ENTITY FRAMEWORK

Entity Lifecycle:

Before we work on CRUD operation (Create, Read, Update, Delete), it's important to understand entity lifecycle and how it's being managed by EntityFramework 4.0.

During entity's lifetime, each entity has an entity state based on operation performed on it via Context (ObjectContext). The entity state is an enum of type System.Data.EntityState that declares the following values:

1. Added
2. Deleted
3. Modified
4. Unchanged
5. Detached

The Context not only holds the reference to all the objects retrieved from the database but also it holds the entity states and maintains modifications to the properties of the entity. This feature is known as *Change Tracking*.

The change in entity state from the Unchanged to the Modified state is the only state that's automatically handled by the context. All other changes must be made explicitly using proper methods of ObjectContext:

Sr.	ObjectContext Methods	Description	EntityState
1	AddObject	Adds an entity to the context	Added
2	Attach	Attaches an entity to the context	Unchanged
3	ApplyCurrentValues	Replace currently attached entity's scalar value with the property values of detached entity.	Modified
4	ApplyOriginalValues	It applies original database values to attached entity's properties.	Unchanged
5	DeleteObject	Delete the object from context.	Deleted
6	AcceptAllChanges	pushes the current values of every attached entity into the original values.	Unchanged
7	ChangeState or ChangeObjectState	Change an entity from one state to another without any restrictions (except for Detached)	Based on passed state
8	Detach	Removes an entity from the context.	Detached

You can query EDM mainly by three ways, 1) LINQ to Entities 2) Entity SQL 3) Native SQL.

1) LINQ to Entities: L2E query syntax is easier to learn than Entity SQL. You can use your LINQ skills for querying with EDM. Following code snippet shows how you can query with EDM created in previous step.

```
   //Querying with LINQ to Entities
    using (var objCtx = new SchoolDBEntities())
    {
        var schoolCourse = from cs in objCtx.Courses
                           where cs.CourseName == "Course1"
                           select cs;
        Course mathCourse = schoolCourse.FirstOrDefault<Course>();
        IList<Course> courseList = schoolCourse.ToList<Course>();

        string courseName = mathCourse.CourseName;
    }
```

First, you have to create object of context class which is SchoolDBEntities. You should initialize it in "using()" so that once it goes out of scope then it will automatically call Dispose() method of context class. Now, you can use LINQ with context object. LINQ query will return IQueryable<> object but underlying type of var will be ObjectQuery. You can then get single object using FirstOrDefault<>() or list of objects by using ToList<>().

2) Entity SQL: Another way to create a query, instead of LINQ to Entities, is by using the Entity Framework's Object Services directly. You can create an ObjectQuery directly combined with the Entity Framework's T-SQL-like query language, called Entity SQL, to build the query expression.

Following code snippet shows same query result as L2E query above.

```
    //Querying with Object Services and Entity SQL
    using (var objCtx = new SchoolDBEntities())
    {
        string sqlString = "SELECT VALUE cs FROM
SchoolDBEntities.Courses
                            AS cs WHERE cs.CourseName == 'Maths'";
        ObjectQuery<Course> course =
objCtx.CreateQuery<Course>(sqlString);
        Course coursename1 = course.FirstOrDefault<Course>();
    }
```

Here also, you have to create object of context class. Now you have to write SQL query as per Entity to SQL syntax and pass it in CreateQuery<>() method of context object. It will return ObjectQuery<> result. You can then single object using FirstOrDefault<>() or list of object by using ToList<>().

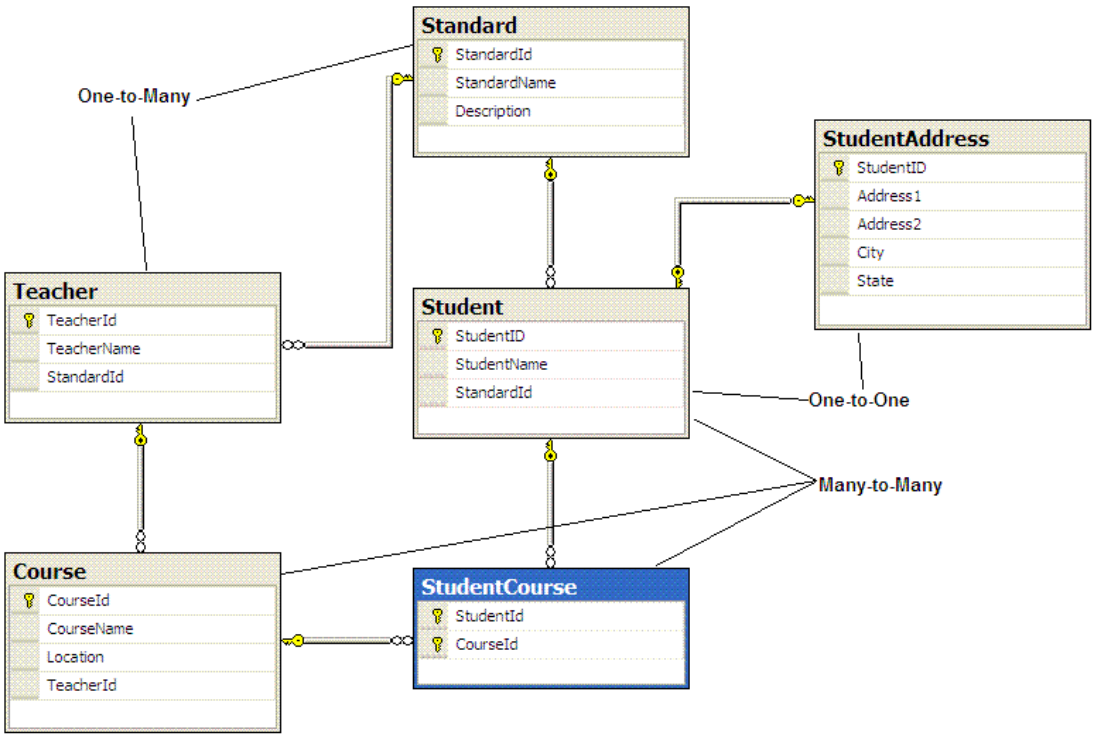
3) Native SQL In the Entity Framework v4 new methods ExecuteFunction(), ExecuteStoreQuery() and

ExecuteStoreCommand() were added to the class ObjectContext. So you can use these methods to execute Native SQL to the database as following:

```
    //Querying with native sql
    using (var objCtx = new SchoolDBEntities())
        {
            //Inserting Student using ExecuteStoreCommand
            int InsertedRows = objCtx.ExecuteStoreCommand("Insert into
Student(StudentName,StandardId) values('StudentName1',1)");

            //Fetching student using ExecuteStoreQuery
            var student = objCtx.ExecuteStoreQuery<Student>("Select *
from Student where StudentName = 'StudentName1'", null).ToList();

        }
```

Entity Relationships:

You can have three types of relations in EDM as in database. 1) One to One 2) One to Many 3) Many to Many. Let's examine database table design before going into relationships in EDM. Following figure is a database diagram of SchoolDB used in this tutorial.

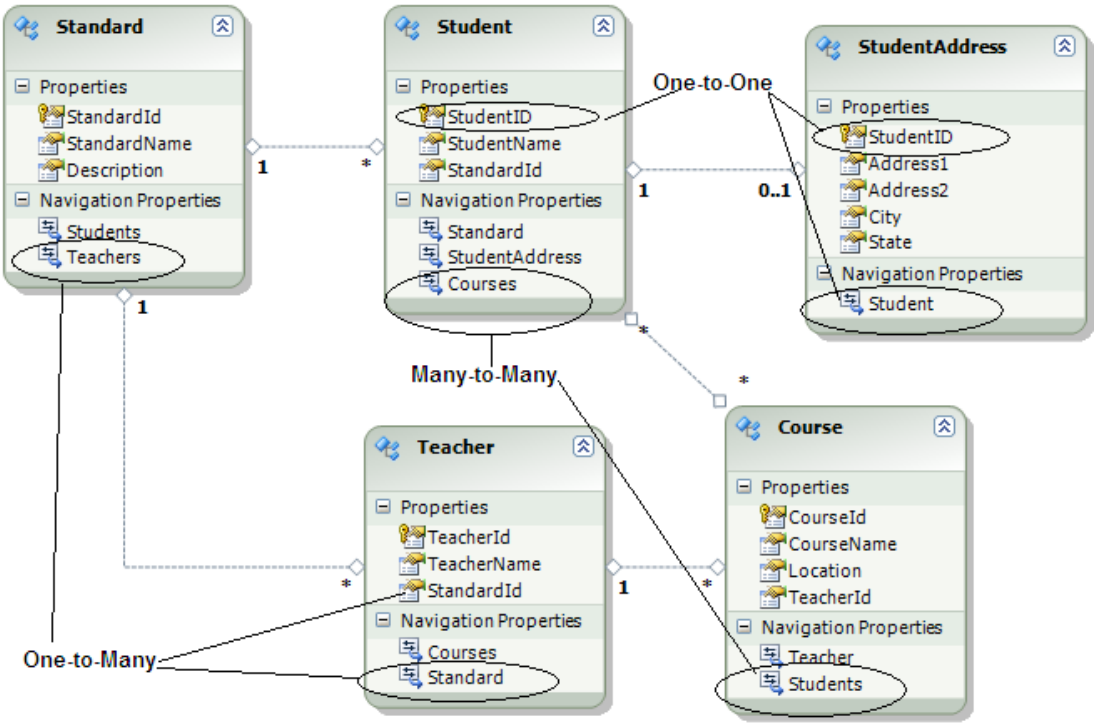


As you can see in the figure, student and StudentAddress have One-to-One relationshionship where each student has zero or one address.

Standard and Teacher has One-to-Many relationship where one standard can have many teachers but one teacher can't go to many standard (Standard is a classroom).

Student and Course has Many-to-Many relationships by using StudentCourse table. StudentCourse consists primary key of both the tables and thus it makes relation Many-to-Many.

When you create ADO.NET Entity Data Model from this database using 'Generate from existing database' option, it will create following entities and relationships into EDM:



As you can see in the above figure, Student and StudentAddress has One to One relationship (zero or one). StudentAddress entity has StudentId property as PK which makes it One-to-One relationship. Standard and teach has One-to-Many relation marked by multiplicity where 1 is for One and * is for Many.

Standard entity has navigation property "Teachers" which indicates that one Standard can have list of teachers and Teacher entity has "Standard" navigation property which indicates that Teacher is associated with one Standard. This makes it One-to-Many relationship.

Student and Course have Many-to-Many relationships marked by * multiplicity, but it doesn't display entityset for middle table "StudentCourse" where primary key of both tables will be stored. This is because The EDM represents many-to-many relationships by not having entityset for the joining table in CSDL, instead it manages through mapping. It can do this only when the join table has just the relevant keys and no additional fields. If the join tables had additional properties, such as DateCreated, the EDM would have created entities for them and you have to manage Many-to-Many relationship entities manually.

So now let's see how Many-to-Many relationship is being managed in EDM.

Open EDM in XML view. You can see that SSDL has StudentCourse entityset but CSDL doesn't have StudentCourse entityset instead it's being mapped in navigation property of Student and Course entity. In MSL (C-S Mapping), it has a mapping between Student and Course into StudentCourse table in <AssociationSetMapping/>

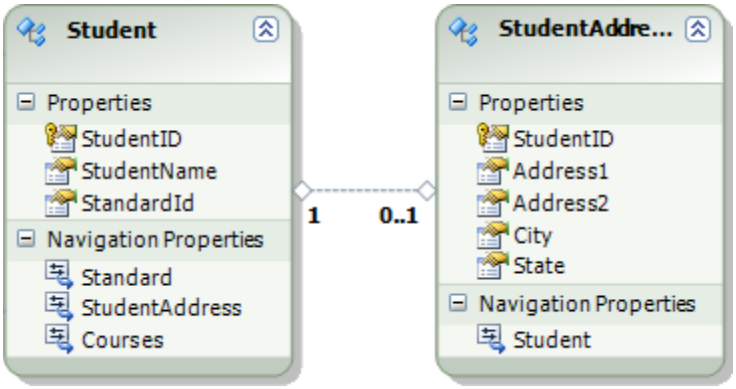
```
<AssociationSetMapping Name="StudentCourse" TypeName="SchoolDBModel.StudentCourse" StoreEntitySet="StudentCourse">
  <EndProperty Name="Course">
    <ScalarProperty Name="CourseId" ColumnName="CourseId" />
  </EndProperty>
  <EndProperty Name="Student">
    <ScalarProperty Name="StudentID" ColumnName="StudentId" />
  </EndProperty>
</AssociationSetMapping>
```

Thus Many-to-Many relationship is being managed in C-S mapping in EDM. So when you add student in course or Course in Student entity and when you save it then it will insert PK of added student and course in StudentCourse table. So this mapping not only enables a convenient association directly between the two entities, but also manages querying, inserts, and updates across this join.

But remember EDM does this only when joining table has PK columns for both tables. If you have some other columns in joining table then EDM will treat as normal entity and you have to use 'Join' in your query to fetch the data.

Add One-to-One Relationship Entity Graph using DBContext

We will see how to add new Student and StudentAddress entities which has One-to-One relationship that results in new rows in Student and StudentAddress table.



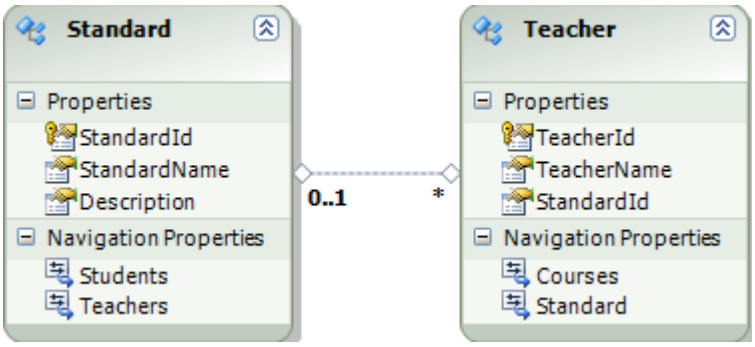
[Student and StudentAddress has One-to-One relationship]

```
            // create new student entity object
            var student = new Student();

            // Assign student name
            student.StudentName = "New Student1";

            // Create new StudentAddress entity and assign it to
student entity
            student.StudentAddress = new StudentAddress() { Address1 =
"Student1's Address1",
                    Address2 = "Student1's Address2", City =
"Student1's City",
                    State = "Student1's State" };
            //create DBContext object
            using (var dbCtx = new SchoolDBEntities())
            {
                //Add student object into Student's EntitySet
```

```
                dbCtx.Students.Add(student);
                // call SaveChanges method to save student &
StudentAddress into database
                dbCtx.SaveChanges();
```

Add One-to-Many Relationship Entity Graph using DBContext

We will see how to add new Standard and Teacher entities which has One-to-Many relationship which results in single entry in 'Standard' database table and multiple entry in 'Teacher' table.



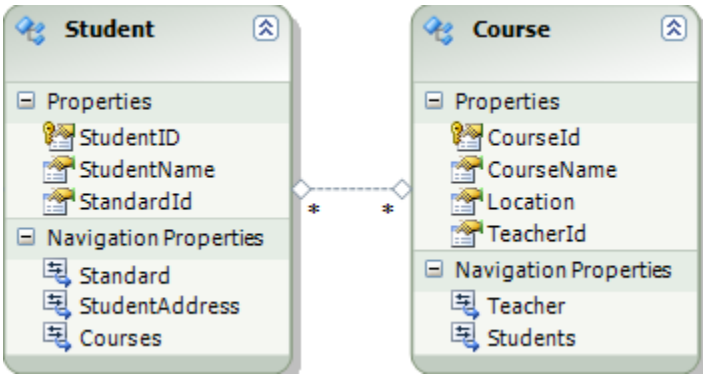
[Standard and Teacher has One-to-Many relationship]

```
    //Create new standard
    var standard = new Standard();
    standard.StandardName = "Standard1";

    //create three new teachers
    var teacher1 = new Teacher();
    teacher1.TeacherName = "New Teacher1";

    var teacher2 = new Teacher();
    teacher2.TeacherName = "New Teacher2";

    var teacher3 = new Teacher();
    teacher3.TeacherName = "New Teacher3";

    //add teachers for new standard
    standard.Teachers.Add(teacher1);
    standard.Teachers.Add(teacher2);
    standard.Teachers.Add(teacher3);

    using (var dbCtx = new SchoolDBEntities())
    {
        //add standard entity into standards entitySet
        dbCtx.Standards.Add(standard);
        //Save whole entity graph to the database
        dbCtx.SaveChanges();
```

```
    }
```

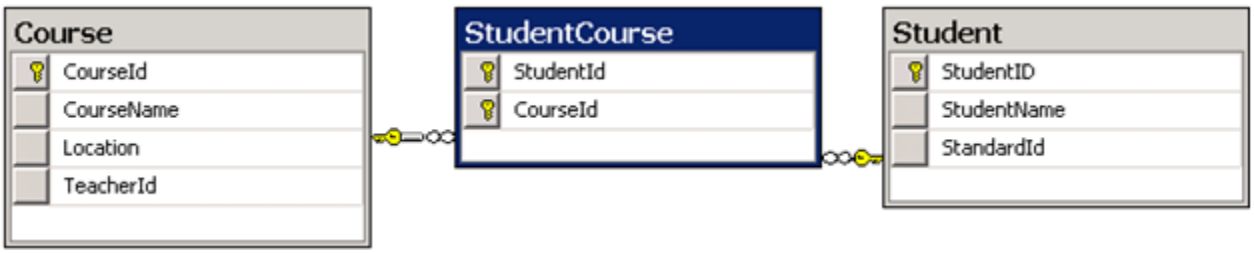
Add Many-to-Many Relationship Entity Graph using DBContext

We will see how to add new courses in student's course collection. Student and Course has Many-to-Many relationship which results in insert new rows in Student and StudentCourse tables.



[Student and Course has Many-to-Many relationship]

If you see database design, actually there are three tables participates in Many-to-Many relationship between Student and Course, Student, Course and StudentCourse tables. StudentCourse table consist StudentID and CourseId where both StudentId and CourseId is composite key (combined primary key).



Now let's see code to add these entities into DBContext:

```
    //Create student entity
    var student1 = new Student();
    student1.StudentName = "New Student2";

    //Create course entities
    var course1 = new Course();
    course1.CourseName = "New Course1";
    course1.Location = "City1";

    var course2 = new Course();
    course2.CourseName = "New Course2";
    course2.Location = "City2";

    var course3 = new Course();
    course3.CourseName = "New Course3";
    course3.Location = "City1";

    // add multiple courses for student entity
```

```
    student1.Courses.Add(course1);
    student1.Courses.Add(course2);
    student1.Courses.Add(course3);

    using (var dbCtx = new SchoolDBEntities())
    {
        //add student into DBContext
        dbCtx.Students.Add(student1);
        //call SaveChanges
        dbCtx.SaveChanges();
    }
```

SaveChanges results in seven inserts query, 1 for student, 3 for Course and 3 for StudentCourse table.

Update Entity using DBContext

As we have learned about DBContext.Entry method in previous chapter, Entry method is useful to get any DBEntityEntry for given Entity. DBEntityEntry provides access to information and control of entities that are being tracked by the DbContext.

As a general rule, we can add any existing modified Entity and mark it as modified as following:

dbCtx.Entry(Entity).State = System.Data.EntityState.Modified;

Let's see how to update an existing single 'Standard' entity:

```
    Student stud ;
    // Get student from DB
    using (var ctx = new SchoolDBEntities())
    {
        stud = ctx.Students.Where(s => s.StudentName == "New
Student1").FirstOrDefault<Student>();
    }

    // change student name in disconnected mode (out of DBContext
scope)
    if (stud != null)
    {
        stud.StudentName = "Updated Student1";
    }

    //save modified entity using new DBContext
    using (var dbCtx = new SchoolDBEntities())
    {
        //Mark entity as modified
        dbCtx.Entry(stud).State = System.Data.EntityState.Modified;
        dbCtx.SaveChanges();
    }
```

As you see in the above code snippet, we are doing following steps:

1. Get the existing student
2. Change student name out of DBContext scope (disconnected mode)
3. We pass modified entity into Entry method to get its DBEntityEntry object and then marking its state as Modified
4. Calling SaveChanges to update student information into the database.

Update One-to-Many Entities

Connected Scenario:

Following code shows how we can save modified Standard and Teachers entity graph which has One-to-Many relationship to the database in connected scenario:

```
using (var ctx = new SchoolDBEntities())
           {
            //fetching existing standard from the db
            Standard std = (from s in ctx.Standards
                            where s.StandardName == "standard3"
                            select s).FirstOrDefault<Standard>();
            std.StandardName = "Updated standard3";
            std.Description = "Updated standard";
            //getting first teacher to be removed
            Teacher tchr = std.Teachers.FirstOrDefault<Teacher>();
         //removing teachers (enable cascading delete for the teacher)
            if (tchr != null)
                ctx.Teachers.DeleteObject(tchr);
             Teacher newTeacher = new Teacher();
             newTeacher.TeacherName = "New Teacher";
            std.Teachers.Add(newTeacher);

             std.Teachers.Add(existingTeacher);
            ctx.SaveChanges();
        }
```

Update Many-to-Many Entities

Connected Scenario:

Following code saves modified Student and Courses (for that student) to the database:

```
using (var ctx = new SchoolDBEntities())
            {
                Student student = (from s in ctx.Students
                                   where s.StudentName == "Student3"s
                                  select s).FirstOrDefault<Student>();

                student.StudentName = "Updated Student3";

              Course cours = student.Courses.FirstOrDefault<Course>();
                //removing course from student
                student.Courses.Remove(cours);
                ctx.SaveChanges();
            }
```

Delete One-to-One Entities

```
using (var ctx = new SchoolDBEntities())
            {
                Student student = (from s in ctx.Students
                                   where s.StudentName == "Student1"
                                   select s).FirstOrDefault<Student>()
;

                StudentAddress sAddress = student.StudentAddress;
```

```
                ctx.StudentAddresses.DeleteObject(sAddress);

                ctx.SaveChanges();
            }
```

Delete One-to-Many Entities

Connected Scenario:

Following code deletes the teacher for standard which has One-to-Many relationship from the database in connected scenario:

```
using (var ctx = new SchoolDBEntities())
            {
                //fetching existing standard from the db
                Standard std = (from s in ctx.Standards
                                where s.StandardName == "standard3"
                                select s).FirstOrDefault<Standard>();

                //getting first teacher to be removed
                Teacher tchr = std.Teachers.FirstOrDefault<Teacher>();
                //removing teachers
                if (tchr != null)
                    ctx.Teachers.DeleteObject(tchr);
                ctx.SaveChanges();
            }
```

DeleteObject deletes a parent object and also deletes all the child objects in the constraint relationship.

Delete Many-to-Many Entities

Connected Scenario:

Following code deletes the course from student's courses in connected scenario. This will delete row in StudentCourse table but not delete the actual course from Course table in the database:

```
using (SchoolDBContext ctx = new SchoolDBContext())
            {
                Student student = (from s in ctx.Students
                                   where s.StudentName == "Student3"
                                   select s).FirstOrDefault<Student>()
;


                Course cours = student.Courses.FirstOrDefault<Course>(
);


                //removing course from student
                student.Courses.Remove(cours);


                ctx.SaveChanges();
            }
```

View Generated SQL Statements

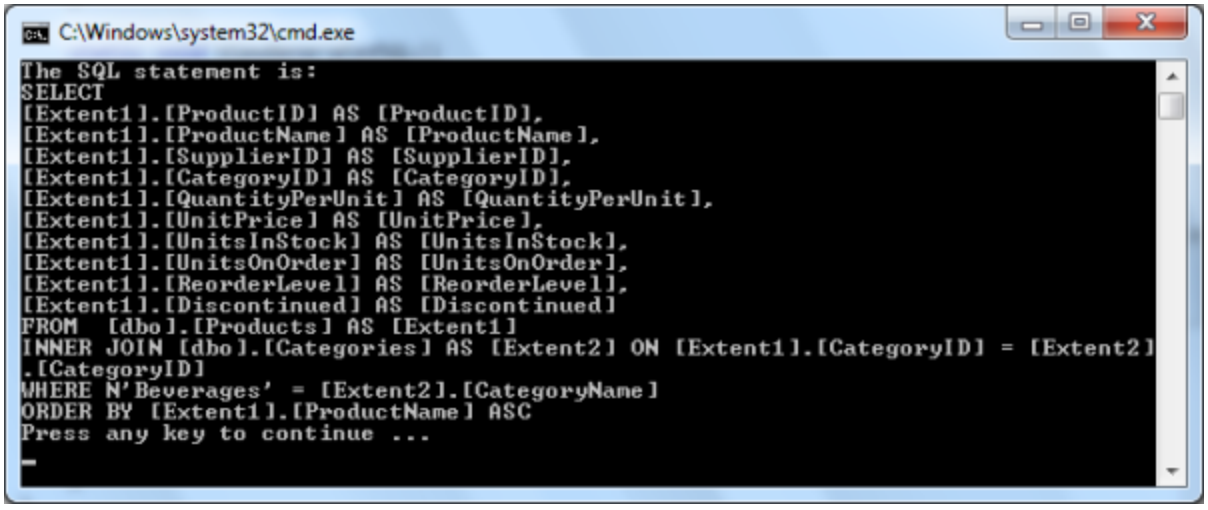
You may wonder what the actual SQL statements used by LINQ to Entities to interact with the databases are. In this section, we will explain two ways to view the generated SQL statements used by LINQ to Entities queries.

There are two ways to view the generated LINQ to Entities SQL statements. The first one is to use the `ObjectQuery.ToTraceString` method, and the second one is to use SQL Pro

```
using System;
using System.Collections.Generic;
using System.Linq;
using System.Text;
using System.Data.Objects;
namespace TestLINQToEntitiesApp
{
    class Program
    {
        static void Main(string[] args)
        {
            // CRUD operations on tables
            //TestTables();
            ViewGeneratedSQL();
            Console.WriteLine("Press any key to continue ...");
            Console.ReadKey();
        }
```

```
        static void TestTables()
        {
             // the body of this method is omitted to save space
        }
        static void ViewGeneratedSQL()
        {
            NorthwindEntities NWEntities = new NorthwindEntities();
            IQueryable<Product> beverages =
                from p in NWEntities.Products
                where p.Category.CategoryName == "Beverages"
                orderby p.ProductName
                select p;
            // view SQL using ToTraceString method
            Console.WriteLine("The SQL statement is:\n" +
                beverages.ToTraceString());
            NWEntities.Dispose();
        }
    }
    public static class MyExtensions
    {
        public static string ToTraceString<T>(this IQueryable<T> t)
        {
            string sql = "";
            ObjectQuery<T> oqt = t as ObjectQuery<T>;
            if (oqt != null)
                sql = oqt.ToTraceString();
            return sql;
        }
    }
}
```

Run this program, and you will see the following output:



View SQL Statements Using Profiler

With the `ToTraceString` method, we can view the generated SQL statements for some LINQ to Entities expressions, but not all of them. For example, when we add a new product to the database, or when we execute a Stored Procedure in the database, there is no `IQueryable` object for us to use

to view the generated SQL statements. In this case, we can use the SQL profiler to view the SQL statements. But if you go to view the generated SQL statements for the above query, you may be confused, as there is no SQL statement displayed in SQL profiler. So we will not explain the steps to view the SQL statements in the Profiler here, but we will explain it in the next section, together with the explanation of another important LINQ to Entities feature, deferred execution.