(T12)討論 DefaultIfEmpty、FirstOrDefault、LastOrDefault、ElementAtOrDefault、SingleOrDefault
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(T12)討論 DefaultIfEmpty、FirstOrDefault、LastOrDefault、ElementAtOrDefault、SingleOrDefault
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0. Summary

1.
First, FirstOrDefault, Last, LastOrDefault, ElementAt, ElementAtOrDefault, Single, SingleOrDefault, and DefaultIfEmpty are Element Operators which retrieve a single element from a sequence. All of these have their own overloading methods.

2.
First V.S. FirstOrDefault

2.1.
First V.S. FirstOrDefault

2.1.1.
First
throws InvalidOperationException
if the sequence does not contain any elements
or if no element in the sequence satisfies the condition

2.1.2.
FirstOrDefault
returns default value of type
if the sequence does not contain any elements
or if no element in the sequence satisfies the condition
For the reference type, the default value is null.

2.2.
Enumerable.First<TSource>
(this IEnumerable<TSource> source)
OR
Enumerable.FirstOrDefault<TSource>
(this IEnumerable<TSource> source)
Reference:
https://msdn.microsoft.com/en-us/library/bb291976(v=vs.110).aspx
https://msdn.microsoft.com/en-us/library/bb340482(v=vs.110).aspx
Returns the first element of a sequence.

2.3.
Enumerable.First<TSource>
(this IEnumerable<TSource> source, Func<TSource, Boolean> predicate)
OR
Enumerable.FirstOrDefault<TSource>
(this IEnumerable<TSource> source, Func<TSource, Boolean> predicate)
Reference:
https://msdn.microsoft.com/en-us/library/bb535050(v=vs.110).aspx
https://msdn.microsoft.com/en-us/library/bb549039(v=vs.110).aspx
Returns the first element in a sequence that satisfies a specified condition.

3.
Last V.S. LastOrDefault

3.1.
Last V.S. LastOrDefault

3.1.1.
Last
throws InvalidOperationException
if the sequence does not contain any elements
or if no element in the sequence satisfies the condition

3.1.2.
LastOrDefault
returns default value of type
if the sequence does not contain any elements
or if no element in the sequence satisfies the condition
For the reference type, the default value is null.

3.2.
Enumerable.Last<TSource>
(this IEnumerable<TSource> source)
OR
Enumerable.LastOrDefault<TSource>
(this IEnumerable<TSource> source)
Reference:
https://msdn.microsoft.com/en-us/library/bb358775(v=vs.110).aspx
https://msdn.microsoft.com/en-us/library/bb301849(v=vs.110).aspx
Returns the last element of a sequence.

3.3.
Enumerable.Last<TSource>
(this IEnumerable<TSource> source, Func<TSource, Boolean> predicate)
OR
Enumerable.LastOrDefault<TSource>
(this IEnumerable<TSource> source, Func<TSource, Boolean> predicate)
Reference:
https://msdn.microsoft.com/en-us/library/bb549138(v=vs.110).aspx
https://msdn.microsoft.com/en-us/library/bb548915(v=vs.110).aspx
Returns the last element of a sequence that satisfies a specified condition.

4.
ElementAt V.S. ElementAtOrDefault

4.1.
Enumerable.ElementAt<TSource>
(this IEnumerable<TSource> source, Int32 index)
Reference:
https://msdn.microsoft.com/en-us/library/bb299233(v=vs.110).aspx
Returns the element at a specified index in a sequence.
Throws ArgumentNullException if source is null.
Throws ArgumentOutOfRangeException
if index is less than 0 or greater than or equal to the number of elements in source.

4.2.
Enumerable.ElementAtOrDefault<TSource>
(this IEnumerable<TSource> source, Int32 index)
Reference:
https://msdn.microsoft.com/en-us/library/bb494386(v=vs.110).aspx
Returns the element at a specified index in a sequence
or a default value if the index is out of range.
Throws ArgumentNullException if source is null.

5.
Single V.S. SingleOrDefault

5.1.
Single V.S. SingleOrDefault

5.1.1.
Single
throws ArgumentNullException if source is null.
Throws InvalidOperationException
if the input sequence contains more than one element.
or if The input sequence is empty.

5.1.2.
SingleOrDefault
throws ArgumentNullException if source is null.
Throws InvalidOperationException
if the input sequence contains more than one element.

5.2.

5.2.1.
Enumerable.Single<TSource>
(this IEnumerable<TSource> source)
Reference:
https://msdn.microsoft.com/en-us/library/bb155325(v=vs.110).aspx
Returns the only element of a sequence,
and throws an exception
if there is not exactly one element in the sequence.

5.2.2.
Enumerable.SingleOrDefault<TSource>
(this IEnumerable<TSource> source)
Reference:
https://msdn.microsoft.com/en-us/library/bb342451(v=vs.110).aspx
Returns the only element of a sequence,
or a default value if the sequence is empty;
this method throws an exception
if there is more than one element in the sequence.

5.3.

5.3.1.
Enumerable.Single<TSource>
(this IEnumerable<TSource> source, Func<TSource, Boolean> predicate)
Reference:
https://msdn.microsoft.com/en-us/library/bb535118(v=vs.110).aspx
Returns the only element of a sequence that satisfies a specified condition,
and throws an exception if more than one such element exists.

5.3.2.
Enumerable.SingleOrDefault<TSource>
(this IEnumerable<TSource> source, Func<TSource, Boolean> predicate)
Reference:
https://msdn.microsoft.com/en-us/library/bb549274(v=vs.110).aspx
Returns the only element of a sequence that satisfies a specified condition
or a default value if no such element exists;
this method throws an exception
if more than one element satisfies the condition.

6.
DefaultIfEmpty

6.1.
Enumerable.DefaultIfEmpty<TSource>
(this IEnumerable<TSource> source)
Reference:
https://msdn.microsoft.com/en-us/library/bb360179(v=vs.110).aspx
Returns the elements of the specified sequence
or the type parameter's default value in a singleton collection
if the sequence is empty.

6.2.
Enumerable.DefaultIfEmpty<TSource>
(this IEnumerable<TSource> source, TSource defaultValue)
Reference:
https://msdn.microsoft.com/en-us/library/bb355419(v=vs.110).aspx
Returns the elements of the specified sequence
or the specified value in a singleton collection
if the sequence is empty.
==

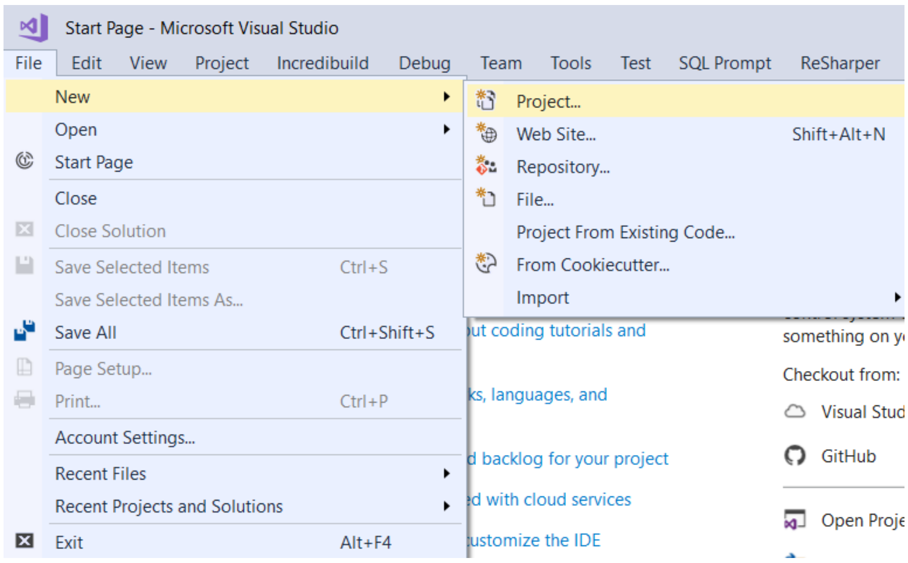
1. New Project

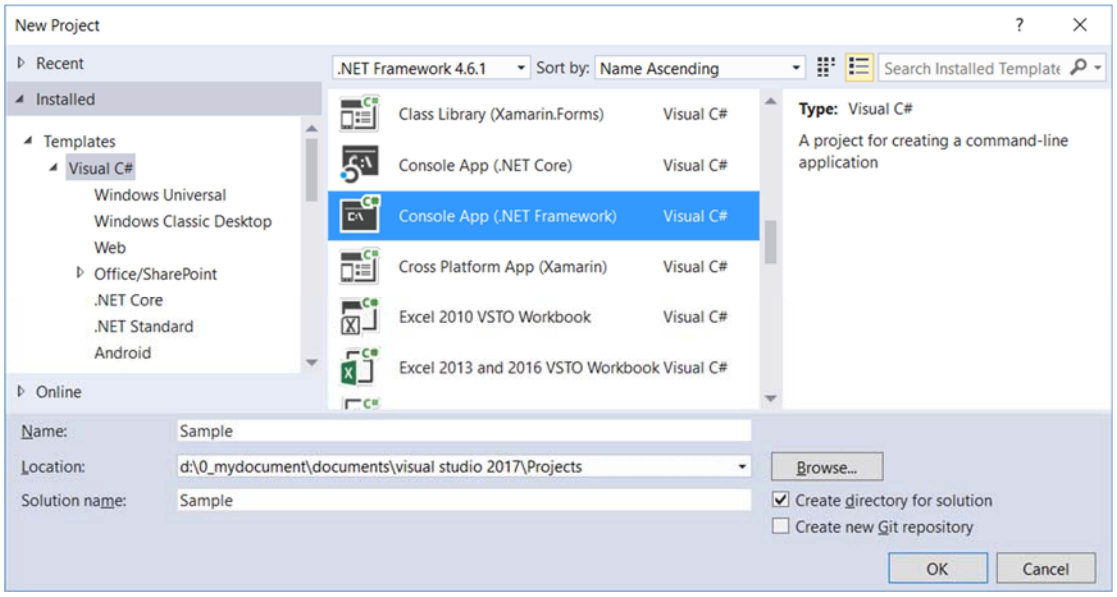
1.1. Create New Project : Sample

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

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

Name: **Sample**




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 Template
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#
Browse...
OK
Cancel

Type: Visual C#

A project for creating a command-line application

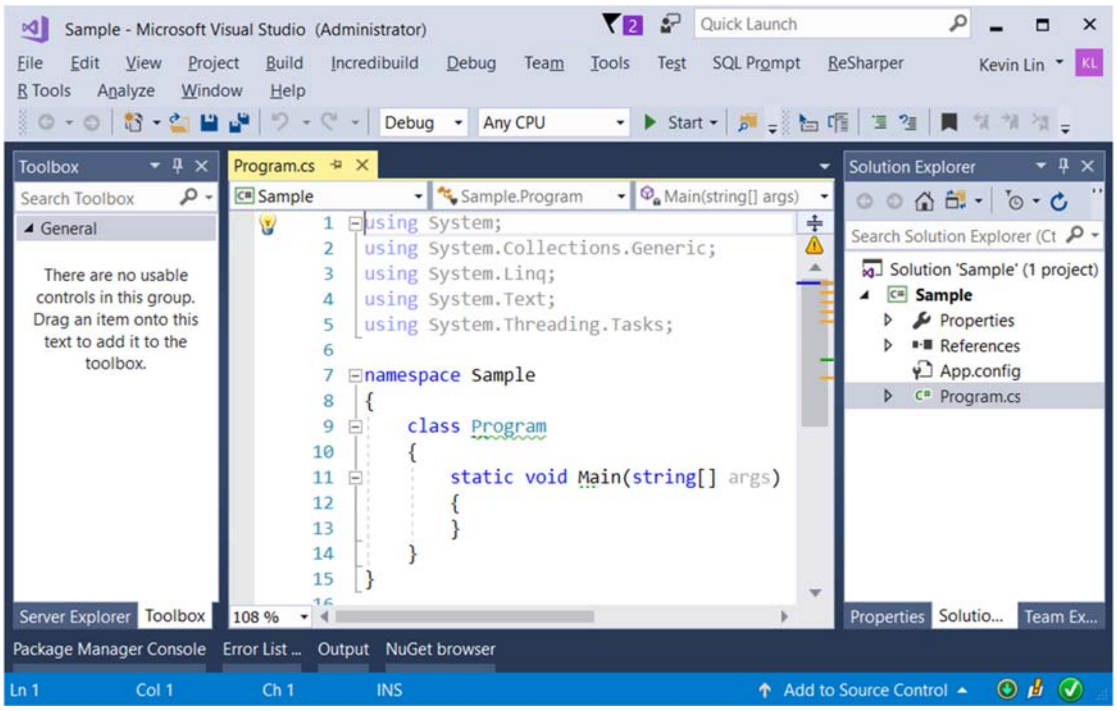
Name: Sample

Location: d:\0_mydocument\documents\visual studio 2017\Projects

Solution name: Sample

☑ Create directory for solution

☐ Create new Git repository


Sample - Microsoft Visual Studio (Administrator)
Quick Launch
File Edit View Project Build Incredibuild Debug Team Tools Test SQL Prompt ReSharper Kevin Lin KL
R Tools Analyze Window Help
Debug Any CPU Start
Toolbox
Search Toolbox
General
Program.cs
Sample Sample.Program 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 ... Output NuGet browser
Ln 1 Col 1 Ch 1 INS
Add to Source Control

There are no usable controls in this group. Drag an item onto this text to add it to the toolbox.

```
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)
        {
        }
    }
}
```

==

2. Sample : Program.cs

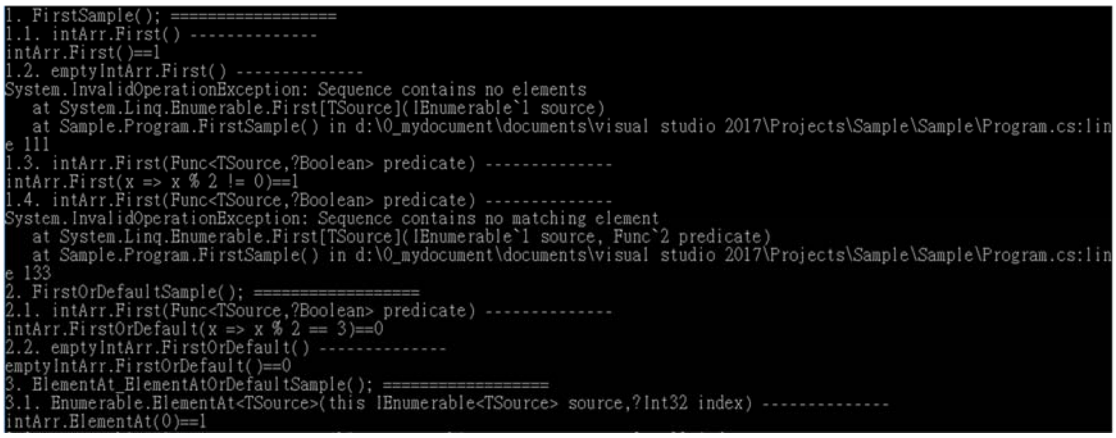
```
using System;
using System.Collections.Generic;
using System.Linq;
namespace Sample
{
    class Program
    {
        static void Main(string[] args)
        {
            // 1. ======================================
            //FirstSample()
            Console.WriteLine("1. FirstSample(); ================== ");
            FirstSample();
            // 2. ======================================
            //FirstOrDefaultSample()
            Console.WriteLine("2. FirstOrDefaultSample(); ================== ");
            FirstOrDefaultSample();
            //Last() is similar to First(),
            //Last() return last item,
            //First() return first item.
            //LastOrDefault() is similar to FirstOrDefault(),
            //LastOrDefault() return last item or
            //default value of type if last item was not found.
            //FirstOrDefault() return first item or
            //default value of type if first item was not found.
            // 3. ======================================
            //ElementAt_ElementAtOrDefaultSample()
            Console.WriteLine("3. ElementAt_ElementAtOrDefaultSample(); ================== ");
            ElementAt_ElementAtOrDefaultSample();
            // 4. ======================================
            //Single_SingleOrDefaultSample()
            Console.WriteLine("4. Single_SingleOrDefaultSample(); ================== ");
             Single_SingleOrDefaultSample();
            // 5. ======================================
            //DefaultIfEmptySample()
            Console.WriteLine("5. DefaultIfEmptySample(); ================== ");
             DefaultIfEmptySample();
            Console.ReadLine();
        }


       // 1. ======================================
        //FirstSample()
        static void FirstSample()
        {
            // 2.
            // First V.S. FirstOrDefault
            // ---------------------------------
            // 2.1.
            // First V.S. FirstOrDefault
            // --------------
            // 2.1.1.
            // First
            // throws InvalidOperationException
            // if the sequence does not contain any elements
            // or if no element in the sequence satisfies the condition
            // --------------
            // 2.1.2.
            // FirstOrDefault
            // returns default value of type
            // if the sequence does not contain any elements
            // or if no element in the sequence satisfies the condition
            // For the reference type, the default value is null.
            // ---------------------------------
            // 2.2.
            // Enumerable.First<TSource>
            // (this IEnumerable<TSource> source)
            // OR
            // Enumerable.FirstOrDefault<TSource>
            // (this IEnumerable<TSource> source)
            // Reference:
            // https://msdn.microsoft.com/en-us/library/bb291976(v=vs.110).aspx
            // https://msdn.microsoft.com/en-us/library/bb340482(v=vs.110).aspx
            // Returns the first element of a sequence.
            // ---------------------------------
            // 2.3.
            // Enumerable.First<TSource>
            // (this IEnumerable<TSource> source, Func<TSource, Boolean> predicate)
            // OR
            // Enumerable.FirstOrDefault<TSource>
            // (this IEnumerable<TSource> source, Func<TSource, Boolean> predicate)
            // Reference:
            // https://msdn.microsoft.com/en-us/library/bb535050(v=vs.110).aspx
            // https://msdn.microsoft.com/en-us/library/bb549039(v=vs.110).aspx
```

```
            // Returns the first element in a sequence that satisfies a specified condition.
            int[] intArr = { 1, 2, 3, 4, 5, 6, 7, 8, 9 };
            int[] emptyIntArr = { };
            // 1.1. -----------------------------------
            Console.WriteLine("1.1. intArr.First() -------------- ");
            int intArrFirst = intArr.First();
            Console.WriteLine($"intArr.First()=={intArrFirst}");
            //intArr.First()==1
            // 1.2. -----------------------------------
            Console.WriteLine("1.2. emptyIntArr.First() -------------- ");
            try
            {
                int emptyIntArrFirst = emptyIntArr.First();
                //Throws InvalidOperationException.
                Console.WriteLine($"emptyIntArr.First()=={emptyIntArrFirst}");
            }
            catch (Exception e)
            {
                Console.WriteLine(e);
            }
            // System.InvalidOperationException: Sequence contains no elements
            // at System.Linq.Enumerable.First[TSource](IEnumerable`1 source)
            // at Sample.Program.FirstSample() in d:\0_mydocument\documents\visual studio
2017\Projects\Sample\Sample\Program.cs:line 39
            // 1.3. -----------------------------------
            Console.WriteLine("1.3. intArr.First(Func<TSource, Boolean> predicate) -------------- ");
            int intArrFirstOddNumber = intArr.First(x => x % 2 != 0);
            Console.WriteLine($"intArr.First(x => x % 2 != 0)=={intArrFirstOddNumber}");
            // intArr.First(x => x % 2 != 0)==1
            // 1.4. -----------------------------------
            Console.WriteLine("1.4. intArr.First(Func<TSource, Boolean> predicate) -------------- ");
            try
            {
                int intArrFirstMod2Equal3 = intArr.First(x => x % 2 == 3);
                //Throws InvalidOperationException, as no element in the sequence satisfies
                Console.WriteLine($"intArr.First(x => x % 2 == 3)=={intArrFirstMod2Equal3}");
            }
            catch (Exception e)
            {
                Console.WriteLine(e);
            }
            // System.InvalidOperationException: Sequence contains no matching element
            // at System.Linq.Enumerable.First[TSource](IEnumerable`1 source, Func`2 predicate)
            // at Sample.Program.FirstSample() in d:\0_mydocument\documents\visual studio
2017\Projects\Sample\Sample\Program.cs:line 58
        }



        // 2. ====================================
        //FirstOrDefaultSample()
        static void FirstOrDefaultSample()
        {
            // 2.1.2.
            // FirstOrDefault
            // returns default value of type
            // if the sequence does not contain any elements
            // or if no element in the sequence satisfies the condition
            // For the reference type, the default value is null.
            int[] intArr = { 1, 2, 3, 4, 5, 6, 7, 8, 9 };
            int[] emptyIntArr = { };
            // 2.1. -----------------------------------
            Console.WriteLine("2.1. intArr.First(Func<TSource, Boolean> predicate) -------------- ");
            int intArrFirstMod2Equal3 = intArr.FirstOrDefault(x => x % 2 == 3);
            Console.WriteLine($"intArr.FirstOrDefault(x => x % 2 == 3)=={intArrFirstMod2Equal3}");
            //intArr.FirstOrDefault(x => x % 2 == 3)==0
            // 2.2. -----------------------------------
            Console.WriteLine("2.2. emptyIntArr.FirstOrDefault() -------------- ");
            int emptyIntArrFirstOrDefault = emptyIntArr.FirstOrDefault();
            Console.WriteLine($"emptyIntArr.FirstOrDefault()=={emptyIntArrFirstOrDefault}");
            //emptyIntArr.FirstOrDefault()==0
        }
        // 3. =====================================
        //ElementAt_ElementAtOrDefaultSample()
        static void ElementAt_ElementAtOrDefaultSample()
        {
            // 4.
            // ElementAt V.S. ElementAtOrDefault
            // ---------------------------------
            // 4.1.
            // Enumerable.ElementAt<TSource>
            // (this IEnumerable<TSource> source, Int32 index)
            // Reference:
            // https://msdn.microsoft.com/en-us/library/bb299233(v=vs.110).aspx
            // Returns the element at a specified index in a sequence.
            // Throws ArgumentNullException if source is null.
            // Throws ArgumentOutOfRangeException
            // if index is less than 0 or greater than or equal to the number of elements in source.
            // ---------------------------------
            // 4.2.
            // Enumerable.ElementAtOrDefault<TSource>
            // (this IEnumerable<TSource> source, Int32 index)
            // Reference:
            // https://msdn.microsoft.com/en-us/library/bb494386(v=vs.110).aspx
            // Returns the element at a specified index in a sequence
            // or a default value if the index is out of range.
            // Throws ArgumentNullException if source is null.
            int[] intArr = { 1, 2, 3, 4, 5, 6, 7, 8, 9 };
            int[] emptyIntArr = { };
            // 3.1. -----------------------------------
            Console.WriteLine("3.1. Enumerable.ElementAt<TSource>(this IEnumerable<TSource> source, Int32
index) -------------- ");
            int intArrElementAt0 = intArr.ElementAt(0);
            Console.WriteLine($"intArr.ElementAt(0)=={intArrElementAt0}");
            //intArr.ElementAt(0)==1
            // 3.2. -----------------------------------
            Console.WriteLine("3.2. Enumerable.ElementAt<TSource>(this IEnumerable<TSource> source, Int32
index) -------------- ");
            try
            {
                int emptyIntArrElementAt0 = emptyIntArr.ElementAt(0);
                Console.WriteLine($"emptyIntArr.ElementAt(0)=={emptyIntArrElementAt0}");
                //Throws ArgumentOutOfRangeException
            }
            catch (Exception e)
            {
                Console.WriteLine(e);
            }
            // 3.3. -----------------------------------
            Console.WriteLine("3.3. Enumerable.ElementAtOrDefault<TSource>(this IEnumerable<TSource>
source, Int32 index) -------------- ");
            int emptyIntArrElementAtOrDefault0 = emptyIntArr.ElementAtOrDefault(0);
            Console.WriteLine($"emptyIntArr.ElementAtOrDefault(0)=={emptyIntArrElementAtOrDefault0}");
            //emptyIntArr.ElementAtOrDefault(0)==0
        }


       // 4. ======================================
        //Single_SingleOrDefaultSample()
        static void Single_SingleOrDefaultSample()
        {
            // 5.
            // Single V.S. SingleOrDefault
            // ---------------------------------
            // 5.1.
            // Single V.S. SingleOrDefault
            // --------------
            // 5.1.1.
            // Single
            // throws ArgumentNullException if source is null.
            // Throws InvalidOperationException
            // if the input sequence contains more than one element.
            // or if The input sequence is empty.
            // --------------
            // 5.1.2.
            // SingleOrDefault
            // throws ArgumentNullException if source is null.
            // Throws InvalidOperationException
            // if the input sequence contains more than one element.
            // ---------------------------------
            // 5.2.
            // --------------
            // 5.2.1.
            // Enumerable.Single<TSource>
            // (this IEnumerable<TSource> source)
            // Reference:
            // https://msdn.microsoft.com/en-us/library/bb155325(v=vs.110).aspx
            // Returns the only element of a sequence,
            // and throws an exception
            // if there is not exactly one element in the sequence.
            // --------------
            // 5.2.2.
            // Enumerable.SingleOrDefault<TSource>
            // (this IEnumerable<TSource> source)
            // Reference:
            // https://msdn.microsoft.com/en-us/library/bb342451(v=vs.110).aspx
            // Returns the only element of a sequence,
            // or a default value if the sequence is empty;
            // this method throws an exception
            // if there is more than one element in the sequence.
            // --------------------------------
            // 5.3.
            // --------------
            // 5.3.1.
            // Enumerable.Single<TSource>
            // (this IEnumerable<TSource> source, Func<TSource, Boolean> predicate)
            // Reference:
            // https://msdn.microsoft.com/en-us/library/bb535118(v=vs.110).aspx
            // Returns the only element of a sequence that satisfies a specified condition,
            // and throws an exception if more than one such element exists.
            // --------------
            // 5.3.2.
            // Enumerable.SingleOrDefault<TSource>
            // (this IEnumerable<TSource> source, Func<TSource, Boolean> predicate)
            // Reference:
            // https://msdn.microsoft.com/en-us/library/bb549274(v=vs.110).aspx
            // Returns the only element of a sequence that satisfies a specified condition
            // or a default value if no such element exists;
            // this method throws an exception
            // if more than one element satisfies the condition.
            int[] intArr = { 1, 2, 3, 4, 5, 6, 7, 8, 9 };
            int[] intSingleArr = { 2 };
            int[] emptyIntArr = { };
            // 4.1. ----------------------------------
            Console.WriteLine("4.1. Enumerable.Single<TSource>(this IEnumerable<TSource> source) ---------
----- ");
            int intSingleArrSingle = intSingleArr.Single();
            Console.WriteLine($"intSingleArr.Single()=={intSingleArrSingle}");
            //intSingleArr.Single()==2
            // 4.2. ----------------------------------
            Console.WriteLine("4.2. Enumerable.Single<TSource>(this IEnumerable<TSource> source) ---------
----- ");
            try
            {
                int intArrSingle = intArr.Single();
                //Throws InvalidOperationException
                Console.WriteLine($"intArr.Single()=={intArrSingle}");
            }
            catch (Exception e)
            {
                Console.WriteLine(e);
            }
            // 4.3. ----------------------------------
            Console.WriteLine("4.3. Enumerable.Single<TSource>(this IEnumerable<TSource> source,
Func<TSource, Boolean> predicate) -------------- ");
            try
            {
                int intArrSingleMod2 = intArr.Single(x => x % 2 == 0);
                //Throws InvalidOperationException because mroe than one results.
                Console.WriteLine($"intArr.Single(x => x % 2 == 0)=={intArrSingleMod2}");
            }
            catch (Exception e)
            {
                Console.WriteLine(e);
            }
            // 4.4. -----------------------------------
            Console.WriteLine("4.4. Enumerable.SingleOrDefault<TSource>(this IEnumerable<TSource> source)
-------------- ");
            int emptyIntArrSingleOrDefault = emptyIntArr.SingleOrDefault();
            Console.WriteLine($"emptyIntArr.SingleOrDefault()=={emptyIntArrSingleOrDefault}");
            //emptyIntArr.SingleOrDefault()==0
            // 4.5. -----------------------------------
            Console.WriteLine("4.5. Enumerable.SingleOrDefault<TSource>(this IEnumerable<TSource> source)
-------------- ");
            try
            {
                int intArrSingle = intArr.SingleOrDefault();
                //Throws InvalidOperationException
                Console.WriteLine($"intArr.SingleOrDefault()=={intArrSingle}");
            }
            catch (Exception e)
            {
                Console.WriteLine(e);
            }
            // 4.6. -----------------------------------
            Console.WriteLine("4.6. Enumerable.SingleOrDefault<TSource>(this IEnumerable<TSource> source,
Func<TSource, Boolean> predicate) -------------- ");
            try
            {
                int intArrSingleMod2 = intArr.SingleOrDefault(x => x % 2 == 0);
                //Throws InvalidOperationException because mroe than one results.
                Console.WriteLine($"intArr.SingleOrDefault(x => x % 2 == 0)=={intArrSingleMod2}");
            }
            catch (Exception e)
            {
                Console.WriteLine(e);
            }
        }


       // 5. ======================================
        //DefaultIfEmptySample()
        static void DefaultIfEmptySample()
        {
            // 6.
            // DefaultIfEmpty
            // ---------------------------------
            // 6.1.
            // Enumerable.DefaultIfEmpty<TSource>
            // (this IEnumerable<TSource> source)
            // Reference:
            // https://msdn.microsoft.com/en-us/library/bb360179(v=vs.110).aspx
            // Returns the elements of the specified sequence
            // or the type parameter's default value in a singleton collection
            // if the sequence is empty.
            // ---------------------------------
            // 6.2.
            // Enumerable.DefaultIfEmpty<TSource>
            // (this IEnumerable<TSource> source, TSource defaultValue)
            // Reference:
            // https://msdn.microsoft.com/en-us/library/bb355419(v=vs.110).aspx
            // Returns the elements of the specified sequence
            // or the specified value in a singleton collection
            // if the sequence is empty.
            int[] intArr = { 1, 2, 3, 4, 5, 6, 7, 8, 9 };
            int[] emptyIntArr = { };
            // 5.1. -----------------------------------
            Console.WriteLine("5.1. Enumerable.DefaultIfEmpty<TSource>(this IEnumerable<TSource> source) -
------------- ");
            IEnumerable<int> intArrDefaultIfEmpty = intArr.DefaultIfEmpty();
            foreach (int i in intArrDefaultIfEmpty)
            {
                Console.Write($" [ {i} ] ");
            }
            Console.WriteLine();
            // [ 1 ]  [ 2 ]  [ 3 ]  [ 4 ]  [ 5 ]  [ 6 ]  [ 7 ]  [ 8 ]  [ 9 ]
            // 5.2. -----------------------------------
            Console.WriteLine("5.2. Enumerable.DefaultIfEmpty<TSource>(this IEnumerable<TSource> source) -
------------- ");
            IEnumerable<int> emptyIntArrDefaultIfEmpty = emptyIntArr.DefaultIfEmpty();
            foreach (int i in emptyIntArrDefaultIfEmpty)
            {
                Console.Write($" [ {i} ] ");
            }
            Console.WriteLine();
            // [ 0 ]
            // 5.3. -----------------------------------
            Console.WriteLine("5.3. Enumerable.DefaultIfEmpty<TSource>(this IEnumerable<TSource> source,
TSource defaultValue) -------------- ");
            IEnumerable<int> emptyIntArrDefaultIfEmpty100 = emptyIntArr.DefaultIfEmpty(100);
            foreach (int i in emptyIntArrDefaultIfEmpty100)
            {
                Console.Write($" [ {i} ] ");
            }
            Console.WriteLine();
            // [ 100 ]
        }
    }
}


/*
1.
First, FirstOrDefault, Last, LastOrDefault, ElementAt, ElementAtOrDefault, Single, SingleOrDefault, and
DefaultIfEmpty are Element Operators which retrieve a single element from a sequence.  All of these have
their own overloading methods.
-----------------------------------------------
2.
First V.S. FirstOrDefault
---------------------------------
```

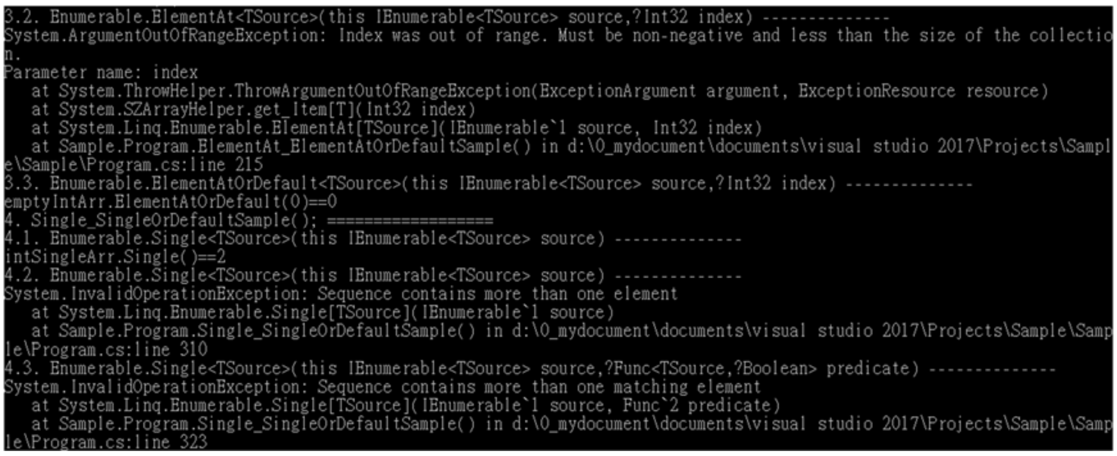
```
2.1.
First V.S. FirstOrDefault
--------------
2.1.1.
First
throws InvalidOperationException
if the sequence does not contain any elements
or if no element in the sequence satisfies the condition
--------------
2.1.2.
FirstOrDefault
returns default value of type
if the sequence does not contain any elements
or if no element in the sequence satisfies the condition
For the reference type, the default value is null.
---------------------------------
2.2.
Enumerable.First<TSource>
(this IEnumerable<TSource> source)
OR
Enumerable.FirstOrDefault<TSource>
(this IEnumerable<TSource> source)
Reference:
https://msdn.microsoft.com/en-us/library/bb291976(v=vs.110).aspx
https://msdn.microsoft.com/en-us/library/bb340482(v=vs.110).aspx
Returns the first element of a sequence.
---------------------------------
2.3.
Enumerable.First<TSource>
(this IEnumerable<TSource> source, Func<TSource, Boolean> predicate)
OR
Enumerable.FirstOrDefault<TSource>
(this IEnumerable<TSource> source, Func<TSource, Boolean> predicate)
Reference:
https://msdn.microsoft.com/en-us/library/bb535050(v=vs.110).aspx
https://msdn.microsoft.com/en-us/library/bb549039(v=vs.110).aspx
Returns the first element in a sequence that satisfies a specified condition.
-----------------------------------------------
3.
Last V.S. LastOrDefault
---------------------------------
3.1.
Last V.S. LastOrDefault
--------------
3.1.1.
Last
throws InvalidOperationException
if the sequence does not contain any elements
or if no element in the sequence satisfies the condition
--------------
3.1.2.
LastOrDefault
returns default value of type
if the sequence does not contain any elements
or if no element in the sequence satisfies the condition
For the reference type, the default value is null.
---------------------------------
3.2.
Enumerable.Last<TSource>
(this IEnumerable<TSource> source)
OR
Enumerable.LastOrDefault<TSource>
(this IEnumerable<TSource> source)
Reference:
https://msdn.microsoft.com/en-us/library/bb358775(v=vs.110).aspx
https://msdn.microsoft.com/en-us/library/bb301849(v=vs.110).aspx
Returns the last element of a sequence.
```

```
---------------------------------
3.3.
Enumerable.Last<TSource>
(this IEnumerable<TSource> source, Func<TSource, Boolean> predicate)
OR
Enumerable.LastOrDefault<TSource>
(this IEnumerable<TSource> source, Func<TSource, Boolean> predicate)
Reference:
https://msdn.microsoft.com/en-us/library/bb549138(v=vs.110).aspx
https://msdn.microsoft.com/en-us/library/bb548915(v=vs.110).aspx
Returns the last element of a sequence that satisfies a specified condition.
-----------------------------------------------
4.
ElementAt V.S. ElementAtOrDefault
---------------------------------
4.1.
Enumerable.ElementAt<TSource>
(this IEnumerable<TSource> source, Int32 index)
Reference:
https://msdn.microsoft.com/en-us/library/bb299233(v=vs.110).aspx
Returns the element at a specified index in a sequence.
Throws ArgumentNullException if source is null.
Throws ArgumentOutOfRangeException
if index is less than 0 or greater than or equal to the number of elements in source.
---------------------------------
4.2.
Enumerable.ElementAtOrDefault<TSource>
(this IEnumerable<TSource> source, Int32 index)
Reference:
https://msdn.microsoft.com/en-us/library/bb494386(v=vs.110).aspx
Returns the element at a specified index in a sequence
or a default value if the index is out of range.
Throws ArgumentNullException if source is null.



-----------------------------------------------
5.
Single V.S. SingleOrDefault
---------------------------------
5.1.
Single V.S. SingleOrDefault
--------------
5.1.1.
Single
throws ArgumentNullException if source is null.
Throws InvalidOperationException
if the input sequence contains more than one element.
or if The input sequence is empty.
--------------
5.1.2.
SingleOrDefault
throws ArgumentNullException if source is null.
Throws InvalidOperationException
if the input sequence contains more than one element.
---------------------------------
5.2.
--------------
5.2.1.
Enumerable.Single<TSource>
(this IEnumerable<TSource> source)
Reference:
https://msdn.microsoft.com/en-us/library/bb155325(v=vs.110).aspx
Returns the only element of a sequence,
and throws an exception
if there is not exactly one element in the sequence.
--------------
5.2.2.
```

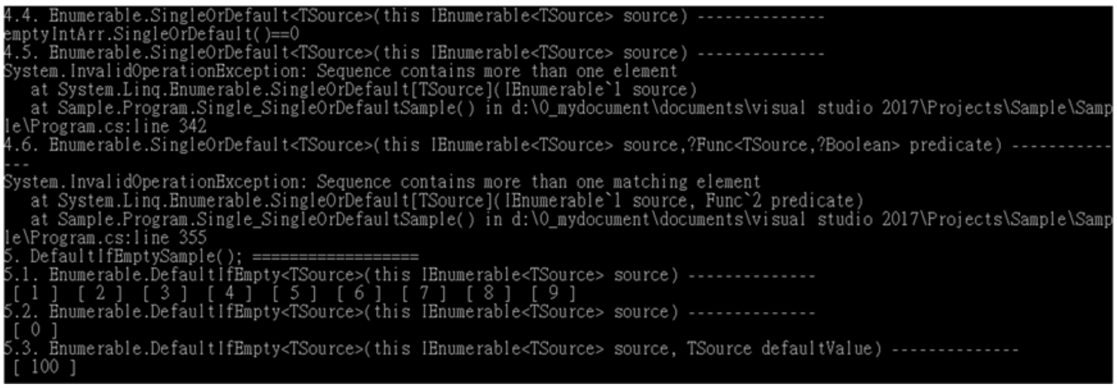
```
Enumerable.SingleOrDefault<TSource>
(this IEnumerable<TSource> source)
Reference:
https://msdn.microsoft.com/en-us/library/bb342451(v=vs.110).aspx
Returns the only element of a sequence,
or a default value if the sequence is empty;
this method throws an exception
if there is more than one element in the sequence.
---------------------------------
5.3.
--------------
5.3.1.
Enumerable.Single<TSource>
(this IEnumerable<TSource> source, Func<TSource, Boolean> predicate)
Reference:
https://msdn.microsoft.com/en-us/library/bb535118(v=vs.110).aspx
Returns the only element of a sequence that satisfies a specified condition,
and throws an exception if more than one such element exists.
--------------
5.3.2.
Enumerable.SingleOrDefault<TSource>
(this IEnumerable<TSource> source, Func<TSource, Boolean> predicate)
Reference:
https://msdn.microsoft.com/en-us/library/bb549274(v=vs.110).aspx
Returns the only element of a sequence that satisfies a specified condition
or a default value if no such element exists;
this method throws an exception
if more than one element satisfies the condition.
-----------------------------------------------
6.
DefaultIfEmpty
---------------------------------
6.1.
Enumerable.DefaultIfEmpty<TSource>
(this IEnumerable<TSource> source)
Reference:
https://msdn.microsoft.com/en-us/library/bb360179(v=vs.110).aspx
Returns the elements of the specified sequence
or the type parameter's default value in a singleton collection
if the sequence is empty.
---------------------------------
6.2.
Enumerable.DefaultIfEmpty<TSource>
(this IEnumerable<TSource> source, TSource defaultValue)
Reference:
https://msdn.microsoft.com/en-us/library/bb355419(v=vs.110).aspx
Returns the elements of the specified sequence
or the specified value in a singleton collection
if the sequence is empty.
*/
```



```
1. FirstSample(); ==================
1.1. intArr.First() --------------
intArr.First()==1
1.2. emptyIntArr.First() --------------
System.InvalidOperationException: Sequence contains no elements
   at System.Linq.Enumerable.First[TSource](IEnumerable`1 source)
   at Sample.Program.FirstSample() in d:\0_mydocument\documents\visual studio 2017\Projects\Sample\Sample\Program.cs:lin
e 111
1.3. intArr.First(Func<TSource,?Boolean> predicate) --------------
intArr.First(x => x % 2 != 0)==1
1.4. intArr.First(Func<TSource,?Boolean> predicate) --------------
System.InvalidOperationException: Sequence contains no matching element
   at System.Linq.Enumerable.First[TSource](IEnumerable`1 source, Func`2 predicate)
   at Sample.Program.FirstSample() in d:\0_mydocument\documents\visual studio 2017\Projects\Sample\Sample\Program.cs:lin
e 133
2. FirstOrDefaultSample(); ==================
2.1. intArr.First(Func<TSource,?Boolean> predicate) --------------
intArr.FirstOrDefault(x => x % 2 == 3)==0
2.2. emptyIntArr.FirstOrDefault() --------------
emptyIntArr.FirstOrDefault()==0
3. ElementAt_ElementAtOrDefaultSample(); ==================
3.1. Enumerable.ElementAt<TSource>(this IEnumerable<TSource> source,?Int32 index) --------------
intArr.ElementAt(0)==1
```



```
3.2. Enumerable.ElementAt<TSource>(this IEnumerable<TSource> source,?Int32 index) --------------
System.ArgumentOutOfRangeException: Index was out of range. Must be non-negative and less than the size of the collectio
n.
Parameter name: index
   at System.ThrowHelper.ThrowArgumentOutOfRangeException(ExceptionArgument argument, ExceptionResource resource)
   at System.SZArrayHelper.get_Item[T](Int32 index)
   at System.Linq.Enumerable.ElementAt[TSource](IEnumerable`1 source, Int32 index)
   at Sample.Program.ElementAt_ElementAtOrDefaultSample() in d:\0_mydocument\documents\visual studio 2017\Projects\Sampl
e\Sample\Program.cs:line 215
3.3. Enumerable.ElementAtOrDefault<TSource>(this IEnumerable<TSource> source,?Int32 index) --------------
emptyIntArr.ElementAtOrDefault(0)==0
4. Single_SingleOrDefaultSample(); ==================
4.1. Enumerable.Single<TSource>(this IEnumerable<TSource> source) --------------
intSingleArr.Single()==2
4.2. Enumerable.Single<TSource>(this IEnumerable<TSource> source) --------------
System.InvalidOperationException: Sequence contains more than one element
   at System.Linq.Enumerable.Single[TSource](IEnumerable`1 source)
   at Sample.Program.Single_SingleOrDefaultSample() in d:\0_mydocument\documents\visual studio 2017\Projects\Sample\Samp
le\Program.cs:line 310
4.3. Enumerable.Single<TSource>(this IEnumerable<TSource> source,?Func<TSource,?Boolean> predicate) --------------
System.InvalidOperationException: Sequence contains more than one matching element
   at System.Linq.Enumerable.Single[TSource](IEnumerable`1 source, Func`2 predicate)
   at Sample.Program.Single_SingleOrDefaultSample() in d:\0_mydocument\documents\visual studio 2017\Projects\Sample\Samp
le\Program.cs:line 323
```



```
4.4. Enumerable.SingleOrDefault<TSource>(this IEnumerable<TSource> source) --------------
emptyIntArr.SingleOrDefault()==0
4.5. Enumerable.SingleOrDefault<TSource>(this IEnumerable<TSource> source) --------------
System.InvalidOperationException: Sequence contains more than one element
   at System.Linq.Enumerable.SingleOrDefault[TSource](IEnumerable`1 source)
   at Sample.Program.Single_SingleOrDefaultSample() in d:\0_mydocument\documents\visual studio 2017\Projects\Sample\Samp
le\Program.cs:line 342
4.6. Enumerable.SingleOrDefault<TSource>(this IEnumerable<TSource> source,?Func<TSource,?Boolean> predicate) -----------
---
System.InvalidOperationException: Sequence contains more than one matching element
   at System.Linq.Enumerable.SingleOrDefault[TSource](IEnumerable`1 source, Func`2 predicate)
   at Sample.Program.Single_SingleOrDefaultSample() in d:\0_mydocument\documents\visual studio 2017\Projects\Sample\Samp
le\Program.cs:line 355
5. DefaultIfEmptySample(); ==================
5.1. Enumerable.DefaultIfEmpty<TSource>(this IEnumerable<TSource> source) --------------
[ 1 ]  [ 2 ]  [ 3 ]  [ 4 ]  [ 5 ]  [ 6 ]  [ 7 ]  [ 8 ]  [ 9 ]
5.2. Enumerable.DefaultIfEmpty<TSource>(this IEnumerable<TSource> source) --------------
[ 0 ]
5.3. Enumerable.DefaultIfEmpty<TSource>(this IEnumerable<TSource> source, TSource defaultValue) --------------
[ 100 ]
```