

# LinksPlatform's Platform.Collections Class Library

## 1.1 ./csharp/Platform.Collections/Arrays/ArrayFiller[TElement, TReturnConstant].cs

```

1  using System.Collections.Generic;
2  using System.Runtime.CompilerServices;
3
4  namespace Platform.Collections.Arrays
5  {
6      /// <summary>
7      /// <para>Represents <see cref="T:TElement[]"> array filler with additional methods that
8      ///     ↪ return a given constant of type <typeparamref cref="TReturnConstant"/>.</para>
9      /// <para>Представляет заполнитель массива <see cref="T:TElement[]"> с дополнительными
10     ↪ методами, возвращающими заданную константу типа <typeparamref
11     ↪ cref="TReturnConstant"/>.</para>
12     /// </summary>
13     /// <typeparam name="TElement"><para>The elements' type.</para><para>Тип элементов
14     ↪ массива.</para></typeparam>
15     /// <typeparam name="TReturnConstant"><para>The return constant's type.</para><para>Тип
16     ↪ возвращаемой константы.</para></typeparam>
17     public class ArrayFiller<TElement, TReturnConstant> : ArrayFiller<TElement>
18     {
19         /// <summary>
20         /// <para>
21         ///     The return constant.
22         /// </para>
23         /// <para></para>
24         /// </summary>
25         protected readonly TReturnConstant _returnConstant;
26
27         /// <summary>
28         /// <para>Initializes a new instance of the <see cref="ArrayFiller"/> class using the
29         ↪ specified array, the offset from which filling will start and the constant returned
30         ↪ when elements are being filled.</para>
31         /// <para>Инициализирует новый экземпляр класса <see cref="ArrayFiller"/>, используя
32         ↪ указанный массив, смещение с которого начнётся заполнение и константу возвращаемую
33         ↪ при заполнении элементов.</para>
34         /// </summary>
35         /// <param name="array"><para>The array to fill.</para><para>Массив для
36         ↪ заполнения.</para></param>
37         /// <param name="offset"><para>The offset from which to start the array
38         ↪ filling.</para><para>Смещение с которого начнётся заполнение массива.</para></param>
39         /// <param name="returnConstant"><para>The constant's value.</para><para>Значение
40         ↪ константы.</para></param>
41         [MethodImpl(MethodImplOptions.AggressiveInlining)]
42         public ArrayFiller(TElement[] array, long offset, TReturnConstant returnConstant) :
43             ↪ base(array, offset) => _returnConstant = returnConstant;
44
45         /// <summary>
46         /// <para>Initializes a new instance of the <see cref="ArrayFiller"/> class using the
47         ↪ specified array and the constant returned when elements are being filled. Filling
48         ↪ will start from the beginning of the array.</para>
49         /// <para>Инициализирует новый экземпляр класса <see cref="ArrayFiller"/>, используя
50         ↪ указанный массив и константу возвращаемую при заполнении элементов. Заполнение
51         ↪ начнётся с начала массива.</para>
52         /// </summary>
53         /// <param name="array"><para>The array to fill.</para><para>Массив для
54         ↪ заполнения.</para></param>
55         /// <param name="returnConstant"><para>The constant's value.</para><para>Значение
56         ↪ константы.</para></param>
57         [MethodImpl(MethodImplOptions.AggressiveInlining)]
58         public ArrayFiller(TElement[] array, TReturnConstant returnConstant) : this(array, 0,
59             ↪ returnConstant) { }
60
61         /// <summary>
62         /// <para>Adds an item into the array and returns the constant.</para>
63         /// <para>Добавляет элемент в массив и возвращает константу.</para>
64         /// </summary>
65         /// <param name="element"><para>The element to add.</para><para>Добавляемый
66         ↪ элемент.</para></param>
67         /// <returns>
68         /// <para>The constant's value.</para>
69         /// <para>Значение константы.</para>
70         /// </returns>
71         [MethodImpl(MethodImplOptions.AggressiveInlining)]
72         public TReturnConstant AddAndReturnConstant(TElement element) =>
73             ↪ _array.AddAndReturnConstant(ref _position, element, _returnConstant);
74
75         /// <summary>

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54     /// <para>Adds the first element from the specified list to the filled array and returns
    → the constant.</para>
55     /// <para>Добавляет первый элемент из указанного списка в заполняемый массив и
    → возвращает константу.</para>
56     /// </summary>
57     /// <param name="element"><para>The list from which the first item will be
    → added.</para><para>Список из которого будет добавлен первый элемент.</para></param>
58     /// <returns>
59     /// <para>The constant's value.</para>
60     /// <para>Значение константы.</para>
61     /// </returns>
62     [MethodImpl(MethodImplOptions.AggressiveInlining)]
63     public TReturnConstant AddFirstAndReturnConstant(ICollection<TElement> elements) =>
    → _array.AddFirstAndReturnConstant(ref _position, elements, _returnConstant);
64
65     /// <summary>
66     /// <para>Adds all elements from the specified list to the filled array and returns the
    → constant.</para>
67     /// <para>Добавляет все элементы из указанного списка в заполняемый массив и возвращает
    → константу.</para>
68     /// </summary>
69     /// <param name="elements"><para>The list of values to add.</para><para>Список значений
    → для добавления.</para></param>
70     /// <returns>
71     /// <para>The constant's value.</para>
72     /// <para>Значение константы.</para>
73     /// </returns>
74     [MethodImpl(MethodImplOptions.AggressiveInlining)]
75     public TReturnConstant AddAllAndReturnConstant(ICollection<TElement> elements) =>
    → _array.AddAllAndReturnConstant(ref _position, elements, _returnConstant);
76
77     /// <summary>
78     /// <para>Adds the elements of the list to the array, skipping the first element and
    → returns the constant.</para>
79     /// <para>Добавляет элементы списка в массив пропуская первый элемент и возвращает
    → константу.</para>
80     /// </summary>
81     /// <param name="elements"><para>The list of values to add.</para><para>Список значений
    → для добавления.</para></param>
82     /// <returns>
83     /// <para>The constant's value.</para>
84     /// <para>Значение константы.</para>
85     /// </returns>
86     [MethodImpl(MethodImplOptions.AggressiveInlining)]
87     public TReturnConstant AddSkipFirstAndReturnConstant(ICollection<TElement> elements) =>
    → _array.AddSkipFirstAndReturnConstant(ref _position, elements, _returnConstant);
88 }
89 }

```

## 1.2 ./csharp/Platform.Collections/Arrays/ArrayFiller[TElement].cs

```

1  using System.Collections.Generic;
2  using System.Runtime.CompilerServices;
3
4  namespace Platform.Collections.Arrays
5  {
6      /// <summary>
7      /// <para>Represents an <see cref="T:TElement[]"> array filler.</para>
8      /// <para>Представляет заполнитель массива <see cref="T:TElement[]">.</para>
9      /// </summary>
10     /// <typeparam name="TElement"><para>The elements' type.</para><para>Тип элементов
    → массива.</para></typeparam>
11     public class ArrayFiller<TElement>
12     {
13         /// <summary>
14         /// <para>
15         /// The array.
16         /// </para>
17         /// <para></para>
18         /// </summary>
19         protected readonly TElement[] _array;
20         /// <summary>
21         /// <para>
22         /// The position.
23         /// </para>
24         /// <para></para>
25         /// </summary>
26         protected long _position;

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```

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/// <summary>
/// <para>Initializes a new instance of the <see cref="ArrayFiller"/> class using the
→ specified array as the array to fill and the offset from which to start
→ filling.</para>
/// <para>Инициализирует новый экземпляр класса <see cref="ArrayFiller"/>, используя
→ указанный массив в качестве заполняемого и смещение с которого начнётся
→ заполнение.</para>
/// </summary>
/// <param name="array"><para>The array to fill.</para><para>Массив для
→ заполнения.</para></param>
/// <param name="offset"><para>The offset from which to start filling the
→ array.</para><para>Смещение с которого начнётся заполнение массива.</para></param>
[MethodImpl(MethodImplOptions.AggressiveInlining)]
public ArrayFiller(TElement[] array, long offset)
{
    _array = array;
    _position = offset;
}

/// <summary>
/// <para>Initializes a new instance of the <see cref="ArrayFiller"/> class using the
→ specified array. Filling will start from the beginning of the array.</para>
/// <para>Инициализирует новый экземпляр класса <see cref="ArrayFiller"/>, используя
→ указанный массив. Заполнение начнётся с начала массива.</para>
/// </summary>
/// <param name="array"><para>The array to fill.</para><para>Массив для
→ заполнения.</para></param>
[MethodImpl(MethodImplOptions.AggressiveInlining)]
public ArrayFiller(TElement[] array) : this(array, 0) { }

/// <summary>
/// <para>Adds an item into the array.</para>
/// <para>Добавляет элемент в массив.</para>
/// </summary>
/// <param name="element"><para>The element to add.</para><para>Добавляемый
→ элемент.</para></param>
[MethodImpl(MethodImplOptions.AggressiveInlining)]
public void Add(TElement element) => _array[_position++] = element;

/// <summary>
/// <para>Adds an item into the array and returns <see langword="true"/>.</para>
/// <para>Добавляет элемент в массив и возвращает <see langword="true"/>.</para>
/// </summary>
/// <param name="element"><para>The element to add.</para><para>Добавляемый
→ элемент.</para></param>
/// <returns>
/// <para>The <see langword="true"/> value.</para>
/// <para>Значение <see langword="true"/>.</para>
/// </returns>
[MethodImpl(MethodImplOptions.AggressiveInlining)]
public bool AddAndReturnTrue(TElement element) => _array.AddAndReturnConstant(ref
→ _position, element, true);

/// <summary>
/// <para>Adds the first element from the specified list to the array to fill and
→ returns <see langword="true"/>.</para>
/// <para>Добавляет первый элемент из указанного списка в заполняемый массив и
→ возвращает <see langword="true"/>.</para>
/// </summary>
/// <param name="elements"><para>The list from which the first item will be
→ added.</para><para>Список из которого будет добавлен первый элемент.</para></param>
/// <returns>
/// <para>The <see langword="true"/> value.</para>
/// <para>Значение <see langword="true"/>.</para>
/// </returns>
[MethodImpl(MethodImplOptions.AggressiveInlining)]
public bool AddFirstAndReturnTrue(ICollection<TElement> elements) =>
→ _array.AddFirstAndReturnConstant(ref _position, elements, true);

/// <summary>
/// <para>Adds all elements from the specified list to the array to fill and returns
→ <see langword="true"/>.</para>
/// <para>Добавляет все элементы из указанного списка в заполняемый массив и возвращает
→ <see langword="true"/>.</para>
/// </summary>

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85     /// <param name="elements"><para>The list of values to add.</para><para>Список значений
    ↪ которые необходимо добавить.</para></param>
86     /// <returns>
87     /// <para>The <see langword="true"/> value.</para>
88     /// <para>Значение <see langword="true"/>.</para>
89     /// </returns>
90     [MethodImpl(MethodImplOptions.AggressiveInlining)]
91     public bool AddAllAndReturnTrue(IList<TElement> elements) =>
    ↪ _array.AddAllAndReturnConstant(ref _position, elements, true);
92
93     /// <summary>
94     /// <para>Adds values to the array skipping the first element and returns <see
    ↪ langword="true"/>.</para>
95     /// <para>Добавляет значения в массив пропуская первый элемент и возвращает <see
    ↪ langword="true"/>.</para>
96     /// </summary>
97     /// <param name="elements"><para>A list from which elements will be added except the
    ↪ first.</para><para>Список из которого будут добавлены элементы кроме
    ↪ первого.</para></param>
98     /// <returns>
99     /// <para>The <see langword="true"/> value.</para>
100    /// <para>Значение <see langword="true"/>.</para>
101    /// </returns>
102    [MethodImpl(MethodImplOptions.AggressiveInlining)]
103    public bool AddSkipFirstAndReturnTrue(IList<TElement> elements) =>
    ↪ _array.AddSkipFirstAndReturnConstant(ref _position, elements, true);
104 }
105 }

```

### 1.3 ./csharp/Platform.Collections/Arrays/ArrayPool.cs

```

1  using System.Runtime.CompilerServices;
2
3  namespace Platform.Collections.Arrays
4  {
5      /// <summary>
6      /// <para>Represents a set of wrapper methods over <see cref="ArrayPool{T}"/> class methods
    ↪ to simplify access to them.</para>
7      /// <para>Представляет набор методов обёрток над методами класса <see cref="ArrayPool{T}"/>
    ↪ для упрощения доступа к ним.</para>
8      /// </summary>
9      public static class ArrayPool
10     {
11         /// <summary>
12         /// <para>
13         /// The default sizes amount.
14         /// </para>
15         /// <para></para>
16         /// </summary>
17         public static readonly int DefaultSizesAmount = 512;
18         /// <summary>
19         /// <para>
20         /// The default max arrays per size.
21         /// </para>
22         /// <para></para>
23         /// </summary>
24         public static readonly int DefaultMaxArraysPerSize = 32;
25
26         /// <summary>
27         /// <para>Allocation of an array of a specified size from the array pool.</para>
28         /// <para>Выделение массива указанного размера из пула массивов.</para>
29         /// </summary>
30         /// <typeparam name="T"><para>The array elements type.</para><para>Тип элементов
    ↪ массива.</para></typeparam>
31         /// <param name="size"><para>The allocated array size.</para><para>Размер выделяемого
    ↪ массива.</para></param>
32         /// <returns>
33         /// <para>The array from a pool of arrays.</para>
34         /// <para>Массив из пулла массивов.</para>
35         /// </returns>
36         [MethodImpl(MethodImplOptions.AggressiveInlining)]
37         public static T[] Allocate<T>(long size) => ArrayPool<T>.ThreadInstance.Allocate(size);
38
39         /// <summary>
40         /// <para>Freeing an array into an array pool.</para>
41         /// <para>Освобождение массива в пул массивов.</para>
42         /// </summary>
43         /// <typeparam name="T"><para>The array elements type.</para><para>Тип элементов
    ↪ массива.</para></typeparam>

```

```

44     /// <param name="array"><para>The array to be freed into the pull.</para></param>
    ↪    который нужно освободить в пулл.</para></param>
45     [MethodImpl(MethodImplOptions.AggressiveInlining)]
46     public static void Free<T>(T[] array) => ArrayPool<T>.ThreadInstance.Free(array);
47 }
48 }

```

#### 1.4 ./csharp/Platform.Collections/Arrays/ArrayPool[T].cs

```

1  using System;
2  using System.Collections.Generic;
3  using System.Runtime.CompilerServices;
4  using Platform.Disposables;
5  using Platform.Collections.Stacks;
6
7  namespace Platform.Collections.Arrays
8  {
9      /// <summary>
10     /// <para>Represents a set of arrays ready for reuse.</para>
11     /// <para>Представляет собой набор массивов готовых к повторному использованию.</para>
12     /// </summary>
13     /// <typeparam name="T"><para>The array elements type.</para></typeparam>
    ↪    массива.</para></typeparam>
14     /// <remarks>
15     /// Original idea from
    ↪    http://geekswithblogs.net/blackrob/archive/2014/12/18/array-pooling-in-csharp.aspx
16     /// </remarks>
17     public class ArrayPool<T>
18     {
19         // May be use Default class for that later.
20         /// <summary>
21         /// <para>
22         /// The thread instance.
23         /// </para>
24         /// <para></para>
25         /// </summary>
26         [ThreadStatic]
27         private static ArrayPool<T> _threadInstance;
28         /// <summary>
29         /// <para>
30         /// Gets the thread instance value.
31         /// </para>
32         /// <para></para>
33         /// </summary>
34         internal static ArrayPool<T> ThreadInstance => _threadInstance ?? (_threadInstance = new
    ↪    ArrayPool<T>());
35         private readonly int _maxArraysPerSize;
36         private readonly Dictionary<long, Stack<T[]>> _pool = new Dictionary<long,
    ↪    Stack<T[]>>(ArrayPool.DefaultSizesAmount);
37
38         /// <summary>
39         /// <para>Initializes a new instance of the ArrayPool class using the specified maximum
    ↪    number of arrays per size.</para>
40         /// <para>Инициализирует новый экземпляр класса ArrayPool, используя указанное
    ↪    максимальное количество массивов на каждый размер.</para>
41         /// </summary>
42         /// <param name="maxArraysPerSize"><para>The maximum number of arrays in the pool per
    ↪    size.</para></param><para>Максимальное количество массивов в пуле на каждый
    ↪    размер.</para></param>
43         [MethodImpl(MethodImplOptions.AggressiveInlining)]
44         public ArrayPool(int maxArraysPerSize) => _maxArraysPerSize = maxArraysPerSize;
45
46         /// <summary>
47         /// <para>Initializes a new instance of the ArrayPool class using the default maximum
    ↪    number of arrays per size.</para>
48         /// <para>Инициализирует новый экземпляр класса ArrayPool, используя максимальное
    ↪    количество массивов на каждый размер по умолчанию.</para>
49         /// </summary>
50         [MethodImpl(MethodImplOptions.AggressiveInlining)]
51         public ArrayPool() : this(ArrayPool.DefaultMaxArraysPerSize) { }
52
53         /// <summary>
54         /// <para>Retrieves an array from the pool, which will automatically return to the pool
    ↪    when the container is disposed.</para>
55         /// <para>Извлекает из пула массив, который автоматически вернётся в пул при
    ↪    высвобождении контейнера.</para>
56         /// </summary>
57         /// <param name="size"><para>The allocated array size.</para></param><para>Размер выделяемого
    ↪    массива.</para></param>

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58     /// <returns>
59     /// <para>The disposable container containing either a new array or an array from the
    → pool.</para>
60     /// <para>Высвобождаемый контейнер содержащий либо новый массив, либо массив из
    → пула.</para>
61     /// </returns>
62     [MethodImpl(MethodImplOptions.AggressiveInlining)]
63     public Disposable<T[]> AllocateDisposable(long size) => (Allocate(size), Free);
64
65     /// <summary>
66     /// <para>Replaces the array with another array from the pool with the specified
    → size.</para>
67     /// <para>Заменяет массив на другой массив из пула с указанным размером.</para>
68     /// </summary>
69     /// <param name="source"><para>The source array.</para><para>Исходный
    → массив.</para></param>
70     /// <param name="size"><para>A new array size.</para><para>Новый размер
    → массива.</para></param>
71     /// <returns>
72     /// <para>An array with a new size.</para>
73     /// <para>Массив с новым размером.</para>
74     /// </returns>
75     [MethodImpl(MethodImplOptions.AggressiveInlining)]
76     public Disposable<T[]> Resize(Disposable<T[]> source, long size)
77     {
78         var destination = AllocateDisposable(size);
79         T[] sourceArray = source;
80         if (!sourceArray.IsNullOrEmpty())
81         {
82             T[] destinationArray = destination;
83             Array.Copy(sourceArray, destinationArray, size < sourceArray.LongLength ? size :
    → sourceArray.LongLength);
84             source.Dispose();
85         }
86         return destination;
87     }
88
89     /// <summary>
90     /// <para>Clears the pool.</para>
91     /// <para>Очищает пул.</para>
92     /// </summary>
93     [MethodImpl(MethodImplOptions.AggressiveInlining)]
94     public virtual void Clear() => _pool.Clear();
95
96     /// <summary>
97     /// <para>Retrieves an array with the specified size from the pool.</para>
98     /// <para>Извлекает из пула массив с указанным размером.</para>
99     /// </summary>
100    /// <param name="size"><para>The allocated array size.</para><para>Размер выделяемого
    → массива.</para></param>
101    /// <returns>
102    /// <para>An array from the pool or a new array.</para>
103    /// <para>Массив из пула или новый массив.</para>
104    /// </returns>
105    [MethodImpl(MethodImplOptions.AggressiveInlining)]
106    public virtual T[] Allocate(long size) => size <= 0L ? Array.Empty<T>() :
    → _pool.GetOrDefault(size)?.PopOrDefault() ?? new T[size];
107
108    /// <summary>
109    /// <para>Frees the array to the pool for later reuse.</para>
110    /// <para>Освобождает массив в пул для последующего повторного использования.</para>
111    /// </summary>
112    /// <param name="array"><para>The array to be freed into the pool.</para><para>Массив
    → который нужно освободить в пул.</para></param>
113    [MethodImpl(MethodImplOptions.AggressiveInlining)]
114    public virtual void Free(T[] array)
115    {
116        if (array.IsNullOrEmpty())
117        {
118            return;
119        }
120        var stack = _pool.GetOrAdd(array.LongLength, size => new
    → Stack<T[]>(_maxArraysPerSize));
121        if (stack.Count == _maxArraysPerSize) // Stack is full
122        {
123            return;
124        }

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125         stack.Push(array);
126     }
127 }
128 }

```

## 1.5 ./csharp/Platform.Collections/Arrays/ArrayString.cs

```

1 using System.Runtime.CompilerServices;
2 using Platform.Collections.Segments;
3
4 #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
5
6 namespace Platform.Collections.Arrays
7 {
8     /// <summary>
9     /// <para>
10    /// Represents the array string.
11    /// </para>
12    /// <para></para>
13    /// </summary>
14    /// <seealso cref="Segment{T}" />
15    public class ArrayString<T> : Segment<T>
16    {
17        /// <summary>
18        /// <para>
19        /// Initializes a new <see cref="ArrayString" /> instance.
20        /// </para>
21        /// <para></para>
22        /// </summary>
23        /// <param name="length">
24        /// <para>A length.</para>
25        /// <para></para>
26        /// </param>
27        [MethodImpl(MethodImplOptions.AggressiveInlining)]
28        public ArrayString(int length) : base(new T[length], 0, length) { }
29
30        /// <summary>
31        /// <para>
32        /// Initializes a new <see cref="ArrayString" /> instance.
33        /// </para>
34        /// <para></para>
35        /// </summary>
36        /// <param name="array">
37        /// <para>A array.</para>
38        /// <para></para>
39        /// </param>
40        [MethodImpl(MethodImplOptions.AggressiveInlining)]
41        public ArrayString(T[] array) : base(array, 0, array.Length) { }
42
43        /// <summary>
44        /// <para>
45        /// Initializes a new <see cref="ArrayString" /> instance.
46        /// </para>
47        /// <para></para>
48        /// </summary>
49        /// <param name="array">
50        /// <para>A array.</para>
51        /// <para></para>
52        /// </param>
53        /// <param name="length">
54        /// <para>A length.</para>
55        /// <para></para>
56        /// </param>
57        [MethodImpl(MethodImplOptions.AggressiveInlining)]
58        public ArrayString(T[] array, int length) : base(array, 0, length) { }
59    }
60 }

```

## 1.6 ./csharp/Platform.Collections/Arrays/CharArrayExtensions.cs

```

1 using System.Runtime.CompilerServices;
2
3 namespace Platform.Collections.Arrays
4 {
5     /// <summary>
6     /// <para>
7     /// Represents the char array extensions.
8     /// </para>
9     /// <para></para>
10    /// </summary>

```

```

11 public static unsafe class CharArrayExtensions
12 {
13     /// <summary>
14     /// <para>Generates a hash code for an array segment with the specified offset and
15     → length. The hash code is generated based on the values of the array elements
16     → included in the specified segment.</para>
17     /// <para>Генерирует хэш-код сегмента массива с указанным смещением и длиной. Хэш-код
18     → генерируется на основе значений элементов массива входящих в указанный
19     → сегмент.</para>
20     /// </summary>
21     /// <param name="array"><para>The array to hash.</para><para>Массив для
22     → хеширования.</para></param>
23     /// <param name="offset"><para>The offset from which reading of the specified number of
24     → elements in the array starts.</para><para>Смещение, с которого начинается чтение
25     → указанного количества элементов в массиве.</para></param>
26     /// <param name="length"><para>The number of array elements used to calculate the
27     → hash.</para><para>Количество элементов массива, на основе которых будет вычислен
28     → хэш.</para></param>
29     /// <returns>
30     /// <para>The hash code of the segment in the array.</para>
31     /// <para>Хэш-код сегмента в массиве.</para>
32     /// </returns>
33     /// <remarks>
34     /// Based on https://github.com/Microsoft/referencesource/blob/3b1eaf5203992df69de44c783\_
35     → a3eda37d3d4cd10/mscorlib/system/string.cs#L833
36     /// </remarks>
37     [MethodImpl(MethodImplOptions.AggressiveInlining)]
38     public static int GenerateHashCode(this char[] array, int offset, int length)
39     {
40         var hashSeed = 5381;
41         var hashAccumulator = hashSeed;
42         fixed (char* arrayPointer = &array[offset])
43         {
44             for (char* charPointer = arrayPointer, last = charPointer + length; charPointer
45             → < last; charPointer++)
46             {
47                 hashAccumulator = (hashAccumulator << 5) + hashAccumulator ^ *charPointer;
48             }
49             return hashAccumulator + (hashSeed * 1566083941);
50         }
51     }
52     /// <summary>
53     /// <para>Checks if all elements of two lists are equal.</para>
54     /// <para>Проверяет равны ли все элементы двух списков.</para>
55     /// </summary>
56     /// <param name="left"><para>The first compared array.</para><para>Первый массив для
57     → сравнения.</para></param>
58     /// <param name="leftOffset"><para>The offset from which reading of the specified number
59     → of elements in the first array starts.</para><para>Смещение, с которого начинается
60     → чтение элементов в первом массиве.</para></param>
61     /// <param name="length"><para>The number of checked elements.</para><para>Количество
62     → проверяемых элементов.</para></param>
63     /// <param name="right"><para>The second compared array.</para><para>Второй массив для
64     → сравнения.</para></param>
65     /// <param name="rightOffset"><para>The offset from which reading of the specified
66     → number of elements in the second array starts.</para><para>Смещение, с которого
67     → начинается чтение элементов в втором массиве.</para></param>
68     /// <returns>
69     /// <para><see langword="true"/> if the segments of the passed arrays are equal to each
70     → other otherwise <see langword="false"/>.</para>
71     /// <para><see langword="true"/>, если сегменты переданных массивов равны друг другу,
72     → иначе же <see langword="false"/>.</para>
73     /// </returns>
74     /// <remarks>
75     /// Based on https://github.com/Microsoft/referencesource/blob/3b1eaf5203992df69de44c783\_
76     → a3eda37d3d4cd10/mscorlib/system/string.cs#L364
77     /// </remarks>
78     [MethodImpl(MethodImplOptions.AggressiveInlining)]
79     public static bool ContentEqualTo(this char[] left, int leftOffset, int length, char[]
80     → right, int rightOffset)
81     {
82         fixed (char* leftPointer = &left[leftOffset])
83         {
84             fixed (char* rightPointer = &right[rightOffset])
85             {

```



```

65         char* leftPointerCopy = leftPointer, rightPointerCopy = rightPointer;
66         if (!CheckArraysMainPartForEquality(ref leftPointerCopy, ref
        ↪ rightPointerCopy, ref length))
67         {
68             return false;
69         }
70         CheckArraysRemainderForEquality(ref leftPointerCopy, ref rightPointerCopy,
        ↪ ref length);
71         return length <= 0;
72     }
73 }
74 }
75 [MethodImpl(MethodImplOptions.AggressiveInlining)]
76 private static bool CheckArraysMainPartForEquality(ref char* left, ref char* right, ref
        ↪ int length)
77 {
78     while (length >= 10)
79     {
80         if ((* (int*)left != * (int*)right)
81             || (* (int*)(left + 2) != * (int*)(right + 2))
82             || (* (int*)(left + 4) != * (int*)(right + 4))
83             || (* (int*)(left + 6) != * (int*)(right + 6))
84             || (* (int*)(left + 8) != * (int*)(right + 8)))
85         {
86             return false;
87         }
88         left += 10;
89         right += 10;
90         length -= 10;
91     }
92     return true;
93 }
94 [MethodImpl(MethodImplOptions.AggressiveInlining)]
95 private static void CheckArraysRemainderForEquality(ref char* left, ref char* right, ref
        ↪ int length)
96 {
97     // This depends on the fact that the String objects are
98     // always zero terminated and that the terminating zero is not included
99     // in the length. For odd string sizes, the last compare will include
100    // the zero terminator.
101    while (length > 0)
102    {
103        if ((* (int*)left != * (int*)right)
104            {
105            break;
106        }
107        left += 2;
108        right += 2;
109        length -= 2;
110    }
111 }
112 }
113 }

```

## 1.7 ./csharp/Platform.Collections/Arrays/GenericArrayExtensions.cs

```

1  using System;
2  using System.Collections.Generic;
3  using System.Runtime.CompilerServices;
4
5  namespace Platform.Collections.Arrays
6  {
7      /// <summary>
8      /// <para>Represents a set of extension methods for a <see cref="T:T[]" /> array.</para>
9      /// <para>Представляет набор методов расширения для массива <see cref="T:T[]" />.</para>
10     /// </summary>
11     public static class GenericArrayExtensions
12     {
13         /// <summary>
14         /// <para>Checks if an array exists, if so, checks the array length using the index
        ↪ variable type int, and if the array length is greater than the index - return
        ↪ array[index], otherwise - default value.</para>
15         /// <para>Проверяет, существует ли массив, если да - идет проверка длины массива с
        ↪ помощью переменной index, и если длина массива больше индекса - возвращает
        ↪ array[index], иначе - значение по умолчанию.</para>
16         /// </summary>
17         /// <typeparam name="T"><para>Array elements type.</para><para>Тип элементов
        ↪ массива.</para></typeparam>

```

```

18  /// <param name="array"><para>Array that will participate in
    → verification.</para><para>Массив который будет участвовать в
19  /// <param name="index"><para>Number type int to compare.</para><para>Число типа int для
    → сравнения.</para></param>
20  /// <returns><para>Array element or default value.</para><para>Элемент массива или же
    → значение по умолчанию.</para></returns>
21  [MethodImpl(MethodImplOptions.AggressiveInlining)]
22  public static T GetElementOrDefault<T>(this T[] array, int index) => array != null &&
    → array.Length > index ? array[index] : default;
23
24  /// <summary>
25  /// <para>Checks whether the array exists, if so, checks the array length using the
    → index variable type long, and if the array length is greater than the index - return
    → array[index], otherwise - default value.</para>
26  /// <para>Проверяет, существует ли массив, если да - идет проверка длины массива с
    → помощью переменной index, и если длина массива больше индекса - возвращает
    → array[index], иначе - значение по умолчанию.</para>
27  /// </summary>
28  /// <typeparam name="T"><para>Array elements type.</para><para>Тип элементов
    → массива.</para></typeparam>
29  /// <param name="array"><para>Array that will participate in
    → verification.</para><para>Массив который будет участвовать в
    → проверке.</para></param>
30  /// <param name="index"><para>Number type long to compare.</para><para>Число типа long
    → для сравнения.</para></param>
31  /// <returns><para>Array element or default value.</para><para>Элемент массива или же
    → значение по умолчанию.</para></returns>
32  [MethodImpl(MethodImplOptions.AggressiveInlining)]
33  public static T GetElementOrDefault<T>(this T[] array, long index) => array != null &&
    → array.LongLength > index ? array[index] : default;
34
35  /// <summary>
36  /// <para>Checks whether the array exist, if so, checks the array length using the index
    → variable type int, and if the array length is greater than the index, set the element
    → variable to array[index] and return <see langword="true"/>.</para>
37  /// <para>Проверяет, существует ли массив, если да, то идет проверка длины массива с
    → помощью переменной index типа int, и если длина массива больше значения index,
    → устанавливает значение переменной element - array[index] и возвращает <see
    → langword="true"/>.</para>
38  /// </summary>
39  /// <typeparam name="T"><para>Array elements type.</para><para>Тип элементов
    → массива.</para></typeparam>
40  /// <param name="array"><para>Array that will participate in
    → verification.</para><para>Массив который будет участвовать в
    → проверке.</para></param>
41  /// <param name="index"><para>Number type int to compare.</para><para>Число типа int для
    → сравнения.</para></param>
42  /// <param name="element"><para>Passing the argument by reference, if successful, it
    → will take the value array[index] otherwise default value.</para><para>Передаёт
    → аргумент по ссылке, в случае успеха он примет значение array[index] в противном
    → случае значение по умолчанию.</para></param>
43  /// <returns><para><see langword="true"/> if successful otherwise <see
    → langword="false"/>.</para><para><see langword="true"/> в случае успеха, в противном
    → случае <see langword="false"/>.</para></returns>
44  [MethodImpl(MethodImplOptions.AggressiveInlining)]
45  public static bool TryGetElement<T>(this T[] array, int index, out T element)
46  {
47      if (array != null && array.Length > index)
48      {
49          element = array[index];
50          return true;
51      }
52      else
53      {
54          element = default;
55          return false;
56      }
57  }
58
59  /// <summary>
60  /// <para>Checks whether the array exist, if so, checks the array length using the
    → index variable type long, and if the array length is greater than the index, set the
    → element variable to array[index] and return <see langword="true"/>.</para>

```

```

61  /// <para>Проверяет, существует ли массив, если да, то идет проверка длины массива с
    → помощью переменной index типа long, и если длина массива больше значения index,
    → устанавливает значение переменной element - array[index] и возвращает <see
    → langword="true"/>.</para>
62  /// </summary>
63  /// <typeparam name="T"><para>Array elements type.</para><para>Тип элементов
    → массива.</para></typeparam>
64  /// <param name="array"><para>Array that will participate in
    → verification.</para><para>Массив который будет участвовать в
    → проверке.</para></param>
65  /// <param name="index"><para>Number type long to compare.</para><para>Число типа long
    → для сравнения.</para></param>
66  /// <param name="element"><para>Passing the argument by reference, if successful, it
    → will take the value array[index] otherwise default value.</para><para>Передаёт
    → аргумент по ссылке, в случае успеха он примет значение array[index] в противном
    → случае значение по умолчанию.</para></param>
67  /// <returns><para><see langword="true"/> if successful otherwise <see
    → langword="false"/>.</para><para><see langword="true"/> в случае успеха, в противном
    → случае <see langword="false"/>.</para></returns>
68  [MethodImpl(MethodImplOptions.AggressiveInlining)]
69  public static bool TryGetElement<T>(this T[] array, long index, out T element)
70  {
71      if (array != null && array.LongLength > index)
72      {
73          element = array[index];
74          return true;
75      }
76      else
77      {
78          element = default;
79          return false;
80      }
81  }
82
83  /// <summary>
84  /// <para>Copying of elements from one array to another array.</para>
85  /// <para>Копирует элементы из одного массива в другой массив.</para>
86  /// </summary>
87  /// <typeparam name="T"><para>Array elements type.</para><para>Тип элементов
    → массива.</para></typeparam>
88  /// <param name="array"><para>The array to copy.</para><para>Массив который необходимо
    → скопировать.</para></param>
89  /// <returns><para>Copy of the array.</para><para>Копию массива.</para></returns>
90  [MethodImpl(MethodImplOptions.AggressiveInlining)]
91  public static T[] Clone<T>(this T[] array)
92  {
93      var copy = new T[array.LongLength];
94      Array.Copy(array, 0L, copy, 0L, array.LongLength);
95      return copy;
96  }
97
98  /// <summary>
99  /// <para>Shifts all the elements of the array by one position to the right.</para>
100  /// <para>Сдвигает вправо все элементы массива на одну позицию.</para>
101  /// </summary>
102  /// <typeparam name="T"><para>The array item type.</para><para>Тип элементов
    → массива.</para></typeparam>
103  /// <param name="array"><para>The array to copy from.</para><para>Массив для
    → копирования.</para></param>
104  /// <returns>
105  /// <para>Array with a shift of elements by one position.</para>
106  /// <para>Массив со сдвигом элементов на одну позицию.</para>
107  /// </returns>
108  [MethodImpl(MethodImplOptions.AggressiveInlining)]
109  public static IList<T> ShiftRight<T>(this T[] array) => array.ShiftRight(1L);
110
111  /// <summary>
112  /// <para>Shifts all elements of the array to the right by the specified number of
    → elements.</para>
113  /// <para>Сдвигает вправо все элементы массива на указанное количество элементов.</para>
114  /// </summary>
115  /// <typeparam name="T"><para>The array item type.</para><para>Тип элементов
    → массива.</para></typeparam>
116  /// <param name="array"><para>The array to copy from.</para><para>Массив для
    → копирования.</para></param>
117  /// <param name="shift"><para>The number of items to shift.</para><para>Количество
    → сдвигаемых элементов.</para></param>

```

```

118 /// <returns>
119 /// <para>If the value of the shift variable is less than zero - an <see
    → cref="NotImplementedException"/> exception is thrown, but if the value of the shift
    → variable is 0 - an exact copy of the array is returned. Otherwise, an array is
    → returned with the shift of the elements.</para>
120 /// <para>Если значение переменной shift меньше нуля - выбрасывается исключение <see
    → cref="NotImplementedException"/>, если же значение переменной shift равно 0 -
    → возвращается точная копия массива. Иначе возвращается массив со сдвигом
    → элементов.</para>
121 /// </returns>
122 [MethodImpl(MethodImplOptions.AggressiveInlining)]
123 public static IList<T> ShiftRight<T>(this T[] array, long shift)
124 {
125     if (shift < 0)
126     {
127         throw new NotImplementedException();
128     }
129     if (shift == 0)
130     {
131         return array.Clone<T>();
132     }
133     else
134     {
135         var restrictions = new T[array.LongLength + shift];
136         Array.Copy(array, 0L, restrictions, shift, array.LongLength);
137         return restrictions;
138     }
139 }
140
141 /// <summary>
142 /// <para>Adding in array the passed element at the specified position and increments
    → position value by one.</para>
143 /// <para>Добавляет в массив переданный элемент на указанную позицию и увеличивает
    → значение position на единицу.</para>
144 /// </summary>
145 /// <typeparam name="T"><para>Array elements type.</para><para>Тип элементов
    → массива.</para></typeparam>
146 /// <param name="array"><para>The array to add the element to.</para><para>Массив в
    → который необходимо добавить элемент.</para></param>
147 /// <param name="position"><para>A reference to the position of type int where the
    → element will be added.</para><para>Ссылка на позицию типа int, в которую будет
    → добавлен элемент.</para></param>
148 /// <param name="element"><para>The element to add to the array.</para><para>Элемент,
    → который нужно добавить в массив.</para></param>
149 [MethodImpl(MethodImplOptions.AggressiveInlining)]
150 public static void Add<T>(this T[] array, ref int position, T element) =>
    → array[position++] = element;
151
152 /// <summary>
153 /// <para>Adding in array the passed element at the specified position and increments
    → position value by one.</para>
154 /// <para>Добавляет в массив переданный элемент на указанную позицию и увеличивает
    → значение position на единицу.</para>
155 /// </summary>
156 /// <typeparam name="T"><para>Array elements type.</para><para>Тип элементов
    → массива.</para></typeparam>
157 /// <param name="array"><para>The array to add the element to.</para><para>Массив в
    → который необходимо добавить элемент.</para></param>
158 /// <param name="position"><para>A reference to the position of type long where the
    → element will be added.</para><para>Ссылка на позицию типа long, в которую будет
    → добавлен элемент.</para></param>
159 /// <param name="element"><para>The element to add to the array.</para><para>Элемент
    → который необходимо добавить в массив.</para></param>
160 [MethodImpl(MethodImplOptions.AggressiveInlining)]
161 public static void Add<T>(this T[] array, ref long position, T element) =>
    → array[position++] = element;
162
163 /// <summary>
164 /// <para>Adding in array the passed element, at the specified position, increments
    → position value by one and returns the value of the passed constant.</para>
165 /// <para>Добавляет в массив переданный элемент на указанную позицию, увеличивает
    → значение position на единицу и возвращает значение переданной константы.</para>
166 /// </summary>
167 /// <typeparam name="TElement"><para>The array element type.</para><para>Тип элемента
    → массива.</para></typeparam>

```

```

168  /// <typeparam name="TReturnConstant"><para>Type of return constant.</para><para>Тип
    → возвращаемой константы.</para></typeparam>
169  /// <param name="array"><para>The array to add the element to.</para><para>Массив в
    → который необходимо добавить элемент.</para></param>
170  /// <param name="position"><para>Reference to the position to which the element will be
    → added.</para><para>Ссылка на позицию, в которую будет добавлен
    → элемент.</para></param>
171  /// <param name="element"><para>The element to add to the array.</para><para>Элемент
    → который необходимо добавить в массив.</para></param>
172  /// <param name="returnConstant"><para>The constant value that will be
    → returned.</para><para>Значение константы, которое будет возвращено.</para></param>
173  /// </returns>
174  /// <para>The constant value passed as an argument.</para>
175  /// <para>Значение константы, переданное в качестве аргумента.</para>
176  /// </returns>
177  [MethodImpl(MethodImplOptions.AggressiveInlining)]
178  public static TReturnConstant AddAndReturnConstant<TElement, TReturnConstant>(this
    → TElement[] array, ref long position, TElement element, TReturnConstant
    → returnConstant)
179  {
180      array.Add(ref position, element);
181      return returnConstant;
182  }
183
184  /// <summary>
185  /// <para>Adds the first element from the passed collection to the array, at the
    → specified position and increments position value by one.</para>
186  /// <para>Добавляет в массив первый элемент из переданной коллекции, на указанную
    → позицию и увеличивает значение position на единицу.</para>
187  /// </summary>
188  /// <typeparam name="T"><para>Array element type.</para><para>Тип элементов
    → массива.</para></typeparam>
189  /// <param name="array"><para>The array to add the element to.</para><para>Массив в
    → который необходимо добавить элемент.</para></param>
190  /// <param name="position"><para>Reference to the position to which the element will be
    → added.</para><para>Ссылка на позицию, в которую будет добавлен
    → элемент.</para></param>
191  /// <param name="elements"><para>List, the first element of which will be added to the
    → array.</para><para>Список, первый элемент которого будет добавлен в
    → массив.</para></param>
192  [MethodImpl(MethodImplOptions.AggressiveInlining)]
193  public static void AddFirst<T>(this T[] array, ref long position, IList<T> elements) =>
    → array[position++] = elements[0];
194
195  /// <summary>
196  /// <para>Adds the first element from the passed collection to the array, at the
    → specified position, increments position value by one and returns the value of the
    → passed constant.</para>
197  /// <para>Добавляет в массив первый элемент из переданной коллекции, на указанную
    → позицию, увеличивает значение position на единицу и возвращает значение переданной
    → константы.</para>
198  /// </summary>
199  /// <typeparam name="TElement"><para>The array element type.</para><para>Тип элемента
    → массива.</para></typeparam>
200  /// <typeparam name="TReturnConstant"><para>Type of return constant.</para><para>Тип
    → возвращаемой константы.</para></typeparam>
201  /// <param name="array"><para>The array to add the element to.</para><para>Массив в
    → который необходимо добавить элемент.</para></param>
202  /// <param name="position"><para>Reference to the position to which the element will be
    → added.</para><para>Ссылка на позицию, в которую будет добавлен
    → элемент.</para></param>
203  /// <param name="elements"><para>List, the first element of which will be added to the
    → array.</para><para>Список, первый элемент которого будет добавлен в
    → массив.</para></param>
204  /// <param name="returnConstant"><para>The constant value that will be
    → returned.</para><para>Значение константы, которое будет возвращено.</para></param>
205  /// </returns>
206  /// <para>The constant value passed as an argument.</para>
207  /// <para>Значение константы, переданное в качестве аргумента.</para>
208  /// </returns>
209  [MethodImpl(MethodImplOptions.AggressiveInlining)]
210  public static TReturnConstant AddFirstAndReturnConstant<TElement, TReturnConstant>(this
    → TElement[] array, ref long position, IList<TElement> elements, TReturnConstant
    → returnConstant)
211  {

```

```

212     array.AddFirst(ref position, elements);
213     return returnConstant;
214 }
215
216 /// <summary>
217 /// <para>Adding in array all elements from the passed collection, at the specified
    → position, increases the position value by the number of elements added and returns
    → the value of the passed constant.</para>
218 /// <para>Добавляет в массив все элементы из переданной коллекции, на указанную позицию,
    → увеличивает значение position на количество добавленных элементов и возвращает
    → значение переданной константы.</para>
219 /// </summary>
220 /// <typeparam name="TElement"><para>The array element type.</para><para>Тип элемента
    → массива.</para></typeparam>
221 /// <typeparam name="TReturnConstant"><para>Type of return constant.</para><para>Тип
    → возвращаемой константы.</para></typeparam>
222 /// <param name="array"><para>The array to add the element to.</para><para>Массив в
    → который необходимо добавить элементы.</para></param>
223 /// <param name="position"><para>Reference to the position from which elements will be
    → added to the array.</para><para>Ссылка на позицию, начиная с которой будут
    → добавляться элементы в массив.</para></param>
224 /// <param name="elements"><para>List, whose elements will be added to the
    → array.</para><para>Список, элементы которого будут добавлены в
    → массив.</para></param>
225 /// <param name="returnConstant"><para>The constant value that will be
    → returned.</para><para>Значение константы, которое будет возвращено.</para></param>
226 /// <returns>
227 /// <para>The constant value passed as an argument.</para>
228 /// <para>Значение константы, переданное в качестве аргумента.</para>
229 /// </returns>
230 [MethodImpl(MethodImplOptions.AggressiveInlining)]
231 public static TReturnConstant AddAllAndReturnConstant<TElement, TReturnConstant>(this
    → TElement[] array, ref long position, IList<TElement> elements, TReturnConstant
    → returnConstant)
232 {
233     array.AddAll(ref position, elements);
234     return returnConstant;
235 }
236
237 /// <summary>
238 /// <para>Adding in array a collection of elements, starting from a specific position
    → and increases the position value by the number of elements added.</para>
239 /// <para>Добавляет в массив все элементы коллекции, начиная с определенной позиции и
    → увеличивает значение position на количество добавленных элементов.</para>
240 /// </summary>
241 /// <typeparam name="T"><para>Array elements type.</para><para>Тип элементов
    → массива.</para></typeparam>
242 /// <param name="array"><para>The array to add the element to.</para><para>Массив в
    → который необходимо добавить элементы.</para></param>
243 /// <param name="position"><para>Reference to the position from which elements will be
    → added to the array.</para><para>Ссылка на позицию, начиная с которой будут
    → добавляться элементы в массив.</para></param>
244 /// <param name="elements"><para>List, whose elements will be added to the
    → array.</para><para>Список, элементы которого будут добавлены в
    → массив.</para></param>
245 [MethodImpl(MethodImplOptions.AggressiveInlining)]
246 public static void AddAll<T>(this T[] array, ref long position, IList<T> elements)
247 {
248     for (var i = 0; i < elements.Count; i++)
249     {
250         array.Add(ref position, elements[i]);
251     }
252 }
253
254 /// <summary>
255 /// <para>Adding in array all elements of the collection, skipping the first position,
    → increments position value by one and returns the value of the passed constant.</para>
256 /// <para>Добавляет в массив все элементы коллекции, пропуская первую позицию,
    → увеличивает значение position на единицу и возвращает значение переданной
    → константы.</para>
257 /// </summary>
258 /// <typeparam name="TElement"><para>The array element type.</para><para>Тип элемента
    → массива.</para></typeparam>
259 /// <typeparam name="TReturnConstant"><para>Type of return constant.</para><para>Тип
    → возвращаемой константы.</para></typeparam>

```

```

260 /// <param name="array"><para>The array to add items to.</para><para>Массив в который
    ↳ необходимо добавить элементы.</para></param>
261 /// <param name="position"><para>Reference to the position from which to start adding
    ↳ elements.</para><para>Ссылка на позицию, с которой начинается добавление
    ↳ элементов.</para></param>
262 /// <param name="elements"><para>List, whose elements will be added to the
    ↳ array.</para><para>Список, элементы которого будут добавлены в
    ↳ массив.</para></param>
263 /// <param name="returnConstant"><para>The constant value that will be
    ↳ returned.</para><para>Значение константы, которое будет возвращено.</para></param>
264 /// <returns>
265 /// <para>The constant value passed as an argument.</para>
266 /// <para>Значение константы, переданное в качестве аргумента.</para>
267 /// </returns>
268 [MethodImpl(MethodImplOptions.AggressiveInlining)]
269 public static TReturnConstant AddSkipFirstAndReturnConstant<TElement,
    ↳ TReturnConstant>(this TElement[] array, ref long position, IList<TElement> elements,
    ↳ TReturnConstant returnConstant)
270 {
271     array.AddSkipFirst(ref position, elements);
272     return returnConstant;
273 }
274
275 /// <summary>
276 /// <para>Adding in array all elements of the collection, skipping the first position
    ↳ and increments position value by one.</para>
277 /// <para>Добавляет в массив все элементы коллекции, пропуская первую позицию и
    ↳ увеличивает значение position на единицу.</para>
278 /// </summary>
279 /// <typeparam name="T"><para>Array elements type.</para><para>Тип элементов
    ↳ массива.</para></typeparam>
280 /// <param name="array"><para>The array to add items to.</para><para>Массив в который
    ↳ необходимо добавить элементы.</para></param>
281 /// <param name="position"><para>Reference to the position from which to start adding
    ↳ elements.</para><para>Ссылка на позицию, с которой начинается добавление
    ↳ элементов.</para></param>
282 /// <param name="elements"><para>List, whose elements will be added to the
    ↳ array.</para><para>Список, элементы которого будут добавлены в
    ↳ массив.</para></param>
283 [MethodImpl(MethodImplOptions.AggressiveInlining)]
284 public static void AddSkipFirst<T>(this T[] array, ref long position, IList<T> elements)
    ↳ => array.AddSkipFirst(ref position, elements, 1);
285
286 /// <summary>
287 /// <para>Adding in array all but the first element, skipping a specified number of
    ↳ positions and increments position value by one.</para>
288 /// <para>Добавляет в массив все элементы коллекции, кроме первого, пропуская
    ↳ определенное количество позиций и увеличивает значение position на единицу.</para>
289 /// </summary>
290 /// <typeparam name="T"><para>Array elements type.</para><para>Тип элементов
    ↳ массива.</para></typeparam>
291 /// <param name="array"><para>The array to add items to.</para><para>Массив в который
    ↳ необходимо добавить элементы.</para></param>
292 /// <param name="position"><para>Reference to the position from which to start adding
    ↳ elements.</para><para>Ссылка на позицию, с которой начинается добавление
    ↳ элементов.</para></param>
293 /// <param name="elements"><para>List, whose elements will be added to the
    ↳ array.</para><para>Список, элементы которого будут добавлены в
    ↳ массив.</para></param>
294 /// <param name="skip"><para>Number of elements to skip.</para><para>Количество
    ↳ пропускаемых элементов.</para></param>
295 [MethodImpl(MethodImplOptions.AggressiveInlining)]
296 public static void AddSkipFirst<T>(this T[] array, ref long position, IList<T> elements,
    ↳ int skip)
297 {
298     for (var i = skip; i < elements.Count; i++)
299     {
300         array.Add(ref position, elements[i]);
301     }
302 }
303 }
304 }

```

## 1.8 ./csharp/Platform.Collections/BitString.cs

```

1 using System;
2 using System.Collections.Concurrent;

```

```

3 using System.Collections.Generic;
4 using System.Numerics;
5 using System.Runtime.CompilerServices;
6 using System.Threading.Tasks;
7 using Platform.Exceptions;
8 using Platform.Ranges;
9
10 // ReSharper disable ForCanBeConvertedToForeach
11 #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
12
13 namespace Platform.Collections
14 {
15     /// <remarks>
16     /// А что если хранить карту значений, где каждый бит будет означать присутствует ли блок в
17     ///   ↳ 64 бит в массиве значений.
18     /// 64 бита по 0 бит, будут означать отсутствие 64-х блоков по 64 бита. Т.е. упаковка 512
19     ///   ↳ байт в 8 байт.
20     /// Подобный принцип можно применять и к 64-ём блокам и т.п. По сути это карта значений. С
21     ///   ↳ помощью которой можно быстро
22     /// проверять есть ли значения непосредственно далее (ниже по уровню).
23     /// Или как таблица виртуальной памяти где номер блока означает его присутствие и адрес.
24     /// </remarks>
25     public class BitString : IEquatable<BitString>
26     {
27         private static readonly byte[][] _bitsSetIn16Bits;
28         private long[] _array;
29         private long _length;
30         private long _minPositiveWord;
31         private long _maxPositiveWord;
32
33         /// <summary>
34         /// <para>
35         /// The value.
36         /// </para>
37         /// <para></para>
38         /// </summary>
39         public bool this[long index]
40         {
41             [MethodImpl(MethodImplOptions.AggressiveInlining)]
42             get => Get(index);
43             [MethodImpl(MethodImplOptions.AggressiveInlining)]
44             set => Set(index, value);
45         }
46
47         /// <summary>
48         /// <para>
49         /// Gets or sets the length value.
50         /// </para>
51         /// <para></para>
52         /// </summary>
53         public long Length
54         {
55             [MethodImpl(MethodImplOptions.AggressiveInlining)]
56             get => _length;
57             [MethodImpl(MethodImplOptions.AggressiveInlining)]
58             set
59             {
60                 if (_length == value)
61                 {
62                     return;
63                 }
64                 Ensure.Always.ArgumentInRange(value, GetValidLengthRange(), nameof(Length));
65                 // Currently we never shrink the array
66                 if (value > _length)
67                 {
68                     var words = GetWordsCountFromIndex(value);
69                     var oldWords = GetWordsCountFromIndex(_length);
70                     if (words > _array.LongLength)
71                     {
72                         var copy = new long[words];
73                         Array.Copy(_array, copy, _array.LongLength);
74                         _array = copy;
75                     }
76                     else
77                     {
78                         // What is going on here?
79                         Array.Clear(_array, (int)oldWords, (int)(words - oldWords));
80                     }
81                     // What is going on here?
82                 }
83             }
84         }
85     }
86 }

```



```

79         var mask = (int)(_length % 64);
80         if (mask > 0)
81         {
82             _array[oldWords - 1] &= (1L << mask) - 1;
83         }
84     }
85     else
86     {
87         // Looks like minimum and maximum positive words are not updated
88         throw new NotImplementedException();
89     }
90     _length = value;
91 }
92 }
93
94 #region Constructors
95
96 /// <summary>
97 /// <para>
98 /// Initializes a new <see cref="BitString"/> instance.
99 /// </para>
100 /// <para></para>
101 /// </summary>
102 [MethodImpl(MethodImplOptions.AggressiveInlining)]
103 static BitString()
104 {
105     _bitsSetIn16Bits = new byte[65536][];
106     int i, c, k;
107     byte bitIndex;
108     for (i = 0; i < 65536; i++)
109     {
110         // Calculating size of array (number of positive bits)
111         for (c = 0, k = 1; k <= 65536; k <= 1)
112         {
113             if ((i & k) == k)
114             {
115                 c++;
116             }
117         }
118         var array = new byte[c];
119         // Adding positive bits indices into array
120         for (bitIndex = 0, c = 0, k = 1; k <= 65536; k <= 1)
121         {
122             if ((i & k) == k)
123             {
124                 array[c++] = bitIndex;
125             }
126             bitIndex++;
127         }
128         _bitsSetIn16Bits[i] = array;
129     }
130 }
131
132 /// <summary>
133 /// <para>
134 /// Initializes a new <see cref="BitString"/> instance.
135 /// </para>
136 /// <para></para>
137 /// </summary>
138 /// <param name="other">
139 /// <para>A other.</para>
140 /// <para></para>
141 /// </param>
142 [MethodImpl(MethodImplOptions.AggressiveInlining)]
143 public BitString(BitString other)
144 {
145     Ensure.Always.ArgumentNotNull(other, nameof(other));
146     _length = other._length;
147     _array = new long[GetWordsCountFromIndex(_length)];
148     _minPositiveWord = other._minPositiveWord;
149     _maxPositiveWord = other._maxPositiveWord;
150     Array.Copy(other._array, _array, _array.LongLength);
151 }
152
153 /// <summary>
154 /// <para>
155 /// Initializes a new <see cref="BitString"/> instance.
156 /// </para>
157 /// <para></para>

```

```

158     /// </summary>
159     /// <param name="length">
160     /// <para>A length.</para>
161     /// <para></para>
162     /// </param>
163     [MethodImpl(MethodImplOptions.AggressiveInlining)]
164     public BitString(long length)
165     {
166         Ensure.Always.ArgumentInRange(length, GetValidLengthRange(), nameof(length));
167         _length = length;
168         _array = new long[GetWordsCountFromIndex(_length)];
169         MarkBordersAsAllBitsReset();
170     }
171
172     /// <summary>
173     /// <para>
174     /// Initializes a new <see cref="BitString"/> instance.
175     /// </para>
176     /// <para></para>
177     /// </summary>
178     /// <param name="length">
179     /// <para>A length.</para>
180     /// <para></para>
181     /// </param>
182     /// <param name="defaultValue">
183     /// <para>A default value.</para>
184     /// <para></para>
185     /// </param>
186     [MethodImpl(MethodImplOptions.AggressiveInlining)]
187     public BitString(long length, bool defaultValue)
188         : this(length)
189     {
190         if (defaultValue)
191         {
192             SetAll();
193         }
194     }
195
196     #endregion
197
198     /// <summary>
199     /// <para>
200     /// Nots this instance.
201     /// </para>
202     /// <para></para>
203     /// </summary>
204     /// <returns>
205     /// <para>The bit string</para>
206     /// <para></para>
207     /// </returns>
208     [MethodImpl(MethodImplOptions.AggressiveInlining)]
209     public BitString Not()
210     {
211         for (var i = 0L; i < _array.LongLength; i++)
212         {
213             _array[i] = ~_array[i];
214             RefreshBordersByWord(i);
215         }
216         return this;
217     }
218
219     /// <summary>
220     /// <para>
221     /// Parallels the not.
222     /// </para>
223     /// <para></para>
224     /// </summary>
225     /// <returns>
226     /// <para>The bit string</para>
227     /// <para></para>
228     /// </returns>
229     [MethodImpl(MethodImplOptions.AggressiveInlining)]
230     public BitString ParallelNot()
231     {
232         var threads = Environment.ProcessorCount / 2;
233         if (threads <= 1)
234         {
235             return Not();
236         }
237     }

```

```

236     }
237     var partitioner = Partitioner.Create(OL, _array.LongLength, _array.LongLength /
    ↪ threads);
238     Parallel.ForEach(partitioner.GetDynamicPartitions(), new ParallelOptions {
    ↪ MaxDegreeOfParallelism = threads }, range =>
    {
239         var maximum = range.Item2;
240         for (var i = range.Item1; i < maximum; i++)
241         {
242             _array[i] = ~_array[i];
243         }
244     });
245     MarkBordersAsAllBitsSet();
246     TryShrinkBorders();
247     return this;
248 }
249
250
251 /// <summary>
252 /// <para>
253 /// Vectors the not.
254 /// </para>
255 /// <para></para>
256 /// </summary>
257 /// <returns>
258 /// <para>The bit string</para>
259 /// <para></para>
260 /// </returns>
261 [MethodImpl(MethodImplOptions.AggressiveInlining)]
262 public BitString VectorNot()
263 {
264     if (!Vector.IsHardwareAccelerated || _array.LongLength >= int.MaxValue)
265     {
266         return Not();
267     }
268     var step = Vector<long>.Count;
269     if (_array.Length < step)
270     {
271         return Not();
272     }
273     VectorNotLoop(_array, step, 0, _array.Length);
274     MarkBordersAsAllBitsSet();
275     TryShrinkBorders();
276     return this;
277 }
278
279 /// <summary>
280 /// <para>
281 /// Parallels the vector not.
282 /// </para>
283 /// <para></para>
284 /// </summary>
285 /// <returns>
286 /// <para>The bit string</para>
287 /// <para></para>
288 /// </returns>
289 [MethodImpl(MethodImplOptions.AggressiveInlining)]
290 public BitString ParallelVectorNot()
291 {
292     var threads = Environment.ProcessorCount / 2;
293     if (threads <= 1)
294     {
295         return VectorNot();
296     }
297     if (!Vector.IsHardwareAccelerated)
298     {
299         return ParallelNot();
300     }
301     var step = Vector<long>.Count;
302     if (_array.Length < (step * threads))
303     {
304         return VectorNot();
305     }
306     var partitioner = Partitioner.Create(0, _array.Length, _array.Length / threads);
307     Parallel.ForEach(partitioner.GetDynamicPartitions(), new ParallelOptions {
    ↪ MaxDegreeOfParallelism = threads }, range => VectorNotLoop(_array, step,
    ↪ range.Item1, range.Item2));
308     MarkBordersAsAllBitsSet();
309     TryShrinkBorders();

```

```

310         return this;
311     }
312
313     /// <summary>
314     /// <para>
315     /// Vectors the not loop using the specified array.
316     /// </para>
317     /// <para></para>
318     /// </summary>
319     /// <param name="array">
320     /// <para>The array.</para>
321     /// <para></para>
322     /// </param>
323     /// <param name="step">
324     /// <para>The step.</para>
325     /// <para></para>
326     /// </param>
327     /// <param name="start">
328     /// <para>The start.</para>
329     /// <para></para>
330     /// </param>
331     /// <param name="maximum">
332     /// <para>The maximum.</para>
333     /// <para></para>
334     /// </param>
335     [MethodImpl(MethodImplOptions.AggressiveInlining)]
336     static private void VectorNotLoop(long[] array, int step, int start, int maximum)
337     {
338         var i = start;
339         var range = maximum - start - 1;
340         var stop = range - (range % step);
341         for (; i < stop; i += step)
342         {
343             (~new Vector<long>(array, i)).CopyTo(array, i);
344         }
345         for (; i < maximum; i++)
346         {
347             array[i] = ~array[i];
348         }
349     }
350
351     /// <summary>
352     /// <para>
353     /// Ands the other.
354     /// </para>
355     /// <para></para>
356     /// </summary>
357     /// <param name="other">
358     /// <para>The other.</para>
359     /// <para></para>
360     /// </param>
361     /// <returns>
362     /// <para>The bit string</para>
363     /// <para></para>
364     /// </returns>
365     [MethodImpl(MethodImplOptions.AggressiveInlining)]
366     public BitString And(BitString other)
367     {
368         EnsureBitStringHasTheSameSize(other, nameof(other));
369         GetCommonOuterBorders(this, other, out long from, out long to);
370         var otherArray = other._array;
371         for (var i = from; i <= to; i++)
372         {
373             _array[i] &= otherArray[i];
374             RefreshBordersByWord(i);
375         }
376         return this;
377     }
378
379     /// <summary>
380     /// <para>
381     /// Parallels the and using the specified other.
382     /// </para>
383     /// <para></para>
384     /// </summary>
385     /// <param name="other">
386     /// <para>The other.</para>
387     /// <para></para>

```

```

388 /// </param>
389 /// <returns>
390 /// <para>The bit string</para>
391 /// <para></para>
392 /// </returns>
393 [MethodImpl(MethodImplOptions.AggressiveInlining)]
394 public BitString ParallelAnd(BitString other)
395 {
396     var threads = Environment.ProcessorCount / 2;
397     if (threads <= 1)
398     {
399         return And(other);
400     }
401     EnsureBitStringHasTheSameSize(other, nameof(other));
402     GetCommonOuterBorders(this, other, out long from, out long to);
403     var partitioner = Partitioner.Create(from, to + 1, (to - from) / threads);
404     Parallel.ForEach(partitioner.GetDynamicPartitions(), new ParallelOptions {
405         ↪ MaxDegreeOfParallelism = threads }, range =>
406     {
407         var maximum = range.Item2;
408         for (var i = range.Item1; i < maximum; i++)
409         {
410             _array[i] &= other._array[i];
411         }
412     });
413     MarkBordersAsAllBitsSet();
414     TryShrinkBorders();
415     return this;
416 }
417
418 /// <summary>
419 /// <para>
420 /// Vectors the and using the specified other.
421 /// </para>
422 /// <para></para>
423 /// </summary>
424 /// <param name="other">
425 /// <para>The other.</para>
426 /// <para></para>
427 /// </param>
428 /// <returns>
429 /// <para>The bit string</para>
430 /// <para></para>
431 /// </returns>
432 [MethodImpl(MethodImplOptions.AggressiveInlining)]
433 public BitString VectorAnd(BitString other)
434 {
435     if (!Vector.IsHardwareAccelerated || _array.LongLength >= int.MaxValue)
436     {
437         return And(other);
438     }
439     var step = Vector<long>.Count;
440     if (_array.Length < step)
441     {
442         return And(other);
443     }
444     EnsureBitStringHasTheSameSize(other, nameof(other));
445     GetCommonOuterBorders(this, other, out int from, out int to);
446     VectorAndLoop(_array, other._array, step, from, to + 1);
447     MarkBordersAsAllBitsSet();
448     TryShrinkBorders();
449     return this;
450 }
451
452 /// <summary>
453 /// <para>
454 /// Parallels the vector and using the specified other.
455 /// </para>
456 /// <para></para>
457 /// </summary>
458 /// <param name="other">
459 /// <para>The other.</para>
460 /// <para></para>
461 /// </param>
462 /// <returns>
463 /// <para>The bit string</para>
464 /// <para></para>
465 /// </returns>

```

```

465 [MethodImpl(MethodImplOptions.AggressiveInlining)]
466 public BitString ParallelVectorAnd(BitString other)
467 {
468     var threads = Environment.ProcessorCount / 2;
469     if (threads <= 1)
470     {
471         return VectorAnd(other);
472     }
473     if (!Vector.IsHardwareAccelerated)
474     {
475         return ParallelAnd(other);
476     }
477     var step = Vector<long>.Count;
478     if (_array.Length < (step * threads))
479     {
480         return VectorAnd(other);
481     }
482     EnsureBitStringHasTheSameSize(other, nameof(other));
483     GetCommonOuterBorders(this, other, out int from, out int to);
484     var partitioner = Partitioner.Create(from, to + 1, (to - from) / threads);
485     Parallel.ForEach(partitioner.GetDynamicPartitions(), new ParallelOptions {
486         ↪ MaxDegreeOfParallelism = threads }, range => VectorAndLoop(_array, other._array,
487         ↪ step, range.Item1, range.Item2));
488     MarkBordersAsAllBitsSet();
489     TryShrinkBorders();
490     return this;
491 }
492
493 /// <summary>
494 /// <para>
495 /// Vectors the and loop using the specified array.
496 /// </para>
497 /// <para></para>
498 /// </summary>
499 /// <param name="array">
500 /// <para>The array.</para>
501 /// </param>
502 /// <param name="otherArray">
503 /// <para>The other array.</para>
504 /// </param>
505 /// <param name="step">
506 /// <para>The step.</para>
507 /// </param>
508 /// <param name="start">
509 /// <para>The start.</para>
510 /// </param>
511 /// <param name="maximum">
512 /// <para>The maximum.</para>
513 /// </param>
514 [MethodImpl(MethodImplOptions.AggressiveInlining)]
515 static private void VectorAndLoop(long[] array, long[] otherArray, int step, int start,
516 ↪ int maximum)
517 {
518     var i = start;
519     var range = maximum - start - 1;
520     var stop = range - (range % step);
521     for (; i < stop; i += step)
522     {
523         (new Vector<long>(array, i) & new Vector<long>(otherArray, i)).CopyTo(array, i);
524     }
525     for (; i < maximum; i++)
526     {
527         array[i] &= otherArray[i];
528     }
529 }
530
531 /// <summary>
532 /// <para>
533 /// Ors the other.
534 /// </para>
535 /// <para></para>
536 /// </summary>
537 /// <param name="other">

```

```

540 /// <para>The other.</para>
541 /// <para></para>
542 /// </param>
543 /// <returns>
544 /// <para>The bit string</para>
545 /// <para></para>
546 /// </returns>
547 [MethodImpl(MethodImplOptions.AggressiveInlining)]
548 public BitString Or(BitString other)
549 {
550     EnsureBitStringHasTheSameSize(other, nameof(other));
551     GetCommonOuterBorders(this, other, out long from, out long to);
552     for (var i = from; i <= to; i++)
553     {
554         _array[i] |= other._array[i];
555         RefreshBordersByWord(i);
556     }
557     return this;
558 }
559
560 /// <summary>
561 /// <para>
562 /// Parallels the or using the specified other.
563 /// </para>
564 /// <para></para>
565 /// </summary>
566 /// <param name="other">
567 /// <para>The other.</para>
568 /// <para></para>
569 /// </param>
570 /// <returns>
571 /// <para>The bit string</para>
572 /// <para></para>
573 /// </returns>
574 [MethodImpl(MethodImplOptions.AggressiveInlining)]
575 public BitString ParallelOr(BitString other)
576 {
577     var threads = Environment.ProcessorCount / 2;
578     if (threads <= 1)
579     {
580         return Or(other);
581     }
582     EnsureBitStringHasTheSameSize(other, nameof(other));
583     GetCommonOuterBorders(this, other, out long from, out long to);
584     var partitioner = Partitioner.Create(from, to + 1, (to - from) / threads);
585     Parallel.ForEach(partitioner.GetDynamicPartitions(), new ParallelOptions {
586         ↪ MaxDegreeOfParallelism = threads }, range =>
587     {
588         var maximum = range.Item2;
589         for (var i = range.Item1; i < maximum; i++)
590         {
591             _array[i] |= other._array[i];
592         }
593     });
594     MarkBordersAsAllBitsSet();
595     TryShrinkBorders();
596     return this;
597 }
598
599 /// <summary>
600 /// <para>
601 /// Vectors the or using the specified other.
602 /// </para>
603 /// <para></para>
604 /// </summary>
605 /// <param name="other">
606 /// <para>The other.</para>
607 /// <para></para>
608 /// </param>
609 /// <returns>
610 /// <para>The bit string</para>
611 /// <para></para>
612 /// </returns>
613 [MethodImpl(MethodImplOptions.AggressiveInlining)]
614 public BitString VectorOr(BitString other)
615 {
616     if (!Vector.IsHardwareAccelerated || _array.LongLength >= int.MaxValue)

```

```

617         return Or(other);
618     }
619     var step = Vector<long>.Count;
620     if (_array.Length < step)
621     {
622         return Or(other);
623     }
624     EnsureBitStringHasTheSameSize(other, nameof(other));
625     GetCommonOuterBorders(this, other, out int from, out int to);
626     VectorOrLoop(_array, other._array, step, from, to + 1);
627     MarkBordersAsAllBitsSet();
628     TryShrinkBorders();
629     return this;
630 }
631
632 /// <summary>
633 /// <para>
634 /// Parallels the vector or using the specified other.
635 /// </para>
636 /// <para></para>
637 /// </summary>
638 /// <param name="other">
639 /// <para>The other.</para>
640 /// <para></para>
641 /// </param>
642 /// <returns>
643 /// <para>The bit string</para>
644 /// <para></para>
645 /// </returns>
646 [MethodImpl(MethodImplOptions.AggressiveInlining)]
647 public BitString ParallelVectorOr(BitString other)
648 {
649     var threads = Environment.ProcessorCount / 2;
650     if (threads <= 1)
651     {
652         return VectorOr(other);
653     }
654     if (!Vector.IsHardwareAccelerated)
655     {
656         return ParallelOr(other);
657     }
658     var step = Vector<long>.Count;
659     if (_array.Length < (step * threads))
660     {
661         return VectorOr(other);
662     }
663     EnsureBitStringHasTheSameSize(other, nameof(other));
664     GetCommonOuterBorders(this, other, out int from, out int to);
665     var partitioner = Partitioner.Create(from, to + 1, (to - from) / threads);
666     Parallel.ForEach(partitioner.GetDynamicPartitions(), new ParallelOptions {
        ↪ MaxDegreeOfParallelism = threads }, range => VectorOrLoop(_array, other._array,
        ↪ step, range.Item1, range.Item2));
667     MarkBordersAsAllBitsSet();
668     TryShrinkBorders();
669     return this;
670 }
671
672 /// <summary>
673 /// <para>
674 /// Vectors the or loop using the specified array.
675 /// </para>
676 /// <para></para>
677 /// </summary>
678 /// <param name="array">
679 /// <para>The array.</para>
680 /// <para></para>
681 /// </param>
682 /// <param name="otherArray">
683 /// <para>The other array.</para>
684 /// <para></para>
685 /// </param>
686 /// <param name="step">
687 /// <para>The step.</para>
688 /// <para></para>
689 /// </param>
690 /// <param name="start">
691 /// <para>The start.</para>
692 /// <para></para>

```



```

693     /// </param>
694     /// <param name="maximum">
695     /// <para>The maximum.</para>
696     /// <para></para>
697     /// </param>
698     [MethodImpl(MethodImplOptions.AggressiveInlining)]
699     static private void VectorOrLoop(long[] array, long[] otherArray, int step, int start,
700     ↪ int maximum)
701     {
702         var i = start;
703         var range = maximum - start - 1;
704         var stop = range - (range % step);
705         for (; i < stop; i += step)
706         {
707             (new Vector<long>(array, i) | new Vector<long>(otherArray, i)).CopyTo(array, i);
708         }
709         for (; i < maximum; i++)
710         {
711             array[i] |= otherArray[i];
712         }
713     }
714     /// <summary>
715     /// <para>
716     /// Xors the other.
717     /// </para>
718     /// <para></para>
719     /// </summary>
720     /// <param name="other">
721     /// <para>The other.</para>
722     /// <para></para>
723     /// </param>
724     /// <returns>
725     /// <para>The bit string</para>
726     /// <para></para>
727     /// </returns>
728     [MethodImpl(MethodImplOptions.AggressiveInlining)]
729     public BitString Xor(BitString other)
730     {
731         EnsureBitStringHasTheSameSize(other, nameof(other));
732         GetCommonOuterBorders(this, other, out long from, out long to);
733         for (var i = from; i <= to; i++)
734         {
735             _array[i] ^= other._array[i];
736             RefreshBordersByWord(i);
737         }
738         return this;
739     }
740     /// <summary>
741     /// <para>
742     /// Parallels the xor using the specified other.
743     /// </para>
744     /// <para></para>
745     /// </summary>
746     /// <param name="other">
747     /// <para>The other.</para>
748     /// <para></para>
749     /// </param>
750     /// <returns>
751     /// <para>The bit string</para>
752     /// <para></para>
753     /// </returns>
754     [MethodImpl(MethodImplOptions.AggressiveInlining)]
755     public BitString ParallelXor(BitString other)
756     {
757         var threads = Environment.ProcessorCount / 2;
758         if (threads <= 1)
759         {
760             return Xor(other);
761         }
762         EnsureBitStringHasTheSameSize(other, nameof(other));
763         GetCommonOuterBorders(this, other, out long from, out long to);
764         var partitioner = Partitioner.Create(from, to + 1, (to - from) / threads);
765         Parallel.ForEach(partitioner.GetDynamicPartitions(), new ParallelOptions {
766             ↪ MaxDegreeOfParallelism = threads }, range =>
767         {
768             var maximum = range.Item2;

```

```

769         for (var i = range.Item1; i < maximum; i++)
770         {
771             _array[i] ^= other._array[i];
772         }
773     });
774     MarkBordersAsAllBitsSet();
775     TryShrinkBorders();
776     return this;
777 }
778
779 /// <summary>
780 /// <para>
781 /// Vectors the xor using the specified other.
782 /// </para>
783 /// <para></para>
784 /// </summary>
785 /// <param name="other">
786 /// <para>The other.</para>
787 /// <para></para>
788 /// </param>
789 /// <returns>
790 /// <para>The bit string</para>
791 /// <para></para>
792 /// </returns>
793 [MethodImpl(MethodImplOptions.AggressiveInlining)]
794 public BitString VectorXor(BitString other)
795 {
796     if (!Vector.IsHardwareAccelerated || _array.LongLength >= int.MaxValue)
797     {
798         return Xor(other);
799     }
800     var step = Vector<long>.Count;
801     if (_array.Length < step)
802     {
803         return Xor(other);
804     }
805     EnsureBitStringHasTheSameSize(other, nameof(other));
806     GetCommonOuterBorders(this, other, out int from, out int to);
807     VectorXorLoop(_array, other._array, step, from, to + 1);
808     MarkBordersAsAllBitsSet();
809     TryShrinkBorders();
810     return this;
811 }
812
813 /// <summary>
814 /// <para>
815 /// Parallels the vector xor using the specified other.
816 /// </para>
817 /// <para></para>
818 /// </summary>
819 /// <param name="other">
820 /// <para>The other.</para>
821 /// <para></para>
822 /// </param>
823 /// <returns>
824 /// <para>The bit string</para>
825 /// <para></para>
826 /// </returns>
827 [MethodImpl(MethodImplOptions.AggressiveInlining)]
828 public BitString ParallelVectorXor(BitString other)
829 {
830     var threads = Environment.ProcessorCount / 2;
831     if (threads <= 1)
832     {
833         return VectorXor(other);
834     }
835     if (!Vector.IsHardwareAccelerated)
836     {
837         return ParallelXor(other);
838     }
839     var step = Vector<long>.Count;
840     if (_array.Length < (step * threads))
841     {
842         return VectorXor(other);
843     }
844     EnsureBitStringHasTheSameSize(other, nameof(other));
845     GetCommonOuterBorders(this, other, out int from, out int to);
846     var partitioner = Partitioner.Create(from, to + 1, (to - from) / threads);

```

```

847         Parallel.ForEach(partitioner.GetDynamicPartitions(), new ParallelOptions {
848             ↪ MaxDegreeOfParallelism = threads }, range => VectorXorLoop(_array, other._array,
849             ↪ step, range.Item1, range.Item2));
850         MarkBordersAsAllBitsSet();
851         TryShrinkBorders();
852         return this;
853     }
854
855     /// <summary>
856     /// <para>
857     /// Vectors the xor loop using the specified array.
858     /// </para>
859     /// </summary>
860     /// <param name="array">
861     /// <para>The array.</para>
862     /// </param>
863     /// <param name="otherArray">
864     /// <para>The other array.</para>
865     /// </param>
866     /// <param name="step">
867     /// <para>The step.</para>
868     /// </param>
869     /// <param name="start">
870     /// <para>The start.</para>
871     /// </param>
872     /// <param name="maximum">
873     /// <para>The maximum.</para>
874     /// </param>
875     [MethodImpl(MethodImplOptions.AggressiveInlining)]
876     static private void VectorXorLoop(long[] array, long[] otherArray, int step, int start,
877     ↪ int maximum)
878     {
879         var i = start;
880         var range = maximum - start - 1;
881         var stop = range - (range % step);
882         for (; i < stop; i += step)
883         {
884             (new Vector<long>(array, i) ^ new Vector<long>(otherArray, i)).CopyTo(array, i);
885         }
886         for (; i < maximum; i++)
887         {
888             array[i] ^= otherArray[i];
889         }
890     }
891
892     [MethodImpl(MethodImplOptions.AggressiveInlining)]
893     private void RefreshBordersByWord(long wordIndex)
894     {
895         if (_array[wordIndex] == 0)
896         {
897             if (wordIndex == _minPositiveWord && wordIndex != _array.LongLength - 1)
898             {
899                 _minPositiveWord++;
900             }
901             if (wordIndex == _maxPositiveWord && wordIndex != 0)
902             {
903                 _maxPositiveWord--;
904             }
905         }
906         else
907         {
908             if (wordIndex < _minPositiveWord)
909             {
910                 _minPositiveWord = wordIndex;
911             }
912             if (wordIndex > _maxPositiveWord)
913             {
914                 _maxPositiveWord = wordIndex;
915             }
916         }
917     }
918 }
919
920 /// <summary>

```

```

922     /// <para>
923     /// Determines whether this instance try shrink borders.
924     /// </para>
925     /// <para></para>
926     /// </summary>
927     /// <returns>
928     /// <para>The borders updated.</para>
929     /// <para></para>
930     /// </returns>
931     [MethodImpl(MethodImplOptions.AggressiveInlining)]
932     public bool TryShrinkBorders()
933     {
934         GetBorders(out long from, out long to);
935         while (from <= to && _array[from] == 0)
936         {
937             from++;
938         }
939         if (from > to)
940         {
941             MarkBordersAsAllBitsReset();
942             return true;
943         }
944         while (to >= from && _array[to] == 0)
945         {
946             to--;
947         }
948         if (to < from)
949         {
950             MarkBordersAsAllBitsReset();
951             return true;
952         }
953         var bordersUpdated = from != _minPositiveWord || to != _maxPositiveWord;
954         if (bordersUpdated)
955         {
956             SetBorders(from, to);
957         }
958         return bordersUpdated;
959     }
960
961     /// <summary>
962     /// <para>
963     /// Determines whether this instance get.
964     /// </para>
965     /// <para></para>
966     /// </summary>
967     /// <param name="index">
968     /// <para>The index.</para>
969     /// <para></para>
970     /// </param>
971     /// <returns>
972     /// <para>The bool</para>
973     /// <para></para>
974     /// </returns>
975     [MethodImpl(MethodImplOptions.AggressiveInlining)]
976     public bool Get(long index)
977     {
978         Ensure.Always.ArgumentInRange(index, GetValidIndexRange(), nameof(index));
979         return (_array[GetWordIndexFromIndex(index)] & GetBitMaskFromIndex(index)) != 0;
980     }
981
982     /// <summary>
983     /// <para>
984     /// Sets the index.
985     /// </para>
986     /// <para></para>
987     /// </summary>
988     /// <param name="index">
989     /// <para>The index.</para>
990     /// <para></para>
991     /// </param>
992     /// <param name="value">
993     /// <para>The value.</para>
994     /// <para></para>
995     /// </param>
996     [MethodImpl(MethodImplOptions.AggressiveInlining)]
997     public void Set(long index, bool value)
998     {
999         if (value)

```

```

1000     {
1001         Set(index);
1002     }
1003     else
1004     {
1005         Reset(index);
1006     }
1007 }
1008
1009 /// <summary>
1010 /// <para>
1011 /// Sets the index.
1012 /// </para>
1013 /// <para></para>
1014 /// </summary>
1015 /// <param name="index">
1016 /// <para>The index.</para>
1017 /// <para></para>
1018 /// </param>
1019 [MethodImpl(MethodImplOptions.AggressiveInlining)]
1020 public void Set(long index)
1021 {
1022     Ensure.Always.ArgumentInRange(index, GetValidIndexRange(), nameof(index));
1023     var wordIndex = GetWordIndexFromIndex(index);
1024     var mask = GetBitMaskFromIndex(index);
1025     _array[wordIndex] |= mask;
1026     RefreshBordersByWord(wordIndex);
1027 }
1028
1029 /// <summary>
1030 /// <para>
1031 /// Resets the index.
1032 /// </para>
1033 /// <para></para>
1034 /// </summary>
1035 /// <param name="index">
1036 /// <para>The index.</para>
1037 /// <para></para>
1038 /// </param>
1039 [MethodImpl(MethodImplOptions.AggressiveInlining)]
1040 public void Reset(long index)
1041 {
1042     Ensure.Always.ArgumentInRange(index, GetValidIndexRange(), nameof(index));
1043     var wordIndex = GetWordIndexFromIndex(index);
1044     var mask = GetBitMaskFromIndex(index);
1045     _array[wordIndex] &= ~mask;
1046     RefreshBordersByWord(wordIndex);
1047 }
1048
1049 /// <summary>
1050 /// <para>
1051 /// Determines whether this instance add.
1052 /// </para>
1053 /// <para></para>
1054 /// </summary>
1055 /// <param name="index">
1056 /// <para>The index.</para>
1057 /// <para></para>
1058 /// </param>
1059 /// <returns>
1060 /// <para>The bool</para>
1061 /// <para></para>
1062 /// </returns>
1063 [MethodImpl(MethodImplOptions.AggressiveInlining)]
1064 public bool Add(long index)
1065 {
1066     var wordIndex = GetWordIndexFromIndex(index);
1067     var mask = GetBitMaskFromIndex(index);
1068     if ((_array[wordIndex] & mask) == 0)
1069     {
1070         _array[wordIndex] |= mask;
1071         RefreshBordersByWord(wordIndex);
1072         return true;
1073     }
1074     else
1075     {
1076         return false;
1077     }

```

```

1078     }
1079
1080     /// <summary>
1081     /// <para>
1082     /// Sets the all using the specified value.
1083     /// </para>
1084     /// <para></para>
1085     /// </summary>
1086     /// <param name="value">
1087     /// <para>The value.</para>
1088     /// <para></para>
1089     /// </param>
1090     [MethodImpl(MethodImplOptions.AggressiveInlining)]
1091     public void SetAll(bool value)
1092     {
1093         if (value)
1094         {
1095             SetAll();
1096         }
1097         else
1098         {
1099             ResetAll();
1100         }
1101     }
1102
1103     /// <summary>
1104     /// <para>
1105     /// Sets the all.
1106     /// </para>
1107     /// <para></para>
1108     /// </summary>
1109     [MethodImpl(MethodImplOptions.AggressiveInlining)]
1110     public void SetAll()
1111     {
1112         const long fillValue = unchecked((long)0xffffffffffffffff);
1113         var words = GetWordsCountFromIndex(_length);
1114         for (var i = 0; i < words; i++)
1115         {
1116             _array[i] = fillValue;
1117         }
1118         MarkBordersAsAllBitsSet();
1119     }
1120
1121     /// <summary>
1122     /// <para>
1123     /// Resets the all.
1124     /// </para>
1125     /// <para></para>
1126     /// </summary>
1127     [MethodImpl(MethodImplOptions.AggressiveInlining)]
1128     public void ResetAll()
1129     {
1130         const long fillValue = 0;
1131         GetBorders(out long from, out long to);
1132         for (var i = from; i <= to; i++)
1133         {
1134             _array[i] = fillValue;
1135         }
1136         MarkBordersAsAllBitsReset();
1137     }
1138
1139     /// <summary>
1140     /// <para>
1141     /// Gets the set indices.
1142     /// </para>
1143     /// <para></para>
1144     /// </summary>
1145     /// <returns>
1146     /// <para>The result.</para>
1147     /// <para></para>
1148     /// </returns>
1149     [MethodImpl(MethodImplOptions.AggressiveInlining)]
1150     public List<long> GetSetIndices()
1151     {
1152         var result = new List<long>();
1153         GetBorders(out long from, out long to);
1154         for (var i = from; i <= to; i++)
1155         {

```

```

1156         var word = _array[i];
1157         if (word != 0)
1158         {
1159             AppendAllSetBitIndices(result, i, word);
1160         }
1161     }
1162     return result;
1163 }
1164
1165 /// <summary>
1166 /// <para>
1167 /// Gets the set u int 64 indices.
1168 /// </para>
1169 /// <para></para>
1170 /// </summary>
1171 /// <returns>
1172 /// <para>The result.</para>
1173 /// <para></para>
1174 /// </returns>
1175 [MethodImpl(MethodImplOptions.AggressiveInlining)]
1176 public List<ulong> GetSetUInt64Indices()
1177 {
1178     var result = new List<ulong>();
1179     GetBorders(out ulong from, out ulong to);
1180     for (var i = from; i <= to; i++)
1181     {
1182         var word = _array[i];
1183         if (word != 0)
1184         {
1185             AppendAllSetBitIndices(result, i, word);
1186         }
1187     }
1188     return result;
1189 }
1190
1191 /// <summary>
1192 /// <para>
1193 /// Gets the first set bit index.
1194 /// </para>
1195 /// <para></para>
1196 /// </summary>
1197 /// <returns>
1198 /// <para>The long</para>
1199 /// <para></para>
1200 /// </returns>
1201 [MethodImpl(MethodImplOptions.AggressiveInlining)]
1202 public long GetFirstSetBitIndex()
1203 {
1204     var i = _minPositiveWord;
1205     var word = _array[i];
1206     if (word != 0)
1207     {
1208         return GetFirstSetBitForWord(i, word);
1209     }
1210     return -1;
1211 }
1212
1213 /// <summary>
1214 /// <para>
1215 /// Gets the last set bit index.
1216 /// </para>
1217 /// <para></para>
1218 /// </summary>
1219 /// <returns>
1220 /// <para>The long</para>
1221 /// <para></para>
1222 /// </returns>
1223 [MethodImpl(MethodImplOptions.AggressiveInlining)]
1224 public long GetLastSetBitIndex()
1225 {
1226     var i = _maxPositiveWord;
1227     var word = _array[i];
1228     if (word != 0)
1229     {
1230         return GetLastSetBitForWord(i, word);
1231     }
1232     return -1;
1233 }

```

```

1234
1235 /// <summary>
1236 /// <para>
1237 /// Counts the set bits.
1238 /// </para>
1239 /// <para></para>
1240 /// </summary>
1241 /// <returns>
1242 /// <para>The total.</para>
1243 /// <para></para>
1244 /// </returns>
1245 [MethodImpl(MethodImplOptions.AggressiveInlining)]
1246 public long CountSetBits()
1247 {
1248     var total = 0L;
1249     GetBorders(out long from, out long to);
1250     for (var i = from; i <= to; i++)
1251     {
1252         var word = _array[i];
1253         if (word != 0)
1254         {
1255             total += CountSetBitsForWord(word);
1256         }
1257     }
1258     return total;
1259 }
1260
1261 /// <summary>
1262 /// <para>
1263 /// Determines whether this instance have common bits.
1264 /// </para>
1265 /// <para></para>
1266 /// </summary>
1267 /// <param name="other">
1268 /// <para>The other.</para>
1269 /// <para></para>
1270 /// </param>
1271 /// <returns>
1272 /// <para>The bool</para>
1273 /// <para></para>
1274 /// </returns>
1275 [MethodImpl(MethodImplOptions.AggressiveInlining)]
1276 public bool HaveCommonBits(BitString other)
1277 {
1278     EnsureBitStringHasTheSameSize(other, nameof(other));
1279     GetCommonInnerBorders(this, other, out long from, out long to);
1280     var otherArray = other._array;
1281     for (var i = from; i <= to; i++)
1282     {
1283         var left = _array[i];
1284         var right = otherArray[i];
1285         if (left != 0 && right != 0 && (left & right) != 0)
1286         {
1287             return true;
1288         }
1289     }
1290     return false;
1291 }
1292
1293 /// <summary>
1294 /// <para>
1295 /// Counts the common bits using the specified other.
1296 /// </para>
1297 /// <para></para>
1298 /// </summary>
1299 /// <param name="other">
1300 /// <para>The other.</para>
1301 /// <para></para>
1302 /// </param>
1303 /// <returns>
1304 /// <para>The total.</para>
1305 /// <para></para>
1306 /// </returns>
1307 [MethodImpl(MethodImplOptions.AggressiveInlining)]
1308 public long CountCommonBits(BitString other)
1309 {
1310     EnsureBitStringHasTheSameSize(other, nameof(other));
1311     GetCommonInnerBorders(this, other, out long from, out long to);

```



```

1312     var total = 0L;
1313     var otherArray = other._array;
1314     for (var i = from; i <= to; i++)
1315     {
1316         var left = _array[i];
1317         var right = otherArray[i];
1318         var combined = left & right;
1319         if (combined != 0)
1320         {
1321             total += CountSetBitsForWord(combined);
1322         }
1323     }
1324     return total;
1325 }
1326
1327 /// <summary>
1328 /// <para>
1329 /// Gets the common indices using the specified other.
1330 /// </para>
1331 /// <para></para>
1332 /// </summary>
1333 /// <param name="other">
1334 /// <para>The other.</para>
1335 /// <para></para>
1336 /// </param>
1337 /// <returns>
1338 /// <para>The result.</para>
1339 /// <para></para>
1340 /// </returns>
1341 [MethodImpl(MethodImplOptions.AggressiveInlining)]
1342 public List<long> GetCommonIndices(BitString other)
1343 {
1344     EnsureBitStringHasTheSameSize(other, nameof(other));
1345     GetCommonInnerBorders(this, other, out long from, out long to);
1346     var result = new List<long>();
1347     var otherArray = other._array;
1348     for (var i = from; i <= to; i++)
1349     {
1350         var left = _array[i];
1351         var right = otherArray[i];
1352         var combined = left & right;
1353         if (combined != 0)
1354         {
1355             AppendAllSetBitIndices(result, i, combined);
1356         }
1357     }
1358     return result;
1359 }
1360
1361 /// <summary>
1362 /// <para>
1363 /// Gets the common u int 64 indices using the specified other.
1364 /// </para>
1365 /// <para></para>
1366 /// </summary>
1367 /// <param name="other">
1368 /// <para>The other.</para>
1369 /// <para></para>
1370 /// </param>
1371 /// <returns>
1372 /// <para>The result.</para>
1373 /// <para></para>
1374 /// </returns>
1375 [MethodImpl(MethodImplOptions.AggressiveInlining)]
1376 public List<ulong> GetCommonUInt64Indices(BitString other)
1377 {
1378     EnsureBitStringHasTheSameSize(other, nameof(other));
1379     GetCommonBorders(this, other, out ulong from, out ulong to);
1380     var result = new List<ulong>();
1381     var otherArray = other._array;
1382     for (var i = from; i <= to; i++)
1383     {
1384         var left = _array[i];
1385         var right = otherArray[i];
1386         var combined = left & right;
1387         if (combined != 0)
1388         {
1389             AppendAllSetBitIndices(result, i, combined);

```

```

1390     }
1391 }
1392 return result;
1393 }
1394
1395 /// <summary>
1396 /// <para>
1397 /// Gets the first common bit index using the specified other.
1398 /// </para>
1399 /// <para></para>
1400 /// </summary>
1401 /// <param name="other">
1402 /// <para>The other.</para>
1403 /// <para></para>
1404 /// </param>
1405 /// <returns>
1406 /// <para>The long</para>
1407 /// <para></para>
1408 /// </returns>
1409 [MethodImpl(MethodImplOptions.AggressiveInlining)]
1410 public long GetFirstCommonBitIndex(BitString other)
1411 {
1412     EnsureBitStringHasTheSameSize(other, nameof(other));
1413     GetCommonInnerBorders(this, other, out long from, out long to);
1414     var otherArray = other._array;
1415     for (var i = from; i <= to; i++)
1416     {
1417         var left = _array[i];
1418         var right = otherArray[i];
1419         var combined = left & right;
1420         if (combined != 0)
1421         {
1422             return GetFirstSetBitForWord(i, combined);
1423         }
1424     }
1425     return -1;
1426 }
1427
1428 /// <summary>
1429 /// <para>
1430 /// Gets the last common bit index using the specified other.
1431 /// </para>
1432 /// <para></para>
1433 /// </summary>
1434 /// <param name="other">
1435 /// <para>The other.</para>
1436 /// <para></para>
1437 /// </param>
1438 /// <returns>
1439 /// <para>The long</para>
1440 /// <para></para>
1441 /// </returns>
1442 [MethodImpl(MethodImplOptions.AggressiveInlining)]
1443 public long GetLastCommonBitIndex(BitString other)
1444 {
1445     EnsureBitStringHasTheSameSize(other, nameof(other));
1446     GetCommonInnerBorders(this, other, out long from, out long to);
1447     var otherArray = other._array;
1448     for (var i = to; i >= from; i--)
1449     {
1450         var left = _array[i];
1451         var right = otherArray[i];
1452         var combined = left & right;
1453         if (combined != 0)
1454         {
1455             return GetLastSetBitForWord(i, combined);
1456         }
1457     }
1458     return -1;
1459 }
1460
1461 /// <summary>
1462 /// <para>
1463 /// Determines whether this instance equals.
1464 /// </para>
1465 /// <para></para>
1466 /// </summary>
1467 /// <param name="obj">

```

```

1468    /// <para>The obj.</para>
1469    /// <para></para>
1470    /// </param>
1471    /// <returns>
1472    /// <para>The bool</para>
1473    /// <para></para>
1474    /// </returns>
1475    [MethodImpl(MethodImplOptions.AggressiveInlining)]
1476    public override bool Equals(object obj) => obj is BitString @string ? Equals(@string) :
    ↪ false;

1477
1478    /// <summary>
1479    /// <para>
1480    /// Determines whether this instance equals.
1481    /// </para>
1482    /// <para></para>
1483    /// </summary>
1484    /// <param name="other">
1485    /// <para>The other.</para>
1486    /// <para></para>
1487    /// </param>
1488    /// <returns>
1489    /// <para>The bool</para>
1490    /// <para></para>
1491    /// </returns>
1492    [MethodImpl(MethodImplOptions.AggressiveInlining)]
1493    public bool Equals(BitString other)
1494    {
1495        if (_length != other._length)
1496        {
1497            return false;
1498        }
1499        var otherArray = other._array;
1500        if (_array.Length != otherArray.Length)
1501        {
1502            return false;
1503        }
1504        if (_minPositiveWord != other._minPositiveWord)
1505        {
1506            return false;
1507        }
1508        if (_maxPositiveWord != other._maxPositiveWord)
1509        {
1510            return false;
1511        }
1512        GetCommonBorders(this, other, out ulong from, out ulong to);
1513        for (var i = from; i <= to; i++)
1514        {
1515            if (_array[i] != otherArray[i])
1516            {
1517                return false;
1518            }
1519        }
1520        return true;
1521    }
1522    [MethodImpl(MethodImplOptions.AggressiveInlining)]
1523    private void EnsureBitStringHasTheSameSize(BitString other, string argumentName)
1524    {
1525        Ensure.Always.ArgumentNotNull(other, argumentName);
1526        if (_length != other._length)
1527        {
1528            throw new ArgumentException("Bit string must be the same size.", argumentName);
1529        }
1530    }
1531    [MethodImpl(MethodImplOptions.AggressiveInlining)]
1532    private void MarkBordersAsAllBitsReset() => SetBorders(_array.LongLength - 1, 0);
1533    [MethodImpl(MethodImplOptions.AggressiveInlining)]
1534    private void MarkBordersAsAllBitsSet() => SetBorders(0, _array.LongLength - 1);
1535    [MethodImpl(MethodImplOptions.AggressiveInlining)]
1536    private void GetBorders(out long from, out long to)
1537    {
1538        from = _minPositiveWord;
1539        to = _maxPositiveWord;
1540    }
1541    [MethodImpl(MethodImplOptions.AggressiveInlining)]
1542    private void GetBorders(out ulong from, out ulong to)
1543    {
1544        from = (ulong)_minPositiveWord;

```

```

1545         to = (ulong)_maxPositiveWord;
1546     }
1547     [MethodImpl(MethodImplOptions.AggressiveInlining)]
1548     private void SetBorders(long from, long to)
1549     {
1550         _minPositiveWord = from;
1551         _maxPositiveWord = to;
1552     }
1553     [MethodImpl(MethodImplOptions.AggressiveInlining)]
1554     private Range<long> GetValidIndexRange() => (0, _length - 1);
1555     [MethodImpl(MethodImplOptions.AggressiveInlining)]
1556     private static Range<long> GetValidLengthRange() => (0, long.MaxValue);
1557     [MethodImpl(MethodImplOptions.AggressiveInlining)]
1558     private static void AppendAllSetBitIndices(List<ulong> result, ulong wordIndex, long
1559     ↪ wordValue)
1560     {
1561         GetBits(wordValue, out byte[] bits00to15, out byte[] bits16to31, out byte[]
1562         ↪ bits32to47, out byte[] bits48to63);
1563         AppendAllSetIndices(result, wordIndex, bits00to15, bits16to31, bits32to47,
1564         ↪ bits48to63);
1565     }
1566     [MethodImpl(MethodImplOptions.AggressiveInlining)]
1567     private static void AppendAllSetBitIndices(List<long> result, long wordIndex, long
1568     ↪ wordValue)
1569     {
1570         GetBits(wordValue, out byte[] bits00to15, out byte[] bits16to31, out byte[]
1571         ↪ bits32to47, out byte[] bits48to63);
1572         AppendAllSetBitIndices(result, wordIndex, bits00to15, bits16to31, bits32to47,
1573         ↪ bits48to63);
1574     }
1575     [MethodImpl(MethodImplOptions.AggressiveInlining)]
1576     private static long CountSetBitsForWord(long word)
1577     {
1578         GetBits(word, out byte[] bits00to15, out byte[] bits16to31, out byte[] bits32to47,
1579         ↪ out byte[] bits48to63);
1580         return bits00to15.LongLength + bits16to31.LongLength + bits32to47.LongLength +
1581         ↪ bits48to63.LongLength;
1582     }
1583     [MethodImpl(MethodImplOptions.AggressiveInlining)]
1584     private static long GetFirstSetBitForWord(long wordIndex, long wordValue)
1585     {
1586         GetBits(wordValue, out byte[] bits00to15, out byte[] bits16to31, out byte[]
1587         ↪ bits32to47, out byte[] bits48to63);
1588         return GetFirstSetBit(wordIndex, bits00to15, bits16to31, bits32to47, bits48to63);
1589     }
1590     [MethodImpl(MethodImplOptions.AggressiveInlining)]
1591     private static long GetLastSetBitForWord(long wordIndex, long wordValue)
1592     {
1593         GetBits(wordValue, out byte[] bits00to15, out byte[] bits16to31, out byte[]
1594         ↪ bits32to47, out byte[] bits48to63);
1595         return GetLastSetBit(wordIndex, bits00to15, bits16to31, bits32to47, bits48to63);
1596     }
1597     [MethodImpl(MethodImplOptions.AggressiveInlining)]
1598     private static void AppendAllSetBitIndices(List<long> result, long i, byte[] bits00to15,
1599     ↪ byte[] bits16to31, byte[] bits32to47, byte[] bits48to63)
1600     {
1601         for (var j = 0; j < bits00to15.Length; j++)
1602         {
1603             result.Add(bits00to15[j] + (i * 64));
1604         }
1605         for (var j = 0; j < bits16to31.Length; j++)
1606         {
1607             result.Add(bits16to31[j] + 16 + (i * 64));
1608         }
1609         for (var j = 0; j < bits32to47.Length; j++)
1610         {
1611             result.Add(bits32to47[j] + 32 + (i * 64));
1612         }
1613         for (var j = 0; j < bits48to63.Length; j++)
1614         {
1615             result.Add(bits48to63[j] + 48 + (i * 64));
1616         }
1617     }
1618     [MethodImpl(MethodImplOptions.AggressiveInlining)]
1619     private static void AppendAllSetIndices(List<ulong> result, ulong i, byte[] bits00to15,
1620     ↪ byte[] bits16to31, byte[] bits32to47, byte[] bits48to63)
1621     {
1622         for (var j = 0; j < bits00to15.Length; j++)
1623         {
1624             result.Add((ulong)bits00to15[j] + (i * 64));
1625         }
1626         for (var j = 0; j < bits16to31.Length; j++)
1627         {
1628             result.Add((ulong)bits16to31[j] + 16 + (i * 64));
1629         }
1630         for (var j = 0; j < bits32to47.Length; j++)
1631         {
1632             result.Add((ulong)bits32to47[j] + 32 + (i * 64));
1633         }
1634         for (var j = 0; j < bits48to63.Length; j++)
1635         {
1636             result.Add((ulong)bits48to63[j] + 48 + (i * 64));
1637         }
1638     }

```

```

1610     for (var j = 0; j < bits00to15.Length; j++)
1611     {
1612         result.Add(bits00to15[j] + (i * 64));
1613     }
1614     for (var j = 0; j < bits16to31.Length; j++)
1615     {
1616         result.Add(bits16to31[j] + 16UL + (i * 64));
1617     }
1618     for (var j = 0; j < bits32to47.Length; j++)
1619     {
1620         result.Add(bits32to47[j] + 32UL + (i * 64));
1621     }
1622     for (var j = 0; j < bits48to63.Length; j++)
1623     {
1624         result.Add(bits48to63[j] + 48UL + (i * 64));
1625     }
1626 }
1627 [MethodImpl(MethodImplOptions.AggressiveInlining)]
1628 private static long GetFirstSetBit(long i, byte[] bits00to15, byte[] bits16to31, byte[]
1629 ↪ bits32to47, byte[] bits48to63)
1630 {
1631     if (bits00to15.Length > 0)
1632     {
1633         return bits00to15[0] + (i * 64);
1634     }
1635     if (bits16to31.Length > 0)
1636     {
1637         return bits16to31[0] + 16 + (i * 64);
1638     }
1639     if (bits32to47.Length > 0)
1640     {
1641         return bits32to47[0] + 32 + (i * 64);
1642     }
1643     return bits48to63[0] + 48 + (i * 64);
1644 }
1645 [MethodImpl(MethodImplOptions.AggressiveInlining)]
1646 private static long GetLastSetBit(long i, byte[] bits00to15, byte[] bits16to31, byte[]
1647 ↪ bits32to47, byte[] bits48to63)
1648 {
1649     if (bits48to63.Length > 0)
1650     {
1651         return bits48to63[bits48to63.Length - 1] + 48 + (i * 64);
1652     }
1653     if (bits32to47.Length > 0)
1654     {
1655         return bits32to47[bits32to47.Length - 1] + 32 + (i * 64);
1656     }
1657     if (bits16to31.Length > 0)
1658     {
1659         return bits16to31[bits16to31.Length - 1] + 16 + (i * 64);
1660     }
1661     return bits00to15[bits00to15.Length - 1] + (i * 64);
1662 }
1663 [MethodImpl(MethodImplOptions.AggressiveInlining)]
1664 private static void GetBits(long word, out byte[] bits00to15, out byte[] bits16to31, out
1665 ↪ byte[] bits32to47, out byte[] bits48to63)
1666 {
1667     bits00to15 = _bitsSetIn16Bits[word & 0xffffu];
1668     bits16to31 = _bitsSetIn16Bits[(word >> 16) & 0xffffu];
1669     bits32to47 = _bitsSetIn16Bits[(word >> 32) & 0xffffu];
1670     bits48to63 = _bitsSetIn16Bits[(word >> 48) & 0xffffu];
1671 }
1672
1673 /// <summary>
1674 /// <para>
1675 /// Gets the common inner borders using the specified left.
1676 /// </para>
1677 /// <para></para>
1678 /// </summary>
1679 /// <param name="left">
1680 /// <para>The left.</para>
1681 /// <para></para>
1682 /// </param>
1683 /// <param name="right">
1684 /// <para>The right.</para>
1685 /// <para></para>
1686 /// </param>

```

```

1684    /// <param name="from">
1685    /// <para>The from.</para>
1686    /// <para></para>
1687    /// </param>
1688    /// <param name="to">
1689    /// <para>The to.</para>
1690    /// <para></para>
1691    /// </param>
1692    [MethodImpl(MethodImplOptions.AggressiveInlining)]
1693    public static void GetCommonInnerBorders(BitString left, BitString right, out long from,
    ↪ out long to)
1694    {
1695        from = Math.Max(left._minPositiveWord, right._minPositiveWord);
1696        to = Math.Min(left._maxPositiveWord, right._maxPositiveWord);
1697    }
1698
1699    /// <summary>
1700    /// <para>
1701    /// Gets the common outer borders using the specified left.
1702    /// </para>
1703    /// <para></para>
1704    /// </summary>
1705    /// <param name="left">
1706    /// <para>The left.</para>
1707    /// <para></para>
1708    /// </param>
1709    /// <param name="right">
1710    /// <para>The right.</para>
1711    /// <para></para>
1712    /// </param>
1713    /// <param name="from">
1714    /// <para>The from.</para>
1715    /// <para></para>
1716    /// </param>
1717    /// <param name="to">
1718    /// <para>The to.</para>
1719    /// <para></para>
1720    /// </param>
1721    [MethodImpl(MethodImplOptions.AggressiveInlining)]
1722    public static void GetCommonOuterBorders(BitString left, BitString right, out long from,
    ↪ out long to)
1723    {
1724        from = Math.Min(left._minPositiveWord, right._minPositiveWord);
1725        to = Math.Max(left._maxPositiveWord, right._maxPositiveWord);
1726    }
1727
1728    /// <summary>
1729    /// <para>
1730    /// Gets the common outer borders using the specified left.
1731    /// </para>
1732    /// <para></para>
1733    /// </summary>
1734    /// <param name="left">
1735    /// <para>The left.</para>
1736    /// <para></para>
1737    /// </param>
1738    /// <param name="right">
1739    /// <para>The right.</para>
1740    /// <para></para>
1741    /// </param>
1742    /// <param name="from">
1743    /// <para>The from.</para>
1744    /// <para></para>
1745    /// </param>
1746    /// <param name="to">
1747    /// <para>The to.</para>
1748    /// <para></para>
1749    /// </param>
1750    [MethodImpl(MethodImplOptions.AggressiveInlining)]
1751    public static void GetCommonOuterBorders(BitString left, BitString right, out int from,
    ↪ out int to)
1752    {
1753        from = (int)Math.Min(left._minPositiveWord, right._minPositiveWord);
1754        to = (int)Math.Max(left._maxPositiveWord, right._maxPositiveWord);
1755    }
1756
1757    /// <summary>
1758    /// <para>

```

```

1759     /// Gets the common borders using the specified left.
1760     /// </para>
1761     /// <para></para>
1762     /// </summary>
1763     /// <param name="left">
1764     /// <para>The left.</para>
1765     /// <para></para>
1766     /// </param>
1767     /// <param name="right">
1768     /// <para>The right.</para>
1769     /// <para></para>
1770     /// </param>
1771     /// <param name="from">
1772     /// <para>The from.</para>
1773     /// <para></para>
1774     /// </param>
1775     /// <param name="to">
1776     /// <para>The to.</para>
1777     /// <para></para>
1778     /// </param>
1779     [MethodImpl(MethodImplOptions.AggressiveInlining)]
1780     public static void GetCommonBorders(BitString left, BitString right, out ulong from, out
        → ulong to)
1781     {
1782         from = (ulong)Math.Max(left._minPositiveWord, right._minPositiveWord);
1783         to = (ulong)Math.Min(left._maxPositiveWord, right._maxPositiveWord);
1784     }
1785
1786     /// <summary>
1787     /// <para>
1788     /// Gets the words count from index using the specified index.
1789     /// </para>
1790     /// <para></para>
1791     /// </summary>
1792     /// <param name="index">
1793     /// <para>The index.</para>
1794     /// <para></para>
1795     /// </param>
1796     /// <returns>
1797     /// <para>The long</para>
1798     /// <para></para>
1799     /// </returns>
1800     [MethodImpl(MethodImplOptions.AggressiveInlining)]
1801     public static long GetWordsCountFromIndex(long index) => (index + 63) / 64;
1802
1803     /// <summary>
1804     /// <para>
1805     /// Gets the word index from index using the specified index.
1806     /// </para>
1807     /// <para></para>
1808     /// </summary>
1809     /// <param name="index">
1810     /// <para>The index.</para>
1811     /// <para></para>
1812     /// </param>
1813     /// <returns>
1814     /// <para>The long</para>
1815     /// <para></para>
1816     /// </returns>
1817     [MethodImpl(MethodImplOptions.AggressiveInlining)]
1818     public static long GetWordIndexFromIndex(long index) => index >> 6;
1819
1820     /// <summary>
1821     /// <para>
1822     /// Gets the bit mask from index using the specified index.
1823     /// </para>
1824     /// <para></para>
1825     /// </summary>
1826     /// <param name="index">
1827     /// <para>The index.</para>
1828     /// <para></para>
1829     /// </param>
1830     /// <returns>
1831     /// <para>The long</para>
1832     /// <para></para>
1833     /// </returns>
1834     [MethodImpl(MethodImplOptions.AggressiveInlining)]
1835     public static long GetBitMaskFromIndex(long index) => 1L << (int)(index & 63);

```

```

1836
1837     /// <summary>
1838     /// <para>
1839     /// Gets the hash code.
1840     /// </para>
1841     /// <para></para>
1842     /// </summary>
1843     /// <returns>
1844     /// <para>The int</para>
1845     /// <para></para>
1846     /// </returns>
1847     [MethodImpl(MethodImplOptions.AggressiveInlining)]
1848     public override int GetHashCode() => base.GetHashCode();
1849
1850     /// <summary>
1851     /// <para>
1852     /// Returns the string.
1853     /// </para>
1854     /// <para></para>
1855     /// </summary>
1856     /// <returns>
1857     /// <para>The string</para>
1858     /// <para></para>
1859     /// </returns>
1860     [MethodImpl(MethodImplOptions.AggressiveInlining)]
1861     public override string ToString() => base.ToString();
1862 }
1863 }

```

### 1.9 ./csharp/Platform.Collections/BitStringExtensions.cs

```

1 using System.Runtime.CompilerServices;
2 using Platform.Random;
3
4 #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
5
6 namespace Platform.Collections
7 {
8     /// <summary>
9     /// <para>
10    /// Represents the bit string extensions.
11    /// </para>
12    /// <para></para>
13    /// </summary>
14    public static class BitStringExtensions
15    {
16        /// <summary>
17        /// <para>
18        /// Sets the random bits using the specified string.
19        /// </para>
20        /// <para></para>
21        /// </summary>
22        /// <param name="@string">
23        /// <para>The string.</para>
24        /// <para></para>
25        /// </param>
26        [MethodImpl(MethodImplOptions.AggressiveInlining)]
27        public static void SetRandomBits(this BitString @string)
28        {
29            for (var i = 0; i < @string.Length; i++)
30            {
31                var value = RandomHelpers.Default.NextBoolean();
32                @string.Set(i, value);
33            }
34        }
35    }
36 }

```

### 1.10 ./csharp/Platform.Collections/Concurrent/ConcurrentQueueExtensions.cs

```

1 using System.Collections.Concurrent;
2 using System.Collections.Generic;
3 using System.Runtime.CompilerServices;
4
5 #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
6
7 namespace Platform.Collections.Concurrent
8 {
9     /// <summary>
10    /// <para>

```



```

11  /// Represents the concurrent queue extensions.
12  /// </para>
13  /// <para></para>
14  /// </summary>
15  public static class ConcurrentQueueExtensions
16  {
17      /// <summary>
18      /// <para>
19      /// Dequeues the all using the specified queue.
20      /// </para>
21      /// <para></para>
22      /// </summary>
23      /// <typeparam name="T">
24      /// <para>The .</para>
25      /// <para></para>
26      /// </typeparam>
27      /// <param name="queue">
28      /// <para>The queue.</para>
29      /// <para></para>
30      /// </param>
31      /// <returns>
32      /// <para>An enumerable of t</para>
33      /// <para></para>
34      /// </returns>
35      [MethodImpl(MethodImplOptions.AggressiveInlining)]
36      public static IEnumerable<T> DequeueAll<T>(this ConcurrentQueue<T> queue)
37      {
38          while (queue.TryDequeue(out T item))
39          {
40              yield return item;
41          }
42      }
43  }
44  }

```

#### 1.11 ./csharp/Platform.Collections/Concurrent/ConcurrentStackExtensions.cs

```

1  using System.Collections.Concurrent;
2  using System.Runtime.CompilerServices;
3
4  #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
5
6  namespace Platform.Collections.Concurrent
7  {
8      /// <summary>
9      /// <para>
10     /// Represents the concurrent stack extensions.
11     /// </para>
12     /// <para></para>
13     /// </summary>
14     public static class ConcurrentStackExtensions
15     {
16         /// <summary>
17         /// <para>
18         /// Pops the or default using the specified stack.
19         /// </para>
20         /// <para></para>
21         /// </summary>
22         /// <typeparam name="T">
23         /// <para>The .</para>
24         /// <para></para>
25         /// </typeparam>
26         /// <param name="stack">
27         /// <para>The stack.</para>
28         /// <para></para>
29         /// </param>
30         /// <returns>
31         /// <para>The</para>
32         /// <para></para>
33         /// </returns>
34         [MethodImpl(MethodImplOptions.AggressiveInlining)]
35         public static T PopOrDefault<T>(this ConcurrentStack<T> stack) => stack.TryPop(out T
            ↪ value) ? value : default;
36
37         /// <summary>
38         /// <para>
39         /// Peeks the or default using the specified stack.
40         /// </para>
41         /// <para></para>

```

```

42     /// </summary>
43     /// <typeparam name="T">
44     /// <para>The .</para>
45     /// <para></para>
46     /// </typeparam>
47     /// <param name="stack">
48     /// <para>The stack.</para>
49     /// <para></para>
50     /// </param>
51     /// <returns>
52     /// <para>The</para>
53     /// <para></para>
54     /// </returns>
55     [MethodImpl(MethodImplOptions.AggressiveInlining)]
56     public static T PeekOrDefault<T>(this ConcurrentStack<T> stack) => stack.TryPeek(out T
        ↪ value) ? value : default;
57 }
58 }

```

## 1.12 ./csharp/Platform.Collections/EnsureExtensions.cs

```

1  using System;
2  using System.Collections.Generic;
3  using System.Diagnostics;
4  using System.Runtime.CompilerServices;
5  using Platform.Exceptions;
6  using Platform.Exceptions.ExtensionRoots;
7
8  #pragma warning disable IDE0060 // Remove unused parameter
9  #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
10
11 namespace Platform.Collections
12 {
13     /// <summary>
14     /// <para>
15     /// Represents the ensure extensions.
16     /// </para>
17     /// <para></para>
18     /// </summary>
19     public static class EnsureExtensions
20     {
21         #region Always
22
23         /// <summary>
24         /// <para>
25         /// Arguments the not empty using the specified root.
26         /// </para>
27         /// <para></para>
28         /// </summary>
29         /// <typeparam name="T">
30         /// <para>The .</para>
31         /// <para></para>
32         /// </typeparam>
33         /// <param name="root">
34         /// <para>The root.</para>
35         /// <para></para>
36         /// </param>
37         /// <param name="argument">
38         /// <para>The argument.</para>
39         /// <para></para>
40         /// </param>
41         /// <param name="argumentName">
42         /// <para>The argument name.</para>
43         /// <para></para>
44         /// </param>
45         /// <param name="message">
46         /// <para>The message.</para>
47         /// <para></para>
48         /// </param>
49         /// <exception cref="ArgumentException">
50         /// <para></para>
51         /// <para></para>
52         /// </exception>
53         [MethodImpl(MethodImplOptions.AggressiveInlining)]
54         public static void ArgumentNotEmpty<T>(this EnsureAlwaysExtensionRoot root,
        ↪ ICollection<T> argument, string argumentName, string message)
55         {
56             if (argument.IsNullOrEmpty())
57             {

```

```

58         throw new ArgumentException(message, argumentName);
59     }
60 }
61
62 /// <summary>
63 /// <para>
64 /// Arguments the not empty using the specified root.
65 /// </para>
66 /// <para></para>
67 /// </summary>
68 /// <typeparam name="T">
69 /// <para>The .</para>
70 /// <para></para>
71 /// </typeparam>
72 /// <param name="root">
73 /// <para>The root.</para>
74 /// <para></para>
75 /// </param>
76 /// <param name="argument">
77 /// <para>The argument.</para>
78 /// <para></para>
79 /// </param>
80 /// <param name="argumentName">
81 /// <para>The argument name.</para>
82 /// <para></para>
83 /// </param>
84 [MethodImpl(MethodImplOptions.AggressiveInlining)]
85 public static void ArgumentNotEmpty<T>(this EnsureAlwaysExtensionRoot root,
    ↪ ICollection<T> argument, string argumentName) => ArgumentNotEmpty(root, argument,
    ↪ argumentName, null);
86
87 /// <summary>
88 /// <para>
89 /// Arguments the not empty using the specified root.
90 /// </para>
91 /// <para></para>
92 /// </summary>
93 /// <typeparam name="T">
94 /// <para>The .</para>
95 /// <para></para>
96 /// </typeparam>
97 /// <param name="root">
98 /// <para>The root.</para>
99 /// <para></para>
100 /// </param>
101 /// <param name="argument">
102 /// <para>The argument.</para>
103 /// <para></para>
104 /// </param>
105 [MethodImpl(MethodImplOptions.AggressiveInlining)]
106 public static void ArgumentNotEmpty<T>(this EnsureAlwaysExtensionRoot root,
    ↪ ICollection<T> argument) => ArgumentNotEmpty(root, argument, null, null);
107
108 /// <summary>
109 /// <para>
110 /// Arguments the not empty and not white space using the specified root.
111 /// </para>
112 /// <para></para>
113 /// </summary>
114 /// <param name="root">
115 /// <para>The root.</para>
116 /// <para></para>
117 /// </param>
118 /// <param name="argument">
119 /// <para>The argument.</para>
120 /// <para></para>
121 /// </param>
122 /// <param name="argumentName">
123 /// <para>The argument name.</para>
124 /// <para></para>
125 /// </param>
126 /// <param name="message">
127 /// <para>The message.</para>
128 /// <para></para>
129 /// </param>
130 /// <exception cref="ArgumentException">
131 /// <para></para>
132 /// <para></para>

```

```

133     /// </exception>
134     [MethodImpl(MethodImplOptions.AggressiveInlining)]
135     public static void ArgumentNotEmptyAndNotWhiteSpace(this EnsureAlwaysExtensionRoot root,
136     ↪     string argument, string argumentName, string message)
137     {
138         if (string.IsNullOrEmpty(argument))
139         {
140             throw new ArgumentException(message, argumentName);
141         }
142     }
143     /// <summary>
144     /// <para>
145     /// Arguments the not empty and not white space using the specified root.
146     /// </para>
147     /// <para></para>
148     /// </summary>
149     /// <param name="root">
150     /// <para>The root.</para>
151     /// <para></para>
152     /// </param>
153     /// <param name="argument">
154     /// <para>The argument.</para>
155     /// <para></para>
156     /// </param>
157     /// <param name="argumentName">
158     /// <para>The argument name.</para>
159     /// <para></para>
160     /// </param>
161     [MethodImpl(MethodImplOptions.AggressiveInlining)]
162     public static void ArgumentNotEmptyAndNotWhiteSpace(this EnsureAlwaysExtensionRoot root,
163     ↪     string argument, string argumentName) => ArgumentNotEmptyAndNotWhiteSpace(root,
164     ↪     argument, argumentName, null);
165     /// <summary>
166     /// <para>
167     /// Arguments the not empty and not white space using the specified root.
168     /// </para>
169     /// <para></para>
170     /// </summary>
171     /// <param name="root">
172     /// <para>The root.</para>
173     /// <para></para>
174     /// </param>
175     /// <param name="argument">
176     /// <para>The argument.</para>
177     /// <para></para>
178     /// </param>
179     [MethodImpl(MethodImplOptions.AggressiveInlining)]
180     public static void ArgumentNotEmptyAndNotWhiteSpace(this EnsureAlwaysExtensionRoot root,
181     ↪     string argument) => ArgumentNotEmptyAndNotWhiteSpace(root, argument, null, null);
182
183     #endregion
184
185     #region OnDebug
186
187     /// <summary>
188     /// <para>
189     /// Arguments the not empty using the specified root.
190     /// </para>
191     /// <para></para>
192     /// </summary>
193     /// <typeparam name="T">
194     /// <para>The .</para>
195     /// <para></para>
196     /// </typeparam>
197     /// <param name="root">
198     /// <para>The root.</para>
199     /// <para></para>
200     /// </param>
201     /// <param name="argument">
202     /// <para>The argument.</para>
203     /// <para></para>
204     /// </param>
205     /// <param name="argumentName">
206     /// <para>The argument name.</para>
207     /// <para></para>
208     /// </param>

```

```

207     /// <param name="message">
208     /// <para>The message.</para>
209     /// <para></para>
210     /// </param>
211     [Conditional("DEBUG")]
212     public static void ArgumentNotEmpty<T>(this EnsureOnDebugExtensionRoot root,
213     ↪ ICollection<T> argument, string argumentName, string message) =>
214     ↪ Ensure.Always.ArgumentNotEmpty(argument, argumentName, message);
215
216     /// <summary>
217     /// <para>
218     /// Arguments the not empty using the specified root.
219     /// </para>
220     /// <para></para>
221     /// </summary>
222     /// <typeparam name="T">
223     /// <para>The .</para>
224     /// <para></para>
225     /// </typeparam>
226     /// <param name="root">
227     /// <para>The root.</para>
228     /// <para></para>
229     /// </param>
230     /// <param name="argument">
231     /// <para>The argument.</para>
232     /// <para></para>
233     /// </param>
234     /// <param name="argumentName">
235     /// <para>The argument name.</para>
236     /// <para></para>
237     /// </param>
238     [Conditional("DEBUG")]
239     public static void ArgumentNotEmpty<T>(this EnsureOnDebugExtensionRoot root,
240     ↪ ICollection<T> argument, string argumentName) =>
241     ↪ Ensure.Always.ArgumentNotEmpty(argument, argumentName, null);
242
243     /// <summary>
244     /// <para>
245     /// Arguments the not empty using the specified root.
246     /// </para>
247     /// <para></para>
248     /// </summary>
249     /// <typeparam name="T">
250     /// <para>The .</para>
251     /// <para></para>
252     /// </typeparam>
253     /// <param name="root">
254     /// <para>The root.</para>
255     /// <para></para>
256     /// </param>
257     /// <param name="argument">
258     /// <para>The argument.</para>
259     /// <para></para>
260     /// </param>
261     [Conditional("DEBUG")]
262     public static void ArgumentNotEmpty<T>(this EnsureOnDebugExtensionRoot root,
263     ↪ ICollection<T> argument) => Ensure.Always.ArgumentNotEmpty(argument, null, null);
264
265     /// <summary>
266     /// <para>
267     /// Arguments the not empty and not white space using the specified root.
268     /// </para>
269     /// <para></para>
270     /// </summary>
271     /// <param name="root">
272     /// <para>The root.</para>
273     /// <para></para>
274     /// </param>
275     /// <param name="argument">
276     /// <para>The argument.</para>
277     /// <para></para>
278     /// </param>
279     /// <param name="argumentName">
280     /// <para>The argument name.</para>
281     /// <para></para>
282     /// </param>
283     /// <param name="message">

```

```

279     /// <para>The message.</para>
280     /// <para></para>
281     /// </param>
282     [Conditional("DEBUG")]
283     public static void ArgumentNotEmptyAndNotWhiteSpace(this EnsureOnDebugExtensionRoot
        ⇒ root, string argument, string argumentName, string message) =>
        ⇒ Ensure.Always.ArgumentNotEmptyAndNotWhiteSpace(argument, argumentName, message);

284
285     /// <summary>
286     /// <para>
287     /// Arguments the not empty and not white space using the specified root.
288     /// </para>
289     /// <para></para>
290     /// </summary>
291     /// <param name="root">
292     /// <para>The root.</para>
293     /// <para></para>
294     /// </param>
295     /// <param name="argument">
296     /// <para>The argument.</para>
297     /// <para></para>
298     /// </param>
299     /// <param name="argumentName">
300     /// <para>The argument name.</para>
301     /// <para></para>
302     /// </param>
303     [Conditional("DEBUG")]
304     public static void ArgumentNotEmptyAndNotWhiteSpace(this EnsureOnDebugExtensionRoot
        ⇒ root, string argument, string argumentName) =>
        ⇒ Ensure.Always.ArgumentNotEmptyAndNotWhiteSpace(argument, argumentName, null);

305
306     /// <summary>
307     /// <para>
308     /// Arguments the not empty and not white space using the specified root.
309     /// </para>
310     /// <para></para>
311     /// </summary>
312     /// <param name="root">
313     /// <para>The root.</para>
314     /// <para></para>
315     /// </param>
316     /// <param name="argument">
317     /// <para>The argument.</para>
318     /// <para></para>
319     /// </param>
320     [Conditional("DEBUG")]
321     public static void ArgumentNotEmptyAndNotWhiteSpace(this EnsureOnDebugExtensionRoot
        ⇒ root, string argument) => Ensure.Always.ArgumentNotEmptyAndNotWhiteSpace(argument,
        ⇒ null, null);

322
323     #endregion
324 }
325 }

```

### 1.13 ./csharp/Platform.Collections/ICollectionExtensions.cs

```

1  using System.Collections.Generic;
2  using System.Linq;
3  using System.Runtime.CompilerServices;
4
5  #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
6
7  namespace Platform.Collections
8  {
9      /// <summary>
10     /// <para>Presents a set of methods for working with collections.</para>
11     /// <para>Представляет набор методов для работы с коллекциями.</para>
12     /// </summary>
13     public static class ICollectionExtensions
14     {
15         /// <summary>
16         /// <para>Checking collection for empty.</para>
17         /// <para>Проверяет коллекцию на пустоту.</para>
18         /// </summary>
19         /// <param name="collection">
20         /// <para>Method takes an elements collection of <see cref="ICollection<T>" />
21         ⇒ type.</para>
22         /// <para>Метода принимает коллекцию элементов <see cref="ICollection<T>" /> типа.</para>
23         /// </param>

```

```

23     /// <returns>
24     /// <para>Returns a <see cref="bool"/> type variable equal to False if the collection is
    → empty else returns true.</para>
25     /// <para>Возвращает переменную типа <see cref="bool"/> равной false если коллекция
    → пустая иначе возвращает true.</para>
26     /// </returns>
27     [MethodImpl(MethodImplOptions.AggressiveInlining)]
28     public static bool IsNullOrEmpty<T>(this ICollection<T> collection) => collection ==
    → null || collection.Count == 0;
29
30     /// <summary>
31     /// <para>
32     /// Determines whether all equal to default.
33     /// </para>
34     /// <para></para>
35     /// </summary>
36     /// <typeparam name="T">
37     /// <para>The .</para>
38     /// <para></para>
39     /// </typeparam>
40     /// <param name="collection">
41     /// <para>The collection.</para>
42     /// <para></para>
43     /// </param>
44     /// <returns>
45     /// <para>The bool</para>
46     /// <para></para>
47     /// </returns>
48     [MethodImpl(MethodImplOptions.AggressiveInlining)]
49     public static bool AllEqualToDefault<T>(this ICollection<T> collection)
50     {
51         var equalityComparer = EqualityComparer<T>.Default;
52         return collection.All(item => equalityComparer.Equals(item, default));
53     }
54 }
55 }

```

#### 1.14 ./csharp/Platform.Collections/IDictionaryExtensions.cs

```

1  using System;
2  using System.Collections.Generic;
3  using System.Runtime.CompilerServices;
4
5  #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
6
7  namespace Platform.Collections
8  {
9      /// <summary>
10     /// <para>
11     /// Represents the dictionary extensions.
12     /// </para>
13     /// <para></para>
14     /// </summary>
15     public static class IDictionaryExtensions
16     {
17         /// <summary>
18         /// <para>
19         /// Gets the or default using the specified dictionary.
20         /// </para>
21         /// <para></para>
22         /// </summary>
23         /// <typeparam name="TKey">
24         /// <para>The key.</para>
25         /// <para></para>
26         /// </typeparam>
27         /// <typeparam name="TValue">
28         /// <para>The value.</para>
29         /// <para></para>
30         /// </typeparam>
31         /// <param name="dictionary">
32         /// <para>The dictionary.</para>
33         /// <para></para>
34         /// </param>
35         /// <param name="key">
36         /// <para>The key.</para>
37         /// <para></para>
38         /// </param>
39         /// <returns>
40         /// <para>The value.</para>

```

```

41     /// <para></para>
42     /// </returns>
43     [MethodImpl(MethodImplOptions.AggressiveInlining)]
44     public static TValue GetOrCreateDefault<TKey, TValue>(this IDictionary<TKey, TValue>
45     ↪ dictionary, TKey key)
46     {
47         dictionary.TryGetValue(key, out TValue value);
48         return value;
49     }
50     /// <summary>
51     /// <para>
52     /// Gets the or add using the specified dictionary.
53     /// </para>
54     /// <para></para>
55     /// </summary>
56     /// <typeparam name="TKey">
57     /// <para>The key.</para>
58     /// <para></para>
59     /// </typeparam>
60     /// <typeparam name="TValue">
61     /// <para>The value.</para>
62     /// <para></para>
63     /// </typeparam>
64     /// <param name="dictionary">
65     /// <para>The dictionary.</para>
66     /// <para></para>
67     /// </param>
68     /// <param name="key">
69     /// <para>The key.</para>
70     /// <para></para>
71     /// </param>
72     /// <param name="valueFactory">
73     /// <para>The value factory.</para>
74     /// <para></para>
75     /// </param>
76     /// <returns>
77     /// <para>The value.</para>
78     /// <para></para>
79     /// </returns>
80     [MethodImpl(MethodImplOptions.AggressiveInlining)]
81     public static TValue GetOrCreateAdd<TKey, TValue>(this IDictionary<TKey, TValue> dictionary,
82     ↪ TKey key, Func<TKey, TValue> valueFactory)
83     {
84         if (!dictionary.TryGetValue(key, out TValue value))
85         {
86             value = valueFactory(key);
87             dictionary.Add(key, value);
88             return value;
89         }
90     }
91 }
92 }

```

## 1.15 ./csharp/Platform.Collections/Lists/CharIListExtensions.cs

```

1  using System.Collections.Generic;
2  using System.Runtime.CompilerServices;
3
4  namespace Platform.Collections.Lists
5  {
6      /// <summary>
7      /// <para>
8      /// Represents the char list extensions.
9      /// </para>
10     /// <para></para>
11     /// </summary>
12     public static class CharIListExtensions
13     {
14         /// <summary>
15         /// <para>Generates a hash code for the entire list based on the values of its
16         ↪ elements.</para>
17         /// <para>Генерирует хэш-код всего списка, на основе значений его элементов.</para>
18         /// </summary>
19         /// <param name="list"><para>The list to be hashed.</para><para>Список для
20         ↪ хеширования.</para></param>
21         /// <returns>
22         /// <para>The hash code of the list.</para>

```



```

21     /// <para>Хэш-код списка.</para>
22     /// </returns>
23     /// <remarks>
24     /// Based on https://github.com/Microsoft/referencesource/blob/3b1eaf5203992df69de44c783\_
    ↪ a3eda37d3d4cd10/mscorlib/system/string.cs#L833
25     /// </remarks>
26     [MethodImpl(MethodImplOptions.AggressiveInlining)]
27     public static int GenerateHashCode(this IList<char> list)
28     {
29         var hashSeed = 5381;
30         var hashAccumulator = hashSeed;
31         for (var i = 0; i < list.Count; i++)
32         {
33             hashAccumulator = (hashAccumulator << 5) + hashAccumulator ^ list[i];
34         }
35         return hashAccumulator + (hashSeed * 1566083941);
36     }
37
38     /// <summary>
39     /// <para>Compares two lists for equality.</para>
40     /// <para>Сравнивает два списка на равенство.</para>
41     /// </summary>
42     /// <param name="left"><para>The first compared list.</para><para>Первый список для
    ↪ сравнения.</para></param>
43     /// <param name="right"><para>The second compared list.</para><para>Второй список для
    ↪ сравнения.</para></param>
44     /// <returns>
45     /// <para>True, if the passed lists are equal to each other otherwise false.</para>
46     /// <para>True, если переданные списки равны друг другу, иначе false.</para>
47     /// </returns>
48     [MethodImpl(MethodImplOptions.AggressiveInlining)]
49     public static bool EqualTo(this IList<char> left, IList<char> right) =>
    ↪ left.EqualTo(right, ContentEqualTo);
50
51     /// <summary>
52     /// <para>Compares each element in the list for equality.</para>
53     /// <para>Сравнивает на равенство каждый элемент списка.</para>
54     /// </summary>
55     /// <param name="left"><para>The first compared list.</para><para>Первый список для
    ↪ сравнения.</para></param>
56     /// <param name="right"><para>The second compared list.</para><para>Второй список для
    ↪ сравнения.</para></param>
57     /// <returns>
58     /// <para>If at least one element of one list is not equal to the corresponding element
    ↪ from another list returns false, otherwise - true.</para>
59     /// <para>Если как минимум один элемент одного списка не равен соответствующему элементу
    ↪ из другого списка возвращает false, иначе - true.</para>
60     /// </returns>
61     [MethodImpl(MethodImplOptions.AggressiveInlining)]
62     public static bool ContentEqualTo(this IList<char> left, IList<char> right)
63     {
64         for (var i = left.Count - 1; i >= 0; --i)
65         {
66             if (left[i] != right[i])
67             {
68                 return false;
69             }
70         }
71         return true;
72     }
73 }
74 }

```

## 1.16 ./csharp/Platform.Collections/Lists/IListComparer.cs

```

1 using System.Collections.Generic;
2 using System.Runtime.CompilerServices;
3
4 namespace Platform.Collections.Lists
5 {
6     /// <summary>
7     /// <para>
8     /// Represents the list comparer.
9     /// </para>
10    /// <para></para>
11    /// </summary>
12    /// <seealso cref="IComparer{IList{T}}" />
13    public class IListComparer<T> : IComparer<IList<T>>
14    {

```

```

15     /// <summary>
16     /// <para>Compares two lists.</para>
17     /// <para>Сравнивает два списка.</para>
18     /// </summary>
19     /// <typeparam name="T"><para>The list's item type.</para><para>Тип элементов
    → списка.</para></typeparam>
20     /// <param name="left"><para>The first compared list.</para><para>Первый список для
    → сравнения.</para></param>
21     /// <param name="right"><para>The second compared list.</para><para>Второй список для
    → сравнения.</para></param>
22     /// <returns>
23     /// <para>
24     ///     A signed integer that indicates the relative values of <paramref name="left" />
    → and <paramref name="right" /> lists' elements, as shown in the following table.
25     ///     <list type="table">
26     ///         <listheader>
27     ///             <term>Value</term>
28     ///             <description>Meaning</description>
29     ///         </listheader>
30     ///         <item>
31     ///             <term>Is less than zero</term>
32     ///             <description>First non equal element of <paramref name="left" /> list is
    → less than first not equal element of <paramref name="right" /> list.</description>
33     ///         </item>
34     ///         <item>
35     ///             <term>Zero</term>
36     ///             <description>All elements of <paramref name="left" /> list equals to all
    → elements of <paramref name="right" /> list.</description>
37     ///         </item>
38     ///         <item>
39     ///             <term>Is greater than zero</term>
40     ///             <description>First non equal element of <paramref name="left" /> list is
    → greater than first not equal element of <paramref name="right" /> list.</description>
41     ///         </item>
42     ///     </list>
43     /// </para>
44     /// <para>
45     ///     Целое число со знаком, которое указывает относительные значения элементов
    → списков <paramref name="left" /> и <paramref name="right" /> как показано в
    → следующей таблице.
46     ///     <list type="table">
47     ///         <listheader>
48     ///             <term>Значение</term>
49     ///             <description>Смысл</description>
50     ///         </listheader>
51     ///         <item>
52     ///             <term>Меньше нуля</term>
53     ///             <description>Первый не равный элемент <paramref name="left" /> списка
    → меньше первого неравного элемента <paramref name="right" /> списка.</description>
54     ///         </item>
55     ///         <item>
56     ///             <term>Ноль</term>
57     ///             <description>Все элементы <paramref name="left" /> списка равны всем
    → элементам <paramref name="right" /> списка.</description>
58     ///         </item>
59     ///         <item>
60     ///             <term>Больше нуля</term>
61     ///             <description>Первый не равный элемент <paramref name="left" /> списка
    → больше первого неравного элемента <paramref name="right" /> списка.</description>
62     ///         </item>
63     ///     </list>
64     /// </para>
65     /// </returns>
66     [MethodImpl(MethodImplOptions.AggressiveInlining)]
67     public int Compare(IList<T> left, IList<T> right) => left.CompareTo(right);
68 }
69 }

```

## 1.17 ./csharp/Platform.Collections.Lists/IListEqualityComparer.cs

```

1 using System.Collections.Generic;
2 using System.Runtime.CompilerServices;
3
4 namespace Platform.Collections.Lists
5 {
6     /// <summary>
7     /// <para>
8     ///     Represents the list equality comparer.

```

```

9  /// </para>
10 /// <para></para>
11 /// </summary>
12 /// <seealso cref="IEqualityComparer{IList{T}}"/>
13 public class IListEqualityComparer<T> : IEqualityComparer<IList<T>>
14 {
15     /// <summary>
16     /// <para>Compares two lists for equality.</para>
17     /// <para>Сравнивает два списка на равенство.</para>
18     /// </summary>
19     /// <param name="left"><para>The first compared list.</para><para>Первый список для
    → сравнения.</para></param>
20     /// <param name="right"><para>The second compared list.</para><para>Второй список для
    → сравнения.</para></param>
21     /// <returns>
22     /// <para>If the passed lists are equal to each other, true is returned, otherwise
    → false.</para>
23     /// <para>Если переданные списки равны друг другу, возвращается true, иначе же
    → false.</para>
24     /// </returns>
25     [MethodImpl(MethodImplOptions.AggressiveInlining)]
26     public bool Equals(IList<T> left, IList<T> right) => left.EqualTo(right);
27
28     /// <summary>
29     /// <para>Generates a hash code for the entire list based on the values of its
    → elements.</para>
30     /// <para>Генерирует хэш-код всего списка, на основе значений его элементов.</para>
31     /// </summary>
32     /// <param name="list"><para>Hash list.</para><para>Список для
    → хеширования.</para></param>
33     /// <returns>
34     /// <para>The hash code of the list.</para>
35     /// <para>Хэш-код списка.</para>
36     /// </returns>
37     [MethodImpl(MethodImplOptions.AggressiveInlining)]
38     public int GetHashCode(IList<T> list) => list.GenerateHashCode();
39 }
40 }

```

## 1.18 ./csharp/Platform.Collections/Lists/IListExtensions.cs

```

1  using System;
2  using System.Collections.Generic;
3  using System.Runtime.CompilerServices;
4
5  namespace Platform.Collections.Lists
6  {
7      /// <summary>
8      /// <para>
9      /// Represents the list extensions.
10     /// </para>
11     /// <para></para>
12     /// </summary>
13     public static class IListExtensions
14     {
15         /// <summary>
16         /// <para>Gets the element from specified index if the list is not null and the index is
            → within the list's boundaries, otherwise it returns default value of type T.</para>
17         /// <para>Получает элемент из указанного индекса, если список не является null и индекс
            → находится в границах списка, в противном случае он возвращает значение по умолчанию
            → типа T.</para>
18         /// </summary>
19         /// <typeparam name="T"><para>The list's item type.</para><para>Тип элементов
            → списка.</para></typeparam>
20         /// <param name="list"><para>The checked list.</para><para>Проверяемый
            → список.</para></param>
21         /// <param name="index"><para>The index of element.</para><para>Индекс
            → элемента.</para></param>
22         /// <returns>
23         /// <para>If the specified index is within list's boundaries, then - list[index],
            → otherwise the default value.</para>
24         /// <para>Если указанный индекс находится в пределах границ списка, тогда - list[index],
            → иначе же значение по умолчанию.</para>
25         /// </returns>
26         [MethodImpl(MethodImplOptions.AggressiveInlining)]
27         public static T GetElementOrDefault<T>(this IList<T> list, int index) => list != null &&
            → list.Count > index ? list[index] : default;
28

```

```

29     /// <summary>
30     /// <para>Checks if a list is passed, checks its length, and if successful, copies the
    → value of list [index] into the element variable. Otherwise, the element variable has
    → a default value.</para>
31     /// <para>Проверяет, передан ли список, сверяет его длину и в случае успеха копирует
    → значение list[index] в переменную element. Иначе переменная element имеет значение
    → по умолчанию.</para>
32     /// </summary>
33     /// <typeparam name="T"><para>The list's item type.</para><para>Тип элементов
    → списка.</para></typeparam>
34     /// <param name="list"><para>The checked list.</para><para>Список для
    → проверки.</para></param>
35     /// <param name="index"><para>The index of element.</para><para>Индекс
    → элемента.</para></param>
36     /// <param name="element"><para>Variable for passing the index
    → value.</para><para>Переменная для передачи значения индекса.</para></param>
37     /// <returns>
38     /// <para>True on success, false otherwise.</para>
39     /// <para>True в случае успеха, иначе false.</para>
40     /// </returns>
41     [MethodImpl(MethodImplOptions.AggressiveInlining)]
42     public static bool TryGetElement<T>(this IList<T> list, int index, out T element)
43     {
44         if (list != null && list.Count > index)
45         {
46             element = list[index];
47             return true;
48         }
49         else
50         {
51             element = default;
52             return false;
53         }
54     }
55
56     /// <summary>
57     /// <para>Adds a value to the list.</para>
58     /// <para>Добавляет значение в список.</para>
59     /// </summary>
60     /// <typeparam name="T"><para>The list's item type.</para><para>Тип элементов
    → списка.</para></typeparam>
61     /// <param name="list"><para>The list to add the value to.</para><para>Список в который
    → нужно добавить значение.</para></param>
62     /// <param name="element"><para>The item to add to the list.</para><para>Элемент который
    → нужно добавить в список.</para></param>
63     /// <returns>
64     /// <para>True value in any case.</para>
65     /// <para>Значение true в любом случае.</para>
66     /// </returns>
67     [MethodImpl(MethodImplOptions.AggressiveInlining)]
68     public static bool AddAndReturnTrue<T>(this IList<T> list, T element)
69     {
70         list.Add(element);
71         return true;
72     }
73
74     /// <summary>
75     /// <para>Adds the value with first index from other list to this list.</para>
76     /// <para>Добавляет в этот список значение с первым индексом из другого списка.</para>
77     /// </summary>
78     /// <typeparam name="T"><para>The list's item type.</para><para>Тип элементов
    → списка.</para></typeparam>
79     /// <param name="list"><para>The list to add the value to.</para><para>Список в который
    → нужно добавить значение.</para></param>
80     /// <param name="elements"><para>The item to add to the list.</para><para>Элемент
    → который нужно добавить в список</para></param>
81     /// <returns>
82     /// <para>True value in any case.</para>
83     /// <para>Значение true в любом случае.</para>
84     /// </returns>
85     [MethodImpl(MethodImplOptions.AggressiveInlining)]
86     public static bool AddFirstAndReturnTrue<T>(this IList<T> list, IList<T> elements)
87     {
88         list.AddFirst(elements);
89         return true;
90     }
91

```

```

92     /// <summary>
93     /// <para>Adds a value to the list at the first index.</para>
94     /// <para>Добавляет значение в список по первому индексу.</para>
95     /// </summary>
96     /// <typeparam name="T"><para>The list's item type.</para><para>Тип элементов
    → списка.</para></typeparam>
97     /// <param name="list"><para>The list to add the value to.</para><para>Список в который
    → нужно добавить значение.</para></param>
98     /// <param name="elements"><para>The item to add to the list.</para><para>Элемент
    → который нужно добавить в список</para></param>
99     [MethodImpl(MethodImplOptions.AggressiveInlining)]
100    public static void AddFirst<T>(this IList<T> list, IList<T> elements) =>
    → list.Add(elements[0]);
101
102    /// <summary>
103    /// <para>Adds all elements from other list to this list and returns true.</para>
104    /// <para>Добавляет все элементы из другого списка в этот список и возвращает
    → true.</para>
105    /// </summary>
106    /// <typeparam name="T"><para>The list's item type.</para><para>Тип элементов
    → списка.</para></typeparam>
107    /// <param name="list"><para>The list to add the values to.</para><para>Список в который
    → нужно добавить значения.</para></param>
108    /// <param name="elements"><para>List of values to add.</para><para>Список значений
    → которые необходимо добавить.</para></param>
109    /// <returns>
110    /// <para>True value in any case.</para>
111    /// <para>Значение true в любом случае.</para>
112    /// </returns>
113    [MethodImpl(MethodImplOptions.AggressiveInlining)]
114    public static bool AddAllAndReturnTrue<T>(this IList<T> list, IList<T> elements)
115    {
116        list.AddAll(elements);
117        return true;
118    }
119
120    /// <summary>
121    /// <para>Adds all elements from other list to this list.</para>
122    /// <para>Добавляет все элементы из другого списка в этот список.</para>
123    /// </summary>
124    /// <typeparam name="T"><para>The list's item type.</para><para>Тип элементов
    → списка.</para></typeparam>
125    /// <param name="list"><para>The list to add the values to.</para><para>Список в который
    → нужно добавить значения.</para></param>
126    /// <param name="elements"><para>The list of values to add.</para><para>Список значений
    → которые необходимо добавить.</para></param>
127    [MethodImpl(MethodImplOptions.AggressiveInlining)]
128    public static void AddAll<T>(this IList<T> list, IList<T> elements)
129    {
130        for (var i = 0; i < elements.Count; i++)
131        {
132            list.Add(elements[i]);
133        }
134    }
135
136    /// <summary>
137    /// <para>Adds values to the list skipping the first element.</para>
138    /// <para>Добавляет значения в список пропуская первый элемент.</para>
139    /// </summary>
140    /// <typeparam name="T"><para>The list's item type.</para><para>Тип элементов
    → списка.</para></typeparam>
141    /// <param name="list"><para>The list to add the values to.</para><para>Список в который
    → нужно добавить значения.</para></param>
142    /// <param name="elements"><para>The list of values to add.</para><para>Список значений
    → которые необходимо добавить.</para></param>
143    /// <returns>
144    /// <para>True value in any case.</para>
145    /// <para>Значение true в любом случае.</para>
146    /// </returns>
147    [MethodImpl(MethodImplOptions.AggressiveInlining)]
148    public static bool AddSkipFirstAndReturnTrue<T>(this IList<T> list, IList<T> elements)
149    {
150        list.AddSkipFirst(elements);
151        return true;
152    }
153
154    /// <summary>

```

```

155 /// <para>Adds values to the list skipping the first element.</para>
156 /// <para>Добавляет значения в список пропуская первый элемент.</para>
157 /// </summary>
158 /// <typeparam name="T"><para>The list's item type.</para><para>Тип элементов
    ↳ списка.</para></typeparam>
159 /// <param name="list"><para>The list to add the values to.</para><para>Список в который
    ↳ нужно добавить значения.</para></param>
160 /// <param name="elements"><para>List of values to add.</para><para>Список значений
    ↳ которые необходимо добавить.</para></param>
161 [MethodImpl(MethodImplOptions.AggressiveInlining)]
162 public static void AddSkipFirst<T>(this IList<T> list, IList<T> elements) =>
    ↳ list.AddSkipFirst(elements, 1);
163
164 /// <summary>
165 /// <para>Adds values to the list skipping a specified number of first elements.</para>
166 /// <para>Добавляет в список значения пропуская определенное количество первых
    ↳ элементов.</para>
167 /// </summary>
168 /// <typeparam name="T"><para>The list's item type.</para><para>Тип элементов
    ↳ списка.</para></typeparam>
169 /// <param name="list"><para>The list to add the values to.</para><para>Список в который
    ↳ нужно добавить значения.</para></param>
170 /// <param name="elements"><para>List of values to add.</para><para>Список значений
    ↳ которые необходимо добавить.</para></param>
171 /// <param name="skip"><para>Number of elements to skip.</para><para>Количество
    ↳ пропускаемых элементов.</para></param>
172 [MethodImpl(MethodImplOptions.AggressiveInlining)]
173 public static void AddSkipFirst<T>(this IList<T> list, IList<T> elements, int skip)
174 {
175     for (var i = skip; i < elements.Count; i++)
176     {
177         list.Add(elements[i]);
178     }
179 }
180
181 /// <summary>
182 /// <para>Reads the number of elements in the list.</para>
183 /// <para>Считывает число элементов списка.</para>
184 /// </summary>
185 /// <typeparam name="T"><para>The list's item type.</para><para>Тип элементов
    ↳ списка.</para></typeparam>
186 /// <param name="list"><para>The checked list.</para><para>Список для
    ↳ проверки.</para></param>
187 /// <returns>
188 /// <para>The number of items contained in the list or 0.</para>
189 /// <para>Число элементов содержащихся в списке или же 0.</para>
190 /// </returns>
191 [MethodImpl(MethodImplOptions.AggressiveInlining)]
192 public static int GetCountOrZero<T>(this IList<T> list) => list?.Count ?? 0;
193
194 /// <summary>
195 /// <para>Compares two lists for equality.</para>
196 /// <para>Сравнивает два списка на равенство.</para>
197 /// </summary>
198 /// <typeparam name="T"><para>The list's item type.</para><para>Тип элементов
    ↳ списка.</para></typeparam>
199 /// <param name="left"><para>The first compared list.</para><para>Первый список для
    ↳ сравнения.</para></param>
200 /// <param name="right"><para>The second compared list.</para><para>Второй список для
    ↳ сравнения.</para></param>
201 /// <returns>
202 /// <para>If the passed lists are equal to each other, true is returned, otherwise
    ↳ false.</para>
203 /// <para>Если переданные списки равны друг другу, возвращается true, иначе же
    ↳ false.</para>
204 /// </returns>
205 [MethodImpl(MethodImplOptions.AggressiveInlining)]
206 public static bool EqualTo<T>(this IList<T> left, IList<T> right) => EqualTo(left,
    ↳ right, ContentEqualTo);
207
208 /// <summary>
209 /// <para>Compares two lists for equality.</para>
210 /// <para>Сравнивает два списка на равенство.</para>
211 /// </summary>
212 /// <typeparam name="T"><para>The list's item type.</para><para>Тип элементов
    ↳ списка.</para></typeparam>

```

```

213  /// <param name="left"><para>The first compared list.</para><para>Первый список для
    → проверки.</para></param>
214  /// <param name="right"><para>The second compared list.</para><para>Второй список для
    → сравнения.</para></param>
215  /// <param name="contentEqualityComparer"><para>Function to test two lists for their
    → content equality.</para><para>Функция для проверки двух списков на равенство их
    → содержимого.</para></param>
216  /// <returns>
217  /// <para>If the passed lists are equal to each other, true is returned, otherwise
    → false.</para>
218  /// <para>Если переданные списки равны друг другу, возвращается true, иначе же
    → false.</para>
219  /// </returns>
220  [MethodImpl(MethodImplOptions.AggressiveInlining)]
221  public static bool EqualTo<T>(this IList<T> left, IList<T> right, Func<IList<T>,
    → IList<T>, bool> contentEqualityComparer)
222  {
223      if (ReferenceEquals(left, right))
224      {
225          return true;
226      }
227      var leftCount = left.GetCountOrZero();
228      var rightCount = right.GetCountOrZero();
229      if (leftCount == 0 && rightCount == 0)
230      {
231          return true;
232      }
233      if (leftCount == 0 || rightCount == 0 || leftCount != rightCount)
234      {
235          return false;
236      }
237      return contentEqualityComparer(left, right);
238  }
239
240  /// <summary>
241  /// <para>Compares each element in the list for identity.</para>
242  /// <para>Сравнивает на равенство каждый элемент списка.</para>
243  /// </summary>
244  /// <typeparam name="T"><para>The list's item type.</para><para>Тип элементов
    → списка.</para></typeparam>
245  /// <param name="left"><para>The first compared list.</para><para>Первый список для
    → сравнения.</para></param>
246  /// <param name="right"><para>The second compared list.</para><para>Второй список для
    → сравнения.</para></param>
247  /// <returns>
248  /// <para>If at least one element of one list is not equal to the corresponding element
    → from another list returns false, otherwise - true.</para>
249  /// <para>Если как минимум один элемент одного списка не равен соответствующему элементу
    → из другого списка возвращает false, иначе - true.</para>
250  /// </returns>
251  [MethodImpl(MethodImplOptions.AggressiveInlining)]
252  public static bool ContentEqualTo<T>(this IList<T> left, IList<T> right)
253  {
254      var equalityComparer = EqualityComparer<T>.Default;
255      for (var i = left.Count - 1; i >= 0; --i)
256      {
257          if (!equalityComparer.Equals(left[i], right[i]))
258          {
259              return false;
260          }
261      }
262      return true;
263  }
264
265  /// <summary>
266  /// <para>Creates an array by copying all elements from the list that satisfy the
    → predicate. If no list is passed, null is returned.</para>
267  /// <para>Создаёт массив, копируя из списка все элементы которые удовлетворяют
    → предикату. Если список не передан, возвращается null.</para>
268  /// </summary>
269  /// <typeparam name="T"><para>The list's item type.</para><para>Тип элементов
    → списка.</para></typeparam>
270  /// <param name="list"><para>The list to copy from.</para><para>Список для копирования.</para></param>
271  /// <param name="predicate"><para>A function that determines whether an element should
    → be copied.</para><para>Функция определяющая должен ли копироваться
    → элемент.</para></param>
272  /// <returns>

```

```

273 /// <para>An array with copied elements from the list.</para>
274 /// <para>Массив с скопированными элементами из списка.</para>
275 /// </returns>
276 [MethodImpl(MethodImplOptions.AggressiveInlining)]
277 public static T[] ToArray<T>(this IList<T> list, Func<T, bool> predicate)
278 {
279     if (list == null)
280     {
281         return null;
282     }
283     var result = new List<T>(list.Count);
284     for (var i = 0; i < list.Count; i++)
285     {
286         if (predicate(list[i]))
287         {
288             result.Add(list[i]);
289         }
290     }
291     return result.ToArray();
292 }
293
294 /// <summary>
295 /// <para>Copies all the elements of the list into an array and returns it.</para>
296 /// <para>Копирует все элементы списка в массив и возвращает его.</para>
297 /// </summary>
298 /// <typeparam name="T"><para>The list's item type.</para><para>Тип элементов
299   ↳ списка.</para></typeparam>
300 /// <param name="list"><para>The list to copy from.</para><para>Список для
301   ↳ копирования.</para></param>
302 /// <returns>
303 /// <para>An array with all the elements of the passed list.</para>
304 /// <para>Массив со всеми элементами переданного списка.</para>
305 /// </returns>
306 [MethodImpl(MethodImplOptions.AggressiveInlining)]
307 public static T[] ToArray<T>(this IList<T> list)
308 {
309     var array = new T[list.Count];
310     list.CopyTo(array, 0);
311     return array;
312 }
313
314 /// <summary>
315 /// <para>Executes the passed action for each item in the list.</para>
316 /// <para>Выполняет переданное действие для каждого элемента в списке.</para>
317 /// </summary>
318 /// <typeparam name="T"><para>The list's item type.</para><para>Тип элементов
319   ↳ списка.</para></typeparam>
320 /// <param name="list"><para>The list of elements for which the action will be
321   ↳ executed.</para><para>Список элементов для которых будет выполняться
322   ↳ действие.</para></param>
323 /// <param name="action"><para>A function that will be called for each element of the
324   ↳ list.</para><para>Функция которая будет вызываться для каждого элемента
325   ↳ списка.</para></param>
326 [MethodImpl(MethodImplOptions.AggressiveInlining)]
327 public static void ForEach<T>(this IList<T> list, Action<T> action)
328 {
329     for (var i = 0; i < list.Count; i++)
330     {
331         action(list[i]);
332     }
333 }
334
335 /// <summary>
336 /// <para>Generates a hash code for the entire list based on the values of its
337   ↳ elements.</para>
338 /// <para>Генерирует хэш-код всего списка, на основе значений его элементов.</para>
339 /// </summary>
340 /// <typeparam name="T"><para>The list's item type.</para><para>Тип элементов
341   ↳ списка.</para></typeparam>
342 /// <param name="list"><para>Hash list.</para><para>Список для
343   ↳ хеширования.</para></param>
344 /// <returns>
345 /// <para>The hash code of the list.</para>
346 /// <para>Хэш-код списка.</para>
347 /// </returns>
348 /// <remarks>

```



```

339 /// Based on http://stackoverflow.com/questions/263400/what-is-the-best-algorithm-for-an
340 → -overridden-system-object-gethashcode
341 /// </remarks>
342 [MethodImpl(MethodImplOptions.AggressiveInlining)]
343 public static int GenerateHashCode<T>(this IList<T> list)
344 {
345     var hashAccumulator = 17;
346     for (var i = 0; i < list.Count; i++)
347     {
348         hashAccumulator = unchecked((hashAccumulator * 23) + list[i].GetHashCode());
349     }
350     return hashAccumulator;
351 }
352
353 /// <summary>
354 /// <para>Compares two lists.</para>
355 /// <para>Сравнивает два списка.</para>
356 /// </summary>
357 /// <typeparam name="T"><para>The list's item type.</para><para>Тип элементов
358 → списка.</para></typeparam>
359 /// <param name="left"><para>The first compared list.</para><para>Первый список для
360 → сравнения.</para></param>
361 /// <param name="right"><para>The second compared list.</para><para>Второй список для
362 → сравнения.</para></param>
363 /// <returns>
364 /// <para>
365 /// A signed integer that indicates the relative values of <paramref name="left" />
366 → and <paramref name="right" /> lists' elements, as shown in the following table.
367 /// <list type="table">
368 /// <listheader>
369 /// <term>Value</term>
370 /// <description>Meaning</description>
371 /// </listheader>
372 /// <item>
373 /// <term>Is less than zero</term>
374 /// <description>First non equal element of <paramref name="left" /> list is
375 → less than first not equal element of <paramref name="right" /> list.</description>
376 /// </item>
377 /// <item>
378 /// <term>Zero</term>
379 /// <description>All elements of <paramref name="left" /> list equals to all
380 → elements of <paramref name="right" /> list.</description>
381 /// </item>
382 /// <item>
383 /// <term>Is greater than zero</term>
384 /// <description>First non equal element of <paramref name="left" /> list is
385 → greater than first not equal element of <paramref name="right" /> list.</description>
386 /// </item>
387 /// </list>
388 /// </para>
389 /// <para>
390 /// Целое число со знаком, которое указывает относительные значения элементов
391 → списков <paramref name="left" /> и <paramref name="right" /> как показано в
392 → следующей таблице.
393 /// <list type="table">
394 /// <listheader>
395 /// <term>Значение</term>
396 /// <description>Смысл</description>
397 /// </listheader>
398 /// <item>
399 /// <term>Меньше нуля</term>
400 /// <description>Первый не равный элемент <paramref name="left" /> списка
401 → меньше первого неравного элемента <paramref name="right" /> списка.</description>
402 /// </item>
403 /// <item>
404 /// <term>Ноль</term>
405 /// <description>Все элементы <paramref name="left" /> списка равны всем
406 → элементам <paramref name="right" /> списка.</description>
407 /// </item>
408 /// <item>
409 /// <term>Больше нуля</term>
410 /// <description>Первый не равный элемент <paramref name="left" /> списка
411 → больше первого неравного элемента <paramref name="right" /> списка.</description>
412 /// </item>
413 /// </list>
414 /// </para>
415 /// </returns>

```

```

403 [MethodImpl(MethodImplOptions.AggressiveInlining)]
404 public static int CompareTo<T>(this IList<T> left, IList<T> right)
405 {
406     var comparer = Comparer<T>.Default;
407     var leftCount = left.GetCountOrZero();
408     var rightCount = right.GetCountOrZero();
409     var intermediateResult = leftCount.CompareTo(rightCount);
410     for (var i = 0; intermediateResult == 0 && i < leftCount; i++)
411     {
412         intermediateResult = comparer.Compare(left[i], right[i]);
413     }
414     return intermediateResult;
415 }
416
417 /// <summary>
418 /// <para>Skips one element in the list and builds an array from the remaining
419   → elements.</para>
420 /// <para>Пропускает один элемент списка и составляет из оставшихся элементов
421   → массив.</para>
422 /// </summary>
423 /// <typeparam name="T"><para>The list's item type.</para><para>Тип элементов
424   → списка.</para></typeparam>
425 /// <param name="list"><para>The list to copy from.</para><para>Список для
426   → копирования.</para></param>
427 /// <returns>
428 /// <para>If the list is empty, returns an empty array, otherwise - an array with a
429   → missing first element.</para>
430 /// <para>Если список пуст, возвращает пустой массив, иначе - массив с пропущенным
431   → первым элементом.</para>
432 /// </returns>
433 [MethodImpl(MethodImplOptions.AggressiveInlining)]
434 public static T[] SkipFirst<T>(this IList<T> list) => list.SkipFirst(1);
435
436 /// <summary>
437 /// <para>Skips the specified number of elements in the list and builds an array from
438   → the remaining elements.</para>
439 /// <para>Пропускает указанное количество элементов списка и составляет из оставшихся
440   → элементов массив.</para>
441 /// </summary>
442 /// <typeparam name="T"><para>The list's item type.</para><para>Тип элементов
443   → списка.</para></typeparam>
444 /// <param name="list"><para>The list to copy from.</para><para>Список для
445   → копирования.</para></param>
446 /// <param name="skip"><para>The number of items to skip.</para><para>Количество
447   → пропускаемых элементов.</para></param>
448 /// <returns>
449 /// <para>If the list is empty, or the number of skipped elements is greater than the
450   → list, returns an empty array, otherwise - an array with the specified number of
451   → missing elements.</para>
452 /// <para>Если список пуст, или количество пропускаемых элементов больше списка -
453   → возвращает пустой массив, иначе - массив с указанным количеством пропущенных
454   → элементов.</para>
455 /// </returns>
456 [MethodImpl(MethodImplOptions.AggressiveInlining)]
457 public static T[] SkipFirst<T>(this IList<T> list, int skip)
458 {
459     if (list.IsNullOrEmpty() || list.Count <= skip)
460     {
461         return Array.Empty<T>();
462     }
463     var result = new T[list.Count - skip];
464     for (int r = skip, w = 0; r < list.Count; r++, w++)
465     {
466         result[w] = list[r];
467     }
468     return result;
469 }
470
471 /// <summary>
472 /// <para>Shifts all the elements of the list by one position to the right.</para>
473 /// <para>Сдвигает вправо все элементы списка на одну позицию.</para>
474 /// </summary>
475 /// <typeparam name="T"><para>The list's item type.</para><para>Тип элементов
476   → списка.</para></typeparam>
477 /// <param name="list"><para>The list to copy from.</para><para>Список для
478   → копирования.</para></param>
479 /// <returns>

```

```

463     /// <para>Array with a shift of elements by one position.</para>
464     /// <para>Массив со сдвигом элементов на одну позицию.</para>
465     /// </returns>
466     [MethodImpl(MethodImplOptions.AggressiveInlining)]
467     public static IList<T> ShiftRight<T>(this IList<T> list) => list.ShiftRight(1);
468
469     /// <summary>
470     /// <para>Shifts all elements of the list to the right by the specified number of
471     ///     elements.</para>
472     /// <para>Сдвигает вправо все элементы списка на указанное количество элементов.</para>
473     /// </summary>
474     /// <typeparam name="T"><para>The list's item type.</para><para>Тип элементов
475     ///     списка.</para></typeparam>
476     /// <param name="list"><para>The list to copy from.</para><para>Список для
477     ///     копирования.</para></param>
478     /// <param name="shift"><para>The number of items to shift.</para><para>Количество
479     ///     сдвигаемых элементов.</para></param>
480     /// </returns>
481     /// <para>If the value of the shift variable is less than zero - an <see
482     ///     cref="NotImplementedException"/> exception is thrown, but if the value of the shift
483     ///     variable is 0 - an exact copy of the array is returned. Otherwise, an array is
484     ///     returned with the shift of the elements.</para>
485     /// <para>Если значение переменной shift меньше нуля - выбрасывается исключение <see
486     ///     cref="NotImplementedException"/>, если же значение переменной shift равно 0 -
487     ///     возвращается точная копия массива. Иначе возвращается массив со сдвигом
488     ///     элементов.</para>
489     /// </returns>
490     [MethodImpl(MethodImplOptions.AggressiveInlining)]
491     public static IList<T> ShiftRight<T>(this IList<T> list, int shift)
492     {
493         if (shift < 0)
494         {
495             throw new NotImplementedException();
496         }
497         if (shift == 0)
498         {
499             return list.ToArray();
500         }
501         else
502         {
503             var result = new T[list.Count + shift];
504             for (int r = 0, w = shift; r < list.Count; r++, w++)
505             {
506                 result[w] = list[r];
507             }
508             return result;
509         }
510     }
511 }
512 }

```

## 1.19 ./csharp/Platform.Collections/Lists/ListFiller.cs

```

1  using System.Collections.Generic;
2  using System.Runtime.CompilerServices;
3
4  namespace Platform.Collections.Lists
5  {
6      /// <summary>
7      /// <para>
8      ///     Represents the list filler.
9      /// </para>
10     /// <para></para>
11     /// </summary>
12     public class ListFiller<TElement, TReturnConstant>
13     {
14         /// <summary>
15         /// <para>
16         ///     The list.
17         /// </para>
18         /// <para></para>
19         /// </summary>
20         protected readonly List<TElement> _list;
21         /// <summary>
22         /// <para>
23         ///     The return constant.
24         /// </para>
25         /// <para></para>
26         /// </summary>

```

```

27     protected readonly TReturnConstant _returnConstant;
28
29     /// <summary>
30     /// <para>Initializes a new instance of the ListFiller class.</para>
31     /// <para>Инициализирует новый экземпляр класса ListFiller.</para>
32     /// </summary>
33     /// <param name="list"><para>The list to be filled.</para><para>Список который будет
    → заполняться.</para></param>
34     /// <param name="returnConstant"><para>The value for the constant returned by
    → corresponding methods.</para><para>Значение для константы возвращаемой
    → соответствующими методами.</para></param>
35     [MethodImpl(MethodImplOptions.AggressiveInlining)]
36     public ListFiller(List<TElement> list, TReturnConstant returnConstant)
37     {
38         _list = list;
39         _returnConstant = returnConstant;
40     }
41
42     /// <summary>
43     /// <para>
44     /// Initializes a new <see cref="ListFiller"/> instance.
45     /// </para>
46     /// <para></para>
47     /// </summary>
48     /// <param name="list">
49     /// <para>A list.</para>
50     /// <para></para>
51     /// </param>
52     [MethodImpl(MethodImplOptions.AggressiveInlining)]
53     public ListFiller(List<TElement> list) : this(list, default) { }
54
55     /// <summary>
56     /// <para>Adds an item to the end of the list.</para>
57     /// <para>Добавляет элемент в конец списка.</para>
58     /// </summary>
59     /// <param name="element"><para>Element to add.</para><para>Добавляемый
    → элемент.</para></param>
60     [MethodImpl(MethodImplOptions.AggressiveInlining)]
61     public void Add(TElement element) => _list.Add(element);
62
63     /// <summary>
64     /// <para>Adds an item to the end of the list and return true.</para>
65     /// <para>Добавляет элемент в конец списка и возвращает true.</para>
66     /// </summary>
67     /// <param name="element"><para>Element to add.</para><para>Добавляемый
    → элемент.</para></param>
68     /// <returns>
69     /// <para>True value in any case.</para>
70     /// <para>Значение true в любом случае.</para>
71     /// </returns>
72     [MethodImpl(MethodImplOptions.AggressiveInlining)]
73     public bool AddAndReturnTrue(TElement element) => _list.AddAndReturnTrue(element);
74
75     /// <summary>
76     /// <para>Adds a value to the list at the first index and return true.</para>
77     /// <para>Добавляет значение в список по первому индексу и возвращает true.</para>
78     /// </summary>
79     /// <param name="elements"><para>Element to add.</para><para>Добавляемый
    → элемент.</para></param>
80     /// <returns>
81     /// <para>True value in any case.</para>
82     /// <para>Значение true в любом случае.</para>
83     /// </returns>
84     [MethodImpl(MethodImplOptions.AggressiveInlining)]
85     public bool AddFirstAndReturnTrue(IList<TElement> elements) =>
    → _list.AddFirstAndReturnTrue(elements);
86
87     /// <summary>
88     /// <para>Adds all elements from other list to this list and returns true.</para>
89     /// <para>Добавляет все элементы из другого списка в этот список и возвращает
    → true.</para>
90     /// </summary>
91     /// <param name="elements"><para>List of values to add.</para><para>Список значений
    → которые необходимо добавить.</para></param>
92     /// <returns>
93     /// <para>True value in any case.</para>
94     /// <para>Значение true в любом случае.</para>

```

```

95     /// </returns>
96     [MethodImpl(MethodImplOptions.AggressiveInlining)]
97     public bool AddAllAndReturnTrue(IList<TElement> elements) =>
98         ↪ _list.AddAllAndReturnTrue(elements);
99
100     /// <summary>
101     /// <para>Adds values to the list skipping the first element.</para>
102     /// <para>Добавляет значения в список пропуская первый элемент.</para>
103     /// </summary>
104     /// <param name="elements"><para>The list of values to add.</para><para>Список значений
105     ↪ которые необходимо добавить.</para></param>
106     /// <returns>
107     /// <para>True value in any case.</para>
108     /// <para>Значение true в любом случае.</para>
109     /// </returns>
110     [MethodImpl(MethodImplOptions.AggressiveInlining)]
111     public bool AddSkipFirstAndReturnTrue(IList<TElement> elements) =>
112         ↪ _list.AddSkipFirstAndReturnTrue(elements);
113
114     /// <summary>
115     /// <para>Adds an item to the end of the list and return constant.</para>
116     /// <para>Добавляет элемент в конец списка и возвращает константу.</para>
117     /// </summary>
118     /// <param name="element"><para>Element to add.</para><para>Добавляемый
119     ↪ элемент.</para></param>
120     /// <returns>
121     /// <para>Constant value in any case.</para>
122     /// <para>Значение константы в любом случае.</para>
123     /// </returns>
124     [MethodImpl(MethodImplOptions.AggressiveInlining)]
125     public TReturnConstant AddAndReturnConstant(TElement element)
126     {
127         _list.Add(element);
128         return _returnConstant;
129     }
130
131     /// <summary>
132     /// <para>Adds a value to the list at the first index and return constant.</para>
133     /// <para>Добавляет значение в список по первому индексу и возвращает константу.</para>
134     /// </summary>
135     /// <param name="element"><para>Element to add.</para><para>Добавляемый
136     ↪ элемент.</para></param>
137     /// <returns>
138     /// <para>Constant value in any case.</para>
139     /// <para>Значение константы в любом случае.</para>
140     /// </returns>
141     [MethodImpl(MethodImplOptions.AggressiveInlining)]
142     public TReturnConstant AddFirstAndReturnConstant(IList<TElement> elements)
143     {
144         _list.AddFirst(elements);
145         return _returnConstant;
146     }
147
148     /// <summary>
149     /// <para>Adds all elements from other list to this list and returns constant.</para>
150     /// <para>Добавляет все элементы из другого списка в этот список и возвращает
151     ↪ константу.</para>
152     /// </summary>
153     /// <param name="elements"><para>List of values to add.</para><para>Список значений
154     ↪ которые необходимо добавить.</para></param>
155     /// <returns>
156     /// <para>Constant value in any case.</para>
157     /// <para>Значение константы в любом случае.</para>
158     /// </returns>
159     [MethodImpl(MethodImplOptions.AggressiveInlining)]
160     public TReturnConstant AddAllAndReturnConstant(IList<TElement> elements)
161     {
162         _list.AddAll(elements);
163         return _returnConstant;
164     }
165
166     /// <summary>
167     /// <para>Adds values to the list skipping the first element and return constant
168     ↪ value.</para>
169     /// <para>Добавляет значения в список пропуская первый элемент и возвращает значение
170     ↪ константы.</para>
171     /// </summary>

```

```

163     /// <param name="elements"><para>The list of values to add.</para><para>Список значений
    ↪     которые необходимо добавить.</para></param>
164     /// <returns>
165     /// <para>constant value in any case.</para>
166     /// <para>Значение константы в любом случае.</para>
167     /// </returns>
168     [MethodImpl(MethodImplOptions.AggressiveInlining)]
169     public TReturnConstant AddSkipFirstAndReturnConstant(IList<TElement> elements)
170     {
171         _list.AddSkipFirst(elements);
172         return _returnConstant;
173     }
174 }
175 }

```

## 1.20 ./csharp/Platform.Collections/Segments/CharSegment.cs

```

1  using System.Linq;
2  using System.Collections.Generic;
3  using System.Runtime.CompilerServices;
4  using Platform.Collections.Arrays;
5  using Platform.Collections.Lists;
6
7  #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
8
9  namespace Platform.Collections.Segments
10 {
11     /// <summary>
12     /// <para>
13     /// Represents the char segment.
14     /// </para>
15     /// <para></para>
16     /// </summary>
17     /// <seealso cref="Segment{char}"/>
18     public class CharSegment : Segment<char>
19     {
20         /// <summary>
21         /// <para>
22         /// Initializes a new <see cref="CharSegment"/> instance.
23         /// </para>
24         /// <para></para>
25         /// </summary>
26         /// <param name="@base">
27         /// <para>A base.</para>
28         /// <para></para>
29         /// </param>
30         /// <param name="offset">
31         /// <para>A offset.</para>
32         /// <para></para>
33         /// </param>
34         /// <param name="length">
35         /// <para>A length.</para>
36         /// <para></para>
37         /// </param>
38         [MethodImpl(MethodImplOptions.AggressiveInlining)]
39         public CharSegment(IList<char> @base, int offset, int length) : base(@base, offset,
    ↪     length) { }
40
41         /// <summary>
42         /// <para>
43         /// Gets the hash code.
44         /// </para>
45         /// <para></para>
46         /// </summary>
47         /// <returns>
48         /// <para>The int</para>
49         /// <para></para>
50         /// </returns>
51         [MethodImpl(MethodImplOptions.AggressiveInlining)]
52         public override int GetHashCode()
53         {
54             // Base can be not an array, but still IList<char>
55             if (Base is char[] baseArray)
56             {
57                 return baseArray.GenerateHashCode(Offset, Length);
58             }
59             else
60             {
61                 return this.GenerateHashCode();

```

```

62     }
63 }
64
65 /// <summary>
66 /// <para>
67 /// Determines whether this instance equals.
68 /// </para>
69 /// <para></para>
70 /// </summary>
71 /// <param name="other">
72 /// <para>The other.</para>
73 /// <para></para>
74 /// </param>
75 /// <returns>
76 /// <para>The bool</para>
77 /// <para></para>
78 /// </returns>
79 [MethodImpl(MethodImplOptions.AggressiveInlining)]
80 public override bool Equals(Segment<char> other)
81 {
82     bool contentEqualityComparer(IList<char> left, IList<char> right)
83     {
84         // Base can be not an array, but still IList<char>
85         if (Base is char[] baseArray && other.Base is char[] otherArray)
86         {
87             return baseArray.ContentEqualTo(Offset, Length, otherArray, other.Offset);
88         }
89         else
90         {
91             return left.ContentEqualTo(right);
92         }
93     }
94     return this.EqualTo(other, contentEqualityComparer);
95 }
96
97 /// <summary>
98 /// <para>
99 /// Determines whether this instance equals.
100 /// </para>
101 /// <para></para>
102 /// </summary>
103 /// <param name="obj">
104 /// <para>The obj.</para>
105 /// <para></para>
106 /// </param>
107 /// <returns>
108 /// <para>The bool</para>
109 /// <para></para>
110 /// </returns>
111 public override bool Equals(object obj) => obj is Segment<char> charSegment ?
    ↳ Equals(charSegment) : false;
112
113 [MethodImpl(MethodImplOptions.AggressiveInlining)]
114 public static implicit operator string(CharSegment segment)
115 {
116     if (!(segment.Base is char[] array))
117     {
118         array = segment.Base.ToArray();
119     }
120     return new string(array, segment.Offset, segment.Length);
121 }
122
123 /// <summary>
124 /// <para>
125 /// Returns the string.
126 /// </para>
127 /// <para></para>
128 /// </summary>
129 /// <returns>
130 /// <para>The string</para>
131 /// <para></para>
132 /// </returns>
133 [MethodImpl(MethodImplOptions.AggressiveInlining)]
134 public override string ToString() => this;
135 }
136 }

```

## 1.21 ./csharp/Platform.Collections/Segments/Segment.cs

```

1 using System;
2 using System.Collections;
3 using System.Collections.Generic;
4 using System.Runtime.CompilerServices;
5 using Platform.Collections.Arrays;
6 using Platform.Collections.Lists;
7
8 #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
9
10 namespace Platform.Collections.Segments
11 {
12     /// <summary>
13     /// <para>Represents the segment of an <see cref="IList"/>.</para>
14     /// <para>Представляет сегмент <see cref="IList"/>.</para>
15     /// </summary>
16     /// <typeparam name="T"><para>The segment elements type.</para><para>Тип элементов
17     ↪ сегмента.</para></typeparam>
18     public class Segment<T> : IEquatable<Segment<T>>, IList<T>
19     {
20         /// <summary>
21         /// <para>Gets the original list (this segment is a part of it).</para>
22         /// <para>Возвращает исходный список (частью которого является этот сегмент).</para>
23         /// </summary>
24         public IList<T> Base
25         {
26             [MethodImpl(MethodImplOptions.AggressiveInlining)]
27             get;
28         }
29         /// <summary>
30         /// <para>Gets the offset relative to the source list (the index at which this segment
31         ↪ starts).</para>
32         /// <para>Возвращает смещение относительно исходного списка (индекс с которого
33         ↪ начинается этот сегмент).</para>
34         /// </summary>
35         public int Offset
36         {
37             [MethodImpl(MethodImplOptions.AggressiveInlining)]
38             get;
39         }
40         /// <summary>
41         /// <para>Gets the length of a segment.</para>
42         /// <para>Возвращает длину сегмента.</para>
43         /// </summary>
44         public int Length
45         {
46             [MethodImpl(MethodImplOptions.AggressiveInlining)]
47             get;
48         }
49         /// <summary>
50         /// <para>Initializes a new instance of the <see cref="Segment"/> class, using the
51         ↪ <paramref name="base"/> list, <paramref name="offset"/> of the segment and its
52         ↪ <paramref name="length" />.</para>
53         /// <para>Инициализирует новый экземпляр класса <see cref="Segment"/>, используя список
54         ↪ <paramref name="base"/>, <paramref name="offset"/> сегмента и его <paramref
55         ↪ name="length"/>.</para>
56         /// </summary>
57         /// <param name="base"><para>The reference to the original list containing the elements
58         ↪ of this segment.</para><para>Ссылка на исходный список в котором находятся элементы
59         ↪ этого сегмента.</para></param>
60         /// <param name="offset"><para>The offset relative to the <paramref name="base"/> list
61         ↪ from which the segment starts.</para><para>Смещение относительно списка <paramref
62         ↪ name="base"/>, с которого начинается сегмент.</para></param>
63         /// <param name="length"><para>The segment's length.</para><para>Длина
64         ↪ сегмента.</para></param>
65         [MethodImpl(MethodImplOptions.AggressiveInlining)]
66         public Segment(IList<T> @base, int offset, int length)
67         {
68             Base = @base;
69             Offset = offset;
70             Length = length;
71         }
72         /// <summary>
73         /// <para>Gets the hash code of the current <see cref="Segment"/> instance.</para>
74         /// <para>Возвращает хэш-код текущего экземпляра <see cref="Segment"/>.</para>
75         /// </summary>

```



```

66     /// <returns></returns>
67     [MethodImpl(MethodImplOptions.AggressiveInlining)]
68     public override int GetHashCode() => this.GenerateHashCode();
69
70     /// <summary>
71     /// <para>Returns a value indicating whether the current <see cref="Segment"/> is equal
72     → to another <see cref="Segment" />.</para>
73     /// <para>Возвращает значение определяющее, равен ли текущий <see cref="Segment"/>
74     → другому <see cref="Segment"/>.</para>
75     /// </summary>
76     /// <param name="other"><para>An <see cref="Segment"/> object to compare with the
77     → current <see cref="Segment"/>.</para><para>Объект <see cref="Segment"/> для
78     → сравнения с текущим <see cref="Segment"/>.</para></param>
79     /// <returns>
80     /// <para><see langword="true"/> if the current <see cref="Segment"/> is equal to the
81     → <paramref name="other"/> parameter; otherwise, <see langword="false"/>.</para>
82     /// <para><see langword="true"/>, если текущий <see cref="Segment"/> равен параметру
83     → <paramref name="other"/>, в противном случае - <see langword="false"/>.</para>
84     /// </returns>
85     [MethodImpl(MethodImplOptions.AggressiveInlining)]
86     public virtual bool Equals(Segment<T> other) => this.EqualTo(other);
87
88     /// <summary>
89     /// <para>
90     /// Determines whether this instance equals.
91     /// </para>
92     /// <para></para>
93     /// </summary>
94     /// <param name="obj">
95     /// <para>The obj.</para>
96     /// <para></para>
97     /// </param>
98     /// <returns>
99     /// <para>The bool</para>
100    /// <para></para>
101    /// </returns>
102    [MethodImpl(MethodImplOptions.AggressiveInlining)]
103    public override bool Equals(object obj) => obj is Segment<T> other ? Equals(other) :
104    → false;
105
106    #region IList
107
108    /// <summary>
109    /// <para>
110    /// The value.
111    /// </para>
112    /// <para></para>
113    /// </summary>
114    public T this[int i]
115    {
116        [MethodImpl(MethodImplOptions.AggressiveInlining)]
117        get => Base[Offset + i];
118        [MethodImpl(MethodImplOptions.AggressiveInlining)]
119        set => Base[Offset + i] = value;
120    }
121
122    /// <summary>
123    /// <para>Gets the number of elements contained in the <see cref="Segment"/>.</para>
124    /// <para>Возвращает число элементов, содержащихся в <see cref="Segment"/>.</para>
125    /// </summary>
126    /// <value>
127    /// <para>The number of elements contained in the <see cref="Segment"/>.</para>
128    /// <para>Число элементов, содержащихся в <see cref="Segment"/>.</para>
129    /// </value>
130    public int Count
131    {
132        [MethodImpl(MethodImplOptions.AggressiveInlining)]
133        get => Length;
134    }
135
136    /// <summary>
137    /// <para>Gets a value indicating whether the <see cref="Segment"/> is read-only.</para>
138    /// <para>Возвращает значение, указывающее, является ли <see cref="Segment"/> доступным
139    → только для чтения.</para>
140    /// </summary>
141    /// <value>
142    /// <para><see langword="true"/> if the <see cref="Segment"/> is read-only; otherwise,
143    → <see langword="false"/>.</para>

```

```

135  /// <para>Значение <see langword="true"/>, если <see cref="Segment"/> доступен только
136  → для чтения, в противном случае - значение <see langword="false"/>.</para>
137  /// </value>
138  /// <remarks>
139  /// <para>Any <see cref="Segment"/> is read-only.</para>
140  /// <para>Любой <see cref="Segment"/> доступен только для чтения.</para>
141  /// </remarks>
142  public bool IsReadOnly
143  {
144      [MethodImpl(MethodImplOptions.AggressiveInlining)]
145      get => true;
146  }
147  /// <summary>
148  /// <para>Determines the index of a specific item in the <see cref="Segment"/>.</para>
149  /// <para>Определяет индекс конкретного элемента в <see cref="Segment"/>.</para>
150  /// </summary>
151  /// <param name="item"><para>The object to locate in the <see
152  → cref="Segment"/>.</para><para>Элемент для поиска в <see
153  → cref="Segment"/>.</para></param>
154  /// <returns>
155  /// <para>The index of <paramref name="item"/> if found in the segment; otherwise,
156  → -1.</para>
157  /// <para>Индекс <paramref name="item"/>, если он найден в сегменте; в противном случае
158  → - значение -1.</para>
159  /// </returns>
160  [MethodImpl(MethodImplOptions.AggressiveInlining)]
161  public int IndexOf(T item)
162  {
163      var index = Base.IndexOf(item);
164      if (index >= Offset)
165      {
166          var actualIndex = index - Offset;
167          if (actualIndex < Length)
168          {
169              return actualIndex;
170          }
171      }
172      return -1;
173  }
174  /// <summary>
175  /// <para>Inserts an item to the <see cref="Segment"/> at the specified index.</para>
176  /// <para>Вставляет элемент в <see cref="Segment"/> по указанному индексу.</para>
177  /// </summary>
178  /// <param name="index"><para>The zero-based index at which <paramref name="item"/>
179  → should be inserted.</para><para>Отсчитываемый от нуля индекс, по которому следует
180  → вставить элемент <paramref name="item"/>.</para></param>
181  /// <param name="item"><para>The element to insert into the <see
182  → cref="Segment"/>.</para><para>Элемент, вставляемый в <see
183  → cref="Segment"/>.</para></param>
184  /// <exception cref="NotSupportedException">
185  /// <para>The <see cref="Segment"/> is read-only.</para>
186  /// <para><see cref="Segment"/> доступен только для чтения.</para>
187  /// </exception>
188  [MethodImpl(MethodImplOptions.AggressiveInlining)]
189  public void Insert(int index, T item) => throw new NotSupportedException();
190  /// <summary>
191  /// <para>Removes the <see cref="Segment"/> item at the specified index.</para>
192  /// <para>Удаляет элемент <see cref="Segment"/> по указанному индексу.</para>
193  /// </summary>
194  /// <param name="index"><para>The zero-based index of the item to
195  → remove.</para><para>Отсчитываемый от нуля индекс элемента для
196  → удаления.</para></param>
197  /// <exception cref="NotSupportedException">
198  /// <para>The <see cref="Segment"/> is read-only.</para>
199  /// <para><see cref="Segment"/> доступен только для чтения.</para>
200  /// </exception>
201  [MethodImpl(MethodImplOptions.AggressiveInlining)]
202  public void RemoveAt(int index) => throw new NotSupportedException();
203  /// <summary>
204  /// <para>Adds an item to the <see cref="Segment"/>.</para>
205  /// <para>Добавляет элемент в <see cref="Segment"/>.</para>
206  /// </summary>

```

```

200  /// <param name="item"><para>The element to add to the <see
    → cref="Segment"/>.</para><para>Элемент, добавляемый в <see
    → cref="Segment"/>.</para></param>
201  /// <exception cref="NotSupportedException">
202  /// <para>The <see cref="Segment"/> is read-only.</para>
203  /// <para><see cref="Segment"/> доступен только для чтения.</para>
204  /// </exception>
205  [MethodImpl(MethodImplOptions.AggressiveInlining)]
206  public void Add(T item) => throw new NotSupportedException();
207
208  /// <summary>
209  /// <para>Removes all items from the <see cref="Segment"/>.</para>
210  /// <para>Удаляет все элементы из <see cref="Segment"/>.</para>
211  /// </summary>
212  /// <exception cref="NotSupportedException">
213  /// <para>The <see cref="Segment"/> is read-only.</para>
214  /// <para><see cref="Segment"/> доступен только для чтения.</para>
215  /// </exception>
216  [MethodImpl(MethodImplOptions.AggressiveInlining)]
217  public void Clear() => throw new NotSupportedException();
218
219  /// <summary>
220  /// <para>Determines whether the <see cref="Segment"/> contains a specific value.</para>
221  /// <para>Определяет, содержит ли <see cref="Segment"/> определенное значение.</para>
222  /// </summary>
223  /// <param name="item"><para>The value to locate in the <see
    → cref="Segment"/>.</para><para>Значение, которое нужно найти в <see
    → cref="Segment"/>.</para></param>
224  /// <returns>
225  /// <para><see langword="true"/> if the value is found in the <see cref="Segment"/>;
    → otherwise, <see langword="false"/>.</para>
226  /// <para>Значение <see langword="true"/>, если значение находится в <see
    → cref="Segment"/>; в противном случае - <see langword="false"/>.</para>
227  /// </returns>
228  [MethodImpl(MethodImplOptions.AggressiveInlining)]
229  public bool Contains(T item) => IndexOf(item) >= 0;
230
231  /// <summary>
232  /// <para>Copies the elements of the <see cref="Segment"/> into an array, starting at a
    → specific array index.</para>
233  /// <para>Копирует элементы <see cref="Segment"/> в массив, начиная с определенного
    → индекса массива.</para>
234  /// </summary>
235  /// <param name="array"><para>A one-dimensional array that is the destination of the
    → elements copied from <see cref="Segment"/></para><para>Одномерный массив, который
    → является местом назначения элементов, скопированных из <see
    → cref="Segment"/>.</para></param>
236  /// <param name="arrayIndex"><para>The zero-based index in <paramref name="array"/> at
    → which copying begins.</para><para>Отсчитываемый от нуля индекс в массиве <paramref
    → name="array"/>, с которого начинается копирование.</para></param>
237  [MethodImpl(MethodImplOptions.AggressiveInlining)]
238  public void CopyTo(T[] array, int arrayIndex)
239  {
240      for (var i = 0; i < Length; i++)
241      {
242          array.Add(ref arrayIndex, this[i]);
243      }
244  }
245
246  /// <summary>
247  /// <para>Removes the first occurrence of a specific value from the <see
    → cref="Segment"/>.</para>
248  /// <para>Удаляет первое вхождение указанного значения из <see cref="Segment"/>.</para>
249  /// </summary>
250  /// <param name="item"><para>The value to remove from the <see
    → cref="Segment"/>.</para><para>Значение, которые нужно удалить из <see
    → cref="Segment"/>.</para></param>
251  /// <returns></returns>
252  /// <exception cref="NotSupportedException">
253  /// <para>The <see cref="Segment"/> is read-only.</para>
254  /// <para><see cref="Segment"/> доступен только для чтения.</para>
255  /// </exception>
256  [MethodImpl(MethodImplOptions.AggressiveInlining)]
257  public bool Remove(T item) => throw new NotSupportedException();
258
259  /// <summary>
260  /// <para>Gets an enumerator that iterates through a <see cref="Segment"/>.</para>

```

```

261     /// <para>Возвращает перечислитель, который осуществляет итерацию по <see
    → cref="Segment"/>.</para>
262     /// </summary>
263     /// <returns>
264     /// <para>An <see cref="T:System.Collections.IEnumerator"/> object that can be used to
    → iterate through the the <see cref="Segment"/>.</para>
265     /// <para>Объект <see cref="T:System.Collections.IEnumerator"/>, который можно
    → использовать для перебора <see cref="Segment"/>.</para>
266     /// </returns>
267     [MethodImpl(MethodImplOptions.AggressiveInlining)]
268     public IEnumerator<T> GetEnumerator()
269     {
270         for (var i = 0; i < Length; i++)
271         {
272             yield return this[i];
273         }
274     }
275
276     /// <summary>
277     /// <para>Gets an enumerator that iterates through a <see cref="Segment"/>.</para>
278     /// <para>Возвращает перечислитель, который осуществляет итерацию по <see
    → cref="Segment"/>.</para>
279     /// </summary>
280     /// <returns>
281     /// <para>An <see cref="T:System.Collections.IEnumerator"/> object that can be used to
    → iterate through the collection.</para>
282     /// <para>Объект <see cref="T:System.Collections.IEnumerator"/>, который можно
    → использовать для перебора <see cref="Segment"/>.</para>
283     /// </returns>
284     [MethodImpl(MethodImplOptions.AggressiveInlining)]
285     IEnumerator IEnumerable.GetEnumerator() => GetEnumerator();
286
287     #endregion
288 }
289 }

```

## 1.22 ./csharp/Platform.Collections.Segments.Walkers.AllSegmentsWalkerBase.cs

```

1  #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
2
3  namespace Platform.Collections.Segments.Walkers
4  {
5      /// <summary>
6      /// <para>
7      /// Represents the all segments walker base.
8      /// </para>
9      /// <para></para>
10     /// </summary>
11     public abstract class AllSegmentsWalkerBase
12     {
13         /// <summary>
14         /// <para>
15         /// The default minimum string segment length.
16         /// </para>
17         /// <para></para>
18         /// </summary>
19         public static readonly int DefaultMinimumStringSegmentLength = 2;
20     }
21 }

```

## 1.23 ./csharp/Platform.Collections.Segments.Walkers.AllSegmentsWalkerBase<T, TSegment>.cs

```

1  using System.Collections.Generic;
2  using System.Runtime.CompilerServices;
3
4  #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
5
6  namespace Platform.Collections.Segments.Walkers
7  {
8      /// <summary>
9      /// <para>
10     /// Represents the all segments walker base.
11     /// </para>
12     /// <para></para>
13     /// </summary>
14     /// <seealso cref="AllSegmentsWalkerBase"/>
15     public abstract class AllSegmentsWalkerBase<T, TSegment> : AllSegmentsWalkerBase
16     where TSegment : Segment<T>
17     {
18         private readonly int _minimumStringSegmentLength;

```

```

19
20     /// <summary>
21     /// <para>
22     /// Initializes a new <see cref="AllSegmentsWalkerBase"/> instance.
23     /// </para>
24     /// <para></para>
25     /// </summary>
26     /// <param name="minimumStringSegmentLength">
27     /// <para>A minimum string segment length.</para>
28     /// <para></para>
29     /// </param>
30     [MethodImpl(MethodImplOptions.AggressiveInlining)]
31     protected AllSegmentsWalkerBase(int minimumStringSegmentLength) =>
32     ↪     _minimumStringSegmentLength = minimumStringSegmentLength;
33
34     /// <summary>
35     /// <para>
36     /// Initializes a new <see cref="AllSegmentsWalkerBase"/> instance.
37     /// </para>
38     /// <para></para>
39     /// </summary>
40     [MethodImpl(MethodImplOptions.AggressiveInlining)]
41     protected AllSegmentsWalkerBase() : this(DefaultMinimumStringSegmentLength) { }
42
43     /// <summary>
44     /// <para>
45     /// Walks the all using the specified elements.
46     /// </para>
47     /// <para></para>
48     /// </summary>
49     /// <param name="elements">
50     /// <para>The elements.</para>
51     /// <para></para>
52     /// </param>
53     [MethodImpl(MethodImplOptions.AggressiveInlining)]
54     public virtual void WalkAll(ICollection<T> elements)
55     {
56         for (int offset = 0, maxOffset = elements.Count - _minimumStringSegmentLength;
57             ↪ offset <= maxOffset; offset++)
58         {
59             for (int length = _minimumStringSegmentLength, maxLength = elements.Count -
60                 ↪ offset; length <= maxLength; length++)
61             {
62                 Iteration(CreateSegment(elements, offset, length));
63             }
64         }
65     }
66
67     /// <summary>
68     /// <para>
69     /// Creates the segment using the specified elements.
70     /// </para>
71     /// <para></para>
72     /// </summary>
73     /// <param name="elements">
74     /// <para>The elements.</para>
75     /// <para></para>
76     /// </param>
77     /// <param name="offset">
78     /// <para>The offset.</para>
79     /// <para></para>
80     /// </param>
81     /// <param name="length">
82     /// <para>The length.</para>
83     /// <para></para>
84     /// </param>
85     /// <returns>
86     /// <para>The segment</para>
87     /// <para></para>
88     /// </returns>
89     [MethodImpl(MethodImplOptions.AggressiveInlining)]
90     protected abstract TSegment CreateSegment(ICollection<T> elements, int offset, int length);
91
92     /// <summary>
93     /// <para>
94     /// Iterations the segment.
95     /// </para>
96     /// <para></para>
97     /// </summary>
98     /// <param name="segment">
99     /// <para>The segment to iterate.</para>
100    /// <para></para>
101    /// </param>

```

```

94     /// </summary>
95     /// <param name="segment">
96     /// <para>The segment.</para>
97     /// <para></para>
98     /// </param>
99     [MethodImpl(MethodImplOptions.AggressiveInlining)]
100     protected abstract void Iteration(TSegment segment);
101 }
102 }

```

#### 1.24 ./csharp/Platform.Collections/Segments/Walkers/AllSegmentsWalkerBase[T].cs

```

1  using System.Collections.Generic;
2  using System.Runtime.CompilerServices;
3
4  #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
5
6  namespace Platform.Collections.Segments.Walkers
7  {
8      /// <summary>
9      /// <para>
10     /// Represents the all segments walker base.
11     /// </para>
12     /// <para></para>
13     /// </summary>
14     /// <seealso cref="AllSegmentsWalkerBase{T, Segment{T}}"/>
15     public abstract class AllSegmentsWalkerBase<T> : AllSegmentsWalkerBase<T, Segment<T>>
16     {
17         /// <summary>
18         /// <para>
19         /// Creates the segment using the specified elements.
20         /// </para>
21         /// <para></para>
22         /// </summary>
23         /// <param name="elements">
24         /// <para>The elements.</para>
25         /// <para></para>
26         /// </param>
27         /// <param name="offset">
28         /// <para>The offset.</para>
29         /// <para></para>
30         /// </param>
31         /// <param name="length">
32         /// <para>The length.</para>
33         /// <para></para>
34         /// </param>
35         /// <returns>
36         /// <para>A segment of t</para>
37         /// <para></para>
38         /// </returns>
39         [MethodImpl(MethodImplOptions.AggressiveInlining)]
40         protected override Segment<T> CreateSegment(ICollection<T> elements, int offset, int length)
41         {
42             => new Segment<T>(elements, offset, length);
43         }
44     }
45 }

```

#### 1.25 ./csharp/Platform.Collections/Segments/Walkers/AllSegmentsWalkerExtensions.cs

```

1  using System.Runtime.CompilerServices;
2
3  #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
4
5  namespace Platform.Collections.Segments.Walkers
6  {
7      /// <summary>
8      /// <para>
9      /// Represents the all segments walker extensions.
10     /// </para>
11     /// <para></para>
12     /// </summary>
13     public static class AllSegmentsWalkerExtensions
14     {
15         /// <summary>
16         /// <para>
17         /// Walks the all using the specified walker.
18         /// </para>
19         /// <para></para>
20         /// </summary>
21         /// <param name="walker">
22         /// <para>The walker.</para>

```

```

23     /// <para></para>
24     /// </param>
25     /// <param name="@string">
26     /// <para>The string.</para>
27     /// <para></para>
28     /// </param>
29     [MethodImpl(MethodImplOptions.AggressiveInlining)]
30     public static void WalkAll(this AllSegmentsWalkerBase<char> walker, string @string) =>
31         ↪ walker.WalkAll(@string.ToCharArray());
32
33     /// <summary>
34     /// <para>
35     /// Walks the all using the specified walker.
36     /// </para>
37     /// </summary>
38     /// <typeparam name="TSegment">
39     /// <para>The segment.</para>
40     /// <para></para>
41     /// </typeparam>
42     /// <param name="walker">
43     /// <para>The walker.</para>
44     /// <para></para>
45     /// </param>
46     /// <param name="@string">
47     /// <para>The string.</para>
48     /// <para></para>
49     /// </param>
50     [MethodImpl(MethodImplOptions.AggressiveInlining)]
51     public static void WalkAll<TSegment>(this AllSegmentsWalkerBase<char, TSegment> walker,
52         ↪ string @string) where TSegment : Segment<char> =>
53         ↪ walker.WalkAll(@string.ToCharArray());
54 }
55 }

```

## 1.26 ./csharp/Platform.Collections/Segments/Walkers/DictionaryBasedDuplicateSegmentsWalkerBase[T, TSegment]

```

1 using System;
2 using System.Collections.Generic;
3 using System.Runtime.CompilerServices;
4
5 #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
6
7 namespace Platform.Collections.Segments.Walkers
8 {
9     /// <summary>
10    /// <para>
11    /// Represents the dictionary based duplicate segments walker base.
12    /// </para>
13    /// <para></para>
14    /// </summary>
15    /// <seealso cref="DuplicateSegmentsWalkerBase{T, TSegment}"/>
16    public abstract class DictionaryBasedDuplicateSegmentsWalkerBase<T, TSegment> :
17        ↪ DuplicateSegmentsWalkerBase<T, TSegment>
18        where TSegment : Segment<T>
19    {
20        /// <summary>
21        /// <para>
22        /// The default reset dictionary on each walk.
23        /// </para>
24        /// <para></para>
25        /// </summary>
26        public static readonly bool DefaultResetDictionaryOnEachWalk;
27        private readonly bool _resetDictionaryOnEachWalk;
28        /// <summary>
29        /// <para>
30        /// The dictionary.
31        /// </para>
32        /// <para></para>
33        /// </summary>
34        protected IDictionary<TSegment, long> Dictionary;
35
36        /// <summary>
37        /// <para>
38        /// Initializes a new <see cref="DictionaryBasedDuplicateSegmentsWalkerBase"/> instance.
39        /// </para>
40        /// <para></para>
41        /// </summary>
42        /// <param name="dictionary">
43        /// <para>A dictionary.</para>

```

```

43     /// <para></para>
44     /// </param>
45     /// <param name="minimumStringSegmentLength">
46     /// <para>A minimum string segment length.</para>
47     /// <para></para>
48     /// </param>
49     /// <param name="resetDictionaryOnEachWalk">
50     /// <para>A reset dictionary on each walk.</para>
51     /// <para></para>
52     /// </param>
53     [MethodImpl(MethodImplOptions.AggressiveInlining)]
54     protected DictionaryBasedDuplicateSegmentsWalkerBase(IDictionary<TSegment, long>
55     ↪ dictionary, int minimumStringSegmentLength, bool resetDictionaryOnEachWalk)
56     : base(minimumStringSegmentLength)
57     {
58         Dictionary = dictionary;
59         _resetDictionaryOnEachWalk = resetDictionaryOnEachWalk;
60     }
61     /// <summary>
62     /// <para>
63     /// Initializes a new <see cref="DictionaryBasedDuplicateSegmentsWalkerBase"/> instance.
64     /// </para>
65     /// <para></para>
66     /// </summary>
67     /// <param name="dictionary">
68     /// <para>A dictionary.</para>
69     /// <para></para>
70     /// </param>
71     /// <param name="minimumStringSegmentLength">
72     /// <para>A minimum string segment length.</para>
73     /// <para></para>
74     /// </param>
75     [MethodImpl(MethodImplOptions.AggressiveInlining)]
76     protected DictionaryBasedDuplicateSegmentsWalkerBase(IDictionary<TSegment, long>
77     ↪ dictionary, int minimumStringSegmentLength) : this(dictionary,
78     ↪ minimumStringSegmentLength, DefaultResetDictionaryOnEachWalk) { }
79     /// <summary>
80     /// <para>
81     /// Initializes a new <see cref="DictionaryBasedDuplicateSegmentsWalkerBase"/> instance.
82     /// </para>
83     /// <para></para>
84     /// </summary>
85     /// <param name="dictionary">
86     /// <para>A dictionary.</para>
87     /// <para></para>
88     /// </param>
89     [MethodImpl(MethodImplOptions.AggressiveInlining)]
90     protected DictionaryBasedDuplicateSegmentsWalkerBase(IDictionary<TSegment, long>
91     ↪ dictionary) : this(dictionary, DefaultMinimumStringSegmentLength,
92     ↪ DefaultResetDictionaryOnEachWalk) { }
93     /// <summary>
94     /// <para>
95     /// Initializes a new <see cref="DictionaryBasedDuplicateSegmentsWalkerBase"/> instance.
96     /// </para>
97     /// <para></para>
98     /// </summary>
99     /// <param name="minimumStringSegmentLength">
100    /// <para>A minimum string segment length.</para>
101    /// <para></para>
102    /// </param>
103    /// <param name="resetDictionaryOnEachWalk">
104    /// <para>A reset dictionary on each walk.</para>
105    /// <para></para>
106    /// </param>
107    [MethodImpl(MethodImplOptions.AggressiveInlining)]
108    protected DictionaryBasedDuplicateSegmentsWalkerBase(int minimumStringSegmentLength,
109    ↪ bool resetDictionaryOnEachWalk) : this(resetDictionaryOnEachWalk ? null : new
110    ↪ Dictionary<TSegment, long>(), minimumStringSegmentLength, resetDictionaryOnEachWalk)
111    ↪ { }
112    /// <summary>
113    /// <para>
114    /// Initializes a new <see cref="DictionaryBasedDuplicateSegmentsWalkerBase"/> instance.
115    /// </para>

```



```

112     /// <para></para>
113     </summary>
114     <param name="minimumStringSegmentLength">
115     <para>A minimum string segment length.</para>
116     </para></param>
117     [MethodImpl(MethodImplOptions.AggressiveInlining)]
118     protected DictionaryBasedDuplicateSegmentsWalkerBase(int minimumStringSegmentLength) :
119     ↪ this(minimumStringSegmentLength, DefaultResetDictionaryOnEachWalk) { }
120
121     </summary>
122     <para>
123     <para>Initializes a new <see cref="DictionaryBasedDuplicateSegmentsWalkerBase"/> instance.
124     </para>
125     </para></summary>
126     [MethodImpl(MethodImplOptions.AggressiveInlining)]
127     protected DictionaryBasedDuplicateSegmentsWalkerBase() :
128     ↪ this(DefaultMinimumStringSegmentLength, DefaultResetDictionaryOnEachWalk) { }
129
130     </summary>
131     <para>
132     <para>Walks the all using the specified elements.
133     </para>
134     </para></summary>
135     <param name="elements">
136     <para>The elements.</para>
137     </para></param>
138     [MethodImpl(MethodImplOptions.AggressiveInlining)]
139     public override void WalkAll(ICollection<T> elements)
140     {
141         if (_resetDictionaryOnEachWalk)
142         {
143             var capacity = Math.Ceiling(Math.Pow(elements.Count, 2) / 2);
144             Dictionary = new Dictionary<TSegment, long>((int)capacity);
145         }
146         base.WalkAll(elements);
147     }
148
149     </summary>
150     <para>
151     <para>Gets the segment frequency using the specified segment.
152     </para>
153     </para></summary>
154     <param name="segment">
155     <para>The segment.</para>
156     </para></param>
157     <returns>
158     <para>The long</para>
159     </returns>
160     [MethodImpl(MethodImplOptions.AggressiveInlining)]
161     protected override long GetSegmentFrequency(TSegment segment) =>
162     ↪ Dictionary.GetOrDefault(segment);
163
164     </summary>
165     <para>
166     <para>Sets the segment frequency using the specified segment.
167     </para>
168     </para></summary>
169     <param name="segment">
170     <para>The segment.</para>
171     </para></param>
172     <param name="frequency">
173     <para>The frequency.</para>
174     </para></param>
175     [MethodImpl(MethodImplOptions.AggressiveInlining)]
176     protected override void SetSegmentFrequency(TSegment segment, long frequency) =>
177     ↪ Dictionary[segment] = frequency;
178
179     }
180 }
181

```

## 1.27 ./csharp/Platform.Collections.Segments/Walkers/DictionaryBasedDuplicateSegmentsWalkerBase[T].cs

```

1  using System.Collections.Generic;
2  using System.Runtime.CompilerServices;
3
4  #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
5
6  namespace Platform.Collections.Segments.Walkers
7  {
8      /// <summary>
9      /// <para>
10     /// Represents the dictionary based duplicate segments walker base.
11     /// </para>
12     /// <para></para>
13     /// </summary>
14     /// <seealso cref="DictionaryBasedDuplicateSegmentsWalkerBase{T, Segment{T}}"/>
15     public abstract class DictionaryBasedDuplicateSegmentsWalkerBase<T> :
16     DictionaryBasedDuplicateSegmentsWalkerBase<T, Segment<T>>
17     {
18         /// <summary>
19         /// <para>
20         /// Initializes a new <see cref="DictionaryBasedDuplicateSegmentsWalkerBase"/> instance.
21         /// </para>
22         /// <para></para>
23         /// </summary>
24         /// <param name="dictionary">
25         /// <para>A dictionary.</para>
26         /// <para></para>
27         /// </param>
28         /// <param name="minimumStringSegmentLength">
29         /// <para>A minimum string segment length.</para>
30         /// <para></para>
31         /// </param>
32         /// <param name="resetDictionaryOnEachWalk">
33         /// <para>A reset dictionary on each walk.</para>
34         /// <para></para>
35         /// </param>
36         [MethodImpl(MethodImplOptions.AggressiveInlining)]
37         protected DictionaryBasedDuplicateSegmentsWalkerBase(IDictionary<Segment<T>, long>
38         dictionary, int minimumStringSegmentLength, bool resetDictionaryOnEachWalk) :
39         base(dictionary, minimumStringSegmentLength, resetDictionaryOnEachWalk) { }
40
41         /// <summary>
42         /// <para>
43         /// Initializes a new <see cref="DictionaryBasedDuplicateSegmentsWalkerBase"/> instance.
44         /// </para>
45         /// <para></para>
46         /// </summary>
47         /// <param name="dictionary">
48         /// <para>A dictionary.</para>
49         /// <para></para>
50         /// </param>
51         /// <param name="minimumStringSegmentLength">
52         /// <para>A minimum string segment length.</para>
53         /// <para></para>
54         /// </param>
55         [MethodImpl(MethodImplOptions.AggressiveInlining)]
56         protected DictionaryBasedDuplicateSegmentsWalkerBase(IDictionary<Segment<T>, long>
57         dictionary, int minimumStringSegmentLength) : base(dictionary,
58         minimumStringSegmentLength, DefaultResetDictionaryOnEachWalk) { }
59
60         /// <summary>
61         /// <para>
62         /// Initializes a new <see cref="DictionaryBasedDuplicateSegmentsWalkerBase"/> instance.
63         /// </para>
64         /// <para></para>
65         /// </summary>
66         /// <param name="dictionary">
67         /// <para>A dictionary.</para>
68         /// <para></para>
69         /// </param>
70         [MethodImpl(MethodImplOptions.AggressiveInlining)]
71         protected DictionaryBasedDuplicateSegmentsWalkerBase(IDictionary<Segment<T>, long>
72         dictionary) : base(dictionary, DefaultMinimumStringSegmentLength,
73         DefaultResetDictionaryOnEachWalk) { }
74
75         /// <summary>
76         /// <para>
77         /// Initializes a new <see cref="DictionaryBasedDuplicateSegmentsWalkerBase"/> instance.

```

```

71     /// </para>
72     /// <para></para>
73     /// </summary>
74     /// <param name="minimumStringSegmentLength">
75     /// <para>A minimum string segment length.</para>
76     /// <para></para>
77     /// </param>
78     /// <param name="resetDictionaryOnEachWalk">
79     /// <para>A reset dictionary on each walk.</para>
80     /// <para></para>
81     /// </param>
82     [MethodImpl(MethodImplOptions.AggressiveInlining)]
83     protected DictionaryBasedDuplicateSegmentsWalkerBase(int minimumStringSegmentLength,
84         ↪ bool resetDictionaryOnEachWalk) : base(minimumStringSegmentLength,
85         ↪ resetDictionaryOnEachWalk) { }
86
87     /// <summary>
88     /// <para>
89     /// Initializes a new <see cref="DictionaryBasedDuplicateSegmentsWalkerBase"/> instance.
90     /// </para>
91     /// <para></para>
92     /// </summary>
93     /// <param name="minimumStringSegmentLength">
94     /// <para>A minimum string segment length.</para>
95     /// <para></para>
96     /// </param>
97     [MethodImpl(MethodImplOptions.AggressiveInlining)]
98     protected DictionaryBasedDuplicateSegmentsWalkerBase(int minimumStringSegmentLength) :
99     ↪ base(minimumStringSegmentLength, DefaultResetDictionaryOnEachWalk) { }
100
101     /// <summary>
102     /// <para>
103     /// Initializes a new <see cref="DictionaryBasedDuplicateSegmentsWalkerBase"/> instance.
104     /// </para>
105     /// <para></para>
106     /// </summary>
107     [MethodImpl(MethodImplOptions.AggressiveInlining)]
108     protected DictionaryBasedDuplicateSegmentsWalkerBase() :
109     ↪ base(DefaultMinimumStringSegmentLength, DefaultResetDictionaryOnEachWalk) { }
110 }
111 }

```

## 1.28 ./csharp/Platform.Collections.Segments.Walkers/DuplicateSegmentsWalkerBase[T, TSegment].cs

```

1  using System.Runtime.CompilerServices;
2
3  #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
4
5  namespace Platform.Collections.Segments.Walkers
6  {
7      /// <summary>
8      /// <para>
9      /// Represents the duplicate segments walker base.
10     /// </para>
11     /// <para></para>
12     /// </summary>
13     /// <seealso cref="AllSegmentsWalkerBase{T, TSegment}"/>
14     public abstract class DuplicateSegmentsWalkerBase<T, TSegment> : AllSegmentsWalkerBase<T,
15     ↪ TSegment>
16     where TSegment : Segment<T>
17     {
18         /// <summary>
19         /// <para>
20         /// Initializes a new <see cref="DuplicateSegmentsWalkerBase"/> instance.
21         /// </para>
22         /// <para></para>
23         /// </summary>
24         /// <param name="minimumStringSegmentLength">
25         /// <para>A minimum string segment length.</para>
26         /// <para></para>
27         /// </param>
28         [MethodImpl(MethodImplOptions.AggressiveInlining)]
29         protected DuplicateSegmentsWalkerBase(int minimumStringSegmentLength) :
30         ↪ base(minimumStringSegmentLength) { }
31
32         /// <summary>
33         /// <para>
34         /// Initializes a new <see cref="DuplicateSegmentsWalkerBase"/> instance.
35         /// </para>

```

```

34     /// <para></para>
35     /// </summary>
36     [MethodImpl(MethodImplOptions.AggressiveInlining)]
37     protected DuplicateSegmentsWalkerBase() : base(DefaultMinimumStringSegmentLength) { }
38
39     /// <summary>
40     /// <para>
41     /// Iterations the segment.
42     /// </para>
43     /// <para></para>
44     /// </summary>
45     /// <param name="segment">
46     /// <para>The segment.</para>
47     /// <para></para>
48     /// </param>
49     [MethodImpl(MethodImplOptions.AggressiveInlining)]
50     protected override void Iteration(TSegment segment)
51     {
52         var frequency = GetSegmentFrequency(segment);
53         if (frequency == 1)
54         {
55             OnDuplicateFound(segment);
56         }
57         SetSegmentFrequency(segment, frequency + 1);
58     }
59
60     /// <summary>
61     /// <para>
62     /// Ons the duplicate found using the specified segment.
63     /// </para>
64     /// <para></para>
65     /// </summary>
66     /// <param name="segment">
67     /// <para>The segment.</para>
68     /// <para></para>
69     /// </param>
70     [MethodImpl(MethodImplOptions.AggressiveInlining)]
71     protected abstract void OnDuplicateFound(TSegment segment);
72
73     /// <summary>
74     /// <para>
75     /// Gets the segment frequency using the specified segment.
76     /// </para>
77     /// <para></para>
78     /// </summary>
79     /// <param name="segment">
80     /// <para>The segment.</para>
81     /// <para></para>
82     /// </param>
83     /// <returns>
84     /// <para>The long</para>
85     /// <para></para>
86     /// </returns>
87     [MethodImpl(MethodImplOptions.AggressiveInlining)]
88     protected abstract long GetSegmentFrequency(TSegment segment);
89
90     /// <summary>
91     /// <para>
92     /// Sets the segment frequency using the specified segment.
93     /// </para>
94     /// <para></para>
95     /// </summary>
96     /// <param name="segment">
97     /// <para>The segment.</para>
98     /// <para></para>
99     /// </param>
100    /// <param name="frequency">
101    /// <para>The frequency.</para>
102    /// <para></para>
103    /// </param>
104    [MethodImpl(MethodImplOptions.AggressiveInlining)]
105    protected abstract void SetSegmentFrequency(TSegment segment, long frequency);
106 }
107 }

```

## 1.29 ./csharp/Platform.Collections/Segments/Walkers/DuplicateSegmentsWalkerBase[T].cs

```
1 #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
```

```
2
```

```

3 namespace Platform.Collections.Segments.Walkers
4 {
5     /// <summary>
6     /// <para>
7     /// Represents the duplicate segments walker base.
8     /// </para>
9     /// <para></para>
10    /// </summary>
11    /// <seealso cref="DuplicateSegmentsWalkerBase{T, Segment{T}}"/>
12    public abstract class DuplicateSegmentsWalkerBase<T> : DuplicateSegmentsWalkerBase<T,
    ↪ Segment<T>>
13    {
14    }
15 }

```

### 1.30 ./csharp/Platform.Collections.Sets/ISetExtensions.cs

```

1 using System.Collections.Generic;
2 using System.Runtime.CompilerServices;
3
4 #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
5
6 namespace Platform.Collections.Sets
7 {
8     /// <summary>
9     /// <para>
10    /// Represents the set extensions.
11    /// </para>
12    /// <para></para>
13    /// </summary>
14    public static class ISetExtensions
15    {
16        /// <summary>
17        /// <para>
18        /// Adds the and return void using the specified set.
19        /// </para>
20        /// <para></para>
21        /// </summary>
22        /// <typeparam name="T">
23        /// <para>The .</para>
24        /// <para></para>
25        /// </typeparam>
26        /// <param name="set">
27        /// <para>The set.</para>
28        /// <para></para>
29        /// </param>
30        /// <param name="element">
31        /// <para>The element.</para>
32        /// <para></para>
33        /// </param>
34        [MethodImpl(MethodImplOptions.AggressiveInlining)]
35        public static void AddAndReturnVoid<T>(this ISet<T> set, T element) => set.Add(element);
36
37        /// <summary>
38        /// <para>
39        /// Removes the and return void using the specified set.
40        /// </para>
41        /// <para></para>
42        /// </summary>
43        /// <typeparam name="T">
44        /// <para>The .</para>
45        /// <para></para>
46        /// </typeparam>
47        /// <param name="set">
48        /// <para>The set.</para>
49        /// <para></para>
50        /// </param>
51        /// <param name="element">
52        /// <para>The element.</para>
53        /// <para></para>
54        /// </param>
55        [MethodImpl(MethodImplOptions.AggressiveInlining)]
56        public static void RemoveAndReturnVoid<T>(this ISet<T> set, T element) =>
    ↪ set.Remove(element);
57
58        /// <summary>
59        /// <para>
60        /// Determines whether add and return true.
61        /// </para>

```

```

62     /// <para></para>
63     /// </summary>
64     /// <typeparam name="T">
65     /// <para>The .</para>
66     /// <para></para>
67     /// </typeparam>
68     /// <param name="set">
69     /// <para>The set.</para>
70     /// <para></para>
71     /// </param>
72     /// <param name="element">
73     /// <para>The element.</para>
74     /// <para></para>
75     /// </param>
76     /// <returns>
77     /// <para>The bool</para>
78     /// <para></para>
79     /// </returns>
80     [MethodImpl(MethodImplOptions.AggressiveInlining)]
81     public static bool AddAndReturnTrue<T>(this ISet<T> set, T element)
82     {
83         set.Add(element);
84         return true;
85     }
86
87     /// <summary>
88     /// <para>
89     /// Determines whether add first and return true.
90     /// </para>
91     /// <para></para>
92     /// </summary>
93     /// <typeparam name="T">
94     /// <para>The .</para>
95     /// <para></para>
96     /// </typeparam>
97     /// <param name="set">
98     /// <para>The set.</para>
99     /// <para></para>
100    /// </param>
101    /// <param name="elements">
102    /// <para>The elements.</para>
103    /// <para></para>
104    /// </param>
105    /// <returns>
106    /// <para>The bool</para>
107    /// <para></para>
108    /// </returns>
109    [MethodImpl(MethodImplOptions.AggressiveInlining)]
110    public static bool AddFirstAndReturnTrue<T>(this ISet<T> set, IList<T> elements)
111    {
112        AddFirst(set, elements);
113        return true;
114    }
115
116    /// <summary>
117    /// <para>
118    /// Adds the first using the specified set.
119    /// </para>
120    /// <para></para>
121    /// </summary>
122    /// <typeparam name="T">
123    /// <para>The .</para>
124    /// <para></para>
125    /// </typeparam>
126    /// <param name="set">
127    /// <para>The set.</para>
128    /// <para></para>
129    /// </param>
130    /// <param name="elements">
131    /// <para>The elements.</para>
132    /// <para></para>
133    /// </param>
134    [MethodImpl(MethodImplOptions.AggressiveInlining)]
135    public static void AddFirst<T>(this ISet<T> set, IList<T> elements) =>
136        ↪ set.Add(elements[0]);
137
138    /// <summary>
139    /// <para>

```

```

139     /// Determines whether add all and return true.
140     /// </para>
141     /// <para></para>
142     /// </summary>
143     /// <typeparam name="T">
144     /// <para>The .</para>
145     /// <para></para>
146     /// </typeparam>
147     /// <param name="set">
148     /// <para>The set.</para>
149     /// <para></para>
150     /// </param>
151     /// <param name="elements">
152     /// <para>The elements.</para>
153     /// <para></para>
154     /// </param>
155     /// <returns>
156     /// <para>The bool</para>
157     /// <para></para>
158     /// </returns>
159     [MethodImpl(MethodImplOptions.AggressiveInlining)]
160     public static bool AddAllAndReturnTrue<T>(this ISet<T> set, IList<T> elements)
161     {
162         set.AddAll(elements);
163         return true;
164     }
165
166     /// <summary>
167     /// <para>
168     /// Adds the all using the specified set.
169     /// </para>
170     /// <para></para>
171     /// </summary>
172     /// <typeparam name="T">
173     /// <para>The .</para>
174     /// <para></para>
175     /// </typeparam>
176     /// <param name="set">
177     /// <para>The set.</para>
178     /// <para></para>
179     /// </param>
180     /// <param name="elements">
181     /// <para>The elements.</para>
182     /// <para></para>
183     /// </param>
184     [MethodImpl(MethodImplOptions.AggressiveInlining)]
185     public static void AddAll<T>(this ISet<T> set, IList<T> elements)
186     {
187         for (var i = 0; i < elements.Count; i++)
188         {
189             set.Add(elements[i]);
190         }
191     }
192
193     /// <summary>
194     /// <para>
195     /// Determines whether add skip first and return true.
196     /// </para>
197     /// <para></para>
198     /// </summary>
199     /// <typeparam name="T">
200     /// <para>The .</para>
201     /// <para></para>
202     /// </typeparam>
203     /// <param name="set">
204     /// <para>The set.</para>
205     /// <para></para>
206     /// </param>
207     /// <param name="elements">
208     /// <para>The elements.</para>
209     /// <para></para>
210     /// </param>
211     /// <returns>
212     /// <para>The bool</para>
213     /// <para></para>
214     /// </returns>
215     [MethodImpl(MethodImplOptions.AggressiveInlining)]
216     public static bool AddSkipFirstAndReturnTrue<T>(this ISet<T> set, IList<T> elements)

```

```

217 {
218     set.AddSkipFirst(elements);
219     return true;
220 }
221
222 /// <summary>
223 /// <para>
224 /// Adds the skip first using the specified set.
225 /// </para>
226 /// <para></para>
227 /// </summary>
228 /// <typeparam name="T">
229 /// <para>The .</para>
230 /// <para></para>
231 /// </typeparam>
232 /// <param name="set">
233 /// <para>The set.</para>
234 /// <para></para>
235 /// </param>
236 /// <param name="elements">
237 /// <para>The elements.</para>
238 /// <para></para>
239 /// </param>
240 [MethodImpl(MethodImplOptions.AggressiveInlining)]
241 public static void AddSkipFirst<T>(this ISet<T> set, IList<T> elements) =>
    ↪ set.AddSkipFirst(elements, 1);
242
243 /// <summary>
244 /// <para>
245 /// Adds the skip first using the specified set.
246 /// </para>
247 /// <para></para>
248 /// </summary>
249 /// <typeparam name="T">
250 /// <para>The .</para>
251 /// <para></para>
252 /// </typeparam>
253 /// <param name="set">
254 /// <para>The set.</para>
255 /// <para></para>
256 /// </param>
257 /// <param name="elements">
258 /// <para>The elements.</para>
259 /// <para></para>
260 /// </param>
261 /// <param name="skip">
262 /// <para>The skip.</para>
263 /// <para></para>
264 /// </param>
265 [MethodImpl(MethodImplOptions.AggressiveInlining)]
266 public static void AddSkipFirst<T>(this ISet<T> set, IList<T> elements, int skip)
267 {
268     for (var i = skip; i < elements.Count; i++)
269     {
270         set.Add(elements[i]);
271     }
272 }
273
274 /// <summary>
275 /// <para>
276 /// Determines whether do not contains.
277 /// </para>
278 /// <para></para>
279 /// </summary>
280 /// <typeparam name="T">
281 /// <para>The .</para>
282 /// <para></para>
283 /// </typeparam>
284 /// <param name="set">
285 /// <para>The set.</para>
286 /// <para></para>
287 /// </param>
288 /// <param name="element">
289 /// <para>The element.</para>
290 /// <para></para>
291 /// </param>
292 /// <returns>
293 /// <para>The bool</para>

```



```

294     /// <para></para>
295     /// </returns>
296     [MethodImpl(MethodImplOptions.AggressiveInlining)]
297     public static bool DoNotContains<T>(this ISet<T> set, T element) =>
        ↪ !set.Contains(element);
298 }
299 }

```

### 1.31 ./csharp/Platform.Collections/Sets/SetFiller.cs

```

1  using System.Collections.Generic;
2  using System.Runtime.CompilerServices;
3
4  #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
5
6  namespace Platform.Collections.Sets
7  {
8      /// <summary>
9      /// <para>
10     /// Represents the set filler.
11     /// </para>
12     /// <para></para>
13     /// </summary>
14     public class SetFiller<TElement, TReturnConstant>
15     {
16         /// <summary>
17         /// <para>
18         /// The set.
19         /// </para>
20         /// <para></para>
21         /// </summary>
22         protected readonly ISet<TElement> _set;
23         /// <summary>
24         /// <para>
25         /// The return constant.
26         /// </para>
27         /// <para></para>
28         /// </summary>
29         protected readonly TReturnConstant _returnConstant;
30
31         /// <summary>
32         /// <para>
33         /// Initializes a new <see cref="SetFiller"/> instance.
34         /// </para>
35         /// <para></para>
36         /// </summary>
37         /// <param name="set">
38         /// <para>A set.</para>
39         /// <para></para>
40         /// </param>
41         /// <param name="returnConstant">
42         /// <para>A return constant.</para>
43         /// <para></para>
44         /// </param>
45         [MethodImpl(MethodImplOptions.AggressiveInlining)]
46         public SetFiller(ISet<TElement> set, TReturnConstant returnConstant)
47         {
48             _set = set;
49             _returnConstant = returnConstant;
50         }
51
52         /// <summary>
53         /// <para>
54         /// Initializes a new <see cref="SetFiller"/> instance.
55         /// </para>
56         /// <para></para>
57         /// </summary>
58         /// <param name="set">
59         /// <para>A set.</para>
60         /// <para></para>
61         /// </param>
62         [MethodImpl(MethodImplOptions.AggressiveInlining)]
63         public SetFiller(ISet<TElement> set) : this(set, default) { }
64
65         /// <summary>
66         /// <para>
67         /// Adds the element.
68         /// </para>
69         /// <para></para>
70         /// </summary>

```

```

71     /// <param name="element">
72     /// <para>The element.</para>
73     /// </para>
74     /// </param>
75     [MethodImpl(MethodImplOptions.AggressiveInlining)]
76     public void Add(TElement element) => _set.Add(element);
77
78     /// <summary>
79     /// <para>
80     /// Determines whether this instance add and return true.
81     /// </para>
82     /// </para>
83     /// </summary>
84     /// <param name="element">
85     /// <para>The element.</para>
86     /// </para>
87     /// </param>
88     /// <returns>
89     /// <para>The bool</para>
90     /// </para>
91     /// </returns>
92     [MethodImpl(MethodImplOptions.AggressiveInlining)]
93     public bool AddAndReturnTrue(TElement element) => _set.AddAndReturnTrue(element);
94
95     /// <summary>
96     /// <para>
97     /// Determines whether this instance add first and return true.
98     /// </para>
99     /// </para>
100    /// </summary>
101    /// <param name="elements">
102    /// <para>The elements.</para>
103    /// </para>
104    /// </param>
105    /// <returns>
106    /// <para>The bool</para>
107    /// </para>
108    /// </returns>
109    [MethodImpl(MethodImplOptions.AggressiveInlining)]
110    public bool AddFirstAndReturnTrue(ICollection<TElement> elements) =>
111        ↪ _set.AddFirstAndReturnTrue(elements);
112
113    /// <summary>
114    /// <para>
115    /// Determines whether this instance add all and return true.
116    /// </para>
117    /// </para>
118    /// </summary>
119    /// <param name="elements">
120    /// <para>The elements.</para>
121    /// </para>
122    /// </param>
123    /// <returns>
124    /// <para>The bool</para>
125    /// </para>
126    /// </returns>
127    [MethodImpl(MethodImplOptions.AggressiveInlining)]
128    public bool AddAllAndReturnTrue(ICollection<TElement> elements) =>
129        ↪ _set.AddAllAndReturnTrue(elements);
130
131    /// <summary>
132    /// <para>
133    /// Determines whether this instance add skip first and return true.
134    /// </para>
135    /// </para>
136    /// </summary>
137    /// <param name="elements">
138    /// <para>The elements.</para>
139    /// </para>
140    /// </param>
141    /// <returns>
142    /// <para>The bool</para>
143    /// </para>
144    /// </returns>
145    [MethodImpl(MethodImplOptions.AggressiveInlining)]
146    public bool AddSkipFirstAndReturnTrue(ICollection<TElement> elements) =>
147        ↪ _set.AddSkipFirstAndReturnTrue(elements);

```

```

146    /// <summary>
147    /// <para>
148    /// Adds the and return constant using the specified element.
149    /// </para>
150    /// <para></para>
151    /// </summary>
152    /// <param name="element">
153    /// <para>The element.</para>
154    /// <para></para>
155    /// </param>
156    /// <returns>
157    /// <para>The return constant.</para>
158    /// <para></para>
159    /// </returns>
160    [MethodImpl(MethodImplOptions.AggressiveInlining)]
161    public TReturnConstant AddAndReturnConstant(TElement element)
162    {
163        _set.Add(element);
164        return _returnConstant;
165    }
166
167    /// <summary>
168    /// <para>
169    /// Adds the first and return constant using the specified elements.
170    /// </para>
171    /// <para></para>
172    /// </summary>
173    /// <param name="elements">
174    /// <para>The elements.</para>
175    /// <para></para>
176    /// </param>
177    /// <returns>
178    /// <para>The return constant.</para>
179    /// <para></para>
180    /// </returns>
181    [MethodImpl(MethodImplOptions.AggressiveInlining)]
182    public TReturnConstant AddFirstAndReturnConstant(ICollection<TElement> elements)
183    {
184        _set.AddFirst(elements);
185        return _returnConstant;
186    }
187
188    /// <summary>
189    /// <para>
190    /// Adds the all and return constant using the specified elements.
191    /// </para>
192    /// <para></para>
193    /// </summary>
194    /// <param name="elements">
195    /// <para>The elements.</para>
196    /// <para></para>
197    /// </param>
198    /// <returns>
199    /// <para>The return constant.</para>
200    /// <para></para>
201    /// </returns>
202    [MethodImpl(MethodImplOptions.AggressiveInlining)]
203    public TReturnConstant AddAllAndReturnConstant(ICollection<TElement> elements)
204    {
205        _set.AddAll(elements);
206        return _returnConstant;
207    }
208
209    /// <summary>
210    /// <para>
211    /// Adds the skip first and return constant using the specified elements.
212    /// </para>
213    /// <para></para>
214    /// </summary>
215    /// <param name="elements">
216    /// <para>The elements.</para>
217    /// <para></para>
218    /// </param>
219    /// <returns>
220    /// <para>The return constant.</para>
221    /// <para></para>
222    /// </returns>
223    [MethodImpl(MethodImplOptions.AggressiveInlining)]

```

```

224         public TReturnConstant AddSkipFirstAndReturnConstant(IList<TElement> elements)
225         {
226             _set.AddSkipFirst(elements);
227             return _returnConstant;
228         }
229     }
230 }

```

### 1.32 ./csharp/Platform.Collections/Stacks/DefaultStack.cs

```

1  using System.Collections.Generic;
2  using System.Runtime.CompilerServices;
3
4  #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
5
6  namespace Platform.Collections.Stacks
7  {
8      /// <summary>
9      /// <para>
10     /// Represents the default stack.
11     /// </para>
12     /// <para></para>
13     /// </summary>
14     /// <seealso cref="Stack{TElement}"/>
15     /// <seealso cref="IStack{TElement}"/>
16     public class DefaultStack<TElement> : Stack<TElement>, IStack<TElement>
17     {
18         /// <summary>
19         /// <para>
20         /// Gets the is empty value.
21         /// </para>
22         /// <para></para>
23         /// </summary>
24         public bool IsEmpty
25         {
26             [MethodImpl(MethodImplOptions.AggressiveInlining)]
27             get => Count <= 0;
28         }
29     }
30 }

```

### 1.33 ./csharp/Platform.Collections/Stacks/IStack.cs

```

1  using System.Runtime.CompilerServices;
2
3  #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
4
5  namespace Platform.Collections.Stacks
6  {
7      /// <summary>
8      /// <para>
9      /// Defines the stack.
10     /// </para>
11     /// <para></para>
12     /// </summary>
13     public interface IStack<TElement>
14     {
15         /// <summary>
16         /// <para>
17         /// Gets the is empty value.
18         /// </para>
19         /// <para></para>
20         /// </summary>
21         bool IsEmpty
22         {
23             [MethodImpl(MethodImplOptions.AggressiveInlining)]
24             get;
25         }
26
27         /// <summary>
28         /// <para>
29         /// Pushes the element.
30         /// </para>
31         /// <para></para>
32         /// </summary>
33         /// <param name="element">
34         /// <para>The element.</para>
35         /// <para></para>
36         /// </param>
37         [MethodImpl(MethodImplOptions.AggressiveInlining)]
38         void Push(TElement element);

```

```

39
40     /// <summary>
41     /// <para>
42     /// Pops this instance.
43     /// </para>
44     /// <para></para>
45     /// </summary>
46     /// <returns>
47     /// <para>The element</para>
48     /// <para></para>
49     /// </returns>
50     [MethodImpl(MethodImplOptions.AggressiveInlining)]
51     TElement Pop();
52
53     /// <summary>
54     /// <para>
55     /// Peeks this instance.
56     /// </para>
57     /// <para></para>
58     /// </summary>
59     /// <returns>
60     /// <para>The element</para>
61     /// <para></para>
62     /// </returns>
63     [MethodImpl(MethodImplOptions.AggressiveInlining)]
64     TElement Peek();
65 }
66 }

```

### 1.34 ./csharp/Platform.Collections/Stacks/IStackExtensions.cs

```

1 using System.Runtime.CompilerServices;
2
3 #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
4
5 namespace Platform.Collections.Stacks
6 {
7     /// <summary>
8     /// <para>
9     /// Represents the stack extensions.
10    /// </para>
11    /// <para></para>
12    /// </summary>
13    public static class IStackExtensions
14    {
15        /// <summary>
16        /// <para>
17        /// Clears the stack.
18        /// </para>
19        /// <para></para>
20        /// </summary>
21        /// <typeparam name="T">
22        /// <para>The .</para>
23        /// <para></para>
24        /// </typeparam>
25        /// <param name="stack">
26        /// <para>The stack.</para>
27        /// <para></para>
28        /// </param>
29        [MethodImpl(MethodImplOptions.AggressiveInlining)]
30        public static void Clear<T>(this IStack<T> stack)
31        {
32            while (!stack.IsEmpty)
33            {
34                _ = stack.Pop();
35            }
36        }
37
38        /// <summary>
39        /// <para>
40        /// Pops the or default using the specified stack.
41        /// </para>
42        /// <para></para>
43        /// </summary>
44        /// <typeparam name="T">
45        /// <para>The .</para>
46        /// <para></para>
47        /// </typeparam>
48        /// <param name="stack">

```

```

49     /// <para>The stack.</para>
50     /// <para></para>
51     /// </param>
52     /// <returns>
53     /// <para>The</para>
54     /// <para></para>
55     /// </returns>
56     [MethodImpl(MethodImplOptions.AggressiveInlining)]
57     public static T PopOrDefault<T>(this IStack<T> stack) => stack.IsEmpty ? default :
        ↪ stack.Pop();
58
59     /// <summary>
60     /// <para>
61     /// Peeks the or default using the specified stack.
62     /// </para>
63     /// <para></para>
64     /// </summary>
65     /// <typeparam name="T">
66     /// <para>The .</para>
67     /// <para></para>
68     /// </typeparam>
69     /// <param name="stack">
70     /// <para>The stack.</para>
71     /// <para></para>
72     /// </param>
73     /// <returns>
74     /// <para>The</para>
75     /// <para></para>
76     /// </returns>
77     [MethodImpl(MethodImplOptions.AggressiveInlining)]
78     public static T PeekOrDefault<T>(this IStack<T> stack) => stack.IsEmpty ? default :
        ↪ stack.Peek();
79 }
80 }

```

### 1.35 ./csharp/Platform.Collections/Stacks/IStackFactory.cs

```

1  using Platform.Interfaces;
2
3  #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
4
5  namespace Platform.Collections.Stacks
6  {
7      /// <summary>
8      /// <para>
9      /// Defines the stack factory.
10     /// </para>
11     /// <para></para>
12     /// </summary>
13     /// <seealso cref="IFactory{IStack{TElement}}"/>
14     public interface IStackFactory<TElement> : IFactory<IStack<TElement>>
15     {
16     }
17 }

```

### 1.36 ./csharp/Platform.Collections/Stacks/StackExtensions.cs

```

1  using System.Collections.Generic;
2  using System.Runtime.CompilerServices;
3
4  #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
5
6  namespace Platform.Collections.Stacks
7  {
8      /// <summary>
9      /// <para>
10     /// Represents the stack extensions.
11     /// </para>
12     /// <para></para>
13     /// </summary>
14     public static class StackExtensions
15     {
16         /// <summary>
17         /// <para>
18         /// Pops the or default using the specified stack.
19         /// </para>
20         /// <para></para>
21         /// </summary>
22         /// <typeparam name="T">
23         /// <para>The .</para>

```

```

24     /// <para></para>
25     /// </typeparam>
26     /// <param name="stack">
27     /// <para>The stack.</para>
28     /// <para></para>
29     /// </param>
30     /// <returns>
31     /// <para>The</para>
32     /// <para></para>
33     /// </returns>
34     [MethodImpl(MethodImplOptions.AggressiveInlining)]
35     public static T PopOrDefault<T>(this Stack<T> stack) => stack.Count > 0 ? stack.Pop() :
        ↪ default;
36
37     /// <summary>
38     /// <para>
39     /// Peeks the or default using the specified stack.
40     /// </para>
41     /// <para></para>
42     /// </summary>
43     /// <typeparam name="T">
44     /// <para>The .</para>
45     /// <para></para>
46     /// </typeparam>
47     /// <param name="stack">
48     /// <para>The stack.</para>
49     /// <para></para>
50     /// </param>
51     /// <returns>
52     /// <para>The</para>
53     /// <para></para>
54     /// </returns>
55     [MethodImpl(MethodImplOptions.AggressiveInlining)]
56     public static T PeekOrDefault<T>(this Stack<T> stack) => stack.Count > 0 ? stack.Peek()
        ↪ : default;
57 }
58 }

```

### 1.37 ./csharp/Platform.Collections/StringExtensions.cs

```

1  using System;
2  using System.Globalization;
3  using System.Runtime.CompilerServices;
4
5  #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
6
7  namespace Platform.Collections
8  {
9      /// <summary>
10     /// <para>
11     /// Represents the string extensions.
12     /// </para>
13     /// <para></para>
14     /// </summary>
15     public static class StringExtensions
16     {
17         /// <summary>
18         /// <para>
19         /// Capitalizes the first letter using the specified string.
20         /// </para>
21         /// <para></para>
22         /// </summary>
23         /// <param name="@string">
24         /// <para>The string.</para>
25         /// <para></para>
26         /// </param>
27         /// <returns>
28         /// <para>The string.</para>
29         /// <para></para>
30         /// </returns>
31         [MethodImpl(MethodImplOptions.AggressiveInlining)]
32         public static string CapitalizeFirstLetter(this string @string)
33         {
34             if (string.IsNullOrEmpty(@string))
35             {
36                 return @string;
37             }
38             var chars = @string.ToCharArray();
39             for (var i = 0; i < chars.Length; i++)

```

```

40     {
41         var category = char.GetUnicodeCategory(chars[i]);
42         if (category == UnicodeCategory.UppercaseLetter)
43         {
44             return @string;
45         }
46         if (category == UnicodeCategory.LowercaseLetter)
47         {
48             chars[i] = char.ToUpper(chars[i]);
49             return new string(chars);
50         }
51     }
52     return @string;
53 }
54
55 /// <summary>
56 /// <para>
57 /// Truncates the string.
58 /// </para>
59 /// <para></para>
60 /// </summary>
61 /// <param name="@string">
62 /// <para>The string.</para>
63 /// <para></para>
64 /// </param>
65 /// <param name="maxLength">
66 /// <para>The max length.</para>
67 /// <para></para>
68 /// </param>
69 /// <returns>
70 /// <para>The string</para>
71 /// <para></para>
72 /// </returns>
73 [MethodImpl(MethodImplOptions.AggressiveInlining)]
74 public static string Truncate(this string @string, int maxLength) =>
75     ↪ string.IsNullOrEmpty(@string) ? @string : @string.Substring(0,
76     ↪ Math.Min(@string.Length, maxLength));
77
78 /// <summary>
79 /// <para>
80 /// Trims the single using the specified string.
81 /// </para>
82 /// <para></para>
83 /// </summary>
84 /// <param name="@string">
85 /// <para>The string.</para>
86 /// <para></para>
87 /// </param>
88 /// <param name="charToTrim">
89 /// <para>The char to trim.</para>
90 /// <para></para>
91 /// </param>
92 /// <returns>
93 /// <para>The string</para>
94 /// <para></para>
95 /// </returns>
96 [MethodImpl(MethodImplOptions.AggressiveInlining)]
97 public static string TrimSingle(this string @string, char charToTrim)
98 {
99     if (!string.IsNullOrEmpty(@string))
100     {
101         if (@string.Length == 1)
102         {
103             if (@string[0] == charToTrim)
104             {
105                 return "";
106             }
107             else
108             {
109                 return @string;
110             }
111         }
112         else
113         {
114             var left = 0;
115             var right = @string.Length - 1;
116             if (@string[left] == charToTrim)
117             {

```



```

116         left++;
117     }
118     if (@string[right] == charToTrim)
119     {
120         right--;
121     }
122     return @string.Substring(left, right - left + 1);
123 }
124 }
125 else
126 {
127     return @string;
128 }
129 }
130 }
131 }

```

### 1.38 ./csharp/Platform.Collections/Trees/Node.cs

```

1 using System.Collections.Generic;
2 using System.Runtime.CompilerServices;
3
4 // ReSharper disable ForCanBeConvertedToForeach
5 #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
6
7 namespace Platform.Collections.Trees
8 {
9     /// <summary>
10    /// <para>
11    /// Represents the node.
12    /// </para>
13    /// <para></para>
14    /// </summary>
15    public class Node
16    {
17        private Dictionary<object, Node> _childNodes;
18
19        /// <summary>
20        /// <para>
21        /// Gets or sets the value value.
22        /// </para>
23        /// <para></para>
24        /// </summary>
25        public object Value
26        {
27            [MethodImpl(MethodImplOptions.AggressiveInlining)]
28            get;
29            [MethodImpl(MethodImplOptions.AggressiveInlining)]
30            set;
31        }
32
33        /// <summary>
34        /// <para>
35        /// Gets the child nodes value.
36        /// </para>
37        /// <para></para>
38        /// </summary>
39        public Dictionary<object, Node> ChildNodes
40        {
41            [MethodImpl(MethodImplOptions.AggressiveInlining)]
42            get => _childNodes ?? (_childNodes = new Dictionary<object, Node>());
43        }
44
45        /// <summary>
46        /// <para>
47        /// The key.
48        /// </para>
49        /// <para></para>
50        /// </summary>
51        public Node this[object key]
52        {
53            [MethodImpl(MethodImplOptions.AggressiveInlining)]
54            get => GetChild(key) ?? AddChild(key);
55            [MethodImpl(MethodImplOptions.AggressiveInlining)]
56            set => SetChildValue(value, key);
57        }
58
59        /// <summary>
60        /// <para>
61        /// Initializes a new <see cref="Node"/> instance.

```

```

62     /// </para>
63     /// <para></para>
64     /// </summary>
65     /// <param name="value">
66     /// <para>A value.</para>
67     /// <para></para>
68     /// </param>
69     [MethodImpl(MethodImplOptions.AggressiveInlining)]
70     public Node(object value) => Value = value;
71
72     /// <summary>
73     /// <para>
74     /// Initializes a new <see cref="Node"/> instance.
75     /// </para>
76     /// <para></para>
77     /// </summary>
78     [MethodImpl(MethodImplOptions.AggressiveInlining)]
79     public Node() : this(null) { }
80
81     /// <summary>
82     /// <para>
83     /// Determines whether this instance contains child.
84     /// </para>
85     /// <para></para>
86     /// </summary>
87     /// <param name="keys">
88     /// <para>The keys.</para>
89     /// <para></para>
90     /// </param>
91     /// <returns>
92     /// <para>The bool</para>
93     /// <para></para>
94     /// </returns>
95     [MethodImpl(MethodImplOptions.AggressiveInlining)]
96     public bool ContainsChild(params object[] keys) => GetChild(keys) != null;
97
98     /// <summary>
99     /// <para>
100    /// Gets the child using the specified keys.
101    /// </para>
102    /// <para></para>
103    /// </summary>
104    /// <param name="keys">
105    /// <para>The keys.</para>
106    /// <para></para>
107    /// </param>
108    /// <returns>
109    /// <para>The node.</para>
110    /// <para></para>
111    /// </returns>
112    [MethodImpl(MethodImplOptions.AggressiveInlining)]
113    public Node GetChild(params object[] keys)
114    {
115        var node = this;
116        for (var i = 0; i < keys.Length; i++)
117        {
118            node.ChildNodes.TryGetValue(keys[i], out node);
119            if (node == null)
120            {
121                return null;
122            }
123        }
124        return node;
125    }
126
127    /// <summary>
128    /// <para>
129    /// Gets the child value using the specified keys.
130    /// </para>
131    /// <para></para>
132    /// </summary>
133    /// <param name="keys">
134    /// <para>The keys.</para>
135    /// <para></para>
136    /// </param>
137    /// <returns>
138    /// <para>The object</para>
139    /// <para></para>

```

```

140     /// </returns>
141     [MethodImpl(MethodImplOptions.AggressiveInlining)]
142     public object GetChildValue(params object[] keys) => GetChild(keys)?.Value;
143
144     /// <summary>
145     /// <para>
146     /// Adds the child using the specified key.
147     /// </para>
148     /// <para></para>
149     /// </summary>
150     /// <param name="key">
151     /// <para>The key.</para>
152     /// <para></para>
153     /// </param>
154     /// <returns>
155     /// <para>The node</para>
156     /// <para></para>
157     /// </returns>
158     [MethodImpl(MethodImplOptions.AggressiveInlining)]
159     public Node AddChild(object key) => AddChild(key, new Node(null));
160
161     /// <summary>
162     /// <para>
163     /// Adds the child using the specified key.
164     /// </para>
165     /// <para></para>
166     /// </summary>
167     /// <param name="key">
168     /// <para>The key.</para>
169     /// <para></para>
170     /// </param>
171     /// <param name="value">
172     /// <para>The value.</para>
173     /// <para></para>
174     /// </param>
175     /// <returns>
176     /// <para>The node</para>
177     /// <para></para>
178     /// </returns>
179     [MethodImpl(MethodImplOptions.AggressiveInlining)]
180     public Node AddChild(object key, object value) => AddChild(key, new Node(value));
181
182     /// <summary>
183     /// <para>
184     /// Adds the child using the specified key.
185     /// </para>
186     /// <para></para>
187     /// </summary>
188     /// <param name="key">
189     /// <para>The key.</para>
190     /// <para></para>
191     /// </param>
192     /// <param name="child">
193     /// <para>The child.</para>
194     /// <para></para>
195     /// </param>
196     /// <returns>
197     /// <para>The child.</para>
198     /// <para></para>
199     /// </returns>
200     [MethodImpl(MethodImplOptions.AggressiveInlining)]
201     public Node AddChild(object key, Node child)
202     {
203         ChildNodes.Add(key, child);
204         return child;
205     }
206
207     /// <summary>
208     /// <para>
209     /// Sets the child using the specified keys.
210     /// </para>
211     /// <para></para>
212     /// </summary>
213     /// <param name="keys">
214     /// <para>The keys.</para>
215     /// <para></para>
216     /// </param>
217     /// </returns>

```

```

218 /// <para>The node</para>
219 /// <para></para>
220 /// </returns>
221 [MethodImpl(MethodImplOptions.AggressiveInlining)]
222 public Node SetChild(params object[] keys) => SetChildValue(null, keys);
223
224 /// <summary>
225 /// <para>
226 /// Sets the child using the specified key.
227 /// </para>
228 /// <para></para>
229 /// </summary>
230 /// <param name="key">
231 /// <para>The key.</para>
232 /// <para></para>
233 /// </param>
234 /// <returns>
235 /// <para>The node</para>
236 /// <para></para>
237 /// </returns>
238 [MethodImpl(MethodImplOptions.AggressiveInlining)]
239 public Node SetChild(object key) => SetChildValue(null, key);
240
241 /// <summary>
242 /// <para>
243 /// Sets the child value using the specified value.
244 /// </para>
245 /// <para></para>
246 /// </summary>
247 /// <param name="value">
248 /// <para>The value.</para>
249 /// <para></para>
250 /// </param>
251 /// <param name="keys">
252 /// <para>The keys.</para>
253 /// <para></para>
254 /// </param>
255 /// <returns>
256 /// <para>The node.</para>
257 /// <para></para>
258 /// </returns>
259 [MethodImpl(MethodImplOptions.AggressiveInlining)]
260 public Node SetChildValue(object value, params object[] keys)
261 {
262     var node = this;
263     for (var i = 0; i < keys.Length; i++)
264     {
265         node = SetChildValue(value, keys[i]);
266     }
267     node.Value = value;
268     return node;
269 }
270
271 /// <summary>
272 /// <para>
273 /// Sets the child value using the specified value.
274 /// </para>
275 /// <para></para>
276 /// </summary>
277 /// <param name="value">
278 /// <para>The value.</para>
279 /// <para></para>
280 /// </param>
281 /// <param name="key">
282 /// <para>The key.</para>
283 /// <para></para>
284 /// </param>
285 /// <returns>
286 /// <para>The child.</para>
287 /// <para></para>
288 /// </returns>
289 [MethodImpl(MethodImplOptions.AggressiveInlining)]
290 public Node SetChildValue(object value, object key)
291 {
292     if (!ChildNodes.TryGetValue(key, out Node child))
293     {
294         child = AddChild(key, value);
295     }

```

```

296         child.Value = value;
297         return child;
298     }
299 }
300 }

```

### 1.39 ./csharp/Platform.Collections.Tests/ArrayTests.cs

```

1  using Xunit;
2  using Platform.Collections.Arrays;
3
4  namespace Platform.Collections.Tests
5  {
6      public class ArrayTests
7      {
8          [Fact]
9          public void GetElementTest()
10         {
11             var nullArray = (int[])null;
12             Assert.Equal(0, nullArray.GetElementOrDefault(1));
13             Assert.False(nullArray.TryGetElement(1, out int element));
14             Assert.Equal(0, element);
15             var array = new int[] { 1, 2, 3 };
16             Assert.Equal(3, array.GetElementOrDefault(2));
17             Assert.True(array.TryGetElement(2, out element));
18             Assert.Equal(3, element);
19             Assert.Equal(0, array.GetElementOrDefault(10));
20             Assert.False(array.TryGetElement(10, out element));
21             Assert.Equal(0, element);
22         }
23     }
24 }

```

### 1.40 ./csharp/Platform.Collections.Tests/BitStringTests.cs

```

1  using System;
2  using System.Collections;
3  using Xunit;
4  using Platform.Random;
5
6  namespace Platform.Collections.Tests
7  {
8      public static class BitStringTests
9      {
10         [Fact]
11         public static void BitGetSetTest()
12         {
13             const int n = 250;
14             var bitArray = new BitArray(n);
15             var bitString = new BitString(n);
16             for (var i = 0; i < n; i++)
17             {
18                 var value = RandomHelpers.Default.NextBoolean();
19                 bitArray.Set(i, value);
20                 bitString.Set(i, value);
21                 Assert.Equal(value, bitArray.Get(i));
22                 Assert.Equal(value, bitString.Get(i));
23             }
24         }
25
26         [Fact]
27         public static void BitVectorNotTest()
28         {
29             TestToOperationsWithSameMeaning((x, y, w, v) =>
30             {
31                 x.VectorNot();
32                 w.Not();
33             });
34         }
35
36         [Fact]
37         public static void BitParallelNotTest()
38         {
39             TestToOperationsWithSameMeaning((x, y, w, v) =>
40             {
41                 x.ParallelNot();
42                 w.Not();
43             });
44         }
45
46         [Fact]

```

```

47 public static void BitParallelVectorNotTest()
48 {
49     TestToOperationsWithSameMeaning((x, y, w, v) =>
50     {
51         x.ParallelVectorNot();
52         w.Not();
53     });
54 }
55
56 [Fact]
57 public static void BitVectorAndTest()
58 {
59     TestToOperationsWithSameMeaning((x, y, w, v) =>
60     {
61         x.VectorAnd(y);
62         w.And(v);
63     });
64 }
65
66 [Fact]
67 public static void BitParallelAndTest()
68 {
69     TestToOperationsWithSameMeaning((x, y, w, v) =>
70     {
71         x.ParallelAnd(y);
72         w.And(v);
73     });
74 }
75
76 [Fact]
77 public static void BitParallelVectorAndTest()
78 {
79     TestToOperationsWithSameMeaning((x, y, w, v) =>
80     {
81         x.ParallelVectorAnd(y);
82         w.And(v);
83     });
84 }
85
86 [Fact]
87 public static void BitVectorOrTest()
88 {
89     TestToOperationsWithSameMeaning((x, y, w, v) =>
90     {
91         x.VectorOr(y);
92         w.Or(v);
93     });
94 }
95
96 [Fact]
97 public static void BitParallelOrTest()
98 {
99     TestToOperationsWithSameMeaning((x, y, w, v) =>
100    {
101        x.ParallelOr(y);
102        w.Or(v);
103    });
104 }
105
106 [Fact]
107 public static void BitParallelVectorOrTest()
108 {
109     TestToOperationsWithSameMeaning((x, y, w, v) =>
110    {
111        x.ParallelVectorOr(y);
112        w.Or(v);
113    });
114 }
115
116 [Fact]
117 public static void BitVectorXorTest()
118 {
119     TestToOperationsWithSameMeaning((x, y, w, v) =>
120    {
121        x.VectorXor(y);
122        w.Xor(v);
123    });
124 }

```

```

125     [Fact]
126     public static void BitParallelXorTest()
127     {
128         TestToOperationsWithSameMeaning((x, y, w, v) =>
129         {
130             x.ParallelXor(y);
131             w.Xor(v);
132         });
133     }
134
135     [Fact]
136     public static void BitParallelVectorXorTest()
137     {
138         TestToOperationsWithSameMeaning((x, y, w, v) =>
139         {
140             x.ParallelVectorXor(y);
141             w.Xor(v);
142         });
143     }
144
145     private static void TestToOperationsWithSameMeaning(Action<BitString, BitString,
146     ↪ BitString, BitString> test)
147     {
148         const int n = 5654;
149         var x = new BitString(n);
150         var y = new BitString(n);
151         while (x.Equals(y))
152         {
153             x.SetRandomBits();
154             y.SetRandomBits();
155         }
156         var w = new BitString(x);
157         var v = new BitString(y);
158         Assert.False(x.Equals(y));
159         Assert.False(w.Equals(v));
160         Assert.True(x.Equals(w));
161         Assert.True(y.Equals(v));
162         test(x, y, w, v);
163         Assert.True(x.Equals(w));
164     }
165 }

```

#### 1.41 ./csharp/Platform.Collections.Tests/CharsSegmentTests.cs

```

1  using Xunit;
2  using Platform.Collections.Segments;
3
4  namespace Platform.Collections.Tests
5  {
6      public static class CharsSegmentTests
7      {
8          [Fact]
9          public static void GetHashCodeEqualsTest()
10         {
11             const string testString = "test test";
12             var testArray = testString.ToCharArray();
13             var firstHashCode = new CharSegment(testArray, 0, 4).GetHashCode();
14             var secondHashCode = new CharSegment(testArray, 5, 4).GetHashCode();
15             Assert.Equal(firstHashCode, secondHashCode);
16         }
17
18         [Fact]
19         public static void EqualsTest()
20         {
21             const string testString = "test test";
22             var testArray = testString.ToCharArray();
23             var first = new CharSegment(testArray, 0, 4);
24             var second = new CharSegment(testArray, 5, 4);
25             Assert.True(first.Equals(second));
26         }
27     }
28 }

```

#### 1.42 ./csharp/Platform.Collections.Tests/ListTests.cs

```

1  using System.Collections.Generic;
2  using Xunit;
3  using Platform.Collections.Lists;
4

```

```

5
6 namespace Platform.Collections.Tests
7 {
8     public class ListTests
9     {
10         [Fact]
11         public void GetElementTest()
12         {
13             var nullList = (IList<int>)null;
14             Assert.Equal(0, nullList.GetElementOrDefault(1));
15             Assert.False(nullList.TryGetElement(1, out int element));
16             Assert.Equal(0, element);
17             var list = new List<int>() { 1, 2, 3 };
18             Assert.Equal(3, list.GetElementOrDefault(2));
19             Assert.True(list.TryGetElement(2, out element));
20             Assert.Equal(3, element);
21             Assert.Equal(0, list.GetElementOrDefault(10));
22             Assert.False(list.TryGetElement(10, out element));
23             Assert.Equal(0, element);
24         }
25     }
26 }

```

#### 1.43 ./csharp/Platform.Collections.Tests/StringTests.cs

```

1 using Xunit;
2
3 namespace Platform.Collections.Tests
4 {
5     public static class StringTests
6     {
7         [Fact]
8         public static void CapitalizeFirstLetterTest()
9         {
10             Assert.Equal("Hello", "hello".CapitalizeFirstLetter());
11             Assert.Equal("Hello", "Hello".CapitalizeFirstLetter());
12             Assert.Equal(" Hello", " hello".CapitalizeFirstLetter());
13         }
14
15         [Fact]
16         public static void TrimSingleTest()
17         {
18             Assert.Equal("", "".TrimSingle('\'));
19             Assert.Equal("", "''.TrimSingle('\'));
20             Assert.Equal("hello", "'hello'.TrimSingle('\'));
21             Assert.Equal("hello", "hello'.TrimSingle('\'));
22             Assert.Equal("hello", "'hello".TrimSingle('\'));
23         }
24     }
25 }

```

#### 1.44 ./csharp/Platform.Collections.Tests/WalkersTests.cs

```

1 using System;
2 using System.Collections.Generic;
3 using System.Diagnostics;
4 using Platform.Collections.Segments;
5 using Platform.Collections.Segments.Walkers;
6 using Platform.Collections.Trees;
7 using Xunit;
8 using Xunit.Abstractions;
9
10 namespace Platform.Collections.Tests
11 {
12     public class AllRepeatingSubstringsInString
13     {
14         private static readonly string elfen_lied = @"Nacht im Dorf der Wächter rief: Elfe! Ein
15             ↪ ganz kleines Elfchen im Walde schlief wohl um die Elfe! Und meint, es rief ihm aus
16             ↪ dem Tal bei seinem Namen die Nachtigall, oder Silpelit hätt' ihm gerufen.
17 Reibt sich der Elf' die Augen aus, begibt sich vor sein Schneckenhaus und ist als wie ein
18     ↪ trunken Mann, sein Schläflein war nicht voll getan, und humpelt also tippe tapp durch's
19     ↪ Haselholz in's Tal hinab, schlupft an der Mauer hin so dicht, da sitzt der Glühwurm Licht an
20     ↪ Licht.
21 Was sind das helle Fensterlein? Da drin wird eine Hochzeit sein: die Kleinen sitzen bei'm Mahle,
22     ↪ und treiben's in dem Saale. Da guck' ich wohl ein wenig 'nein!""
23 Pfui, stößt den Kopf an harten Stein! Elfe, gelt, du hast genug? Gukuk!";
24     private static readonly string _exampleText =
25         @"([english version] (https://github.com/Konard/LinksPlatform/wiki/About-the-beginning))
26 Обозначение пустоты, какое оно? Темнота ли это? Там где отсутствие света, отсутствие фотонов
27     ↪ (носителей света)? Или это то, что полностью отражает свет? Пустой белый лист бумаги? Там
28     ↪ где есть место для нового начала? Разве пустота это не характеристика пространства?
29     ↪ Пространство это то, что можно чем-то наполнить?

```



22 [![чёрное пространство, белое  
→ пространство](https://raw.githubusercontent.com/Konard/LinksPlatform/master/doc/Intro/1.png  
→ "чёрное пространство, белое пространство")](https://raw.githubusercontent.com/Konard/LinksPlatform/master/doc/Intro/1.png)  
23 Что может быть минимальным рисунком, образом, графикой? Может быть это точка? Это ли простейшая  
→ форма? Но есть ли у точки размер? Цвет? Масса? Координаты? Время существования?  
24 [![чёрное пространство, чёрная  
→ точка](https://raw.githubusercontent.com/Konard/LinksPlatform/master/doc/Intro/2.png  
→ "чёрное пространство, чёрная  
→ точка")](https://raw.githubusercontent.com/Konard/LinksPlatform/master/doc/Intro/2.png)  
25 А что если повторить? Сделать копию? Создать дубликат? Из одного сделать два? Может это быть  
→ так? Инверсия? Отражение? Сумма?  
26 [![белая точка, чёрная  
→ точка](https://raw.githubusercontent.com/Konard/LinksPlatform/master/doc/Intro/3.png "белая  
→ точка, чёрная  
→ точка")](https://raw.githubusercontent.com/Konard/LinksPlatform/master/doc/Intro/3.png)  
27 А что если мы вообразим движение? Нужно ли время? Каким самым коротким будет путь? Что будет  
→ если этот путь зафиксировать? Запомнить след? Как две точки становятся линией? Чертой?  
→ Гранью? Разделителем? Единицей?  
28 [![две белые точки, чёрная вертикальная  
→ линия](https://raw.githubusercontent.com/Konard/LinksPlatform/master/doc/Intro/4.png "две  
→ белые точки, чёрная вертикальная  
→ линия")](https://raw.githubusercontent.com/Konard/LinksPlatform/master/doc/Intro/4.png)  
29 Можно ли замкнуть движение? Может ли это быть кругом? Можно ли замкнуть время? Или остаётся  
→ только спираль? Но что если замкнуть предел? Создать ограничение, разделение? Получится  
→ замкнутая область? Полностью отделённая от всего остального? Но что это всё остальное? Что  
→ можно делить? В каком направлении? Ничего или всё? Пустота или полнота? Начало или конец?  
→ Или может быть это единица и ноль? Дуальность? Противоположность? А что будет с кругом если  
→ у него нет размера? Будет ли круг точкой? Точка состоящая из точек?  
30 [![белая вертикальная линия, чёрный  
→ круг](https://raw.githubusercontent.com/Konard/LinksPlatform/master/doc/Intro/5.png "белая  
→ вертикальная линия, чёрный  
→ круг")](https://raw.githubusercontent.com/Konard/LinksPlatform/master/doc/Intro/5.png)  
31 Как ещё можно использовать грань, черту, линию? А что если она может что-то соединять, может  
→ тогда её нужно повернуть? Почему то, что перпендикулярно вертикальному горизонтально?  
→ Горизонт? Инвертирует ли это смысл? Что такое смысл? Из чего состоит смысл? Существует ли  
→ элементарная единица смысла?  
32 [![белый круг, чёрная горизонтальная  
→ линия](https://raw.githubusercontent.com/Konard/LinksPlatform/master/doc/Intro/6.png "белый  
→ круг, чёрная горизонтальная  
→ линия")](https://raw.githubusercontent.com/Konard/LinksPlatform/master/doc/Intro/6.png)  
33 Соединить, допустим, а какой смысл в этом есть ещё? Что если помимо смысла "соединить",  
→ связать", есть ещё и смысл направления "от начала к концу"? От предка к потомку? От  
→ родителя к ребёнку? От общего к частному?  
34 [![белая горизонтальная линия, чёрная горизонтальная  
→ стрелка](https://raw.githubusercontent.com/Konard/LinksPlatform/master/doc/Intro/7.png  
→ "белая горизонтальная линия, чёрная горизонтальная  
→ стрелка")](https://raw.githubusercontent.com/Konard/LinksPlatform/master/doc/Intro/7.png)  
35 Шаг назад. Возьмём опять отделённую область, которая лишь та же замкнутая линия, что ещё она  
→ может представлять собой? Объект? Но в чём его суть? Разве не в том, что у него есть  
→ граница, разделяющая внутреннее и внешнее? Допустим связь, стрелка, линия соединяет два  
→ объекта, как бы это выглядело?  
36 [![белая связь, чёрная направленная  
→ связь](https://raw.githubusercontent.com/Konard/LinksPlatform/master/doc/Intro/8.png "белая  
→ связь, чёрная направленная  
→ связь")](https://raw.githubusercontent.com/Konard/LinksPlatform/master/doc/Intro/8.png)  
37 Допустим у нас есть смысл "связать" и смысл "направления", много ли это нам даёт? Много ли  
→ вариантов интерпретации? А что если уточнить, каким именно образом выполнена связь? Что если  
→ можно задать ей чёткий, конкретный смысл? Что это будет? Тип? Глагол? Связка? Действие?  
→ Трансформация? Переход из состояния в состояние? Или всё это и есть объект, суть которого в  
→ его конечном состоянии, если конечно конец определён направлением?  
38 [![белая обычная и направленная связи, чёрная типизированная  
→ связь](https://raw.githubusercontent.com/Konard/LinksPlatform/master/doc/Intro/9.png "белая  
→ обычная и направленная связи, чёрная типизированная  
→ связь")](https://raw.githubusercontent.com/Konard/LinksPlatform/master/doc/Intro/9.png)  
39 А что если всё это время, мы смотрели на суть как бы снаружи? Можно ли взглянуть на это изнутри?  
→ Что будет внутри объектов? Объекты ли это? Или это связи? Может ли эта структура описать  
→ сама себя? Но что тогда получится, разве это не рекурсия? Может это фрактал?  
40 [![белая обычная и направленная связи с рекурсивной внутренней структурой, чёрная типизированная  
→ связь с рекурсивной внутренней  
→ структурой](https://raw.githubusercontent.com/Konard/LinksPlatform/master/doc/Intro/10.png  
→ "белая обычная и направленная связи с рекурсивной внутренней структурой, чёрная  
→ типизированная связь с рекурсивной внутренней структурой")](https://raw.githubusercontent.com/Konard/LinksPlatform/master/doc/Intro/10.png)  
41 На один уровень внутрь (вниз)? Или на один уровень во вне (вверх)? Или это можно назвать шагом  
→ рекурсии или фрактала?

```

42  [![белая обычная и направленная связи с двойной рекурсивной внутренней структурой, чёрная
    ↳ типизированная связь с двойной рекурсивной внутренней
    ↳ структурой](https://raw.githubusercontent.com/Konard/LinksPlatform/master/doc/Intro/11.png
    ↳ "белая обычная и направленная связи с двойной рекурсивной внутренней структурой, чёрная
    ↳ типизированная связь с двойной рекурсивной внутренней структурой")](https://raw.githubusercontent.com/Konard/LinksPlatform/master/doc/Intro/11.png)
43  Последовательность? Массив? Список? Множество? Объект? Таблица? Элементы? Цвета? Символы? Буквы?
    ↳ Слово? Цифры? Число? Алфавит? Дерево? Сеть? Граф? Гиперграф?
44  [![белая обычная и направленная связи со структурой из 8 цветных элементов последовательности,
    ↳ чёрная типизированная связь со структурой из 8 цветных элементов последовательности](https://raw.githubusercontent.com/Konard/LinksPlatform/master/doc/Intro/12.png
    ↳ "белая обычная и
    ↳ направленная связи со структурой из 8 цветных элементов последовательности, чёрная
    ↳ типизированная связь со структурой из 8 цветных элементов последовательности")](https://raw.githubusercontent.com/Konard/LinksPlatform/master/doc/Intro/12.png)
45  ...
46  [![анимация](https://raw.githubusercontent.com/Konard/LinksPlatform/master/doc/Intro/intro-animation-500.gif
    ↳ "анимация")](https://raw.githubusercontent.com/Konard/LinksPlatform/master/doc/Intro/intro-animation-500.gif)";
47  private static readonly string _examTpleText = @"Lorem ipsum dolor sit amet, consectetur
    ↳ adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua.
    ↳ Ut enim ad minim veniam, quis nostrud exercitation ullamco laboris nisi ut aliquip
    ↳ ex ea commodo consequat. Duis aute irure dolor in reprehenderit in voluptate velit
    ↳ esse cillum dolore eu fugiat nulla pariatur. Excepteur sint occaecat cupidatat non
    ↳ proident, sunt in culpa qui officia deserunt mollit anim id est laborum.";
48
49  [Fact]
50  public void ConsoleTests()
51  {
52      string text = elfen_lied;
53
54      var iterationsCounter = new IterationsCounter();
55      iterationsCounter.WalkAll(text);
56      var result = iterationsCounter.IterationsCount;
57      Console.WriteLine($"{TextLength: {text.Length}. Iterations: {result}.");
58
59      {
60          var start = new Stopwatch();
61          start.Start();
62
63          var walker = new Walker4();
64          walker.WalkAll(text);
65
66          //foreach (var (key, value) in walker.PublicDictionary)
67          //{
68              Console.WriteLine($"{key} {value}");
69          //}
70
71          start.Stop();
72          Console.WriteLine($"{start.ElapsedMilliseconds}ms");
73      }
74
75      {
76          var start = new Stopwatch();
77          start.Start();
78
79          var walker = new Walker2();
80          walker.WalkAll(text);
81
82          //foreach (var (key, value) in walker._cache)
83          //{
84              Console.WriteLine($"{key} {value}");
85          //}
86
87          start.Stop();
88          Console.WriteLine($"{start.ElapsedMilliseconds}ms");
89      }
90
91      {
92          var start = new Stopwatch();
93          start.Start();
94
95          var walker = new Walker1();
96          walker.WalkAll(text);
97
98          start.Stop();
99          Console.WriteLine($"{start.ElapsedMilliseconds}ms");
100      }
101  }

```

```

102     }
103 }
104
105 public abstract class ConsolePrintedDuplicateWalkerBase : DuplicateSegmentsWalkerBase<char,
↳ CharSegment>
106 {
107     //protected override void OnDuplicateFound(CharSegment segment) =>
↳ Console.WriteLine(segment);
108
109     protected override CharSegment CreateSegment(IList<char> elements, int offset, int
↳ length) => new CharSegment(elements, offset, length);
110 }
111
112 public class Walker1 : ConsolePrintedDuplicateWalkerBase
113 {
114     private Node _rootNode;
115     private Node _currentNode;
116
117     public override void WalkAll(IList<char> elements)
118     {
119         _rootNode = new Node();
120
121         base.WalkAll(elements);
122
123         Console.WriteLine(_rootNode.Value);
124     }
125
126     protected override void OnDuplicateFound(CharSegment segment)
127     {
128
129     }
130
131     protected override long GetSegmentFrequency(CharSegment segment)
132     {
133         for (int i = 0; i < segment.Length; i++)
134         {
135             var element = segment[i];
136
137             _currentNode = _currentNode[element];
138         }
139
140         if (_currentNode.Value is int)
141         {
142             return (int)_currentNode.Value;
143         }
144         else
145         {
146             return 0;
147         }
148     }
149
150     protected override void SetSegmentFrequency(CharSegment segment, long frequency) =>
↳ _currentNode.Value = frequency;
151
152     protected override void Iteration(CharSegment segment)
153     {
154         _currentNode = _rootNode;
155
156         base.Iteration(segment);
157     }
158 }
159
160 // Too much memory, but fast
161 public class Walker2 : ConsolePrintedDuplicateWalkerBase
162 {
163     public Dictionary<string, long> _cache;
164     private string _currentKey;
165     private int _totalDuplicates;
166
167     public override void WalkAll(IList<char> elements)
168     {
169         _cache = new Dictionary<string, long>();
170
171         base.WalkAll(elements);
172
173         Console.WriteLine($"Unique string segments: {_cache.Count}. Total duplicates:
↳ {_totalDuplicates}");
174     }
175
176     protected override void OnDuplicateFound(CharSegment segment)

```

```

177     {
178         _totalDuplicates++;
179     }
180
181     protected override long GetSegmentFrequency(CharSegment segment) =>
182         ↪ _cache.GetOrDefault(_currentKey);
183
184     protected override void SetSegmentFrequency(CharSegment segment, long frequency) =>
185         ↪ _cache[_currentKey] = frequency;
186
187     protected override void Iteration(CharSegment segment)
188     {
189         _currentKey = segment;
190         base.Iteration(segment);
191     }
192
193     public class Walker4 : DictionaryBasedDuplicateSegmentsWalkerBase<char, CharSegment>
194     {
195         public IDictionary<CharSegment, long> PublicDictionary
196         {
197             get
198             {
199                 return Dictionary;
200             }
201         }
202
203         public Walker4()
204             : base(DefaultMinimumStringSegmentLength, resetDictionaryOnEachWalk: true)
205         {
206         }
207         private int _totalDuplicates;
208
209         public override void WalkAll(ICollection<char> elements)
210         {
211             _totalDuplicates = 0;
212
213             base.WalkAll(elements);
214             Console.WriteLine($"Unique string segments: {Dictionary.Count}. Total duplicates:
215                 ↪ {_totalDuplicates}.");
216         }
217
218         protected override CharSegment CreateSegment(ICollection<char> elements, int offset, int
219             ↪ length) => new CharSegment(elements, offset, length);
220
221         protected override void OnDuplicateFound(CharSegment segment)
222         {
223             _totalDuplicates++;
224         }
225     }
226
227     public class IterationsCounter : AllSegmentsWalkerBase<char>
228     {
229         public long IterationsCount;
230
231         protected override void Iteration(Segment<char> segment) => IterationsCount++;
232     }
233 }

```

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