

**Отчет по лабораторной работе № 7 по курсу  
“Базовые компоненты интернет-технологий”**

ИСПОЛНИТЕЛЬ:

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(подпись)

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## Описание задания

Разработать программу, реализующую работу с LINQ to Objects. В качестве примера используйте проект «SimpleLINQ» из примера «Введение в LINQ».

1. Программа должна быть разработана в виде консольного приложения на языке C#.
2. Создайте класс «Сотрудник», содержащий поля:
  - ID записи о сотруднике;
  - Фамилия сотрудника;
  - ID записи об отделе.
3. Создайте класс «Отдел», содержащий поля:
  - ID записи об отделе;
  - Наименование отдела.
4. Предполагая, что «Отдел» и «Сотрудник» связаны соотношением один-ко-многим разработайте следующие запросы:
  - Выведите список всех сотрудников и отделов, отсортированный по отделам.
  - Выведите список всех сотрудников, у которых фамилия начинается с буквы «А».
  - Выведите список всех отделов и количество сотрудников в каждом отделе.
  - Выведите список отделов, в которых у всех сотрудников фамилия начинается с буквы «А».
  - Выведите список отделов, в которых хотя бы у одного сотрудника фамилия начинается с буквы «А».
5. Создайте класс «Сотрудники отдела», содержащий поля:
  - ID записи о сотруднике;
  - ID записи об отделе.
6. Предполагая, что «Отдел» и «Сотрудник» связаны соотношением много-ко-многим с использованием класса «Сотрудники отдела» разработайте следующие запросы:
  - Выведите список всех отделов и список сотрудников в каждом отделе.
  - Выведите список всех отделов и количество сотрудников в каждом отделе.

# Текст программы

## Program.cs

```
using System;
using System.Collections.Generic;
using System.Linq;

namespace Lab7
{
    class Program
    {
        /// <summary>
        /// Класс данных о сотруднике
        /// </summary>
        public class Employee
        {
            /// <summary>
            /// Ключ сотрудника
            /// </summary>
            public int id;

            /// <summary>
            /// Фамилия сотрудника
            /// </summary>
            public string surname;

            /// <summary>
            /// ID записи об отделе
            /// </summary>
            public int id_department;

            /// <summary>
            /// Конструктор
            /// </summary>
            public Employee(int i, string s, int i_d)
            {
                id = i;
                surname = s;
                id_department = i_d;
            }

            /// <summary>
            /// Приведение к строке
            /// </summary>
            public override string ToString()
            {
                return "(id = " + id.ToString() + "; surname = " + surname +
                    "; id_department = " + id_department.ToString() + ")";
            }
        }

        /// <summary>
        /// Класс данных об отделе
        /// </summary>
        public class Department
        {
            /// <summary>
            /// Ключ отдела
            /// </summary>
            public int id_department;

            /// <summary>
```

```

    /// Название отдела
    /// </summary>
    public string name;

    /// <summary>
    /// Конструктор
    /// </summary>
    public Department(int i, string n)
    {
        id_department = i;
        name = n;
    }

    /// <summary>
    /// Приведение к строке
    /// </summary>
    public override string ToString()
    {
        return "(id_department = " + id_department.ToString() + "; name = " +
name + ")";
    }
}

/// <summary>
/// Класс сотрудники отдела
/// </summary>
public class Employees_of_department
{
    /// <summary>
    /// ID сотрудника
    /// </summary>
    public int id;

    /// <summary>
    /// ID отдела
    /// </summary>
    public int id_department;

    /// <summary>
    /// Конструктор
    /// </summary>
    public Employees_of_department(int i, int i_d)
    {
        id = i;
        id_department = i_d;
    }

    /// <summary>
    /// Приведение к строке
    /// </summary>
    public override string ToString()
    {
        return "(id = " + id.ToString() + "; id_department = " +
id_department.ToString() + ")";
    }
}

//Пример данных
static List<Employee> e = new List<Employee>()
{
    new Employee(1, "Dior", 11),
    new Employee(2, "Musk", 12),
    new Employee(3, "Warhol", 13),
    new Employee(5, "King", 15),
    new Employee(6, "Chanel", 11),

```

```

        new Employee(7, "Adam", 13),
        new Employee(4, "Adorée", 17),
        new Employee(8, "Akerman", 17),
        new Employee(9, "Picasso", 13)
    };

    static List<Department> d = new List<Department>()
    {
        new Department(13, "art"),
        new Department(15, "writing"),
        new Department(11, "fashion"),
        new Department(17, "cinema"),
        new Department(12, "technologies")
    };

    static List<Employees_of_department> e_d = new List<Employees_of_department>()
    {
        new Employees_of_department(1, 11),
        new Employees_of_department(2, 12),
        new Employees_of_department(3, 14),
        new Employees_of_department(4, 17),
        new Employees_of_department(5, 15),
        new Employees_of_department(6, 11),
        new Employees_of_department(7, 13),
        new Employees_of_department(8, 17),
        new Employees_of_department(9, 13)
    };

    static void Main(string[] args)
    {
        Console.WriteLine("List of all employees and departments, sorted by
department: ");
        var q1 = from x in e
                  orderby x.id_department descending, x.id ascending
                  select x;
        foreach (var x in q1)
            Console.WriteLine(x);

        Console.WriteLine("A list of all employees whose surname starts with the
letter 'A': ");
        var q2 = from x in e
                  where x.surname[0] is 'A'
                  orderby x.surname ascending, x.id descending
                  select x;
        foreach (var x in q2)
            Console.WriteLine(x);

        Console.WriteLine("List of all departments and number of employees in each
department: ");
        var q3 = from x in d
                  join y in e on x.id_department equals y.id_department into temp
                  from t in temp
                  select new { v1 = x.name, v2 = x.id_department, cnt = temp.Count()
};

        q3 = q3.Distinct();
        foreach (var x in q3)
            Console.WriteLine(x);

        Console.WriteLine("A list of departments in which all employees start with
the letter 'A': ");
        var q4_1 = from x in e
                    join y in q2 on x.id_department equals y.id_department into temp
                    from t in temp
                    select new { v1 = x.id_department, cnt = temp.Count() };
        q4_1 = q4_1.Distinct();
    }
}

```

```

var q4 = from x in q3
        from y in q4_1
        where (x.cnt == y.cnt) && (x.v2 == y.v1)
        select new { v1 = x.v1 };
q4 = q4.Distinct();
foreach (var x in q4)
    Console.WriteLine(x);

Console.WriteLine("List of departments in which at least one employee " +
    "has a surname beginning with the letter 'A': ");
var q5_1 = from x in e
           where x.surname[0] is 'A'
           select new { v1 = x.id_department };
q5_1 = q5_1.Distinct();
var q5 = from x in d
         from y in q5_1
         where x.id_department == y.v1
         select new { v1 = x.name };
q5 = q5.Distinct();
foreach (var x in q5)
    Console.WriteLine(x);

//II

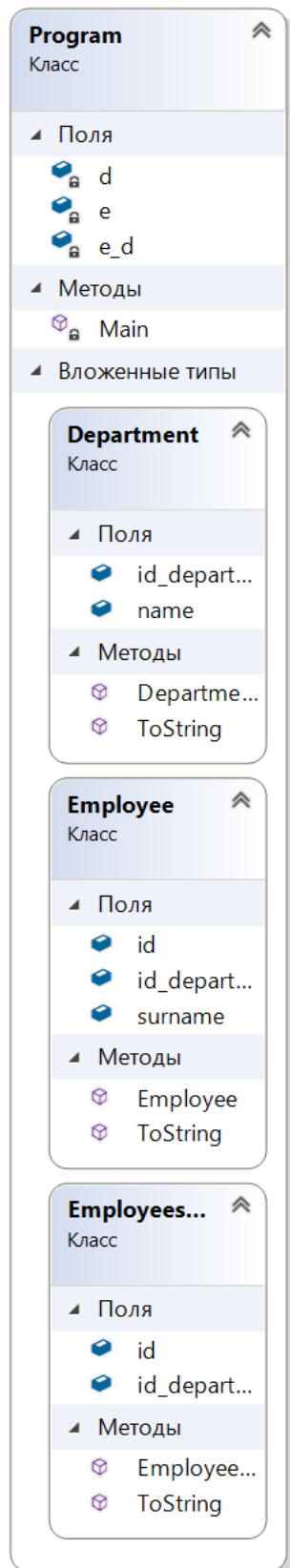
Console.WriteLine("A list of all departments and a list of employees in each
department: ");
var q6_1 = from x in e
           join l in e_d on x.id equals l.id into temp
           from t1 in temp
           join y in d on t1.id_department equals y.id_department into temp2
           from t2 in temp2
           select new { id = x.id_department, name = t2.name };
q6_1 = q6_1.Distinct();
foreach (var x in q6_1)
    Console.WriteLine(x);
var q6_2 = from x in e
           join l in e_d on x.id equals l.id into temp
           from t1 in temp
           join y in e on t1.id equals y.id into temp2
           from t2 in temp2
           select new { id = x.id, surname = t2.surname };
q6_2 = q6_2.Distinct();
foreach (var x in q6_2)
    Console.WriteLine(x);

Console.WriteLine("List of all departments and number of employees in each
department: ");
var q7_1 = from x in e_d
           join y in e on x.id_department equals y.id_department into temp
           from t in temp
           select new { number = temp.Count(), id = t.id_department };
q7_1 = q7_1.Distinct();
var q7_2 = from x in e
           join ed in e_d on x.id equals ed.id into temp
           from t1 in temp
           join y in d on t1.id_department equals y.id_department into temp2
           from t2 in temp2
           select new { name = t2.name, id = t2.id_department };
q7_2 = q7_2.Distinct();
var q7 = from x in q7_1
        from y in q7_2
        where x.id == y.id
        select new { name = y.name, number = x.number };
q7 = q7.Distinct();
foreach (var x in q7)

```

```
        Console.WriteLine(x);  
        Console.ReadKey();  
    }  
}
```

# Диаграмма классов





# Результаты выполнения

```
List of all employees and departments, sorted by department:
(id = 4; surname = Adoree; id_department = 17)
(id = 8; surname = Akerman; id_department = 17)
(id = 5; surname = King; id_department = 15)
(id = 3; surname = Warhol; id_department = 13)
(id = 7; surname = Adam; id_department = 13)
(id = 9; surname = Picasso; id_department = 13)
(id = 2; surname = Musk; id_department = 12)
(id = 1; surname = Dior; id_department = 11)
(id = 6; surname = Chanel; id_department = 11)
A list of all employees whose surname starts with the letter 'A':
(id = 7; surname = Adam; id_department = 13)
(id = 4; surname = Adoree; id_department = 17)
(id = 8; surname = Akerman; id_department = 17)
List of all departments and number of employees in each department:
{ v1 = art, v2 = 13, cnt = 3 }
{ v1 = writing, v2 = 15, cnt = 1 }
{ v1 = fashion, v2 = 11, cnt = 2 }
{ v1 = cinema, v2 = 17, cnt = 2 }
{ v1 = technologies, v2 = 12, cnt = 1 }
A list of departments in which all employees start with the letter 'A':
{ v1 = cinema }
List of departments in which at least one employee has a surname beginning with the letter 'A':
{ v1 = art }
{ v1 = cinema }
A list of all departments and a list of employees in each department:
{ id = 11, name = fashion }
{ id = 12, name = technologies }
{ id = 15, name = writing }
{ id = 13, name = art }
{ id = 17, name = cinema }
{ id = 1, surname = Dior }
{ id = 2, surname = Musk }
{ id = 3, surname = Warhol }
{ id = 5, surname = King }
{ id = 6, surname = Chanel }
{ id = 7, surname = Adam }
{ id = 4, surname = Adoree }
{ id = 8, surname = Akerman }
{ id = 9, surname = Picasso }
List of all departments and number of employees in each department:
```