

Explain LINQ in Detail?

- LINQ(Language Integrated Query) stands for "Language Integrated Query" and pronounced as "LINK".
- LINQ was introduced with .NET Framework 3.5 including Visual Studio 2008, C# 3.0 and VB.NET 2008 (VB 9.0).
- LINQ is **uniform query syntax in C# and VB.NET used to save and retrieve data from different sources** like an Object Collection, SQL server database, XML, web service etc
- LINQ can be **Witten in any .NET Supporting Language.**
- LINQ has its **own Query Processing Engine.**

- Information returned by a **LINQ query is a collection of in-memory object which may be enumerated.**
- The LINQ concept treats the data source as an Object, rather than a Database. So we may say, its an object that is queried.
- LINQ may query any type of data source, like:
 - ❑ LINQ querying SQL (MS SQL Server supported).
 - ❑ LINQ querying Datasets (Querying is possible on Datasets and DataTables)
 - ❑ LINQ querying ORM Solution
 - ❑ LINQ querying Objects (In-memory data may be queried)
 - ❑ LINQ querying XML (Querying is possible on XML data source)
- LINQ supports querying to those objects that implement the IEnumerable Interface.

Why use LINQ ?

- ❑ LINQ has **full type checking at compile-time** and **IntelliSense support** in Visual Studio, since it used the .NET framework languages like C# and VB.NET. This powerful feature helps you to **avoid run-time errors**.
- ❑ LINQ also **provides a uniform programming model** (i.e. common query syntax) to **query various data sources**. Hence you don't need to learn the different ways to query different data sources.

What is LINQ Provider?

- ❑ It is a **way to communicate between LINQ Query to Data source**.
- ❑ It **Converts LINQ Queries to required format that can understand by data source**.
- ❑ There are following types of LINQ Providers
 - ❖ LINQ to Objects
 - ❖ LINQ to XML (XLINQ)
 - ❖ LINQ to SQL (DLINQ)
 - ❖ LINQ to Datasets
 - ❖ LINQ to Entities

What are advantages of LINQ?

There are following advantages of using LINQ

- ❑ It **provides a uniform programming model** (i.e. common query syntax) to query data sources (like SQL databases, XML documents, ADO.NET Datasets, Various Web services and any other objects such as Collections, Generics etc.)
- ❑ It has **full type checking at compile-time and IntelliSense support** in Visual Studio. This powerful feature helps you to avoid run-time errors.
- ❑ It **supports various powerful features like filtering, ordering and grouping** with minimum code.
- ❑ Its **Query can be reused**.
- ❑ It also **allows debugging** through .NET debugger.

What are disadvantages of LINQ?

There are following disadvantages of using LINQ

- ❑ LINQ is **not good to write complex queries** like SQL.
- ❑ LINQ **doesn't take the full advantage of SQL features** like cached execution plan for stored procedure.
- ❑ Performance is degraded if you don't write the LINQ query correctly.
- ❑ If you have done some **changes in your query, you have to recompile it and redeploy its dll to the server**.

What are the different Visual Basic features that support LINQ?

Visual Basic includes the following features that support LINQ

- ❑ Anonymous types - Enables you to create a new type based on a query result.
- ❑ Implicitly typed variables - Enables the compiler to infer and assign a type when you declare and initialize a variable.
- ❑ Extension method - Enables you to extend an existing type with your own methods without modifying the type itself.

What are different flavours of LINQ?

There are following three flavours of LINQ:

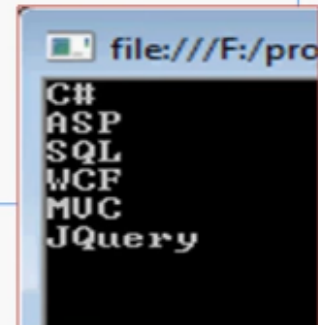
- ❑ LINQ to Objects
- ❑ LINQ to ADO.NET
 - ❖ LINQ to SQL
 - ❖ LINQ to Datasets
 - ❖ LINQ to Entities
- ❑ LINQ to XML (XLINQ)

What is LINQ to Objects ?

- ❑ It enables you to query any in-memory object like as array, collection and generics types.
- ❑ It offers a new way to query objects with many powerful features like filtering, ordering and grouping with minimum code.
- ❑ Queries in LINQ to Objects return variables of type usually **IEnumerable<T>** or **var** only. If we know about the output data type then use **IEnumerable<T>** otherwise use **var**.
- ❑ It offers many advantages of LINQ to Objects over traditional foreach loops like more readability, powerful filtering, capability of grouping, enhanced ordering with minimal application coding.

For Example :Traditional foreach loop approach

```
class Program
{
    static void Main(string[] args)
    {
        string[] Arrsubject = { "C#", "ASP", "SQL", "WCF", "MVC", "jQuery" };
        for (int i = 0; i < Arrsubject.Count(); i++)
        {
            Console.WriteLine(Arrsubject[i]);
        }
        Console.ReadLine();
    }
}
```

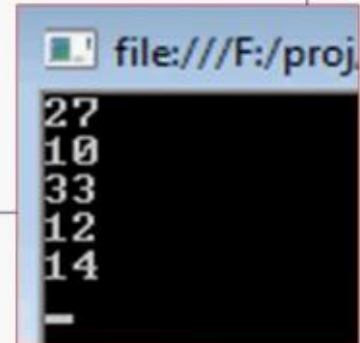


- ❑ It is not simple
- ❑ It is having many statements.
- ❑ Readability is complex
- ❑ It is DECLARATIVE, it does mean, we need to tell code what to do as well how to do.

Example 2 (LINQ to Objects): LINQ with "where" clause

```
class Program
{
    static void Main(string[] args)
    {
        int[] integers = { 1, 6, 2, 27, 10, 33, 12, 8, 14, 5 };
        IEnumerable<int> dg = from numbers in integers
                               where numbers >= 10
                               select numbers;

        foreach (var number in dg)
        {
            Console.WriteLine(number);
        }
        Console.ReadLine();
    }
}
```

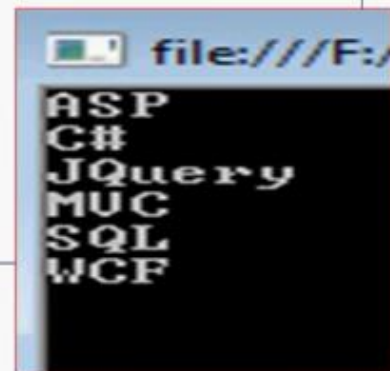


```
file:///F:/proj
27
10
33
12
14
-
```

Example 3 (LINQ to Objects): LINQ with Generating an "Ordered List"

```
class Program
{
    static void Main(string[] args)
    {
        string[] subject = { "C#", "ASP", "SQL", "WCF", "MVC", "jQuery" };
        var list = from t in subject
                    orderby t ascending
                    select t;

        foreach (string s in list)
        {
            Console.WriteLine(s);
        }
        Console.ReadLine();
    }
}
```

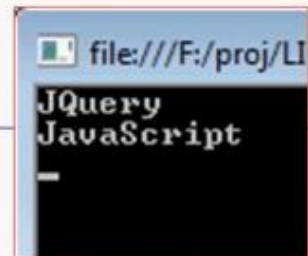


```
file:///F:/
ASP
C#
JQuery
MVC
SQL
WCF
```

Example 4 (LINQ to Objects): LINQ with "StartsWith" keyword

```
class Program
{
    static void Main(string[] args)
    {
        string[] subject = { "C#", "ASP", "SQL", "WCF", "MVC", "jQuery", "JavaScript" };
        var list = from t in subject
                   where t.StartsWith("J")
                   select t;

        foreach (string s in list)
        {
            Console.WriteLine(s);
        }
        Console.ReadLine();
    }
}
```



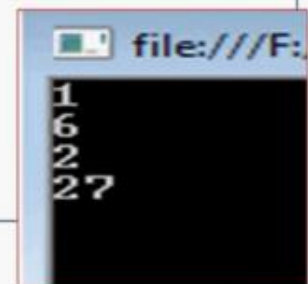
```
file:///F:/proj/LI
jQuery
JavaScript
-
```

Example 5 (LINQ to Objects): LINQ with "Enumerable" output .

Here we know the output type that's why we are using IEnumerable.

```
class Program
{
    static void Main(string[] args)
    {
        int[] integers = { 1, 6, 2, 27, 10, 33, 12, 8, 14, 5 };
        IEnumerable<int> firstFourNumbers = integers.Take(4);

        foreach (var num in firstFourNumbers)
        {
            Console.WriteLine(num);
        }
        Console.ReadLine();
    }
}
```



```
file:///F:
1
6
2
27
```


Example 6 (LINQ to Objects): LINQ with "Complex Data Type"

Step 1: First create a Model class "student.cs"

```
public class Student
{
    public int RollNumber { get; set; }
    public int Section { get; set; }
    public string Name { get; set; }
}
```

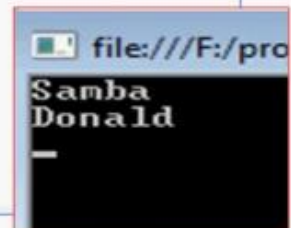
LINQ with Complex Data Type

Step 2: Use model class to perform action with LINQ

```
class Program
{
    static void Main(string[] args)
    {
        List<Student> lstStudents = new List<Student>{
            new Student() { RollNumber = 1, Name = "Alex ", Section = 1 },
            new Student() { RollNumber = 2, Name = "Jonty ", Section = 21 },
            new Student() { RollNumber = 3, Name = "Samba ", Section = 13 },
            new Student() { RollNumber = 4, Name = "Donald ", Section = 2 },
        };

        var std = from r in lstStudents
                  where r.RollNumber >= 3
                  select r;

        foreach (Student student in std)
        {
            Console.WriteLine(student.Name);
        }
        Console.ReadLine();
    }
}
```



```
file:///F:/pro
Samba
Donald
_
```


Example 7 (LINQ to Objects): LINQ with Anonymous Type

Step 1: First create a Model class "student.cs"

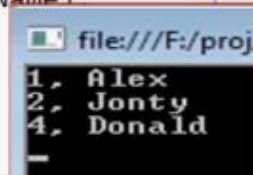
```
public class Student
{
    public int RollNumber { get; set; }
    public int Section { get; set; }
    public string Name { get; set; }
}
```

LINQ with "Anonymous Type"

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Step 2: Use model class to perform action with LINQ by using Anonymous Type

```
class Program
{
    static void Main(string[] args)
    {
        List<Student> lstStudents = new List<Student>
        {
            new Student() { RollNumber = 1, Name = "Alex ", Section = 1 },
            new Student() { RollNumber = 2, Name = "Jonty ", Section = 21 },
            new Student() { RollNumber = 4, Name = "Donald ", Section = 2 },
        };
        var std = from r in lstStudents
                  select new { r.RollNumber, r.Name };
        foreach (var a in std)
        {
            Console.WriteLine(a.RollNumber + ", " + a.Name);
        }
        Console.ReadLine();
    }
}
```



```
file:///F:/proj
1, Alex
2, Jonty
4, Donald
-
```

Example 8 (LINQ to Objects): LINQ with property name to anonymous type

Step 1: First create a Model class "student.cs"

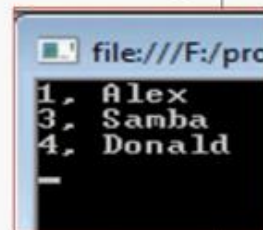
```
public class Student
{
    public int RollNumber { get; set; }
    public int Section { get; set; }
    public string Name { get; set; }
}
```

LINQ with property name to anonymous type

```
class Program
{
    static void Main(string[] args)
    {
        List<Student> lstStudents = new List<Student>
        {
            new Student() { RollNumber = 1, Name = "Alex ", Section = 1 },
            new Student() { RollNumber = 3, Name = "Samba ", Section = 13 },
            new Student() { RollNumber = 4, Name = "Donald ", Section = 2},
        };

        var std = from r in lstStudents
                  select new
                  {
                      strRollNo = r.RollNumber,
                      strName = r.Name;
                  };

        foreach (var a in std)
        {
            Console.WriteLine(a.strRollNo + ", " + a.strName);
        }
        Console.ReadLine();
    }
}
```



```
file:///F:/pro
1, Alex
3, Samba
4, Donald
-
```

In the last slide example strRollNo, strName is the property name. You can give any name whatever you want.

Example 9 (LINQ to Objects): LINQ with "Custom Class"-Retrieve data and assign to custom class property

Step 1: First create a Model class "student.cs"

```
public class Student
{
    public int RollNumber { get; set; }
    public int Section { get; set; }
    public string Name { get; set; }
}
```

LINQ with Custom Class-Retrieve data and assign to custom class property

Step 2: Now create a new custom class "CustomStudent.cs"

```
class CustomStudent
{
    public int CustomRollNumber { get; set; }
    public string CustomName { get; set; }
}
```


LINQ with Custom Class-Retrieve data and assign to custom class

```
class Program
{
    static void Main(string[] args)
    {
        List<Student> lstStudents = new List<Student>
        {
            new Student() { RollNumber = 1, Name = "Alex ", Section = 1 },
            new Student() { RollNumber = 3, Name = "Samba ", Section = 13 },
            new Student() { RollNumber = 4, Name = "Donald ", Section = 2},
        };

        IEnumerable<CustomStudent> custstd = from r in lstStudents
                                              select new CustomStudent
                                              {
                                                  CustomName = r.Name,
                                                  CustomRollNumber = r.RollNumber
                                              };

        foreach (CustomStudent a in custstd)
        { Console.WriteLine(a.CustomName + ", " + a.CustomRollNumber); }
        Console.ReadLine();
    }
}
```

Example 10 (LINQ to Objects): LINQ with Grouping Clause

Step 1: First create a Model class "student.cs"

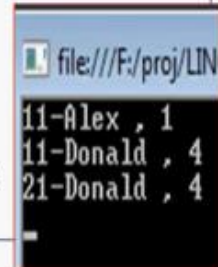
```
public class Student
{
    public int RollNumber { get; set; }
    public int Section { get; set; }
    public string Name { get; set; }
}
```

LINQ with "Grouping" Clause

Step 2: Use model class to perform action with LINQ with Grouping Clause

```
class Program
{
    static void Main(string[] args)
    {
        List<Student> lstStudents = new List<Student>
        {
            new Student() { RollNumber = 1, Name = "Alex ", Section = 11 },
            new Student() { RollNumber = 4, Name = "Donald ", Section = 11},
            new Student() { RollNumber = 4, Name = "Donald ", Section = 21},};
        var orderGroups = from stg in lstStudents
                           group stg by new { stg.Section, stg.RollNumber, stg.Name } into grouping
                           select new
                           {
                               // grouping.Key.DateField,
                               Name= grouping.Key.Name,
                               RollNumber= grouping.Key.RollNumber,
                               Section= grouping.Key.Section };

        ArrayList list = new ArrayList();
        foreach (var i in orderGroups)
        {
            Console.WriteLine(i.Section + "-" + i.Name + ", " + i.RollNumber);
        }
        Console.ReadLine();
    }
}
```



```
file:///F:/proj/LIN
11-Alex , 1
11-Donald , 4
21-Donald , 4
-
```

Example 11 (LINQ to Objects): LINQ with "Count Clause" with into operator

Step 1: First create a Model class "student.cs"

```
public class Student
{
    public int RollNumber { get; set; }
    public int Section { get; set; }
    public string Name { get; set; }
}
```

LINQ with Count Clause with into operator

Step 2: Use model class to perform action with LINQ by using Count Clause with into operator

```
class Program
{
    static void Main(string[] args)
    {
        List<Student> lstStudents = new List<Student>
        {
            new Student() { RollNumber = 2, Name = "Jonty ", Section = 21 },
            new Student() { RollNumber = 3, Name = "Samba ", Section = 11 },
            new Student() { RollNumber = 4, Name = "Donald ", Section = 11},
            new Student() { RollNumber = 4, Name = "Donald ", Section = 21},
        };

        var Counts = from p in lstStudents
                      group p by p.Section into g
                      select new {
                          sectionName = g.Key,
                          SectionCount = g.Count() };

        foreach (var a in Counts)
        {
            Console.WriteLine(a.sectionName + ", " + a.SectionCount);
        }

        Console.ReadLine();
    }
}
```

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21, 2
11, 2
-

Example 12 (LINQ to Objects): :LINQ with "Distinct Clause"

Step 1: First create a Model class "student.cs"

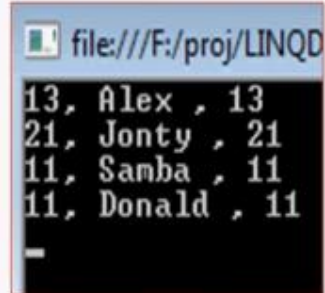
```
public class Student
{
    public int RollNumber { get; set; }
    public int Section { get; set; }
    public string Name { get; set; }
}
```


LINQ with Distinct Clause

Step 2: Use model class to perform action with LINQ by using Distinct Clause

```
class Program
{
    static void Main(string[] args)
    {
        List<Student> lstStudents = new List<Student>
        {
            new Student() { RollNumber = 1, Name = "Alex ", Section = 13 },
            new Student() { RollNumber = 2, Name = "Jonty ", Section = 21 },
            new Student() { RollNumber = 3, Name = "Samba ", Section = 11 },
            new Student() { RollNumber = 4, Name = "Donald ", Section = 11},
            new Student() { RollNumber = 4, Name = "Donald ", Section = 11},
        };

        var distinctSection = (from p in lstStudents select new { p.Section, p.RollNumber, p.Name }).Distinct();
        foreach (var a in distinctSection)
        {
            Console.WriteLine(a.Section + ", " + a.Name + ", " + a.Section);
        }
        Console.ReadLine();
    }
}
```



```
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13, Alex , 13
21, Jonty , 21
11, Samba , 11
11, Donald , 11
-
```

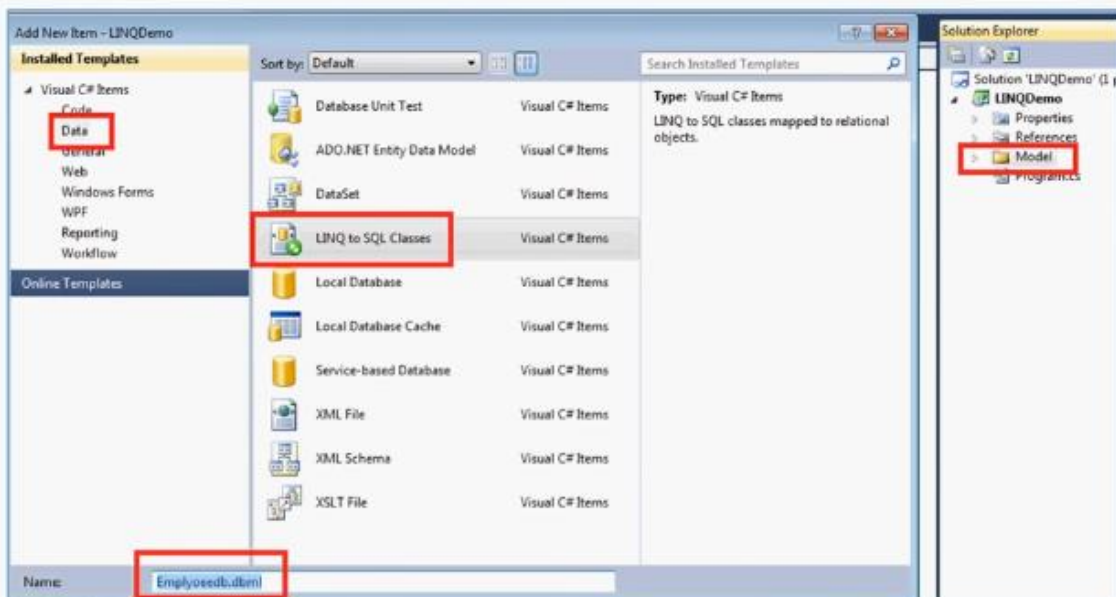
What is LINQ to SQL ?

- ❑ It is specifically **designed to work with only SQL Server database.**
- ❑ It is a ORM framework **for converting LINQ queries into Transact SQL** that can be supported by SQL Server.
- ❑ Basically it will **create a strongly typed .NET class based on the database table** that are further used for the queries.
- ❑ Using LINQ technology to access SQL databases is similar to accessing an in-memory collection.
- ❑ LINQ to SQL **support transactions, views and Stored Procedures** and will work only with SQL Server databases.

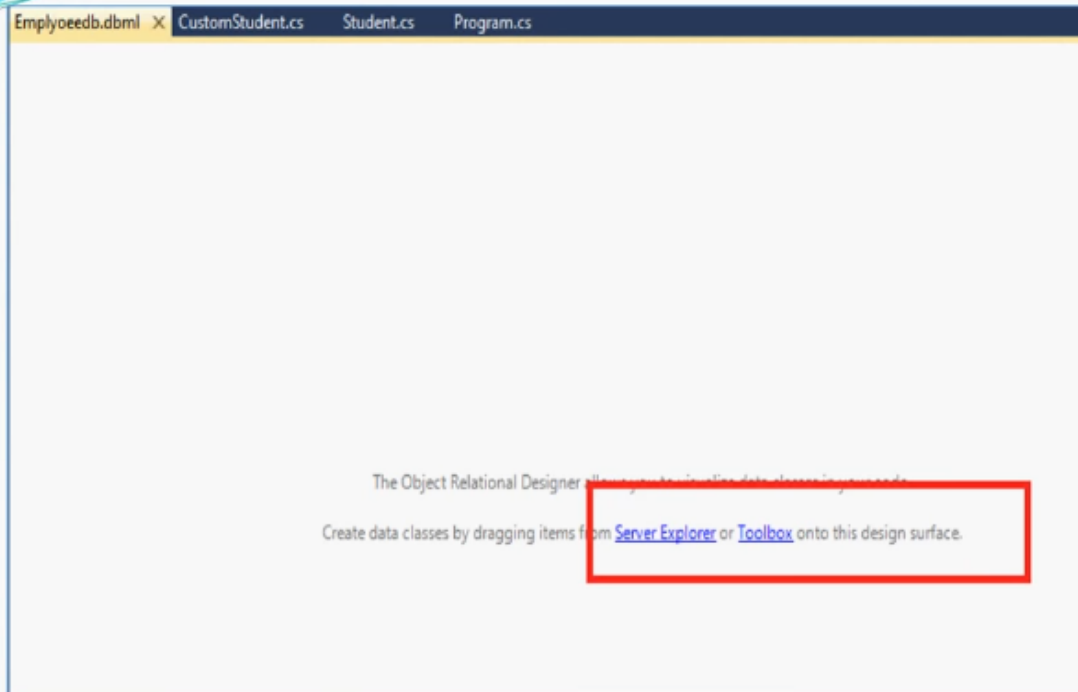
- ❑ Since it is strongly typed, the ORM Framework has **compile type error checking and intelligence**.
- ❑ **Note** "Internally LINQ to SQL provider converted the query into **Transact SQL that has been executed by SQL Server** and returned the required query result from the database table.

How to Start working with LINQ to SQL. Explain with Example ?

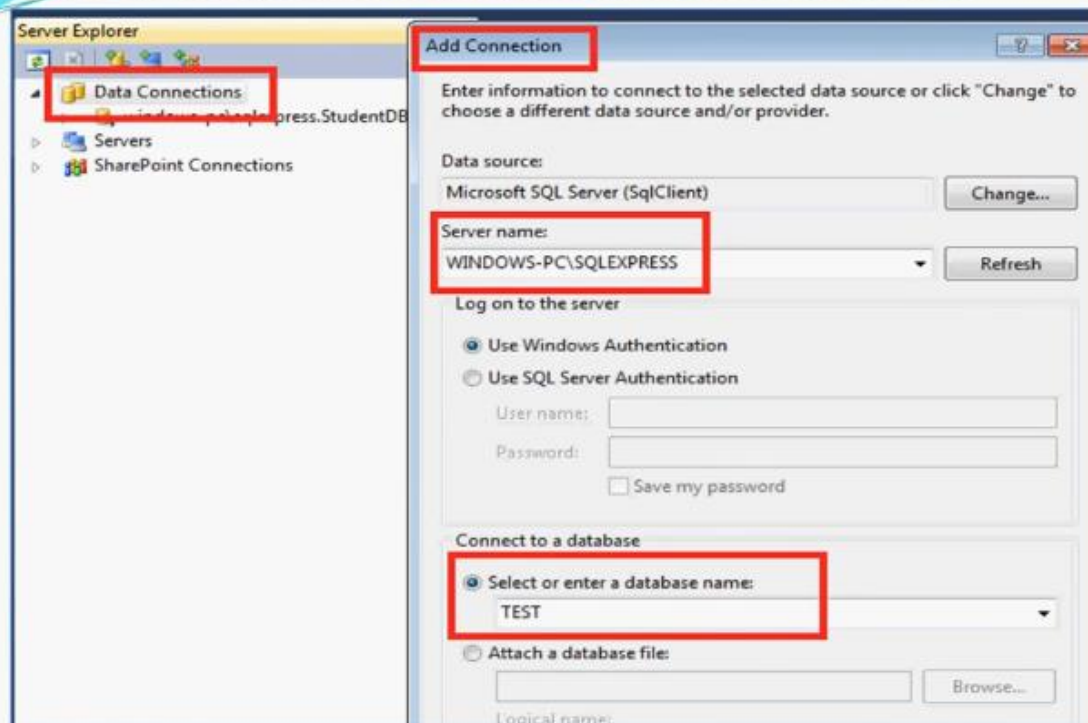
Step 1 : Create a LINQ to SQL classes(Employeeedb.dbml) template in Model Folder



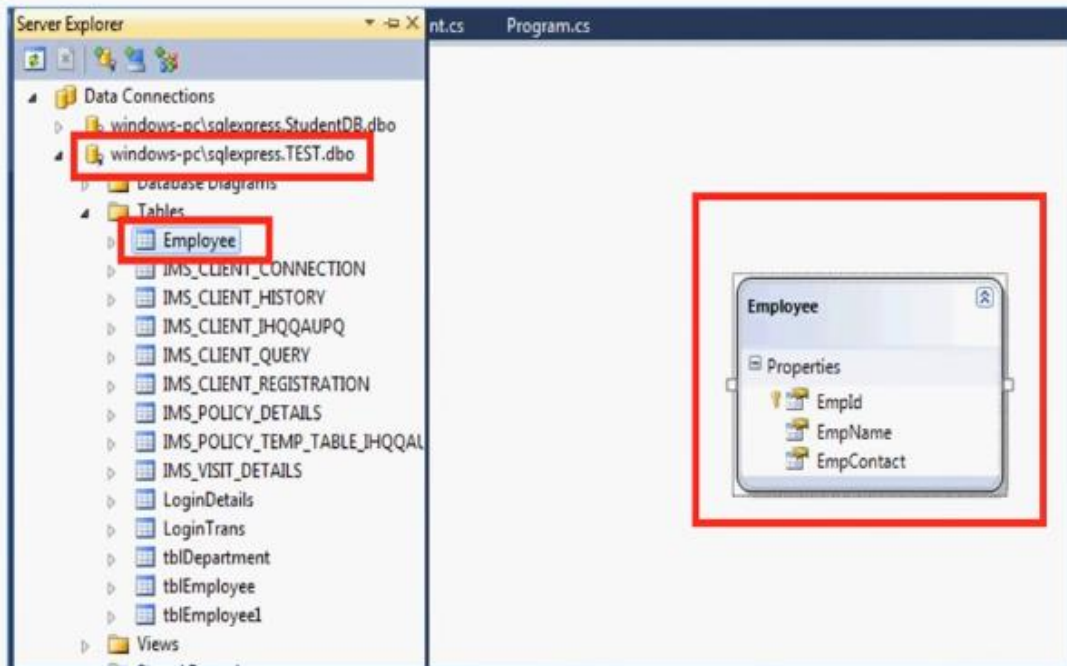
Step 2: Click on Server Explorer



Step 3: Make a new connection with your required database and server



Step 4: Select a required table from Database and build the application



Step 5: Retrieve all Employee Details from database by using LINQ to SQL

```
class Program
{
    static void Main(string[] args)
    {
        //Here is the entry point to database by using LINQ to SQL
        EmployeedbDataContext context = new EmployeedbDataContext();
        var employees = from listemployees in context.Employees
                        select listemployees;
        foreach (var a in employees)
        {
            Console.WriteLine(a.EmpId + ", " + a.EmpName + ", " + a.EmpContact);
        }
        Console.ReadLine();
    }
}
```

The screenshot shows a console window with the following output:

```
1. Mahesh, 9877654377
5. Ajit, 9941234256
6. Sanir, 9919814256
7. Akash, 9941237566
8. Anan, 9841238751
```

Example 2 : LINQ to SQL with where Clause

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```
class Program
{
    static void Main(string[] args)
    {
        //Here is the entry point to database by using LINQ to SQL
        EmployeeedbDataContext context = new EmployeeedbDataContext();
        var employees = from listemployees in context.Employees
                        where listemployees.EmpId > 2
                        select listemployees;

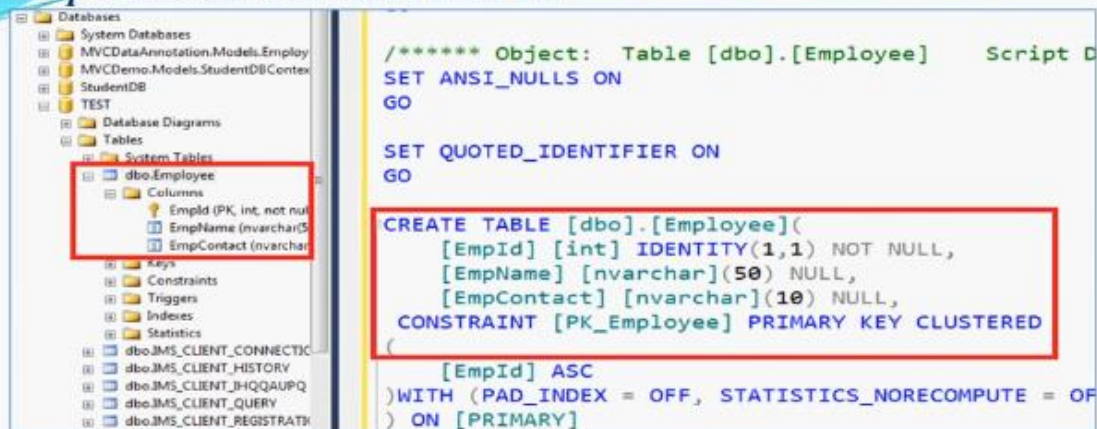
        foreach (var a in employees)
        {
            Console.WriteLine(a.EmpId + ", " + a.EmpName + ", " + a.EmpContact);
        }
        Console.ReadLine();
    }
}
```

```
file:///F:/proj/LINQDemo/LIN
5, Ajit, 9941234256
6, Sanir, 9919814256
7, Raksh, 9941237566
8, Anan, 9841238751
```

Example 3 : LINQ to SQL with Stored Procedure

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Step 1: Create a table in database like



The screenshot shows the SQL Server Enterprise Manager interface. On the left, the 'Databases' tree is expanded to 'TEST' > 'Tables' > 'dbo.Employee'. The table structure is displayed: 'EmpId (PK, int, not null)', 'EmpName (nvarchar(50))', and 'EmpContact (nvarchar(10))'. On the right, the 'Script D' window shows the T-SQL script for creating the table. The script includes 'SET ANSI_NULLS ON', 'SET QUOTED_IDENTIFIER ON', and 'GO' statements. The 'CREATE TABLE' statement is highlighted with a red box.

```
/*===== Object: Table [dbo].[Employee] Script D
SET ANSI_NULLS ON
GO

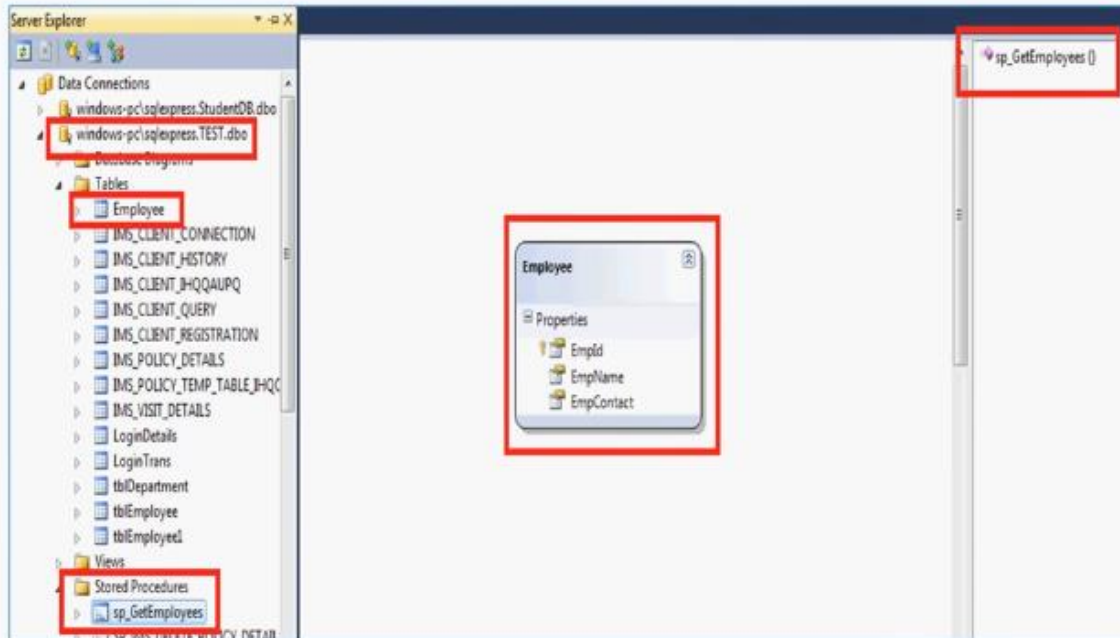
SET QUOTED_IDENTIFIER ON
GO

CREATE TABLE [dbo].[Employee](
    [EmpId] [int] IDENTITY(1,1) NOT NULL,
    [EmpName] [nvarchar](50) NULL,
    [EmpContact] [nvarchar](10) NULL,
    CONSTRAINT [PK_Employee] PRIMARY KEY CLUSTERED
(
    [EmpId] ASC
)WITH (PAD_INDEX = OFF, STATISTICS_NORECOMPUTE = OFF
) ON [PRIMARY]
GO
```

Step 2: Create a Stored Procedure in database like

```
CREATE PROCEDURE [dbo].[sp_GetEmployees]
AS
BEGIN
    SET NOCOUNT ON;
    SELECT * from Employee
END
GO
```

Step 3: Expand the data connection from the Server Explorer and drag and drop the Stored Procedure to the Employeeedb.dbml



Step 4: Call Stored procedure in program like

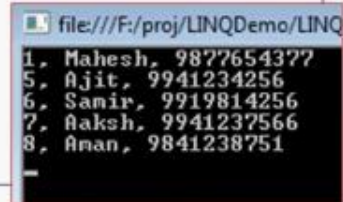
```
class Program
{
    static void Main(string[] args)
    {
        //Here is the entry point to database by using LINQ to SQL
        EmployeeedbDataContext context = new EmployeeedbDataContext();
        var employees = context.sp_GetEmployees();
        foreach (var a in employees)
        {
            Console.WriteLine(a.EmpId + ", " + a.EmpName + ", " + a.EmpContact);
        }
        Console.ReadLine();
    }
}
```

Stored Procedure

```
file:///F:/proj/LINQDemo/LINQ
1, Mahesh, 9877654377
5, Ajit, 9941234256
6, Samir, 9919814256
7, Akash, 9941237566
8, Aman, 9841238751
```


Example 4 : SELECT Using LINQ to SQL

```
class Program
{
    static void Main(string[] args)
    {
        //Here is the entry point to database by using LINQ to SQL
        EmplyoeedbDataContext context = new EmplyoeedbDataContext();
        var employees = from listemployees in context.Employees
                        select listemployees;
        foreach (var a in employees)
        {
            Console.WriteLine(a.EmpId + ", " + a.EmpName + ", " + a.EmpContact);
        }
        Console.ReadLine();
    }
}
```



```
file:///F:/proj/LINQDemo/LINQ
1, Mahesh, 9877654377
5, Ajit, 9941234256
6, Sanir, 9919814256
7, Akash, 9941237566
8, Anan, 9841238751
```

Example 5 : INSERT Using LINQ to SQL for record Insertion into Database

Use below code for insertion data into SQL Database by LINQ to SQL

```
class Program
{
    static void Main(string[] args)
    {
        //Here is the entry point to database by using LINQ to SQL
        EmplyoeedbDataContext OdContext = new EmplyoeedbDataContext();
        Employee objtblEmployee = new Employee();
        objtblEmployee.EmpName = "Sanoj";
        objtblEmployee.EmpContact = "9927834617";
        OdContext.Employees.InsertOnSubmit(objtblEmployee);
        OdContext.SubmitChanges();
    }
}
```

Run the Below query and get the new inserted data into database

The screenshot shows the SQL Server Enterprise Manager interface. On the left, the Object Explorer displays the database structure for 'TEST' on 'SQLSERVEREXPRESS (SQL Server 10.0)'. The 'dbo.Employee' table is expanded, showing columns: 'EmpId (PK, int, not null)', 'EmpName (nvarchar(50))', and 'EmpContact (nvarchar(50))'. On the right, the SQL Query window shows the query: `SELECT * from Employee`. Below the query, the Results pane displays a table with 6 rows and 3 columns: 'EmpId', 'EmpName', and 'EmpContact'. The data is as follows:

EmpId	EmpName	EmpContact
1	Mahesh	9877654377
2	Ajit	9941234256
3	Samir	9919814256
4	Aakash	9941237566
5	Aman	9841238751
6	Sanoj	9927834617

Example 6: UPDATE Using LINQ to SQL for record updating into Database

Use below code for updating data into SQL Database by LINQ to SQL

```
class Program
{
    static void Main(string[] args)
    {
        //Here is the entry point to database by using LINQ to SQL
        EmployeeDataContext OdContext = new EmployeeDataContext();
        Employee objtblEmployee = OdContext.Employees
            .Single(m => m.EmpId == 9);
        objtblEmployee.EmpName = "Sanoj Jagdale";
        objtblEmployee.EmpContact = "9928464617";
        OdContext.SubmitChanges();
    }
}
```

Run the Below query and get the updated data into database

Object Explorer

Connect

SQLQuery5.sql - W...s-PC\Windows (61)

SQLQuery4.sql - W...s-PC\Windows (60)*

SELECT * from Employee

121 %

Results Messages

	EmpId	EmpName	EmpContact
1	1	Mahesh	9877654377
2	5	Ajt	9941234256
3	6	Samir	9919814256
4	7	Aaksh	9941237566
5	8	Aman	9841238751
6	9	Sanoj Jagdale	9928464617

Updated Data

Example 7: DELETE Using LINQ to SQL

Use below code for deletion data into SQL Database by LINQ to SQL

```
class Program
{
    static void Main(string[] args)
    {
        //Here is the entry point to database by using LINQ to SQL
        EmployeeedbDataContext OdContext = new EmployeeedbDataContext();
        Employee objtblEmployee = OdContext.Employees
            .Single(m => m.EmpId == 9);
        OdContext.Employees.DeleteOnSubmit(objtblEmployee);
        OdContext.SubmitChanges();
    }
}
```