(T15)討論 SetOperators 的 Distinct、Union、Intersect、Except、Concat
CourseGUID: 5ba9a6fe-7475-4b0c-8b99-bbcf7f5e2e1c
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0. Summary

0.

0.1.
Three popular ways to solve the problems of Contains() and Equals() and SequenceEqual() for Reference Type, ClassA

0.1.1.
Override Equals() and GetHashCode() methods in ClassA

0.1.2.
If you can not access ClassA, then
Use another overloaded version of SequenceEqual(),Contains() method which can take a sub-class of IEqualityComparer as parameter.

0.1.3.
If you can not access ClassA, then
use Select() or SelectMany() to project into a new anonymous type,
which overrides Equals() and GetHashCode() methods.

0.2.
Three popular ways to solve the problems of Compare() and Sort() for Reference Type, ClassA

0.2.1.
ClassA implement IComparable<ClassA>
and then implement
//public int CompareTo(ClassA other)

0.2.2.

If you can not access ClassA, then
use other class to implement IComparer<ClassA>
E.g.
//public class ClassACompareName: IComparer<ClassA >
and then implement
public int Compare(ClassA current, ClassA other)

0.2.3.
If you can not access ClassA, then
use anonymous type to provide the method to compare.

1.
Distinct, Union, Intersect, Except, and Concat are Set operators.

1.1.
Distinct()
Reference:
https://msdn.microsoft.com/en-us/library/bb348436(v=vs.110).aspx
https://msdn.microsoft.com/en-us/library/bb338049(v=vs.110).aspx
1.1.1.
//Enumerable.Distinct<TSource>(this IEnumerable<TSource> source)
Returns distinct elements from a sequence
by using the default equality comparer to compare values.
1.1.2.
//Enumerable.Distinct<TSource>
//(this IEnumerable<TSource> source, IEqualityComparer<TSource> comparer)
Returns distinct elements from a sequence
by using a specified IEqualityComparer<T> to compare values.

1.2.
Union
Reference:
https://msdn.microsoft.com/en-us/library/bb341731(v=vs.110).aspx
https://msdn.microsoft.com/en-us/library/bb358407(v=vs.110).aspx
1.2.1.
//Enumerable.Union<TSource>
//(this IEnumerable<TSource> first, IEnumerable<TSource> second)
Produces the set union of two sequences
by using the default equality comparer.
1.2.2.
//Enumerable.Union<TSource>
//(this IEnumerable<TSource> first, IEnumerable<TSource> second, IEqualityComparer<TSource> comparer)
Produces the set union of two sequences
by using a specified IEqualityComparer<T>.

1.3.
Intersect
Reference:
https://msdn.microsoft.com/en-us/library/bb460136(v=vs.110).aspx
https://msdn.microsoft.com/en-us/library/bb355408(v=vs.110).aspx

1.3.1.
//Enumerable.Intersect<TSource>
//(this IEnumerable<TSource> first, IEnumerable<TSource> second)
Produces the set intersection of two sequences
by using the default equality comparer to compare values.
1.3.2.
//Enumerable.Intersect<TSource>
//(this IEnumerable<TSource> first, IEnumerable<TSource> second, IEqualityComparer<TSource> comparer)
Produces the set intersection of two sequences
by using the specified IEqualityComparer<T> to compare values.

1.4.
Except
Reference:
https://msdn.microsoft.com/en-us/library/bb300779(v=vs.110).aspx
https://msdn.microsoft.com/en-us/library/bb336390(v=vs.110).aspx
1.4.1.
//Enumerable.Except<TSource>
//(this IEnumerable<TSource> first, IEnumerable<TSource> second)
Produces the set difference of two sequences
by using the default equality comparer to compare values.
1.4.2.
//Enumerable.Except<TSource>
//(this IEnumerable<TSource> first, IEnumerable<TSource> second, IEqualityComparer<TSource> comparer))
Produces the set difference of two sequences
by using the specified IEqualityComparer<T> to compare values.

1.5.
Concat
Reference:
https://msdn.microsoft.com/en-us/library/bb302894(v=vs.110).aspx
//Enumerable.Concat<TSource>
//(this IEnumerable<TSource> first, IEnumerable<TSource> second)

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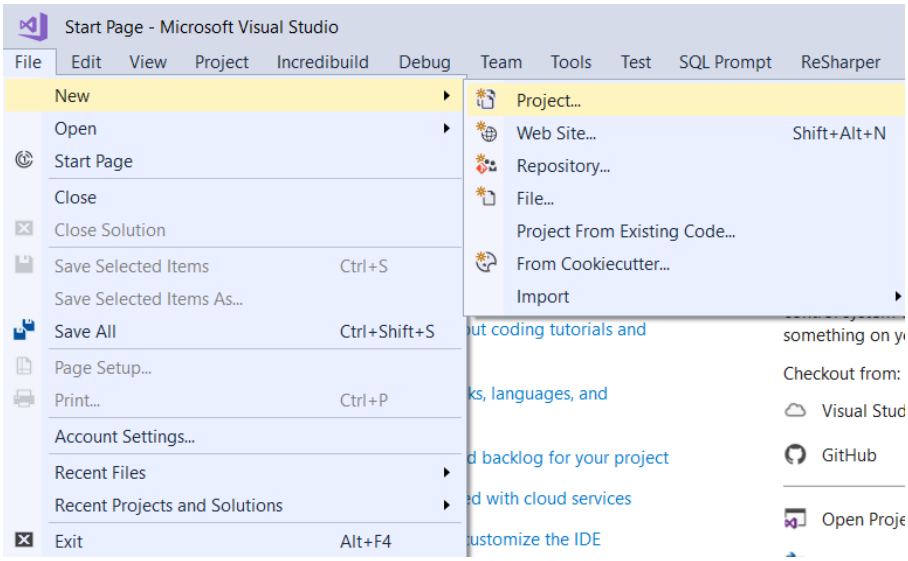
1. New Project

1.1. Create New Project : Sample

File --> New --> Project... -->

Visual C# --> **Console App (.Net Framework)** -->

Name: **Sample**


Start Page - Microsoft Visual Studio
File Edit View Project Incredibuild Debug Team Tools Test SQL Prompt ReSharper
New
Open
Start Page
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Close Solution
Save Selected Items Ctrl+S
Save Selected Items As...
Save All Ctrl+Shift+S
Page Setup...
Print... Ctrl+P
Account Settings...
Recent Files
Recent Projects and Solutions
Exit Alt+F4
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File...
Project From Existing Code...
From Cookiecutter...
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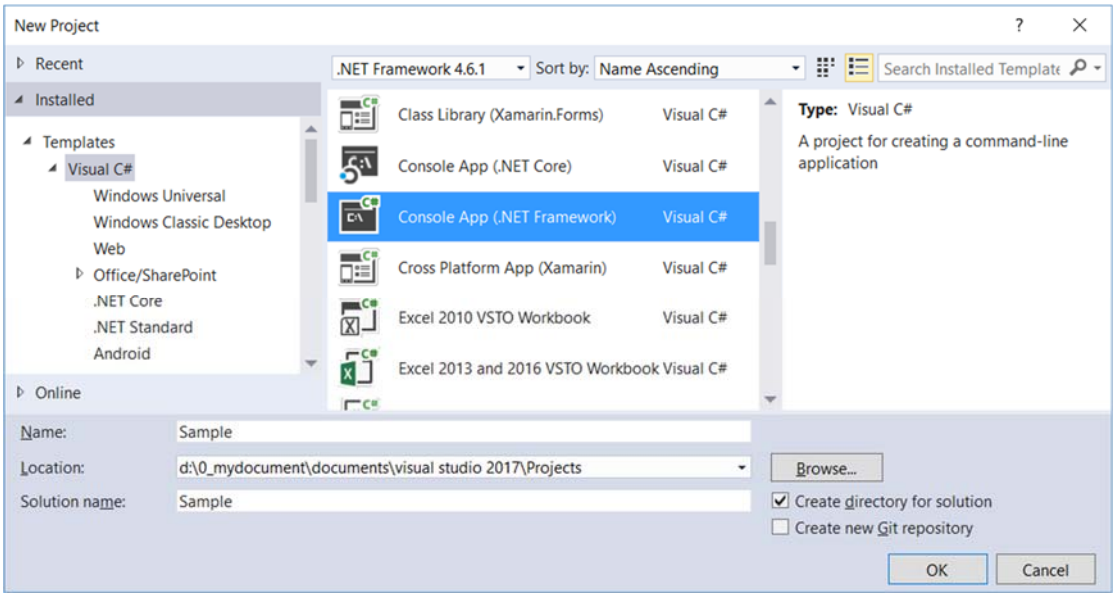
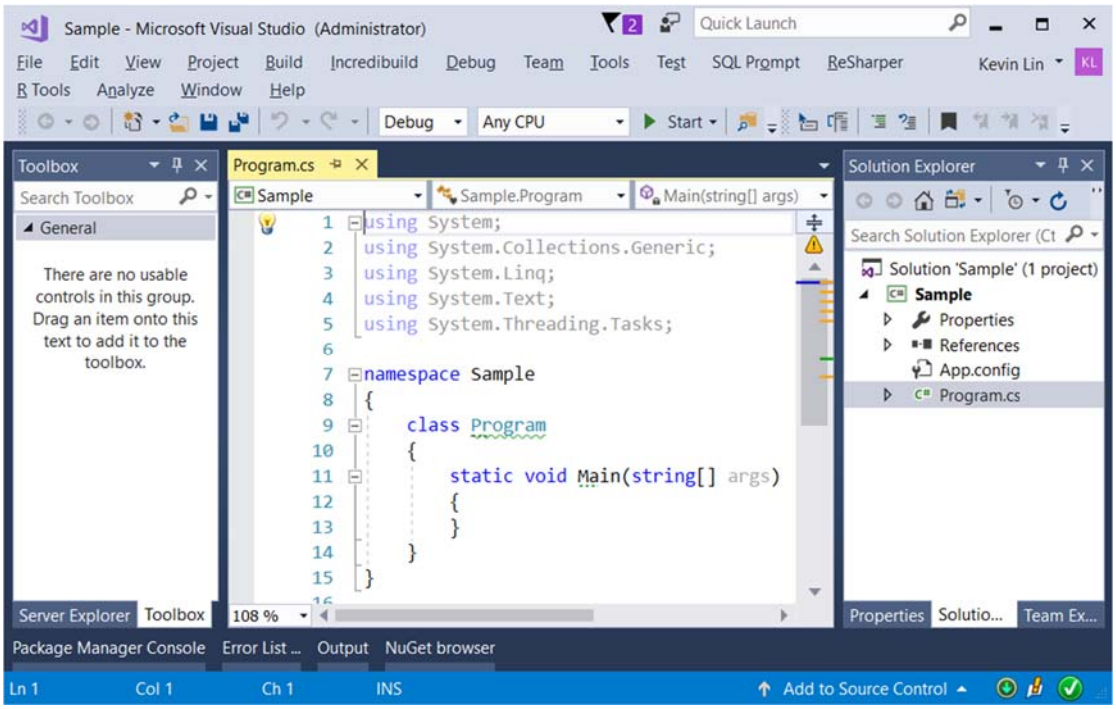

New Project
Recent
Installed
Templates
Visual C#
Windows Universal
Windows Classic Desktop
Web
Office/SharePoint
.NET Core
.NET Standard
Android
Online
.NET Framework 4.6.1
Sort by: Name Ascending
Search Installed Templat
Class Library (Xamarin.Forms) Visual C#
Console App (.NET Core) Visual C#
Console App (.NET Framework) Visual C#
Cross Platform App (Xamarin) Visual C#
Excel 2010 VSTO Workbook Visual C#
Excel 2013 and 2016 VSTO Workbook Visual C#
Type: Visual C#
A project for creating a command-line application
Name: Sample
Location: d:\0_mydocument\documents\visual studio 2017\Projects
Solution name: Sample
Browse...
Create directory for solution
Create new Git repository
OK
Cancel


Sample - Microsoft Visual Studio (Administrator)
Quick Launch
File Edit View Project Build Incredibuild Debug Team Tools Test SQL Prompt ReSharper
R Tools Analyze Window Help
Kevin Lin
Debug
Any CPU
Start
Toolbox
Search Toolbox
General
There are no usable controls in this group. Drag an item onto this text to add it to the toolbox.
Program.cs
Sample
Sample.Program
Main(string[] args)
using System;
using System.Collections.Generic;
using System.Linq;
using System.Text;
using System.Threading.Tasks;
namespace Sample
{
class Program
{
static void Main(string[] args)
{
}
}
}
Solution Explorer
Search Solution Explorer (Ct
Solution 'Sample' (1 project)
Sample
Properties
References
App.config
Program.cs
Server Explorer
Toolbox
108 %
Properties
Solutio...
Team Ex...
Package Manager Console
Error List ...
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2. Sample : Program.cs

```
using System;
using System.Collections.Generic;
using System.Linq;
using OnLieGame;
namespace Sample
{
    class Program
    {
        static void Main(string[] args)
        {
            // 1. ==================================
            //DistinctSample()
            Console.WriteLine("1. DistinctSample ==================");
            DistinctSample();
            // 2. ==================================
            //UnionAndConcatSample()
            Console.WriteLine("2. UnionAndConcatSample ==================");
            UnionAndConcatSample();
            // 3. ==================================
            //IntersectSample()
            Console.WriteLine("3. IntersectSample ==================");
            IntersectSample();
            // 4. ==================================
            //ExceptSample()
            Console.WriteLine("4. ExceptSample ==================");
            ExceptSample();
            Console.ReadLine();
        }


       // 1. ==================================
        //DistinctSample()
        static void DistinctSample()
        {
            Console.WriteLine("1.1. strArr.Distinct() ----------------------------- ");
            string[] strArr = { "Name1", "name1", "Name2", "Name2", "Name3" };
            IEnumerable<string> strArrDistinct = strArr.Distinct();
            foreach (string strArrDistinctItem in strArrDistinct)
            {
                Console.WriteLine($"strArrDistinctItem=={strArrDistinctItem}");
            }
            // strArrDistinctItem==Name1
            // strArrDistinctItem==name1
            // strArrDistinctItem==Name2
            // strArrDistinctItem==Name3
            Console.WriteLine("1.2. strArr2.Distinct(StringComparer.OrdinalIgnoreCase) ------------------
- ");
            string[] strArr2 = { "Name1", "name1", "Name2", "Name2", "Name3" };
            IEnumerable<string> strArr2Distinct = strArr2.Distinct(StringComparer.OrdinalIgnoreCase);
            foreach (string strArr2DistinctItem in strArr2Distinct)
            {
```

```
            Console.WriteLine($"strArr2DistinctItem=={strArr2DistinctItem}");
        }
        // strArr2DistinctItem==Name1
        // strArr2DistinctItem==Name2
        // strArr2DistinctItem==Name3
    }


// 2. ================================
    //UnionAndConcatSample()
    static void UnionAndConcatSample()
    {
        //Concat operator concatenates two sequences into one sequence.
        //Union combines two collections into one collection
        //and remove the duplicate elements.
        // 2.1. -------------------------------------
        //intArrA1.Concat(intArrA2)
        Console.WriteLine("2.1. intArrA1.Concat(intArrA2) -------------- ");
        int[] intArrA1 = { 1, 2, 3, 4, 5 };
        int[] intArrA2 = { 1, 3, 5, 7, 9 };
        IEnumerable<int> intArrA1ConcatintArrA2 =
            intArrA1.Concat(intArrA2);
        foreach (int item in intArrA1ConcatintArrA2)
        {
            Console.Write($" [ {item} ] ");
        }
        Console.WriteLine();
        //  [ 1 ]  [ 2 ]  [ 3 ]  [ 4 ]  [ 5 ]  [ 1 ]  [ 3 ]  [ 5 ]  [ 7 ]  [ 9 ]
        // 2.2. -------------------------------------
        //intArrA1.Union(intArrA2)
        Console.WriteLine("2.2. intArrA1.Union(intArrA2) -------------- ");
        IEnumerable<int> intArrA1UnionintArrA2 =
            intArrA1.Union(intArrA2);
        foreach (int item in intArrA1UnionintArrA2)
        {
            Console.Write($" [ {item} ] ");
        }
        Console.WriteLine();
        //  [ 1 ]  [ 2 ]  [ 3 ]  [ 4 ]  [ 5 ]  [ 7 ]  [ 9 ]
        // 2.3. -------------------------------------
        //gamerList1.Concat(gamerList2)
        Console.WriteLine("2.3. gamerList1.Concat(gamerList2) -------------- ");
        List<Gamer> gamerList1 = new List<Gamer>
        {
            new Gamer { Id = 1, Name = "Name1", TeamId = 1 },
            new Gamer { Id = 2, Name = "Name2", TeamId = 2 },
            new Gamer { Id = 5, Name = "Name9", TeamId = 2 }
        };
        List<Gamer> gamerList2 = new List<Gamer>
        {
            new Gamer { Id = 1, Name = "Name1", TeamId = 1 },
            new Gamer { Id = 3, Name = "Name3", TeamId = 1 },
            new Gamer { Id = 4, Name = "Name4", TeamId = 1 },
            new Gamer { Id = 5, Name = "Name9", TeamId = 2 }
        };
        IEnumerable<Gamer> gamerList1ConcatgamerList2 =
```

```
            gamerList1.Concat(gamerList2);
        foreach (Gamer gamer in gamerList1ConcatgamerList2)
        {
            Console.WriteLine($"{gamer}");
        }
        // GamerId==1,GamerName=Name1,TeamId=1
        // GamerId==2,GamerName=Name2,TeamId=2
        // GamerId==5,GamerName=Name9,TeamId=2
        // GamerId==1,GamerName=Name1,TeamId=1
        // GamerId==3,GamerName=Name3,TeamId=1
        // GamerId==4,GamerName=Name4,TeamId=1
        // GamerId==5,GamerName=Name9,TeamId=2
        // 2.4. ------------------------------------
        //gamerList1.Union(gamerList2)
        Console.WriteLine("2.4. gamerList1.Union(gamerList2) -------------- ");
        IEnumerable<Gamer> gamerList1UniongamerList2 =
            gamerList1.Union(gamerList2);
        foreach (Gamer gamer in gamerList1UniongamerList2)
        {
            Console.WriteLine($"{gamer}");
        }
        // GamerId==1,GamerName=Name1,TeamId=1
        // GamerId==2,GamerName=Name2,TeamId=2
        // GamerId==5,GamerName=Name9,TeamId=2
        // GamerId==1,GamerName=Name1,TeamId=1
        // GamerId==3,GamerName=Name3,TeamId=1
        // GamerId==4,GamerName=Name4,TeamId=1
        // GamerId==5,GamerName=Name9,TeamId=2
        // 2.5. ------------------------------------
        //gamerList1.Union(gamerList2, new GamerHelper())
        Console.WriteLine("2.5. gamerList1.Union(gamerList2, new GamerHelper()).OrderBy(g => g.Id) ---
---------- ");
        IEnumerable<Gamer> gamerList1UniongamerList2V2 =
            gamerList1.Union(gamerList2, new GamerHelper())
            .OrderBy(g => g.Id);
        ////IEnumerable<Gamer> gamerList1ConcatgamerList2V2 =
        ////    gamerList1.Concat(gamerList2, new GamerHelper())
        ////Concat with IEqualityComparer is not possible.
        ////because Union without IEqualityComparer can do the same thing.
        foreach (Gamer gamer in gamerList1UniongamerList2V2)
        {
            Console.WriteLine($"{gamer}");
        }
        // GamerId==1,GamerName=Name1,TeamId=1
        // GamerId==2,GamerName=Name2,TeamId=2
        // GamerId==3,GamerName=Name3,TeamId=1
        // GamerId==4,GamerName=Name4,TeamId=1
        // GamerId==5,GamerName=Name9,TeamId=2
    }


    // 3. ================================
    //IntersectSample()
    static void IntersectSample()
    {
```

```
            //Intersect() returns the elements which both collections have.
            // 3.1. -------------------------------------
            //intArrA1.Intersect(intArrA2)
            Console.WriteLine("3.1. intArrA1.Intersect(intArrA2) ------------------ ");
            int[] intArrA1 = { 1, 2, 3, 4, 5 };
            int[] intArrA2 = { 1, 3, 5, 7, 9 };
            IEnumerable<int> intArrA1IntersectintArrA2 = intArrA1.Intersect(intArrA2);
            foreach (int item in intArrA1IntersectintArrA2)
            {
                Console.Write($" [ {item} ] ");
            }
            Console.WriteLine();
            // [ 1 ]  [ 3 ]  [ 5 ]
            // 3.2. -------------------------------------
            //gamerList1.Intersect(gamerList2)
            Console.WriteLine("3.2. gamerList1.Intersect(gamerList2).OrderBy(g => g.Id) -------------- ");
            List<Gamer> gamerList1 = new List<Gamer>
            {
                new Gamer { Id = 1, Name = "Name1", TeamId = 1 },
                new Gamer { Id = 2, Name = "Name2", TeamId = 2 },
                new Gamer { Id = 5, Name = "Name9", TeamId = 2 }
            };
            List<Gamer> gamerList2 = new List<Gamer>
            {
                new Gamer { Id = 1, Name = "Name1", TeamId = 1 },
                new Gamer { Id = 3, Name = "Name3", TeamId = 1 },
                new Gamer { Id = 4, Name = "Name4", TeamId = 1 },
                new Gamer { Id = 5, Name = "Name9", TeamId = 2 }
            };
            IEnumerable<Gamer> gamerList1IntersectgamerList2 =
                gamerList1.Intersect(gamerList2)
                .OrderBy(g => g.Id);
            foreach (Gamer gamer in gamerList1IntersectgamerList2)
            {
                Console.WriteLine($"{gamer}");
            }
            // Return nothing,
            //because the default Equals() and GetHashCode()
            //of Gamer is not good enough to let Gamer to compare its properties.
            // 3.3. -------------------------------------
            //gamerList1.Intersect(gamerList2)
            Console.WriteLine("3.3. gamerList1.Intersect(gamerList2, new GamerHelper()).OrderBy(g => g.Id)
-------------- ");
            IEnumerable<Gamer> gamerList1IntersectgamerList2V2 =
                gamerList1.Intersect(gamerList2, new GamerHelper())
                .OrderBy(g => g.Id);
            foreach (Gamer gamer in gamerList1IntersectgamerList2V2)
            {
                Console.WriteLine($"{gamer}");
            }
            // GamerId==1,GamerName=Name1,TeamId=1
            // GamerId==5,GamerName=Name9,TeamId=2
        }

        // 4. ==================================
        //ExceptSample()
```

```
        static void ExceptSample()
        {
            //Except() returns the elements
            //that are in the first collection
            //but not in the second collection.
            // 4.1. ------------------------------------
            //intArrA1.Except(intArrA2)
            Console.WriteLine("4.1. intArrA1.Except(intArrA2) ------------------ ");
            int[] intArrA1 = { 1, 2, 3, 4, 5 };
            int[] intArrA2 = { 1, 3, 5, 7, 9 };
            IEnumerable<int> intArrA1ExceptintArrA2 = intArrA1.Except(intArrA2);
            foreach (int item in intArrA1ExceptintArrA2)
            {
                Console.Write($" [ {item} ] ");
            }
            Console.WriteLine();
            // [ 2 ]  [ 4 ]
            // 4.2. ------------------------------------
            //gamerList1.Except(gamerList2)
            Console.WriteLine("4.2. gamerList1.Except(gamerList2) -------------- ");
            List<Gamer> gamerList1 = new List<Gamer>
            {
                new Gamer { Id = 1, Name = "Name1", TeamId = 1 },
                new Gamer { Id = 2, Name = "Name2", TeamId = 2 },
                new Gamer { Id = 5, Name = "Name9", TeamId = 2 }
            };
            List<Gamer> gamerList2 = new List<Gamer>
            {
                new Gamer { Id = 1, Name = "Name1", TeamId = 1 },
                new Gamer { Id = 3, Name = "Name3", TeamId = 1 },
                new Gamer { Id = 4, Name = "Name4", TeamId = 1 },
                new Gamer { Id = 5, Name = "Name9", TeamId = 2 }
            };
            IEnumerable<Gamer> gamerList1ExceptgamerList2 =
                gamerList1.Except(gamerList2);
            foreach (Gamer gamer in gamerList1ExceptgamerList2)
            {
                Console.WriteLine($"{gamer}");
            }
            // GamerId==1,GamerName=Name1,TeamId=1
            // GamerId==2,GamerName=Name2,TeamId=2
            // GamerId==5,GamerName=Name9,TeamId=2
            // 4.3. ------------------------------------
            //gamerList1.Except(gamerList2)
            Console.WriteLine("4.3. gamerList1.Except(gamerList2, new GamerHelper()).OrderBy(g => g.Id) --
---------- ");
            IEnumerable<Gamer> gamerList1ExceptgamerList2V2 =
                gamerList1.Except(gamerList2, new GamerHelper())
                .OrderBy(g => g.Id);
            foreach (Gamer gamer in gamerList1ExceptgamerList2V2)
            {
                Console.WriteLine($"{gamer}");
            }
            // GamerId==2,GamerName=Name2,TeamId=2
        }
    }
```

```
}


namespace OnLieGame
{
    public class Team
    {
        public int Id { get; set; }
        public string Name { get; set; }
        public override string ToString()
        {
            return $"TeamId=={Id},TeamName={Name}";
        }
    }
    public class TeamHelper
    {
        public static List<Team> GetSampleTeam()
        {
            return new List<Team>
            {
                new Team { Id = 1, Name = "Team1"},
                new Team { Id = 2, Name = "Team2"},
                new Team { Id = 3, Name = "Team3"},
            };
        }
    }
    public class Gamer
    {
        public int Id { get; set; }
        public string Name { get; set; }
        public int TeamId { get; set; }
        public override string ToString()
        {
            return $"GamerId=={Id},GamerName={Name},TeamId={TeamId}";
        }
    }
    public class GamerHelper : IEqualityComparer<Gamer>
    {
        public static List<Gamer> GetSampleGamer()
        {
            return new List<Gamer>
            {
                new Gamer { Id = 1, Name = "Name1", TeamId = 1 },
                new Gamer { Id = 2, Name = "Name2", TeamId = 2 },
                new Gamer { Id = 3, Name = "Name3", TeamId = 1 },
                new Gamer { Id = 4, Name = "Name4", TeamId = 1 },
                new Gamer { Id = 5, Name = "Name9", TeamId = 2 },
                new Gamer { Id = 6, Name = "Name10"}
            };
        }
        public bool Equals(Gamer x, Gamer y)
        {
            return y != null && x != null &&
                x.Id == y.Id &&
                x.Name == y.Name &&
                x.TeamId == y.TeamId;
        }
        public int GetHashCode(Gamer obj)
```

```
        {
            return obj.Id.GetHashCode() ^
                obj.TeamId.GetHashCode() ^
                obj.Name.GetHashCode();
        }
    }
}
```

```
1. DistinctSample ==================
1.1. strArr.Distinct() -----------------------------
strArrDistinctItem==Name1
strArrDistinctItem==name1
strArrDistinctItem==Name2
strArrDistinctItem==Name3
1.2. strArr2.Distinct(StringComparer.OrdinalIgnoreCase) --------------------
strArr2DistinctItem==Name1
strArr2DistinctItem==Name2
strArr2DistinctItem==Name3
2. UnionAndConcatSample ==================
2.1. intArrA1.Concat(intArrA2) --------------
 [ 1 ]  [ 2 ]  [ 3 ]  [ 4 ]  [ 5 ]  [ 1 ]  [ 3 ]  [ 5 ]  [ 7 ]  [ 9 ]
2.2. intArrA1.Union(intArrA2) --------------
 [ 1 ]  [ 2 ]  [ 3 ]  [ 4 ]  [ 5 ]  [ 7 ]  [ 9 ]
2.3. gamerList1.Concat(gamerList2) --------------
GamerId==1,GamerName=Name1,TeamId=1
GamerId==2,GamerName=Name2,TeamId=2
GamerId==5,GamerName=Name9,TeamId=2
GamerId==1,GamerName=Name1,TeamId=1
GamerId==3,GamerName=Name3,TeamId=1
GamerId==4,GamerName=Name4,TeamId=1
GamerId==5,GamerName=Name9,TeamId=2
2.4. gamerList1.Union(gamerList2) --------------
GamerId==1,GamerName=Name1,TeamId=1
GamerId==2,GamerName=Name2,TeamId=2
GamerId==5,GamerName=Name9,TeamId=2
GamerId==1,GamerName=Name1,TeamId=1
GamerId==3,GamerName=Name3,TeamId=1
GamerId==4,GamerName=Name4,TeamId=1
GamerId==5,GamerName=Name9,TeamId=2
```

```
2.5. gamerList1.Union(gamerList2, new GamerHelper()).OrderBy(g => g.Id) --------------
GamerId==1,GamerName=Name1,TeamId=1
GamerId==2,GamerName=Name2,TeamId=2
GamerId==3,GamerName=Name3,TeamId=1
GamerId==4,GamerName=Name4,TeamId=1
GamerId==5,GamerName=Name9,TeamId=2
3. IntersectSample ==================
3.1. intArrA1.Intersect(intArrA2) -----------------
 [ 1 ]  [ 3 ]  [ 5 ]
3.2. gamerList1.Intersect(gamerList2).OrderBy(g => g.Id) --------------
3.3. gamerList1.Intersect(gamerList2, new GamerHelper()).OrderBy(g => g.Id) --------------
GamerId==1,GamerName=Name1,TeamId=1
GamerId==5,GamerName=Name9,TeamId=2
4. ExceptSample ==================
4.1. intArrA1.Except(intArrA2) -----------------
 [ 2 ]  [ 4 ]
4.2. gamerList1.Except(gamerList2) --------------
GamerId==1,GamerName=Name1,TeamId=1
GamerId==2,GamerName=Name2,TeamId=2
GamerId==5,GamerName=Name9,TeamId=2
4.3. gamerList1.Except(gamerList2, new GamerHelper()).OrderBy(g => g.Id) --------------
GamerId==2,GamerName=Name2,TeamId=2
```