

# 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>

```

```

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;

```

```

27
28
29 /// <summary>
30 /// <para>Initializes a new instance of the <see cref="ArrayFiller"/> class using the
31   ↳ specified array as the array to fill and the offset from which to start
32   ↳ filling.</para>
33 /// <para>Инициализирует новый экземпляр класса <see cref="ArrayFiller"/>, используя
34   ↳ указанный массив в качестве заполняемого и смещение с которого начнётся
35   ↳ заполнение.</para>
36 /// </summary>
37 /// <param name="array"><para>The array to fill.</para><para>Массив для
38   ↳ заполнения.</para></param>
39 /// <param name="offset"><para>The offset from which to start filling the
40   ↳ array.</para><para>Смещение с которого начнётся заполнение массива.</para></param>
41 [MethodImpl(MethodImplOptions.AggressiveInlining)]
42 public ArrayFiller(TElement[] array, long offset)
43 {
44     _array = array;
45     _position = offset;
46 }
47
48 /// <summary>
49 /// <para>Initializes a new instance of the <see cref="ArrayFiller"/> class using the
50   ↳ specified array. Filling will start from the beginning of the array.</para>
51 /// <para>Инициализирует новый экземпляр класса <see cref="ArrayFiller"/>, используя
52   ↳ указанный массив. Заполнение начнётся с начала массива.</para>
53 /// </summary>
54 /// <param name="array"><para>The array to fill.</para><para>Массив для
55   ↳ заполнения.</para></param>
56 [MethodImpl(MethodImplOptions.AggressiveInlining)]
57 public ArrayFiller(TElement[] array) : this(array, 0) { }
58
59 /// <summary>
60 /// <para>Adds an item into the array.</para>
61 /// <para>Добавляет элемент в массив.</para>
62 /// </summary>
63 /// <param name="element"><para>The element to add.</para><para>Добавляемый
64   ↳ элемент.</para></param>
65 [MethodImpl(MethodImplOptions.AggressiveInlining)]
66 public void Add(TElement element) => _array[_position++] = element;
67
68 /// <summary>
69 /// <para>Adds an item into the array and returns <see langword="true"/>.</para>
70 /// <para>Добавляет элемент в массив и возвращает <see langword="true"/>.</para>
71 /// </summary>
72 /// <param name="element"><para>The element to add.</para><para>Добавляемый
73   ↳ элемент.</para></param>
74 /// <returns>
75 /// <para>The <see langword="true"/> value.</para>
76 /// <para>Значение <see langword="true"/>.</para>
77 /// </returns>
78 [MethodImpl(MethodImplOptions.AggressiveInlining)]
79 public bool AddAndReturnTrue(TElement element) => _array.AddAndReturnConstant(ref
80   ↳ _position, element, true);
81
82 /// <summary>
83 /// <para>Adds the first element from the specified list to the array to fill and
84   ↳ returns <see langword="true"/>.</para>
85 /// <para>Добавляет первый элемент из указанного списка в заполняемый массив и
86   ↳ возвращает <see langword="true"/>.</para>
87 /// </summary>
88 /// <param name="elements"><para>The list from which the first item will be
89   ↳ added.</para><para>Список из которого будет добавлен первый элемент.</para></param>
90 /// <returns>
91 /// <para>The <see langword="true"/> value.</para>
92 /// <para>Значение <see langword="true"/>.</para>
93 /// </returns>
94 [MethodImpl(MethodImplOptions.AggressiveInlining)]
95 public bool AddFirstAndReturnTrue(ICollection<TElement> elements) =>
96   ↳ _array.AddFirstAndReturnConstant(ref _position, elements, true);
97
98 /// <summary>
99 /// <para>Adds all elements from the specified list to the array to fill and returns
100   ↳ <see langword="true"/>.</para>
101 /// <para>Добавляет все элементы из указанного списка в заполняемый массив и возвращает
102   ↳ <see langword="true"/>.</para>
103 /// </summary>
104

```

```

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
36         /// <summary>
37         /// <para>
38         /// The max arrays per size.
39         /// </para>
40         /// <para></para>
41         /// </summary>
42         private readonly int _maxArraysPerSize;
43         /// <summary>
44         /// <para>
45         /// The default sizes amount.
46         /// </para>
47         /// <para></para>
48         /// </summary>
49         private readonly Dictionary<long, Stack<T[]>> _pool = new Dictionary<long,
    ↪    Stack<T[]>>(ArrayPool.DefaultSizesAmount);
50
51         /// <summary>
52         /// <para>Initializes a new instance of the ArrayPool class using the specified maximum
    ↪    number of arrays per size.</para>
53         /// <para>Инициализирует новый экземпляр класса ArrayPool, используя указанное
    ↪    максимальное количество массивов на каждый размер.</para>
54         /// </summary>
55         /// <param name="maxArraysPerSize"><para>The maximum number of arrays in the pool per
    ↪    size.</para></param>
    ↪    Максимальное количество массивов в пуле на каждый
    ↪    размер.</para></param>
56         [MethodImpl(MethodImplOptions.AggressiveInlining)]
57         public ArrayPool(int maxArraysPerSize) => _maxArraysPerSize = maxArraysPerSize;
58
59         /// <summary>
60         /// <para>Initializes a new instance of the ArrayPool class using the default maximum
    ↪    number of arrays per size.</para>

```

```

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

```

```

125     /// <param name="array"><para>The array to be freed into the pool.</para></param>
    ↪    который нужно освободить в пул.</para></param>
126     [MethodImpl(MethodImplOptions.AggressiveInlining)]
127     public virtual void Free(T[] array)
128     {
129         if (array.IsNullOrEmpty())
130         {
131             return;
132         }
133         var stack = _pool.GetOrAdd(array.LongLength, size => new
    ↪     Stack<T[]>(_maxArraysPerSize));
134         if (stack.Count == _maxArraysPerSize) // Stack is full
135         {
136             return;
137         }
138         stack.Push(array);
139     }
140 }
141 }

```

## 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             }
50             return hashAccumulator + (hashSeed * 1566083941);
51         }
52
53         /// <summary>
54         /// <para>Checks if all elements of two lists are equal.</para>
55         /// <para>Проверяет равны ли все элементы двух списков.</para>
56         /// </summary>
57         /// <param name="left"><para>The first compared array.</para><para>Первый массив для
58         → сравнения.</para></param>
59         /// <param name="leftOffset"><para>The offset from which reading of the specified number
60         → of elements in the first array starts.</para><para>Смещение, с которого начинается
61         → чтение элементов в первом массиве.</para></param>
62         /// <param name="length"><para>The number of checked elements.</para><para>Количество
63         → проверяемых элементов.</para></param>
64         /// <param name="right"><para>The second compared array.</para><para>Второй массив для
65         → сравнения.</para></param>
66         /// <param name="rightOffset"><para>The offset from which reading of the specified
67         → number of elements in the second array starts.</para><para>Смещение, с которого
68         → начинается чтение элементов в втором массиве.</para></param>
69         /// <returns>
70         /// <para><see langword="true"/> if the segments of the passed arrays are equal to each
71         → other otherwise <see langword="false"/>.</para>

```



```

53  /// <para><see langword="true"/>, если сегменты переданных массивов равны друг другу,
54  ↪ иначе же <see langword="false"/>.</para>
55  /// </returns>
56  /// <remarks>
57  /// Based on https://github.com/Microsoft/referencesource/blob/3b1eaf5203992df69de44c783\_
58  ↪ a3eda37d3d4cd10/mscorlib/system/string.cs#L364
59  /// </remarks>
60  [MethodImpl(MethodImplOptions.AggressiveInlining)]
61  public static bool ContentEqualTo(this char[] left, int leftOffset, int length, char[]
62  ↪ right, int rightOffset)
63  {
64      fixed (char* leftPointer = &left[leftOffset])
65      {
66          fixed (char* rightPointer = &right[rightOffset])
67          {
68              char* leftPointerCopy = leftPointer, rightPointerCopy = rightPointer;
69              if (!CheckArraysMainPartForEquality(ref leftPointerCopy, ref
70              ↪ rightPointerCopy, ref length))
71              {
72                  return false;
73              }
74              CheckArraysRemainderForEquality(ref leftPointerCopy, ref rightPointerCopy,
75              ↪ ref length);
76              return length <= 0;
77          }
78      }
79  }
80
81  /// <summary>
82  /// <para>
83  /// Determines whether check arrays main part for equality.
84  /// </para>
85  /// </summary>
86  /// <param name="left">
87  /// <para>The left.</para>
88  /// </param>
89  /// <param name="right">
90  /// <para>The right.</para>
91  /// </param>
92  /// <param name="length">
93  /// <para>The length.</para>
94  /// </param>
95  /// <returns>
96  /// <para>The bool</para>
97  /// </returns>
98  [MethodImpl(MethodImplOptions.AggressiveInlining)]
99  private static bool CheckArraysMainPartForEquality(ref char* left, ref char* right, ref
100  ↪ int length)
101  {
102      while (length >= 10)
103      {
104          if ((* (int*)left != *(int*)right)
105              || (*(int*)(left + 2) != *(int*)(right + 2))
106              || (*(int*)(left + 4) != *(int*)(right + 4))
107              || (*(int*)(left + 6) != *(int*)(right + 6))
108              || (*(int*)(left + 8) != *(int*)(right + 8)))
109          {
110              return false;
111          }
112          left += 10;
113          right += 10;
114          length -= 10;
115      }
116      return true;
117  }
118
119  /// <summary>
120  /// <para>
121  /// Checks the arrays remainder for equality using the specified left.
122  /// </para>
123  /// </summary>
124  /// <param name="left">

```

```

125     /// <para>The left.</para>
126     /// <para></para>
127     /// </param>
128     /// <param name="right">
129     /// <para>The right.</para>
130     /// <para></para>
131     /// </param>
132     /// <param name="length">
133     /// <para>The length.</para>
134     /// <para></para>
135     /// </param>
136     [MethodImpl(MethodImplOptions.AggressiveInlining)]
137     private static void CheckArraysRemainderForEquality(ref char* left, ref char* right, ref
    ↪ int length)
138     {
139         // This depends on the fact that the String objects are
140         // always zero terminated and that the terminating zero is not included
141         // in the length. For odd string sizes, the last compare will include
142         // the zero terminator.
143         while (length > 0)
144         {
145             if (*(int*)left != *(int*)right)
146             {
147                 break;
148             }
149             left += 2;
150             right += 2;
151             length -= 2;
152         }
153     }
154 }
155 }

```

## 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
15         ↪ variable type int, and if the array length is greater than the index - return
16         ↪ array[index], otherwise - default value.</para>
17         /// <para>Проверяет, существует ли массив, если да - идет проверка длины массива с
18         ↪ помощью переменной index, и если длина массива больше индекса - возвращает
19         ↪ array[index], иначе - значение по умолчанию.</para>
20         /// </summary>
21         /// <typeparam name="T"><para>Array elements type.</para><para>Тип элементов
22         ↪ массива.</para></typeparam>
23         /// <param name="array"><para>Array that will participate in
24         ↪ verification.</para><para>Массив который будет участвовать в
25         ↪ проверке.</para></param>
26         /// <param name="index"><para>Number type int to compare.</para><para>Число типа int для
27         ↪ сравнения.</para></param>
28         /// <returns><para>Array element or default value.</para><para>Элемент массива или же
29         ↪ значение по умолчанию.</para></returns>
30         [MethodImpl(MethodImplOptions.AggressiveInlining)]
31         public static T GetElementOrDefault<T>(this T[] array, int index) => array != null &&
32         ↪ array.Length > index ? array[index] : default;
33
34         /// <summary>
35         /// <para>Checks whether the array exists, if so, checks the array length using the
36         ↪ index variable type long, and if the array length is greater than the index - return
37         ↪ array[index], otherwise - default value.</para>
38         /// <para>Проверяет, существует ли массив, если да - идет проверка длины массива с
39         ↪ помощью переменной index, и если длина массива больше индекса - возвращает
40         ↪ array[index], иначе - значение по умолчанию.</para>
41         /// </summary>
42         /// <typeparam name="T"><para>Array elements type.</para><para>Тип элементов
43         ↪ 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
88   → массива.</para></typeparam>
89 /// <param name="array"><para>The array to copy.</para><para>Массив который необходимо
90   → скопировать.</para></param>
91 /// <returns><para>Copy of the array.</para><para>Копию массива.</para></returns>
92 [MethodImpl(MethodImplOptions.AggressiveInlining)]
93 public static T[] Clone<T>(this T[] array)
94 {
95     var copy = new T[array.LongLength];
96     Array.Copy(array, 0L, copy, 0L, array.LongLength);
97     return copy;
98 }
99
100 /// <summary>
101 /// <para>Shifts all the elements of the array by one position to the right.</para>
102 /// <para>Сдвигает вправо все элементы массива на одну позицию.</para>
103 /// </summary>
104 /// <typeparam name="T"><para>The array item type.</para><para>Тип элементов
105   → массива.</para></typeparam>
106 /// <param name="array"><para>The array to copy from.</para><para>Массив для
107   → копирования.</para></param>
108 /// <returns>
109 /// <para>Array with a shift of elements by one position.</para>
110 /// <para>Массив со сдвигом элементов на одну позицию.</para>
111 /// </returns>
112 [MethodImpl(MethodImplOptions.AggressiveInlining)]
113 public static IList<T> ShiftRight<T>(this T[] array) => array.ShiftRight(1L);
114
115 /// <summary>
116 /// <para>Shifts all elements of the array to the right by the specified number of
117   → elements.</para>
118 /// <para>Сдвигает вправо все элементы массива на указанное количество элементов.</para>
119 /// </summary>
120 /// <typeparam name="T"><para>The array item type.</para><para>Тип элементов
121   → массива.</para></typeparam>
122 /// <param name="array"><para>The array to copy from.</para><para>Массив для
123   → копирования.</para></param>
124 /// <param name="shift"><para>The number of items to shift.</para><para>Количество
125   → сдвигаемых элементов.</para></param>
126 /// <returns>
127 /// <para>If the value of the shift variable is less than zero - an <see
128   → cref="NotImplementedException"/> exception is thrown, but if the value of the shift
129   → variable is 0 - an exact copy of the array is returned. Otherwise, an array is
130   → returned with the shift of the elements.</para>
131 /// <para>Если значение переменной shift меньше нуля - выбрасывается исключение <see
132   → cref="NotImplementedException"/>, если же значение переменной shift равно 0 -
133   → возвращается точная копия массива. Иначе возвращается массив со сдвигом
134   → элементов.</para>
135 /// </returns>
136 [MethodImpl(MethodImplOptions.AggressiveInlining)]
137 public static IList<T> ShiftRight<T>(this T[] array, long shift)
138 {
139     if (shift < 0)
140     {
141         throw new NotImplementedException();
142     }
143     if (shift == 0)
144     {
145         return array.Clone<T>();
146     }
147     else
148     {

```

```

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
143   ↳ position value by one.</para>
144 /// <para>Добавляет в массив переданный элемент на указанную позицию и увеличивает
145   ↳ значение position на единицу.</para>
146 /// </summary>
147 /// <typeparam name="T"><para>Array elements type.</para><para>Тип элементов
148   ↳ массива.</para></typeparam>
149 /// <param name="array"><para>The array to add the element to.</para><para>Массив в
150   ↳ который необходимо добавить элемент.</para></param>
151 /// <param name="position"><para>A reference to the position of type int where the
152   ↳ element will be added.</para><para>Ссылка на позицию типа int, в которую будет
153   ↳ добавлен элемент.</para></param>
154 /// <param name="element"><para>The element to add to the array.</para><para>Элемент,
155   ↳ который нужно добавить в массив.</para></param>
156 [MethodImpl(MethodImplOptions.AggressiveInlining)]
157 public static void Add<T>(this T[] array, ref int position, T element) =>
158   ↳ array[position++] = element;
159
160 /// <summary>
161 /// <para>Adding in array the passed element at the specified position and increments
162   ↳ position value by one.</para>
163 /// <para>Добавляет в массив переданный элемент на указанную позицию и увеличивает
164   ↳ значение position на единицу.</para>
165 /// </summary>
166 /// <typeparam name="T"><para>Array elements type.</para><para>Тип элементов
167   ↳ массива.</para></typeparam>
168 /// <param name="array"><para>The array to add the element to.</para><para>Массив в
169   ↳ который необходимо добавить элемент.</para></param>
170 /// <param name="position"><para>A reference to the position of type long where the
171   ↳ element will be added.</para><para>Ссылка на позицию типа long, в которую будет
172   ↳ добавлен элемент.</para></param>
173 /// <param name="element"><para>The element to add to the array.</para><para>Элемент
174   ↳ который необходимо добавить в массив.</para></param>
175 [MethodImpl(MethodImplOptions.AggressiveInlining)]
176 public static void Add<T>(this T[] array, ref long position, T element) =>
177   ↳ array[position++] = element;
178
179 /// <summary>
180 /// <para>Adding in array the passed element, at the specified position, increments
181   ↳ position value by one and returns the value of the passed constant.</para>
182 /// <para>Добавляет в массив переданный элемент на указанную позицию, увеличивает
183   ↳ значение position на единицу и возвращает значение переданной константы.</para>
184 /// </summary>
185 /// <typeparam name="TElement"><para>The array element type.</para><para>Тип элемента
186   ↳ массива.</para></typeparam>
187 /// <typeparam name="TReturnConstant"><para>Type of return constant.</para><para>Тип
188   ↳ возвращаемой константы.</para></typeparam>
189 /// <param name="array"><para>The array to add the element to.</para><para>Массив в
190   ↳ который необходимо добавить элемент.</para></param>
191 /// <param name="position"><para>Reference to the position to which the element will be
192   ↳ added.</para><para>Ссылка на позицию, в которую будет добавлен
193   ↳ элемент.</para></param>
194 /// <param name="element"><para>The element to add to the array.</para><para>Элемент
195   ↳ который необходимо добавить в массив.</para></param>
196 /// <param name="returnConstant"><para>The constant value that will be
197   ↳ returned.</para><para>Значение константы, которое будет возвращено.</para></param>
198 /// <returns>
199 /// <para>The constant value passed as an argument.</para>
200 /// <para>Значение константы, переданное в качестве аргумента.</para>
201 /// </returns>
202 [MethodImpl(MethodImplOptions.AggressiveInlining)]
203 public static TReturnConstant AddAndReturnConstant<TElement, TReturnConstant>(this
204   ↳ TElement[] array, ref long position, TElement element, TReturnConstant
205   ↳ returnConstant)
206 {
207     array.Add(ref position, element);
208     return returnConstant;
209 }

```

```

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
277     → and increments position value by one.</para>
278     /// <para>Добавляет в массив все элементы коллекции, пропуская первую позицию и
279     → увеличивает значение position на единицу.</para>
280     /// </summary>
281     /// <typeparam name="T"><para>Array elements type.</para><para>Тип элементов
282     → массива.</para></typeparam>
283     /// <param name="array"><para>The array to add items to.</para><para>Массив в который
284     → необходимо добавить элементы.</para></param>
285     /// <param name="position"><para>Reference to the position from which to start adding
286     → elements.</para><para>Ссылка на позицию, с которой начинается добавление
287     → элементов.</para></param>
288     /// <param name="elements"><para>List, whose elements will be added to the
289     → array.</para><para>Список, элементы которого будут добавлены в
290     → массив.</para></param>
291     [MethodImpl(MethodImplOptions.AggressiveInlining)]
292     public static void AddSkipFirst<T>(this T[] array, ref long position, IList<T> elements)
293     → => array.AddSkipFirst(ref position, elements, 1);
294
295     /// <summary>
296     /// <para>Adding in array all but the first element, skipping a specified number of
297     → positions and increments position value by one.</para>
298     /// <para>Добавляет в массив все элементы коллекции, кроме первого, пропуская
299     → определенное количество позиций и увеличивает значение position на единицу.</para>
300     /// </summary>
301     /// <typeparam name="T"><para>Array elements type.</para><para>Тип элементов
302     → массива.</para></typeparam>
303     /// <param name="array"><para>The array to add items to.</para><para>Массив в который
304     → необходимо добавить элементы.</para></param>
305     /// <param name="position"><para>Reference to the position from which to start adding
306     → elements.</para><para>Ссылка на позицию, с которой начинается добавление
307     → элементов.</para></param>
308     /// <param name="elements"><para>List, whose elements will be added to the
309     → array.</para><para>Список, элементы которого будут добавлены в
310     → массив.</para></param>
311     /// <param name="skip"><para>Number of elements to skip.</para><para>Количество
312     → пропускаемых элементов.</para></param>
313     [MethodImpl(MethodImplOptions.AggressiveInlining)]
314     public static void AddSkipFirst<T>(this T[] array, ref long position, IList<T> elements,
315     → int skip)
316     {
317         for (var i = skip; i < elements.Count; i++)
318         {
319             array.Add(ref position, elements[i]);
320         }
321     }
322 }
323
324 }

```

## 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         /// <summary>

```



```

25     /// <para>
26     /// The bits set in 16 bits.
27     /// </para>
28     /// <para></para>
29     /// </summary>
30     private static readonly byte[] [] _bitsSetIn16Bits;
31     /// <summary>
32     /// <para>
33     /// The array.
34     /// </para>
35     /// <para></para>
36     /// </summary>
37     private long[] _array;
38     /// <summary>
39     /// <para>
40     /// The length.
41     /// </para>
42     /// <para></para>
43     /// </summary>
44     private long _length;
45     /// <summary>
46     /// <para>
47     /// The min positive word.
48     /// </para>
49     /// <para></para>
50     /// </summary>
51     private long _minPositiveWord;
52     /// <summary>
53     /// <para>
54     /// The max positive word.
55     /// </para>
56     /// <para></para>
57     /// </summary>
58     private long _maxPositiveWord;
59
60     /// <summary>
61     /// <para>
62     /// The value.
63     /// </para>
64     /// <para></para>
65     /// </summary>
66     public bool this[long index]
67     {
68         [MethodImpl(MethodImplOptions.AggressiveInlining)]
69         get => Get(index);
70         [MethodImpl(MethodImplOptions.AggressiveInlining)]
71         set => Set(index, value);
72     }
73
74     /// <summary>
75     /// <para>
76     /// Gets or sets the length value.
77     /// </para>
78     /// <para></para>
79     /// </summary>
80     public long Length
81     {
82         [MethodImpl(MethodImplOptions.AggressiveInlining)]
83         get => _length;
84         [MethodImpl(MethodImplOptions.AggressiveInlining)]
85         set
86         {
87             if (_length == value)
88             {
89                 return;
90             }
91             Ensure.Always.ArgumentInRange(value, GetValidLengthRange(), nameof(Length));
92             // Currently we never shrink the array
93             if (value > _length)
94             {
95                 var words = GetWordsCountFromIndex(value);
96                 var oldWords = GetWordsCountFromIndex(_length);
97                 if (words > _array.LongLength)
98                 {
99                     var copy = new long[words];
100                     Array.Copy(_array, copy, _array.LongLength);
101                     _array = copy;
102                 }
103                 else

```

```

104         {
105             // What is going on here?
106             Array.Clear(_array, (int)oldWords, (int)(words - oldWords));
107         }
108         // What is going on here?
109         var mask = (int)(_length % 64);
110         if (mask > 0)
111         {
112             _array[oldWords - 1] &= (1L << mask) - 1;
113         }
114     }
115     else
116     {
117         // Looks like minimum and maximum positive words are not updated
118         throw new NotImplementedException();
119     }
120     _length = value;
121 }
122
123
124 #region Constructors
125
126 /// <summary>
127 /// <para>
128 /// Initializes a new <see cref="BitString"/> instance.
129 /// </para>
130 /// <para></para>
131 /// </summary>
132 [MethodImpl(MethodImplOptions.AggressiveInlining)]
133 static BitString()
134 {
135     _bitsSetIn16Bits = new byte[65536][];
136     int i, c, k;
137     byte bitIndex;
138     for (i = 0; i < 65536; i++)
139     {
140         // Calculating size of array (number of positive bits)
141         for (c = 0, k = 1; k <= 65536; k <= 1)
142         {
143             if ((i & k) == k)
144             {
145                 c++;
146             }
147         }
148         var array = new byte[c];
149         // Adding positive bits indices into array
150         for (bitIndex = 0, c = 0, k = 1; k <= 65536; k <= 1)
151         {
152             if ((i & k) == k)
153             {
154                 array[c++] = bitIndex;
155             }
156             bitIndex++;
157         }
158         _bitsSetIn16Bits[i] = array;
159     }
160 }
161
162 /// <summary>
163 /// <para>
164 /// Initializes a new <see cref="BitString"/> instance.
165 /// </para>
166 /// <para></para>
167 /// </summary>
168 /// <param name="other">
169 /// <para>A other.</para>
170 /// <para></para>
171 /// </param>
172 [MethodImpl(MethodImplOptions.AggressiveInlining)]
173 public BitString(BitString other)
174 {
175     Ensure.Always.ArgumentNotNull(other, nameof(other));
176     _length = other._length;
177     _array = new long[GetWordsCountFromIndex(_length)];
178     _minPositiveWord = other._minPositiveWord;
179     _maxPositiveWord = other._maxPositiveWord;
180     Array.Copy(other._array, _array, _array.LongLength);
181 }
182

```

```

183     /// <summary>
184     /// <para>
185     /// Initializes a new <see cref="BitString"/> instance.
186     /// </para>
187     /// <para></para>
188     /// </summary>
189     /// <param name="length">
190     /// <para>A length.</para>
191     /// <para></para>
192     /// </param>
193     [MethodImpl(MethodImplOptions.AggressiveInlining)]
194     public BitString(long length)
195     {
196         Ensure.Always.ArgumentInRange(length, GetValidLengthRange(), nameof(length));
197         _length = length;
198         _array = new long[GetWordsCountFromIndex(_length)];
199         MarkBordersAsAllBitsReset();
200     }
201
202     /// <summary>
203     /// <para>
204     /// Initializes a new <see cref="BitString"/> instance.
205     /// </para>
206     /// <para></para>
207     /// </summary>
208     /// <param name="length">
209     /// <para>A length.</para>
210     /// <para></para>
211     /// </param>
212     /// <param name="defaultValue">
213     /// <para>A default value.</para>
214     /// <para></para>
215     /// </param>
216     [MethodImpl(MethodImplOptions.AggressiveInlining)]
217     public BitString(long length, bool defaultValue)
218         : this(length)
219     {
220         if (defaultValue)
221         {
222             SetAll();
223         }
224     }
225
226     #endregion
227
228     /// <summary>
229     /// <para>
230     /// Nots this instance.
231     /// </para>
232     /// <para></para>
233     /// </summary>
234     /// <returns>
235     /// <para>The bit string</para>
236     /// <para></para>
237     /// </returns>
238     [MethodImpl(MethodImplOptions.AggressiveInlining)]
239     public BitString Not()
240     {
241         for (var i = 0L; i < _array.LongLength; i++)
242         {
243             _array[i] = ~_array[i];
244             RefreshBordersByWord(i);
245         }
246         return this;
247     }
248
249     /// <summary>
250     /// <para>
251     /// Parallels the not.
252     /// </para>
253     /// <para></para>
254     /// </summary>
255     /// <returns>
256     /// <para>The bit string</para>
257     /// <para></para>
258     /// </returns>
259     [MethodImpl(MethodImplOptions.AggressiveInlining)]
260     public BitString ParallelNot()

```

```

261 {
262     var threads = Environment.ProcessorCount / 2;
263     if (threads <= 1)
264     {
265         return Not();
266     }
267     var partitioner = Partitioner.Create(OL, _array.LongLength, _array.LongLength /
268     ↪ threads);
269     Parallel.ForEach(partitioner.GetDynamicPartitions(), new ParallelOptions {
270     ↪ MaxDegreeOfParallelism = threads }, range =>
271     {
272         var maximum = range.Item2;
273         for (var i = range.Item1; i < maximum; i++)
274         {
275             _array[i] = ~_array[i];
276         }
277     });
278     MarkBordersAsAllBitsSet();
279     TryShrinkBorders();
280     return this;
281 }
282
283 /// <summary>
284 /// <para>
285 /// Vectors the not.
286 /// </para>
287 /// <para></para>
288 /// </summary>
289 /// <returns>
290 /// <para>The bit string</para>
291 /// <para></para>
292 /// </returns>
293 [MethodImpl(MethodImplOptions.AggressiveInlining)]
294 public BitString VectorNot()
295 {
296     if (!Vector.IsHardwareAccelerated || _array.LongLength >= int.MaxValue)
297     {
298         return Not();
299     }
300     var step = Vector<long>.Count;
301     if (_array.Length < step)
302     {
303         return Not();
304     }
305     VectorNotLoop(_array, step, 0, _array.Length);
306     MarkBordersAsAllBitsSet();
307     TryShrinkBorders();
308     return this;
309 }
310
311 /// <summary>
312 /// <para>
313 /// Parallels the vector not.
314 /// </para>
315 /// <para></para>
316 /// </summary>
317 /// <returns>
318 /// <para>The bit string</para>
319 /// <para></para>
320 /// </returns>
321 [MethodImpl(MethodImplOptions.AggressiveInlining)]
322 public BitString ParallelVectorNot()
323 {
324     var threads = Environment.ProcessorCount / 2;
325     if (threads <= 1)
326     {
327         return VectorNot();
328     }
329     if (!Vector.IsHardwareAccelerated)
330     {
331         return ParallelNot();
332     }
333     var step = Vector<long>.Count;
334     if (_array.Length < (step * threads))
335     {
336         return VectorNot();
337     }
338     var partitioner = Partitioner.Create(0, _array.Length, _array.Length / threads);

```

```

337         Parallel.ForEach(partitioner.GetDynamicPartitions(), new ParallelOptions {
338             ↪ MaxDegreeOfParallelism = threads }, range => VectorNotLoop(_array, step,
339             ↪ range.Item1, range.Item2));
340         MarkBordersAsAllBitsSet();
341         TryShrinkBorders();
342         return this;
343     }
344
345     /// <summary>
346     /// <para>
347     /// Vectors the not loop using the specified array.
348     /// </para>
349     /// </summary>
350     /// <param name="array">
351     /// <para>The array.</para>
352     /// </param>
353     /// <param name="step">
354     /// <para>The step.</para>
355     /// </param>
356     /// <param name="start">
357     /// <para>The start.</para>
358     /// </param>
359     /// <param name="maximum">
360     /// <para>The maximum.</para>
361     /// </param>
362     [MethodImpl(MethodImplOptions.AggressiveInlining)]
363     static private void VectorNotLoop(long[] array, int step, int start, int maximum)
364     {
365         var i = start;
366         var range = maximum - start - 1;
367         var stop = range - (range % step);
368         for (; i < stop; i += step)
369         {
370             (~new Vector<long>(array, i)).CopyTo(array, i);
371         }
372         for (; i < maximum; i++)
373         {
374             array[i] = ~array[i];
375         }
376     }
377
378     /// <summary>
379     /// <para>
380     /// Ands the other.
381     /// </para>
382     /// </summary>
383     /// <param name="other">
384     /// <para>The other.</para>
385     /// </param>
386     /// <returns>
387     /// <para>The bit string</para>
388     /// </returns>
389     [MethodImpl(MethodImplOptions.AggressiveInlining)]
390     public BitString And(BitString other)
391     {
392         EnsureBitStringHasTheSameSize(other, nameof(other));
393         GetCommonOuterBorders(this, other, out long from, out long to);
394         var otherArray = other._array;
395         for (var i = from; i <= to; i++)
396         {
397             _array[i] &= otherArray[i];
398             RefreshBordersByWord(i);
399         }
400         return this;
401     }
402
403     /// <summary>
404     /// <para>
405     /// Parallels the and using the specified other.
406     /// </para>

```

```

413 /// <para></para>
414 /// </summary>
415 /// <param name="other">
416 /// <para>The other.</para>
417 /// <para></para>
418 /// </param>
419 /// <returns>
420 /// <para>The bit string</para>
421 /// <para></para>
422 /// </returns>
423 [MethodImpl(MethodImplOptions.AggressiveInlining)]
424 public BitString ParallelAnd(BitString other)
425 {
426     var threads = Environment.ProcessorCount / 2;
427     if (threads <= 1)
428     {
429         return And(other);
430     }
431     EnsureBitStringHasTheSameSize(other, nameof(other));
432     GetCommonOuterBorders(this, other, out long from, out long to);
433     var partitioner = Partitioner.Create(from, to + 1, (to - from) / threads);
434     Parallel.ForEach(partitioner.GetDynamicPartitions(), new ParallelOptions {
435         ↳ MaxDegreeOfParallelism = threads }, range =>
436     {
437         var maximum = range.Item2;
438         for (var i = range.Item1; i < maximum; i++)
439         {
440             _array[i] &= other._array[i];
441         }
442     });
443     MarkBordersAsAllBitsSet();
444     TryShrinkBorders();
445     return this;
446 }
447
448 /// <summary>
449 /// <para>
450 /// Vectors the and using the specified other.
451 /// </para>
452 /// <para></para>
453 /// </summary>
454 /// <param name="other">
455 /// <para>The other.</para>
456 /// <para></para>
457 /// </param>
458 /// <returns>
459 /// <para>The bit string</para>
460 /// <para></para>
461 /// </returns>
462 [MethodImpl(MethodImplOptions.AggressiveInlining)]
463 public BitString VectorAnd(BitString other)
464 {
465     if (!Vector.IsHardwareAccelerated || _array.LongLength >= int.MaxValue)
466     {
467         return And(other);
468     }
469     var step = Vector<long>.Count;
470     if (_array.Length < step)
471     {
472         return And(other);
473     }
474     EnsureBitStringHasTheSameSize(other, nameof(other));
475     GetCommonOuterBorders(this, other, out int from, out int to);
476     VectorAndLoop(_array, other._array, step, from, to + 1);
477     MarkBordersAsAllBitsSet();
478     TryShrinkBorders();
479     return this;
480 }
481
482 /// <summary>
483 /// <para>
484 /// Parallels the vector and using the specified other.
485 /// </para>
486 /// <para></para>
487 /// </summary>
488 /// <param name="other">
489 /// <para>The other.</para>
490 /// <para></para>

```

```

490 /// </param>
491 /// <returns>
492 /// <para>The bit string</para>
493 /// <para></para>
494 /// </returns>
495 [MethodImpl(MethodImplOptions.AggressiveInlining)]
496 public BitString ParallelVectorAnd(BitString other)
497 {
498     var threads = Environment.ProcessorCount / 2;
499     if (threads <= 1)
500     {
501         return VectorAnd(other);
502     }
503     if (!Vector.IsHardwareAccelerated)
504     {
505         return ParallelAnd(other);
506     }
507     var step = Vector<long>.Count;
508     if (_array.Length < (step * threads))
509     {
510         return VectorAnd(other);
511     }
512     EnsureBitStringHasTheSameSize(other, nameof(other));
513     GetCommonOuterBorders(this, other, out int from, out int to);
514     var partitioner = Partitioner.Create(from, to + 1, (to - from) / threads);
515     Parallel.ForEach(partitioner.GetDynamicPartitions(), new ParallelOptions {
516         ↪ MaxDegreeOfParallelism = threads }, range => VectorAndLoop(_array, other._array,
517         ↪ step, range.Item1, range.Item2));
518     MarkBordersAsAllBitsSet();
519     TryShrinkBorders();
520     return this;
521 }
522
523 /// <summary>
524 /// <para>
525 /// Vectors the and loop using the specified array.
526 /// </para>
527 /// <para></para>
528 /// </summary>
529 /// <param name="array">
530 /// <para>The array.</para>
531 /// <para></para>
532 /// </param>
533 /// <param name="otherArray">
534 /// <para>The other array.</para>
535 /// <para></para>
536 /// </param>
537 /// <param name="step">
538 /// <para>The step.</para>
539 /// <para></para>
540 /// </param>
541 /// <param name="start">
542 /// <para>The start.</para>
543 /// <para></para>
544 /// </param>
545 /// <param name="maximum">
546 /// <para>The maximum.</para>
547 /// <para></para>
548 /// </param>
549 [MethodImpl(MethodImplOptions.AggressiveInlining)]
550 static private void VectorAndLoop(long[] array, long[] otherArray, int step, int start,
551 ↪ int maximum)
552 {
553     var i = start;
554     var range = maximum - start - 1;
555     var stop = range - (range % step);
556     for (; i < stop; i += step)
557     {
558         (new Vector<long>(array, i) & new Vector<long>(otherArray, i)).CopyTo(array, i);
559     }
560     for (; i < maximum; i++)
561     {
562         array[i] &= otherArray[i];
563     }
564 }
565
566 /// <summary>
567 /// <para>

```

```

565     /// Ors the other.
566     /// </para>
567     /// <para></para>
568     /// </summary>
569     /// <param name="other">
570     /// <para>The other.</para>
571     /// <para></para>
572     /// </param>
573     /// <returns>
574     /// <para>The bit string</para>
575     /// <para></para>
576     /// </returns>
577     [MethodImpl(MethodImplOptions.AggressiveInlining)]
578     public BitString Or(BitString other)
579     {
580         EnsureBitStringHasTheSameSize(other, nameof(other));
581         GetCommonOuterBorders(this, other, out long from, out long to);
582         for (var i = from; i <= to; i++)
583         {
584             _array[i] |= other._array[i];
585             RefreshBordersByWord(i);
586         }
587         return this;
588     }
589
590     /// <summary>
591     /// <para>
592     /// Parallels the or using the specified other.
593     /// </para>
594     /// <para></para>
595     /// </summary>
596     /// <param name="other">
597     /// <para>The other.</para>
598     /// <para></para>
599     /// </param>
600     /// <returns>
601     /// <para>The bit string</para>
602     /// <para></para>
603     /// </returns>
604     [MethodImpl(MethodImplOptions.AggressiveInlining)]
605     public BitString ParallelOr(BitString other)
606     {
607         var threads = Environment.ProcessorCount / 2;
608         if (threads <= 1)
609         {
610             return Or(other);
611         }
612         EnsureBitStringHasTheSameSize(other, nameof(other));
613         GetCommonOuterBorders(this, other, out long from, out long to);
614         var partitioner = Partitioner.Create(from, to + 1, (to - from) / threads);
615         Parallel.ForEach(partitioner.GetDynamicPartitions(), new ParallelOptions {
616             ↪ MaxDegreeOfParallelism = threads }, range =>
617         {
618             var maximum = range.Item2;
619             for (var i = range.Item1; i < maximum; i++)
620             {
621                 _array[i] |= other._array[i];
622             }
623         });
624         MarkBordersAsAllBitsSet();
625         TryShrinkBorders();
626         return this;
627     }
628
629     /// <summary>
630     /// <para>
631     /// Vectors the or using the specified other.
632     /// </para>
633     /// <para></para>
634     /// </summary>
635     /// <param name="other">
636     /// <para>The other.</para>
637     /// <para></para>
638     /// </param>
639     /// <returns>
640     /// <para>The bit string</para>
641     /// <para></para>
642     /// </returns>

```



```

642 [MethodImpl(MethodImplOptions.AggressiveInlining)]
643 public BitString VectorOr(BitString other)
644 {
645     if (!Vector.IsHardwareAccelerated || _array.LongLength >= int.MaxValue)
646     {
647         return Or(other);
648     }
649     var step = Vector<long>.Count;
650     if (_array.Length < step)
651     {
652         return Or(other);
653     }
654     EnsureBitStringHasTheSameSize(other, nameof(other));
655     GetCommonOuterBorders(this, other, out int from, out int to);
656     VectorOrLoop(_array, other._array, step, from, to + 1);
657     MarkBordersAsAllBitsSet();
658     TryShrinkBorders();
659     return this;
660 }
661
662 /// <summary>
663 /// <para>
664 /// Parallels the vector or using the specified other.
665 /// </para>
666 /// <para></para>
667 /// </summary>
668 /// <param name="other">
669 /// <para>The other.</para>
670 /// <para></para>
671 /// </param>
672 /// <returns>
673 /// <para>The bit string</para>
674 /// <para></para>
675 /// </returns>
676 [MethodImpl(MethodImplOptions.AggressiveInlining)]
677 public BitString ParallelVectorOr(BitString other)
678 {
679     var threads = Environment.ProcessorCount / 2;
680     if (threads <= 1)
681     {
682         return VectorOr(other);
683     }
684     if (!Vector.IsHardwareAccelerated)
685     {
686         return ParallelOr(other);
687     }
688     var step = Vector<long>.Count;
689     if (_array.Length < (step * threads))
690     {
691         return VectorOr(other);
692     }
693     EnsureBitStringHasTheSameSize(other, nameof(other));
694     GetCommonOuterBorders(this, other, out int from, out int to);
695     var partitioner = Partitioner.Create(from, to + 1, (to - from) / threads);
696     Parallel.ForEach(partitioner.GetDynamicPartitions(), new ParallelOptions {
697         ↪ MaxDegreeOfParallelism = threads }, range => VectorOrLoop(_array, other._array,
698         ↪ step, range.Item1, range.Item2));
699     MarkBordersAsAllBitsSet();
700     TryShrinkBorders();
701     return this;
702 }
703
704 /// <summary>
705 /// <para>
706 /// Vectors the or loop using the specified array.
707 /// </para>
708 /// <para></para>
709 /// </summary>
710 /// <param name="array">
711 /// <para>The array.</para>
712 /// <para></para>
713 /// </param>
714 /// <param name="otherArray">
715 /// <para>The other array.</para>
716 /// <para></para>
717 /// </param>
718 /// <param name="step">
719 /// <para>The step.</para>

```

```

718     /// <para></para>
719     /// </param>
720     /// <param name="start">
721     /// <para>The start.</para>
722     /// <para></para>
723     /// </param>
724     /// <param name="maximum">
725     /// <para>The maximum.</para>
726     /// <para></para>
727     /// </param>
728     [MethodImpl(MethodImplOptions.AggressiveInlining)]
729     static private void VectorOrLoop(long[] array, long[] otherArray, int step, int start,
730     ↪ int maximum)
731     {
732         var i = start;
733         var range = maximum - start - 1;
734         var stop = range - (range % step);
735         for (; i < stop; i += step)
736         {
737             (new Vector<long>(array, i) | new Vector<long>(otherArray, i)).CopyTo(array, i);
738         }
739         for (; i < maximum; i++)
740         {
741             array[i] |= otherArray[i];
742         }
743     }
744     /// <summary>
745     /// <para>
746     /// Xors the other.
747     /// </para>
748     /// <para></para>
749     /// </summary>
750     /// <param name="other">
751     /// <para>The other.</para>
752     /// <para></para>
753     /// </param>
754     /// <returns>
755     /// <para>The bit string</para>
756     /// <para></para>
757     /// </returns>
758     [MethodImpl(MethodImplOptions.AggressiveInlining)]
759     public BitString Xor(BitString other)
760     {
761         EnsureBitStringHasTheSameSize(other, nameof(other));
762         GetCommonOuterBorders(this, other, out long from, out long to);
763         for (var i = from; i <= to; i++)
764         {
765             _array[i] ^= other._array[i];
766             RefreshBordersByWord(i);
767         }
768         return this;
769     }
770     /// <summary>
771     /// <para>
772     /// Parallels the xor using the specified other.
773     /// </para>
774     /// <para></para>
775     /// </summary>
776     /// <param name="other">
777     /// <para>The other.</para>
778     /// <para></para>
779     /// </param>
780     /// <returns>
781     /// <para>The bit string</para>
782     /// <para></para>
783     /// </returns>
784     [MethodImpl(MethodImplOptions.AggressiveInlining)]
785     public BitString ParallelXor(BitString other)
786     {
787         var threads = Environment.ProcessorCount / 2;
788         if (threads <= 1)
789         {
790             return Xor(other);
791         }
792         EnsureBitStringHasTheSameSize(other, nameof(other));
793         GetCommonOuterBorders(this, other, out long from, out long to);

```

```

795     var partitioner = Partitioner.Create(from, to + 1, (to - from) / threads);
796     Parallel.ForEach(partitioner.GetDynamicPartitions(), new ParallelOptions {
797         ↪ MaxDegreeOfParallelism = threads }, range =>
798     {
799         var maximum = range.Item2;
800         for (var i = range.Item1; i < maximum; i++)
801         {
802             _array[i] ^= other._array[i];
803         }
804     });
805     MarkBordersAsAllBitsSet();
806     TryShrinkBorders();
807     return this;
808 }
809
810 /// <summary>
811 /// <para>
812 /// Vectors the xor using the specified other.
813 /// </para>
814 /// <para></para>
815 /// </summary>
816 /// <param name="other">
817 /// <para>The other.</para>
818 /// <para></para>
819 /// </param>
820 /// <returns>
821 /// <para>The bit string</para>
822 /// <para></para>
823 /// </returns>
824 [MethodImpl(MethodImplOptions.AggressiveInlining)]
825 public BitString VectorXor(BitString other)
826 {
827     if (!Vector.IsHardwareAccelerated || _array.LongLength >= int.MaxValue)
828     {
829         return Xor(other);
830     }
831     var step = Vector<long>.Count;
832     if (_array.Length < step)
833     {
834         return Xor(other);
835     }
836     EnsureBitStringHasTheSameSize(other, nameof(other));
837     GetCommonOuterBorders(this, other, out int from, out int to);
838     VectorXorLoop(_array, other._array, step, from, to + 1);
839     MarkBordersAsAllBitsSet();
840     TryShrinkBorders();
841     return this;
842 }
843
844 /// <summary>
845 /// <para>
846 /// Parallels the vector xor using the specified other.
847 /// </para>
848 /// <para></para>
849 /// </summary>
850 /// <param name="other">
851 /// <para>The other.</para>
852 /// <para></para>
853 /// </param>
854 /// <returns>
855 /// <para>The bit string</para>
856 /// <para></para>
857 /// </returns>
858 [MethodImpl(MethodImplOptions.AggressiveInlining)]
859 public BitString ParallelVectorXor(BitString other)
860 {
861     var threads = Environment.ProcessorCount / 2;
862     if (threads <= 1)
863     {
864         return VectorXor(other);
865     }
866     if (!Vector.IsHardwareAccelerated)
867     {
868         return ParallelXor(other);
869     }
870     var step = Vector<long>.Count;
871     if (_array.Length < (step * threads))
872     {

```

```

872         return VectorXor(other);
873     }
874     EnsureBitStringHasTheSameSize(other, nameof(other));
875     GetCommonOuterBorders(this, other, out int from, out int to);
876     var partitioner = Partitioner.Create(from, to + 1, (to - from) / threads);
877     Parallel.ForEach(partitioner.GetDynamicPartitions(), new ParallelOptions {
        ↪ MaxDegreeOfParallelism = threads }, range => VectorXorLoop(_array, other._array,
        ↪ step, range.Item1, range.Item2));
878     MarkBordersAsAllBitsSet();
879     TryShrinkBorders();
880     return this;
881 }
882
883 /// <summary>
884 /// <para>
885 /// Vectors the xor loop using the specified array.
886 /// </para>
887 /// <para></para>
888 /// </summary>
889 /// <param name="array">
890 /// <para>The array.</para>
891 /// <para></para>
892 /// </param>
893 /// <param name="otherArray">
894 /// <para>The other array.</para>
895 /// <para></para>
896 /// </param>
897 /// <param name="step">
898 /// <para>The step.</para>
899 /// <para></para>
900 /// </param>
901 /// <param name="start">
902 /// <para>The start.</para>
903 /// <para></para>
904 /// </param>
905 /// <param name="maximum">
906 /// <para>The maximum.</para>
907 /// <para></para>
908 /// </param>
909 [MethodImpl(MethodImplOptions.AggressiveInlining)]
910 static private void VectorXorLoop(long[] array, long[] otherArray, int step, int start,
    ↪ int maximum)
911 {
912     var i = start;
913     var range = maximum - start - 1;
914     var stop = range - (range % step);
915     for (; i < stop; i += step)
916     {
917         (new Vector<long>(array, i) ^ new Vector<long>(otherArray, i)).CopyTo(array, i);
918     }
919     for (; i < maximum; i++)
920     {
921         array[i] ^= otherArray[i];
922     }
923 }
924
925 /// <summary>
926 /// <para>
927 /// Refreshes the borders by word using the specified word index.
928 /// </para>
929 /// <para></para>
930 /// </summary>
931 /// <param name="wordIndex">
932 /// <para>The word index.</para>
933 /// <para></para>
934 /// </param>
935 [MethodImpl(MethodImplOptions.AggressiveInlining)]
936 private void RefreshBordersByWord(long wordIndex)
937 {
938     if (_array[wordIndex] == 0)
939     {
940         if (wordIndex == _minPositiveWord && wordIndex != _array.LongLength - 1)
941         {
942             _minPositiveWord++;
943         }
944         if (wordIndex == _maxPositiveWord && wordIndex != 0)
945         {
946             _maxPositiveWord--;

```

```

947     }
948 }
949 else
950 {
951     if (wordIndex < _minPositiveWord)
952     {
953         _minPositiveWord = wordIndex;
954     }
955     if (wordIndex > _maxPositiveWord)
956     {
957         _maxPositiveWord = wordIndex;
958     }
959 }
960 }
961
962 /// <summary>
963 /// <para>
964 /// Determines whether this instance try shrink borders.
965 /// </para>
966 /// <para></para>
967 /// </summary>
968 /// <returns>
969 /// <para>The borders updated.</para>
970 /// <para></para>
971 /// </returns>
972 [MethodImpl(MethodImplOptions.AggressiveInlining)]
973 public bool TryShrinkBorders()
974 {
975     GetBorders(out long from, out long to);
976     while (from <= to && _array[from] == 0)
977     {
978         from++;
979     }
980     if (from > to)
981     {
982         MarkBordersAsAllBitsReset();
983         return true;
984     }
985     while (to >= from && _array[to] == 0)
986     {
987         to--;
988     }
989     if (to < from)
990     {
991         MarkBordersAsAllBitsReset();
992         return true;
993     }
994     var bordersUpdated = from != _minPositiveWord || to != _maxPositiveWord;
995     if (bordersUpdated)
996     {
997         SetBorders(from, to);
998     }
999     return bordersUpdated;
1000 }
1001
1002 /// <summary>
1003 /// <para>
1004 /// Determines whether this instance get.
1005 /// </para>
1006 /// <para></para>
1007 /// </summary>
1008 /// <param name="index">
1009 /// <para>The index.</para>
1010 /// <para></para>
1011 /// </param>
1012 /// <returns>
1013 /// <para>The bool</para>
1014 /// <para></para>
1015 /// </returns>
1016 [MethodImpl(MethodImplOptions.AggressiveInlining)]
1017 public bool Get(long index)
1018 {
1019     Ensure.Always.ArgumentInRange(index, GetValidIndexRange(), nameof(index));
1020     return (_array[GetWordIndexFromIndex(index)] & GetBitMaskFromIndex(index)) != 0;
1021 }
1022
1023 /// <summary>
1024 /// <para>
1025 /// Sets the index.

```

```

1026    /// </para>
1027    /// <para></para>
1028    /// </summary>
1029    /// <param name="index">
1030    /// <para>The index.</para>
1031    /// <para></para>
1032    /// </param>
1033    /// <param name="value">
1034    /// <para>The value.</para>
1035    /// <para></para>
1036    /// </param>
1037    [MethodImpl(MethodImplOptions.AggressiveInlining)]
1038    public void Set(long index, bool value)
1039    {
1040        if (value)
1041        {
1042            Set(index);
1043        }
1044        else
1045        {
1046            Reset(index);
1047        }
1048    }
1049
1050    /// <summary>
1051    /// <para>
1052    /// Sets the index.
1053    /// </para>
1054    /// <para></para>
1055    /// </summary>
1056    /// <param name="index">
1057    /// <para>The index.</para>
1058    /// <para></para>
1059    /// </param>
1060    [MethodImpl(MethodImplOptions.AggressiveInlining)]
1061    public void Set(long index)
1062    {
1063        Ensure.Always.ArgumentInRange(index, GetValidIndexRange(), nameof(index));
1064        var wordIndex = GetWordIndexFromIndex(index);
1065        var mask = GetBitMaskFromIndex(index);
1066        _array[wordIndex] |= mask;
1067        RefreshBordersByWord(wordIndex);
1068    }
1069
1070    /// <summary>
1071    /// <para>
1072    /// Resets the index.
1073    /// </para>
1074    /// <para></para>
1075    /// </summary>
1076    /// <param name="index">
1077    /// <para>The index.</para>
1078    /// <para></para>
1079    /// </param>
1080    [MethodImpl(MethodImplOptions.AggressiveInlining)]
1081    public void Reset(long index)
1082    {
1083        Ensure.Always.ArgumentInRange(index, GetValidIndexRange(), nameof(index));
1084        var wordIndex = GetWordIndexFromIndex(index);
1085        var mask = GetBitMaskFromIndex(index);
1086        _array[wordIndex] &= ~mask;
1087        RefreshBordersByWord(wordIndex);
1088    }
1089
1090    /// <summary>
1091    /// <para>
1092    /// Determines whether this instance add.
1093    /// </para>
1094    /// <para></para>
1095    /// </summary>
1096    /// <param name="index">
1097    /// <para>The index.</para>
1098    /// <para></para>
1099    /// </param>
1100    /// <returns>
1101    /// <para>The bool</para>
1102    /// <para></para>
1103    /// </returns>

```

```

1104 [MethodImpl(MethodImplOptions.AggressiveInlining)]
1105 public bool Add(long index)
1106 {
1107     var wordIndex = GetWordIndexFromIndex(index);
1108     var mask = GetBitMaskFromIndex(index);
1109     if ((_array[wordIndex] & mask) == 0)
1110     {
1111         _array[wordIndex] |= mask;
1112         RefreshBordersByWord(wordIndex);
1113         return true;
1114     }
1115     else
1116     {
1117         return false;
1118     }
1119 }
1120
1121 /// <summary>
1122 /// <para>
1123 /// Sets the all using the specified value.
1124 /// </para>
1125 /// <para></para>
1126 /// </summary>
1127 /// <param name="value">
1128 /// <para>The value.</para>
1129 /// <para></para>
1130 /// </param>
1131 [MethodImpl(MethodImplOptions.AggressiveInlining)]
1132 public void SetAll(bool value)
1133 {
1134     if (value)
1135     {
1136         SetAll();
1137     }
1138     else
1139     {
1140         ResetAll();
1141     }
1142 }
1143
1144 /// <summary>
1145 /// <para>
1146 /// Sets the all.
1147 /// </para>
1148 /// <para></para>
1149 /// </summary>
1150 [MethodImpl(MethodImplOptions.AggressiveInlining)]
1151 public void SetAll()
1152 {
1153     const long fillValue = unchecked((long)0xffffffffffffffff);
1154     var words = GetWordsCountFromIndex(_length);
1155     for (var i = 0; i < words; i++)
1156     {
1157         _array[i] = fillValue;
1158     }
1159     MarkBordersAsAllBitsSet();
1160 }
1161
1162 /// <summary>
1163 /// <para>
1164 /// Resets the all.
1165 /// </para>
1166 /// <para></para>
1167 /// </summary>
1168 [MethodImpl(MethodImplOptions.AggressiveInlining)]
1169 public void ResetAll()
1170 {
1171     const long fillValue = 0;
1172     GetBorders(out long from, out long to);
1173     for (var i = from; i <= to; i++)
1174     {
1175         _array[i] = fillValue;
1176     }
1177     MarkBordersAsAllBitsReset();
1178 }
1179
1180 /// <summary>
1181 /// <para>

```

```

1182     /// Gets the set indices.
1183     /// </para>
1184     /// <para></para>
1185     /// </summary>
1186     /// <returns>
1187     /// <para>The result.</para>
1188     /// <para></para>
1189     /// </returns>
1190     [MethodImpl(MethodImplOptions.AggressiveInlining)]
1191     public List<long> GetSetIndices()
1192     {
1193         var result = new List<long>();
1194         GetBorders(out long from, out long to);
1195         for (var i = from; i <= to; i++)
1196         {
1197             var word = _array[i];
1198             if (word != 0)
1199             {
1200                 AppendAllSetBitIndices(result, i, word);
1201             }
1202         }
1203         return result;
1204     }
1205
1206     /// <summary>
1207     /// <para>
1208     /// Gets the set u int 64 indices.
1209     /// </para>
1210     /// <para></para>
1211     /// </summary>
1212     /// <returns>
1213     /// <para>The result.</para>
1214     /// <para></para>
1215     /// </returns>
1216     [MethodImpl(MethodImplOptions.AggressiveInlining)]
1217     public List<ulong> GetSetUInt64Indices()
1218     {
1219         var result = new List<ulong>();
1220         GetBorders(out ulong from, out ulong to);
1221         for (var i = from; i <= to; i++)
1222         {
1223             var word = _array[i];
1224             if (word != 0)
1225             {
1226                 AppendAllSetBitIndices(result, i, word);
1227             }
1228         }
1229         return result;
1230     }
1231
1232     /// <summary>
1233     /// <para>
1234     /// Gets the first set bit index.
1235     /// </para>
1236     /// <para></para>
1237     /// </summary>
1238     /// <returns>
1239     /// <para>The long</para>
1240     /// <para></para>
1241     /// </returns>
1242     [MethodImpl(MethodImplOptions.AggressiveInlining)]
1243     public long GetFirstSetBitIndex()
1244     {
1245         var i = _minPositiveWord;
1246         var word = _array[i];
1247         if (word != 0)
1248         {
1249             return GetFirstSetBitForWord(i, word);
1250         }
1251         return -1;
1252     }
1253
1254     /// <summary>
1255     /// <para>
1256     /// Gets the last set bit index.
1257     /// </para>
1258     /// <para></para>
1259     /// </summary>

```



```

1260 /// <returns>
1261 /// <para>The long</para>
1262 /// <para></para>
1263 /// </returns>
1264 [MethodImpl(MethodImplOptions.AggressiveInlining)]
1265 public long GetLastSetBitIndex()
1266 {
1267     var i = _maxPositiveWord;
1268     var word = _array[i];
1269     if (word != 0)
1270     {
1271         return GetLastSetBitForWord(i, word);
1272     }
1273     return -1;
1274 }
1275
1276 /// <summary>
1277 /// <para>
1278 /// Counts the set bits.
1279 /// </para>
1280 /// <para></para>
1281 /// </summary>
1282 /// <returns>
1283 /// <para>The total.</para>
1284 /// <para></para>
1285 /// </returns>
1286 [MethodImpl(MethodImplOptions.AggressiveInlining)]
1287 public long CountSetBits()
1288 {
1289     var total = 0L;
1290     GetBorders(out long from, out long to);
1291     for (var i = from; i <= to; i++)
1292     {
1293         var word = _array[i];
1294         if (word != 0)
1295         {
1296             total += CountSetBitsForWord(word);
1297         }
1298     }
1299     return total;
1300 }
1301
1302 /// <summary>
1303 /// <para>
1304 /// Determines whether this instance have common bits.
1305 /// </para>
1306 /// <para></para>
1307 /// </summary>
1308 /// <param name="other">
1309 /// <para>The other.</para>
1310 /// <para></para>
1311 /// </param>
1312 /// <returns>
1313 /// <para>The bool</para>
1314 /// <para></para>
1315 /// </returns>
1316 [MethodImpl(MethodImplOptions.AggressiveInlining)]
1317 public bool HaveCommonBits(BitString other)
1318 {
1319     EnsureBitStringHasTheSameSize(other, nameof(other));
1320     GetCommonInnerBorders(this, other, out long from, out long to);
1321     var otherArray = other._array;
1322     for (var i = from; i <= to; i++)
1323     {
1324         var left = _array[i];
1325         var right = otherArray[i];
1326         if (left != 0 && right != 0 && (left & right) != 0)
1327         {
1328             return true;
1329         }
1330     }
1331     return false;
1332 }
1333
1334 /// <summary>
1335 /// <para>
1336 /// Counts the common bits using the specified other.
1337 /// </para>

```

```

1338     /// <para></para>
1339     /// </summary>
1340     /// <param name="other">
1341     /// <para>The other.</para>
1342     /// <para></para>
1343     /// </param>
1344     /// <returns>
1345     /// <para>The total.</para>
1346     /// <para></para>
1347     /// </returns>
1348     [MethodImpl(MethodImplOptions.AggressiveInlining)]
1349     public long CountCommonBits(BitString other)
1350     {
1351         EnsureBitStringHasTheSameSize(other, nameof(other));
1352         GetCommonInnerBorders(this, other, out long from, out long to);
1353         var total = 0L;
1354         var otherArray = other._array;
1355         for (var i = from; i <= to; i++)
1356         {
1357             var left = _array[i];
1358             var right = otherArray[i];
1359             var combined = left & right;
1360             if (combined != 0)
1361             {
1362                 total += CountSetBitsForWord(combined);
1363             }
1364         }
1365         return total;
1366     }
1367
1368     /// <summary>
1369     /// <para>
1370     /// Gets the common indices using the specified other.
1371     /// </para>
1372     /// <para></para>
1373     /// </summary>
1374     /// <param name="other">
1375     /// <para>The other.</para>
1376     /// <para></para>
1377     /// </param>
1378     /// <returns>
1379     /// <para>The result.</para>
1380     /// <para></para>
1381     /// </returns>
1382     [MethodImpl(MethodImplOptions.AggressiveInlining)]
1383     public List<long> GetCommonIndices(BitString other)
1384     {
1385         EnsureBitStringHasTheSameSize(other, nameof(other));
1386         GetCommonInnerBorders(this, other, out long from, out long to);
1387         var result = new List<long>();
1388         var otherArray = other._array;
1389         for (var i = from; i <= to; i++)
1390         {
1391             var left = _array[i];
1392             var right = otherArray[i];
1393             var combined = left & right;
1394             if (combined != 0)
1395             {
1396                 AppendAllSetBitIndices(result, i, combined);
1397             }
1398         }
1399         return result;
1400     }
1401
1402     /// <summary>
1403     /// <para>
1404     /// Gets the common u int 64 indices using the specified other.
1405     /// </para>
1406     /// <para></para>
1407     /// </summary>
1408     /// <param name="other">
1409     /// <para>The other.</para>
1410     /// <para></para>
1411     /// </param>
1412     /// <returns>
1413     /// <para>The result.</para>
1414     /// <para></para>
1415     /// </returns>

```

```

1416 [MethodImpl(MethodImplOptions.AggressiveInlining)]
1417 public List<ulong> GetCommonUInt64Indices(BitString other)
1418 {
1419     EnsureBitStringHasTheSameSize(other, nameof(other));
1420     GetCommonBorders(this, other, out ulong from, out ulong to);
1421     var result = new List<ulong>();
1422     var otherArray = other._array;
1423     for (var i = from; i <= to; i++)
1424     {
1425         var left = _array[i];
1426         var right = otherArray[i];
1427         var combined = left & right;
1428         if (combined != 0)
1429         {
1430             AppendAllSetBitIndices(result, i, combined);
1431         }
1432     }
1433     return result;
1434 }
1435
1436 /// <summary>
1437 /// <para>
1438 /// Gets the first common bit index using the specified other.
1439 /// </para>
1440 /// <para></para>
1441 /// </summary>
1442 /// <param name="other">
1443 /// <para>The other.</para>
1444 /// <para></para>
1445 /// </param>
1446 /// <returns>
1447 /// <para>The long</para>
1448 /// <para></para>
1449 /// </returns>
1450 [MethodImpl(MethodImplOptions.AggressiveInlining)]
1451 public long GetFirstCommonBitIndex(BitString other)
1452 {
1453     EnsureBitStringHasTheSameSize(other, nameof(other));
1454     GetCommonInnerBorders(this, other, out long from, out long to);
1455     var otherArray = other._array;
1456     for (var i = from; i <= to; i++)
1457     {
1458         var left = _array[i];
1459         var right = otherArray[i];
1460         var combined = left & right;
1461         if (combined != 0)
1462         {
1463             return GetFirstSetBitForWord(i, combined);
1464         }
1465     }
1466     return -1;
1467 }
1468
1469 /// <summary>
1470 /// <para>
1471 /// Gets the last common bit index using the specified other.
1472 /// </para>
1473 /// <para></para>
1474 /// </summary>
1475 /// <param name="other">
1476 /// <para>The other.</para>
1477 /// <para></para>
1478 /// </param>
1479 /// <returns>
1480 /// <para>The long</para>
1481 /// <para></para>
1482 /// </returns>
1483 [MethodImpl(MethodImplOptions.AggressiveInlining)]
1484 public long GetLastCommonBitIndex(BitString other)
1485 {
1486     EnsureBitStringHasTheSameSize(other, nameof(other));
1487     GetCommonInnerBorders(this, other, out long from, out long to);
1488     var otherArray = other._array;
1489     for (var i = to; i >= from; i--)
1490     {
1491         var left = _array[i];
1492         var right = otherArray[i];
1493         var combined = left & right;

```

```

1494         if (combined != 0)
1495         {
1496             return GetLastSetBitForWord(i, combined);
1497         }
1498     }
1499     return -1;
1500 }
1501
1502 /// <summary>
1503 /// <para>
1504 /// Determines whether this instance equals.
1505 /// </para>
1506 /// <para></para>
1507 /// </summary>
1508 /// <param name="obj">
1509 /// <para>The obj.</para>
1510 /// <para></para>
1511 /// </param>
1512 /// <returns>
1513 /// <para>The bool</para>
1514 /// <para></para>
1515 /// </returns>
1516 [MethodImpl(MethodImplOptions.AggressiveInlining)]
1517 public override bool Equals(object obj) => obj is BitString @string ? Equals(@string) :
    ↪ false;
1518
1519 /// <summary>
1520 /// <para>
1521 /// Determines whether this instance equals.
1522 /// </para>
1523 /// <para></para>
1524 /// </summary>
1525 /// <param name="other">
1526 /// <para>The other.</para>
1527 /// <para></para>
1528 /// </param>
1529 /// <returns>
1530 /// <para>The bool</para>
1531 /// <para></para>
1532 /// </returns>
1533 [MethodImpl(MethodImplOptions.AggressiveInlining)]
1534 public bool Equals(BitString other)
1535 {
1536     if (_length != other._length)
1537     {
1538         return false;
1539     }
1540     var otherArray = other._array;
1541     if (_array.Length != otherArray.Length)
1542     {
1543         return false;
1544     }
1545     if (_minPositiveWord != other._minPositiveWord)
1546     {
1547         return false;
1548     }
1549     if (_maxPositiveWord != other._maxPositiveWord)
1550     {
1551         return false;
1552     }
1553     GetCommonBorders(this, other, out ulong from, out ulong to);
1554     for (var i = from; i <= to; i++)
1555     {
1556         if (_array[i] != otherArray[i])
1557         {
1558             return false;
1559         }
1560     }
1561     return true;
1562 }
1563
1564 /// <summary>
1565 /// <para>
1566 /// Ensures the bit string has the same size using the specified other.
1567 /// </para>
1568 /// <para></para>
1569 /// </summary>
1570 /// <param name="other">

```

```

1571    /// <para>The other.</para>
1572    /// <para></para>
1573    /// </param>
1574    /// <param name="argumentName">
1575    /// <para>The argument name.</para>
1576    /// <para></para>
1577    /// </param>
1578    /// <exception cref="ArgumentException">
1579    /// <para>Bit string must be the same size. </para>
1580    /// <para></para>
1581    /// </exception>
1582    [MethodImpl(MethodImplOptions.AggressiveInlining)]
1583    private void EnsureBitStringHasTheSameSize(BitString other, string argumentName)
1584    {
1585        Ensure.Always.ArgumentNotNull(other, argumentName);
1586        if (_length != other._length)
1587        {
1588            throw new ArgumentException("Bit string must be the same size.", argumentName);
1589        }
1590    }
1591
1592    /// <summary>
1593    /// <para>
1594    /// Marks the borders as all bits reset.
1595    /// </para>
1596    /// <para></para>
1597    /// </summary>
1598    [MethodImpl(MethodImplOptions.AggressiveInlining)]
1599    private void MarkBordersAsAllBitsReset() => SetBorders(_array.LongLength - 1, 0);
1600
1601    /// <summary>
1602    /// <para>
1603    /// Marks the borders as all bits set.
1604    /// </para>
1605    /// <para></para>
1606    /// </summary>
1607    [MethodImpl(MethodImplOptions.AggressiveInlining)]
1608    private void MarkBordersAsAllBitsSet() => SetBorders(0, _array.LongLength - 1);
1609
1610    /// <summary>
1611    /// <para>
1612    /// Gets the borders using the specified from.
1613    /// </para>
1614    /// <para></para>
1615    /// </summary>
1616    /// <param name="from">
1617    /// <para>The from.</para>
1618    /// <para></para>
1619    /// </param>
1620    /// <param name="to">
1621    /// <para>The to.</para>
1622    /// <para></para>
1623    /// </param>
1624    [MethodImpl(MethodImplOptions.AggressiveInlining)]
1625    private void GetBorders(out long from, out long to)
1626    {
1627        from = _minPositiveWord;
1628        to = _maxPositiveWord;
1629    }
1630
1631    /// <summary>
1632    /// <para>
1633    /// Gets the borders using the specified from.
1634    /// </para>
1635    /// <para></para>
1636    /// </summary>
1637    /// <param name="from">
1638    /// <para>The from.</para>
1639    /// <para></para>
1640    /// </param>
1641    /// <param name="to">
1642    /// <para>The to.</para>
1643    /// <para></para>
1644    /// </param>
1645    [MethodImpl(MethodImplOptions.AggressiveInlining)]
1646    private void GetBorders(out ulong from, out ulong to)
1647    {
1648        from = (ulong)_minPositiveWord;

```

```

1649         to = (ulong)_maxPositiveWord;
1650     }
1651
1652     /// <summary>
1653     /// <para>
1654     /// Sets the borders using the specified from.
1655     /// </para>
1656     /// <para></para>
1657     /// </summary>
1658     /// <param name="from">
1659     /// <para>The from.</para>
1660     /// <para></para>
1661     /// </param>
1662     /// <param name="to">
1663     /// <para>The to.</para>
1664     /// <para></para>
1665     /// </param>
1666     [MethodImpl(MethodImplOptions.AggressiveInlining)]
1667     private void SetBorders(long from, long to)
1668     {
1669         _minPositiveWord = from;
1670         _maxPositiveWord = to;
1671     }
1672
1673     /// <summary>
1674     /// <para>
1675     /// Gets the valid index range.
1676     /// </para>
1677     /// <para></para>
1678     /// </summary>
1679     /// <returns>
1680     /// <para>A range of long</para>
1681     /// <para></para>
1682     /// </returns>
1683     [MethodImpl(MethodImplOptions.AggressiveInlining)]
1684     private Range<long> GetValidIndexRange() => (0, _length - 1);
1685
1686     /// <summary>
1687     /// <para>
1688     /// Gets the valid length range.
1689     /// </para>
1690     /// <para></para>
1691     /// </summary>
1692     /// <returns>
1693     /// <para>A range of long</para>
1694     /// <para></para>
1695     /// </returns>
1696     [MethodImpl(MethodImplOptions.AggressiveInlining)]
1697     private static Range<long> GetValidLengthRange() => (0, long.MaxValue);
1698
1699     /// <summary>
1700     /// <para>
1701     /// Appends the all set bit indices using the specified result.
1702     /// </para>
1703     /// <para></para>
1704     /// </summary>
1705     /// <param name="result">
1706     /// <para>The result.</para>
1707     /// <para></para>
1708     /// </param>
1709     /// <param name="wordIndex">
1710     /// <para>The word index.</para>
1711     /// <para></para>
1712     /// </param>
1713     /// <param name="wordValue">
1714     /// <para>The word value.</para>
1715     /// <para></para>
1716     /// </param>
1717     [MethodImpl(MethodImplOptions.AggressiveInlining)]
1718     private static void AppendAllSetBitIndices(List<ulong> result, ulong wordIndex, long
1719     ↪ wordValue)
1720     {
1721         GetBits(wordValue, out byte[] bits00to15, out byte[] bits16to31, out byte[]
1722         ↪ bits32to47, out byte[] bits48to63);
1723         AppendAllSetIndices(result, wordIndex, bits00to15, bits16to31, bits32to47,
1724         ↪ bits48to63);
1725     }

```

```

1724     /// <summary>
1725     /// <para>
1726     /// Appends the all set bit indices using the specified result.
1727     /// </para>
1728     /// <para></para>
1729     /// </summary>
1730     /// <param name="result">
1731     /// <para>The result.</para>
1732     /// <para></para>
1733     /// </param>
1734     /// <param name="wordIndex">
1735     /// <para>The word index.</para>
1736     /// <para></para>
1737     /// </param>
1738     /// <param name="wordValue">
1739     /// <para>The word value.</para>
1740     /// <para></para>
1741     /// </param>
1742     [MethodImpl(MethodImplOptions.AggressiveInlining)]
1743     private static void AppendAllSetBitIndices(List<long> result, long wordIndex, long
        ↪ wordValue)
1744     {
1745         GetBits(wordValue, out byte[] bits00to15, out byte[] bits16to31, out byte[]
        ↪ bits32to47, out byte[] bits48to63);
1746         AppendAllSetBitIndices(result, wordIndex, bits00to15, bits16to31, bits32to47,
        ↪ bits48to63);
1747     }
1748
1749     /// <summary>
1750     /// <para>
1751     /// Counts the set bits for word using the specified word.
1752     /// </para>
1753     /// <para></para>
1754     /// </summary>
1755     /// <param name="word">
1756     /// <para>The word.</para>
1757     /// <para></para>
1758     /// </param>
1759     /// <returns>
1760     /// <para>The long</para>
1761     /// <para></para>
1762     /// </returns>
1763     [MethodImpl(MethodImplOptions.AggressiveInlining)]
1764     private static long CountSetBitsForWord(long word)
1765     {
1766         GetBits(word, out byte[] bits00to15, out byte[] bits16to31, out byte[] bits32to47,
        ↪ out byte[] bits48to63);
1767         return bits00to15.LongLength + bits16to31.LongLength + bits32to47.LongLength +
        ↪ bits48to63.LongLength;
1768     }
1769
1770     /// <summary>
1771     /// <para>
1772     /// Gets the first set bit for word using the specified word index.
1773     /// </para>
1774     /// <para></para>
1775     /// </summary>
1776     /// <param name="wordIndex">
1777     /// <para>The word index.</para>
1778     /// <para></para>
1779     /// </param>
1780     /// <param name="wordValue">
1781     /// <para>The word value.</para>
1782     /// <para></para>
1783     /// </param>
1784     /// <returns>
1785     /// <para>The long</para>
1786     /// <para></para>
1787     /// </returns>
1788     [MethodImpl(MethodImplOptions.AggressiveInlining)]
1789     private static long GetFirstSetBitForWord(long wordIndex, long wordValue)
1790     {
1791         GetBits(wordValue, out byte[] bits00to15, out byte[] bits16to31, out byte[]
        ↪ bits32to47, out byte[] bits48to63);
1792         return GetFirstSetBit(wordIndex, bits00to15, bits16to31, bits32to47, bits48to63);
1793     }
1794

```

```

1795     /// <summary>
1796     /// <para>
1797     /// Gets the last set bit for word using the specified word index.
1798     /// </para>
1799     /// <para></para>
1800     /// </summary>
1801     /// <param name="wordIndex">
1802     /// <para>The word index.</para>
1803     /// <para></para>
1804     /// </param>
1805     /// <param name="wordValue">
1806     /// <para>The word value.</para>
1807     /// <para></para>
1808     /// </param>
1809     /// <returns>
1810     /// <para>The long</para>
1811     /// <para></para>
1812     /// </returns>
1813     [MethodImpl(MethodImplOptions.AggressiveInlining)]
1814     private static long GetLastSetBitForWord(long wordIndex, long wordValue)
1815     {
1816         GetBits(wordValue, out byte[] bits00to15, out byte[] bits16to31, out byte[]
            ↪ bits32to47, out byte[] bits48to63);
1817         return GetLastSetBit(wordIndex, bits00to15, bits16to31, bits32to47, bits48to63);
1818     }
1819
1820     /// <summary>
1821     /// <para>
1822     /// Appends the all set bit indices using the specified result.
1823     /// </para>
1824     /// <para></para>
1825     /// </summary>
1826     /// <param name="result">
1827     /// <para>The result.</para>
1828     /// <para></para>
1829     /// </param>
1830     /// <param name="i">
1831     /// <para>The .</para>
1832     /// <para></para>
1833     /// </param>
1834     /// <param name="bits00to15">
1835     /// <para>The bits 00to 15.</para>
1836     /// <para></para>
1837     /// </param>
1838     /// <param name="bits16to31">
1839     /// <para>The bits 16to 31.</para>
1840     /// <para></para>
1841     /// </param>
1842     /// <param name="bits32to47">
1843     /// <para>The bits 32to 47.</para>
1844     /// <para></para>
1845     /// </param>
1846     /// <param name="bits48to63">
1847     /// <para>The bits 48to 63.</para>
1848     /// <para></para>
1849     /// </param>
1850     [MethodImpl(MethodImplOptions.AggressiveInlining)]
1851     private static void AppendAllSetBitIndices(List<long> result, long i, byte[] bits00to15,
            ↪ byte[] bits16to31, byte[] bits32to47, byte[] bits48to63)
1852     {
1853         for (var j = 0; j < bits00to15.Length; j++)
1854         {
1855             result.Add(bits00to15[j] + (i * 64));
1856         }
1857         for (var j = 0; j < bits16to31.Length; j++)
1858         {
1859             result.Add(bits16to31[j] + 16 + (i * 64));
1860         }
1861         for (var j = 0; j < bits32to47.Length; j++)
1862         {
1863             result.Add(bits32to47[j] + 32 + (i * 64));
1864         }
1865         for (var j = 0; j < bits48to63.Length; j++)
1866         {
1867             result.Add(bits48to63[j] + 48 + (i * 64));
1868         }
1869     }
1870

```



```

1871     /// <summary>
1872     /// <para>
1873     /// Appends the all set indices using the specified result.
1874     /// </para>
1875     /// <para></para>
1876     /// </summary>
1877     /// <param name="result">
1878     /// <para>The result.</para>
1879     /// <para></para>
1880     /// </param>
1881     /// <param name="i">
1882     /// <para>The .</para>
1883     /// <para></para>
1884     /// </param>
1885     /// <param name="bits00to15">
1886     /// <para>The bits 00to 15.</para>
1887     /// <para></para>
1888     /// </param>
1889     /// <param name="bits16to31">
1890     /// <para>The bits 16to 31.</para>
1891     /// <para></para>
1892     /// </param>
1893     /// <param name="bits32to47">
1894     /// <para>The bits 32to 47.</para>
1895     /// <para></para>
1896     /// </param>
1897     /// <param name="bits48to63">
1898     /// <para>The bits 48to 63.</para>
1899     /// <para></para>
1900     /// </param>
1901     [MethodImpl(MethodImplOptions.AggressiveInlining)]
1902     private static void AppendAllSetIndices(List<ulong> result, ulong i, byte[] bits00to15,
1903     ↪ byte[] bits16to31, byte[] bits32to47, byte[] bits48to63)
1904     {
1905         for (var j = 0; j < bits00to15.Length; j++)
1906         {
1907             result.Add(bits00to15[j] + (i * 64));
1908         }
1909         for (var j = 0; j < bits16to31.Length; j++)
1910         {
1911             result.Add(bits16to31[j] + 16UL + (i * 64));
1912         }
1913         for (var j = 0; j < bits32to47.Length; j++)
1914         {
1915             result.Add(bits32to47[j] + 32UL + (i * 64));
1916         }
1917         for (var j = 0; j < bits48to63.Length; j++)
1918         {
1919             result.Add(bits48to63[j] + 48UL + (i * 64));
1920         }
1921     }
1922     /// <summary>
1923     /// <para>
1924     /// Gets the first set bit using the specified i.
1925     /// </para>
1926     /// <para></para>
1927     /// </summary>
1928     /// <param name="i">
1929     /// <para>The .</para>
1930     /// <para></para>
1931     /// </param>
1932     /// <param name="bits00to15">
1933     /// <para>The bits 00to 15.</para>
1934     /// <para></para>
1935     /// </param>
1936     /// <param name="bits16to31">
1937     /// <para>The bits 16to 31.</para>
1938     /// <para></para>
1939     /// </param>
1940     /// <param name="bits32to47">
1941     /// <para>The bits 32to 47.</para>
1942     /// <para></para>
1943     /// </param>
1944     /// <param name="bits48to63">
1945     /// <para>The bits 48to 63.</para>
1946     /// <para></para>
1947     /// </param>

```

```

1948     /// <returns>
1949     /// <para>The long</para>
1950     /// <para></para>
1951     /// </returns>
1952     [MethodImpl(MethodImplOptions.AggressiveInlining)]
1953     private static long GetFirstSetBit(long i, byte[] bits00to15, byte[] bits16to31, byte[]
    ↪ bits32to47, byte[] bits48to63)
1954     {
1955         if (bits00to15.Length > 0)
1956         {
1957             return bits00to15[0] + (i * 64);
1958         }
1959         if (bits16to31.Length > 0)
1960         {
1961             return bits16to31[0] + 16 + (i * 64);
1962         }
1963         if (bits32to47.Length > 0)
1964         {
1965             return bits32to47[0] + 32 + (i * 64);
1966         }
1967         return bits48to63[0] + 48 + (i * 64);
1968     }
1969
1970     /// <summary>
1971     /// <para>
1972     /// Gets the last set bit using the specified i.
1973     /// </para>
1974     /// <para></para>
1975     /// </summary>
1976     /// <param name="i">
1977     /// <para>The .</para>
1978     /// <para></para>
1979     /// </param>
1980     /// <param name="bits00to15">
1981     /// <para>The bits 00to 15.</para>
1982     /// <para></para>
1983     /// </param>
1984     /// <param name="bits16to31">
1985     /// <para>The bits 16to 31.</para>
1986     /// <para></para>
1987     /// </param>
1988     /// <param name="bits32to47">
1989     /// <para>The bits 32to 47.</para>
1990     /// <para></para>
1991     /// </param>
1992     /// <param name="bits48to63">
1993     /// <para>The bits 48to 63.</para>
1994     /// <para></para>
1995     /// </param>
1996     /// <returns>
1997     /// <para>The long</para>
1998     /// <para></para>
1999     /// </returns>
2000     [MethodImpl(MethodImplOptions.AggressiveInlining)]
2001     private static long GetLastSetBit(long i, byte[] bits00to15, byte[] bits16to31, byte[]
    ↪ bits32to47, byte[] bits48to63)
2002     {
2003         if (bits48to63.Length > 0)
2004         {
2005             return bits48to63[bits48to63.Length - 1] + 48 + (i * 64);
2006         }
2007         if (bits32to47.Length > 0)
2008         {
2009             return bits32to47[bits32to47.Length - 1] + 32 + (i * 64);
2010         }
2011         if (bits16to31.Length > 0)
2012         {
2013             return bits16to31[bits16to31.Length - 1] + 16 + (i * 64);
2014         }
2015         return bits00to15[bits00to15.Length - 1] + (i * 64);
2016     }
2017
2018     /// <summary>
2019     /// <para>
2020     /// Gets the bits using the specified word.
2021     /// </para>
2022     /// <para></para>
2023     /// </summary>

```

```

2024    /// <param name="word">
2025    /// <para>The word.</para>
2026    /// <para></para>
2027    /// </param>
2028    /// <param name="bits00to15">
2029    /// <para>The bits 00to 15.</para>
2030    /// <para></para>
2031    /// </param>
2032    /// <param name="bits16to31">
2033    /// <para>The bits 16to 31.</para>
2034    /// <para></para>
2035    /// </param>
2036    /// <param name="bits32to47">
2037    /// <para>The bits 32to 47.</para>
2038    /// <para></para>
2039    /// </param>
2040    /// <param name="bits48to63">
2041    /// <para>The bits 48to 63.</para>
2042    /// <para></para>
2043    /// </param>
2044    [MethodImpl(MethodImplOptions.AggressiveInlining)]
2045    private static void GetBits(long word, out byte[] bits00to15, out byte[] bits16to31, out
    → byte[] bits32to47, out byte[] bits48to63)
2046    {
2047        bits00to15 = _bitsSetIn16Bits[word & 0xffffu];
2048        bits16to31 = _bitsSetIn16Bits[(word >> 16) & 0xffffu];
2049        bits32to47 = _bitsSetIn16Bits[(word >> 32) & 0xffffu];
2050        bits48to63 = _bitsSetIn16Bits[(word >> 48) & 0xffffu];
2051    }
2052
2053    /// <summary>
2054    /// <para>
2055    /// Gets the common inner borders using the specified left.
2056    /// </para>
2057    /// <para></para>
2058    /// </summary>
2059    /// <param name="left">
2060    /// <para>The left.</para>
2061    /// <para></para>
2062    /// </param>
2063    /// <param name="right">
2064    /// <para>The right.</para>
2065    /// <para></para>
2066    /// </param>
2067    /// <param name="from">
2068    /// <para>The from.</para>
2069    /// <para></para>
2070    /// </param>
2071    /// <param name="to">
2072    /// <para>The to.</para>
2073    /// <para></para>
2074    /// </param>
2075    [MethodImpl(MethodImplOptions.AggressiveInlining)]
2076    public static void GetCommonInnerBorders(BitString left, BitString right, out long from,
    → out long to)
2077    {
2078        from = Math.Max(left._minPositiveWord, right._minPositiveWord);
2079        to = Math.Min(left._maxPositiveWord, right._maxPositiveWord);
2080    }
2081
2082    /// <summary>
2083    /// <para>
2084    /// Gets the common outer borders using the specified left.
2085    /// </para>
2086    /// <para></para>
2087    /// </summary>
2088    /// <param name="left">
2089    /// <para>The left.</para>
2090    /// <para></para>
2091    /// </param>
2092    /// <param name="right">
2093    /// <para>The right.</para>
2094    /// <para></para>
2095    /// </param>
2096    /// <param name="from">
2097    /// <para>The from.</para>
2098    /// <para></para>
2099    /// </param>

```

```

2100 /// <param name="to">
2101 /// <para>The to.</para>
2102 /// <para></para>
2103 /// </param>
2104 [MethodImpl(MethodImplOptions.AggressiveInlining)]
2105 public static void GetCommonOuterBorders(BitString left, BitString right, out long from,
    ↳ out long to)
2106 {
2107     from = Math.Min(left._minPositiveWord, right._minPositiveWord);
2108     to = Math.Max(left._maxPositiveWord, right._maxPositiveWord);
2109 }
2110
2111 /// <summary>
2112 /// <para>
2113 /// Gets the common outer borders using the specified left.
2114 /// </para>
2115 /// <para></para>
2116 /// </summary>
2117 /// <param name="left">
2118 /// <para>The left.</para>
2119 /// <para></para>
2120 /// </param>
2121 /// <param name="right">
2122 /// <para>The right.</para>
2123 /// <para></para>
2124 /// </param>
2125 /// <param name="from">
2126 /// <para>The from.</para>
2127 /// <para></para>
2128 /// </param>
2129 /// <param name="to">
2130 /// <para>The to.</para>
2131 /// <para></para>
2132 /// </param>
2133 [MethodImpl(MethodImplOptions.AggressiveInlining)]
2134 public static void GetCommonOuterBorders(BitString left, BitString right, out int from,
    ↳ out int to)
2135 {
2136     from = (int)Math.Min(left._minPositiveWord, right._minPositiveWord);
2137     to = (int)Math.Max(left._maxPositiveWord, right._maxPositiveWord);
2138 }
2139
2140 /// <summary>
2141 /// <para>
2142 /// Gets the common borders using the specified left.
2143 /// </para>
2144 /// <para></para>
2145 /// </summary>
2146 /// <param name="left">
2147 /// <para>The left.</para>
2148 /// <para></para>
2149 /// </param>
2150 /// <param name="right">
2151 /// <para>The right.</para>
2152 /// <para></para>
2153 /// </param>
2154 /// <param name="from">
2155 /// <para>The from.</para>
2156 /// <para></para>
2157 /// </param>
2158 /// <param name="to">
2159 /// <para>The to.</para>
2160 /// <para></para>
2161 /// </param>
2162 [MethodImpl(MethodImplOptions.AggressiveInlining)]
2163 public static void GetCommonBorders(BitString left, BitString right, out ulong from, out
    ↳ ulong to)
2164 {
2165     from = (ulong)Math.Max(left._minPositiveWord, right._minPositiveWord);
2166     to = (ulong)Math.Min(left._maxPositiveWord, right._maxPositiveWord);
2167 }
2168
2169 /// <summary>
2170 /// <para>
2171 /// Gets the words count from index using the specified index.
2172 /// </para>
2173 /// <para></para>
2174 /// </summary>

```

```

2175     /// <param name="index">
2176     /// <para>The index.</para>
2177     /// <para></para>
2178     /// </param>
2179     /// <returns>
2180     /// <para>The long</para>
2181     /// <para></para>
2182     /// </returns>
2183     [MethodImpl(MethodImplOptions.AggressiveInlining)]
2184     public static long GetWordsCountFromIndex(long index) => (index + 63) / 64;
2185
2186     /// <summary>
2187     /// <para>
2188     /// Gets the word index from index using the specified index.
2189     /// </para>
2190     /// <para></para>
2191     /// </summary>
2192     /// <param name="index">
2193     /// <para>The index.</para>
2194     /// <para></para>
2195     /// </param>
2196     /// <returns>
2197     /// <para>The long</para>
2198     /// <para></para>
2199     /// </returns>
2200     [MethodImpl(MethodImplOptions.AggressiveInlining)]
2201     public static long GetWordIndexFromIndex(long index) => index >> 6;
2202
2203     /// <summary>
2204     /// <para>
2205     /// Gets the bit mask from index using the specified index.
2206     /// </para>
2207     /// <para></para>
2208     /// </summary>
2209     /// <param name="index">
2210     /// <para>The index.</para>
2211     /// <para></para>
2212     /// </param>
2213     /// <returns>
2214     /// <para>The long</para>
2215     /// <para></para>
2216     /// </returns>
2217     [MethodImpl(MethodImplOptions.AggressiveInlining)]
2218     public static long GetBitMaskFromIndex(long index) => 1L << (int)(index & 63);
2219
2220     /// <summary>
2221     /// <para>
2222     /// Gets the hash code.
2223     /// </para>
2224     /// <para></para>
2225     /// </summary>
2226     /// <returns>
2227     /// <para>The int</para>
2228     /// <para></para>
2229     /// </returns>
2230     [MethodImpl(MethodImplOptions.AggressiveInlining)]
2231     public override int GetHashCode() => base.GetHashCode();
2232
2233     /// <summary>
2234     /// <para>
2235     /// Returns the string.
2236     /// </para>
2237     /// <para></para>
2238     /// </summary>
2239     /// <returns>
2240     /// <para>The string</para>
2241     /// <para></para>
2242     /// </returns>
2243     [MethodImpl(MethodImplOptions.AggressiveInlining)]
2244     public override string ToString() => base.ToString();
2245 }
2246 }

```

## 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
36            ↪ value) ? value : default;
37
38        /// <summary>
39        /// <para>
40        /// Peeks 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 PeekOrDefault<T>(this ConcurrentStack<T> stack) => stack.TryPeek(out T
58            ↪ value) ? value : default;
59    }
60 }
```

### 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 }
```

```

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,
55      ↪ ICollection<T> argument, string argumentName, string message)
56      {
57          if (argument.IsNullOrEmpty())
58          {
59              throw new ArgumentException(message, argumentName);
60          }
61      }
62
63      /// <summary>
64      /// <para>
65      /// Arguments the not empty using the specified root.
66      /// </para>
67      /// <para></para>
68      /// </summary>
69      /// <typeparam name="T">
70      /// <para>The .</para>
71      /// <para></para>
72      /// </typeparam>
73      /// <param name="root">
74      /// <para>The root.</para>
75      /// <para></para>
76      /// </param>
77      /// <param name="argument">
78      /// <para>The argument.</para>
79      /// <para></para>
80      /// </param>
81      /// <param name="argumentName">
82      /// <para>The argument name.</para>
83      /// <para></para>
84      /// </param>
85      [MethodImpl(MethodImplOptions.AggressiveInlining)]
86      public static void ArgumentNotEmpty<T>(this EnsureAlwaysExtensionRoot root,
87      ↪ ICollection<T> argument, string argumentName) => ArgumentNotEmpty(root, argument,
88      ↪ argumentName, null);
89
90      /// <summary>
91      /// <para>
92      /// Arguments the not empty using the specified root.
93      /// </para>
94      /// <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,
    ↪     string argument, string argumentName, string message)
136    {
137        if (string.IsNullOrEmpty(argument))
138        {
139            throw new ArgumentException(message, argumentName);
140        }
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,
    ↪     string argument, string argumentName) => ArgumentNotEmptyAndNotWhiteSpace(root,
    ↪     argument, argumentName, null);
163
164    /// <summary>

```

```

165     /// <para>
166     /// Arguments the not empty and not white space using the specified root.
167     /// </para>
168     /// <para></para>
169     /// </summary>
170     /// <param name="root">
171     /// <para>The root.</para>
172     /// <para></para>
173     /// </param>
174     /// <param name="argument">
175     /// <para>The argument.</para>
176     /// <para></para>
177     /// </param>
178     [MethodImpl(MethodImplOptions.AggressiveInlining)]
179     public static void ArgumentNotEmptyAndNotWhiteSpace(this EnsureAlwaysExtensionRoot root,
180         ↪ string argument) => ArgumentNotEmptyAndNotWhiteSpace(root, argument, null, null);
181
182     #endregion
183
184     #region OnDebug
185
186     /// <summary>
187     /// <para>
188     /// Arguments the not empty using the specified root.
189     /// </para>
190     /// <para></para>
191     /// </summary>
192     /// <typeparam name="T">
193     /// <para>The .</para>
194     /// <para></para>
195     /// </typeparam>
196     /// <param name="root">
197     /// <para>The root.</para>
198     /// <para></para>
199     /// </param>
200     /// <param name="argument">
201     /// <para>The argument.</para>
202     /// <para></para>
203     /// </param>
204     /// <param name="argumentName">
205     /// <para>The argument name.</para>
206     /// <para></para>
207     /// </param>
208     /// <param name="message">
209     /// <para>The message.</para>
210     /// <para></para>
211     /// </param>
212     [Conditional("DEBUG")]
213     public static void ArgumentNotEmpty<T>(this EnsureOnDebugExtensionRoot root,
214         ↪ ICollection<T> argument, string argumentName, string message) =>
215         ↪ Ensure.Always.ArgumentNotEmpty(argument, argumentName, message);
216
217     /// <summary>
218     /// <para>
219     /// Arguments the not empty using the specified root.
220     /// </para>
221     /// <para></para>
222     /// </summary>
223     /// <typeparam name="T">
224     /// <para>The .</para>
225     /// <para></para>
226     /// </typeparam>
227     /// <param name="root">
228     /// <para>The root.</para>
229     /// <para></para>
230     /// </param>
231     /// <param name="argument">
232     /// <para>The argument.</para>
233     /// <para></para>
234     /// </param>
235     /// <param name="argumentName">
236     /// <para>The argument name.</para>
237     /// <para></para>
238     /// </param>
239     [Conditional("DEBUG")]
240     public static void ArgumentNotEmpty<T>(this EnsureOnDebugExtensionRoot root,
241         ↪ ICollection<T> argument, string argumentName) =>
242         ↪ Ensure.Always.ArgumentNotEmpty(argument, argumentName, null);

```

```

238
239     /// <summary>
240     /// <para>
241     /// Arguments the not empty using the specified root.
242     /// </para>
243     /// <para></para>
244     /// </summary>
245     /// <typeparam name="T">
246     /// <para>The .</para>
247     /// <para></para>
248     /// </typeparam>
249     /// <param name="root">
250     /// <para>The root.</para>
251     /// <para></para>
252     /// </param>
253     /// <param name="argument">
254     /// <para>The argument.</para>
255     /// <para></para>
256     /// </param>
257     [Conditional("DEBUG")]
258     public static void ArgumentNotEmpty<T>(this EnsureOnDebugExtensionRoot root,
259     ↪ ICollection<T> argument) => Ensure.Always.ArgumentNotEmpty(argument, null, null);
260
261     /// <summary>
262     /// <para>
263     /// Arguments the not empty and not white space using the specified root.
264     /// </para>
265     /// <para></para>
266     /// </summary>
267     /// <param name="root">
268     /// <para>The root.</para>
269     /// <para></para>
270     /// </param>
271     /// <param name="argument">
272     /// <para>The argument.</para>
273     /// <para></para>
274     /// </param>
275     /// <param name="argumentName">
276     /// <para>The argument name.</para>
277     /// <para></para>
278     /// </param>
279     /// <param name="message">
280     /// <para>The message.</para>
281     /// <para></para>
282     /// </param>
283     [Conditional("DEBUG")]
284     public static void ArgumentNotEmptyAndNotWhiteSpace(this EnsureOnDebugExtensionRoot
285     ↪ root, string argument, string argumentName, string message) =>
286     ↪ Ensure.Always.ArgumentNotEmptyAndNotWhiteSpace(argument, argumentName, message);
287
288     /// <summary>
289     /// <para>
290     /// Arguments the not empty and not white space using the specified root.
291     /// </para>
292     /// <para></para>
293     /// </summary>
294     /// <param name="root">
295     /// <para>The root.</para>
296     /// <para></para>
297     /// </param>
298     /// <param name="argument">
299     /// <para>The argument.</para>
300     /// <para></para>
301     /// </param>
302     /// <param name="argumentName">
303     /// <para>The argument name.</para>
304     /// <para></para>
305     /// </param>
306     [Conditional("DEBUG")]
307     public static void ArgumentNotEmptyAndNotWhiteSpace(this EnsureOnDebugExtensionRoot
308     ↪ root, string argument, string argumentName) =>
309     ↪ Ensure.Always.ArgumentNotEmptyAndNotWhiteSpace(argument, argumentName, null);
310
311     /// <summary>
312     /// <para>
313     /// Arguments the not empty and not white space using the specified root.
314     /// </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>Метод принимает коллекцию элементов <see cref="ICollection<T>" /> типа.</para>
23         /// </param>
24         /// <returns>
25         /// <para>Returns a <see cref="bool" /> type variable equal to False if the collection is
26         ↪ empty else returns true.</para>
27         /// <para>Возвращает переменную типа <see cref="bool" /> равной false если коллекция
28         ↪ пустая иначе возвращает true.</para>
29         /// </returns>
30         [MethodImpl(MethodImplOptions.AggressiveInlining)]
31         public static bool IsNullOrEmpty<T>(this ICollection<T> collection) => collection ==
32         ↪ null || collection.Count == 0;
33
34         /// <summary>
35         /// <para>
36         /// <para>Determines whether all equal to default.
37         /// </para>
38         /// <para></para>
39         /// </summary>
40         /// <typeparam name="T">
41         /// <para>The .</para>
42         /// <para></para>
43         /// </typeparam>
44         /// <param name="collection">
45         /// <para>The collection.</para>
46         /// <para></para>
47         /// </param>
48         /// <returns>
49         /// <para>The bool</para>
50         /// <para></para>
51         /// </returns>
52         [MethodImpl(MethodImplOptions.AggressiveInlining)]
53         public static bool AllEqualToDefault<T>(this ICollection<T> collection)
54         {
55             var equalityComparer = EqualityComparer<T>.Default;
56             return collection.All(item => equalityComparer.Equals(item, default));
57         }
58     }
59 }

```

```
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 GetOrDefault<TKey, TValue>(this IDictionary<TKey, TValue>
45        → dictionary, TKey key)
46        {
47            dictionary.TryGetValue(key, out TValue value);
48            return value;
49        }
50
51        /// <summary>
52        /// <para>
53        /// Gets the or add using the specified dictionary.
54        /// </para>
55        /// <para></para>
56        /// </summary>
57        /// <typeparam name="TKey">
58        /// <para>The key.</para>
59        /// <para></para>
60        /// </typeparam>
61        /// <typeparam name="TValue">
62        /// <para>The value.</para>
63        /// <para></para>
64        /// </typeparam>
65        /// <param name="dictionary">
66        /// <para>The dictionary.</para>
67        /// <para></para>
68        /// </param>
69        /// <param name="key">
70        /// <para>The key.</para>
71        /// <para></para>
72        /// </param>
73        /// <param name="valueFactory">
74        /// <para>The value factory.</para>
75        /// <para></para>
```

```

75     /// </param>
76     /// <returns>
77     /// <para>The value.</para>
78     /// <para></para>
79     /// </returns>
80     [MethodImpl(MethodImplOptions.AggressiveInlining)]
81     public static TValue GetOrAdd<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         return value;
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>
23         /// <para>Хэш-код списка.</para>
24         /// </returns>
25         /// <remarks>
26         /// Based on https://github.com/Microsoft/referencesource/blob/3b1eaf5203992df69de44c7831a3eda37d3d4cd10/mscorlib/system/string.cs#L833
27         ↪
28         /// </remarks>
29         [MethodImpl(MethodImplOptions.AggressiveInlining)]
30         public static int GenerateHashCode(this IList<char> list)
31         {
32             var hashSeed = 5381;
33             var hashAccumulator = hashSeed;
34             for (var i = 0; i < list.Count; i++)
35             {
36                 hashAccumulator = (hashAccumulator << 5) + hashAccumulator ^ list[i];
37             }
38             return hashAccumulator + (hashSeed * 1566083941);
39         }
40
41         /// <summary>
42         /// <para>Compares two lists for equality.</para>
43         /// <para>Сравнивает два списка на равенство.</para>
44         /// </summary>
45         /// <param name="left"><para>The first compared list.</para><para>Первый список для
46         ↪ сравнения.</para></param>
47         /// <param name="right"><para>The second compared list.</para><para>Второй список для
48         ↪ сравнения.</para></param>
49         /// <returns>
50         /// <para>True, if the passed lists are equal to each other otherwise false.</para>
51         /// <para>True, если переданные списки равны друг другу, иначе false.</para>
52         /// </returns>
53         [MethodImpl(MethodImplOptions.AggressiveInlining)]
54         public static bool EqualTo(this IList<char> left, IList<char> right) =>
55             ↪ left.EqualTo(right, ContentEqualTo);
56
57         /// <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
46     ///     ↪ списков <paramref name="left" /> и <paramref name="right" /> как показано в
47     ///     ↪ следующей таблице.
48     ///     <list type="table">
49     ///         <listheader>
50     ///             <term>Значение</term>
51     ///             <description>Смысл</description>
52     ///         </listheader>
53     ///         <item>
54     ///             <term>Меньше нуля</term>
55     ///             <description>Первый не равный элемент <paramref name="left" /> списка
56     ///             ↪ меньше первого неравного элемента <paramref name="right" /> списка.</description>
57     ///         </item>
58     ///         <item>
59     ///             <term>Ноль</term>
60     ///             <description>Все элементы <paramref name="left" /> списка равны всем
61     ///             ↪ элементам <paramref name="right" /> списка.</description>
62     ///         </item>
63     ///         <item>
64     ///             <term>Больше нуля</term>
65     ///             <description>Первый не равный элемент <paramref name="left" /> списка
66     ///             ↪ больше первого неравного элемента <paramref name="right" /> списка.</description>
67     ///         </item>
68     ///     </list>
69     /// </para>
70     /// </returns>
71     [MethodImpl(MethodImplOptions.AggressiveInlining)]
72     public int Compare(ICollection<T> left, ICollection<T> right) => left.CompareTo(right);
73 }
74 }

```

## 1.17 ./csharp/Platform.Collections/Lists/ICollectionEqualityComparer.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="ICollectionEqualityComparer{T}" />
13     public class ICollectionEqualityComparer<T> : ICollectionEqualityComparer<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
20         ///     ↪ сравнения.</para></param>
21         /// <param name="right"><para>The second compared list.</para><para>Второй список для
22         ///     ↪ сравнения.</para></param>
23         /// <returns>
24         /// <para>If the passed lists are equal to each other, true is returned, otherwise
25         ///     ↪ false.</para>
26         /// <para>Если переданные списки равны друг другу, возвращается true, иначе же
27         ///     ↪ false.</para>
28         /// </returns>
29         [MethodImpl(MethodImplOptions.AggressiveInlining)]
30         public bool Equals(ICollection<T> left, ICollection<T> right) => left.Equals(right);
31
32         /// <summary>
33         /// <para>Generates a hash code for the entire list based on the values of its
34         ///     ↪ elements.</para>
35         /// <para>Генерирует хэш-код всего списка, на основе значений его элементов.</para>
36         /// </summary>
37         /// <param name="list"><para>Hash list.</para><para>Список для
38         ///     ↪ хеширования.</para></param>
39         /// <returns>
40         /// <para>The hash code of the list.</para>
41         /// <para>Хэш-код списка.</para>
42         /// </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
17         ///     → within the list's boundaries, otherwise it returns default value of type T.</para>
18         /// <para>Получает элемент из указанного индекса, если список не является null и индекс
19         ///     → находится в границах списка, в противном случае он возвращает значение по умолчанию
20         ///     → типа T.</para>
21         /// </summary>
22         /// <typeparam name="T"><para>The list's item type.</para><para>Тип элементов
23         ///     → списка.</para></typeparam>
24         /// <param name="list"><para>The checked list.</para><para>Проверяемый
25         ///     → список.</para></param>
26         /// <param name="index"><para>The index of element.</para><para>Индекс
27         ///     → элемента.</para></param>
28         /// <returns>
29         /// <para>If the specified index is within list's boundaries, then - list[index],
30         ///     → otherwise the default value.</para>
31         /// <para>Если указанный индекс находится в пределах границ списка, тогда - list[index],
32         ///     → иначе же значение по умолчанию.</para>
33         /// </returns>
34         [MethodImpl(MethodImplOptions.AggressiveInlining)]
35         public static T GetElementOrDefault<T>(this IList<T> list, int index) => list != null &&
36         ///     → list.Count > index ? list[index] : default;
37
38         /// <summary>
39         /// <para>Checks if a list is passed, checks its length, and if successful, copies the
40         ///     → value of list [index] into the element variable. Otherwise, the element variable has
41         ///     → a default value.</para>
42         /// <para>Проверяет, передан ли список, сверяет его длину и в случае успеха копирует
43         ///     → значение list[index] в переменную element. Иначе переменная element имеет значение
44         ///     → по умолчанию.</para>
45         /// </summary>
46         /// <typeparam name="T"><para>The list's item type.</para><para>Тип элементов
47         ///     → списка.</para></typeparam>
48         /// <param name="list"><para>The checked list.</para><para>Список для
49         ///     → проверки.</para></param>
50         /// <param name="index"><para>The index of element.</para><para>Индекс
51         ///     → элемента.</para></param>
52         /// <param name="element"><para>Variable for passing the index
53         ///     → value.</para><para>Переменная для передачи значения индекса.</para></param>
54         /// <returns>
55         /// <para>True on success, false otherwise.</para>
56         /// <para>True в случае успеха, иначе false.</para>
57         /// </returns>
58         [MethodImpl(MethodImplOptions.AggressiveInlining)]
59         public static bool TryGetElement<T>(this IList<T> list, int index, out T element)
60         {
61             if (list != null && list.Count > index)
62             {
63                 element = list[index];
64                 return true;
65             }
66             else
67             {
68                 element = default;
69                 return false;
70             }
71         }
72     }
73 }

```

```

55 /// <summary>
56 /// <para>Adds a value to the list.</para>
57 /// <para>Добавляет значение в список.</para>
58 /// </summary>
59 /// <typeparam name="T"><para>The list's item type.</para><para>Тип элементов
60 → списка.</para></typeparam>
61 /// <param name="list"><para>The list to add the value to.</para><para>Список в который
62 → нужно добавить значение.</para></param>
63 /// <param name="element"><para>The item to add to the list.</para><para>Элемент который
64 → нужно добавить в список.</para></param>
65 /// <returns>
66 /// <para>True value in any case.</para>
67 /// <para>Значение true в любом случае.</para>
68 /// </returns>
69 [MethodImpl(MethodImplOptions.AggressiveInlining)]
70 public static bool AddAndReturnTrue<T>(this IList<T> list, T element)
71 {
72     list.Add(element);
73     return true;
74 }
75
76 /// <summary>
77 /// <para>Adds the value with first index from other list to this list.</para>
78 /// <para>Добавляет в этот список значение с первым индексом из другого списка.</para>
79 /// </summary>
80 /// <typeparam name="T"><para>The list's item type.</para><para>Тип элементов
81 → списка.</para></typeparam>
82 /// <param name="list"><para>The list to add the value to.</para><para>Список в который
83 → нужно добавить значение.</para></param>
84 /// <param name="elements"><para>The item to add to the list.</para><para>Элемент
85 → который нужно добавить в список</para></param>
86 /// <returns>
87 /// <para>True value in any case.</para>
88 /// <para>Значение true в любом случае.</para>
89 /// </returns>
90 [MethodImpl(MethodImplOptions.AggressiveInlining)]
91 public static bool AddFirstAndReturnTrue<T>(this IList<T> list, IList<T> elements)
92 {
93     list.AddFirst(elements);
94     return true;
95 }
96
97 /// <summary>
98 /// <para>Adds a value to the list at the first index.</para>
99 /// <para>Добавляет значение в список по первому индексу.</para>
100 /// </summary>
101 /// <typeparam name="T"><para>The list's item type.</para><para>Тип элементов
102 → списка.</para></typeparam>
103 /// <param name="list"><para>The list to add the value to.</para><para>Список в который
104 → нужно добавить значение.</para></param>
105 /// <param name="elements"><para>The item to add to the list.</para><para>Элемент
106 → который нужно добавить в список</para></param>
107 [MethodImpl(MethodImplOptions.AggressiveInlining)]
108 public static void AddFirst<T>(this IList<T> list, IList<T> elements) =>
109     list.Add(elements[0]);
110
111 /// <summary>
112 /// <para>Adds all elements from other list to this list and returns true.</para>
113 /// <para>Добавляет все элементы из другого списка в этот список и возвращает
114 → true.</para>
115 /// </summary>
116 /// <typeparam name="T"><para>The list's item type.</para><para>Тип элементов
117 → списка.</para></typeparam>
118 /// <param name="list"><para>The list to add the values to.</para><para>Список в который
119 → нужно добавить значения.</para></param>
120 /// <param name="elements"><para>List of values to add.</para><para>Список значений
121 → которые необходимо добавить.</para></param>
122 /// <returns>
123 /// <para>True value in any case.</para>
124 /// <para>Значение true в любом случае.</para>
125 /// </returns>
126 [MethodImpl(MethodImplOptions.AggressiveInlining)]
127 public static bool AddAllAndReturnTrue<T>(this IList<T> list, IList<T> elements)
128 {
129     list.AddAll(elements);
130     return true;
131 }

```

```

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
    → списка.</para></typeparam>
299 /// <param name="list"><para>The list to copy from.</para><para>Список для
    → копирования.</para></param>
300 /// <returns>
301 /// <para>An array with all the elements of the passed list.</para>
302 /// <para>Массив со всеми элементами переданного списка.</para>
303 /// </returns>
304 [MethodImpl(MethodImplOptions.AggressiveInlining)]
305 public static T[] ToArray<T>(this IList<T> list)

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306 {
307     var array = new T[list.Count];
308     list.CopyTo(array, 0);
309     return array;
310 }
311
312 /// <summary>
313 /// <para>Executes the passed action for each item in the list.</para>
314 /// <para>Выполняет переданное действие для каждого элемента в списке.</para>
315 /// </summary>
316 /// <typeparam name="T"><para>The list's item type.</para><para>Тип элементов
    ↳ списка.</para></typeparam>
317 /// <param name="list"><para>The list of elements for which the action will be
    ↳ executed.</para><para>Список элементов для которых будет выполняться
    ↳ действие.</para></param>
318 /// <param name="action"><para>A function that will be called for each element of the
    ↳ list.</para><para>Функция которая будет вызываться для каждого элемента
    ↳ списка.</para></param>
319 [MethodImpl(MethodImplOptions.AggressiveInlining)]
320 public static void ForEach<T>(this IList<T> list, Action<T> action)
321 {
322     for (var i = 0; i < list.Count; i++)
323     {
324         action(list[i]);
325     }
326 }
327
328 /// <summary>
329 /// <para>Generates a hash code for the entire list based on the values of its
    ↳ elements.</para>
330 /// <para>Генерирует хэш-код всего списка, на основе значений его элементов.</para>
331 /// </summary>
332 /// <typeparam name="T"><para>The list's item type.</para><para>Тип элементов
    ↳ списка.</para></typeparam>
333 /// <param name="list"><para>Hash list.</para><para>Список для
    ↳ хеширования.</para></param>
334 /// <returns>
335 /// <para>The hash code of the list.</para>
336 /// <para>Хэш-код списка.</para>
337 /// </returns>
338 /// <remarks>
339 /// Based on http://stackoverflow.com/questions/263400/what-is-the-best-algorithm-for-an
    ↳ -overridden-system-object-gethashcode
340 /// </remarks>
341 [MethodImpl(MethodImplOptions.AggressiveInlining)]
342 public static int GenerateHashCode<T>(this IList<T> list)
343 {
344     var hashAccumulator = 17;
345     for (var i = 0; i < list.Count; i++)
346     {
347         hashAccumulator = unchecked((hashAccumulator * 23) + list[i].GetHashCode());
348     }
349     return hashAccumulator;
350 }
351
352 /// <summary>
353 /// <para>Compares two lists.</para>
354 /// <para>Сравнивает два списка.</para>
355 /// </summary>
356 /// <typeparam name="T"><para>The list's item type.</para><para>Тип элементов
    ↳ списка.</para></typeparam>
357 /// <param name="left"><para>The first compared list.</para><para>Первый список для
    ↳ сравнения.</para></param>
358 /// <param name="right"><para>The second compared list.</para><para>Второй список для
    ↳ сравнения.</para></param>
359 /// <returns>
360 /// <para>
361 ///     A signed integer that indicates the relative values of <paramref name="left" />
    ↳ and <paramref name="right" /> lists' elements, as shown in the following table.
362 ///     <list type="table">
363 ///         <listheader>
364 ///             <term>Value</term>
365 ///             <description>Meaning</description>
366 ///         </listheader>
367 ///         <item>
368 ///             <term>Is less than zero</term>

```

```

369      <description>First non equal element of <paramref name="left" /> list is
370      ↪ less than first not equal element of <paramref name="right" /> list.</description>
371    </item>
372    <term>Zero</term>
373    <description>All elements of <paramref name="left" /> list equals to all
374    ↪ elements of <paramref name="right" /> list.</description>
375  </item>
376  <term>Is greater than zero</term>
377  <description>First non equal element of <paramref name="left" /> list is
378  ↪ greater than first not equal element of <paramref name="right" /> list.</description>
379  </item>
380  </list>
381  </para>
382  <para>
383    Целое число со знаком, которое указывает относительные значения элементов
384    ↪ списков <paramref name="left" /> и <paramref name="right" /> как показано в
385    ↪ следующей таблице.
386    <list type="table">
387      <listheader>
388        <term>Значение</term>
389        <description>Смысл</description>
390      </listheader>
391      <item>
392        <term>Меньше нуля</term>
393        <description>Первый не равный элемент <paramref name="left" /> списка
394        ↪ меньше первого неравного элемента <paramref name="right" /> списка.</description>
395      </item>
396      <item>
397        <term>Ноль</term>
398        <description>Все элементы <paramref name="left" /> списка равны всем
399        ↪ элементам <paramref name="right" /> списка.</description>
400      </item>
401      <item>
402        <term>Больше нуля</term>
403        <description>Первый не равный элемент <paramref name="left" /> списка
404        ↪ больше первого неравного элемента <paramref name="right" /> списка.</description>
405      </item>
406    </list>
407  </para>
408  </returns>
409  [MethodImpl(MethodImplOptions.AggressiveInlining)]
410  public static int CompareTo<T>(this IList<T> left, IList<T> right)
411  {
412    var comparer = Comparer<T>.Default;
413    var leftCount = left.GetCountOrZero();
414    var rightCount = right.GetCountOrZero();
415    var intermediateResult = leftCount.CompareTo(rightCount);
416    for (var i = 0; intermediateResult == 0 && i < leftCount; i++)
417    {
418      intermediateResult = comparer.Compare(left[i], right[i]);
419    }
420    return intermediateResult;
421  }
422
423  <summary>
424  <para>Skips one element in the list and builds an array from the remaining
425  ↪ elements.</para>
426  <para>Пропускает один элемент списка и составляет из оставшихся элементов
427  ↪ массив.</para>
428  </summary>
429  <typeparam name="T"><para>The list's item type.</para><para>Тип элементов
430  ↪ списка.</para></typeparam>
431  <param name="list"><para>The list to copy from.</para><para>Список для
432  ↪ копирования.</para></param>
433  </returns>
434  <para>If the list is empty, returns an empty array, otherwise - an array with a
435  ↪ missing first element.</para>
436  <para>Если список пуст, возвращает пустой массив, иначе - массив с пропущенным
437  ↪ первым элементом.</para>
438  </returns>
439  [MethodImpl(MethodImplOptions.AggressiveInlining)]
440  public static T[] SkipFirst<T>(this IList<T> list) => list.SkipFirst(1);
441
442  <summary>

```

```

431 /// <para>Skips the specified number of elements in the list and builds an array from
432   ↳ the remaining elements.</para>
433 /// <para>Пропускает указанное количество элементов списка и составляет из оставшихся
434   ↳ элементов массив.</para>
435 /// </summary>
436 /// <typeparam name="T"><para>The list's item type.</para><para>Тип элементов
437   ↳ списка.</para></typeparam>
438 /// <param name="list"><para>The list to copy from.</para><para>Список для
439   ↳ копирования.</para></param>
440 /// <param name="skip"><para>The number of items to skip.</para><para>Количество
441   ↳ пропускаемых элементов.</para></param>
442 /// <returns>
443 /// <para>If the list is empty, or the number of skipped elements is greater than the
444   ↳ list, returns an empty array, otherwise - an array with the specified number of
445   ↳ missing elements.</para>
446 /// <para>Если список пуст, или количество пропускаемых элементов больше списка -
447   ↳ возвращает пустой массив, иначе - массив с указанным количеством пропущенных
448   ↳ элементов.</para>
449 /// </returns>
450 [MethodImpl(MethodImplOptions.AggressiveInlining)]
451 public static T[] SkipFirst<T>(this IList<T> list, int skip)
452 {
453     if (list.IsNullOrEmpty() || list.Count <= skip)
454     {
455         return Array.Empty<T>();
456     }
457     var result = new T[list.Count - skip];
458     for (int r = skip, w = 0; r < list.Count; r++, w++)
459     {
460         result[w] = list[r];
461     }
462     return result;
463 }
464
465 /// <summary>
466 /// <para>Shifts all the elements of the list by one position to the right.</para>
467 /// <para>Сдвигает вправо все элементы списка на одну позицию.</para>
468 /// </summary>
469 /// <typeparam name="T"><para>The list's item type.</para><para>Тип элементов
470   ↳ списка.</para></typeparam>
471 /// <param name="list"><para>The list to copy from.</para><para>Список для
472   ↳ копирования.</para></param>
473 /// <returns>
474 /// <para>Array with a shift of elements by one position.</para>
475 /// <para>Массив со сдвигом элементов на одну позицию.</para>
476 /// </returns>
477 [MethodImpl(MethodImplOptions.AggressiveInlining)]
478 public static IList<T> ShiftRight<T>(this IList<T> list) => list.ShiftRight(1);
479
480 /// <summary>
481 /// <para>Shifts all elements of the list to the right by the specified number of
482   ↳ elements.</para>
483 /// <para>Сдвигает вправо все элементы списка на указанное количество элементов.</para>
484 /// </summary>
485 /// <typeparam name="T"><para>The list's item type.</para><para>Тип элементов
486   ↳ списка.</para></typeparam>
487 /// <param name="list"><para>The list to copy from.</para><para>Список для
488   ↳ копирования.</para></param>
489 /// <param name="shift"><para>The number of items to shift.</para><para>Количество
490   ↳ сдвигаемых элементов.</para></param>
491 /// <returns>
492 /// <para>If the value of the shift variable is less than zero - an <see
493   ↳ cref="NotImplementedException"/> exception is thrown, but if the value of the shift
494   ↳ variable is 0 - an exact copy of the array is returned. Otherwise, an array is
495   ↳ returned with the shift of the elements.</para>
496 /// <para>Если значение переменной shift меньше нуля - выбрасывается исключение <see
497   ↳ cref="NotImplementedException"/>, если же значение переменной shift равно 0 -
498   ↳ возвращается точная копия массива. Иначе возвращается массив со сдвигом
499   ↳ элементов.</para>
500 /// </returns>
501 [MethodImpl(MethodImplOptions.AggressiveInlining)]
502 public static IList<T> ShiftRight<T>(this IList<T> list, int shift)
503 {
504     if (shift < 0)
505     {
506         throw new NotImplementedException();
507     }
508 }

```



```

486     }
487     if (shift == 0)
488     {
489         return list.ToArray();
490     }
491     else
492     {
493         var result = new T[list.Count + shift];
494         for (int r = 0, w = shift; r < list.Count; r++, w++)
495         {
496             result[w] = list[r];
497         }
498         return result;
499     }
500 }
501 }
502 }

```

### 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
34         ↪ заполняться.</para></param>
35         /// <param name="returnConstant"><para>The value for the constant returned by
36         ↪ corresponding methods.</para><para>Значение для константы возвращаемой
37         ↪ соответствующими методами.</para></param>
38         [MethodImpl(MethodImplOptions.AggressiveInlining)]
39         public ListFiller(List<TElement> list, TReturnConstant returnConstant)
40         {
41             _list = list;
42             _returnConstant = returnConstant;
43         }
44
45         /// <summary>
46         /// <para>
47         /// Initializes a new <see cref="ListFiller"/> instance.
48         /// </para>
49         /// <para></para>
50         /// </summary>
51         /// <param name="list">
52         /// <para>A list.</para>
53         /// <para></para>
54         /// </param>
55         [MethodImpl(MethodImplOptions.AggressiveInlining)]
56         public ListFiller(List<TElement> list) : this(list, default) { }
57
58         /// <summary>
59         /// <para>Adds an item to the end of the list.</para>
60         /// <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(ICollection<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(ICollection<TElement> elements) =>
    → _list.AddAllAndReturnTrue(elements);
98
99     /// <summary>
100    /// <para>Adds values to the list skipping the first element.</para>
101    /// <para>Добавляет значения в список пропуская первый элемент.</para>
102    /// </summary>
103    /// <param name="elements"><para>The list of values to add.</para><para>Список значений
    → которые необходимо добавить.</para></param>
104    /// <returns>
105    /// <para>True value in any case.</para>
106    /// <para>Значение true в любом случае.</para>
107    /// </returns>
108    [MethodImpl(MethodImplOptions.AggressiveInlining)]
109    public bool AddSkipFirstAndReturnTrue(ICollection<TElement> elements) =>
    → _list.AddSkipFirstAndReturnTrue(elements);
110
111    /// <summary>
112    /// <para>Adds an item to the end of the list and return constant.</para>
113    /// <para>Добавляет элемент в конец списка и возвращает константу.</para>
114    /// </summary>
115    /// <param name="element"><para>Element to add.</para><para>Добавляемый
    → элемент.</para></param>
116    /// <returns>
117    /// <para>Constant value in any case.</para>
118    /// <para>Значение константы в любом случае.</para>
119    /// </returns>
120    [MethodImpl(MethodImplOptions.AggressiveInlining)]
121    public TReturnConstant AddAndReturnConstant(TElement element)
122    {
123        _list.Add(element);
124        return _returnConstant;
    }

```

```

125     }
126
127     /// <summary>
128     /// <para>Adds a value to the list at the first index and return constant.</para>
129     /// <para>Добавляет значение в список по первому индексу и возвращает константу.</para>
130     /// </summary>
131     /// <param name="element"><para>Element to add.</para><para>Добавляемый
    → элемент.</para></param>
132     /// <returns>
133     /// <para>Constant value in any case.</para>
134     /// <para>Значение константы в любом случае.</para>
135     /// </returns>
136     [MethodImpl(MethodImplOptions.AggressiveInlining)]
137     public TReturnConstant AddFirstAndReturnConstant(ICollection<TElement> elements)
138     {
139         _list.AddFirst(elements);
140         return _returnConstant;
141     }
142
143     /// <summary>
144     /// <para>Adds all elements from other list to this list and returns constant.</para>
145     /// <para>Добавляет все элементы из другого списка в этот список и возвращает
    → константу.</para>
146     /// </summary>
147     /// <param name="elements"><para>List of values to add.</para><para>Список значений
    → которые необходимо добавить.</para></param>
148     /// <returns>
149     /// <para>Constant value in any case.</para>
150     /// <para>Значение константы в любом случае.</para>
151     /// </returns>
152     [MethodImpl(MethodImplOptions.AggressiveInlining)]
153     public TReturnConstant AddAllAndReturnConstant(ICollection<TElement> elements)
154     {
155         _list.AddAll(elements);
156         return _returnConstant;
157     }
158
159     /// <summary>
160     /// <para>Adds values to the list skipping the first element and return constant
    → value.</para>
161     /// <para>Добавляет значения в список пропуская первый элемент и возвращает значение
    → константы.</para>
162     /// </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(ICollection<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(ICollection<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 ICollection<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(ICollection<char> left, ICollection<char> right)
83         {
84             // Base can be not an array, but still ICollection<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 относительного исходного списка (индекс с которого
33         ↪ начинается этот сегмент).</para>
34         /// </summary>
35         public int Offset
36         {

```

```

34     [MethodImpl(MethodImplOptions.AggressiveInlining)]
35     get;
36 }
37 /// <summary>
38 /// <para>Gets the length of a segment.</para>
39 /// <para>Возвращает длину сегмента.</para>
40 /// </summary>
41 public int Length
42 {
43     [MethodImpl(MethodImplOptions.AggressiveInlining)]
44     get;
45 }
46
47 /// <summary>
48 /// <para>Initializes a new instance of the <see cref="Segment"/> class, using the
49   → <paramref name="base"/> list, <paramref name="offset"/> of the segment and its
50   → <paramref name="length" />.</para>
51 /// <para>Инициализирует новый экземпляр класса <see cref="Segment"/>, используя список
52   → <paramref name="base"/>, <paramref name="offset"/> сегмента и его <paramref
53   → name="length"/>.</para>
54 /// </summary>
55 /// <param name="base"><para>The reference to the original list containing the elements
56   → of this segment.</para><para>Ссылка на исходный список в котором находятся элементы
57   → этого сегмента.</para></param>
58 /// <param name="offset"><para>The offset relative to the <paramref name="base"/> list
59   → from which the segment starts.</para><para>Смещение относительно списка <paramref
60   → name="base"/>, с которого начинается сегмент.</para></param>
61 /// <param name="length"><para>The segment's length.</para><para>Длина
62   → сегмента.</para></param>
63 [MethodImpl(MethodImplOptions.AggressiveInlining)]
64 public Segment(IList<T> @base, int offset, int length)
65 {
66     Base = @base;
67     Offset = offset;
68     Length = length;
69 }
70
71 /// <summary>
72 /// <para>Gets the hash code of the current <see cref="Segment"/> instance.</para>
73 /// <para>Возвращает хэш-код текущего экземпляра <see cref="Segment"/>.</para>
74 /// </summary>
75 /// <returns></returns>
76 [MethodImpl(MethodImplOptions.AggressiveInlining)]
77 public override int GetHashCode() => this.GenerateHashCode();
78
79 /// <summary>
80 /// <para>Returns a value indicating whether the current <see cref="Segment"/> is equal
81   → to another <see cref="Segment" />.</para>
82 /// <para>Возвращает значение определяющее, равен ли текущий <see cref="Segment"/>
83   → другому <see cref="Segment"/>.</para>
84 /// </summary>
85 /// <param name="other"><para>An <see cref="Segment"/> object to compare with the
86   → current <see cref="Segment"/>.</para><para>Объект <see cref="Segment"/> для
87   → сравнения с текущим <see cref="Segment"/>.</para></param>
88 /// <returns>
89 /// <para><see langword="true"/> if the current <see cref="Segment"/> is equal to the
90   → <paramref name="other"/> parameter; otherwise, <see langword="false"/>.</para>
91 /// <para><see langword="true"/>, если текущий <see cref="Segment"/> равен параметру
92   → <paramref name="other"/>, в противном случае - <see langword="false"/>.</para>
93 /// </returns>
94 [MethodImpl(MethodImplOptions.AggressiveInlining)]
95 public virtual bool Equals(Segment<T> other) => this.EqualTo(other);

```

```

96 [MethodImpl(MethodImplOptions.AggressiveInlining)]
97 public override bool Equals(object obj) => obj is Segment<T> other ? Equals(other) :
    ↳ false;
98
99 #region IList
100
101 /// <summary>
102 /// <para>
103 /// The value.
104 /// </para>
105 /// <para></para>
106 /// </summary>
107 public T this[int i]
108 {
109     [MethodImpl(MethodImplOptions.AggressiveInlining)]
110     get => Base[Offset + i];
111     [MethodImpl(MethodImplOptions.AggressiveInlining)]
112     set => Base[Offset + i] = value;
113 }
114
115 /// <summary>
116 /// <para>Gets the number of elements contained in the <see cref="Segment"/>.</para>
117 /// <para>Возвращает число элементов, содержащихся в <see cref="Segment"/>.</para>
118 /// </summary>
119 /// <value>
120 /// <para>The number of elements contained in the <see cref="Segment"/>.</para>
121 /// <para>Число элементов, содержащихся в <see cref="Segment"/>.</para>
122 /// </value>
123 public int Count
124 {
125     [MethodImpl(MethodImplOptions.AggressiveInlining)]
126     get => Length;
127 }
128
129 /// <summary>
130 /// <para>Gets a value indicating whether the <see cref="Segment"/> is read-only.</para>
131 /// <para>Возвращает значение, указывающее, является ли <see cref="Segment"/> доступным
    ↳ только для чтения.</para>
132 /// </summary>
133 /// <value>
134 /// <para><see langword="true"/> if the <see cref="Segment"/> is read-only; otherwise,
    ↳ <see langword="false"/>.</para>
135 /// <para>Значение <see langword="true"/>, если <see cref="Segment"/> доступен только
    ↳ для чтения, в противном случае - значение <see langword="false"/>.</para>
136 /// </value>
137 /// <remarks>
138 /// <para>Any <see cref="Segment"/> is read-only.</para>
139 /// <para>Любой <see cref="Segment"/> доступен только для чтения.</para>
140 /// </remarks>
141 public bool IsReadOnly
142 {
143     [MethodImpl(MethodImplOptions.AggressiveInlining)]
144     get => true;
145 }
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
    ↳ cref="Segment"/>.</para><para>Элемент для поиска в <see
    ↳ cref="Segment"/>.</para></param>
152 /// <returns>
153 /// <para>The index of <paramref name="item"/> if found in the segment; otherwise,
    ↳ -1.</para>
154 /// <para>Индекс <paramref name="item"/>, если он найден в сегменте; в противном случае
    ↳ - значение -1.</para>
155 /// </returns>
156 [MethodImpl(MethodImplOptions.AggressiveInlining)]
157 public int IndexOf(T item)
158 {
159     var index = Base.IndexOf(item);
160     if (index >= Offset)
161     {
162         var actualIndex = index - Offset;
163         if (actualIndex < Length)
164         {
165             return actualIndex;

```

```

166     }
167 }
168 return -1;
169 }
170
171 /// <summary>
172 /// <para>Inserts an item to the <see cref="Segment"/> at the specified index.</para>
173 /// <para>Вставляет элемент в <see cref="Segment"/> по указанному индексу.</para>
174 /// </summary>
175 /// <param name="index"><para>The zero-based index at which <paramref name="item"/>
  → should be inserted.</para><para>Отсчитываемый от нуля индекс, по которому следует
  → вставить элемент <paramref name="item"/>.</para></param>
176 /// <param name="item"><para>The element to insert into the <see
  → cref="Segment"/>.</para><para>Элемент, вставляемый в <see
  → cref="Segment"/>.</para></param>
177 /// <exception cref="NotSupportedException">
178 /// <para>The <see cref="Segment"/> is read-only.</para>
179 /// <para><see cref="Segment"/> доступен только для чтения.</para>
180 /// </exception>
181 [MethodImpl(MethodImplOptions.AggressiveInlining)]
182 public void Insert(int index, T item) => throw new NotSupportedException();
183
184 /// <summary>
185 /// <para>Removes the <see cref="Segment"/> item at the specified index.</para>
186 /// <para>Удаляет элемент <see cref="Segment"/> по указанному индексу.</para>
187 /// </summary>
188 /// <param name="index"><para>The zero-based index of the item to
  → remove.</para><para>Отсчитываемый от нуля индекс элемента для
  → удаления.</para></param>
189 /// <exception cref="NotSupportedException">
190 /// <para>The <see cref="Segment"/> is read-only.</para>
191 /// <para><see cref="Segment"/> доступен только для чтения.</para>
192 /// </exception>
193 [MethodImpl(MethodImplOptions.AggressiveInlining)]
194 public void RemoveAt(int index) => throw new NotSupportedException();
195
196 /// <summary>
197 /// <para>Adds an item to the <see cref="Segment"/>.</para>
198 /// <para>Добавляет элемент в <see cref="Segment"/>.</para>
199 /// </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         /// <summary>
19         /// <para>
20         /// The minimum string segment length.
21         /// </para>
22         /// <para></para>
23         /// </summary>
24         private readonly int _minimumStringSegmentLength;
25
26         /// <summary>
27         /// <para>
28         /// Initializes a new <see cref="AllSegmentsWalkerBase"/> instance.
29         /// </para>
30         /// <para></para>
31         /// </summary>
32         /// <param name="minimumStringSegmentLength">
33         /// <para>A minimum string segment length.</para>
34         /// <para></para>
35         /// </param>
36         [MethodImpl(MethodImplOptions.AggressiveInlining)]
37         protected AllSegmentsWalkerBase(int minimumStringSegmentLength) =>
38             ↪ _minimumStringSegmentLength = minimumStringSegmentLength;
39
40         /// <summary>
41         /// <para>
42         /// Initializes a new <see cref="AllSegmentsWalkerBase"/> instance.
43         /// </para>
44         /// <para></para>
45         /// </summary>
46         [MethodImpl(MethodImplOptions.AggressiveInlining)]
47         protected AllSegmentsWalkerBase() : this(DefaultMinimumStringSegmentLength) { }
48
49         /// <summary>
50         /// <para>
51         /// Walks the all using the specified elements.
52         /// </para>
53         /// <para></para>
54         /// </summary>
55         /// <param name="elements">
```

```

55     /// <para>The elements.</para>
56     /// <para></para>
57     /// </param>
58     [MethodImpl(MethodImplOptions.AggressiveInlining)]
59     public virtual void WalkAll(ICollection<T> elements)
60     {
61         for (int offset = 0, maxOffset = elements.Count - _minimumStringSegmentLength;
62             ↪ offset <= maxOffset; offset++)
63         {
64             for (int length = _minimumStringSegmentLength, maxLength = elements.Count -
65                 ↪ offset; length <= maxLength; length++)
66             {
67                 Iteration(CreateSegment(elements, offset, length));
68             }
69         }
70         /// <summary>
71         /// <para>
72         /// Creates the segment using the specified elements.
73         /// </para>
74         /// <para></para>
75         /// </summary>
76         /// <param name="elements">
77         /// <para>The elements.</para>
78         /// <para></para>
79         /// </param>
80         /// <param name="offset">
81         /// <para>The offset.</para>
82         /// <para></para>
83         /// </param>
84         /// <param name="length">
85         /// <para>The length.</para>
86         /// <para></para>
87         /// </param>
88         /// <returns>
89         /// <para>The segment</para>
90         /// <para></para>
91         /// </returns>
92         [MethodImpl(MethodImplOptions.AggressiveInlining)]
93         protected abstract TSegment CreateSegment(ICollection<T> elements, int offset, int length);
94
95         /// <summary>
96         /// <para>
97         /// Iterations the segment.
98         /// </para>
99         /// <para></para>
100        /// </summary>
101        /// <param name="segment">
102        /// <para>The segment.</para>
103        /// <para></para>
104        /// </param>
105        [MethodImpl(MethodImplOptions.AggressiveInlining)]
106        protected abstract void Iteration(TSegment segment);
107    }
108 }

```

#### 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(IList<T> elements, int offset, int length)
41     ↪ => new Segment<T>(elements, offset, length);
42 }

```

## 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         /// <para></para>
38         /// </summary>
39         /// <typeparam name="TSegment">
40         /// <para>The segment.</para>
41         /// <para></para>
42         /// </typeparam>
43         /// <param name="walker">
44         /// <para>The walker.</para>
45         /// <para></para>
46         /// </param>
47         /// <param name="@string">
48         /// <para>The string.</para>
49         /// <para></para>
50         /// </param>
51         [MethodImpl(MethodImplOptions.AggressiveInlining)]

```

```

51         public static void WalkAll<TSegment>(this AllSegmentsWalkerBase<char, TSegment> walker,
        ↪     string @string) where TSegment : Segment<char> =>
        ↪     walker.WalkAll(@string.ToCharArray());
52     }
53 }

```

## 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> :
        ↪ DuplicateSegmentsWalkerBase<T, TSegment>
        ↪ where TSegment : Segment<T>
17     {
18         /// <summary>
19         /// <para>
20         /// The default reset dictionary on each walk.
21         /// </para>
22         /// <para></para>
23         /// </summary>
24         public static readonly bool DefaultResetDictionaryOnEachWalk;
25
26         /// <summary>
27         /// <para>
28         /// The reset dictionary on each walk.
29         /// </para>
30         /// <para></para>
31         /// </summary>
32         private readonly bool _resetDictionaryOnEachWalk;
33         /// <summary>
34         /// <para>
35         /// The dictionary.
36         /// </para>
37         /// <para></para>
38         /// </summary>
39         protected IDictionary<TSegment, long> Dictionary;
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         /// <param name="resetDictionaryOnEachWalk">
56         /// <para>A reset dictionary on each walk.</para>
57         /// <para></para>
58         /// </param>
59         [MethodImpl(MethodImplOptions.AggressiveInlining)]
60         protected DictionaryBasedDuplicateSegmentsWalkerBase(IDictionary<TSegment, long>
        ↪     dictionary, int minimumStringSegmentLength, bool resetDictionaryOnEachWalk)
        ↪     : base(minimumStringSegmentLength)
61         {
62             Dictionary = dictionary;
63             _resetDictionaryOnEachWalk = resetDictionaryOnEachWalk;
64         }
65
66         /// <summary>
67         /// <para>
68         /// Initializes a new <see cref="DictionaryBasedDuplicateSegmentsWalkerBase"/> instance.

```

```

71     /// </para>
72     /// <para></para>
73     /// </summary>
74     /// <param name="dictionary">
75     /// <para>A dictionary.</para>
76     /// <para></para>
77     /// </param>
78     /// <param name="minimumStringSegmentLength">
79     /// <para>A minimum string segment length.</para>
80     /// <para></para>
81     /// </param>
82     [MethodImpl(MethodImplOptions.AggressiveInlining)]
83     protected DictionaryBasedDuplicateSegmentsWalkerBase(IDictionary<TSegment, long>
        ↪ dictionary, int minimumStringSegmentLength) : this(dictionary,
        ↪ minimumStringSegmentLength, DefaultResetDictionaryOnEachWalk) { }

84
85     /// <summary>
86     /// <para>
87     /// Initializes a new <see cref="DictionaryBasedDuplicateSegmentsWalkerBase"/> instance.
88     /// </para>
89     /// <para></para>
90     /// </summary>
91     /// <param name="dictionary">
92     /// <para>A dictionary.</para>
93     /// <para></para>
94     /// </param>
95     [MethodImpl(MethodImplOptions.AggressiveInlining)]
96     protected DictionaryBasedDuplicateSegmentsWalkerBase(IDictionary<TSegment, long>
        ↪ dictionary) : this(dictionary, DefaultMinimumStringSegmentLength,
        ↪ DefaultResetDictionaryOnEachWalk) { }

97
98     /// <summary>
99     /// <para>
100    /// Initializes a new <see cref="DictionaryBasedDuplicateSegmentsWalkerBase"/> instance.
101    /// </para>
102    /// <para></para>
103    /// </summary>
104    /// <param name="minimumStringSegmentLength">
105    /// <para>A minimum string segment length.</para>
106    /// <para></para>
107    /// </param>
108    /// <param name="resetDictionaryOnEachWalk">
109    /// <para>A reset dictionary on each walk.</para>
110    /// <para></para>
111    /// </param>
112    [MethodImpl(MethodImplOptions.AggressiveInlining)]
113    protected DictionaryBasedDuplicateSegmentsWalkerBase(int minimumStringSegmentLength,
        ↪ bool resetDictionaryOnEachWalk) : this(resetDictionaryOnEachWalk ? null : new
        ↪ Dictionary<TSegment, long>(), minimumStringSegmentLength, resetDictionaryOnEachWalk)
        ↪ { }

114
115    /// <summary>
116    /// <para>
117    /// Initializes a new <see cref="DictionaryBasedDuplicateSegmentsWalkerBase"/> instance.
118    /// </para>
119    /// <para></para>
120    /// </summary>
121    /// <param name="minimumStringSegmentLength">
122    /// <para>A minimum string segment length.</para>
123    /// <para></para>
124    /// </param>
125    [MethodImpl(MethodImplOptions.AggressiveInlining)]
126    protected DictionaryBasedDuplicateSegmentsWalkerBase(int minimumStringSegmentLength) :
        ↪ this(minimumStringSegmentLength, DefaultResetDictionaryOnEachWalk) { }

127
128    /// <summary>
129    /// <para>
130    /// Initializes a new <see cref="DictionaryBasedDuplicateSegmentsWalkerBase"/> instance.
131    /// </para>
132    /// <para></para>
133    /// </summary>
134    [MethodImpl(MethodImplOptions.AggressiveInlining)]
135    protected DictionaryBasedDuplicateSegmentsWalkerBase() :
        ↪ this(DefaultMinimumStringSegmentLength, DefaultResetDictionaryOnEachWalk) { }

136
137    /// <summary>
138    /// <para>

```

```

139     /// Walks the all using the specified elements.
140     /// </para>
141     /// <para></para>
142     /// </summary>
143     /// <param name="elements">
144     /// <para>The elements.</para>
145     /// <para></para>
146     /// </param>
147     [MethodImpl(MethodImplOptions.AggressiveInlining)]
148     public override void WalkAll(ICollection<T> elements)
149     {
150         if (_resetDictionaryOnEachWalk)
151         {
152             var capacity = Math.Ceiling(Math.Pow(elements.Count, 2) / 2);
153             Dictionary = new Dictionary<TSegment, long>((int)capacity);
154         }
155         base.WalkAll(elements);
156     }
157
158     /// <summary>
159     /// <para>
160     /// Gets the segment frequency using the specified segment.
161     /// </para>
162     /// <para></para>
163     /// </summary>
164     /// <param name="segment">
165     /// <para>The segment.</para>
166     /// <para></para>
167     /// </param>
168     /// <returns>
169     /// <para>The long</para>
170     /// <para></para>
171     /// </returns>
172     [MethodImpl(MethodImplOptions.AggressiveInlining)]
173     protected override long GetSegmentFrequency(TSegment segment) =>
174         Dictionary.TryGetValue(segment, out var frequency) ? frequency : 0;
175
176     /// <summary>
177     /// <para>
178     /// Sets the segment frequency using the specified segment.
179     /// </para>
180     /// <para></para>
181     /// </summary>
182     /// <param name="segment">
183     /// <para>The segment.</para>
184     /// <para></para>
185     /// </param>
186     /// <param name="frequency">
187     /// <para>The frequency.</para>
188     /// <para></para>
189     /// </param>
190     [MethodImpl(MethodImplOptions.AggressiveInlining)]
191     protected override void SetSegmentFrequency(TSegment segment, long frequency) =>
192         Dictionary[segment] = frequency;
193 }

```

## 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.

```

```

20     /// </para>
21     /// <para></para>
22     /// </summary>
23     /// <param name="dictionary">
24     /// <para>A dictionary.</para>
25     /// <para></para>
26     /// </param>
27     /// <param name="minimumStringSegmentLength">
28     /// <para>A minimum string segment length.</para>
29     /// <para></para>
30     /// </param>
31     /// <param name="resetDictionaryOnEachWalk">
32     /// <para>A reset dictionary on each walk.</para>
33     /// <para></para>
34     /// </param>
35     [MethodImpl(MethodImplOptions.AggressiveInlining)]
36     protected DictionaryBasedDuplicateSegmentsWalkerBase(IDictionary<Segment<T>, long>
        ↪ dictionary, int minimumStringSegmentLength, bool resetDictionaryOnEachWalk) :
        ↪ base(dictionary, minimumStringSegmentLength, resetDictionaryOnEachWalk) { }
37
38     /// <summary>
39     /// <para>
40     /// Initializes a new <see cref="DictionaryBasedDuplicateSegmentsWalkerBase"/> instance.
41     /// </para>
42     /// <para></para>
43     /// </summary>
44     /// <param name="dictionary">
45     /// <para>A dictionary.</para>
46     /// <para></para>
47     /// </param>
48     /// <param name="minimumStringSegmentLength">
49     /// <para>A minimum string segment length.</para>
50     /// <para></para>
51     /// </param>
52     [MethodImpl(MethodImplOptions.AggressiveInlining)]
53     protected DictionaryBasedDuplicateSegmentsWalkerBase(IDictionary<Segment<T>, long>
        ↪ dictionary, int minimumStringSegmentLength) : base(dictionary,
        ↪ minimumStringSegmentLength, DefaultResetDictionaryOnEachWalk) { }
54
55     /// <summary>
56     /// <para>
57     /// Initializes a new <see cref="DictionaryBasedDuplicateSegmentsWalkerBase"/> instance.
58     /// </para>
59     /// <para></para>
60     /// </summary>
61     /// <param name="dictionary">
62     /// <para>A dictionary.</para>
63     /// <para></para>
64     /// </param>
65     [MethodImpl(MethodImplOptions.AggressiveInlining)]
66     protected DictionaryBasedDuplicateSegmentsWalkerBase(IDictionary<Segment<T>, long>
        ↪ dictionary) : base(dictionary, DefaultMinimumStringSegmentLength,
        ↪ DefaultResetDictionaryOnEachWalk) { }
67
68     /// <summary>
69     /// <para>
70     /// 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,
        ↪ bool resetDictionaryOnEachWalk) : base(minimumStringSegmentLength,
        ↪ resetDictionaryOnEachWalk) { }
84
85     /// <summary>
86     /// <para>
87     /// Initializes a new <see cref="DictionaryBasedDuplicateSegmentsWalkerBase"/> instance.
88     /// </para>

```



```

89     /// <para></para>
90     /// </summary>
91     /// <param name="minimumStringSegmentLength">
92     /// <para>A minimum string segment length.</para>
93     /// <para></para>
94     /// </param>
95     [MethodImpl(MethodImplOptions.AggressiveInlining)]
96     protected DictionaryBasedDuplicateSegmentsWalkerBase(int minimumStringSegmentLength) :
97         ↪ base(minimumStringSegmentLength, DefaultResetDictionaryOnEachWalk) { }
98
99     /// <summary>
100    /// <para>
101    /// Initializes a new <see cref="DictionaryBasedDuplicateSegmentsWalkerBase"/> instance.
102    /// </para>
103    /// <para></para>
104    /// </summary>
105    [MethodImpl(MethodImplOptions.AggressiveInlining)]
106    protected DictionaryBasedDuplicateSegmentsWalkerBase() :
107        ↪ base(DefaultMinimumStringSegmentLength, DefaultResetDictionaryOnEachWalk) { }
108    }
109 }

```

## 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>
36         /// <para></para>
37         /// </summary>
38         [MethodImpl(MethodImplOptions.AggressiveInlining)]
39         protected DuplicateSegmentsWalkerBase() : base(DefaultMinimumStringSegmentLength) { }
40
41         /// <summary>
42         /// <para>
43         /// Iterations the segment.
44         /// </para>
45         /// <para></para>
46         /// </summary>
47         /// <param name="segment">
48         /// <para>The segment.</para>
49         /// <para></para>
50         /// </param>
51         [MethodImpl(MethodImplOptions.AggressiveInlining)]
52         protected override void Iteration(TSegment segment)
53         {
54             var frequency = GetSegmentFrequency(segment);
55             if (frequency == 1)

```

```

54         {
55             OnDuplicateFound(segment);
56         }
57         SetSegmentFrequency(segment, frequency + 1);
58     }
59
60     /// <summary>
61     /// <para>
62     /// On 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,
13         ↪ Segment<T>>
14     {
15     }
16 }

```

### 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) =>
57            ↪ set.Remove(element);
58
59        /// <summary>
60        /// <para>
61        /// Determines whether add and return true.
62        /// </para>
63        /// <para></para>
64        /// </summary>
65        /// <typeparam name="T">
66        /// <para>The .</para>
67        /// <para></para>
68        /// </typeparam>
69        /// <param name="set">
70        /// <para>The set.</para>
71        /// <para></para>
72        /// </param>
73        /// <param name="element">
74        /// <para>The element.</para>
75        /// <para></para>
76        /// </param>
77        /// <returns>
78        /// <para>The bool</para>
79        /// <para></para>
80        /// </returns>
81        [MethodImpl(MethodImplOptions.AggressiveInlining)]
82        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>
140    /// Determines whether add all and return true.
141    /// </para>
142    /// <para></para>
143    /// </summary>
144    /// <typeparam name="T">
145    /// <para>The .</para>
146    /// <para></para>
147    /// </typeparam>
148    /// <param name="set">
149    /// <para>The set.</para>
150    /// <para></para>
151    /// </param>
152    /// <param name="elements">
153    /// <para>The elements.</para>
154    /// <para></para>
155    /// </param>
156    /// <returns>
157    /// <para>The bool</para>
158    /// <para></para>
159    /// </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></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></para>
83      /// </summary>
84      /// <param name="element">
85      /// <para>The element.</para>
86      /// <para></para>
87      /// </param>
88      /// <returns>
89      /// <para>The bool</para>

```

```

90     /// <para></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></para>
100    /// </summary>
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 bool AddFirstAndReturnTrue(IList<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></para>
118    /// </summary>
119    /// <param name="elements">
120    /// <para>The elements.</para>
121    /// <para></para>
122    /// </param>
123    /// <returns>
124    /// <para>The bool</para>
125    /// <para></para>
126    /// </returns>
127    [MethodImpl(MethodImplOptions.AggressiveInlining)]
128    public bool AddAllAndReturnTrue(IList<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></para>
136    /// </summary>
137    /// <param name="elements">
138    /// <para>The elements.</para>
139    /// <para></para>
140    /// </param>
141    /// <returns>
142    /// <para>The bool</para>
143    /// <para></para>
144    /// </returns>
145    [MethodImpl(MethodImplOptions.AggressiveInlining)]
146    public bool AddSkipFirstAndReturnTrue(IList<TElement> elements) =>
147        ↪ _set.AddSkipFirstAndReturnTrue(elements);
148
149    /// <summary>
150    /// <para>
151    /// Adds the and return constant using the specified element.
152    /// </para>
153    /// <para></para>
154    /// </summary>
155    /// <param name="element">
156    /// <para>The element.</para>
157    /// <para></para>
158    /// </param>
159    /// <returns>
160    /// <para>The return constant.</para>
161    /// <para></para>
162    /// </returns>
163    [MethodImpl(MethodImplOptions.AggressiveInlining)]
164    public TReturnConstant AddAndReturnConstant(TElement element)
165    {
166        ↪ _set.Add(element);
167        return _returnConstant;
168    }

```



```

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(ICollection<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 :
58             ↪ stack.Pop();
59
60         /// <summary>
61         /// <para>
62         /// Peeks the or default using the specified stack.
63         /// </para>
64         /// <para></para>
65         /// </summary>
66         /// <typeparam name="T">
67         /// <para>The .</para>
68         /// <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()
57     ↪      : default;
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                 {
118                     left++;
119                 }
120                 if (@string[right] == charToTrim)
121                 {
122                     right--;
123                 }
124                 return @string.Substring(left, right - left + 1);
125             }
126         }
127         else
128         {
129             return @string;
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        /// <summary>
18        /// <para>
19        /// The child nodes.
20        /// </para>
21        /// <para></para>
22        /// </summary>
23        private Dictionary<object, Node> _childNodes;
24
25        /// <summary>
26        /// <para>
27        /// Gets or sets the value value.
28        /// </para>
29        /// <para></para>
30        /// </summary>
31        public object Value
32        {
33            [MethodImpl(MethodImplOptions.AggressiveInlining)]
34            get;
35            [MethodImpl(MethodImplOptions.AggressiveInlining)]
36            set;
37        }
38
39        /// <summary>
40        /// <para>
41        /// Gets the child nodes value.
42        /// </para>
43        /// <para></para>
44        /// </summary>
45        public Dictionary<object, Node> ChildNodes
46        {
47            [MethodImpl(MethodImplOptions.AggressiveInlining)]
48            get => _childNodes ?? (_childNodes = new Dictionary<object, Node>());
49        }
50
51        /// <summary>
52        /// <para>
53        /// The key.
54        /// </para>
55        /// <para></para>
56        /// </summary>
57        public Node this[object key]
58        {
59            [MethodImpl(MethodImplOptions.AggressiveInlining)]
60            get => GetChild(key) ?? AddChild(key);
61            [MethodImpl(MethodImplOptions.AggressiveInlining)]
62            set => SetChildValue(value, key);
63        }
64
65        /// <summary>
66        /// <para>
67        /// Initializes a new <see cref="Node"/> instance.
68        /// </para>
69        /// <para></para>
70        /// </summary>
71        /// <param name="value">
72        /// <para>A value.</para>
73        /// <para></para>
74        /// </param>
75        [MethodImpl(MethodImplOptions.AggressiveInlining)]
76        public Node(object value) => Value = value;
77
78        /// <summary>
79        /// <para>
80        /// Initializes a new <see cref="Node"/> instance.
81        /// </para>
82        /// <para></para>
83        /// </summary>

```

```

84 [MethodImpl(MethodImplOptions.AggressiveInlining)]
85 public Node() : this(null) { }
86
87 /// <summary>
88 /// <para>
89 /// Determines whether this instance contains child.
90 /// </para>
91 /// <para></para>
92 /// </summary>
93 /// <param name="keys">
94 /// <para>The keys.</para>
95 /// <para></para>
96 /// </param>
97 /// <returns>
98 /// <para>The bool</para>
99 /// <para></para>
100 /// </returns>
101 [MethodImpl(MethodImplOptions.AggressiveInlining)]
102 public bool ContainsChild(params object[] keys) => GetChild(keys) != null;
103
104 /// <summary>
105 /// <para>
106 /// Gets the child using the specified keys.
107 /// </para>
108 /// <para></para>
109 /// </summary>
110 /// <param name="keys">
111 /// <para>The keys.</para>
112 /// <para></para>
113 /// </param>
114 /// <returns>
115 /// <para>The node.</para>
116 /// <para></para>
117 /// </returns>
118 [MethodImpl(MethodImplOptions.AggressiveInlining)]
119 public Node GetChild(params object[] keys)
120 {
121     var node = this;
122     for (var i = 0; i < keys.Length; i++)
123     {
124         node.ChildNodes.TryGetValue(keys[i], out node);
125         if (node == null)
126         {
127             return null;
128         }
129     }
130     return node;
131 }
132
133 /// <summary>
134 /// <para>
135 /// Gets the child value using the specified keys.
136 /// </para>
137 /// <para></para>
138 /// </summary>
139 /// <param name="keys">
140 /// <para>The keys.</para>
141 /// <para></para>
142 /// </param>
143 /// <returns>
144 /// <para>The object</para>
145 /// <para></para>
146 /// </returns>
147 [MethodImpl(MethodImplOptions.AggressiveInlining)]
148 public object GetChildValue(params object[] keys) => GetChild(keys)?.Value;
149
150 /// <summary>
151 /// <para>
152 /// Adds the child using the specified key.
153 /// </para>
154 /// <para></para>
155 /// </summary>
156 /// <param name="key">
157 /// <para>The key.</para>
158 /// <para></para>
159 /// </param>
160 /// <returns>
161 /// <para>The node</para>

```



```

162     /// <para></para>
163     /// </returns>
164     [MethodImpl(MethodImplOptions.AggressiveInlining)]
165     public Node AddChild(object key) => AddChild(key, new Node(null));
166
167     /// <summary>
168     /// <para>
169     /// Adds the child using the specified key.
170     /// </para>
171     /// <para></para>
172     /// </summary>
173     /// <param name="key">
174     /// <para>The key.</para>
175     /// <para></para>
176     /// </param>
177     /// <param name="value">
178     /// <para>The value.</para>
179     /// <para></para>
180     /// </param>
181     /// <returns>
182     /// <para>The node</para>
183     /// <para></para>
184     /// </returns>
185     [MethodImpl(MethodImplOptions.AggressiveInlining)]
186     public Node AddChild(object key, object value) => AddChild(key, new Node(value));
187
188     /// <summary>
189     /// <para>
190     /// Adds the child using the specified key.
191     /// </para>
192     /// <para></para>
193     /// </summary>
194     /// <param name="key">
195     /// <para>The key.</para>
196     /// <para></para>
197     /// </param>
198     /// <param name="child">
199     /// <para>The child.</para>
200     /// <para></para>
201     /// </param>
202     /// <returns>
203     /// <para>The child.</para>
204     /// <para></para>
205     /// </returns>
206     [MethodImpl(MethodImplOptions.AggressiveInlining)]
207     public Node AddChild(object key, Node child)
208     {
209         ChildNodes.Add(key, child);
210         return child;
211     }
212
213     /// <summary>
214     /// <para>
215     /// Sets the child using the specified keys.
216     /// </para>
217     /// <para></para>
218     /// </summary>
219     /// <param name="keys">
220     /// <para>The keys.</para>
221     /// <para></para>
222     /// </param>
223     /// <returns>
224     /// <para>The node</para>
225     /// <para></para>
226     /// </returns>
227     [MethodImpl(MethodImplOptions.AggressiveInlining)]
228     public Node SetChild(params object[] keys) => SetChildValue(null, keys);
229
230     /// <summary>
231     /// <para>
232     /// Sets the child using the specified key.
233     /// </para>
234     /// <para></para>
235     /// </summary>
236     /// <param name="key">
237     /// <para>The key.</para>
238     /// <para></para>
239     /// </param>

```

```

240     /// <returns>
241     /// <para>The node</para>
242     /// <para></para>
243     /// </returns>
244     [MethodImpl(MethodImplOptions.AggressiveInlining)]
245     public Node SetChild(object key) => SetChildValue(null, key);
246
247     /// <summary>
248     /// <para>
249     /// Sets the child value using the specified value.
250     /// </para>
251     /// <para></para>
252     /// </summary>
253     /// <param name="value">
254     /// <para>The value.</para>
255     /// <para></para>
256     /// </param>
257     /// <param name="keys">
258     /// <para>The keys.</para>
259     /// <para></para>
260     /// </param>
261     /// <returns>
262     /// <para>The node.</para>
263     /// <para></para>
264     /// </returns>
265     [MethodImpl(MethodImplOptions.AggressiveInlining)]
266     public Node SetChildValue(object value, params object[] keys)
267     {
268         var node = this;
269         for (var i = 0; i < keys.Length; i++)
270         {
271             node = SetChildValue(value, keys[i]);
272         }
273         node.Value = value;
274         return node;
275     }
276
277     /// <summary>
278     /// <para>
279     /// Sets the child value using the specified value.
280     /// </para>
281     /// <para></para>
282     /// </summary>
283     /// <param name="value">
284     /// <para>The value.</para>
285     /// <para></para>
286     /// </param>
287     /// <param name="key">
288     /// <para>The key.</para>
289     /// <para></para>
290     /// </param>
291     /// <returns>
292     /// <para>The child.</para>
293     /// <para></para>
294     /// </returns>
295     [MethodImpl(MethodImplOptions.AggressiveInlining)]
296     public Node SetChildValue(object value, object key)
297     {
298         if (!ChildNodes.TryGetValue(key, out Node child))
299         {
300             child = AddChild(key, value);
301         }
302         child.Value = value;
303         return child;
304     }
305 }
306 }

```

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

```

1  using Xunit;
2  using Platform.Collections.Arrays;
3
4  namespace Platform.Collections.Tests
5  {
6      /// <summary>
7      /// <para>
8      /// Represents the array tests.
9      /// </para>
10     /// <para></para>

```

```

11  /// </summary>
12  public class ArrayTests
13  {
14      /// <summary>
15      /// <para>
16      /// Tests that get element test.
17      /// </para>
18      /// <para></para>
19      /// </summary>
20      [Fact]
21      public void GetElementTest()
22      {
23          var nullArray = (int[])null;
24          Assert.Equal(0, nullArray.GetElementOrDefault(1));
25          Assert.False(nullArray.TryGetElement(1, out int element));
26          Assert.Equal(0, element);
27          var array = new int[] { 1, 2, 3 };
28          Assert.Equal(3, array.GetElementOrDefault(2));
29          Assert.True(array.TryGetElement(2, out element));
30          Assert.Equal(3, element);
31          Assert.Equal(0, array.GetElementOrDefault(10));
32          Assert.False(array.TryGetElement(10, out element));
33          Assert.Equal(0, element);
34      }
35  }
36  }

```

#### 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      /// <summary>
9      /// <para>
10     /// Represents the bit string tests.
11     /// </para>
12     /// <para></para>
13     /// </summary>
14     public static class BitStringTests
15     {
16         /// <summary>
17         /// <para>
18         /// Tests that bit get set test.
19         /// </para>
20         /// <para></para>
21         /// </summary>
22         [Fact]
23         public static void BitGetSetTest()
24         {
25             const int n = 250;
26             var bitArray = new BitArray(n);
27             var bitString = new BitString(n);
28             for (var i = 0; i < n; i++)
29             {
30                 var value = RandomHelpers.Default.NextBoolean();
31                 bitArray.Set(i, value);
32                 bitString.Set(i, value);
33                 Assert.Equal(value, bitArray.Get(i));
34                 Assert.Equal(value, bitString.Get(i));
35             }
36         }
37
38         /// <summary>
39         /// <para>
40         /// Tests that bit vector not test.
41         /// </para>
42         /// <para></para>
43         /// </summary>
44         [Fact]
45         public static void BitVectorNotTest()
46         {
47             TestToOperationsWithSameMeaning((x, y, w, v) =>
48             {
49                 x.VectorNot();
50                 w.Not();
51             });

```

```

52     }
53
54     /// <summary>
55     /// <para>
56     /// Tests that bit parallel not test.
57     /// </para>
58     /// <para></para>
59     /// </summary>
60     [Fact]
61     public static void BitParallelNotTest()
62     {
63         TestToOperationsWithSameMeaning((x, y, w, v) =>
64         {
65             x.ParallelNot();
66             w.Not();
67         });
68     }
69
70     /// <summary>
71     /// <para>
72     /// Tests that bit parallel vector not test.
73     /// </para>
74     /// <para></para>
75     /// </summary>
76     [Fact]
77     public static void BitParallelVectorNotTest()
78     {
79         TestToOperationsWithSameMeaning((x, y, w, v) =>
80         {
81             x.ParallelVectorNot();
82             w.Not();
83         });
84     }
85
86     /// <summary>
87     /// <para>
88     /// Tests that bit vector and test.
89     /// </para>
90     /// <para></para>
91     /// </summary>
92     [Fact]
93     public static void BitVectorAndTest()
94     {
95         TestToOperationsWithSameMeaning((x, y, w, v) =>
96         {
97             x.VectorAnd(y);
98             w.And(v);
99         });
100     }
101
102     /// <summary>
103     /// <para>
104     /// Tests that bit parallel and test.
105     /// </para>
106     /// <para></para>
107     /// </summary>
108     [Fact]
109     public static void BitParallelAndTest()
110     {
111         TestToOperationsWithSameMeaning((x, y, w, v) =>
112         {
113             x.ParallelAnd(y);
114             w.And(v);
115         });
116     }
117
118     /// <summary>
119     /// <para>
120     /// Tests that bit parallel vector and test.
121     /// </para>
122     /// <para></para>
123     /// </summary>
124     [Fact]
125     public static void BitParallelVectorAndTest()
126     {
127         TestToOperationsWithSameMeaning((x, y, w, v) =>
128         {
129             x.ParallelVectorAnd(y);

```

```

130         w.And(v);
131     });
132 }
133
134 /// <summary>
135 /// <para>
136 /// Tests that bit vector or test.
137 /// </para>
138 /// <para></para>
139 /// </summary>
140 [Fact]
141 public static void BitVectorOrTest()
142 {
143     TestToOperationsWithSameMeaning((x, y, w, v) =>
144     {
145         x.VectorOr(y);
146         w.Or(v);
147     });
148 }
149
150 /// <summary>
151 /// <para>
152 /// Tests that bit parallel or test.
153 /// </para>
154 /// <para></para>
155 /// </summary>
156 [Fact]
157 public static void BitParallelOrTest()
158 {
159     TestToOperationsWithSameMeaning((x, y, w, v) =>
160     {
161         x.ParallelOr(y);
162         w.Or(v);
163     });
164 }
165
166 /// <summary>
167 /// <para>
168 /// Tests that bit parallel vector or test.
169 /// </para>
170 /// <para></para>
171 /// </summary>
172 [Fact]
173 public static void BitParallelVectorOrTest()
174 {
175     TestToOperationsWithSameMeaning((x, y, w, v) =>
176     {
177         x.ParallelVectorOr(y);
178         w.Or(v);
179     });
180 }
181
182 /// <summary>
183 /// <para>
184 /// Tests that bit vector xor test.
185 /// </para>
186 /// <para></para>
187 /// </summary>
188 [Fact]
189 public static void BitVectorXorTest()
190 {
191     TestToOperationsWithSameMeaning((x, y, w, v) =>
192     {
193         x.VectorXor(y);
194         w.Xor(v);
195     });
196 }
197
198 /// <summary>
199 /// <para>
200 /// Tests that bit parallel xor test.
201 /// </para>
202 /// <para></para>
203 /// </summary>
204 [Fact]
205 public static void BitParallelXorTest()
206 {
207     TestToOperationsWithSameMeaning((x, y, w, v) =>

```

```

208     {
209         x.ParallelXor(y);
210         w.Xor(v);
211     });
212 }
213
214 /// <summary>
215 /// <para>
216 /// Tests that bit parallel vector xor test.
217 /// </para>
218 /// <para></para>
219 /// </summary>
220 [Fact]
221 public static void BitParallelVectorXorTest()
222 {
223     TestToOperationsWithSameMeaning((x, y, w, v) =>
224     {
225         x.ParallelVectorXor(y);
226         w.Xor(v);
227     });
228 }
229
230 /// <summary>
231 /// <para>
232 /// Tests the to operations with same meaning using the specified test.
233 /// </para>
234 /// <para></para>
235 /// </summary>
236 /// <param name="test">
237 /// <para>The test.</para>
238 /// <para></para>
239 /// </param>
240 private static void TestToOperationsWithSameMeaning(Action<BitString, BitString,
    ↪ BitString, BitString> test)
241 {
242     const int n = 5654;
243     var x = new BitString(n);
244     var y = new BitString(n);
245     while (x.Equals(y))
246     {
247         x.SetRandomBits();
248         y.SetRandomBits();
249     }
250     var w = new BitString(x);
251     var v = new BitString(y);
252     Assert.False(x.Equals(y));
253     Assert.False(w.Equals(v));
254     Assert.True(x.Equals(w));
255     Assert.True(y.Equals(v));
256     test(x, y, w, v);
257     Assert.True(x.Equals(w));
258 }
259 }
260 }

```

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

```

1 using Xunit;
2 using Platform.Collections.Segments;
3
4 namespace Platform.Collections.Tests
5 {
6     /// <summary>
7     /// <para>
8     /// Represents the chars segment tests.
9     /// </para>
10    /// <para></para>
11    /// </summary>
12    public static class CharsSegmentTests
13    {
14        /// <summary>
15        /// <para>
16        /// Tests that get hash code equals test.
17        /// </para>
18        /// <para></para>
19        /// </summary>
20        [Fact]
21        public static void GetHashCodeEqualsTest()
22        {

```

```

23     const string testString = "test test";
24     var testArray = testString.ToCharArray();
25     var firstHashCode = new CharSegment(testArray, 0, 4).GetHashCode();
26     var secondHashCode = new CharSegment(testArray, 5, 4).GetHashCode();
27     Assert.Equal(firstHashCode, secondHashCode);
28 }
29
30 /// <summary>
31 /// <para>
32 /// Tests that equals test.
33 /// </para>
34 /// <para></para>
35 /// </summary>
36 [Fact]
37 public static void EqualsTest()
38 {
39     const string testString = "test test";
40     var testArray = testString.ToCharArray();
41     var first = new CharSegment(testArray, 0, 4);
42     var second = new CharSegment(testArray, 5, 4);
43     Assert.True(first.Equals(second));
44 }
45 }
46 }

```

#### 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     /// <summary>
9     /// <para>
10    /// Represents the list tests.
11    /// </para>
12    /// <para></para>
13    /// </summary>
14    public class ListTests
15    {
16        /// <summary>
17        /// <para>
18        /// Tests that get element test.
19        /// </para>
20        /// <para></para>
21        /// </summary>
22        [Fact]
23        public void GetElementTest()
24        {
25            var nullList = (IList<int>)null;
26            Assert.Equal(0, nullList.GetElementOrDefault(1));
27            Assert.False(nullList.TryGetElement(1, out int element));
28            Assert.Equal(0, element);
29            var list = new List<int>() { 1, 2, 3 };
30            Assert.Equal(3, list.GetElementOrDefault(2));
31            Assert.True(list.TryGetElement(2, out element));
32            Assert.Equal(3, element);
33            Assert.Equal(0, list.GetElementOrDefault(10));
34            Assert.False(list.TryGetElement(10, out element));
35            Assert.Equal(0, element);
36        }
37    }
38 }

```

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

```

1 using Xunit;
2
3 namespace Platform.Collections.Tests
4 {
5     /// <summary>
6     /// <para>
7     /// Represents the string tests.
8     /// </para>
9     /// <para></para>
10    /// </summary>
11    public static class StringTests
12    {

```

```

13     /// <summary>
14     /// <para>
15     /// Tests that capitalize first letter test.
16     /// </para>
17     /// <para></para>
18     /// </summary>
19     [Fact]
20     public static void CapitalizeFirstLetterTest()
21     {
22         Assert.Equal("Hello", "hello".CapitalizeFirstLetter());
23         Assert.Equal("Hello", "Hello".CapitalizeFirstLetter());
24         Assert.Equal(" Hello", " hello".CapitalizeFirstLetter());
25     }
26
27     /// <summary>
28     /// <para>
29     /// Tests that trim single test.
30     /// </para>
31     /// <para></para>
32     /// </summary>
33     [Fact]
34     public static void TrimSingleTest()
35     {
36         Assert.Equal("", "".TrimSingle('\'));
37         Assert.Equal("", "''.TrimSingle('\'));
38         Assert.Equal("hello", "'hello'.TrimSingle('\'));
39         Assert.Equal("hello", "hello".TrimSingle('\'));
40         Assert.Equal("hello", "'hello'.TrimSingle('\'));
41     }
42 }
43 }

```

#### 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
11 namespace Platform.Collections.Tests
12 {
13     /// <summary>
14     /// <para>
15     /// Represents the all repeating substrings in string.
16     /// </para>
17     /// <para></para>
18     /// </summary>
19     public class AllRepeatingSubstringsInString
20     {
21         /// <summary>
22         /// <para>
23         /// The elfen lied.
24         /// </para>
25         /// <para></para>
26         /// </summary>
27         private static readonly string elfen_lied = @"Nacht im Dorf der Wächter rief: Elfe! Ein
28             ↳ ganz kleines Elfchen im Walde schlief wohl um die Elfe! Und meint, es rief ihm aus
29             ↳ dem Tal bei seinem Namen die Nachtigall, oder Silpelit hätt' ihm gerufen.
30 Reibt sich der Elf' die Augen aus, begibt sich vor sein Schneckenhaus und ist als wie ein
31 ↳ trunken Mann, sein Schläflein war nicht voll getan, und humpelt also tippe tapp durch's
32 ↳ Haselholz in's Tal hinab, schlupft an der Mauer hin so dicht, da sitzt der Glühwurm Licht an
33 ↳ Licht.
34 Was sind das helle Fensterlein? Da drin wird eine Hochzeit sein: die Kleinen sitzen bei'm Mahle,
35 ↳ und treiben's in dem Saale. Da guck' ich wohl ein wenig 'nein!""
36 Pfui, stößt den Kopf an harten Stein! Elfe, gelt, du hast genug? Gukuk!";
37
38         /// <summary>
39         /// <para>
40         /// The example text.
41         /// </para>
42         /// <para></para>
43         /// </summary>
44         private static readonly string _exampleText =
45             @"([english version] (https://github.com/Konard/LinksPlatform/wiki/About-the-beginning))

```



39 Обозначение пустоты, какое оно? Темнота ли это? Там где отсутствие света, отсутствие фотонов  
→ (носителей света)? Или это то, что полностью отражает свет? Пустой белый лист бумаги? Там  
→ где есть место для нового начала? Разве пустота это не характеристика пространства?  
→ Пространство это то, что можно чем-то наполнить?

40 [![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)

41 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?

42 [![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)

43 А что если повторить? Сделать копию? Создать дубликат? Из одного сделать два? Может это быть  
→ так? Инверсия? Отражение? Сумма?

44 [![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)

45 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?

46 [![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)

47 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?

48 [![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)

49 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?

50 [![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)

51 Соединять, 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?

52 [![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)

53 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?

54 [![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)

55 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?

56 [![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)

57 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?

58 [![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)

```

59 На один уровень внутрь (вниз)? Или на один уровень во вне (вверх)? Или это можно назвать шагом
   ↳ рекурсии или фрактала?
60 [![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)
61 Последовательность? Массив? Список? Множество? Объект? Таблица? Цвета? Символы? Буквы?
   ↳ Слово? Цифры? Число? Алфавит? Дерево? Сеть? Граф? Гиперграф?
62 [![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)
63 ...
64 [![анимация](https://raw.githubusercontent.com/Konard/LinksPlatform/master/doc/Intro/intro-animat
   ↳ ion-500.gif
   ↳ "анимация")](https://raw.githubusercontent.com/Konard/LinksPlatform/master/doc/Intro/intro
   ↳ -animation-500.gif)";

65
66
67     /// <summary>
68     /// <para>
69     /// The exam rple text.
70     /// </para>
71     /// <para></para>
72     /// </summary>
73     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.";

74
75     /// <summary>
76     /// <para>
77     /// Tests that console tests.
78     /// </para>
79     /// <para></para>
80     /// </summary>
81     [Fact]
82     public void ConsoleTests()
83     {
84         string text = elfen_lied;
85
86         var iterationsCounter = new IterationsCounter();
87         iterationsCounter.WalkAll(text);
88         var result = iterationsCounter.IterationsCount;
89         Console.WriteLine($"TextLength: {text.Length}. Iterations: {result}.");
90
91         {
92             var start = new Stopwatch();
93             start.Start();
94
95             var walker = new Walker4();
96             walker.WalkAll(text);
97
98             //foreach (var (key, value) in walker.PublicDictionary)
99             //{
100                 // Console.WriteLine($"{key} {value}");
101             //}
102
103             start.Stop();
104             Console.WriteLine($"{{start.ElapsedMilliseconds}}ms");
105         }
106
107         {
108             var start = new Stopwatch();
109             start.Start();
110
111             var walker = new Walker2();
112             walker.WalkAll(text);
113
114             //foreach (var (key, value) in walker._cache)
115             //{
116                 // Console.WriteLine($"{key} {value}");
117             //}

```

```

118         //}
119
120         start.Stop();
121         Console.WriteLine($"{start.ElapsedMilliseconds}ms");
122     }
123
124     {
125         var start = new Stopwatch();
126         start.Start();
127
128         var walker = new Walker1();
129         walker.WalkAll(text);
130
131         start.Stop();
132         Console.WriteLine($"{start.ElapsedMilliseconds}ms");
133     }
134 }
135
136
137 /// <summary>
138 /// <para>
139 /// Represents the console printed duplicate walker base.
140 /// </para>
141 /// <para></para>
142 /// </summary>
143 /// <seealso cref="DuplicateSegmentsWalkerBase{char, CharSegment}"/>
144 public abstract class ConsolePrintedDuplicateWalkerBase : DuplicateSegmentsWalkerBase<char,
    ↳ CharSegment>
145 {
146     //protected override void OnDuplicateFound(CharSegment segment) =>
    ↳ Console.WriteLine(segment);
147
148     /// <summary>
149     /// <para>
150     /// Creates the segment using the specified elements.
151     /// </para>
152     /// <para></para>
153     /// </summary>
154     /// <param name="elements">
155     /// <para>The elements.</para>
156     /// <para></para>
157     /// </param>
158     /// <param name="offset">
159     /// <para>The offset.</para>
160     /// <para></para>
161     /// </param>
162     /// <param name="length">
163     /// <para>The length.</para>
164     /// <para></para>
165     /// </param>
166     /// <returns>
167     /// <para>The char segment</para>
168     /// <para></para>
169     /// </returns>
170     protected override CharSegment CreateSegment(IList<char> elements, int offset, int
    ↳ length) => new CharSegment(elements, offset, length);
171 }
172
173 /// <summary>
174 /// <para>
175 /// Represents the walker.
176 /// </para>
177 /// <para></para>
178 /// </summary>
179 /// <seealso cref="ConsolePrintedDuplicateWalkerBase"/>
180 public class Walker1 : ConsolePrintedDuplicateWalkerBase
181 {
182     /// <summary>
183     /// <para>
184     /// The root node.
185     /// </para>
186     /// <para></para>
187     /// </summary>
188     private Node _rootNode;
189     /// <summary>
190     /// <para>
191     /// The current node.
192     /// </para>

```

```

193     /// <para></para>
194     /// </summary>
195     private Node _currentNode;
196
197     /// <summary>
198     /// <para>
199     /// Walks the all using the specified elements.
200     /// </para>
201     /// <para></para>
202     /// </summary>
203     /// <param name="elements">
204     /// <para>The elements.</para>
205     /// <para></para>
206     /// </param>
207     public override void WalkAll(IList<char> elements)
208     {
209         _rootNode = new Node();
210
211         base.WalkAll(elements);
212
213         Console.WriteLine(_rootNode.Value);
214     }
215
216     /// <summary>
217     /// <para>
218     /// Ons the duplicate found using the specified segment.
219     /// </para>
220     /// <para></para>
221     /// </summary>
222     /// <param name="segment">
223     /// <para>The segment.</para>
224     /// <para></para>
225     /// </param>
226     protected override void OnDuplicateFound(CharSegment segment)
227     {
228
229     }
230
231     /// <summary>
232     /// <para>
233     /// Gets the segment frequency using the specified segment.
234     /// </para>
235     /// <para></para>
236     /// </summary>
237     /// <param name="segment">
238     /// <para>The segment.</para>
239     /// <para></para>
240     /// </param>
241     /// <returns>
242     /// <para>The long</para>
243     /// <para></para>
244     /// </returns>
245     protected override long GetSegmentFrequency(CharSegment segment)
246     {
247         for (int i = 0; i < segment.Length; i++)
248         {
249             var element = segment[i];
250
251             _currentNode = _currentNode[element];
252         }
253
254         if (_currentNode.Value is int)
255         {
256             return (int)_currentNode.Value;
257         }
258         else
259         {
260             return 0;
261         }
262     }
263
264     /// <summary>
265     /// <para>
266     /// Sets the segment frequency using the specified segment.
267     /// </para>
268     /// <para></para>
269     /// </summary>
270     /// <param name="segment">
271     /// <para>The segment.</para>

```

```

272     /// <para></para>
273     /// </param>
274     /// <param name="frequency">
275     /// <para>The frequency.</para>
276     /// <para></para>
277     /// </param>
278     protected override void SetSegmentFrequency(CharSegment segment, long frequency) =>
279         ↪ _currentNode.Value = frequency;
280
281     /// <summary>
282     /// <para>
283     /// Iterations the segment.
284     /// </para>
285     /// <para></para>
286     /// </summary>
287     /// <param name="segment">
288     /// <para>The segment.</para>
289     /// <para></para>
290     /// </param>
291     protected override void Iteration(CharSegment segment)
292     {
293         _currentNode = _rootNode;
294
295         base.Iteration(segment);
296     }
297
298     // Too much memory, but fast
299     /// <summary>
300     /// <para>
301     /// Represents the walker.
302     /// </para>
303     /// <para></para>
304     /// </summary>
305     /// <seealso cref="ConsolePrintedDuplicateWalkerBase"/>
306     public class Walker2 : ConsolePrintedDuplicateWalkerBase
307     {
308         /// <summary>
309         /// <para>
310         /// The cache.
311         /// </para>
312         /// <para></para>
313         /// </summary>
314         public Dictionary<string, long> _cache;
315         /// <summary>
316         /// <para>
317         /// The current key.
318         /// </para>
319         /// <para></para>
320         /// </summary>
321         private string _currentKey;
322         /// <summary>
323         /// <para>
324         /// The total duplicates.
325         /// </para>
326         /// <para></para>
327         /// </summary>
328         private int _totalDuplicates;
329
330         /// <summary>
331         /// <para>
332         /// Walks the all using the specified elements.
333         /// </para>
334         /// <para></para>
335         /// </summary>
336         /// <param name="elements">
337         /// <para>The elements.</para>
338         /// <para></para>
339         /// </param>
340         public override void WalkAll(ICollection<char> elements)
341         {
342             _cache = new Dictionary<string, long>();
343
344             base.WalkAll(elements);
345
346             Console.WriteLine($"Unique string segments: {_cache.Count}. Total duplicates:
347                 ↪ {_totalDuplicates}");
348         }

```

```

348
349     /// <summary>
350     /// <para>
351     /// Ons the dublicate found using the specified segment.
352     /// </para>
353     /// <para></para>
354     /// </summary>
355     /// <param name="segment">
356     /// <para>The segment.</para>
357     /// <para></para>
358     /// </param>
359     protected override void OnDuplicateFound(CharSegment segment)
360     {
361         _totalDuplicates++;
362     }
363
364     /// <summary>
365     /// <para>
366     /// Gets the segment frequency using the specified segment.
367     /// </para>
368     /// <para></para>
369     /// </summary>
370     /// <param name="segment">
371     /// <para>The segment.</para>
372     /// <para></para>
373     /// </param>
374     /// <returns>
375     /// <para>The long</para>
376     /// <para></para>
377     /// </returns>
378     protected override long GetSegmentFrequency(CharSegment segment) =>
379         ↪ _cache.GetOrDefault(_currentKey);
380
381     /// <summary>
382     /// <para>
383     /// Sets the segment frequency using the specified segment.
384     /// </para>
385     /// <para></para>
386     /// </summary>
387     /// <param name="segment">
388     /// <para>The segment.</para>
389     /// <para></para>
390     /// </param>
391     /// <param name="frequency">
392     /// <para>The frequency.</para>
393     /// <para></para>
394     /// </param>
395     protected override void SetSegmentFrequency(CharSegment segment, long frequency) =>
396         ↪ _cache[_currentKey] = frequency;
397
398     /// <summary>
399     /// <para>
400     /// Iterations the segment.
401     /// </para>
402     /// <para></para>
403     /// </summary>
404     /// <param name="segment">
405     /// <para>The segment.</para>
406     /// <para></para>
407     /// </param>
408     protected override void Iteration(CharSegment segment)
409     {
410         _currentKey = segment;
411         base.Iteration(segment);
412     }
413
414     /// <summary>
415     /// <para>
416     /// Represents the walker.
417     /// </para>
418     /// <para></para>
419     /// </summary>
420     /// <seealso cref="DictionaryBasedDuplicateSegmentsWalkerBase<char, CharSegment>" />
421     public class Walker4 : DictionaryBasedDuplicateSegmentsWalkerBase<char, CharSegment>
422     {
423         /// <summary>

```

```

424 /// <para>
425 /// Gets the public dictionary value.
426 /// </para>
427 /// <para></para>
428 /// </summary>
429 public IDictionary<CharSegment, long> PublicDictionary
430 {
431     get
432     {
433         return Dictionary;
434     }
435 }
436
437 /// <summary>
438 /// <para>
439 /// Initializes a new <see cref="Walker4"/> instance.
440 /// </para>
441 /// <para></para>
442 /// </summary>
443 public Walker4()
444     : base(DefaultMinimumStringSegmentLength, resetDictionaryOnEachWalk: true)
445 {
446 }
447
448 /// <summary>
449 /// <para>
450 /// The total duplicates.
451 /// </para>
452 /// <para></para>
453 /// </summary>
454 private int _totalDuplicates;
455
456 /// <summary>
457 /// <para>
458 /// Walks the all using the specified elements.
459 /// </para>
460 /// <para></para>
461 /// </summary>
462 /// <param name="elements">
463 /// <para>The elements.</para>
464 /// <para></para>
465 /// </param>
466 public override void WalkAll(ICollection<char> elements)
467 {
468     _totalDuplicates = 0;
469
470     base.WalkAll(elements);
471     Console.WriteLine($"Unique string segments: {Dictionary.Count}. Total duplicates:
472         ↪ {_totalDuplicates}.");
473 }
474
475 /// <summary>
476 /// <para>
477 /// Creates the segment using the specified elements.
478 /// </para>
479 /// <para></para>
480 /// </summary>
481 /// <param name="elements">
482 /// <para>The elements.</para>
483 /// <para></para>
484 /// </param>
485 /// <param name="offset">
486 /// <para>The offset.</para>
487 /// <para></para>
488 /// </param>
489 /// <param name="length">
490 /// <para>The length.</para>
491 /// <para></para>
492 /// </param>
493 /// <returns>
494 /// <para>The char segment</para>
495 /// <para></para>
496 /// </returns>
497 protected override CharSegment CreateSegment(ICollection<char> elements, int offset, int
498     ↪ length) => new CharSegment(elements, offset, length);
499
500 /// <summary>
501 /// <para>

```

```

500     /// Ons the duplicate found using the specified segment.
501     /// </para>
502     /// <para></para>
503     /// </summary>
504     /// <param name="segment">
505     /// <para>The segment.</para>
506     /// <para></para>
507     /// </param>
508     protected override void OnDuplicateFound(CharSegment segment)
509     {
510         _totalDuplicates++;
511     }
512 }
513
514 /// <summary>
515 /// <para>
516 /// Represents the iterations counter.
517 /// </para>
518 /// <para></para>
519 /// </summary>
520 /// <seealso cref="AllSegmentsWalkerBase{char}"/>
521 public class IterationsCounter : AllSegmentsWalkerBase<char>
522 {
523     /// <summary>
524     /// <para>
525     /// The iterations count.
526     /// </para>
527     /// <para></para>
528     /// </summary>
529     public long IterationsCount;
530
531     /// <summary>
532     /// <para>
533     /// Iterations the segment.
534     /// </para>
535     /// <para></para>
536     /// </summary>
537     /// <param name="segment">
538     /// <para>The segment.</para>
539     /// <para></para>
540     /// </param>
541     protected override void Iteration(Segment<char> segment) => IterationsCount++;
542 }
543 }

```



## Index

- ./csharp/Platform.Collections.Tests/ArrayTests.cs, 98
- ./csharp/Platform.Collections.Tests/BitStringTests.cs, 99
- ./csharp/Platform.Collections.Tests/CharsSegmentTests.cs, 102
- ./csharp/Platform.Collections.Tests/ListTests.cs, 103
- ./csharp/Platform.Collections.Tests/StringTests.cs, 103
- ./csharp/Platform.Collections.Tests/WalkersTests.cs, 104
- ./csharp/Platform.Collections/Arrays/ArrayFiller[TElement, TReturnConstant].cs, 1
- ./csharp/Platform.Collections/Arrays/ArrayFiller[TElement].cs, 2
- ./csharp/Platform.Collections/Arrays/ArrayPool.cs, 4
- ./csharp/Platform.Collections/Arrays/ArrayPool[T].cs, 5
- ./csharp/Platform.Collections/Arrays/ArrayString.cs, 7
- ./csharp/Platform.Collections/Arrays/CharArrayExtensions.cs, 8
- ./csharp/Platform.Collections/Arrays/GenericArrayExtensions.cs, 10
- ./csharp/Platform.Collections/BitString.cs, 16
- ./csharp/Platform.Collections/BitStringExtensions.cs, 45
- ./csharp/Platform.Collections/Concurrent/ConcurrentQueueExtensions.cs, 46
- ./csharp/Platform.Collections/Concurrent/ConcurrentStackExtensions.cs, 46
- ./csharp/Platform.Collections/EnsureExtensions.cs, 47
- ./csharp/Platform.Collections/ICollectionExtensions.cs, 52
- ./csharp/Platform.Collections/IDictionaryExtensions.cs, 53
- ./csharp/Platform.Collections/Lists/CharListExtensions.cs, 54
- ./csharp/Platform.Collections/Lists/ICollectionComparer.cs, 55
- ./csharp/Platform.Collections/Lists/ICollectionEqualityComparer.cs, 56
- ./csharp/Platform.Collections/Lists/ICollectionExtensions.cs, 57
- ./csharp/Platform.Collections/Lists/ListFiller.cs, 65
- ./csharp/Platform.Collections/Segments/CharSegment.cs, 67
- ./csharp/Platform.Collections/Segments/Segment.cs, 69
- ./csharp/Platform.Collections/Segments/Walkers/AllSegmentsWalkerBase.cs, 73
- ./csharp/Platform.Collections/Segments/Walkers/AllSegmentsWalkerBase[T, TSegment].cs, 74
- ./csharp/Platform.Collections/Segments/Walkers/AllSegmentsWalkerBase[T].cs, 75
- ./csharp/Platform.Collections/Segments/Walkers/AllSegmentsWalkerExtensions.cs, 76
- ./csharp/Platform.Collections/Segments/Walkers/DictionaryBasedDuplicateSegmentsWalkerBase[T, Segment].cs, 77
- ./csharp/Platform.Collections/Segments/Walkers/DictionaryBasedDuplicateSegmentsWalkerBase[T].cs, 79
- ./csharp/Platform.Collections/Segments/Walkers/DuplicateSegmentsWalkerBase[T, TSegment].cs, 81
- ./csharp/Platform.Collections/Segments/Walkers/DuplicateSegmentsWalkerBase[T].cs, 82
- ./csharp/Platform.Collections/Sets/ISetExtensions.cs, 82
- ./csharp/Platform.Collections/Sets/SetFiller.cs, 86
- ./csharp/Platform.Collections/Stacks/DefaultStack.cs, 89
- ./csharp/Platform.Collections/Stacks/IStack.cs, 90
- ./csharp/Platform.Collections/Stacks/IStackExtensions.cs, 91
- ./csharp/Platform.Collections/Stacks/IStackFactory.cs, 92
- ./csharp/Platform.Collections/Stacks/StackExtensions.cs, 92
- ./csharp/Platform.Collections/StringExtensions.cs, 93
- ./csharp/Platform.Collections/Trees/Node.cs, 94