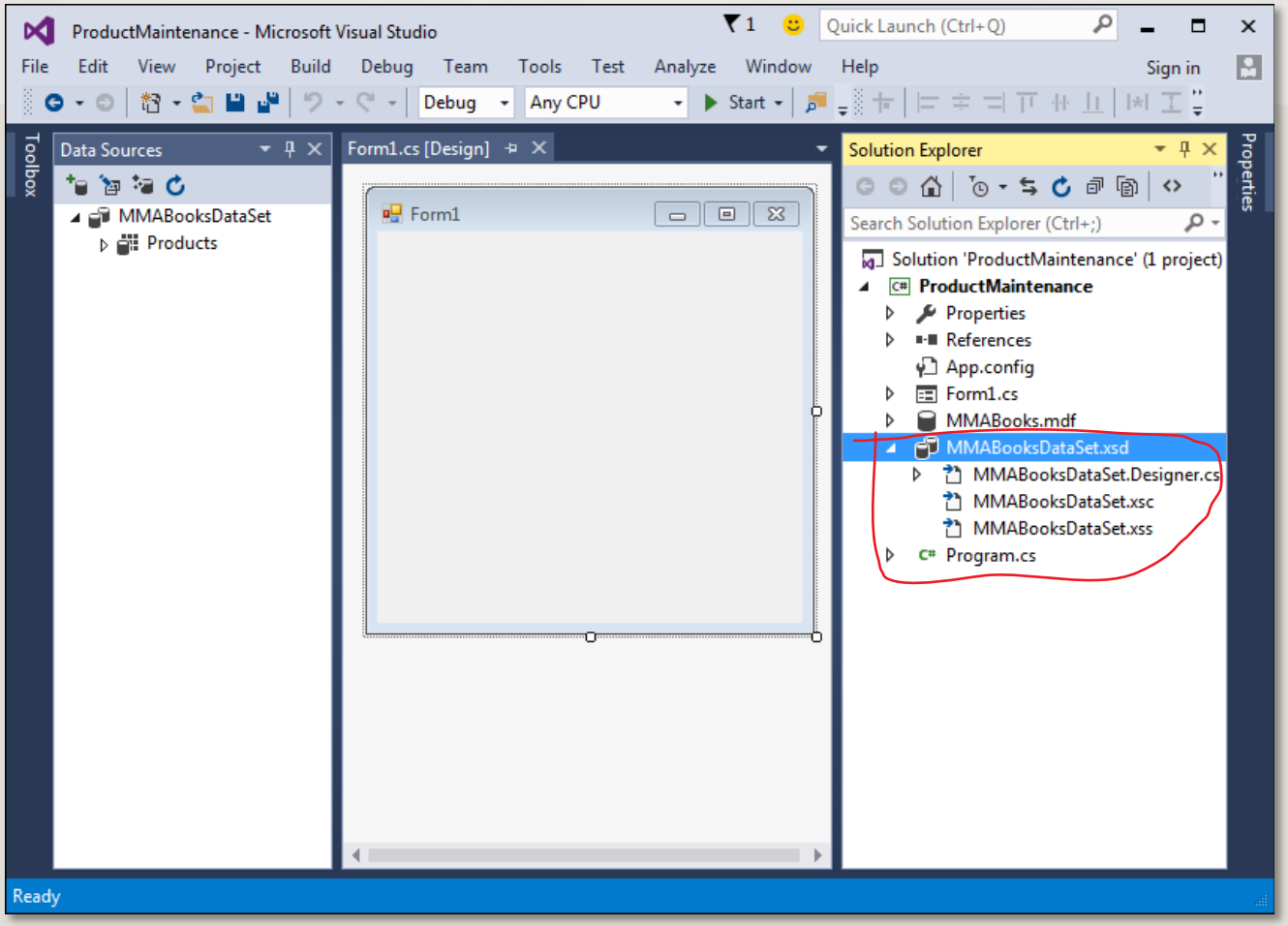
THE DATA SOURCE CONFIGURATION WIZARD: STEP 5



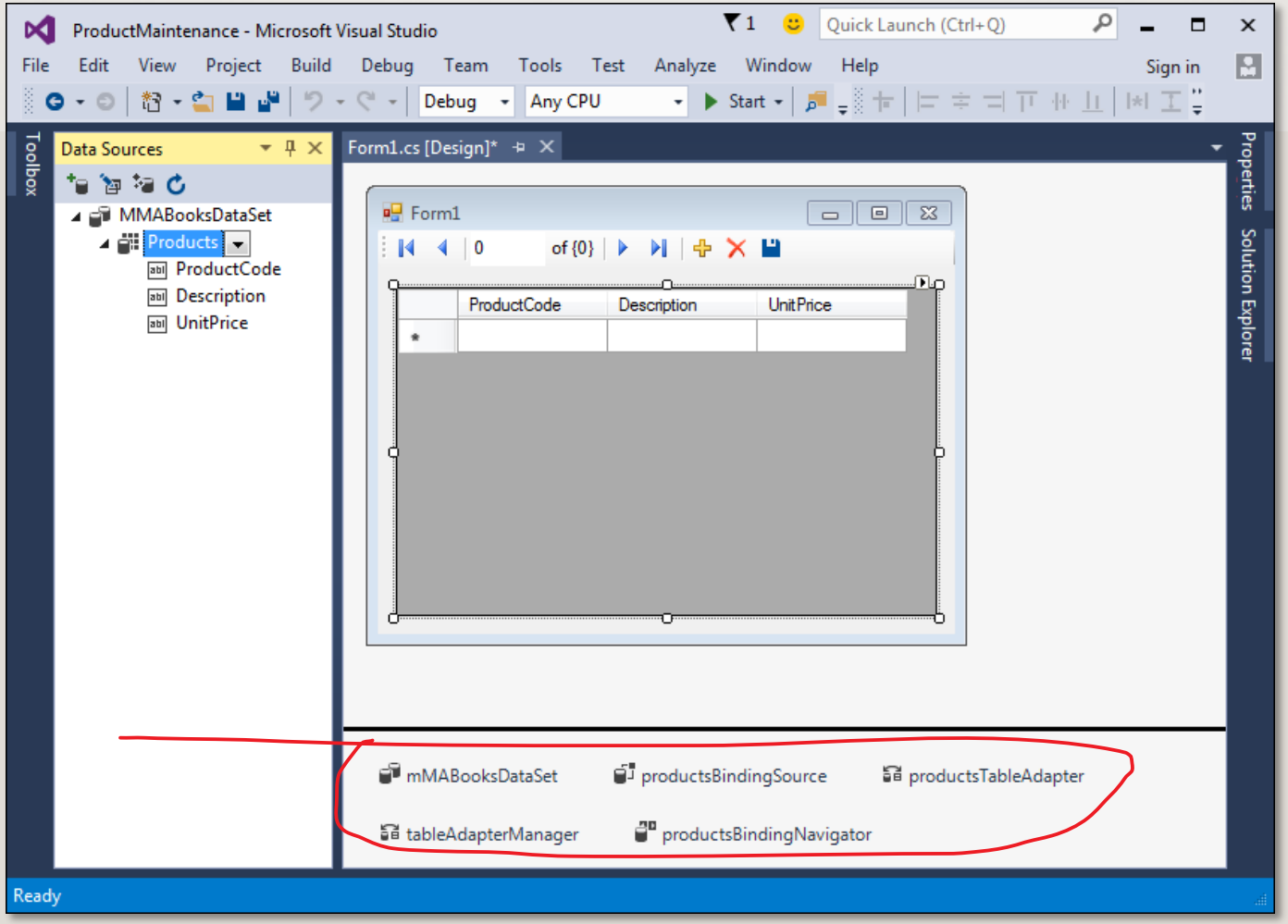
HOW TO WORK WITH COLUMNS THAT HAVE DEFAULT VALUES

- Omit columns with default values from the dataset unless they're needed by the application.
- Provide values for those columns whenever a row is added to the dataset.

A PROJECT WITH A DATASET DEFINED BY A DATA SOURCE



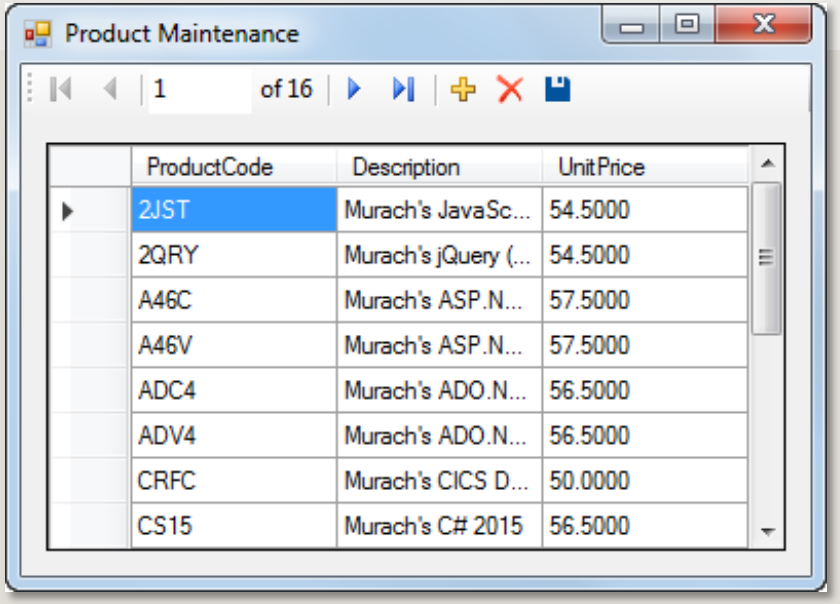
A FORM WITH THE PRODUCTS TABLE DRAGGED ONTO IT



THE CONTROLS AND OBJECTS THAT ARE CREATED WHEN YOU DRAG A DATA SOURCE TO A FORM

- DataGridView control
- BindingNavigator control
- BindingSource object
- DataSet object
- TableAdapter object
- TableAdapterManager object

THE USER INTERFACE FOR THE PRODUCT MAINTENANCE APPLICATION



THE CODE THAT'S GENERATED BY VISUAL STUDIO


```
private void Form1_Load(object sender, EventArgs e)
{
    // TODO: This line of code loads data into the
    // 'mMABooksDataSet.Products' table.
    // You can move, or remove it, as needed.
    this.productsTableAdapter.Fill(
        this.mMABooksDataSet.Products);
}

private void productsBindingNavigatorSaveItem_Click(
    object sender, EventArgs e)
{
    this.Validate();
    this.productsBindingSource.EndEdit();
    this.tableAdapterManager.UpdateAll(
        this.mMABooksDataSet);
}
```

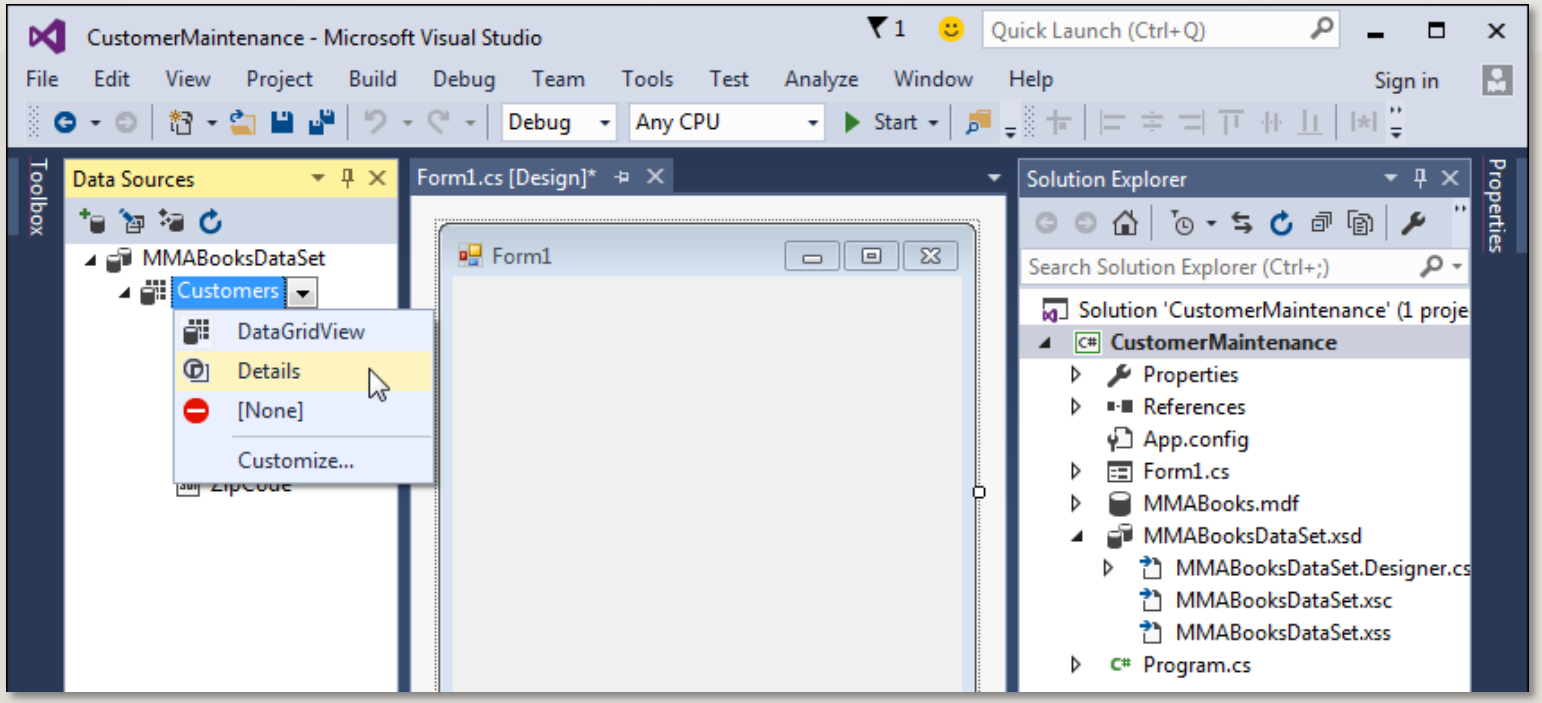
THE SYNTAX OF THE FILL METHOD


```
tableAdapter.Fill(dataSet.TableName)
```

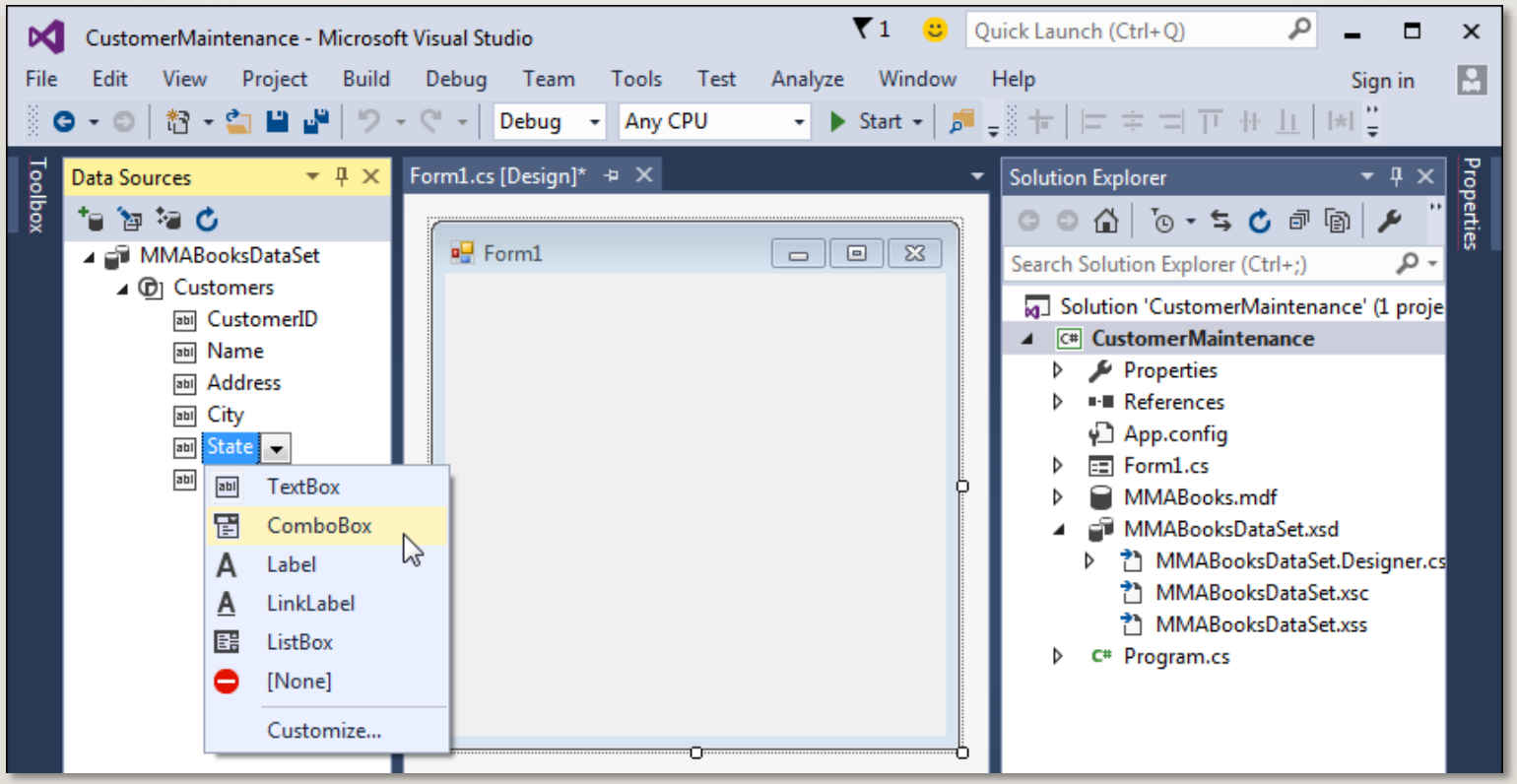
The syntax of the UpdateAll method

```
tableAdapterManager.UpdateAll(dataSet)
```

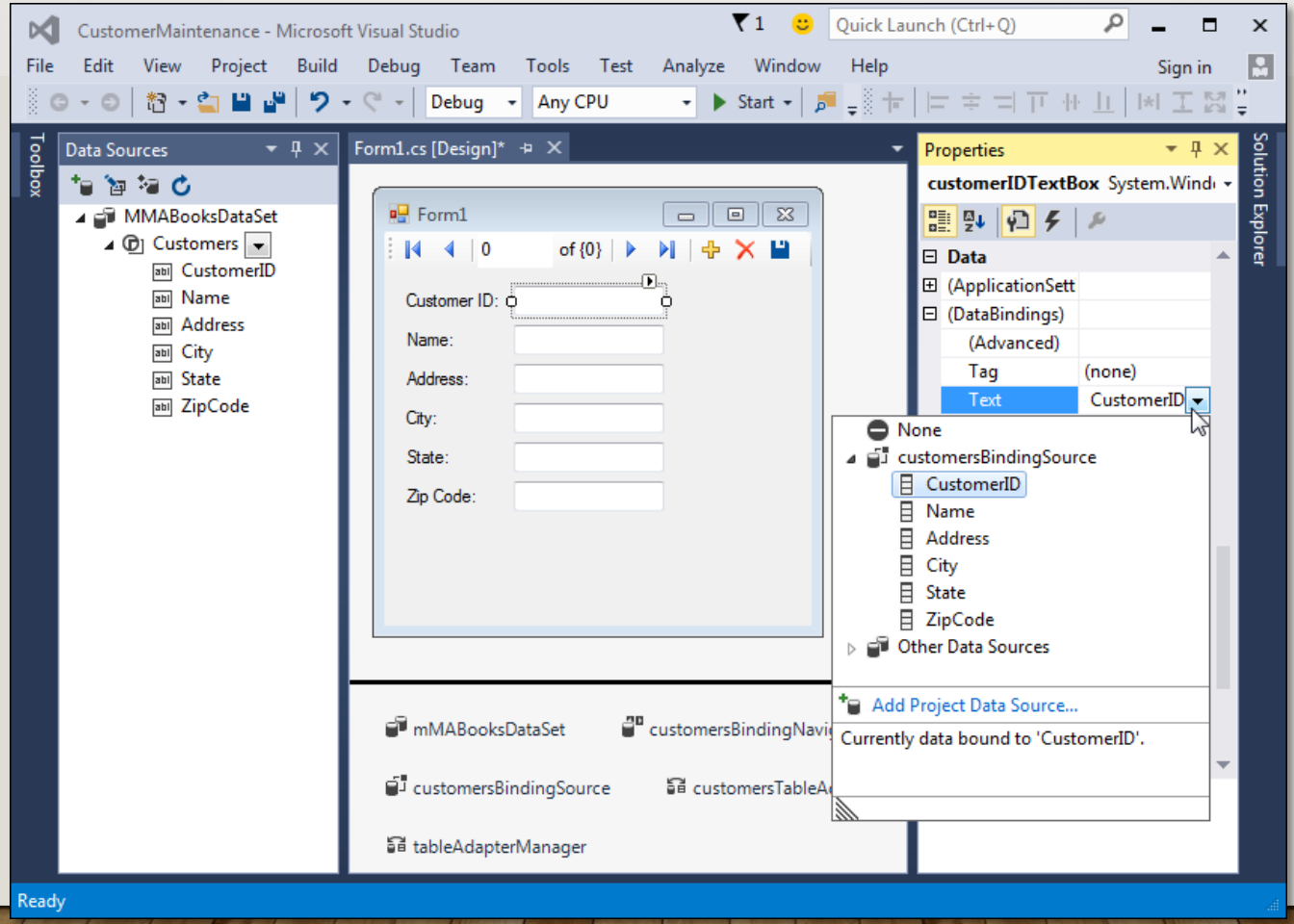
HOW TO CHANGE THE DEFAULT CONTROL FOR A DATA TABLE



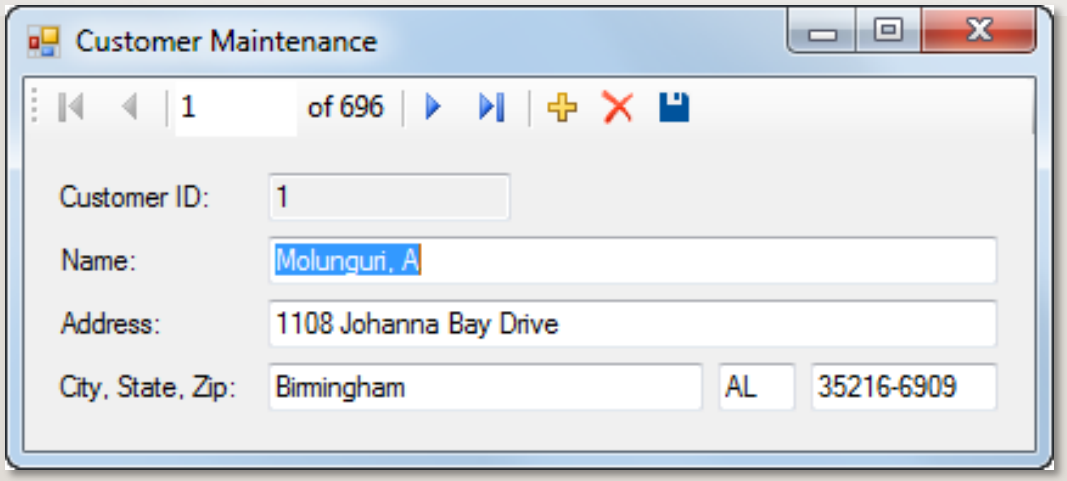
HOW TO CHANGE THE DEFAULT CONTROL FOR A COLUMN IN A DATA TABLE



A FORM WITH THE CUSTOMERS TABLE DRAGGED ONTO IT



THE USER INTERFACE FOR THE CUSTOMER MAINTENANCE APPLICATION



THE CODE FOR THE APPLICATION


```
private void Form1_Load(object sender, EventArgs e)
{
    // TODO: This line of code loads data into the
    // 'mMABooksDataSet.Customers' table.
    // You can move, or remove it, as needed.
    this.customersTableAdapter.Fill(
        this.mMABooksDataSet.Customers);
}

private void customersBindingNavigatorSaveItem_Click(
    object sender, EventArgs e)
{
    this.Validate();
    this.customersBindingSource.EndEdit();
    this.tableAdapterManager.UpdateAll(
        this.mMABooksDataSet);
}
```

.NET DATA PROVIDER EXCEPTION CLASSES

```
SqlException
OdbcException
OleDbException
```

COMMON MEMBERS OF THE .NET DATA PROVIDER EXCEPTION CLASSES

```
Number
Message
Source
Errors
GetType()
```

CODE THAT CATCHES A SQL EXCEPTION


```
private void Form1_Load(object sender, EventArgs e)
{
    try
    {
        this.customersTableAdapter.Fill(
            this.mMABooksDataSet.Customers);
    }
    catch (SqlException ex)
    {
        MessageBox.Show("Database error # " + ex.Number +
            ": " + ex.Message, ex.GetType().ToString());
    }
}
```

COMMON ADO.NET EXCEPTION CLASSES

- `DBConcurrencyException`
- `DataException`
- `ConstraintException`
- `NoNullAllowedException`

Common members of the ADO.NET classes

- `Message`
- `GetType()`

CODE THAT HANDLES ADO.NET ERRORS


```
try
{
    this.customersBindingSource.EndEdit();
    this.tableAdapterManager.UpdateAll(this.mMABooksDataSet);
}
catch (DBConcurrencyException)
{
    MessageBox.Show("A concurrency error occurred. " +
        "Some rows were not updated.", "Concurrency Exception");
    this.customersTableAdapter.Fill(this.mMABooksDataSet.Customers);
}
catch (DataException ex)
{
    MessageBox.Show(ex.Message, ex.GetType().ToString());
    customersBindingSource.CancelEdit();
}
catch (SqlException ex)
{
    MessageBox.Show("Database error # " + ex.Number +
        ": " + ex.Message, ex.GetType().ToString());
}
```

AN EVENT OF THE DATAGRIDVIEW CONTROL

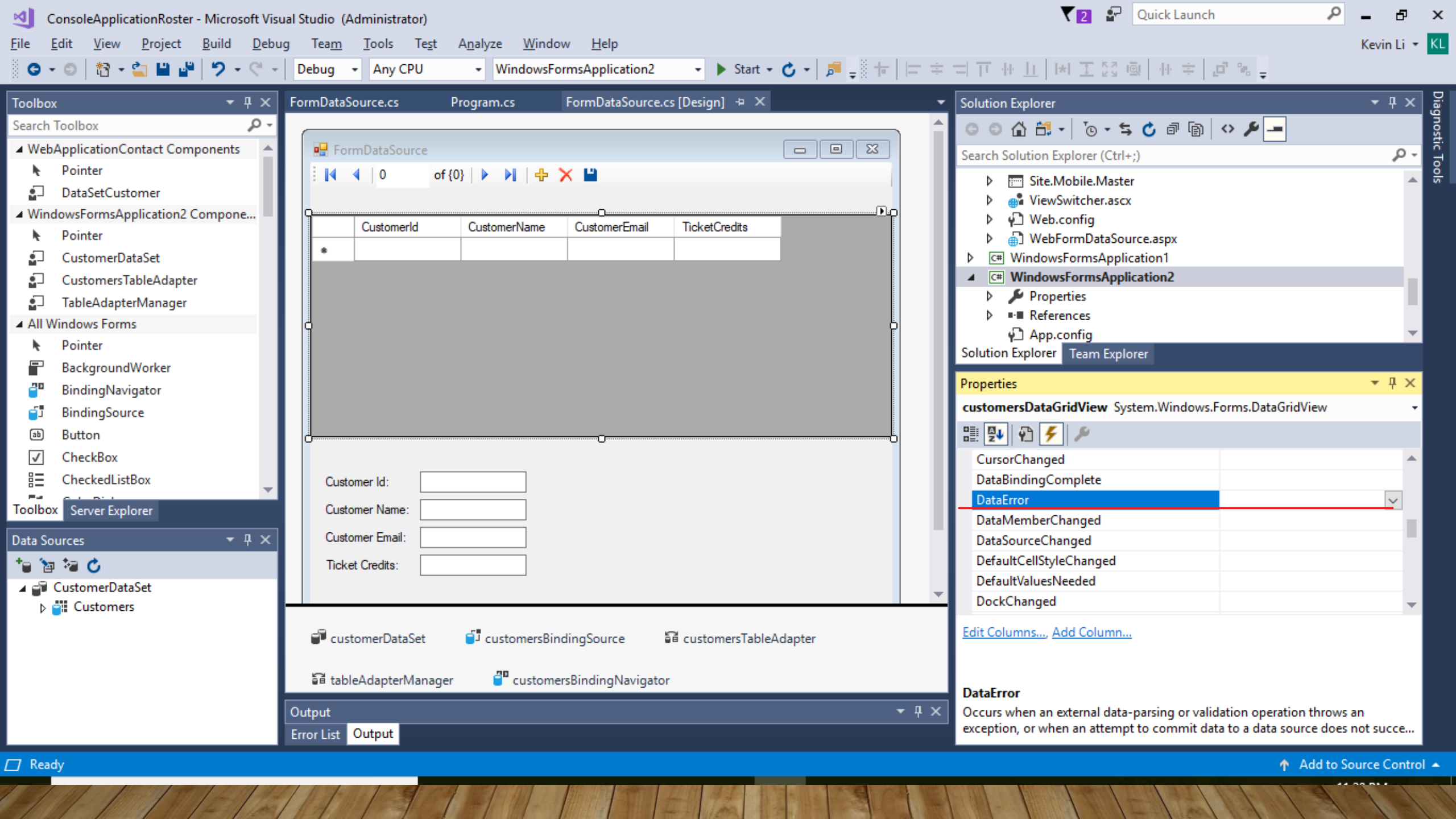
- `DataError`

Three properties of the DataGridViewDataErrorEventArgs class

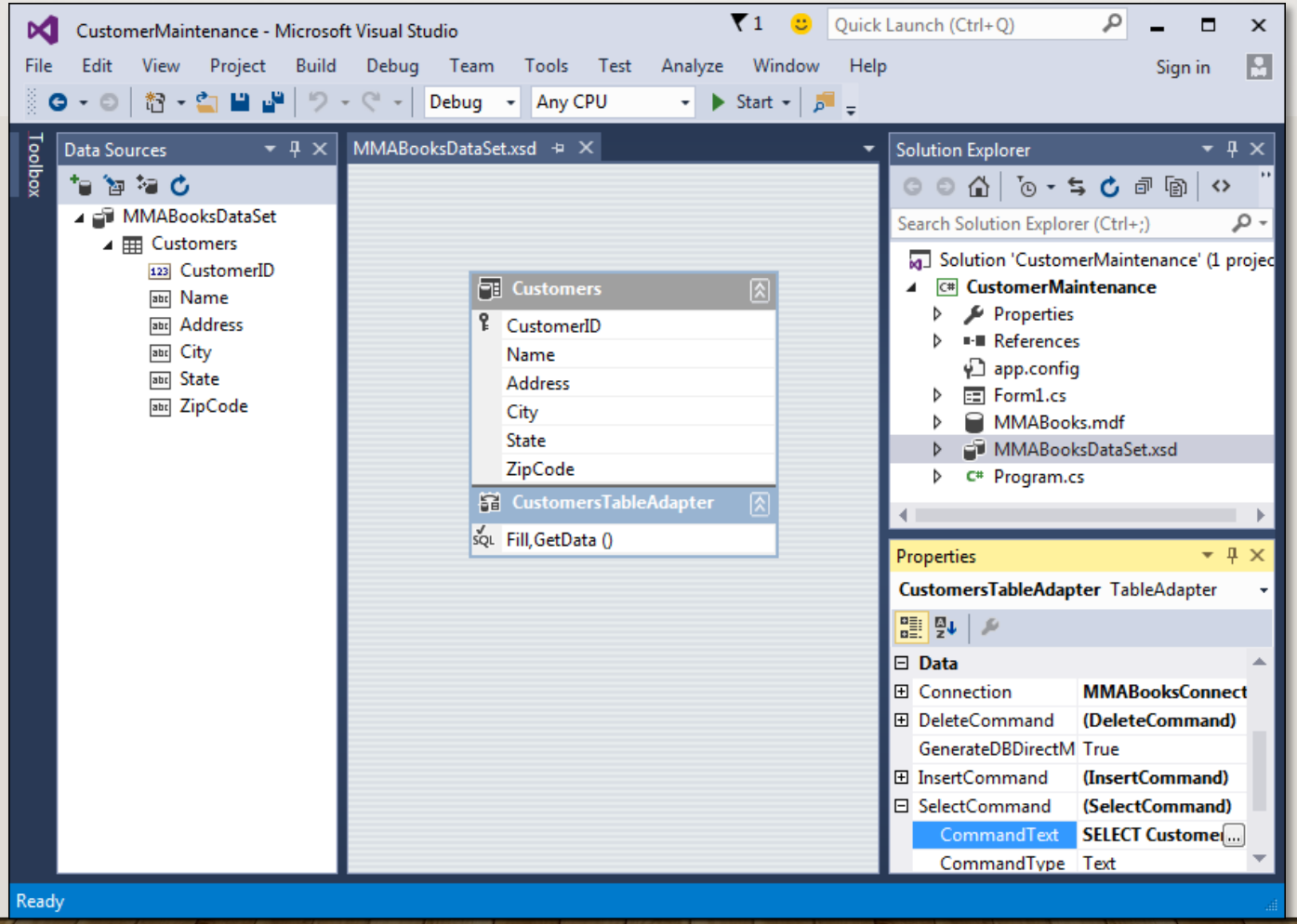
- `Exception`
- `RowIndex`
- `ColumnIndex`

CODE THAT HANDLES A DATA ERROR FOR A DATAGRIDVIEW CONTROL

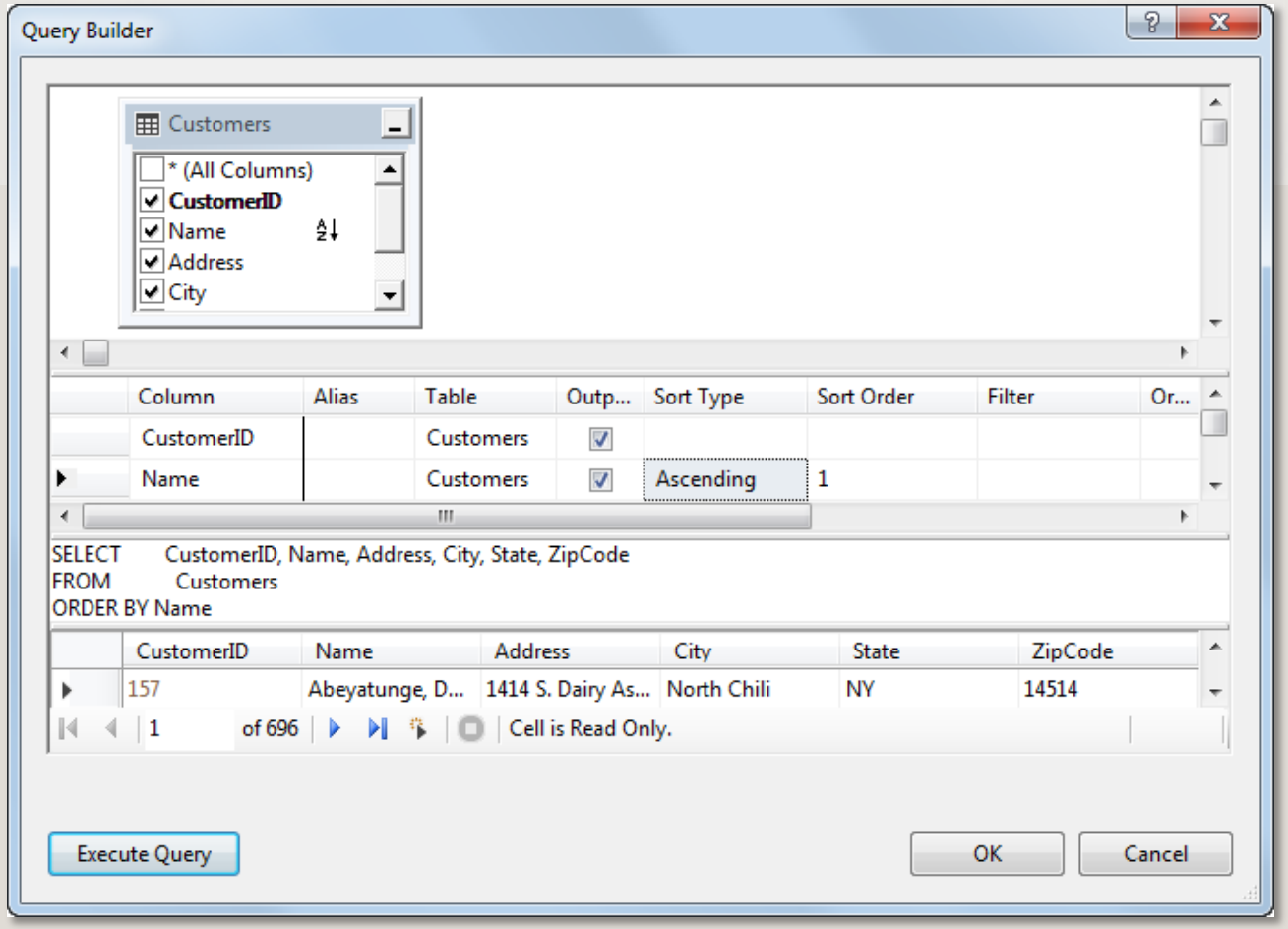
```
private void productsDataGridView_DataError(
    object sender, DataGridViewDataErrorEventArgs e)
{
    int row = e.RowIndex + 1;
    string errorMessage = "A data error occurred.\n" +
        "Row: " + row + "\n" +
        "Error: " + e.Exception.Message;
    MessageBox.Show(errorMessage, "Data Error");
}
```


ConsoleApplicationRoster - Microsoft Visual Studio (Administrator)
File Edit View Project Build Debug Team Tools Test Analyze Window Help
Kevin Li
Debug
Any CPU
WindowsFormsApplication2
Start
Toolbox
Search Toolbox
WebApplicationContact Components
Pointer
DataSetCustomer
WindowsFormsApplication2 Compone...
Pointer
CustomerDataSet
CustomersTableAdapter
TableAdapterManager
All Windows Forms
Pointer
BackgroundWorker
BindingNavigator
BindingSource
Button
CheckBox
CheckedListBox
Toolbox
Server Explorer
Data Sources
CustomerDataSet
Customers
FormDataSource.cs
Program.cs
FormDataSource.cs [Design]
FormDataSource
0
of {0}
CustomerId
CustomerName
CustomerEmail
TicketCredits
Customer Id:
Customer Name:
Customer Email:
Ticket Credits:
customerDataSet
customersBindingSource
customersTableAdapter
tableAdapterManager
customersBindingNavigator
Output
Error List
Output
Solution Explorer
Search Solution Explorer (Ctrl+;)
Site.Mobile.Master
ViewSwitcher.ascx
Web.config
WebFormDataSource.aspx
WindowsFormsApplication1
WindowsFormsApplication2
Properties
References
App.config
Solution Explorer
Team Explorer
Properties
customersDataGridView System.Windows.Forms.DataGridView
CursorChanged
DataBindingComplete
DataError
DataMemberChanged
DataSourceChanged
DefaultCellStyleChanged
DefaultValuesNeeded
DockChanged
Edit Columns..., Add Column...
DataError
Occurs when an external data-parsing or validation operation throws an exception, or when an attempt to commit data to a data source does not succe...
Diagnostic Tools
Ready
Add to Source Control

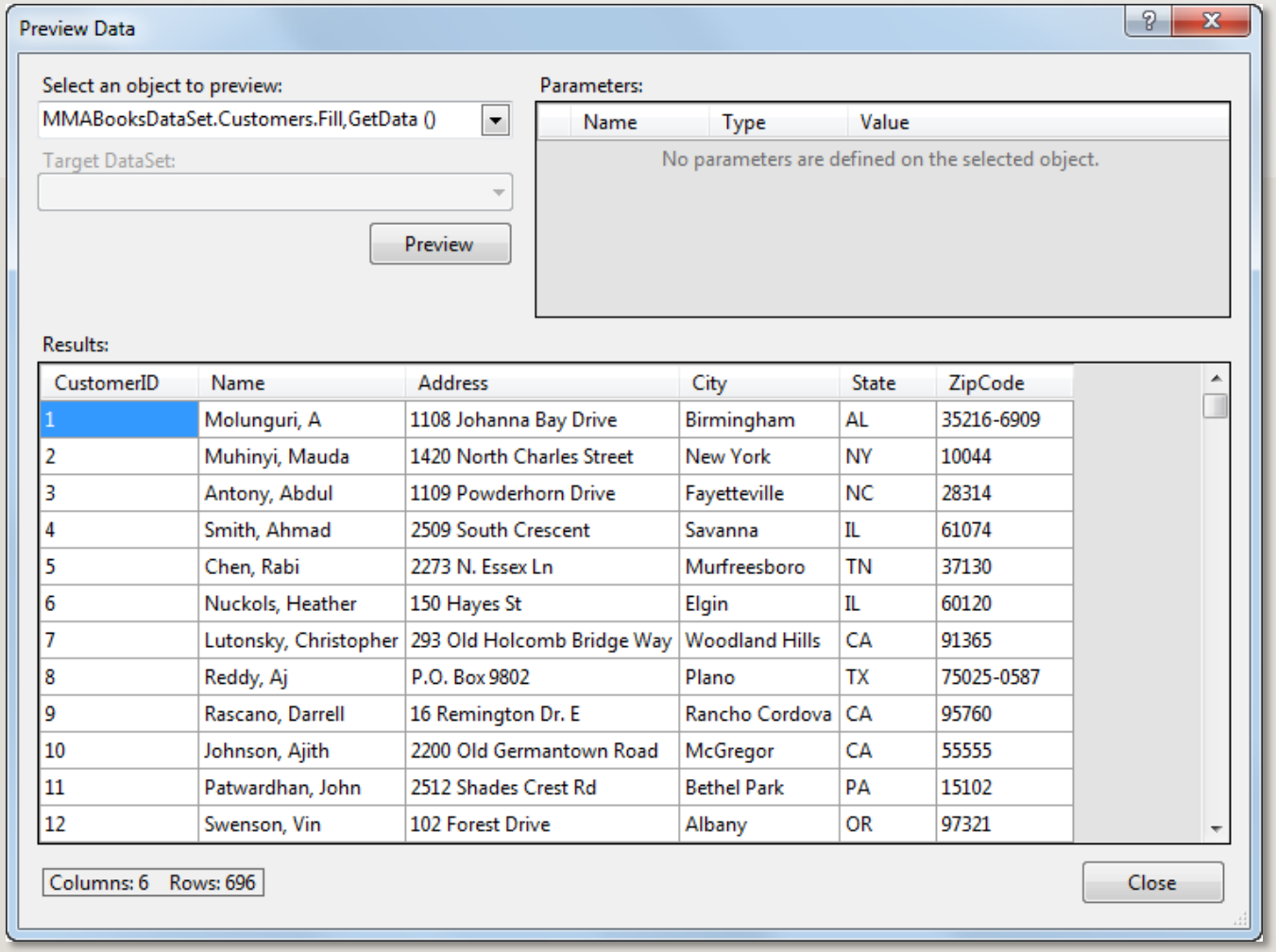
THE SCHEMA DISPLAYED IN THE DATASET DESIGNER



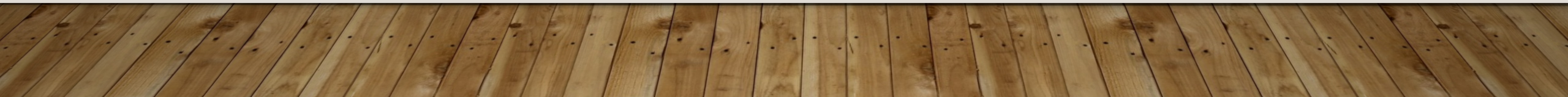
THE QUERY BUILDER

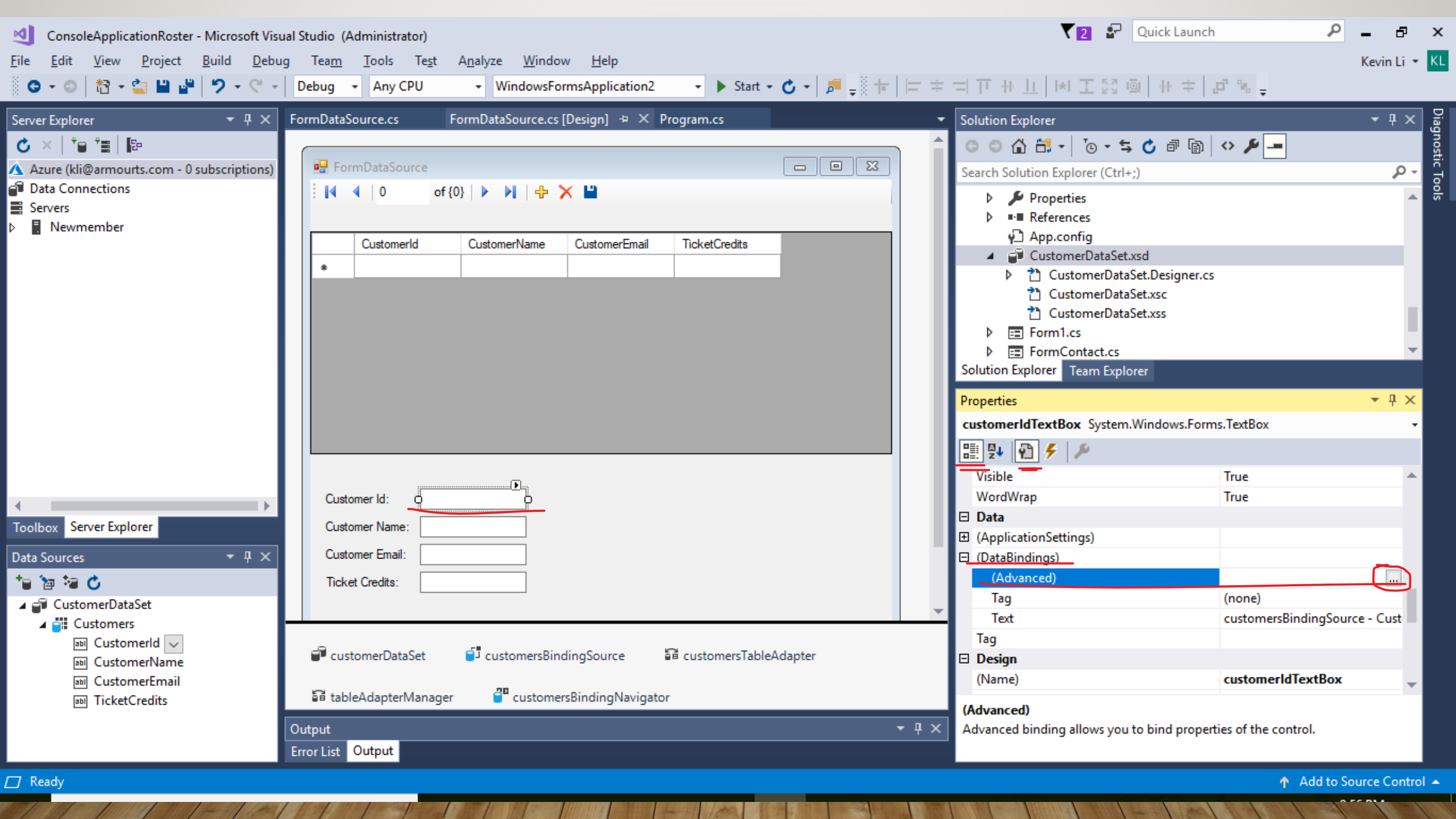


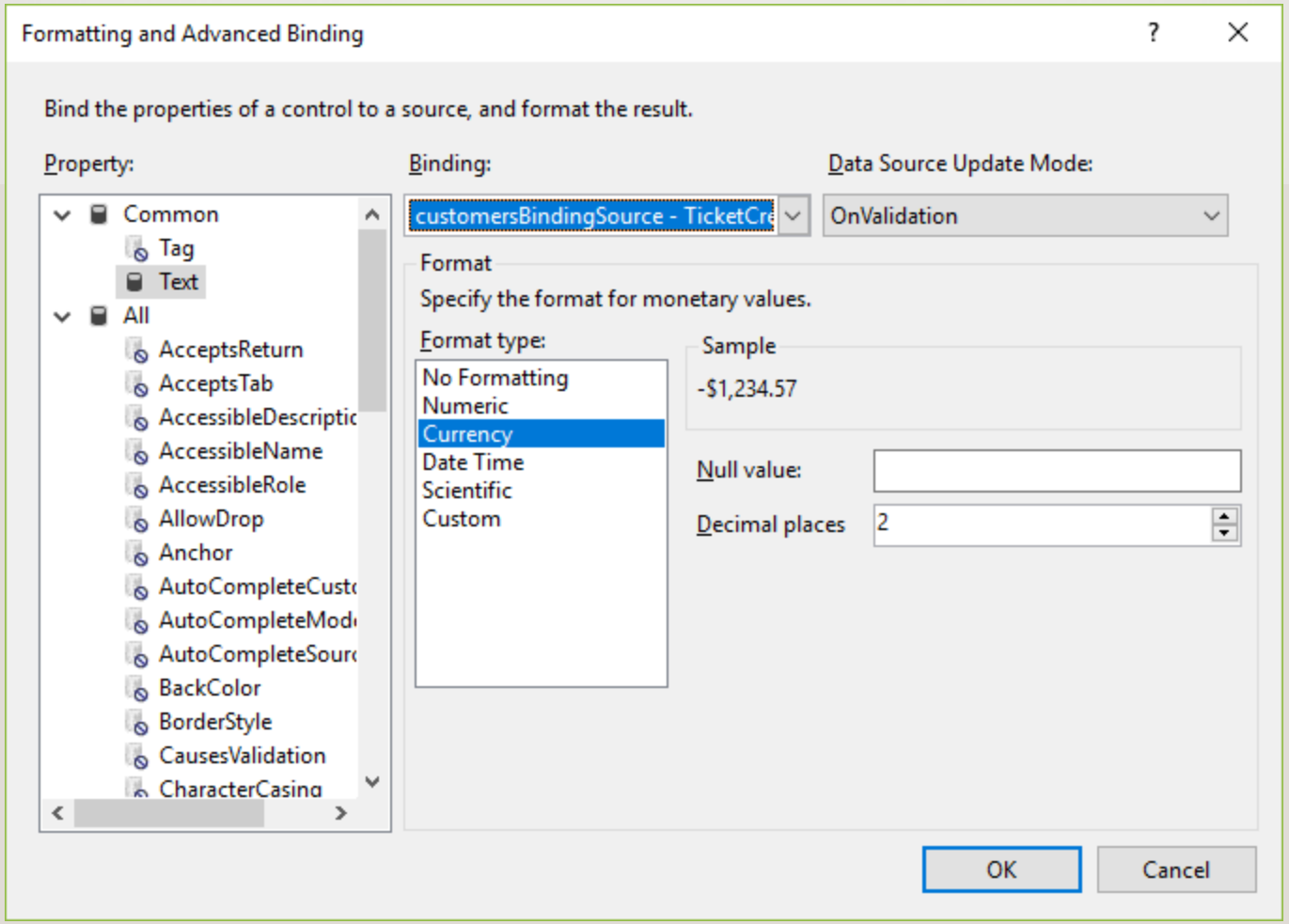
THE PREVIEW DATA DIALOG BOX



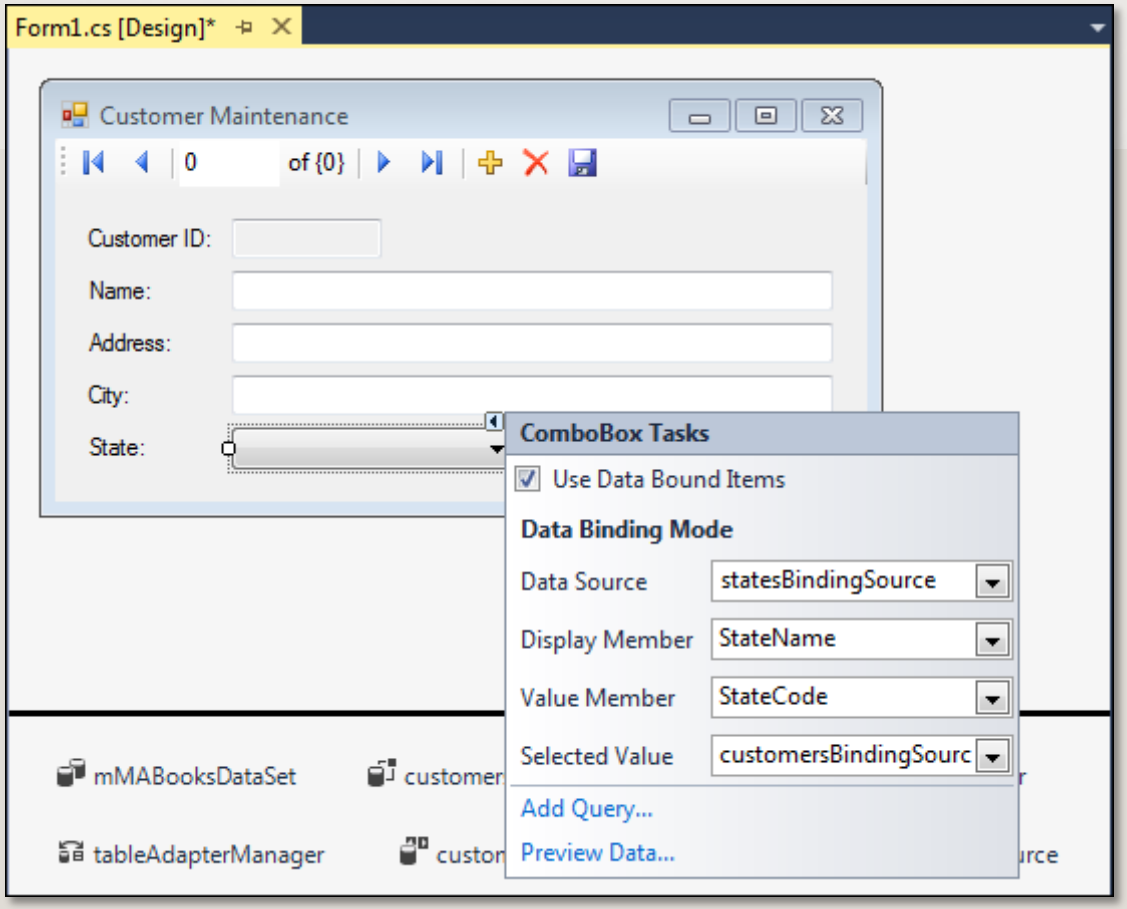
Learn the data manipulation steps from the generated SQL queries.




ConsoleApplicationRoster - Microsoft Visual Studio (Administrator)
File Edit View Project Build Debug Team Tools Test Analyze Window Help
Kevin Li
Debug
Any CPU
WindowsFormsApplication2
Start
Server Explorer
Azure (kli@armourts.com - 0 subscriptions)
Data Connections
Servers
Newmember
Toolbox
Server Explorer
Data Sources
CustomerDataSet
Customers
CustomerId
CustomerName
CustomerEmail
TicketCredits
FormDataSource.cs
FormDataSource.cs [Design]
Program.cs
FormDataSource
0
of {0}
CustomerId
CustomerName
CustomerEmail
TicketCredits
Customer Id:
Customer Name:
Customer Email:
Ticket Credits:
customerDataSet
customersBindingSource
customersTableAdapter
tableAdapterManager
customersBindingNavigator
Output
Error List
Output
Solution Explorer
Search Solution Explorer (Ctrl+;)
Properties
App.config
CustomerDataSet.xsd
CustomerDataSet.Designer.cs
CustomerDataSet.xsc
CustomerDataSet.xss
Form1.cs
FormContact.cs
Solution Explorer
Team Explorer
Properties
customerIdTextBox System.Windows.Forms.TextBox
Visible True
WordWrap True
Data
(ApplicationSettings)
(DataBindings)
(Advanced)
Tag (none)
Text customersBindingSource - Cust
Tag
Design
(Name) customerIdTextBox
(Advanced)
Advanced binding allows you to bind properties of the control.
Diagnostic Tools
Ready
Add to Source Control


Formatting and Advanced Binding
Bind the properties of a control to a source, and format the result.
Property:
Binding:
Data Source Update Mode:
Common
Tag
Text
All
AcceptsReturn
AcceptsTab
AccessibleDescriptic
AccessibleName
AccessibleRole
AllowDrop
Anchor
AutoCompleteCust
AutoCompleteMod
AutoCompleteSourc
BackColor
BorderStyle
CausesValidation
CharacterCasing
customersBindingSource - TicketCr
OnValidation
Format
Specify the format for monetary values.
Format type:
No Formatting
Numeric
Currency
Date Time
Scientific
Custom
Sample
-$1,234.57
Null value:
Decimal places
2
OK
Cancel

A COMBO BOX THAT'S BOUND TO A DATA SOURCE



COMBO BOX PROPERTIES FOR BINDING

- `DataSource`
- `DisplayMember`
- `ValueMember`
- `SelectedValue`

COMMON PROPERTIES OF THE BINDINGSOURCE CLASS

- `Position`
- `Count`

COMMON METHODS OF THE BINDINGSOURCE CLASS

```
AddNew()
EndEdit()
CancelEdit()
RemoveCurrent()
MoveFirst()
MovePrevious()
MoveNext()
MoveLast()
```

A STATEMENT THAT ADDS A NEW ROW TO A DATA SOURCE

```
this.customersBindingSource.AddNew();
```

A statement that saves the changes to the current row and ends the edit

```
this.customersBindingSource.EndEdit();
```

A statement that cancels the changes to the current row

```
this.customersBindingSource.CancelEdit();
```

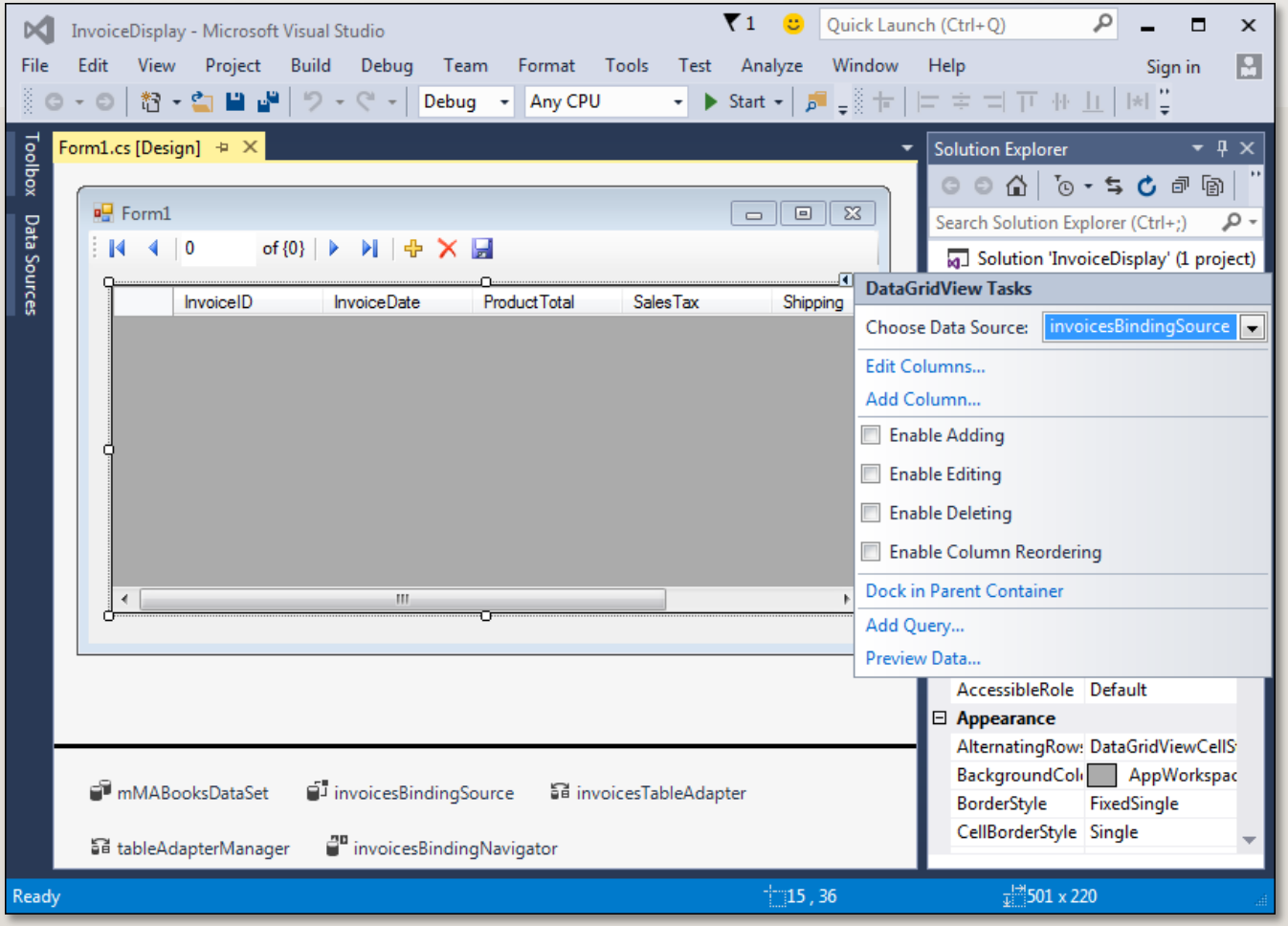
A statement that removes the current row from a data source

```
this.customersBindingSource.RemoveCurrent();
```

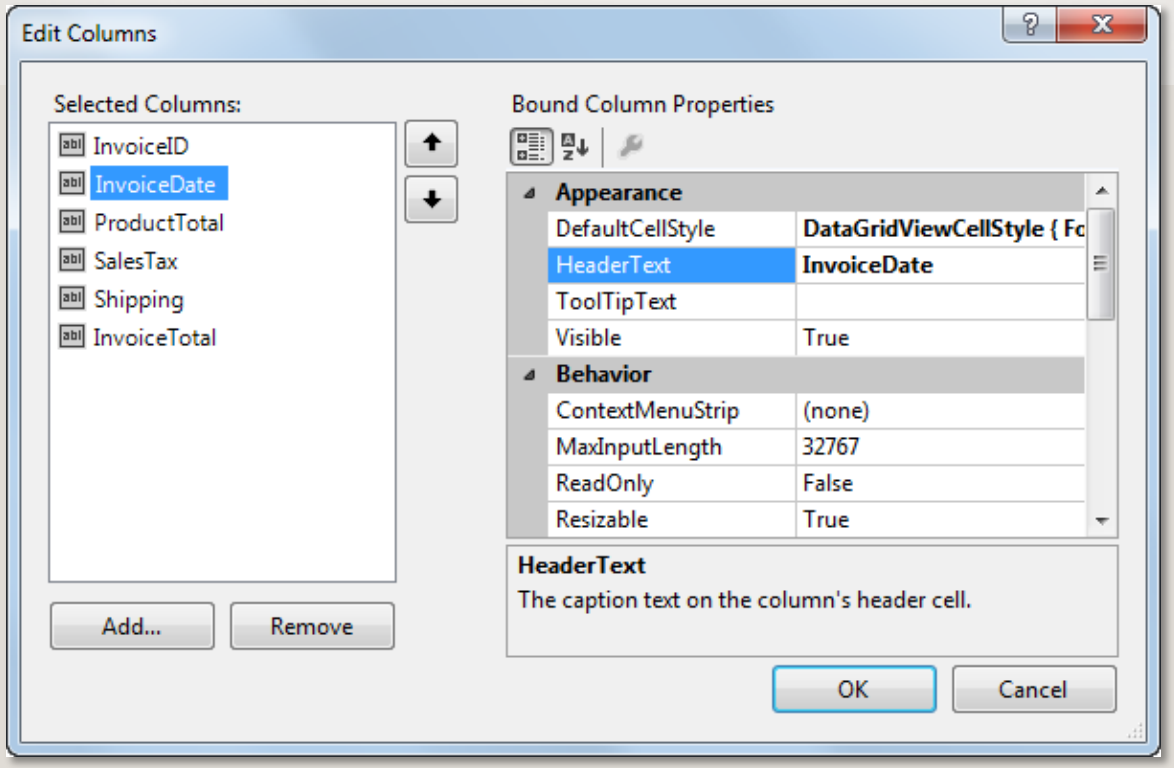
CODE THAT MOVES TO THE NEXT ROW AND DISPLAYS THE POSITION AND COUNT

```
private void btnNext_Click(object sender, EventArgs e)
{
    this.customersBindingSource.MoveNext();
    int position = customersBindingSource.Position + 1;
    txtPosition.Text = position + " of " +
        customersBindingSource.Count;
}
```

THE SMART TAG MENU FOR A DATAGRIDVIEW CONTROL



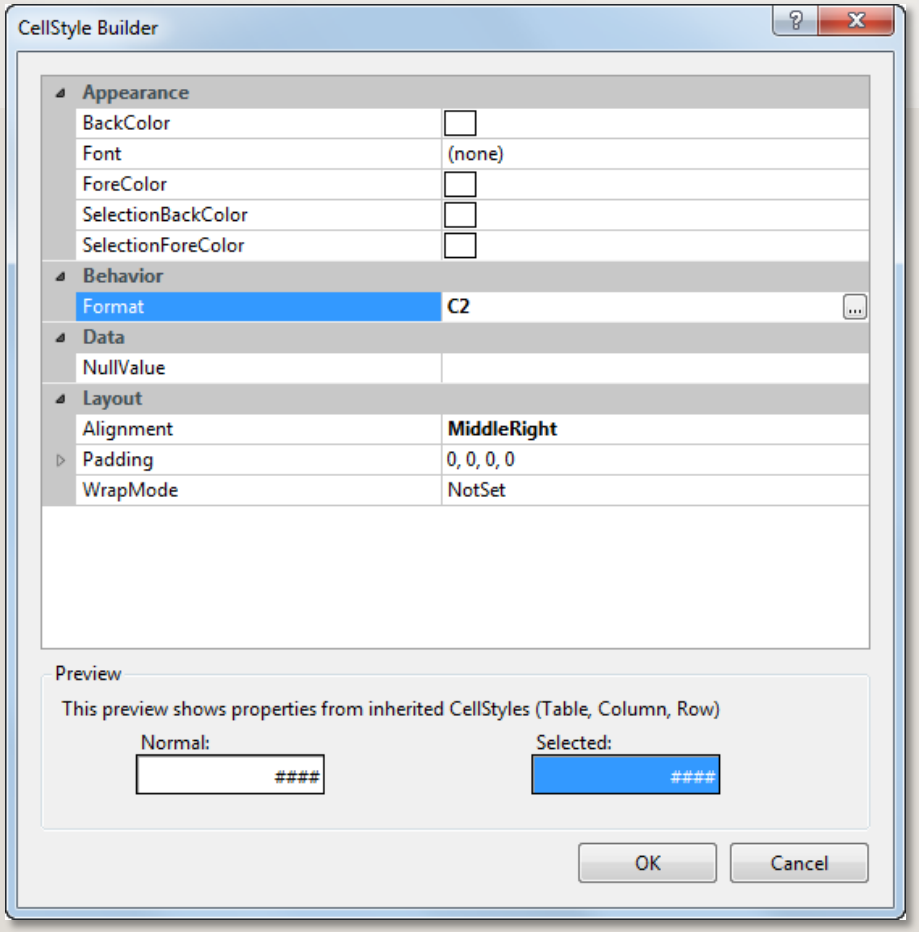
THE DIALOG BOX FOR EDITING DATAGRIDVIEW COLUMNS



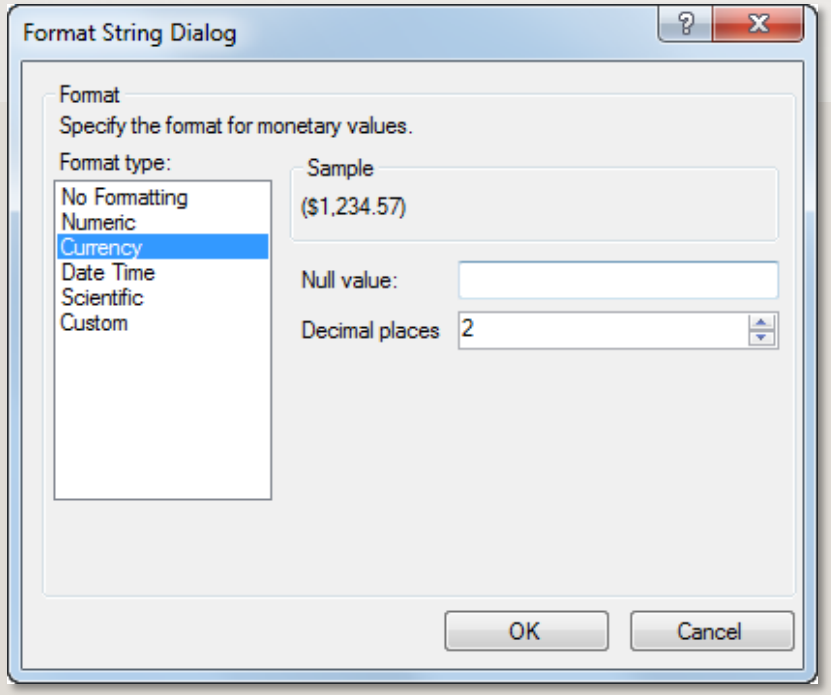
COMMON PROPERTIES OF A COLUMN

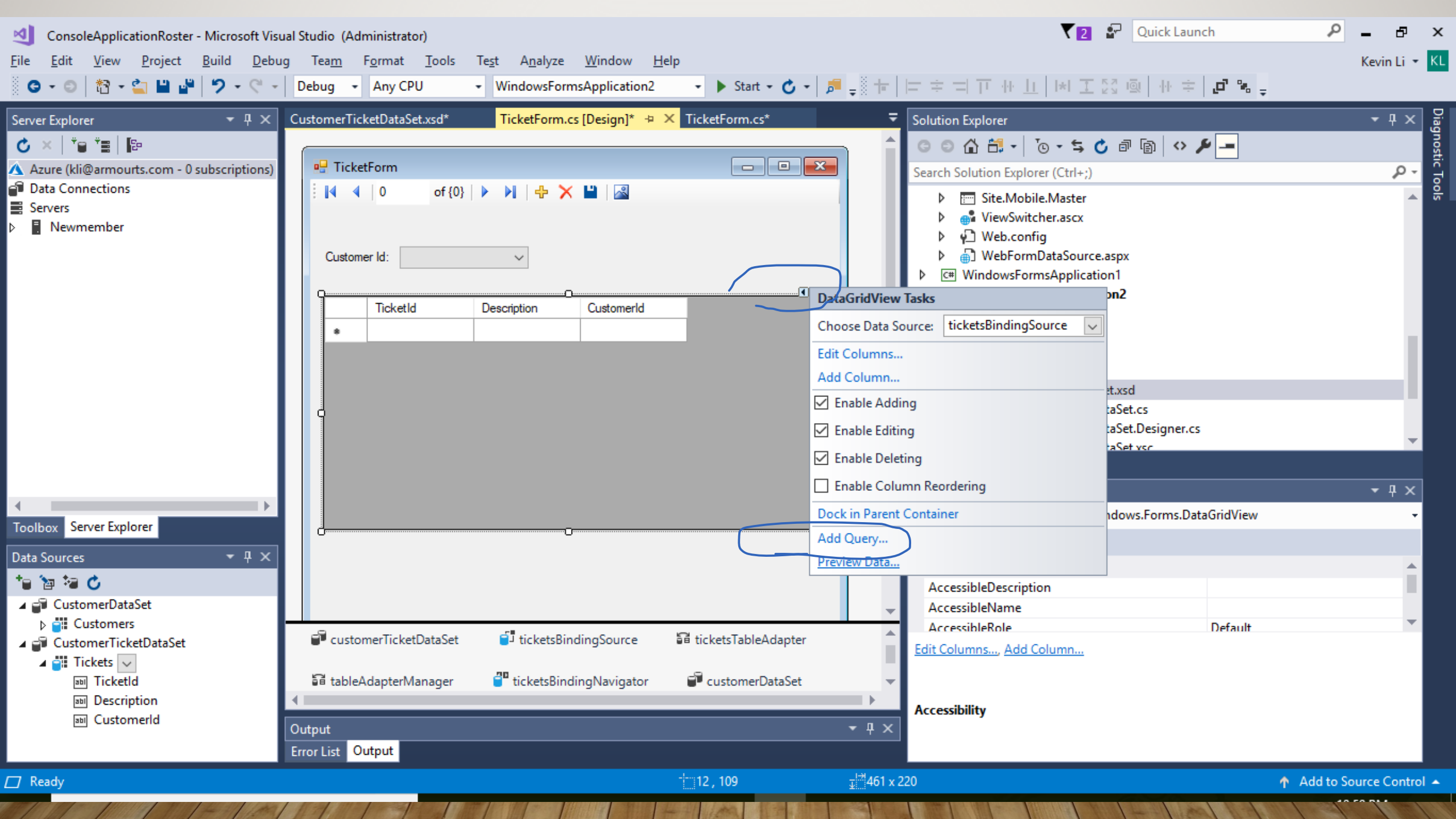
- `HeaderText`
- `Width`
- `DefaultCellStyle`
- `ReadOnly`
- `SortMode`

TO FORMAT COLUMNS: THE CELLSTYLE BUILDER DIALOG BOX

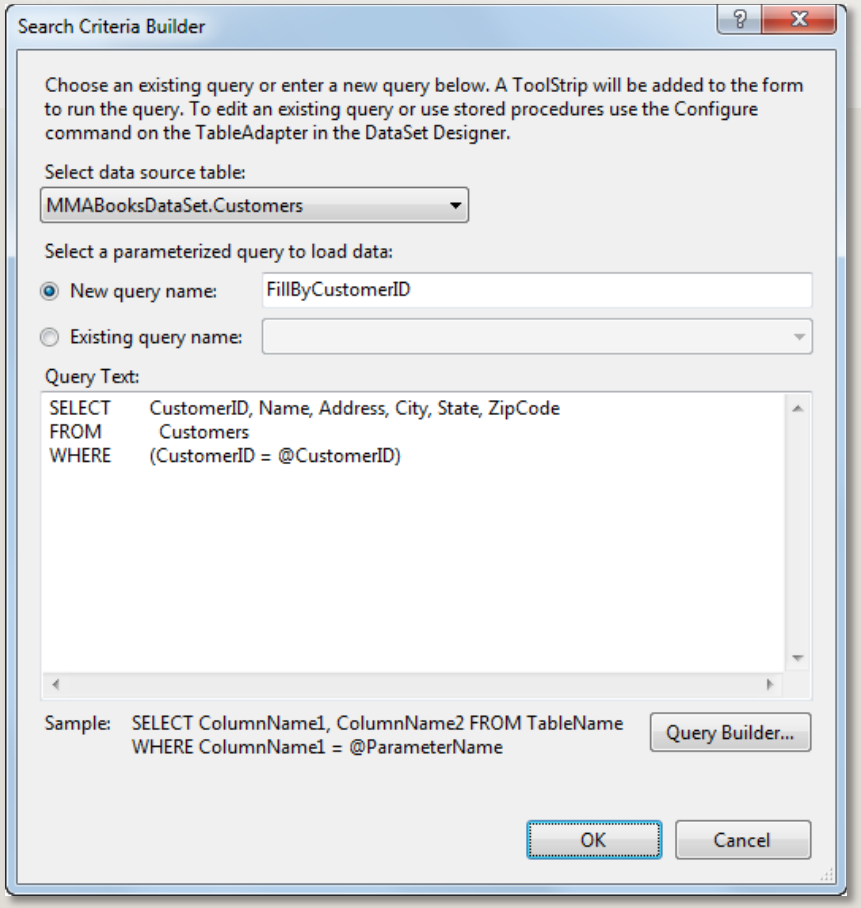


TO FORMAT COLUMNS: THE FORMAT STRING DIALOG BOX

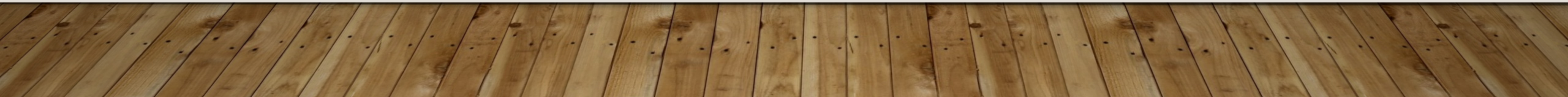



ConsoleApplicationRoster - Microsoft Visual Studio (Administrator)
Quick Launch
File Edit View Project Build Debug Team Format Tools Test Analyze Window Help
Kevin Li
Debug
Any CPU
WindowsFormsApplication2
Start
Server Explorer
Azure (kli@armourts.com - 0 subscriptions)
Data Connections
Servers
Newmember
Toolbox
Server Explorer
Data Sources
CustomerDataSet
Customers
CustomerTicketDataSet
Tickets
TicketId
Description
CustomerId
CustomerTicketDataSet.xsd*
TicketForm.cs [Design]*
TicketForm.cs*
TicketForm
0
of {0}
Customer Id:
TicketId
Description
CustomerId
DataGridView Tasks
Choose Data Source:
ticketsBindingSource
Edit Columns...
Add Column...
Enable Adding
Enable Editing
Enable Deleting
Enable Column Reordering
Dock in Parent Container
Add Query...
Preview Data...
customerTicketDataSet
ticketsBindingSource
ticketsTableAdapter
tableAdapterManager
ticketsBindingNavigator
customerDataSet
Output
Error List
Output
Solution Explorer
Search Solution Explorer (Ctrl+;)
Site.Mobile.Master
ViewSwitcher.ascx
Web.config
WebFormDataSource.aspx
WindowsFormsApplication1
AccessibleDescription
AccessibleName
AccessibleRole
Default
Edit Columns..., Add Column...
Accessibility
Diagnostic Tools
Ready
12 , 109
461 x 220
Add to Source Control

THE DIALOG BOX FOR CREATING A PARAMETERIZED QUERY



DEMO OF ADO.NET IN A MVC/ASP. NET PROJECT



LAST ASSIGNMENT - ADO .NET

Create an app to do CRUD on your SQL database.

Basic requirements:
Create a table named with your name in your SQL database
Do at least one of the CRUD (Create, read, update and delete) to the SQL database.
Use the basic ADO. NET classes: SqlConnection, SqlCommand, SqlDataReader and/or SqlDataAdapter etc.
Please zip and upload your sources code files files(at least the one doing db connection.)

Options for higher scores:
All the CRUD
Use any of these:
Dataset classes
SqlCommand.Parameters
A separated class doing db connections and the CRUD commands
A data model class to hold your data