2015

SQL Fundamentals

LEARN TO DESIGN & BUILD A WINDOWS SQL DATABASE

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Database

What is a database?
A file structured for the repository of data. Organized for easy retrieval, sorting, grouping, relating to other data, used to analysis information in numerous ways.

Example: Customer database
To store Customer Data, use a simple text file, not easily manageable. Why not use an Excel spreadsheet file? No easy way to relate sales data to customer information

Relational Database Management System RDBMS
Relational Database Theory – Organizing data into tables that can be related together, this reducing redundancy and increasing the integrity of the data.

Normalization – the process of determining what information belongs in which tables to minimize redundancy and increase integrity.

Database Objects
- Tables contain
  - Columns
  - Rows or records the value of a single column and a single row is a called a "field"

Data Types
Text varchar(100)
```
Create TABLE person (
        Name varchar(100)
);
```

Double pie
Exact number
Int or integer unsigned integer is a positive number.
```
CREATE TABLE person (
        AGE INTEGER UNSIGNED // expected to be a positive value
);
```

```
Decimal                                  The is the default (10, 0)
Decimal(precision, scope)                1234567890
Decimal (10, 0)
CREATE TABLE Student (                   (5, 2)
        avg_score decimal(6, 2)          123.45
);
                                         (8, 7)
                                         9.999999
```

```
CREATE TABLE student (
        id integer auto_increment // given to primary keys
)
```

```
date        'YYYY-MM-DD' // format of string ' '
time        '[H]HH:MM:SS
datetime    'YYYY-MM-DD HH:MM:SS'
```

```
CREATE TABLE order (
        order_date date
);
```

Booleans 0 is false non-0 or 1 is true
Boo
Boolean tinyint(1)
```
CREATE TABLE order (
        fulfilled Boolean // true or false  0 or 1
);
```

Data Integrity

Keeping data valid, of the correct data type, etc., so that it is usable for its intended purpose. Customers can be moved separate tables

What Needs to be Defined

- The data type for each column in a table
- The maximum size of data that will be stores in the column
- The nullability of a column

In the customer table the credit limit field is a real data type, this is so that the user has to enter a numerical value, so that calculations can be made using the numerical data. The real data type is approximate numerical. The customer since is a date time data type, only dates can be enter into this field. Null fields allow records to be saved to the database, to maintain data integrity.

Primary Key
A field or combination of fields that make a given row unique in the database. A way of differentiating each row in a table when all other fields might be duplicated in other rows in the same table. It can never be null, and must be set when the record is created and never changed.

CONSTRAINT
A rule that is enforced on the table.
CONSTRAINT check_id CHECK (customerID BETWEEN 0 and 10000)

Identity column an attribute that will be automatically increment a field of data in each successive row added to the database. Typically used on the primary key fields to make them unique.

Foreign key
Relate one or more rows in one table to a record in another table that shares the same value in its primary key. To check who made the order use customerID as a foreign key to relate the tables in the database. Data is linked, order is linked to the customer who created the order, i.e. query the database; how much a customer has spent. Adding a FK constraint prevents deletions in the customer table to create orphaned rows in the order table. FK constraints enforce "Referential Integrity".

Customer			
KEY	customerID	int (11)	
	firstName	varchar(50)	
	lastName	varchar(50)	
	address	varchar(200)	Null
	city	varchar(200)	Null
	county	char(10)	Null
	zip	char(10)	Null
	creditLimit	real	
	customerSince	datetime	

Order	
KEY	orderID
	orderDate
	orderAmount
	paymentType
FK	customerID

CRUD
CREATE, Read /SELECT, UPDATE, DELETE
CREATE - Tables are created using the CREATE TABLE statement
CREATE TABLE Customer (inside specify the table details, database schema);

SELECT - Read rows a table
SELECT firstName, lastName FROM Customer;
Or read all rows from a table
SELECT * FROM Customer;

DELETE – Delete rows from table
DELETE FROM Customer – deletes all rows from Customer table

UPDATE - Used to change data in existing rows in the table.
Specific the table after the keyword UPDATE Customer SET firstName = 'Stephen'

Selecting records
WHERE
Reading data is the main thing you do with a database. WHERE can be used to filter records.
Only select a row where the given value is true.
SELECT * FROM Customer WHERE firstName = 'Stephen' // selects a single row from the database.

Also can select the column value
SELECT * FROM Customer WHERE CustomerID = 3;
SELECT * FROM Customers WHERE CustomerID != 3;
SELECT * FROM Customer WHERE lastName = CustomerID > 5;
More than one condition AND /OR keywords can chain where clauses
SELECT * FROM Customers WHERE CustomerID = 1 OR CustomerID = 2;
IN To specify multiple possible values for a column or to shorten the above statement
SELECT * FROM Customers WHERE CustomerID IN (1, 2); // a list of value in parenthesis
LIKE Search for a pattern % 0 or more of any other character
SELECT * FROM Customer WHERE firstName LIKE 'S%'
SELECT * FROM Customer WHERE lastName = 'OConnor' AND CustomerID > 5;
SELECT * FROM Customer WHERE lastName = 'OConnor' OR CustomerID > 5;

Comparsion		Logical	
=	Equals	ALL	NOT
>	Greater Than	AND	OR
<	Less Than	ANY	SOME
>=	Greater than or equal	BETWEEN	IN
<=	Less than or equal	EXISTS	LIKE
<>	Not Equal to	BETWEEN	Between an inclusive range
!=	Not Equal to		

Order Customers table sort data by date use ORDER BY. Can be used with ASC or DESC.

customerID	firstName	lastName	address	city	county	zip	creditLimit	customerSince
1	Ste	OConnor	Lucan	Dublin	Dublin	12	100	15/08/2002
2	John	Henry	Limetree	Limerick	Limerick	10	500	11/03/2004
3	Henry	Chinaski	Blossom	Tralee	Kerry	38	1000	02/11/2003
4	Harvey	Pecar	Cherrywood	Galway	Galway	3	75	24/07/2015
5	Brendan	Behan	Ringsend	Dublin	Dublin	11	5000	03/12/2009

SELECT * ORDER BY customerSince

customerID	firstName	lastName	address	city	county	zip	creditLimit	customerSince
1	Ste	OConnor	Lucan	Dublin	Dublin	12	100	15/08/2002
3	Henry	Chinaski	Blossom	Tralee	Kerry	38	1000	02/11/2003
2	John	Henry	Limetree	Limerick	Limerick	10	500	11/03/2004
5	Brendan	Behan	Ringsend	Dublin	Dublin	11	5000	03/12/2009
4	Harvey	Pecar	Cherrywood	Galway	Galway	3	75	24/07/2015

Group SELECT customerID, zip FROM Customers GROUP BY customerID

customerID	zip
1	12
2	10
3	38
4	3
5	11

Aggregate functions
Perform a calculation on a set of values and return a single value. Except for COUNT, aggregate functions ignore null values. Aggregate functions are frequently used with the GROUP BY clause of the SELECT statement.

Useful aggregate functions:
AVG() - Returns the average value.
COUNT() - Returns the number of rows.
FIRST() - Returns the first value.
LAST() - Returns the last value.
MAX() - Returns the largest value.
MIN() - Returns the smallest value.
SUM() - Returns the sum.

HAVING
The HAVING clause was added to SQL because the WHERE keyword could not be used with aggregate functions.

```
SELECT Employees.LastName, COUNT(Orders.OrderID) AS NumberOfOrders FROM (Orders
INNER JOIN Employees
ON Orders.EmployeeID=Employees.EmployeeID)
GROUP BY LastName
HAVING COUNT(Orders.OrderID) > 10;
```

LastName	NumberOfOrders
OConnor	11
Henry	27
Chinaski	14

```
SELECT Employees.LastName, COUNT(Orders.OrderID) AS NumberOfOrders FROM Orders
INNER JOIN Employees
ON Orders.EmployeeID=Employees.EmployeeID
WHERE LastName=OConnor OR LastName=Henry
GROUP BY LastName
HAVING COUNT(Orders.OrderID) > 25;
```

LastName	NumberOfOrders
Henry	27

CAST
Converts an expression of one data type to another in SQL Server.
Syntax for CAST:
CAST (expression AS data_type [(length)])

Table Student_Score

Column Name	Data Type
StudentID	integer
First_Name	char(20)
Score	float

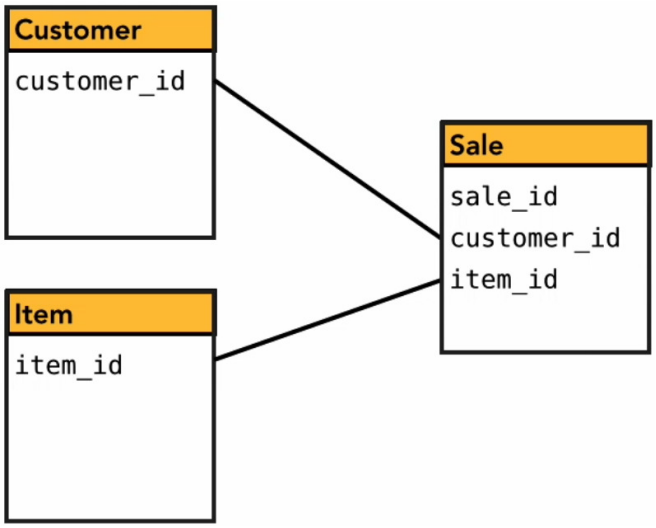
Table Student_Score Rows

StudentID	First_Name	Score
1	Jenny	85.2
2	Bob	92.5
3	Alice	90
4	James	120.1

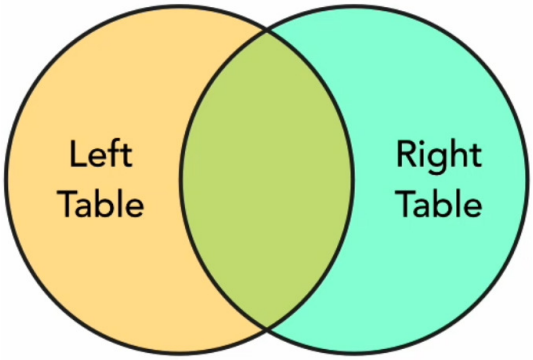
Example 1
SELECT First_Name, CAST(Score AS Integer) Int_Score FROM Student_Score;
Result:

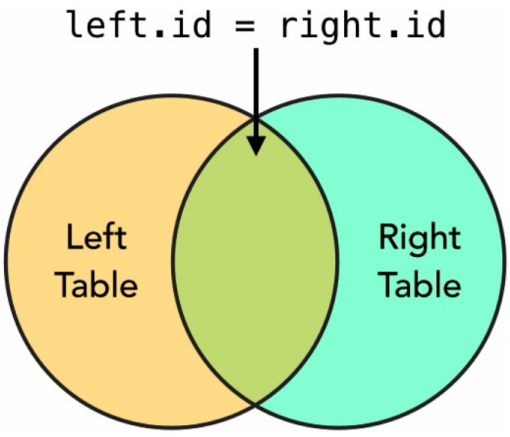
First_Name	Int_Score
Jenny	85
Bob	92
Alice	90
James	120

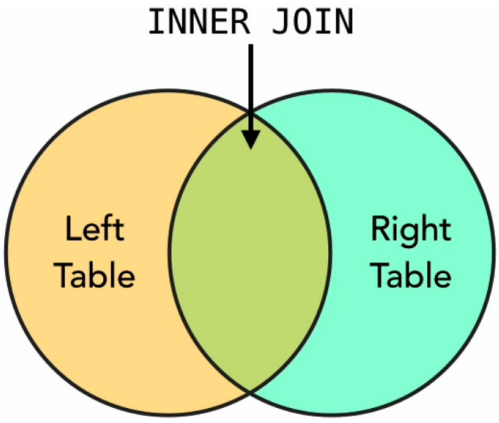
Table Relationships
Some tables contain information related to other tables.

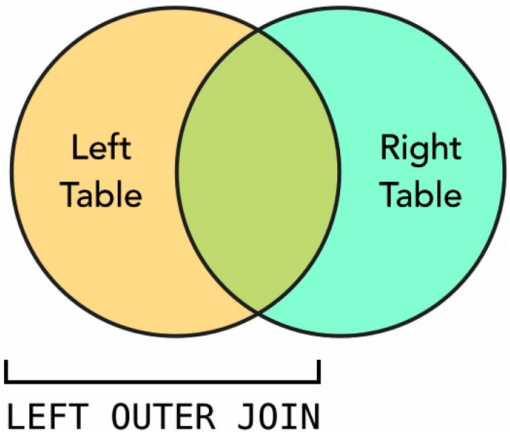


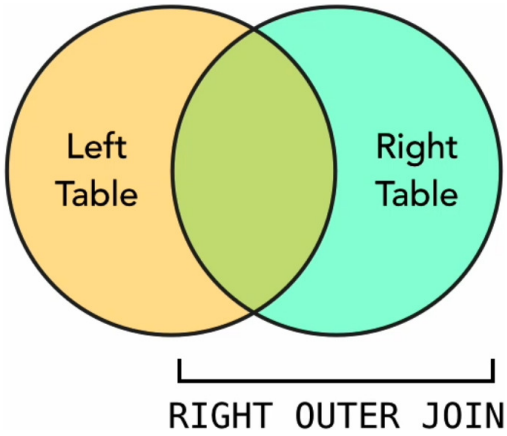
Join
Using the join statement, SQL has powerful tools for extracting related data from multiple tables. Typically unique id fields are used to create relationships. Unique id fields work well for creating and managing simple or complex relationships between tables. When a result is needed from multiple rows in multiple tables use a join query. The easiest way to understand joins is by using a venn diagram. Matching ids The simplest most common join is the inner join, this is the default join. Many databases including SQLite do not support a right join or full other join. Inter section of the tables, where the tables overlap a condition is met.

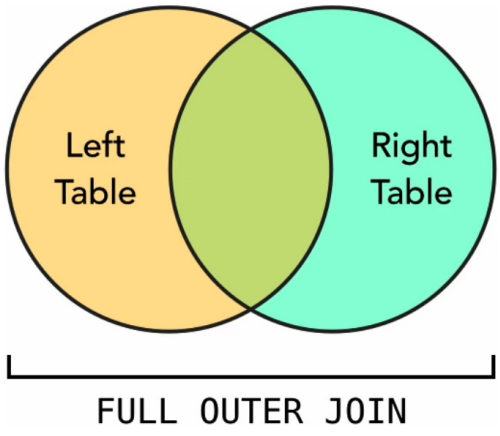




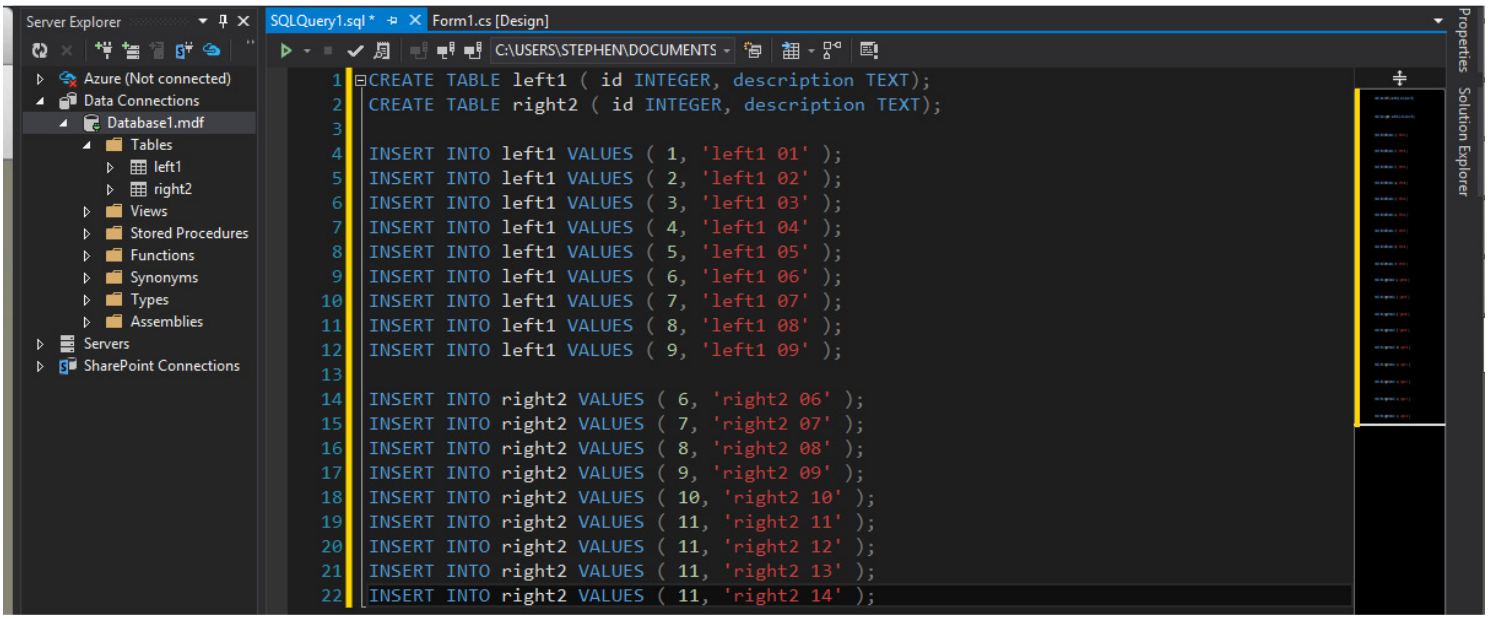






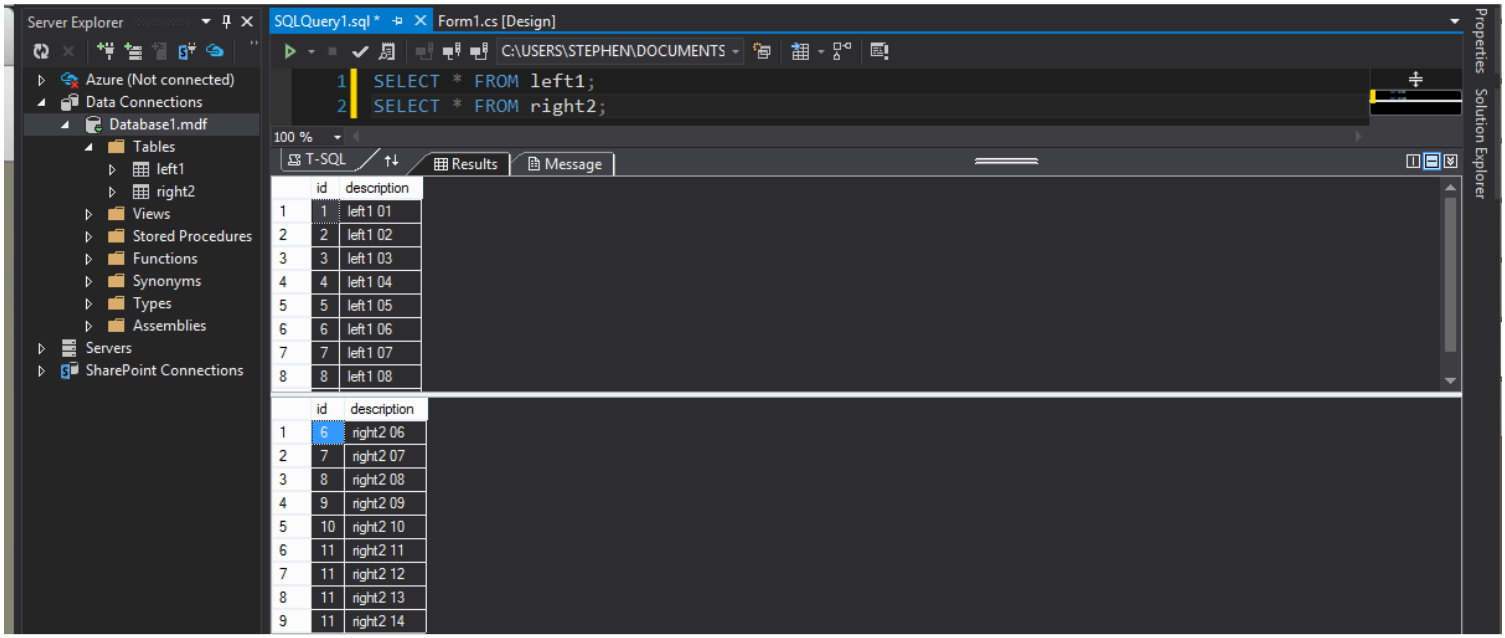


Exercise Joins
Create a new database at the following SQL

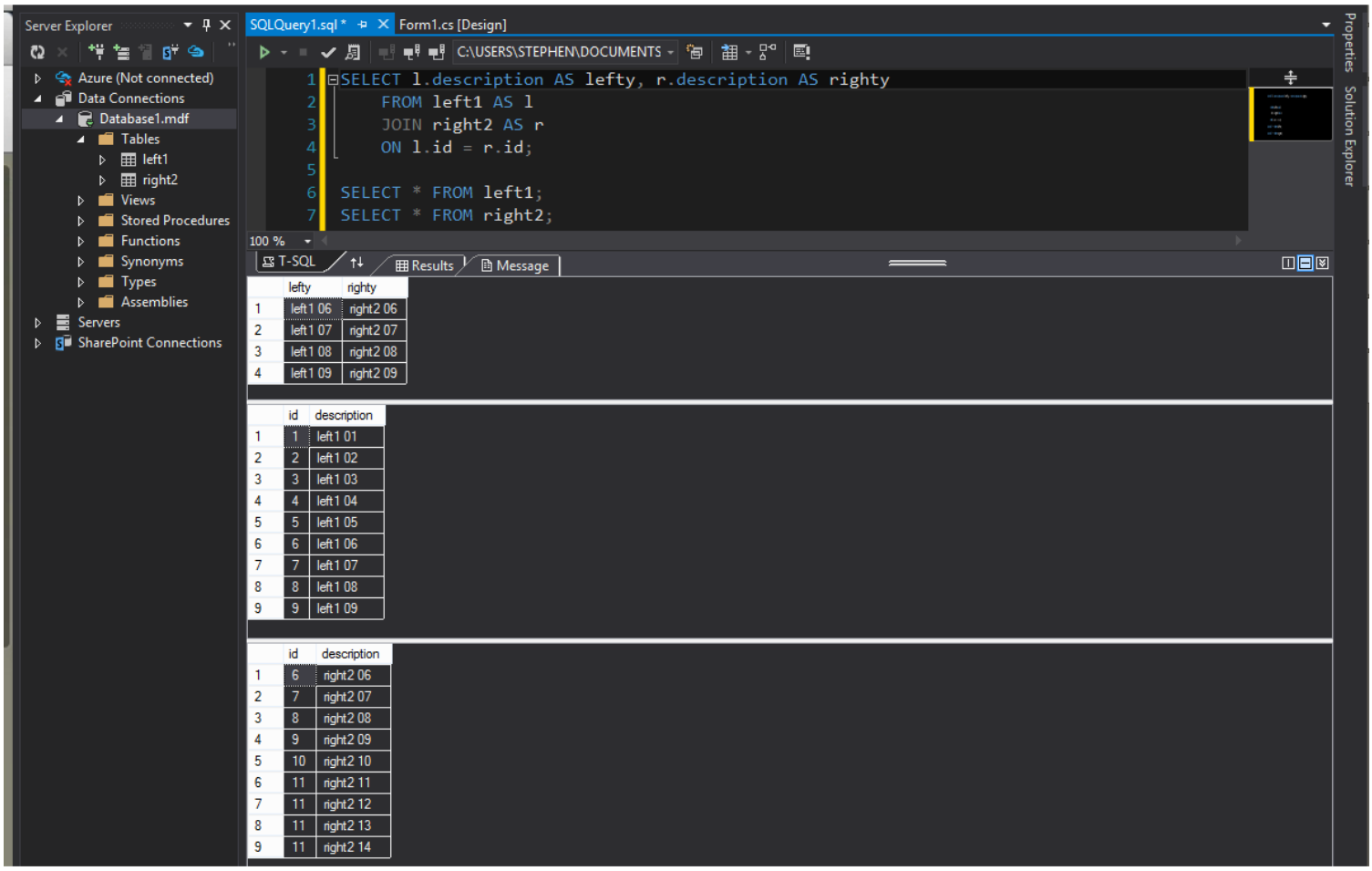


SQL Fundamentals

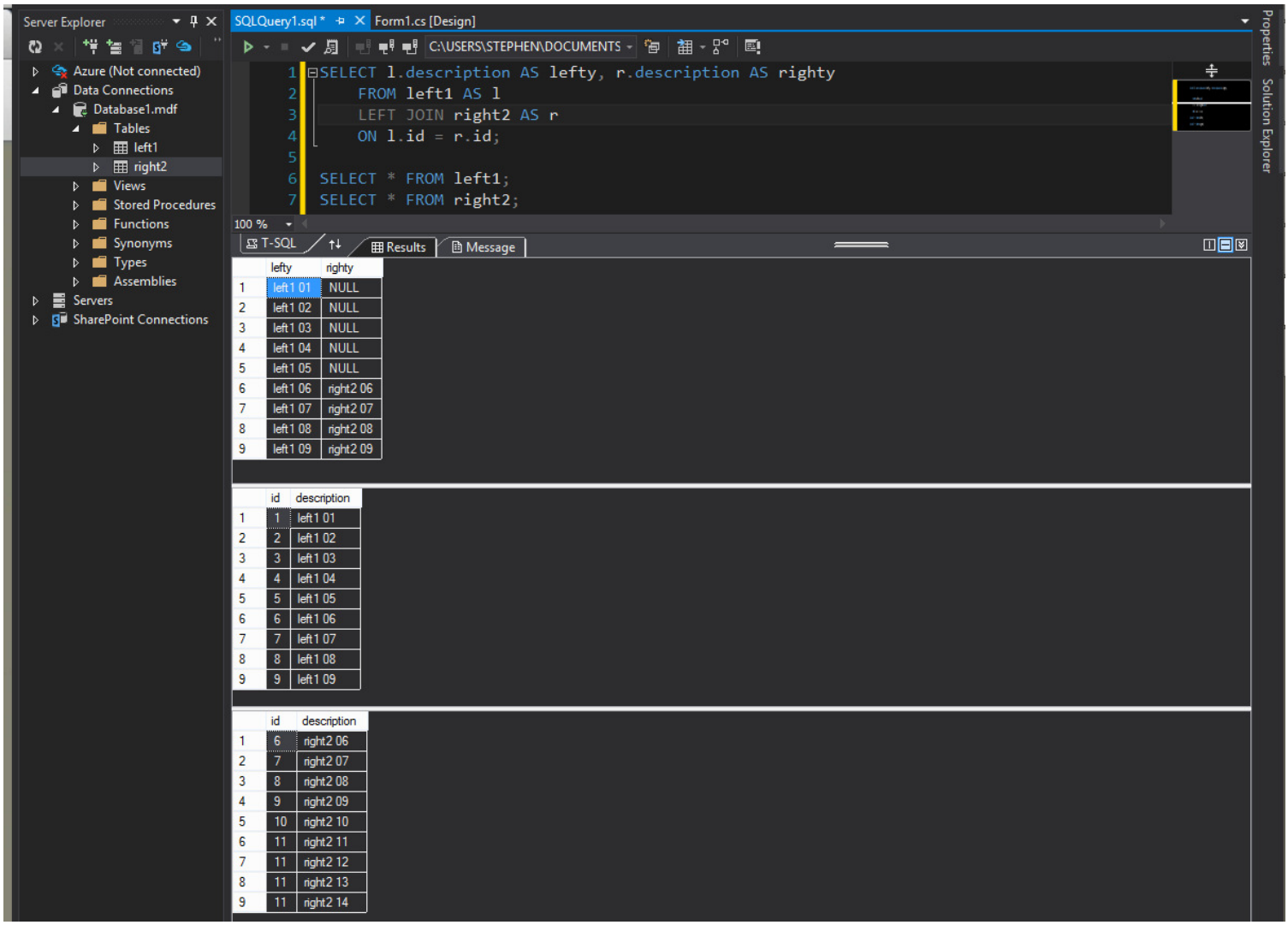
Select both tables



Create a basic join. `ON l.id = r.id;  // join on the rows that the condition is met`



All the results from the left column and the inner join.

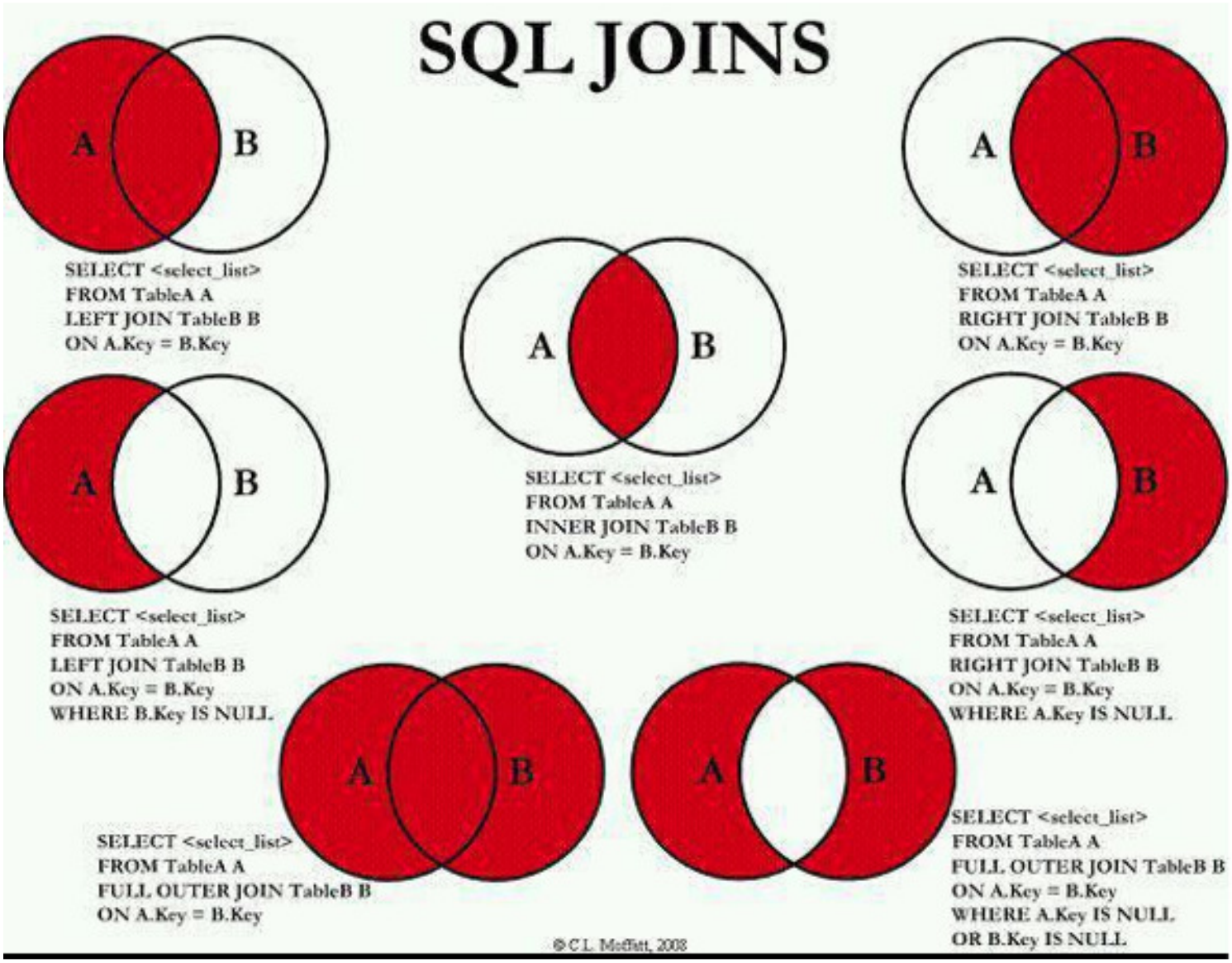


	lefty	righty
1	left1 01	NULL
2	left1 02	NULL
3	left1 03	NULL
4	left1 04	NULL
5	left1 05	NULL
6	left1 06	right2 06
7	left1 07	right2 07
8	left1 08	right2 08
9	left1 09	right2 09

	id	description
1	1	left1 01
2	2	left1 02
3	3	left1 03
4	4	left1 04
5	5	left1 05
6	6	left1 06
7	7	left1 07
8	8	left1 08
9	9	left1 09

	id	description
1	6	right2 06
2	7	right2 07
3	8	right2 08
4	9	right2 09
5	10	right2 10
6	11	right2 11
7	11	right2 12
8	11	right2 13
9	11	right2 14

Join SELECT * FROM Orders INNER JOIN Customers;
SELECT firstName, lastName, orderAmount FROM Customers INNER JOIN Orders ON CustomerID = CustomerID;



View
A view stores the select statement as a table.
CREATE VIEW employeeName AS
SELECT firstName, lastName, FROM employees
Select all from the view.
SELECT * FROM employeeName

GRANT statement
Use the GRANT statement to give privileges to a specific user or role, or to all users, to perform actions on database objects. You can also use the GRANT statement to grant a role to a user, to PUBLIC, or to another role.
Syntax
GRANT privilege-type **ON [TABLE] {** table-Name **|** view-Name **} TO** grantees
Example
To grant the SELECT privilege on table Clerks to all users, use the following syntax:
GRANT SELECT ON TABLE Clerks to PUBLIC

INDEX
The CREATE INDEX statement is used to create indexes in tables.
Indexes allow the database application to find data fast; without reading the whole table.
CREATE INDEX index_name
ON table_name (column_name)
Example
CREATE INDEX LOCATION_POSTAL_CODE
ON Locations (Postal_Code)

SQL Fundamentals

Download and PowerShell, run SQLite3.exe create new database.

```
sqlite>../sqlite3.exe PatsClothesShop.db
Customer     Order
```

```
sqlite> CREATE TABLE Customer(
   costumerID INT PRIMARY KEY   NOT NULL,
   firstName           CHAR(50) NOT NULL,
   lastName            CHAR(50) NOT NULL,
   address             VARCHAR(200),
   city                CHAR(10),
   county              CHAR(10),
   creditLimit…….      REAL,
   costomerSince       DATETIME
);
```

```
sqlite> CREATE TABLE Order(
   orderID INT PRIMARY KEY    NOT NULL,
   orderDate          DATETIME NOT NULL,
   orderAmount        REAL,
   paymentType        INT,
   customerID         INT      NOT NULL
);
```

```
sqlite>.tables
Customer     Order
```

```
sqlite>.header on
sqlite>.mode column
sqlite>.timer on
```

Insert 5 customers like below

```
INSERT INTO Customers (firstName, lastName, address, city, county, creditLimit,
costomerSince)
VALUES (1, 'Paul', 'Murphy' 32, 'Apt 1', 'Dublin', 15000.00, '2007-01-01 10:00:00' );
```

Databinding

Utilizing Databinding in a C# Win forms App. Data sets working with the System.Data Namespace (aka ADO.NET) Working with the Visual Studio's IDE's tools, windows, etc. Microsoft Visual Studio 2013 makes it easily to create databases for beginners and experts.

Databinding the user interface controls, retrieve and display data from a data source without requiring the programmer to worry about all the programmatic details of this process. Each user interface control has different properties that can be bound to a data source.

ADO = ActiveX Data Objects
User interface controls must be data binding "aware", ADO.NET(System.Data) classes support data binding.

- ADO.NET creates a connection to a data source (database)
- ADO.NET manages the conversation (requests and responses) between your application and the database.
- ADO.NET manages the data that is retrieved forum the response to the database query.
- BindingSource manages the connection between the user interface controls and the underlying data set retrieved from the database. Provides an application interface to reduce learning curve for the end user. Restrict access to the database to maintain security. To control the presentation of the data. Maintain the integrity of the data.Practice

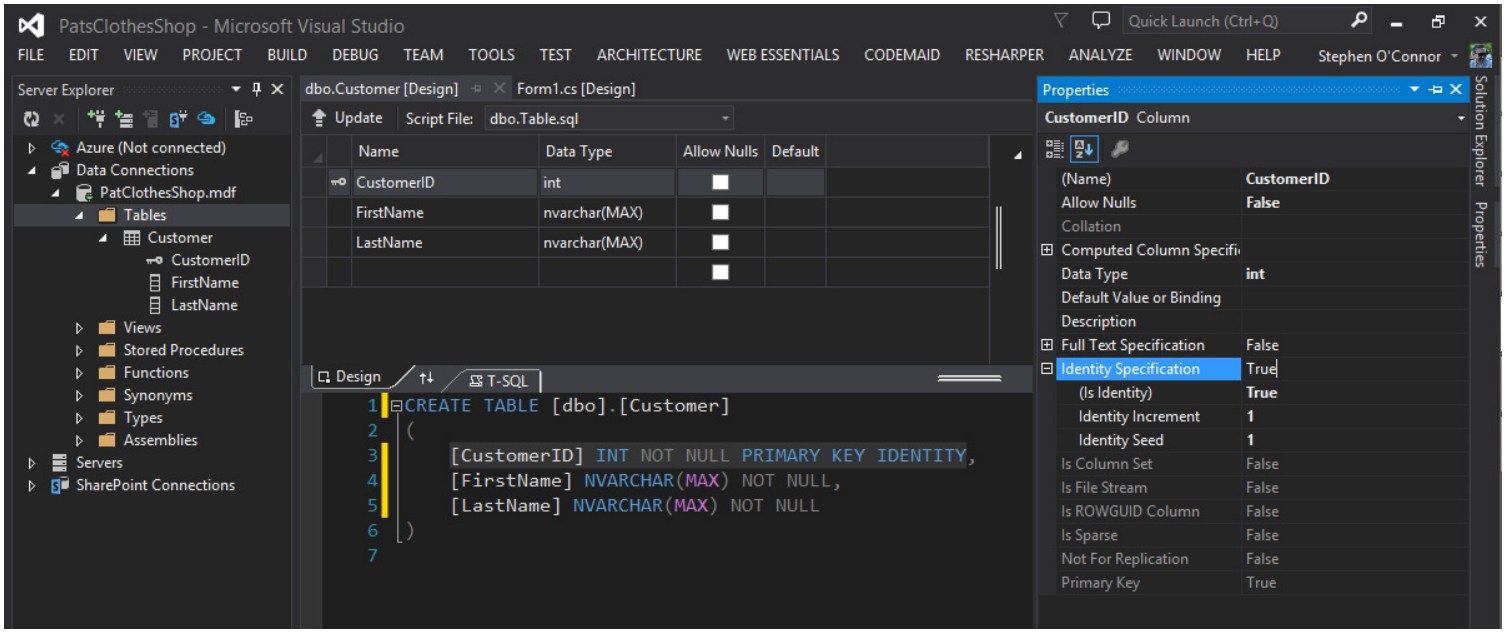
ADO.NET does a lot of the grunt work, it is not necessary to know all about ADO.NET.

Write application interface

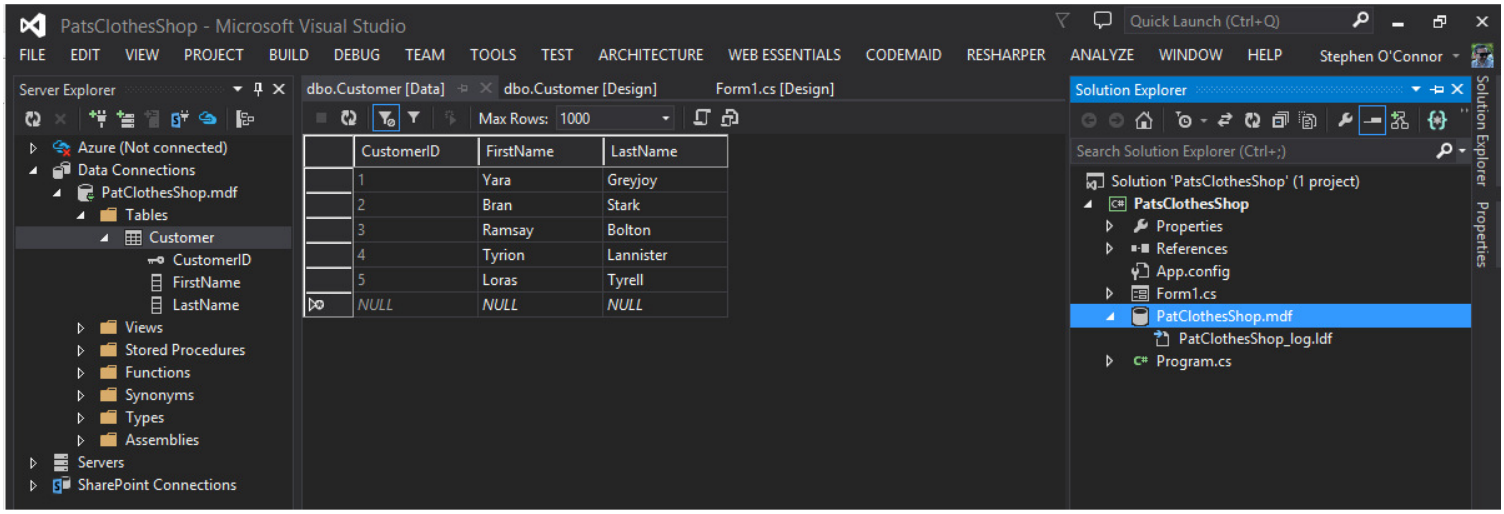
- Reduce the learning curve for the end user
- Restrict access to the database to maintain security
- To control the presentation of the data – website, content management system
- To maintain the integrity of the data

SQL Server
A high end relational database management system.
SQL server 2013 Express Edition, similar power, but intended for smaller projects.
In Visual Studio 2013 download the latest SQL Server Data Tools, if already not installed.

Learn by doing
Create a new project and a database called PatClothesShop
Create a project called Pats
Add a table called customer with the data below.

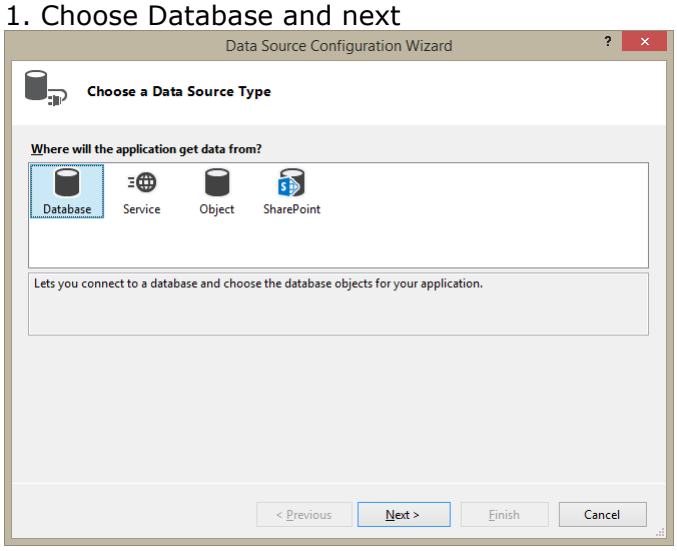


Go to show table data in the Server Explorer add five persons.

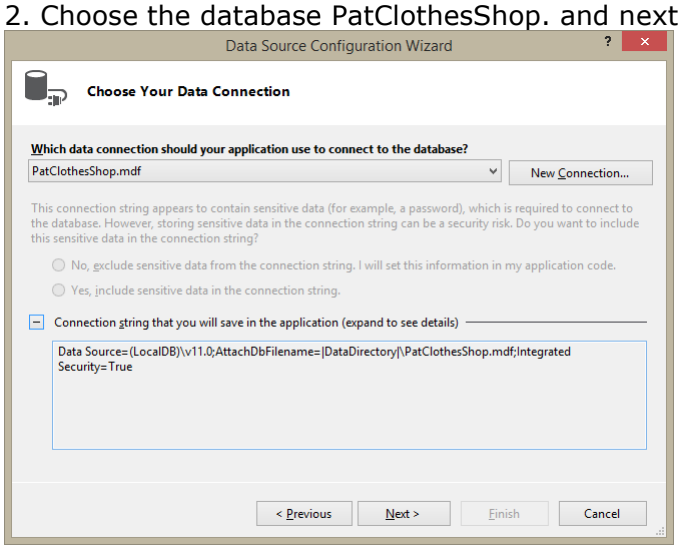


On the menu bar, choose View, Other Windows, Data Sources (or choose the Shift+Alt+D keys). Follow the steps.

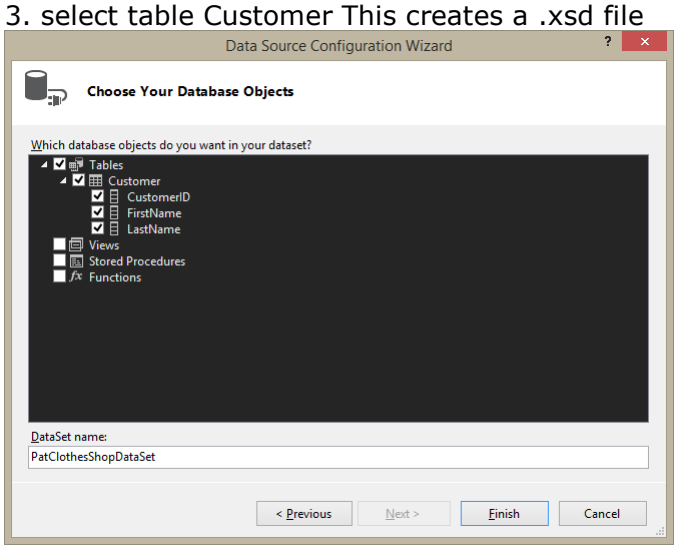
1. Choose Database and next



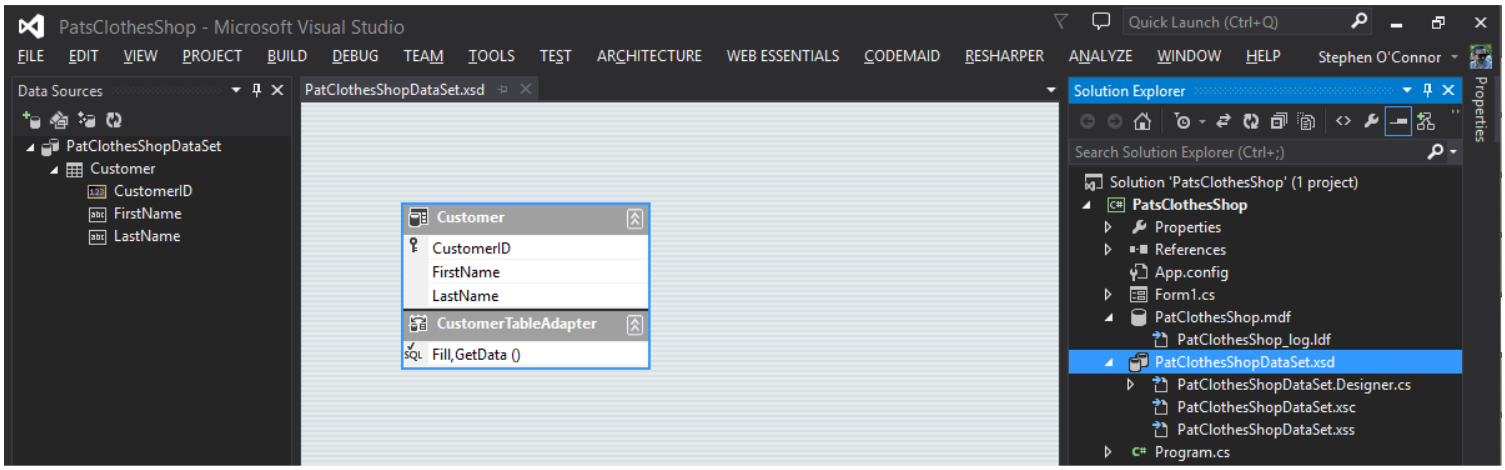
2. Choose the database PatClothesShop. and next



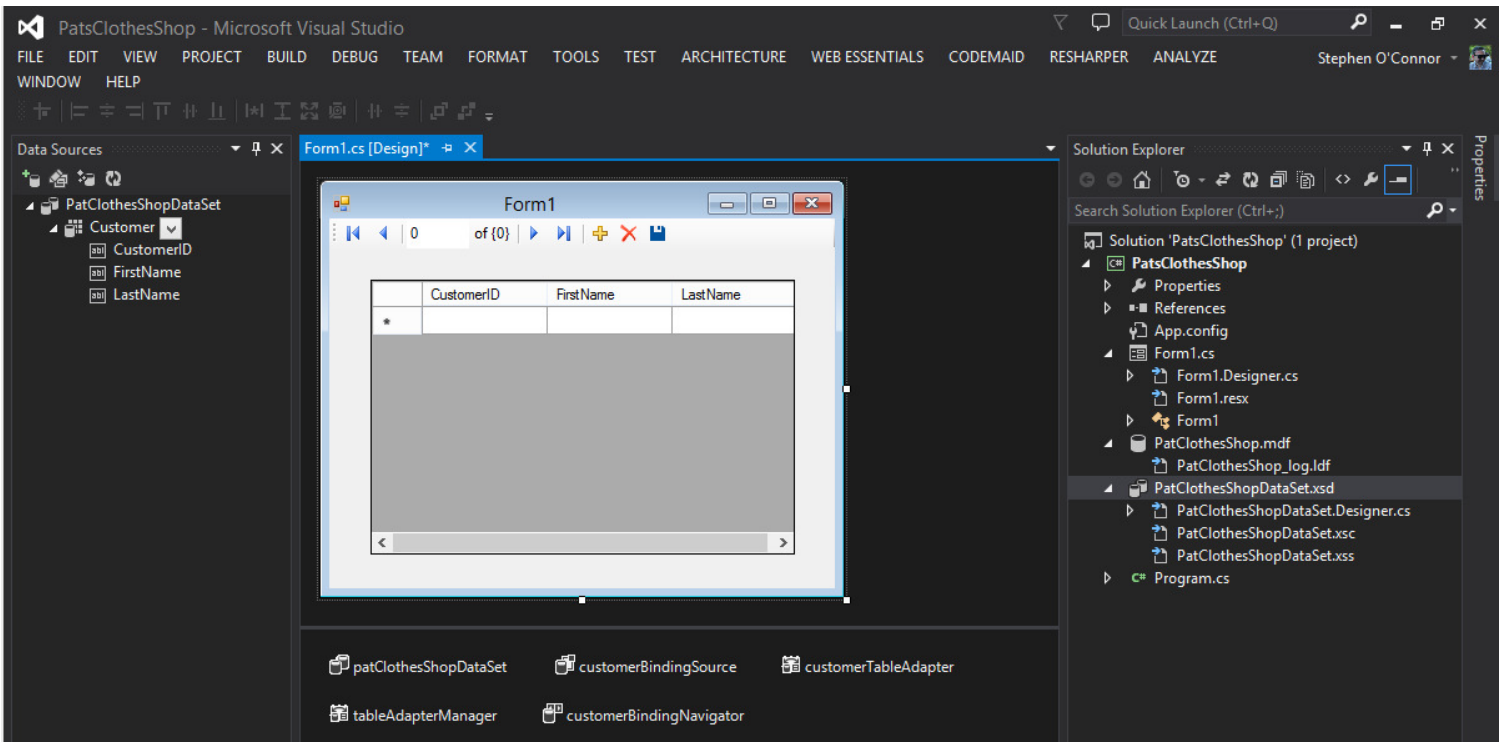
3. select table Customer This creates a .xsd file



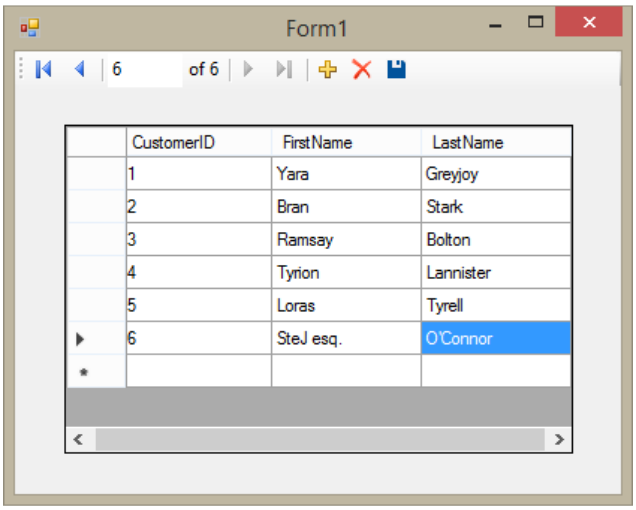
A PatClothesDataSet.xsd file right click on the xsd file and view designer mode. Xsd file is the xml schema document. The xsd file a local copy of database, this file defines the database, temporary stores the data.



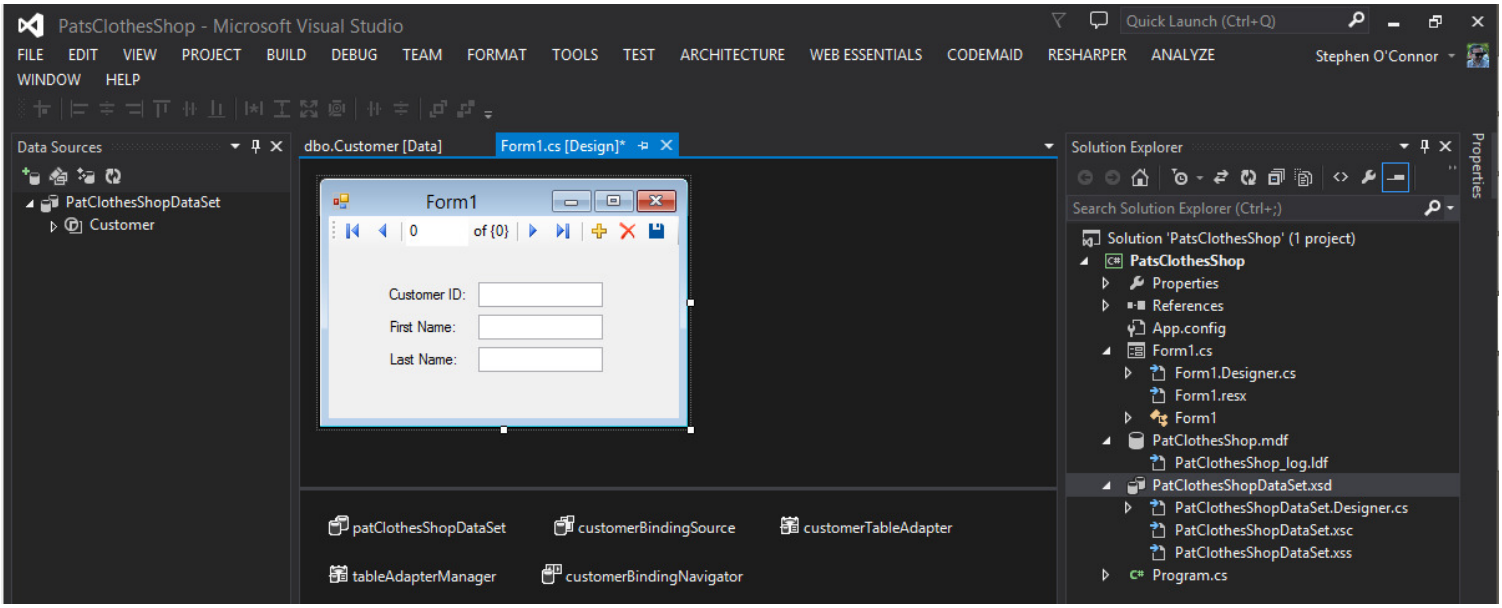
Drag and drop customer table from the Data Sources toolbar.



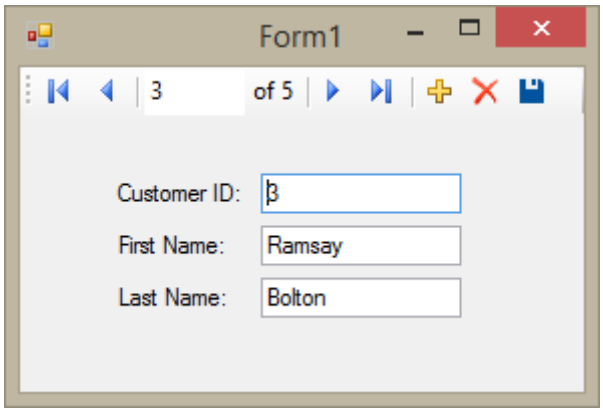
Run the project. A grid of the database navigate through the grid and add an extra row.



To create a Form view; select details from the drop down onto Form1



Run the application and navigate through the details view.



Designer tray.
patClothesShopDataSet
The local container for the data within the application. Once the form is opened the dataset gets populated from the data from the database. Temporary storage container.

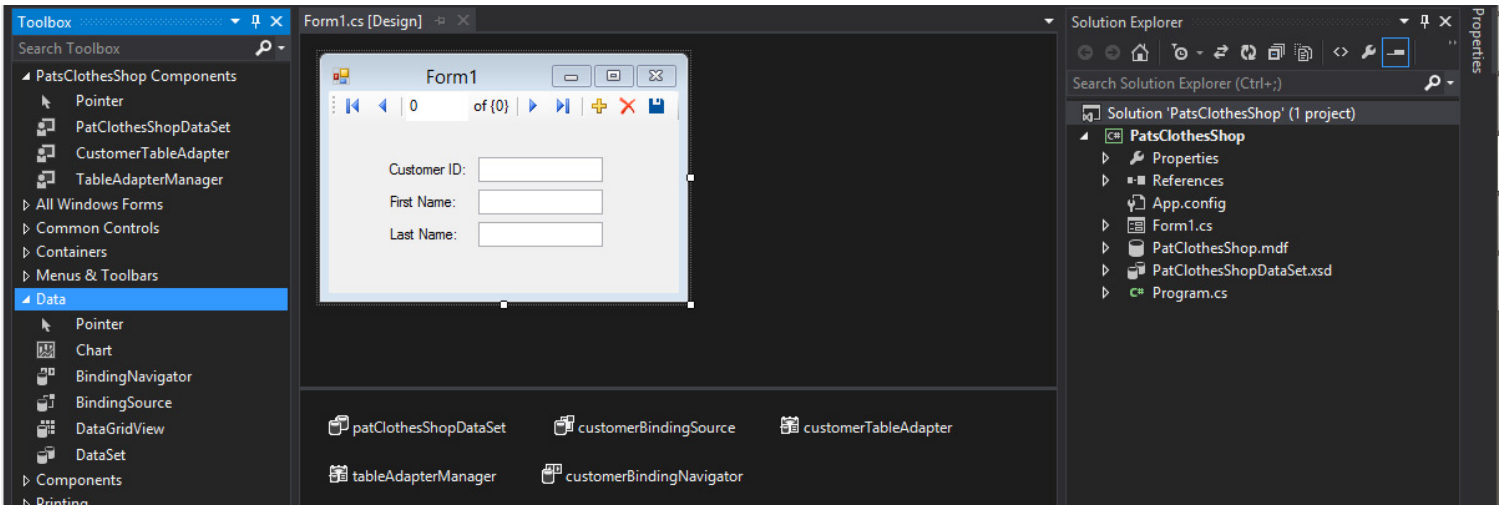
patClothesShopBindingSource
Object /bridge between the information in the dataset and the current row that's being displayed on the form. Keep all of the controls on the form bound to row of data in the DataSet. Co-ordinates what row of data should be currently displayed. The user indicated wanted to go to the first row or the next row or the last row

patClothesShopTableAdapter
Retrives data from the database, it contains a connection to the database. Contains an object that connects to the PatClothesShop.mdf to retrieve and resolve the information back into the database. Delete, update, add.

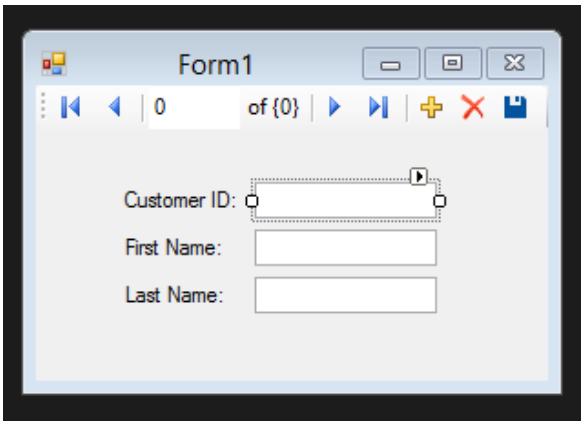
patClothesShopAdapterManager
Service interface

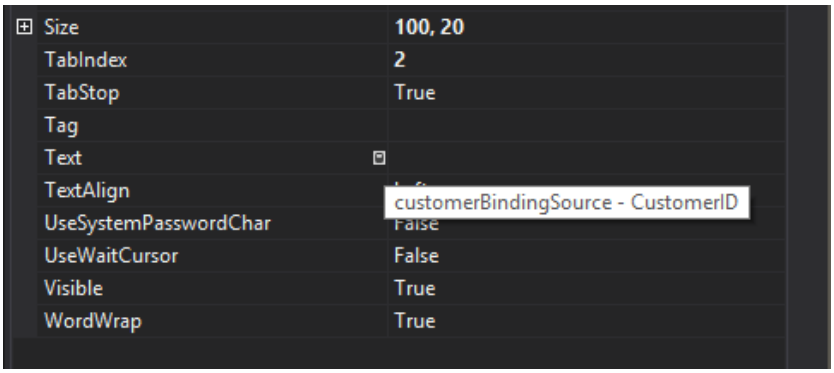
patClothesShopBindingNavigator
Toolbar at the top of the form.

Go to toolbox and select data to show data tools that can be added manually to the form.

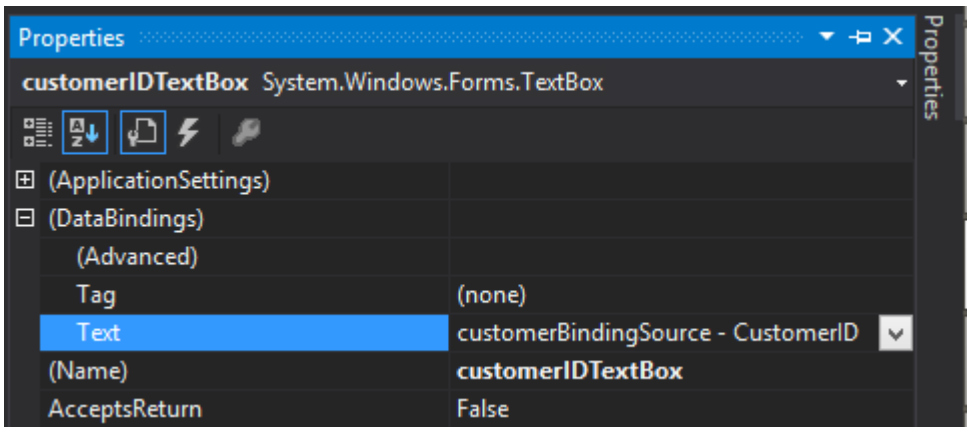


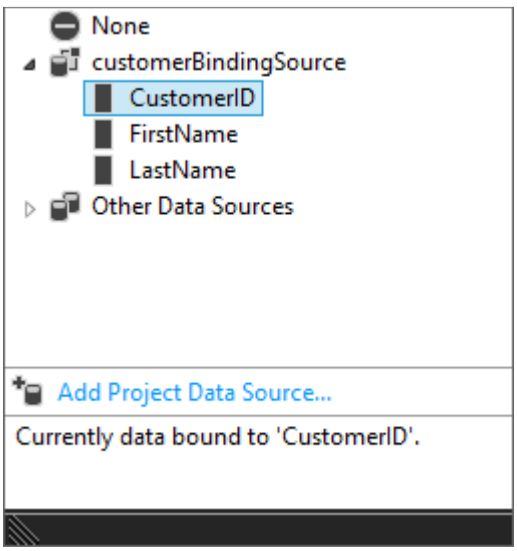
Properties of the first textbox. In the Text a Database icon is displayed.



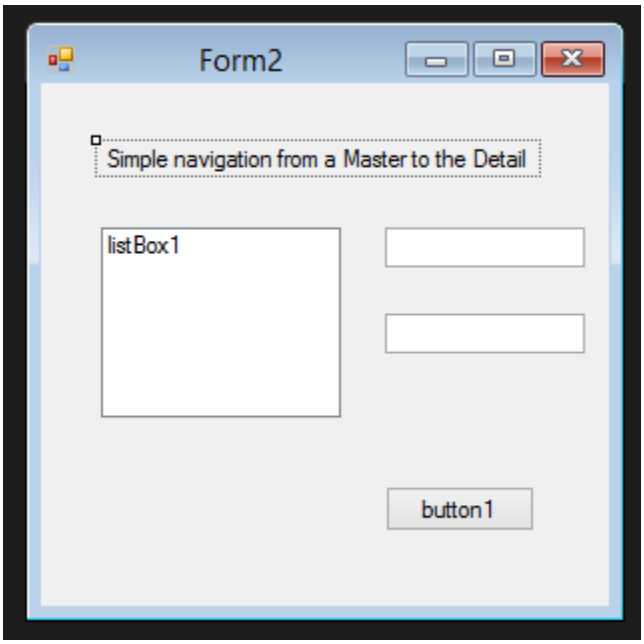


Select and right click to display the propertites of the textbox. CustomerID is binded to the first textbox. Binding source schema document. By using the data sources toolbar the database can be dragged and dropped onto the form, sets the textboxs automatically.



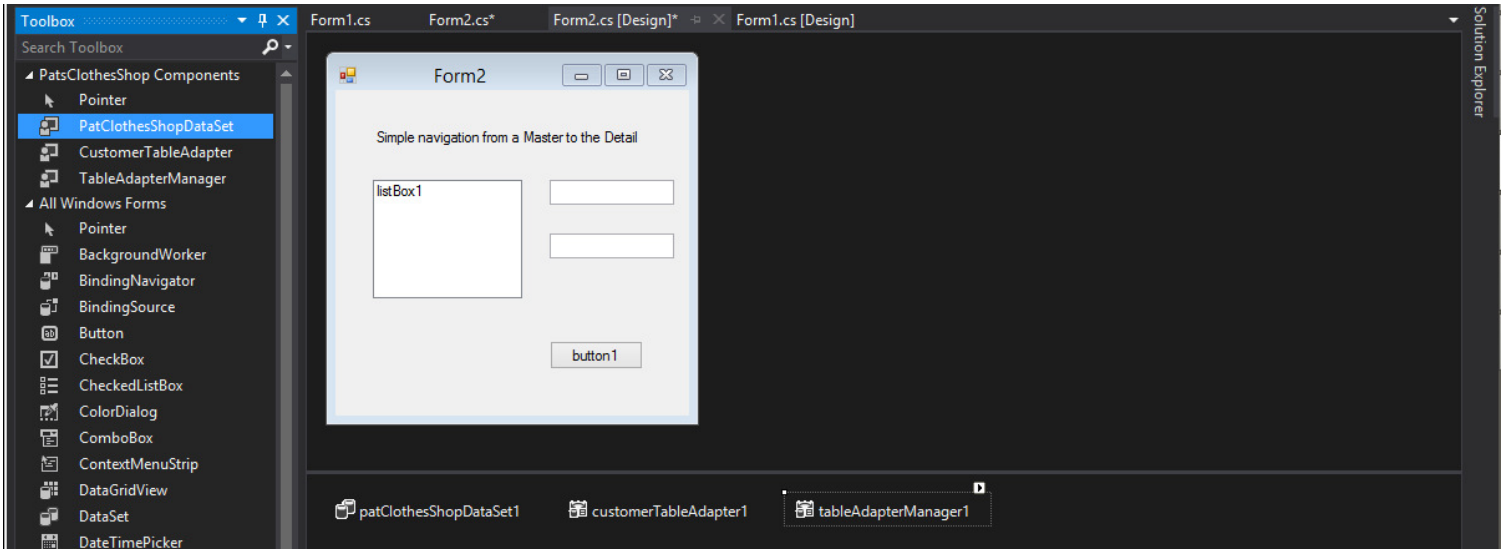


Add the data items manually.
Strongly typed components or preconfigured.
Create a new form form2 add the items displayed in the below image. Label, Listbox, 2 textboxs and a button.



Add a button to form1 to open form2. Type the code below to create an instance of the class Form2

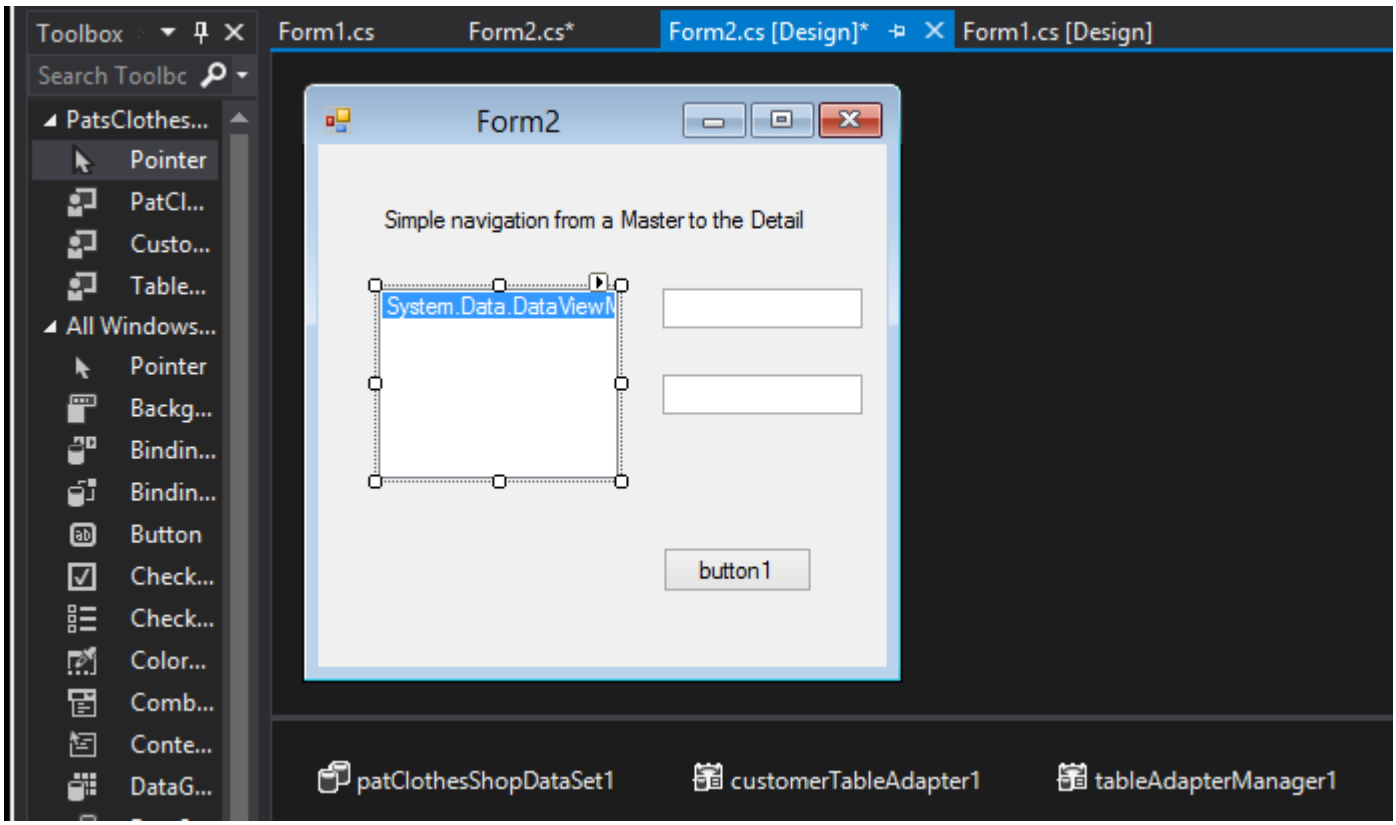
```
Form2 myForm = new Form2();
            myForm.Show();
```

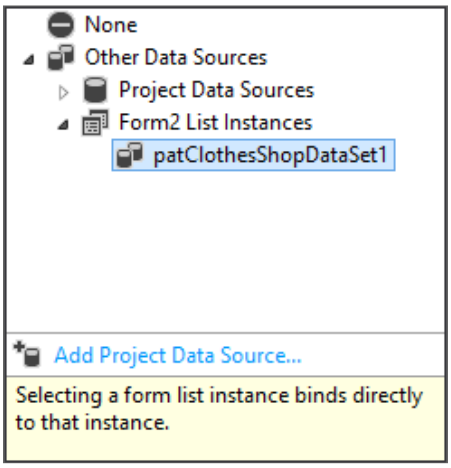


Double click form2 type the code below. Fill method passes in `patClothesShopDataSet1.Customer`
Fill method takes action to grab the data from the database and populate the customer table of the database with the data it retrieves.

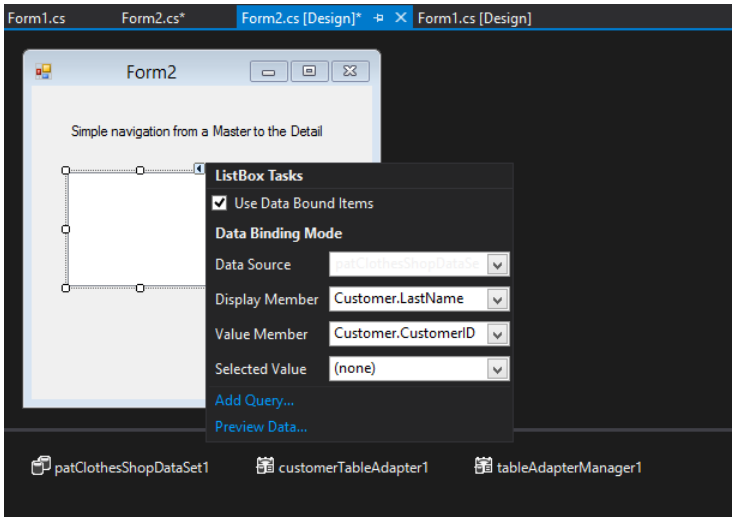
```
private void Form2_Load(object sender, EventArgs e)
        {
            customerTableAdapter1.Fill(patClothesShopDataSet1.Customer);
        }
```

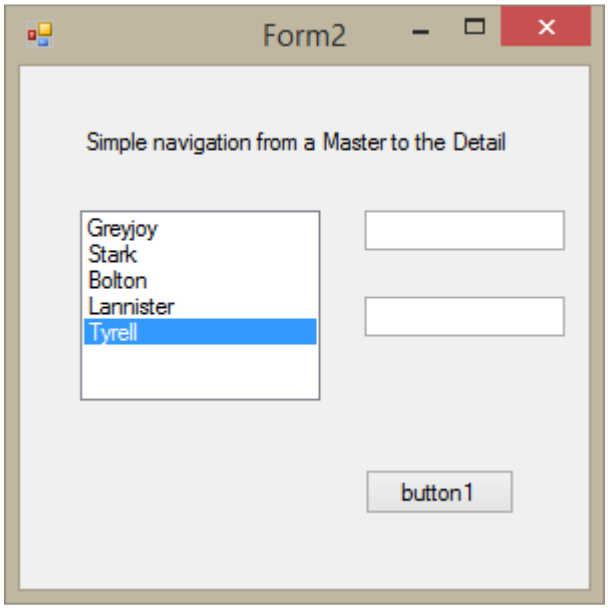
Select the listbox click the arrow and select patClothesShopDataSet1, from the pop-up box.



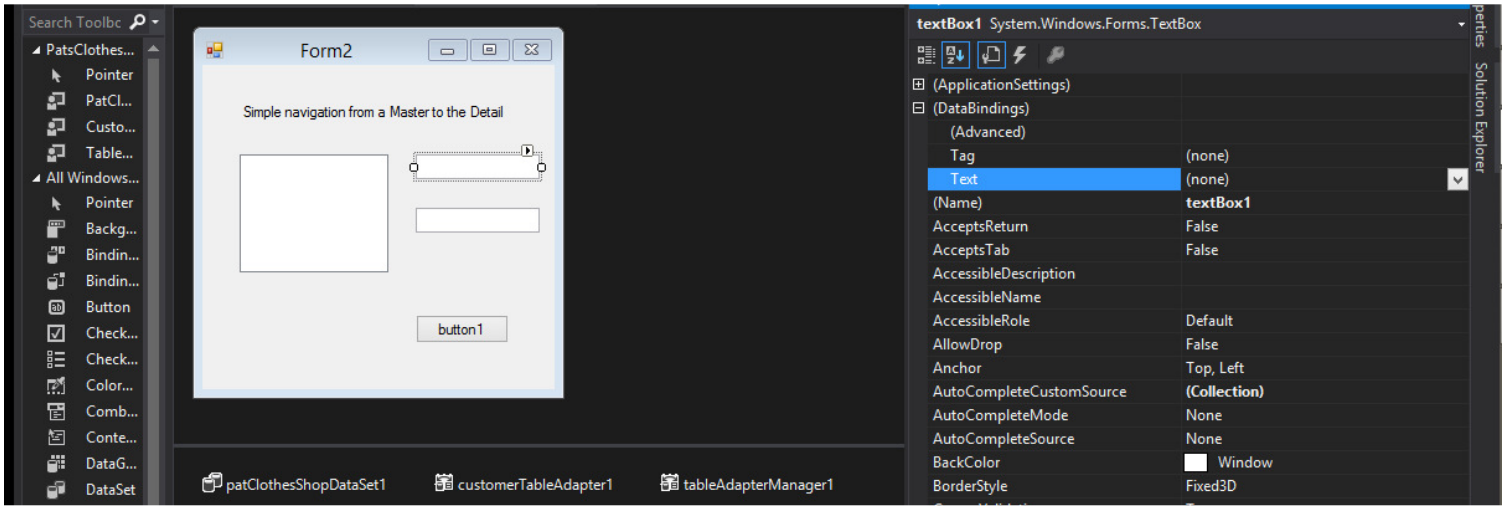


Select the list box and click the arrow button to data bound the listbox to the dataabse. Check the checkbox Use data bound items. From the pop-up select the data source patclothesshop1. In Display member select the last name and Customer last name this will displayed. In value member select the CustomerID, which is always unique.

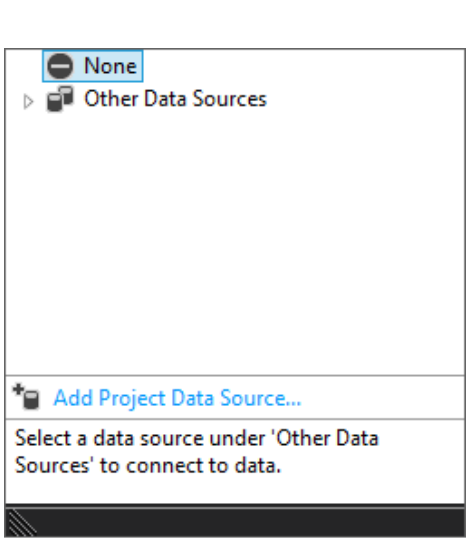


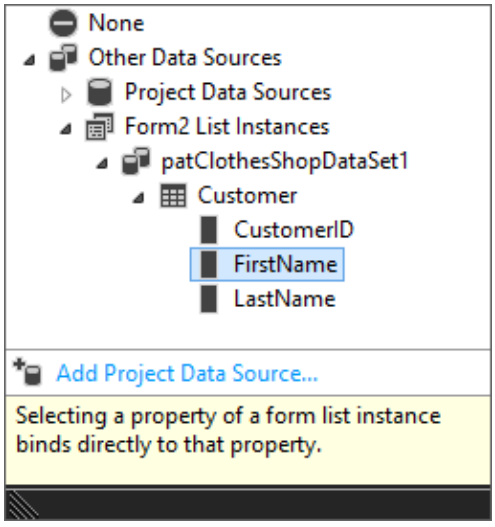


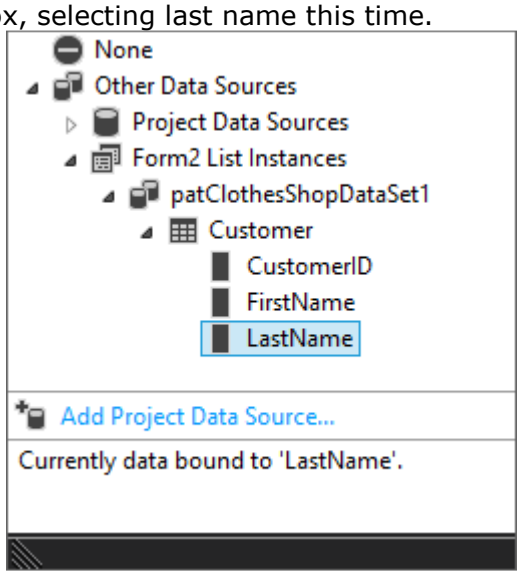
Bind the textboxs on the right with the listbox on the left. Select the first textbox and right click properties go to databindings and select text click the drop down arrow.



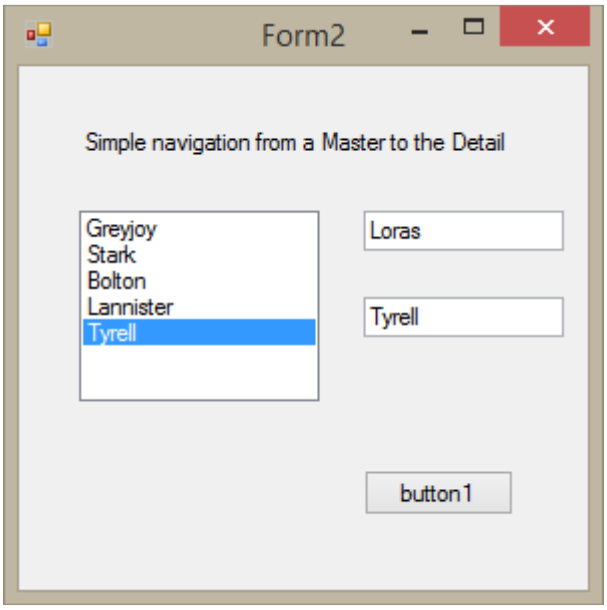
From the pop-up select first name for the first textbox. Go back to the form and select and right click the second textbox go to properties and repeat steps for the second textbox, selecting last name this time.



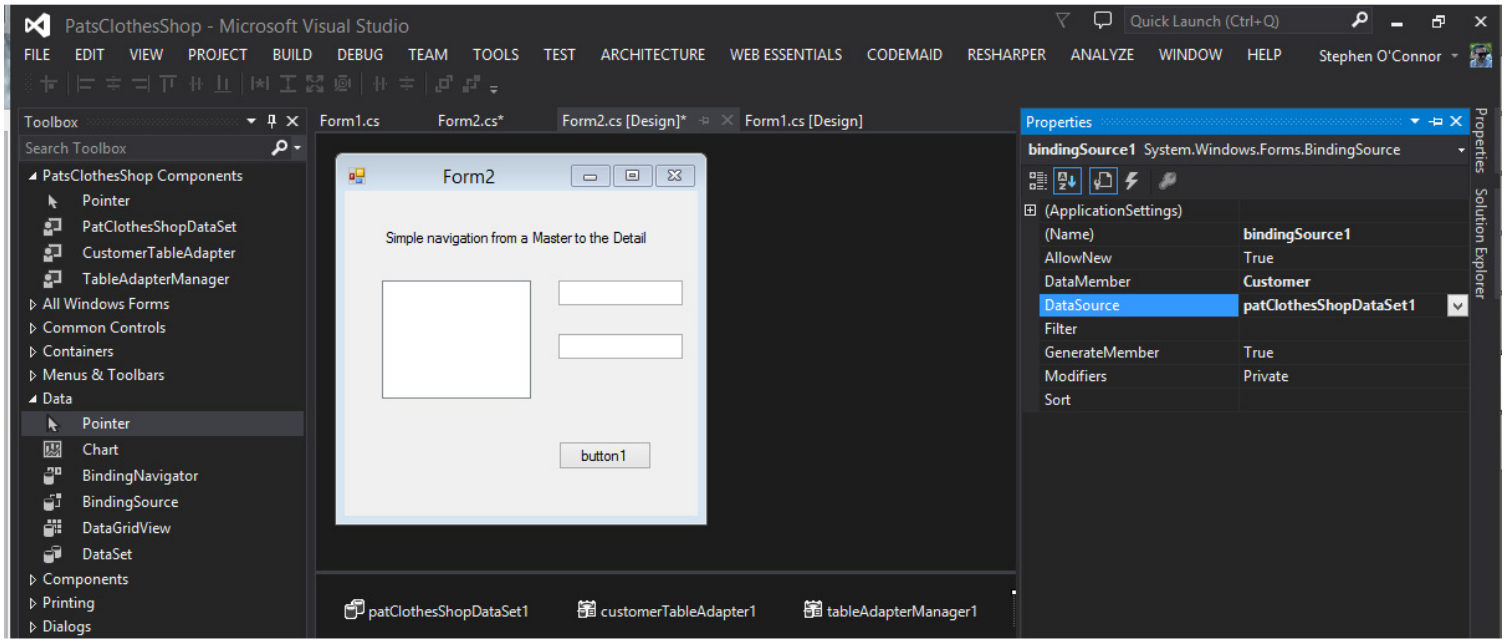




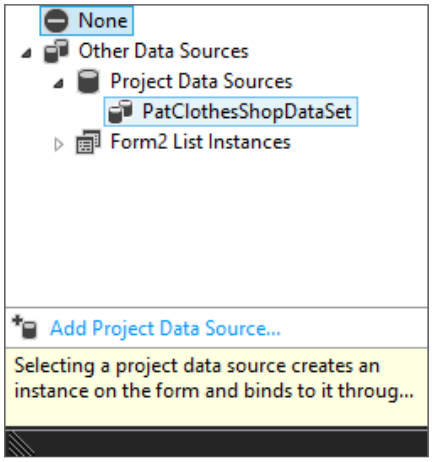
Run the application, open second form. Select from the listbox to display the first name and last name of the person in the textboxs.



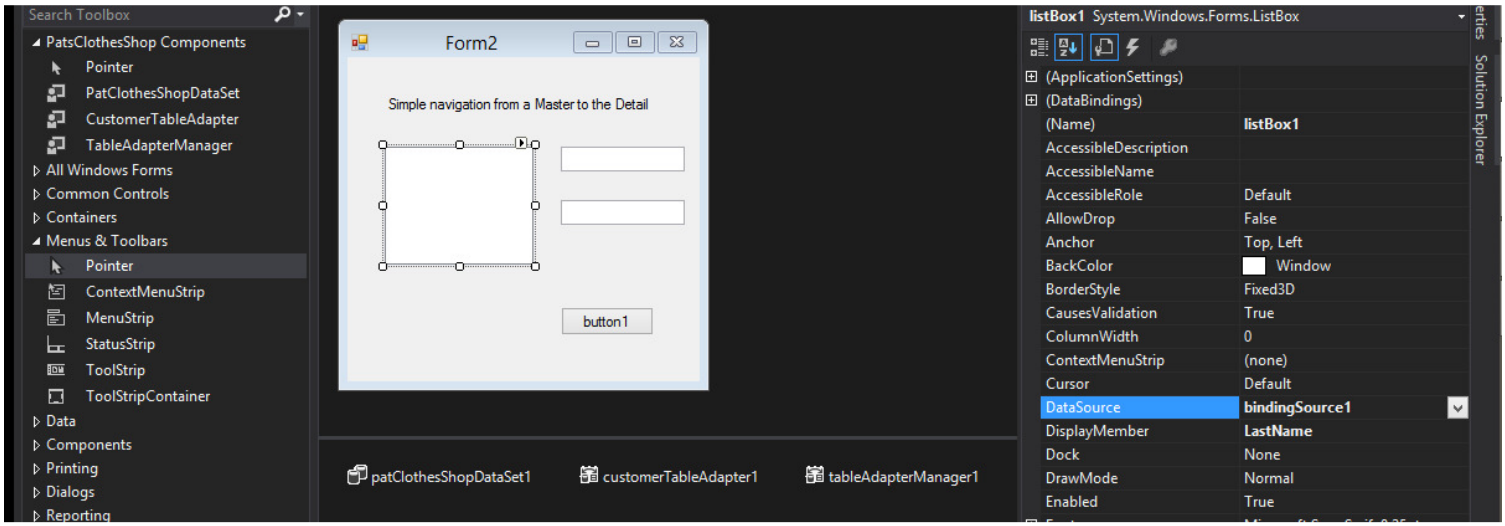
Updating capabilities. Drag and drop the BindingSource onto form2. To update the data. Hover over and read the description of the BindingSource tool. The bindingSource1 has been added to the designer tray.

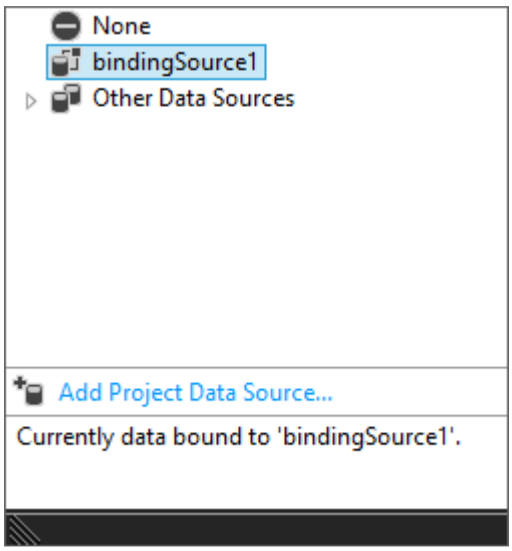


Click bindingSource1 and select PatClothesShopDataSet from the properties DataSource pop-up. Select Customer as the DataMember.

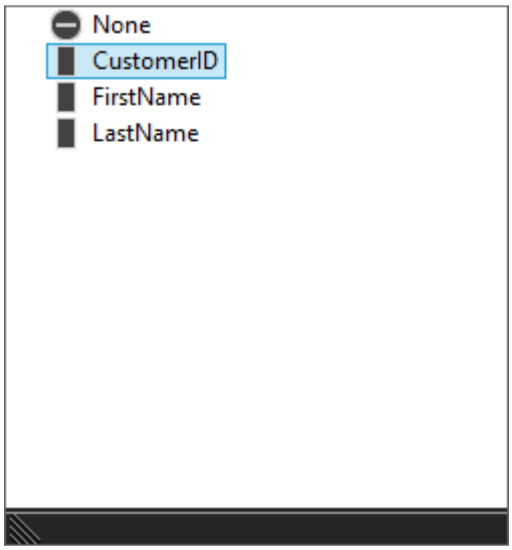


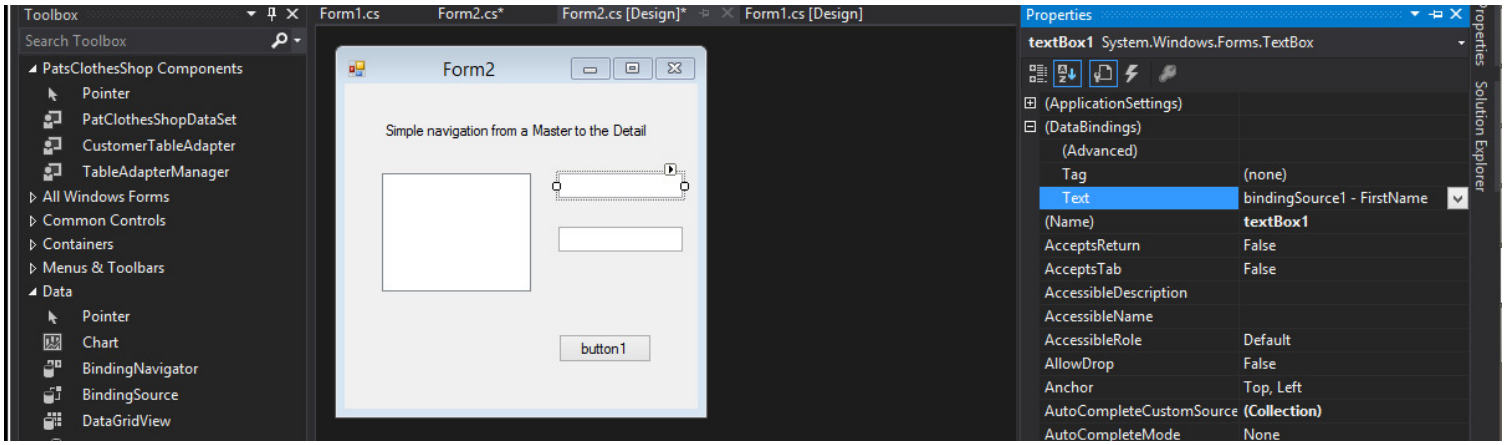
Select listbox go to data source select bindingSource1. Change the DisplayMember to LastName.



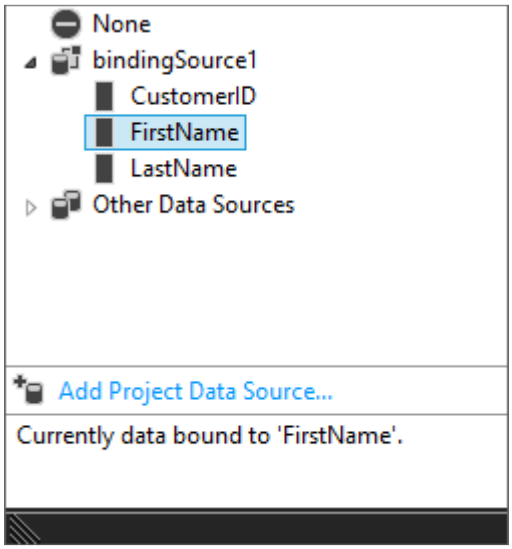


Select Value member in the listbox from properties and change to CustomerID.

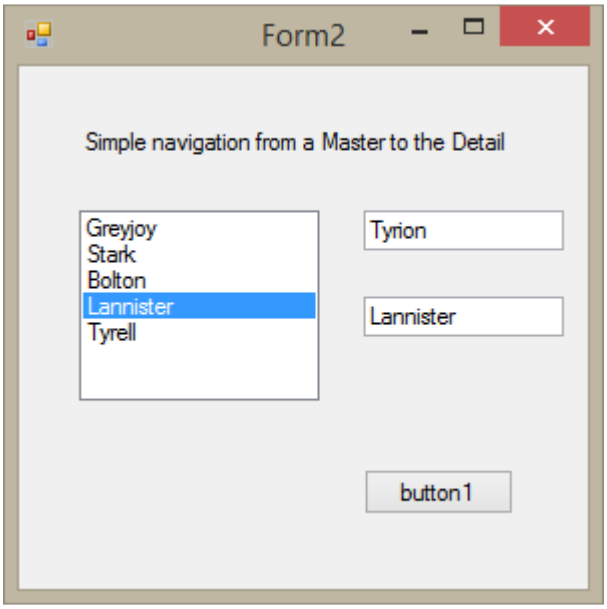




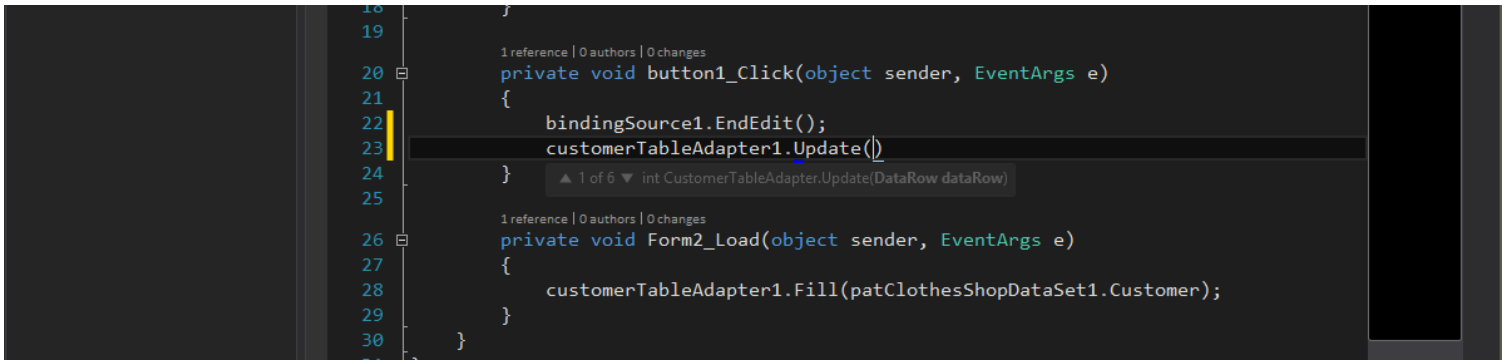
Select the properties of the first and second textboxs and select first and last name respectively.



Run application to check if it still works.



Double click the button on form2




```
private void button1_Click(object sender, EventArgs e)
        {
            bindingSource1.EndEdit();
            customerTableAdapter1.Update(patClothesShopDataSet1.Customer);
        }
```

```
            // save changes to the dataset
            bindingSource1.EndEdit();

            // select TableAdapter and return number of items updated
            customerTableAdapter1.Update(patClothesShopDataSet1.Customer);
```

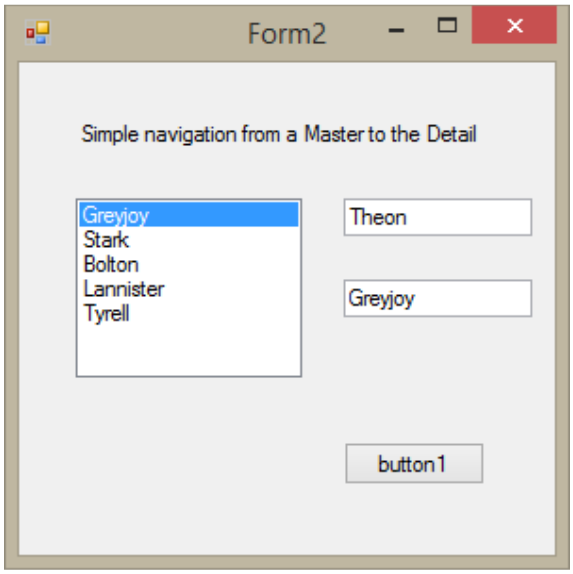
```
            // save changes to the dataset
            bindingSource1.EndEdit();

            int result = 0;

            // return number of items updated
            result = customerTableAdapter1.Update(patClothesShopDataSet1.Customer);

            // display the row has been updated
            MessageBox.Show(result.ToString());
```

Open the .exe file in the debug /bin folder. Change Yara (first name to Theon) close and reopen .exe file and see the change made to the database.



stackoverflow
Actually this is not a issue with update command. Visual Studio keeps two databases. One in project folder and one in bin/debug folder. Database in bin/debug folder always update with Database in project folder. If you view Database through Visual Studio, it always shows the Database inside the project folder not other one inside bin/debug folder.

XML eXtensible Markup Language
Similar to HTML in it's use of the tags <></>
XML contains self-describing structured data but omits presentation (formatting) information.
XML is used to store or transfer data between disparate computing platforms, operating systems, software application, etc.
XML is an open standard, as opposed to a proprietary data format.
Common easily readable format for computer and humans, very portable.
XML used extensively in the .NET Framework.
XML's relationship to ADO.NET Datasets
Allows for a disconnected means of working with data, then allows for easy synchronization of changes back to the original data store.

- XML is used for syndicated RSS feeds
- XML is used to store or transfer data between disparate computing
- XML contains self-describing

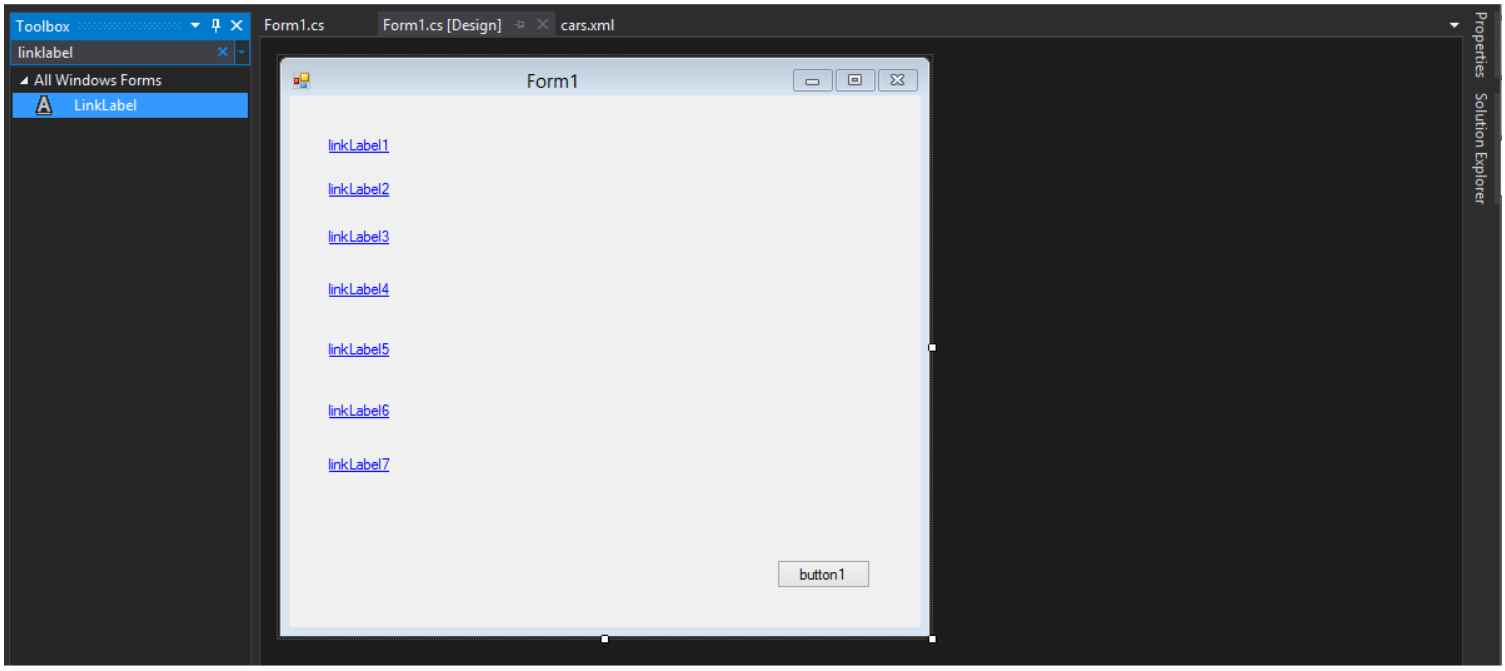
Create an XML file called cars.
Create a root element /node `carcollection`, all XML documents have to have a root element.
Inside the `carcollection` element /node create two elements called car these are the sub elements /children of `carcollection`.
Inside the car elements create a sub-element called make.
It can one or the other but not both or it can contain an attribute.
Tag name are created by the programmer.
Pretty much free form, however follow a pattern to make it readable for others and yourself.
A need for consentience valid documents the structure of the XML and follows the rules of XML a well formed XML document.
A valid document and well formed.

```
<?xml version="1.0" encoding="utf-8" ?>
<carcollection>
  <car>
    <make>DeLorean</make>
    <model>Time Machine</model>
    <year>1981</year>
  </car>
  <car>
    <make>Cadillac</make>
    <model>Ecto-1</model>
    <year>1984</year>
  </car>
</carcollection>
```

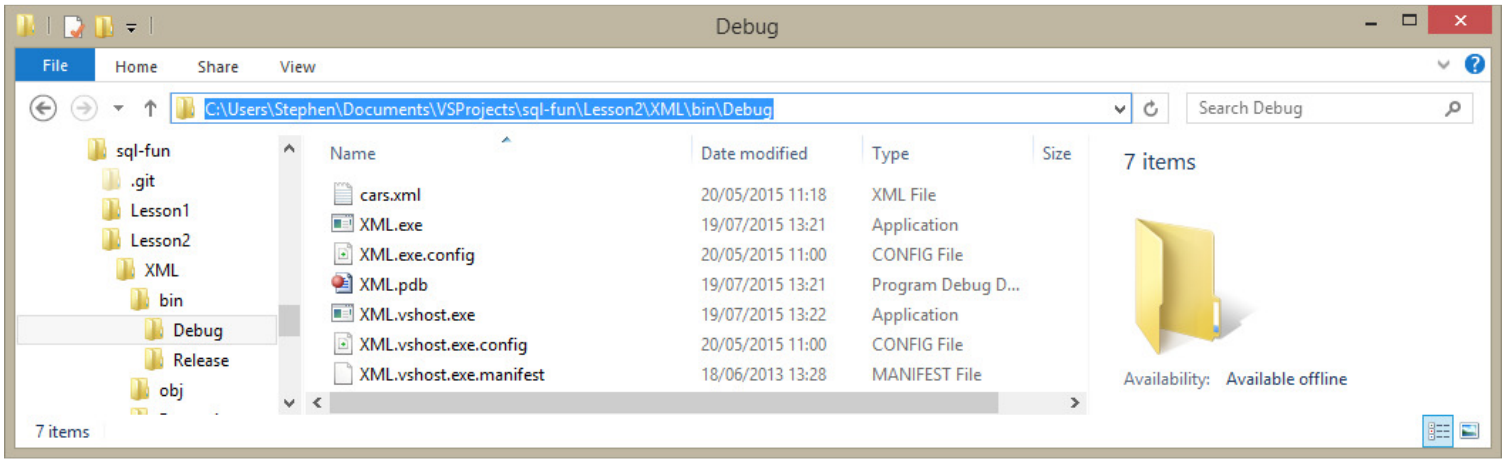
XML Schema Document

Using C# and .NET Framework Class Library to open and navigate through an XML file

Add seven linkLabels and a button



Save the XML document in the bin /debug folder



@"cars.xml" is the location of the XML file

```
            // StreamReader will retrieve the file from the source
            // and will convert it into a stream ready to be processed
            System.IO.StreamReader sr = new System.IO.StreamReader(@"cars.xml");
```

```
            // XmlTextReader
            System.Xml.XmlTextReader xr = new System.Xml.XmlTextReader(sr);

            // XmlDocument
            System.Xml.XmlDocument carCollectionDoc = new System.Xml.XmlDocument();

            carCollectionDoc.Load(xr);

            // using the InnerText property will give us just the data
            // ... since we are at the entire Document level, it will
            // give us *all* the values (no delimiter).
            linkLabel1.Text = carCollectionDoc.InnerText;
```

SQL Fundamentals

Useful links
View Constraint
Aggregate Functions (Transact-SQL)
GRANT statement
SQL HAVING Clause
SQL Cast
SQL JOINS using SETS

A view provides several benefits.
1. Views can hide complexity
If you have a query that requires joining several tables, or has complex logic or calculations, you can code all that logic into a view, then select from the view just like you would a table.
2. Views can be used as a security mechanism
A view can select certain columns and/or rows from a table, and permissions set on the view instead of the underlying tables. This allows surfacing only the data that a user needs to see.
3. Views can simplify supporting legacy code
If you need to refactor a table that would break a lot of code, you can replace the table with a view of the same name. The view provides the exact same schema as the original table, while the actual schema has changed. This keeps the legacy code that references the table from breaking, allowing you to change the legacy code at your leisure.
These are just some of the many examples of how views can be useful.

SQL Fundamentals

My Set-up