

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         protected readonly TReturnConstant _returnConstant;
20
21         /// <summary>
22         /// <para>Initializes a new instance of the <see cref="ArrayFiller"/> class using the
23         → specified array, the offset from which filling will start and the constant returned
24         → when elements are being filled.</para>
25         /// <para>Инициализирует новый экземпляр класса <see cref="ArrayFiller"/>, используя
26         → указанный массив, смещение с которого начнётся заполнение и константу возвращаемую
27         → при заполнении элементов.</para>
28         </summary>
29         <param name="array"><para>The array to fill.</para><para>Массив для
30         → заполнения.</para></param>
31         <param name="offset"><para>The offset from which to start the array
32         → filling.</para><para>Смещение с которого начнётся заполнение массива.</para></param>
33         <param name="returnConstant"><para>The constant's value.</para><para>Значение
34         → константы.</para></param>
35         [MethodImpl(MethodImplOptions.AggressiveInlining)]
36         public ArrayFiller(TElement[] array, long offset, TReturnConstant returnConstant) :
37         → base(array, offset) => _returnConstant = returnConstant;
38
39         /// <summary>
40         /// <para>Initializes a new instance of the <see cref="ArrayFiller"/> class using the
41         → specified array and the constant returned when elements are being filled. Filling
42         → will start from the beginning of the array.</para>
43         /// <para>Инициализирует новый экземпляр класса <see cref="ArrayFiller"/>, используя
44         → указанный массив и константу возвращаемую при заполнении элементов. Заполнение
45         → начнётся с начала массива.</para>
46         </summary>
47         <param name="array"><para>The array to fill.</para><para>Массив для
48         → заполнения.</para></param>
49         <param name="returnConstant"><para>The constant's value.</para><para>Значение
50         → константы.</para></param>
51         [MethodImpl(MethodImplOptions.AggressiveInlining)]
52         public ArrayFiller(TElement[] array, TReturnConstant returnConstant) : this(array, 0,
53         → returnConstant) { }
54
55         /// <summary>
56         /// <para>Adds an item into the array and returns the constant.</para>
57         /// <para>Добавляет элемент в массив и возвращает константу.</para>
58         </summary>
59         <param name="element"><para>The element to add.</para><para>Добавляемый
60         → элемент.</para></param>
61         </returns>
62         <para>The constant's value.</para>
63         <para>Значение константы.</para>
64         </returns>
65         [MethodImpl(MethodImplOptions.AggressiveInlining)]
66         public TReturnConstant AddAndReturnConstant(TElement element) =>
67         → _array.AddAndReturnConstant(ref _position, element, _returnConstant);
68
69         /// <summary>
70         /// <para>Adds the first element from the specified list to the filled array and returns
71         → the constant.</para>
72         /// <para>Добавляет первый элемент из указанного списка в заполняемый массив и
73         → возвращает константу.</para>
74         </summary>

```

```

51     /// <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>
52     /// <returns>
53     /// <para>The constant's value.</para>
54     /// <para>Значение константы.</para>
55     /// <returns>
56     [MethodImpl(MethodImplOptions.AggressiveInlining)]
57     public TReturnConstant AddFirstAndReturnConstant(ICollection<TElement> elements) =>
    → _array.AddFirstAndReturnConstant(ref _position, elements, _returnConstant);
58
59     /// <summary>
60     /// <para>Adds all elements from the specified list to the filled array and returns the
    → constant.</para>
61     /// <para>Добавляет все элементы из указанного списка в заполняемый массив и возвращает
    → константу.</para>
62     /// </summary>
63     /// <param name="elements"><para>The list of values to add.</para><para>Список значений
    → для добавления.</para></param>
64     /// <returns>
65     /// <para>The constant's value.</para>
66     /// <para>Значение константы.</para>
67     /// <returns>
68     [MethodImpl(MethodImplOptions.AggressiveInlining)]
69     public TReturnConstant AddAllAndReturnConstant(ICollection<TElement> elements) =>
    → _array.AddAllAndReturnConstant(ref _position, elements, _returnConstant);
70
71     /// <summary>
72     /// <para>Adds the elements of the list to the array, skipping the first element and
    → returns the constant.</para>
73     /// <para>Добавляет элементы списка в массив пропуская первый элемент и возвращает
    → константу.</para>
74     /// </summary>
75     /// <param name="elements"><para>The list of values to add.</para><para>Список значений
    → для добавления.</para></param>
76     /// <returns>
77     /// <para>The constant's value.</para>
78     /// <para>Значение константы.</para>
79     /// </returns>
80     [MethodImpl(MethodImplOptions.AggressiveInlining)]
81     public TReturnConstant AddSkipFirstAndReturnConstant(ICollection<TElement> elements) =>
    → _array.AddSkipFirstAndReturnConstant(ref _position, elements, _returnConstant);
82 }
83 }

```

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         protected readonly TElement[] _array;
14         protected long _position;
15
16         /// <summary>
17         /// <para>Initializes a new instance of the <see cref="ArrayFiller"/> class using the
    → specified array as the array to fill and the offset from which to start
    → filling.</para></summary>
18         /// <para>Инициализирует новый экземпляр класса <see cref="ArrayFiller"/>, используя
    → указанный массив в качестве заполняемого и смещение с которого начнётся
    → заполнение.</para>
19         /// </summary>
20         /// <param name="array"><para>The array to fill.</para><para>Массив для
    → заполнения.</para></param>
21         /// <param name="offset"><para>The offset from which to start filling the
    → array.</para><para>Смещение с которого начнётся заполнение массива.</para></param>
22         [MethodImpl(MethodImplOptions.AggressiveInlining)]
23         public ArrayFiller(TElement[] array, long offset)
24         {
25             _array = array;

```

```

26     _position = offset;
27 }
28
29 /// <summary>
30 /// <para>Initializes a new instance of the <see cref="ArrayFiller"/> class using the
    → specified array. Filling will start from the beginning of the array.</para>
31 /// <para>Инициализирует новый экземпляр класса <see cref="ArrayFiller"/>, используя
    → указанный массив. Заполнение начнётся с начала массива.</para>
32 /// </summary>
33 /// <param name="array"><para>The array to fill.</para><para>Массив для
    → заполнения.</para></param>
34 [MethodImpl(MethodImplOptions.AggressiveInlining)]
35 public ArrayFiller(TElement[] array) : this(array, 0) { }
36
37 /// <summary>
38 /// <para>Adds an item into the array.</para>
39 /// <para>Добавляет элемент в массив.</para>
40 /// </summary>
41 /// <param name="element"><para>The element to add.</para><para>Добавляемый
    → элемент.</para></param>
42 [MethodImpl(MethodImplOptions.AggressiveInlining)]
43 public void Add(TElement element) => _array[_position++] = element;
44
45 /// <summary>
46 /// <para>Adds an item into the array and returns <see langword="true"/>.</para>
47 /// <para>Добавляет элемент в массив и возвращает <see langword="true"/>.</para>
48 /// </summary>
49 /// <param name="element"><para>The element to add.</para><para>Добавляемый
    → элемент.</para></param>
50 /// <returns>
51 /// <para>The <see langword="true"/> value.</para>
52 /// <para>Значение <see langword="true"/>.</para>
53 /// </returns>
54 [MethodImpl(MethodImplOptions.AggressiveInlining)]
55 public bool AddAndReturnTrue(TElement element) => _array.AddAndReturnConstant(ref
    → _position, element, true);
56
57 /// <summary>
58 /// <para>Adds the first element from the specified list to the array to fill and
    → returns <see langword="true"/>.</para>
59 /// <para>Добавляет первый элемент из указанного списка в заполняемый массив и
    → возвращает <see langword="true"/>.</para>
60 /// </summary>
61 /// <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>
62 /// <returns>
63 /// <para>The <see langword="true"/> value.</para>
64 /// <para>Значение <see langword="true"/>.</para>
65 /// </returns>
66 [MethodImpl(MethodImplOptions.AggressiveInlining)]
67 public bool AddFirstAndReturnTrue(IList<TElement> elements) =>
    → _array.AddFirstAndReturnConstant(ref _position, elements, true);
68
69 /// <summary>
70 /// <para>Adds all elements from the specified list to the array to fill and returns
    → <see langword="true"/>.</para>
71 /// <para>Добавляет все элементы из указанного списка в заполняемый массив и возвращает
    → <see langword="true"/>.</para>
72 /// </summary>
73 /// <param name="elements"><para>The list of values to add.</para><para>Список значений
    → которые необходимо добавить.</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 AddAllAndReturnTrue(IList<TElement> elements) =>
    → _array.AddAllAndReturnConstant(ref _position, elements, true);
80
81 /// <summary>
82 /// <para>Adds values to the array skipping the first element and returns <see
    → langword="true"/>.</para>
83 /// <para>Добавляет значения в массив пропуская первый элемент и возвращает <see
    → langword="true"/>.</para>
84 /// </summary>

```

```

85     /// <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>
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 AddSkipFirstAndReturnTrue(IList<TElement> elements) =>
    ↪     _array.AddSkipFirstAndReturnConstant(ref _position, elements, true);
92 }
93 }

```

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         public static readonly int DefaultSizesAmount = 512;
12         public static readonly int DefaultMaxArraysPerSize = 32;
13
14         /// <summary>
15         /// <para>Allocation of an array of a specified size from the array pool.</para>
16         /// <para>Выделение массива указанного размера из пула массивов.</para>
17         /// </summary>
18         /// <typeparam name="T"><para>The array elements type.</para><para>Тип элементов
    ↪ массива.</para></typeparam>
19         /// <param name="size"><para>The allocated array size.</para><para>Размер выделяемого
    ↪ массива.</para></param>
20         /// <returns>
21         /// <para>The array from a pool of arrays.</para>
22         /// <para>Массив из пулла массивов.</para>
23         /// </returns>
24         [MethodImpl(MethodImplOptions.AggressiveInlining)]
25         public static T[] Allocate<T>(long size) => ArrayPool<T>.ThreadInstance.Allocate(size);
26
27         /// <summary>
28         /// <para>Freeing an array into an array pool.</para>
29         /// <para>Освобождение массива в пул массивов.</para>
30         /// </summary>
31         /// <typeparam name="T"><para>The array elements type.</para><para>Тип элементов
    ↪ массива.</para></typeparam>
32         /// <param name="array"><para>The array to be freed into the pull.</para><para>Массив
    ↪ который нужно освободить в пулл.</para></param>
33         [MethodImpl(MethodImplOptions.AggressiveInlining)]
34         public static void Free<T>(T[] array) => ArrayPool<T>.ThreadInstance.Free(array);
35     }
36 }

```

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><para>Тип элементов
    ↪ 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 [ThreadStatic]
21 private static ArrayPool<T> _threadInstance;
22 internal static ArrayPool<T> ThreadInstance => _threadInstance ?? (_threadInstance = new
    ↳ ArrayPool<T>());
23
24 private readonly int _maxArraysPerSize;
25 private readonly Dictionary<long, Stack<T[]>> _pool = new Dictionary<long,
    ↳ Stack<T[]>>(ArrayPool.DefaultSizesAmount);
26
27 /// <summary>
28 /// <para>Initializes a new instance of the ArrayPool class using the specified maximum
    ↳ number of arrays per size.</para>
29 /// <para>Инициализирует новый экземпляр класса ArrayPool, используя указанное
    ↳ максимальное количество массивов на каждый размер.</para>
30 /// </summary>
31 /// <param name="maxArraysPerSize"><para>The maximum number of arrays in the pool per
    ↳ size.</para><para>Максимальное количество массивов в пуле на каждый
    ↳ размер.</para></param>
32 [MethodImpl(MethodImplOptions.AggressiveInlining)]
33 public ArrayPool(int maxArraysPerSize) => _maxArraysPerSize = maxArraysPerSize;
34
35 /// <summary>
36 /// <para>Initializes a new instance of the ArrayPool class using the default maximum
    ↳ number of arrays per size.</para>
37 /// <para>Инициализирует новый экземпляр класса ArrayPool, используя максимальное
    ↳ количество массивов на каждый размер по умолчанию.</para>
38 /// </summary>
39 [MethodImpl(MethodImplOptions.AggressiveInlining)]
40 public ArrayPool() : this(ArrayPool.DefaultMaxArraysPerSize) { }
41
42 /// <summary>
43 /// <para>Retrieves an array from the pool, which will automatically return to the pool
    ↳ when the container is disposed.</para>
44 /// <para>Извлекает из пула массив, который автоматически вернётся в пул при
    ↳ высвобождении контейнера.</para>
45 /// </summary>
46 /// <param name="size"><para>The allocated array size.</para><para>Размер выделяемого
    ↳ массива.</para></param>
47 /// <returns>
48 /// <para>The disposable container containing either a new array or an array from the
    ↳ pool.</para>
49 /// <para>Высвобождаемый контейнер содержащий либо новый массив, либо массив из
    ↳ пула.</para>
50 /// </returns>
51 [MethodImpl(MethodImplOptions.AggressiveInlining)]
52 public Disposable<T[]> AllocateDisposable(long size) => (Allocate(size), Free);
53
54 /// <summary>
55 /// <para>Replaces the array with another array from the pool with the specified
    ↳ size.</para>
56 /// <para>Заменяет массив на другой массив из пула с указанным размером.</para>
57 /// </summary>
58 /// <param name="source"><para>The source array.</para><para>Исходный
    ↳ массив.</para></param>
59 /// <param name="size"><para>A new array size.</para><para>Новый размер
    ↳ массива.</para></param>
60 /// <returns>
61 /// <para>An array with a new size.</para>
62 /// <para>Массив с новым размером.</para>
63 /// </returns>
64 [MethodImpl(MethodImplOptions.AggressiveInlining)]
65 public Disposable<T[]> Resize(Disposable<T[]> source, long size)
66 {
67     var destination = AllocateDisposable(size);
68     T[] sourceArray = source;
69     if (!sourceArray.IsNullOrEmpty())
70     {
71         T[] destinationArray = destination;
72         Array.Copy(sourceArray, destinationArray, size < sourceArray.LongLength ? size :
            ↳ sourceArray.LongLength);
73         source.Dispose();
74     }
75     return destination;
76 }
77
78 /// <summary>

```

```

79     /// <para>Clears the pool.</para>
80     /// <para>Очищает пул.</para>
81     /// </summary>
82     [MethodImpl(MethodImplOptions.AggressiveInlining)]
83     public virtual void Clear() => _pool.Clear();
84
85     /// <summary>
86     /// <para>Retrieves an array with the specified size from the pool.</para>
87     /// <para>Извлекает из пула массив с указанным размером.</para>
88     /// </summary>
89     /// <param name="size"><para>The allocated array size.</para><para>Размер выделяемого
    ↳ массива.</para></param>
90     /// <returns>
91     /// <para>An array from the pool or a new array.</para>
92     /// <para>Массив из пула или новый массив.</para>
93     /// </returns>
94     [MethodImpl(MethodImplOptions.AggressiveInlining)]
95     public virtual T[] Allocate(long size) => size <= 0L ? Array.Empty<T>() :
    ↳ _pool.GetOrDefault(size)?.PopOrDefault() ?? new T[size];
96
97     /// <summary>
98     /// <para>Frees the array to the pool for later reuse.</para>
99     /// <para>Освобождает массив в пул для последующего повторного использования.</para>
100    /// </summary>
101    /// <param name="array"><para>The array to be freed into the pool.</para><para>Массив
    ↳ который нужно освободить в пул.</para></param>
102    [MethodImpl(MethodImplOptions.AggressiveInlining)]
103    public virtual void Free(T[] array)
104    {
105        if (array.IsNullOrEmpty())
106        {
107            return;
108        }
109        var stack = _pool.GetOrAdd(array.LongLength, size => new
    ↳ Stack<T[]>(_maxArraysPerSize));
110        if (stack.Count == _maxArraysPerSize) // Stack is full
111        {
112            return;
113        }
114        stack.Push(array);
115    }
116 }
117 }

```

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      public class ArrayString<T> : Segment<T>
9      {
10         [MethodImpl(MethodImplOptions.AggressiveInlining)]
11         public ArrayString(int length) : base(new T[length], 0, length) { }
12
13         [MethodImpl(MethodImplOptions.AggressiveInlining)]
14         public ArrayString(T[] array) : base(array, 0, array.Length) { }
15
16         [MethodImpl(MethodImplOptions.AggressiveInlining)]
17         public ArrayString(T[] array, int length) : base(array, 0, length) { }
18     }
19 }

```

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

```

1  using System.Runtime.CompilerServices;
2
3  namespace Platform.Collections.Arrays
4  {
5      public static unsafe class CharArrayExtensions
6      {
7          /// <summary>
8          /// <para>Generates a hash code for an array segment with the specified offset and
    ↳ length. The hash code is generated based on the values of the array elements
    ↳ included in the specified segment.</para>
9          /// <para>Генерирует хэш-код сегмента массива с указанным смещением и длиной. Хэш-код
    ↳ генерируется на основе значений элементов массива входящих в указанный
    ↳ сегмент.</para>

```

```

10  /// </summary>
11  /// <param name="array"><para>The array to hash.</para><para>Массив для
    ↳ хеширования.</para></param>
12  /// <param name="offset"><para>The offset from which reading of the specified number of
    ↳ elements in the array starts.</para><para>Смещение, с которого начинается чтение
    ↳ указанного количества элементов в массиве.</para></param>
13  /// <param name="length"><para>The number of array elements used to calculate the
    ↳ hash.</para><para>Количество элементов массива, на основе которых будет вычислен
    ↳ хэш.</para></param>
14  /// <returns>
15  /// <para>The hash code of the segment in the array.</para>
16  /// <para>Хэш-код сегмента в массиве.</para>
17  /// </returns>
18  /// <remarks>
19  /// Based on https://github.com/Microsoft/referencesource/blob/3b1eaf5203992df69de44c783\_
    ↳ a3eda37d3d4cd10/mscorlib/system/string.cs#L833
20  /// </remarks>
21  [MethodImpl(MethodImplOptions.AggressiveInlining)]
22  public static int GenerateHashCode(this char[] array, int offset, int length)
23  {
24      var hashSeed = 5381;
25      var hashAccumulator = hashSeed;
26      fixed (char* arrayPointer = &array[offset])
27      {
28          for (char* charPointer = arrayPointer, last = charPointer + length; charPointer
    ↳ < last; charPointer++)
29          {
30              hashAccumulator = (hashAccumulator << 5) + hashAccumulator ^ *charPointer;
31          }
32      }
33      return hashAccumulator + (hashSeed * 1566083941);
34  }
35
36  /// <summary>
37  /// <para>Checks if all elements of two lists are equal.</para>
38  /// <para>Проверяет равны ли все элементы двух списков.</para>
39  /// </summary>
40  /// <param name="left"><para>The first compared array.</para><para>Первый массив для
    ↳ сравнения.</para></param>
41  /// <param name="leftOffset"><para>The offset from which reading of the specified number
    ↳ of elements in the first array starts.</para><para>Смещение, с которого начинается
    ↳ чтение элементов в первом массиве.</para></param>
42  /// <param name="length"><para>The number of checked elements.</para><para>Количество
    ↳ проверяемых элементов.</para></param>
43  /// <param name="right"><para>The second compared array.</para><para>Второй массив для
    ↳ сравнения.</para></param>
44  /// <param name="rightOffset"><para>The offset from which reading of the specified
    ↳ number of elements in the second array starts.</para><para>Смещение, с которого
    ↳ начинается чтение элементов в втором массиве.</para></param>
45  /// <returns>
46  /// <para><see langword="true"/> if the segments of the passed arrays are equal to each
    ↳ other otherwise <see langword="false"/>.</para>
47  /// <para><see langword="true"/>, если сегменты переданных массивов равны друг другу,
    ↳ иначе же <see langword="false"/>.</para>
48  /// </returns>
49  /// <remarks>
50  /// Based on https://github.com/Microsoft/referencesource/blob/3b1eaf5203992df69de44c783\_
    ↳ a3eda37d3d4cd10/mscorlib/system/string.cs#L364
51  /// </remarks>
52  [MethodImpl(MethodImplOptions.AggressiveInlining)]
53  public static bool ContentEqualTo(this char[] left, int leftOffset, int length, char[]
    ↳ right, int rightOffset)
54  {
55      fixed (char* leftPointer = &left[leftOffset])
56      {
57          fixed (char* rightPointer = &right[rightOffset])
58          {
59              char* leftPointerCopy = leftPointer, rightPointerCopy = rightPointer;
60              if (!CheckArraysMainPartForEquality(ref leftPointerCopy, ref
    ↳ rightPointerCopy, ref length))
61              {
62                  return false;
63              }
64              CheckArraysRemainderForEquality(ref leftPointerCopy, ref rightPointerCopy,
    ↳ ref length);
65              return length <= 0;

```

```

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

```

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)]

```



```

22 public static T GetElementOrDefault<T>(this T[] array, int index) => array != null &&
23     → array.Length > index ? array[index] : default;
24
25 /// <summary>
26 /// <para>Checks whether the array exists, if so, checks the array length using the
27     → index variable type long, and if the array length is greater than the index - return
28     → array[index], otherwise - default value.</para>
29 /// <para>Проверяет, существует ли массив, если да - идет проверка длины массива с
30     → помощью переменной index, и если длина массива больше индекса - возвращает
31     → array[index], иначе - значение по умолчанию.</para>
32 /// </summary>
33 /// <typeparam name="T"><para>Array elements type.</para><para>Тип элементов
34     → массива.</para></typeparam>
35 /// <param name="array"><para>Array that will participate in
36     → verification.</para><para>Массив который будет участвовать в
37     → проверке.</para></param>
38 /// <param name="index"><para>Number type long to compare.</para><para>Число типа long
39     → для сравнения.</para></param>
40 /// <returns><para>Array element or default value.</para><para>Элемент массива или же
41     → значение по умолчанию.</para></returns>
42 [MethodImpl(MethodImplOptions.AggressiveInlining)]
43 public static T GetElementOrDefault<T>(this T[] array, long index) => array != null &&
44     → array.LongLength > index ? array[index] : default;
45
46 /// <summary>
47 /// <para>Checks whether the array exist, if so, checks the array length using the index
48     → variable type int, and if the array length is greater than the index, set the element
49     → variable to array[index] and return <see langword="true"/>.</para>
50 /// <para>Проверяет, существует ли массив, если да, то идет проверка длины массива с
51     → помощью переменной index типа int, и если длина массива больше значения index,
52     → устанавливает значение переменной element - array[index] и возвращает <see
53     → langword="true"/>.</para>
54 /// </summary>
55 /// <typeparam name="T"><para>Array elements type.</para><para>Тип элементов
56     → массива.</para></typeparam>
57 /// <param name="array"><para>Array that will participate in
58     → verification.</para><para>Массив который будет участвовать в
59     → проверке.</para></param>
60 /// <param name="index"><para>Number type int to compare.</para><para>Число типа int для
61     → сравнения.</para></param>
62 /// <param name="element"><para>Passing the argument by reference, if successful, it
63     → will take the value array[index] otherwise default value.</para><para>Передаёт
64     → аргумент по ссылке, в случае успеха он примет значение array[index] в противном
65     → случае значение по умолчанию.</para></param>
66 /// <returns><para><see langword="true"/> if successful otherwise <see
67     → langword="false"/>.</para><para><see langword="true"/> в случае успеха, в противном
68     → случае <see langword="false"/>.</para></returns>
69 [MethodImpl(MethodImplOptions.AggressiveInlining)]
70 public static bool TryGetElement<T>(this T[] array, int index, out T element)
71 {
72     if (array != null && array.Length > index)
73     {
74         element = array[index];
75         return true;
76     }
77     else
78     {
79         element = default;
80         return false;
81     }
82 }
83
84 /// <summary>
85 /// <para>Checks whether the array exist, if so, checks the array length using the
86     → index variable type long, and if the array length is greater than the index, set the
87     → element variable to array[index] and return <see langword="true"/>.</para>
88 /// <para>Проверяет, существует ли массив, если да, то идет проверка длины массива с
89     → помощью переменной index типа long, и если длина массива больше значения index,
90     → устанавливает значение переменной element - array[index] и возвращает <see
91     → langword="true"/>.</para>
92 /// </summary>
93 /// <typeparam name="T"><para>Array elements type.</para><para>Тип элементов
94     → массива.</para></typeparam>
95 /// <param name="array"><para>Array that will participate in
96     → verification.</para><para>Массив который будет участвовать в
97     → проверке.</para></param>

```

```

65  /// <param name="index"><para>Number type long to compare.</para><para>Число типа long
    ↳ для сравнения.</para></param>
66  /// <param name="element"><para>Passing the argument by reference, if successful, it
    ↳ will take the value array[index] otherwise default value.</para><para>Передаёт
    ↳ аргумент по ссылке, в случае успеха он примет значение array[index] в противном
    ↳ случае значение по умолчанию.</para></param>
67  /// <returns><para><see langword="true"/> if successful otherwise <see
    ↳ langword="false"/>.</para><para><see langword="true"/> в случае успеха, в противном
    ↳ случае <see langword="false"/>.</para></returns>
68  [MethodImpl(MethodImplOptions.AggressiveInlining)]
69  public static bool TryGetElement<T>(this T[] array, long index, out T element)
70  {
71      if (array != null && array.LongLength > index)
72      {
73          element = array[index];
74          return true;
75      }
76      else
77      {
78          element = default;
79          return false;
80      }
81  }
82
83  /// <summary>
84  /// <para>Copying of elements from one array to another array.</para>
85  /// <para>Копирует элементы из одного массива в другой массив.</para>
86  /// </summary>
87  /// <typeparam name="T"><para>Array elements type.</para><para>Тип элементов
    ↳ массива.</para></typeparam>
88  /// <param name="array"><para>The array to copy.</para><para>Массив который необходимо
    ↳ скопировать.</para></param>
89  /// <returns><para>Copy of the array.</para><para>Копию массива.</para></returns>
90  [MethodImpl(MethodImplOptions.AggressiveInlining)]
91  public static T[] Clone<T>(this T[] array)
92  {
93      var copy = new T[array.LongLength];
94      Array.Copy(array, 0L, copy, 0L, array.LongLength);
95      return copy;
96  }
97
98  /// <summary>
99  /// <para>Shifts all the elements of the array by one position to the right.</para>
100  /// <para>Сдвигает вправо все элементы массива на одну позицию.</para>
101  /// </summary>
102  /// <typeparam name="T"><para>The array item type.</para><para>Тип элементов
    ↳ массива.</para></typeparam>
103  /// <param name="array"><para>The array to copy from.</para><para>Массив для
    ↳ копирования.</para></param>
104  /// <returns>
105  /// <para>Array with a shift of elements by one position.</para>
106  /// <para>Массив со сдвигом элементов на одну позицию.</para>
107  /// </returns>
108  [MethodImpl(MethodImplOptions.AggressiveInlining)]
109  public static IList<T> ShiftRight<T>(this T[] array) => array.ShiftRight(1L);
110
111  /// <summary>
112  /// <para>Shifts all elements of the array to the right by the specified number of
    ↳ elements.</para>
113  /// <para>Сдвигает вправо все элементы массива на указанное количество элементов.</para>
114  /// </summary>
115  /// <typeparam name="T"><para>The array item type.</para><para>Тип элементов
    ↳ массива.</para></typeparam>
116  /// <param name="array"><para>The array to copy from.</para><para>Массив для
    ↳ копирования.</para></param>
117  /// <param name="skip"><para>The number of items to shift.</para><para>Количество
    ↳ сдвигаемых элементов.</para></param>
118  /// <returns>
119  /// <para>If the value of the shift variable is less than zero - an <see
    ↳ cref="NotImplementedException"/> exception is thrown, but if the value of the shift
    ↳ variable is 0 - an exact copy of the array is returned. Otherwise, an array is
    ↳ returned with the shift of the elements.</para>
120  /// <para>Если значение переменной shift меньше нуля - выбрасывается исключение <see
    ↳ cref="NotImplementedException"/>, если же значение переменной shift равно 0 -
    ↳ возвращается точная копия массива. Иначе возвращается массив со сдвигом
    ↳ элементов.</para>
121  /// </returns>

```

```

122 [MethodImpl(MethodImplOptions.AggressiveInlining)]
123 public static IList<T> ShiftRight<T>(this T[] array, long shift)
124 {
125     if (shift < 0)
126     {
127         throw new NotImplementedException();
128     }
129     if (shift == 0)
130     {
131         return array.Clone<T>();
132     }
133     else
134     {
135         var restrictions = new T[array.LongLength + shift];
136         Array.Copy(array, 0L, restrictions, shift, array.LongLength);
137         return restrictions;
138     }
139 }
140
141 /// <summary>
142 /// <para>Adding in array the passed element at the specified position and increments
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>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>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>

```

```

173 /// <returns>
174 /// <para>The constant value passed as an argument.</para>
175 /// <para>Значение константы, переданное в качестве аргумента.</para>
176 /// </returns>
177 [MethodImpl(MethodImplOptions.AggressiveInlining)]
178 public static TReturnConstant AddAndReturnConstant<TElement, TReturnConstant>(this
    → TElement[] array, ref long position, TElement element, TReturnConstant
    → returnConstant)
179 {
180     array.Add(ref position, element);
181     return returnConstant;
182 }
183
184 /// <summary>
185 /// <para>Adds the first element from the passed collection to the array, at the
    → specified position and increments position value by one.</para>
186 /// <para>Добавляет в массив первый элемент из переданной коллекции, на указанную
    → позицию и увеличивает значение position на единицу.</para>
187 /// </summary>
188 /// <typeparam name="T"><para>Array element type.</para><para>Тип элементов
    → массива.</para></typeparam>
189 /// <param name="array"><para>The array to add the element to.</para><para>Массив в
    → который необходимо добавить элемент.</para></param>
190 /// <param name="position"><para>Reference to the position to which the element will be
    → added.</para><para>Ссылка на позицию, в которую будет добавлен
    → элемент.</para></param>
191 /// <param name="elements"><para>List, the first element of which will be added to the
    → array.</para><para>Список, первый элемент которого будет добавлен в
    → массив.</para></param>
192 [MethodImpl(MethodImplOptions.AggressiveInlining)]
193 public static void AddFirst<T>(this T[] array, ref long position, IList<T> elements) =>
    → array[position++] = elements[0];
194
195 /// <summary>
196 /// <para>Adds the first element from the passed collection to the array, at the
    → specified position, increments position value by one and returns the value of the
    → passed constant.</para>
197 /// <para>Добавляет в массив первый элемент из переданной коллекции, на указанную
    → позицию, увеличивает значение position на единицу и возвращает значение переданной
    → константы.</para>
198 /// </summary>
199 /// <typeparam name="TElement"><para>The array element type.</para><para>Тип элемента
    → массива.</para></typeparam>
200 /// <typeparam name="TReturnConstant"><para>Type of return constant.</para><para>Тип
    → возвращаемой константы.</para></typeparam>
201 /// <param name="array"><para>The array to add the element to.</para><para>Массив в
    → который необходимо добавить элемент.</para></param>
202 /// <param name="position"><para>Reference to the position to which the element will be
    → added.</para><para>Ссылка на позицию, в которую будет добавлен
    → элемент.</para></param>
203 /// <param name="elements"><para>List, the first element of which will be added to the
    → array.</para><para>Список, первый элемент которого будет добавлен в
    → массив.</para></param>
204 /// <param name="returnConstant"><para>The constant value that will be
    → returned.</para><para>Значение константы, которое будет возвращено.</para></param>
205 /// <returns>
206 /// <para>The constant value passed as an argument.</para>
207 /// <para>Значение константы, переданное в качестве аргумента.</para>
208 /// </returns>
209 [MethodImpl(MethodImplOptions.AggressiveInlining)]
210 public static TReturnConstant AddFirstAndReturnConstant<TElement, TReturnConstant>(this
    → TElement[] array, ref long position, IList<TElement> elements, TReturnConstant
    → returnConstant)
211 {
212     array.AddFirst(ref position, elements);
213     return returnConstant;
214 }
215
216 /// <summary>
217 /// <para>Adding in array all elements from the passed collection, at the specified
    → position, increases the position value by the number of elements added and returns
    → the value of the passed constant.</para>
218 /// <para>Добавляет в массив все элементы из переданной коллекции, на указанную позицию,
    → увеличивает значение position на количество добавленных элементов и возвращает
    → значение переданной константы.</para>
219 /// </summary>

```

```

220 /// <typeparam name="TElement"><para>The array element type.</para><para>Тип элемента
221   ↳ массива.</para></typeparam>
222 /// <typeparam name="TReturnConstant"><para>Type of return constant.</para><para>Тип
223   ↳ возвращаемой константы.</para></typeparam>
224 /// <param name="array"><para>The array to add the element to.</para><para>Массив в
225   ↳ который необходимо добавить элементы.</para></param>
226 /// <param name="position"><para>Reference to the position from which elements will be
227   ↳ added to the array.</para><para>Ссылка на позицию, начиная с которой будут
228   ↳ добавляться элементы в массив.</para></param>
229 /// <param name="elements"><para>List, whose elements will be added to the
230   ↳ array.</para><para>Список, элементы которого будут добавлены в
231   ↳ массив.</para></param>
232 /// <param name="returnConstant"><para>The constant value that will be
233   ↳ returned.</para><para>Значение константы, которое будет возвращено.</para></param>
234 /// <returns>
235 /// <para>The constant value passed as an argument.</para>
236 /// <para>Значение константы, переданное в качестве аргумента.</para>
237 /// </returns>
238 [MethodImpl(MethodImplOptions.AggressiveInlining)]
239 public static TReturnConstant AddAllAndReturnConstant<TElement, TReturnConstant>(this
240   ↳ TElement[] array, ref long position, IList<TElement> elements, TReturnConstant
241   ↳ returnConstant)
242 {
243     array.AddAll(ref position, elements);
244     return returnConstant;
245 }
246
247 /// <summary>
248 /// <para>Adding in array a collection of elements, starting from a specific position
249   ↳ and increases the position value by the number of elements added.</para>
250 /// <para>Добавляет в массив все элементы коллекции, начиная с определенной позиции и
251   ↳ увеличивает значение position на количество добавленных элементов.</para>
252 /// </summary>
253 /// <typeparam name="T"><para>Array elements type.</para><para>Тип элементов
254   ↳ массива.</para></typeparam>
255 /// <param name="array"><para>The array to add the element to.</para><para>Массив в
256   ↳ который необходимо добавить элементы.</para></param>
257 /// <param name="position"><para>Reference to the position from which elements will be
258   ↳ added to the array.</para><para>Ссылка на позицию, начиная с которой будут
259   ↳ добавляться элементы в массив.</para></param>
260 /// <param name="elements"><para>List, whose elements will be added to the
261   ↳ array.</para><para>Список, элементы которого будут добавлены в
262   ↳ массив.</para></param>
263 [MethodImpl(MethodImplOptions.AggressiveInlining)]
264 public static void AddAll<T>(this T[] array, ref long position, IList<T> elements)
265 {
266     for (var i = 0; i < elements.Count; i++)
267     {
268         array.Add(ref position, elements[i]);
269     }
270 }
271
272 /// <summary>
273 /// <para>Adding in array all elements of the collection, skipping the first position,
274   ↳ increments position value by one and returns the value of the passed constant.</para>
275 /// <para>Добавляет в массив все элементы коллекции, пропуская первую позицию,
276   ↳ увеличивает значение position на единицу и возвращает значение переданной
277   ↳ константы.</para>
278 /// </summary>
279 /// <typeparam name="TElement"><para>The array element type.</para><para>Тип элемента
280   ↳ массива.</para></typeparam>
281 /// <typeparam name="TReturnConstant"><para>Type of return constant.</para><para>Тип
282   ↳ возвращаемой константы.</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 /// <param name="returnConstant"><para>The constant value that will be
292   ↳ returned.</para><para>Значение константы, которое будет возвращено.</para></param>
293 /// <returns>
294 /// <para>The constant value passed as an argument.</para>

```

```

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

```

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

```

1  using System;
2  using System.Collections.Concurrent;
3  using System.Collections.Generic;
4  using System.Numerics;
5  using System.Runtime.CompilerServices;
6  using System.Threading.Tasks;
7  using Platform.Exceptions;
8  using Platform.Ranges;
9
10 // ReSharper disable ForCanBeConvertedToForeach
11 #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
12
13 namespace Platform.Collections
14 {
15     /// <remarks>

```

```

16  /// А что если хранить карту значений, где каждый бит будет означать присутствует ли блок в
17  ↪ 64 бит в массиве значений.
18  /// 64 бита по 0 бит, будут означать отсутствие 64-х блоков по 64 бита. Т.е. упаковка 512
19  ↪ байт в 8 байт.
20  /// Подобный принцип можно применять и к 64-ём блокам и т.п. По сути это карта значений. С
21  ↪ помощью которой можно быстро
22  /// проверять есть ли значения непосредственно далее (ниже по уровню).
23  /// Или как таблица виртуальной памяти где номер блока означает его присутствие и адрес.
24  </remarks>
25  public class BitString : IEquatable<BitString>
26  {
27      private static readonly byte[] [] _bitsSetIn16Bits;
28      private long[] _array;
29      private long _length;
30      private long _minPositiveWord;
31      private long _maxPositiveWord;
32
33      public bool this[long index]
34      {
35          [MethodImpl(MethodImplOptions.AggressiveInlining)]
36          get => Get(index);
37          [MethodImpl(MethodImplOptions.AggressiveInlining)]
38          set => Set(index, value);
39      }
40
41      public long Length
42      {
43          [MethodImpl(MethodImplOptions.AggressiveInlining)]
44          get => _length;
45          [MethodImpl(MethodImplOptions.AggressiveInlining)]
46          set
47          {
48              if (_length == value)
49              {
50                  return;
51              }
52              Ensure.Always.ArgumentInRange(value, GetValidLengthRange(), nameof(Length));
53              // Currently we never shrink the array
54              if (value > _length)
55              {
56                  var words = GetWordsCountFromIndex(value);
57                  var oldWords = GetWordsCountFromIndex(_length);
58                  if (words > _array.LongLength)
59                  {
60                      var copy = new long[words];
61                      Array.Copy(_array, copy, _array.LongLength);
62                      _array = copy;
63                  }
64                  else
65                  {
66                      // What is going on here?
67                      Array.Clear(_array, (int)oldWords, (int)(words - oldWords));
68                  }
69                  // What is going on here?
70                  var mask = (int)(_length % 64);
71                  if (mask > 0)
72                  {
73                      _array[oldWords - 1] &= (1L << mask) - 1;
74                  }
75              }
76              else
77              {
78                  // Looks like minimum and maximum positive words are not updated
79                  throw new NotImplementedException();
80              }
81              _length = value;
82          }
83      }
84
85      #region Constructors
86
87      [MethodImpl(MethodImplOptions.AggressiveInlining)]
88      static BitString()
89      {
90          {
91              _bitsSetIn16Bits = new byte[65536][];
92              int i, c, k;
93              byte bitIndex;
94              for (i = 0; i < 65536; i++)
95              {

```

```

92         // Calculating size of array (number of positive bits)
93         for (c = 0, k = 1; k <= 65536; k <= 1)
94         {
95             if ((i & k) == k)
96             {
97                 c++;
98             }
99         }
100         var array = new byte[c];
101         // Adding positive bits indices into array
102         for (bitIndex = 0, c = 0, k = 1; k <= 65536; k <= 1)
103         {
104             if ((i & k) == k)
105             {
106                 array[c++] = bitIndex;
107             }
108             bitIndex++;
109         }
110         _bitsSetIn16Bits[i] = array;
111     }
112 }
113
114 [MethodImpl(MethodImplOptions.AggressiveInlining)]
115 public BitString(BitString other)
116 {
117     Ensure.Always.ArgumentNotNull(other, nameof(other));
118     _length = other._length;
119     _array = new long[GetWordsCountFromIndex(_length)];
120     _minPositiveWord = other._minPositiveWord;
121     _maxPositiveWord = other._maxPositiveWord;
122     Array.Copy(other._array, _array, _array.LongLength);
123 }
124
125 [MethodImpl(MethodImplOptions.AggressiveInlining)]
126 public BitString(long length)
127 {
128     Ensure.Always.ArgumentInRange(length, GetValidLengthRange(), nameof(length));
129     _length = length;
130     _array = new long[GetWordsCountFromIndex(_length)];
131     MarkBordersAsAllBitsReset();
132 }
133
134 [MethodImpl(MethodImplOptions.AggressiveInlining)]
135 public BitString(long length, bool defaultValue)
136     : this(length)
137 {
138     if (defaultValue)
139     {
140         SetAll();
141     }
142 }
143
144 #endregion
145
146 [MethodImpl(MethodImplOptions.AggressiveInlining)]
147 public BitString Not()
148 {
149     for (var i = 0L; i < _array.LongLength; i++)
150     {
151         _array[i] = ~_array[i];
152         RefreshBordersByWord(i);
153     }
154     return this;
155 }
156
157 [MethodImpl(MethodImplOptions.AggressiveInlining)]
158 public BitString ParallelNot()
159 {
160     var threads = Environment.ProcessorCount / 2;
161     if (threads <= 1)
162     {
163         return Not();
164     }
165     var partitioner = Partitioner.Create(0L, _array.LongLength, _array.LongLength /
166     ↪ threads);
167     Parallel.ForEach(partitioner.GetDynamicPartitions(), new ParallelOptions {
168     ↪ MaxDegreeOfParallelism = threads }, range =>
169     {
170         var maximum = range.Item2;

```



```

169         for (var i = range.Item1; i < maximum; i++)
170         {
171             _array[i] = ~_array[i];
172         }
173     });
174     MarkBordersAsAllBitsSet();
175     TryShrinkBorders();
176     return this;
177 }
178
179 [MethodImpl(MethodImplOptions.AggressiveInlining)]
180 public BitString VectorNot()
181 {
182     if (!Vector.IsHardwareAccelerated || _array.LongLength >= int.MaxValue)
183     {
184         return Not();
185     }
186     var step = Vector<long>.Count;
187     if (_array.Length < step)
188     {
189         return Not();
190     }
191     VectorNotLoop(_array, step, 0, _array.Length);
192     MarkBordersAsAllBitsSet();
193     TryShrinkBorders();
194     return this;
195 }
196
197 [MethodImpl(MethodImplOptions.AggressiveInlining)]
198 public BitString ParallelVectorNot()
199 {
200     var threads = Environment.ProcessorCount / 2;
201     if (threads <= 1)
202     {
203         return VectorNot();
204     }
205     if (!Vector.IsHardwareAccelerated)
206     {
207         return ParallelNot();
208     }
209     var step = Vector<long>.Count;
210     if (_array.Length < (step * threads))
211     {
212         return VectorNot();
213     }
214     var partitioner = Partitioner.Create(0, _array.Length, _array.Length / threads);
215     Parallel.ForEach(partitioner.GetDynamicPartitions(), new ParallelOptions {
216         ↪ MaxDegreeOfParallelism = threads }, range => VectorNotLoop(_array, step,
217         ↪ range.Item1, range.Item2));
218     MarkBordersAsAllBitsSet();
219     TryShrinkBorders();
220     return this;
221 }
222
223 [MethodImpl(MethodImplOptions.AggressiveInlining)]
224 static private void VectorNotLoop(long[] array, int step, int start, int maximum)
225 {
226     var i = start;
227     var range = maximum - start - 1;
228     var stop = range - (range % step);
229     for (; i < stop; i += step)
230     {
231         (~new Vector<long>(array, i)).CopyTo(array, i);
232     }
233     for (; i < maximum; i++)
234     {
235         array[i] = ~array[i];
236     }
237 }
238
239 [MethodImpl(MethodImplOptions.AggressiveInlining)]
240 public BitString And(BitString other)
241 {
242     EnsureBitStringHasTheSameSize(other, nameof(other));
243     GetCommonOuterBorders(this, other, out long from, out long to);
244     var otherArray = other._array;
245     for (var i = from; i <= to; i++)
246     {

```

```

245         _array[i] &= otherArray[i];
246         RefreshBordersByWord(i);
247     }
248     return this;
249 }
250
251 [MethodImpl(MethodImplOptions.AggressiveInlining)]
252 public BitString ParallelAnd(BitString other)
253 {
254     var threads = Environment.ProcessorCount / 2;
255     if (threads <= 1)
256     {
257         return And(other);
258     }
259     EnsureBitStringHasTheSameSize(other, nameof(other));
260     GetCommonOuterBorders(this, other, out long from, out long to);
261     var partitioner = Partitioner.Create(from, to + 1, (to - from) / threads);
262     Parallel.ForEach(partitioner.GetDynamicPartitions(), new ParallelOptions {
263         ↪ MaxDegreeOfParallelism = threads }, range =>
264     {
265         var maximum = range.Item2;
266         for (var i = range.Item1; i < maximum; i++)
267         {
268             _array[i] &= other._array[i];
269         }
270     });
271     MarkBordersAsAllBitsSet();
272     TryShrinkBorders();
273     return this;
274 }
275
276 [MethodImpl(MethodImplOptions.AggressiveInlining)]
277 public BitString VectorAnd(BitString other)
278 {
279     if (!Vector.IsHardwareAccelerated || _array.LongLength >= int.MaxValue)
280     {
281         return And(other);
282     }
283     var step = Vector<long>.Count;
284     if (_array.Length < step)
285     {
286         return And(other);
287     }
288     EnsureBitStringHasTheSameSize(other, nameof(other));
289     GetCommonOuterBorders(this, other, out int from, out int to);
290     VectorAndLoop(_array, other._array, step, from, to + 1);
291     MarkBordersAsAllBitsSet();
292     TryShrinkBorders();
293     return this;
294 }
295
296 [MethodImpl(MethodImplOptions.AggressiveInlining)]
297 public BitString ParallelVectorAnd(BitString other)
298 {
299     var threads = Environment.ProcessorCount / 2;
300     if (threads <= 1)
301     {
302         return VectorAnd(other);
303     }
304     if (!Vector.IsHardwareAccelerated)
305     {
306         return ParallelAnd(other);
307     }
308     var step = Vector<long>.Count;
309     if (_array.Length < (step * threads))
310     {
311         return VectorAnd(other);
312     }
313     EnsureBitStringHasTheSameSize(other, nameof(other));
314     GetCommonOuterBorders(this, other, out int from, out int to);
315     var partitioner = Partitioner.Create(from, to + 1, (to - from) / threads);
316     Parallel.ForEach(partitioner.GetDynamicPartitions(), new ParallelOptions {
317         ↪ MaxDegreeOfParallelism = threads }, range => VectorAndLoop(_array, other._array,
318         ↪ step, range.Item1, range.Item2));
319     MarkBordersAsAllBitsSet();
320     TryShrinkBorders();
321     return this;
322 }

```

```

320 [MethodImpl(MethodImplOptions.AggressiveInlining)]
321 static private void VectorAndLoop(long[] array, long[] otherArray, int step, int start,
322 ↪ int maximum)
323 {
324     var i = start;
325     var range = maximum - start - 1;
326     var stop = range - (range % step);
327     for (; i < stop; i += step)
328     {
329         (new Vector<long>(array, i) & new Vector<long>(otherArray, i)).CopyTo(array, i);
330     }
331     for (; i < maximum; i++)
332     {
333         array[i] &= otherArray[i];
334     }
335 }
336
337 [MethodImpl(MethodImplOptions.AggressiveInlining)]
338 public BitString Or(BitString other)
339 {
340     EnsureBitStringHasTheSameSize(other, nameof(other));
341     GetCommonOuterBorders(this, other, out long from, out long to);
342     for (var i = from; i <= to; i++)
343     {
344         _array[i] |= other._array[i];
345         RefreshBordersByWord(i);
346     }
347     return this;
348 }
349
350 [MethodImpl(MethodImplOptions.AggressiveInlining)]
351 public BitString ParallelOr(BitString other)
352 {
353     var threads = Environment.ProcessorCount / 2;
354     if (threads <= 1)
355     {
356         return Or(other);
357     }
358     EnsureBitStringHasTheSameSize(other, nameof(other));
359     GetCommonOuterBorders(this, other, out long from, out long to);
360     var partitioner = Partitioner.Create(from, to + 1, (to - from) / threads);
361     Parallel.ForEach(partitioner.GetDynamicPartitions(), new ParallelOptions {
362 ↪ MaxDegreeOfParallelism = threads }, range =>
363     {
364         var maximum = range.Item2;
365         for (var i = range.Item1; i < maximum; i++)
366         {
367             _array[i] |= other._array[i];
368         }
369     });
370     MarkBordersAsAllBitsSet();
371     TryShrinkBorders();
372     return this;
373 }
374
375 [MethodImpl(MethodImplOptions.AggressiveInlining)]
376 public BitString VectorOr(BitString other)
377 {
378     if (!Vector.IsHardwareAccelerated || _array.LongLength >= int.MaxValue)
379     {
380         return Or(other);
381     }
382     var step = Vector<long>.Count;
383     if (_array.Length < step)
384     {
385         return Or(other);
386     }
387     EnsureBitStringHasTheSameSize(other, nameof(other));
388     GetCommonOuterBorders(this, other, out int from, out int to);
389     VectorOrLoop(_array, other._array, step, from, to + 1);
390     MarkBordersAsAllBitsSet();
391     TryShrinkBorders();
392     return this;
393 }
394
395 [MethodImpl(MethodImplOptions.AggressiveInlining)]
396 public BitString ParallelVectorOr(BitString other)

```

```

396 {
397     var threads = Environment.ProcessorCount / 2;
398     if (threads <= 1)
399     {
400         return VectorOr(other);
401     }
402     if (!Vector.IsHardwareAccelerated)
403     {
404         return ParallelOr(other);
405     }
406     var step = Vector<long>.Count;
407     if (_array.Length < (step * threads))
408     {
409         return VectorOr(other);
410     }
411     EnsureBitStringHasTheSameSize(other, nameof(other));
412     GetCommonOuterBorders(this, other, out int from, out int to);
413     var partitioner = Partitioner.Create(from, to + 1, (to - from) / threads);
414     Parallel.ForEach(partitioner.GetDynamicPartitions(), new ParallelOptions {
415         ↪ MaxDegreeOfParallelism = threads }, range => VectorOrLoop(_array, other._array,
416         ↪ step, range.Item1, range.Item2));
417     MarkBordersAsAllBitsSet();
418     TryShrinkBorders();
419     return this;
420 }
421
422 [MethodImpl(MethodImplOptions.AggressiveInlining)]
423 static private void VectorOrLoop(long[] array, long[] otherArray, int step, int start,
424 ↪ int maximum)
425 {
426     var i = start;
427     var range = maximum - start - 1;
428     var stop = range - (range % step);
429     for (; i < stop; i += step)
430     {
431         (new Vector<long>(array, i) | new Vector<long>(otherArray, i)).CopyTo(array, i);
432     }
433     for (; i < maximum; i++)
434     {
435         array[i] |= otherArray[i];
436     }
437 }
438
439 [MethodImpl(MethodImplOptions.AggressiveInlining)]
440 public BitString Xor(BitString other)
441 {
442     EnsureBitStringHasTheSameSize(other, nameof(other));
443     GetCommonOuterBorders(this, other, out long from, out long to);
444     for (var i = from; i <= to; i++)
445     {
446         _array[i] ^= other._array[i];
447         RefreshBordersByWord(i);
448     }
449     return this;
450 }
451
452 [MethodImpl(MethodImplOptions.AggressiveInlining)]
453 public BitString ParallelXor(BitString other)
454 {
455     var threads = Environment.ProcessorCount / 2;
456     if (threads <= 1)
457     {
458         return Xor(other);
459     }
460     EnsureBitStringHasTheSameSize(other, nameof(other));
461     GetCommonOuterBorders(this, other, out long from, out long to);
462     var partitioner = Partitioner.Create(from, to + 1, (to - from) / threads);
463     Parallel.ForEach(partitioner.GetDynamicPartitions(), new ParallelOptions {
464         ↪ MaxDegreeOfParallelism = threads }, range =>
465     {
466         var maximum = range.Item2;
467         for (var i = range.Item1; i < maximum; i++)
468         {
469             _array[i] ^= other._array[i];
470         }
471     });
472     MarkBordersAsAllBitsSet();
473     TryShrinkBorders();
474 }

```

```

470     return this;
471 }
472
473 [MethodImpl(MethodImplOptions.AggressiveInlining)]
474 public BitString VectorXor(BitString other)
475 {
476     if (!Vector.IsHardwareAccelerated || _array.LongLength >= int.MaxValue)
477     {
478         return Xor(other);
479     }
480     var step = Vector<long>.Count;
481     if (_array.Length < step)
482     {
483         return Xor(other);
484     }
485     EnsureBitStringHasTheSameSize(other, nameof(other));
486     GetCommonOuterBorders(this, other, out int from, out int to);
487     VectorXorLoop(_array, other._array, step, from, to + 1);
488     MarkBordersAsAllBitsSet();
489     TryShrinkBorders();
490     return this;
491 }
492
493 [MethodImpl(MethodImplOptions.AggressiveInlining)]
494 public BitString ParallelVectorXor(BitString other)
495 {
496     var threads = Environment.ProcessorCount / 2;
497     if (threads <= 1)
498     {
499         return VectorXor(other);
500     }
501     if (!Vector.IsHardwareAccelerated)
502     {
503         return ParallelXor(other);
504     }
505     var step = Vector<long>.Count;
506     if (_array.Length < (step * threads))
507     {
508         return VectorXor(other);
509     }
510     EnsureBitStringHasTheSameSize(other, nameof(other));
511     GetCommonOuterBorders(this, other, out int from, out int to);
512     var partitioner = Partitioner.Create(from, to + 1, (to - from) / threads);
513     Parallel.ForEach(partitioner.GetDynamicPartitions(), new ParallelOptions {
514         ↪ MaxDegreeOfParallelism = threads }, range => VectorXorLoop(_array, other._array,
515         ↪ step, range.Item1, range.Item2));
516     MarkBordersAsAllBitsSet();
517     TryShrinkBorders();
518     return this;
519 }
520
521 [MethodImpl(MethodImplOptions.AggressiveInlining)]
522 static private void VectorXorLoop(long[] array, long[] otherArray, int step, int start,
523     ↪ int maximum)
524 {
525     var i = start;
526     var range = maximum - start - 1;
527     var stop = range - (range % step);
528     for (; i < stop; i += step)
529     {
530         (new Vector<long>(array, i) ^ new Vector<long>(otherArray, i)).CopyTo(array, i);
531     }
532     for (; i < maximum; i++)
533     {
534         array[i] ^= otherArray[i];
535     }
536 }
537
538 [MethodImpl(MethodImplOptions.AggressiveInlining)]
539 private void RefreshBordersByWord(long wordIndex)
540 {
541     if (_array[wordIndex] == 0)
542     {
543         if (wordIndex == _minPositiveWord && wordIndex != _array.LongLength - 1)
544         {
545             _minPositiveWord++;
546         }
547         if (wordIndex == _maxPositiveWord && wordIndex != 0)

```

```

545         {
546             _maxPositiveWord--;
547         }
548     }
549     else
550     {
551         if (wordIndex < _minPositiveWord)
552         {
553             _minPositiveWord = wordIndex;
554         }
555         if (wordIndex > _maxPositiveWord)
556         {
557             _maxPositiveWord = wordIndex;
558         }
559     }
560 }
561
562 [MethodImpl(MethodImplOptions.AggressiveInlining)]
563 public bool TryShrinkBorders()
564 {
565     GetBorders(out long from, out long to);
566     while (from <= to && _array[from] == 0)
567     {
568         from++;
569     }
570     if (from > to)
571     {
572         MarkBordersAsAllBitsReset();
573         return true;
574     }
575     while (to >= from && _array[to] == 0)
576     {
577         to--;
578     }
579     if (to < from)
580     {
581         MarkBordersAsAllBitsReset();
582         return true;
583     }
584     var bordersUpdated = from != _minPositiveWord || to != _maxPositiveWord;
585     if (bordersUpdated)
586     {
587         SetBorders(from, to);
588     }
589     return bordersUpdated;
590 }
591
592 [MethodImpl(MethodImplOptions.AggressiveInlining)]
593 public bool Get(long index)
594 {
595     Ensure.Always.ArgumentInRange(index, GetValidIndexRange(), nameof(index));
596     return (_array[GetWordIndexFromIndex(index)] & GetBitMaskFromIndex(index)) != 0;
597 }
598
599 [MethodImpl(MethodImplOptions.AggressiveInlining)]
600 public void Set(long index, bool value)
601 {
602     if (value)
603     {
604         Set(index);
605     }
606     else
607     {
608         Reset(index);
609     }
610 }
611
612 [MethodImpl(MethodImplOptions.AggressiveInlining)]
613 public void Set(long index)
614 {
615     Ensure.Always.ArgumentInRange(index, GetValidIndexRange(), nameof(index));
616     var wordIndex = GetWordIndexFromIndex(index);
617     var mask = GetBitMaskFromIndex(index);
618     _array[wordIndex] |= mask;
619     RefreshBordersByWord(wordIndex);
620 }
621
622 [MethodImpl(MethodImplOptions.AggressiveInlining)]
623 public void Reset(long index)

```

```

624 {
625     Ensure.Always.ArgumentInRange(index, GetValidIndexRange(), nameof(index));
626     var wordIndex = GetWordIndexFromIndex(index);
627     var mask = GetBitMaskFromIndex(index);
628     _array[wordIndex] &= ~mask;
629     RefreshBordersByWord(wordIndex);
630 }
631
632 [MethodImpl(MethodImplOptions.AggressiveInlining)]
633 public bool Add(long index)
634 {
635     var wordIndex = GetWordIndexFromIndex(index);
636     var mask = GetBitMaskFromIndex(index);
637     if ((_array[wordIndex] & mask) == 0)
638     {
639         _array[wordIndex] |= mask;
640         RefreshBordersByWord(wordIndex);
641         return true;
642     }
643     else
644     {
645         return false;
646     }
647 }
648
649 [MethodImpl(MethodImplOptions.AggressiveInlining)]
650 public void SetAll(bool value)
651 {
652     if (value)
653     {
654         SetAll();
655     }
656     else
657     {
658         ResetAll();
659     }
660 }
661
662 [MethodImpl(MethodImplOptions.AggressiveInlining)]
663 public void SetAll()
664 {
665     const long fillValue = unchecked((long)0xffffffffffffffff);
666     var words = GetWordsCountFromIndex(_length);
667     for (var i = 0; i < words; i++)
668     {
669         _array[i] = fillValue;
670     }
671     MarkBordersAsAllBitsSet();
672 }
673
674 [MethodImpl(MethodImplOptions.AggressiveInlining)]
675 public void ResetAll()
676 {
677     const long fillValue = 0;
678     GetBorders(out long from, out long to);
679     for (var i = from; i <= to; i++)
680     {
681         _array[i] = fillValue;
682     }
683     MarkBordersAsAllBitsReset();
684 }
685
686 [MethodImpl(MethodImplOptions.AggressiveInlining)]
687 public List<long> GetSetIndices()
688 {
689     var result = new List<long>();
690     GetBorders(out long from, out long to);
691     for (var i = from; i <= to; i++)
692     {
693         var word = _array[i];
694         if (word != 0)
695         {
696             AppendAllSetBitIndices(result, i, word);
697         }
698     }
699     return result;
700 }
701
702 [MethodImpl(MethodImplOptions.AggressiveInlining)]

```

```

703 public List<ulong> GetSetUInt64Indices()
704 {
705     var result = new List<ulong>();
706     GetBorders(out ulong from, out ulong to);
707     for (var i = from; i <= to; i++)
708     {
709         var word = _array[i];
710         if (word != 0)
711         {
712             AppendAllSetBitIndices(result, i, word);
713         }
714     }
715     return result;
716 }
717
718 [MethodImpl(MethodImplOptions.AggressiveInlining)]
719 public long GetFirstSetBitIndex()
720 {
721     var i = _minPositiveWord;
722     var word = _array[i];
723     if (word != 0)
724     {
725         return GetFirstSetBitForWord(i, word);
726     }
727     return -1;
728 }
729
730 [MethodImpl(MethodImplOptions.AggressiveInlining)]
731 public long GetLastSetBitIndex()
732 {
733     var i = _maxPositiveWord;
734     var word = _array[i];
735     if (word != 0)
736     {
737         return GetLastSetBitForWord(i, word);
738     }
739     return -1;
740 }
741
742 [MethodImpl(MethodImplOptions.AggressiveInlining)]
743 public long CountSetBits()
744 {
745     var total = 0L;
746     GetBorders(out long from, out long to);
747     for (var i = from; i <= to; i++)
748     {
749         var word = _array[i];
750         if (word != 0)
751         {
752             total += CountSetBitsForWord(word);
753         }
754     }
755     return total;
756 }
757
758 [MethodImpl(MethodImplOptions.AggressiveInlining)]
759 public bool HaveCommonBits(BitString other)
760 {
761     EnsureBitStringHasTheSameSize(other, nameof(other));
762     GetCommonInnerBorders(this, other, out long from, out long to);
763     var otherArray = other._array;
764     for (var i = from; i <= to; i++)
765     {
766         var left = _array[i];
767         var right = otherArray[i];
768         if (left != 0 && right != 0 && (left & right) != 0)
769         {
770             return true;
771         }
772     }
773     return false;
774 }
775
776 [MethodImpl(MethodImplOptions.AggressiveInlining)]
777 public long CountCommonBits(BitString other)
778 {
779     EnsureBitStringHasTheSameSize(other, nameof(other));
780     GetCommonInnerBorders(this, other, out long from, out long to);
781     var total = 0L;

```



```

782     var otherArray = other._array;
783     for (var i = from; i <= to; i++)
784     {
785         var left = _array[i];
786         var right = otherArray[i];
787         var combined = left & right;
788         if (combined != 0)
789         {
790             total += CountSetBitsForWord(combined);
791         }
792     }
793     return total;
794 }
795
796 [MethodImpl(MethodImplOptions.AggressiveInlining)]
797 public List<long> GetCommonIndices(BitString other)
798 {
799     EnsureBitStringHasTheSameSize(other, nameof(other));
800     GetCommonInnerBorders(this, other, out long from, out long to);
801     var result = new List<long>();
802     var otherArray = other._array;
803     for (var i = from; i <= to; i++)
804     {
805         var left = _array[i];
806         var right = otherArray[i];
807         var combined = left & right;
808         if (combined != 0)
809         {
810             AppendAllSetBitIndices(result, i, combined);
811         }
812     }
813     return result;
814 }
815
816 [MethodImpl(MethodImplOptions.AggressiveInlining)]
817 public List<ulong> GetCommonUInt64Indices(BitString other)
818 {
819     EnsureBitStringHasTheSameSize(other, nameof(other));
820     GetCommonBorders(this, other, out ulong from, out ulong to);
821     var result = new List<ulong>();
822     var otherArray = other._array;
823     for (var i = from; i <= to; i++)
824     {
825         var left = _array[i];
826         var right = otherArray[i];
827         var combined = left & right;
828         if (combined != 0)
829         {
830             AppendAllSetBitIndices(result, i, combined);
831         }
832     }
833     return result;
834 }
835
836 [MethodImpl(MethodImplOptions.AggressiveInlining)]
837 public long GetFirstCommonBitIndex(BitString other)
838 {
839     EnsureBitStringHasTheSameSize(other, nameof(other));
840     GetCommonInnerBorders(this, other, out long from, out long to);
841     var otherArray = other._array;
842     for (var i = from; i <= to; i++)
843     {
844         var left = _array[i];
845         var right = otherArray[i];
846         var combined = left & right;
847         if (combined != 0)
848         {
849             return GetFirstSetBitForWord(i, combined);
850         }
851     }
852     return -1;
853 }
854
855 [MethodImpl(MethodImplOptions.AggressiveInlining)]
856 public long GetLastCommonBitIndex(BitString other)
857 {
858     EnsureBitStringHasTheSameSize(other, nameof(other));
859     GetCommonInnerBorders(this, other, out long from, out long to);
860     var otherArray = other._array;

```

```

861     for (var i = to; i >= from; i--)
862     {
863         var left = _array[i];
864         var right = otherArray[i];
865         var combined = left & right;
866         if (combined != 0)
867         {
868             return GetLastSetBitForWord(i, combined);
869         }
870     }
871     return -1;
872 }
873
874 [MethodImpl(MethodImplOptions.AggressiveInlining)]
875 public override bool Equals(object obj) => obj is BitString @string ? Equals(@string) :
    ↪ false;
876
877 [MethodImpl(MethodImplOptions.AggressiveInlining)]
878 public bool Equals(BitString other)
879 {
880     if (_length != other._length)
881     {
882         return false;
883     }
884     var otherArray = other._array;
885     if (_array.Length != otherArray.Length)
886     {
887         return false;
888     }
889     if (_minPositiveWord != other._minPositiveWord)
890     {
891         return false;
892     }
893     if (_maxPositiveWord != other._maxPositiveWord)
894     {
895         return false;
896     }
897     GetCommonBorders(this, other, out ulong from, out ulong to);
898     for (var i = from; i <= to; i++)
899     {
900         if (_array[i] != otherArray[i])
901         {
902             return false;
903         }
904     }
905     return true;
906 }
907
908 [MethodImpl(MethodImplOptions.AggressiveInlining)]
909 private void EnsureBitStringHasTheSameSize(BitString other, string argumentName)
910 {
911     Ensure.Always.ArgumentNotNull(other, argumentName);
912     if (_length != other._length)
913     {
914         throw new ArgumentException("Bit string must be the same size.", argumentName);
915     }
916 }
917
918 [MethodImpl(MethodImplOptions.AggressiveInlining)]
919 private void MarkBordersAsAllBitsReset() => SetBorders(_array.LongLength - 1, 0);
920
921 [MethodImpl(MethodImplOptions.AggressiveInlining)]
922 private void MarkBordersAsAllBitsSet() => SetBorders(0, _array.LongLength - 1);
923
924 [MethodImpl(MethodImplOptions.AggressiveInlining)]
925 private void GetBorders(out long from, out long to)
926 {
927     from = _minPositiveWord;
928     to = _maxPositiveWord;
929 }
930
931 [MethodImpl(MethodImplOptions.AggressiveInlining)]
932 private void GetBorders(out ulong from, out ulong to)
933 {
934     from = (ulong)_minPositiveWord;
935     to = (ulong)_maxPositiveWord;
936 }
937
938 [MethodImpl(MethodImplOptions.AggressiveInlining)]

```

```

939 private void SetBorders(long from, long to)
940 {
941     _minPositiveWord = from;
942     _maxPositiveWord = to;
943 }
944
945 [MethodImpl(MethodImplOptions.AggressiveInlining)]
946 private Range<long> GetValidIndexRange() => (0, _length - 1);
947
948 [MethodImpl(MethodImplOptions.AggressiveInlining)]
949 private static Range<long> GetValidLengthRange() => (0, long.MaxValue);
950
951 [MethodImpl(MethodImplOptions.AggressiveInlining)]
952 private static void AppendAllSetBitIndices(List<ulong> result, ulong wordIndex, long
    ↪ wordValue)
953 {
954     GetBits(wordValue, out byte[] bits00to15, out byte[] bits16to31, out byte[]
    ↪ bits32to47, out byte[] bits48to63);
955     AppendAllSetIndices(result, wordIndex, bits00to15, bits16to31, bits32to47,
    ↪ bits48to63);
956 }
957
958 [MethodImpl(MethodImplOptions.AggressiveInlining)]
959 private static void AppendAllSetBitIndices(List<long> result, long wordIndex, long
    ↪ wordValue)
960 {
961     GetBits(wordValue, out byte[] bits00to15, out byte[] bits16to31, out byte[]
    ↪ bits32to47, out byte[] bits48to63);
962     AppendAllSetBitIndices(result, wordIndex, bits00to15, bits16to31, bits32to47,
    ↪ bits48to63);
963 }
964
965 [MethodImpl(MethodImplOptions.AggressiveInlining)]
966 private static long CountSetBitsForWord(long word)
967 {
968     GetBits(word, out byte[] bits00to15, out byte[] bits16to31, out byte[] bits32to47,
    ↪ out byte[] bits48to63);
969     return bits00to15.LongLength + bits16to31.LongLength + bits32to47.LongLength +
    ↪ bits48to63.LongLength;
970 }
971
972 [MethodImpl(MethodImplOptions.AggressiveInlining)]
973 private static long GetFirstSetBitForWord(long wordIndex, long wordValue)
974 {
975     GetBits(wordValue, out byte[] bits00to15, out byte[] bits16to31, out byte[]
    ↪ bits32to47, out byte[] bits48to63);
976     return GetFirstSetBit(wordIndex, bits00to15, bits16to31, bits32to47, bits48to63);
977 }
978
979 [MethodImpl(MethodImplOptions.AggressiveInlining)]
980 private static long GetLastSetBitForWord(long wordIndex, long wordValue)
981 {
982     GetBits(wordValue, out byte[] bits00to15, out byte[] bits16to31, out byte[]
    ↪ bits32to47, out byte[] bits48to63);
983     return GetLastSetBit(wordIndex, bits00to15, bits16to31, bits32to47, bits48to63);
984 }
985
986 [MethodImpl(MethodImplOptions.AggressiveInlining)]
987 private static void AppendAllSetBitIndices(List<long> result, long i, byte[] bits00to15,
    ↪ byte[] bits16to31, byte[] bits32to47, byte[] bits48to63)
988 {
989     for (var j = 0; j < bits00to15.Length; j++)
990     {
991         result.Add(bits00to15[j] + (i * 64));
992     }
993     for (var j = 0; j < bits16to31.Length; j++)
994     {
995         result.Add(bits16to31[j] + 16 + (i * 64));
996     }
997     for (var j = 0; j < bits32to47.Length; j++)
998     {
999         result.Add(bits32to47[j] + 32 + (i * 64));
1000     }
1001     for (var j = 0; j < bits48to63.Length; j++)
1002     {
1003         result.Add(bits48to63[j] + 48 + (i * 64));
1004     }
1005 }

```

```

1006 [MethodImpl(MethodImplOptions.AggressiveInlining)]
1007 private static void AppendAllSetIndices(List<ulong> result, ulong i, byte[] bits00to15,
1008 ↪ byte[] bits16to31, byte[] bits32to47, byte[] bits48to63)
1009 {
1010     for (var j = 0; j < bits00to15.Length; j++)
1011     {
1012         result.Add(bits00to15[j] + (i * 64));
1013     }
1014     for (var j = 0; j < bits16to31.Length; j++)
1015     {
1016         result.Add(bits16to31[j] + 16UL + (i * 64));
1017     }
1018     for (var j = 0; j < bits32to47.Length; j++)
1019     {
1020         result.Add(bits32to47[j] + 32UL + (i * 64));
1021     }
1022     for (var j = 0; j < bits48to63.Length; j++)
1023     {
1024         result.Add(bits48to63[j] + 48UL + (i * 64));
1025     }
1026 }
1027
1028 [MethodImpl(MethodImplOptions.AggressiveInlining)]
1029 private static long GetFirstSetBit(long i, byte[] bits00to15, byte[] bits16to31, byte[]
1030 ↪ bits32to47, byte[] bits48to63)
1031 {
1032     if (bits00to15.Length > 0)
1033     {
1034         return bits00to15[0] + (i * 64);
1035     }
1036     if (bits16to31.Length > 0)
1037     {
1038         return bits16to31[0] + 16 + (i * 64);
1039     }
1040     if (bits32to47.Length > 0)
1041     {
1042         return bits32to47[0] + 32 + (i * 64);
1043     }
1044     return bits48to63[0] + 48 + (i * 64);
1045 }
1046
1047 [MethodImpl(MethodImplOptions.AggressiveInlining)]
1048 private static long GetLastSetBit(long i, byte[] bits00to15, byte[] bits16to31, byte[]
1049 ↪ bits32to47, byte[] bits48to63)
1050 {
1051     if (bits48to63.Length > 0)
1052     {
1053         return bits48to63[bits48to63.Length - 1] + 48 + (i * 64);
1054     }
1055     if (bits32to47.Length > 0)
1056     {
1057         return bits32to47[bits32to47.Length - 1] + 32 + (i * 64);
1058     }
1059     if (bits16to31.Length > 0)
1060     {
1061         return bits16to31[bits16to31.Length - 1] + 16 + (i * 64);
1062     }
1063     return bits00to15[bits00to15.Length - 1] + (i * 64);
1064 }
1065
1066 [MethodImpl(MethodImplOptions.AggressiveInlining)]
1067 private static void GetBits(long word, out byte[] bits00to15, out byte[] bits16to31, out
1068 ↪ byte[] bits32to47, out byte[] bits48to63)
1069 {
1070     bits00to15 = _bitsSetIn16Bits[word & 0xfffffu];
1071     bits16to31 = _bitsSetIn16Bits[(word >> 16) & 0xfffffu];
1072     bits32to47 = _bitsSetIn16Bits[(word >> 32) & 0xfffffu];
1073     bits48to63 = _bitsSetIn16Bits[(word >> 48) & 0xfffffu];
1074 }
1075
1076 [MethodImpl(MethodImplOptions.AggressiveInlining)]
1077 public static void GetCommonInnerBorders(BitString left, BitString right, out long from,
1078 ↪ out long to)
1079 {
1080     from = Math.Max(left._minPositiveWord, right._minPositiveWord);
1081     to = Math.Min(left._maxPositiveWord, right._maxPositiveWord);

```

```

1078     }
1079
1080     [MethodImpl(MethodImplOptions.AggressiveInlining)]
1081     public static void GetCommonOuterBorders(BitString left, BitString right, out long from,
1082     ↪ out long to)
1083     {
1084         from = Math.Min(left._minPositiveWord, right._minPositiveWord);
1085         to = Math.Max(left._maxPositiveWord, right._maxPositiveWord);
1086     }
1087
1088     [MethodImpl(MethodImplOptions.AggressiveInlining)]
1089     public static void GetCommonOuterBorders(BitString left, BitString right, out int from,
1090     ↪ out int to)
1091     {
1092         from = (int)Math.Min(left._minPositiveWord, right._minPositiveWord);
1093         to = (int)Math.Max(left._maxPositiveWord, right._maxPositiveWord);
1094     }
1095
1096     [MethodImpl(MethodImplOptions.AggressiveInlining)]
1097     public static void GetCommonBorders(BitString left, BitString right, out ulong from, out
1098     ↪ ulong to)
1099     {
1100         from = (ulong)Math.Max(left._minPositiveWord, right._minPositiveWord);
1101         to = (ulong)Math.Min(left._maxPositiveWord, right._maxPositiveWord);
1102     }
1103
1104     [MethodImpl(MethodImplOptions.AggressiveInlining)]
1105     public static long GetWordsCountFromIndex(long index) => (index + 63) / 64;
1106
1107     [MethodImpl(MethodImplOptions.AggressiveInlining)]
1108     public static long GetWordIndexFromIndex(long index) => index >> 6;
1109
1110     [MethodImpl(MethodImplOptions.AggressiveInlining)]
1111     public static long GetBitMaskFromIndex(long index) => 1L << (int)(index & 63);
1112
1113     [MethodImpl(MethodImplOptions.AggressiveInlining)]
1114     public override int GetHashCode() => base.GetHashCode();
1115
1116     [MethodImpl(MethodImplOptions.AggressiveInlining)]
1117     public override string ToString() => base.ToString();
1118 }
1119 }

```

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     public static class BitStringExtensions
9     {
10         [MethodImpl(MethodImplOptions.AggressiveInlining)]
11         public static void SetRandomBits(this BitString @string)
12         {
13             for (var i = 0; i < @string.Length; i++)
14             {
15                 var value = RandomHelpers.Default.NextBoolean();
16                 @string.Set(i, value);
17             }
18         }
19     }
20 }

```

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     public static class ConcurrentQueueExtensions
10     {
11         [MethodImpl(MethodImplOptions.AggressiveInlining)]
12         public static IEnumerable<T> DequeueAll<T>(this ConcurrentQueue<T> queue)
13         {

```

```

14         while (queue.TryDequeue(out T item))
15         {
16             yield return item;
17         }
18     }
19 }
20 }

```

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     public static class ConcurrentStackExtensions
9     {
10         [MethodImpl(MethodImplOptions.AggressiveInlining)]
11         public static T PopOrDefault<T>(this ConcurrentStack<T> stack) => stack.TryPop(out T
12             ↪ value) ? value : default;
13
14         [MethodImpl(MethodImplOptions.AggressiveInlining)]
15         public static T PeekOrDefault<T>(this ConcurrentStack<T> stack) => stack.TryPeek(out T
16             ↪ value) ? value : default;
17     }
18 }

```

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     public static class EnsureExtensions
14     {
15         #region Always
16
17         [MethodImpl(MethodImplOptions.AggressiveInlining)]
18         public static void ArgumentNotEmpty<T>(this EnsureAlwaysExtensionRoot root,
19             ↪ ICollection<T> argument, string argumentName, string message)
20         {
21             if (argument.IsNullOrEmpty())
22             {
23                 throw new ArgumentException(message, argumentName);
24             }
25         }
26
27         [MethodImpl(MethodImplOptions.AggressiveInlining)]
28         public static void ArgumentNotEmpty<T>(this EnsureAlwaysExtensionRoot root,
29             ↪ ICollection<T> argument, string argumentName) => ArgumentNotEmpty(root, argument,
30             ↪ argumentName, null);
31
32         [MethodImpl(MethodImplOptions.AggressiveInlining)]
33         public static void ArgumentNotEmpty<T>(this EnsureAlwaysExtensionRoot root,
34             ↪ ICollection<T> argument) => ArgumentNotEmpty(root, argument, null, null);
35
36         [MethodImpl(MethodImplOptions.AggressiveInlining)]
37         public static void ArgumentNotEmptyAndNotWhiteSpace(this EnsureAlwaysExtensionRoot root,
38             ↪ string argument, string argumentName, string message)
39         {
40             if (string.IsNullOrEmpty(argument))
41             {
42                 throw new ArgumentException(message, argumentName);
43             }
44         }
45
46         [MethodImpl(MethodImplOptions.AggressiveInlining)]
47         public static void ArgumentNotEmptyAndNotWhiteSpace(this EnsureAlwaysExtensionRoot root,
48             ↪ string argument, string argumentName) => ArgumentNotEmptyAndNotWhiteSpace(root,
49             ↪ argument, argumentName, null);
50     }
51 }

```

```

44     [MethodImpl(MethodImplOptions.AggressiveInlining)]
45     public static void ArgumentNotEmptyAndNotWhiteSpace(this EnsureAlwaysExtensionRoot root,
46         ↪ string argument) => ArgumentNotEmptyAndNotWhiteSpace(root, argument, null, null);
47
48     #endregion
49
50     #region OnDebug
51
52     [Conditional("DEBUG")]
53     public static void ArgumentNotEmpty<T>(this EnsureOnDebugExtensionRoot root,
54         ↪ ICollection<T> argument, string argumentName, string message) =>
55         ↪ Ensure.Always.ArgumentNotEmpty(argument, argumentName, message);
56
57     [Conditional("DEBUG")]
58     public static void ArgumentNotEmpty<T>(this EnsureOnDebugExtensionRoot root,
59         ↪ ICollection<T> argument, string argumentName) =>
60         ↪ Ensure.Always.ArgumentNotEmpty(argument, argumentName, null);
61
62     [Conditional("DEBUG")]
63     public static void ArgumentNotEmpty<T>(this EnsureOnDebugExtensionRoot root,
64         ↪ ICollection<T> argument) => Ensure.Always.ArgumentNotEmpty(argument, null, null);
65
66     [Conditional("DEBUG")]
67     public static void ArgumentNotEmptyAndNotWhiteSpace(this EnsureOnDebugExtensionRoot
68         ↪ root, string argument, string argumentName, string message) =>
69         ↪ Ensure.Always.ArgumentNotEmptyAndNotWhiteSpace(argument, argumentName, message);
70
71     [Conditional("DEBUG")]
72     public static void ArgumentNotEmptyAndNotWhiteSpace(this EnsureOnDebugExtensionRoot
73         ↪ root, string argument, string argumentName) =>
74         ↪ Ensure.Always.ArgumentNotEmptyAndNotWhiteSpace(argument, argumentName, null);
75
76     [Conditional("DEBUG")]
77     public static void ArgumentNotEmptyAndNotWhiteSpace(this EnsureOnDebugExtensionRoot
78         ↪ root, string argument) => Ensure.Always.ArgumentNotEmptyAndNotWhiteSpace(argument,
79         ↪ null, null);
80
81     #endregion
82 }
83
84 }

```

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      public static class ICollectionExtensions
10     {
11         [MethodImpl(MethodImplOptions.AggressiveInlining)]
12         public static bool IsNullOrEmpty<T>(this ICollection<T> collection) => collection ==
13             ↪ null || collection.Count == 0;
14
15         [MethodImpl(MethodImplOptions.AggressiveInlining)]
16         public static bool AllEqualToDefault<T>(this ICollection<T> collection)
17         {
18             var equalityComparer = EqualityComparer<T>.Default;
19             return collection.All(item => equalityComparer.Equals(item, default));
20         }
21     }
22 }

```

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      public static class IDictionaryExtensions
10     {
11         [MethodImpl(MethodImplOptions.AggressiveInlining)]
12         public static TValue GetOrDefault<TKey, TValue>(this IDictionary<TKey, TValue>
13             ↪ dictionary, TKey key)

```

```

13     {
14         dictionary.TryGetValue(key, out TValue value);
15         return value;
16     }
17
18     [MethodImpl(MethodImplOptions.AggressiveInlining)]
19     public static TValue GetOrAdd<TKey, TValue>(this IDictionary<TKey, TValue> dictionary,
20     ↪ TKey key, Func<TKey, TValue> valueFactory)
21     {
22         if (!dictionary.TryGetValue(key, out TValue value))
23         {
24             value = valueFactory(key);
25             dictionary.Add(key, value);
26             return value;
27         }
28         return value;
29     }
30 }

```

1.15 ./csharp/Platform.Collections/Lists/CharListExtensions.cs

```

1  using System.Collections.Generic;
2  using System.Runtime.CompilerServices;
3
4  namespace Platform.Collections.Lists
5  {
6      public static class CharListExtensions
7      {
8          /// <summary>
9          /// <para>Generates a hash code for the entire list based on the values of its
10         ↪ elements.</para>
11         /// <para>Генерирует хэш-код всего списка, на основе значений его элементов.</para>
12         /// </summary>
13         /// <param name="list"><para>The list to be hashed.</para><para>Список для
14         ↪ хеширования.</para></param>
15         /// <returns>
16         /// <para>The hash code of the list.</para>
17         /// <para>Хэш-код списка.</para>
18         /// </returns>
19         /// <remarks>
20         /// Based on https://github.com/Microsoft/referencesource/blob/3b1eaf5203992df69de44c783\_
21         ↪ a3eda37d3d4cd10/mscorlib/system/string.cs#L833
22         /// </remarks>
23         [MethodImpl(MethodImplOptions.AggressiveInlining)]
24         public static int GenerateHashCode(this IList<char> list)
25         {
26             var hashSeed = 5381;
27             var hashAccumulator = hashSeed;
28             for (var i = 0; i < list.Count; i++)
29             {
30                 hashAccumulator = (hashAccumulator << 5) + hashAccumulator ^ list[i];
31             }
32             return hashAccumulator + (hashSeed * 1566083941);
33         }
34
35         /// <summary>
36         /// <para>Compares two lists for equality.</para>
37         /// <para>Сравнивает два списка на равенство.</para>
38         /// </summary>
39         /// <param name="left"><para>The first compared list.</para><para>Первый список для
40         ↪ сравнения.</para></param>
41         /// <param name="right"><para>The second compared list.</para><para>Второй список для
42         ↪ сравнения.</para></param>
43         /// <returns>
44         /// <para>True, if the passed lists are equal to each other otherwise false.</para>
45         /// <para>True, если переданные списки равны друг другу, иначе false.</para>
46         /// </returns>
47         [MethodImpl(MethodImplOptions.AggressiveInlining)]
48         public static bool EqualTo(this IList<char> left, IList<char> right) =>
49         ↪ left.EqualTo(right, ContentEqualTo);
50
51         /// <summary>
52         /// <para>Compares each element in the list for equality.</para>
53         /// <para>Сравнивает на равенство каждый элемент списка.</para>
54         /// </summary>
55         /// <param name="left"><para>The first compared list.</para><para>Первый список для
56         ↪ сравнения.</para></param>

```



```

50     /// <param name="right"><para>The second compared list.</para><para>Второй список для
    → сравнения.</para></param>
51     /// <returns>
52     /// <para>If at least one element of one list is not equal to the corresponding element
    → from another list returns false, otherwise - true.</para>
53     /// <para>Если как минимум один элемент одного списка не равен соответствующему элементу
    → из другого списка возвращает false, иначе - true.</para>
54     /// </returns>
55     [MethodImpl(MethodImplOptions.AggressiveInlining)]
56     public static bool ContentEqualTo(this IList<char> left, IList<char> right)
57     {
58         for (var i = left.Count - 1; i >= 0; --i)
59         {
60             if (left[i] != right[i])
61             {
62                 return false;
63             }
64         }
65         return true;
66     }
67 }
68 }

```

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      public class IListComparer<T> : IComparer<IList<T>>
7      {
8          /// <summary>
9          /// <para>Compares two lists.</para>
10         /// <para>Сравнивает два списка.</para>
11         /// </summary>
12         /// <typeparam name="T"><para>The list's item type.</para><para>Тип элементов
            → списка.</para></typeparam>
13         /// <param name="left"><para>The first compared list.</para><para>Первый список для
            → сравнения.</para></param>
14         /// <param name="right"><para>The second compared list.</para><para>Второй список для
            → сравнения.</para></param>
15         /// <returns>
16         /// <para>
17         ///     A signed integer that indicates the relative values of <paramref name="left" />
            → and <paramref name="right" /> lists' elements, as shown in the following table.
18         ///     <list type="table">
19         ///         <listheader>
20         ///             <term>Value</term>
21         ///             <description>Meaning</description>
22         ///         </listheader>
23         ///         <item>
24         ///             <term>Is less than zero</term>
25         ///             <description>First non equal element of <paramref name="left" /> list is
            → less than first not equal element of <paramref name="right" /> list.</description>
26         ///         </item>
27         ///         <item>
28         ///             <term>Zero</term>
29         ///             <description>All elements of <paramref name="left" /> list equals to all
            → elements of <paramref name="right" /> list.</description>
30         ///         </item>
31         ///         <item>
32         ///             <term>Is greater than zero</term>
33         ///             <description>First non equal element of <paramref name="left" /> list is
            → greater than first not equal element of <paramref name="right" /> list.</description>
34         ///         </item>
35         ///     </list>
36         /// <para>
37         /// <para>
38         ///     Целое число со знаком, которое указывает относительные значения элементов
            → списков <paramref name="left" /> и <paramref name="right" /> как показано в
            → следующей таблице.
39         ///     <list type="table">
40         ///         <listheader>
41         ///             <term>Значение</term>
42         ///             <description>Смысл</description>
43         ///         </listheader>
44         ///         <item>

```

```

45     /// <term>Меньше нуля</term>
46     /// <description>Первый не равный элемент <paramref name="left" /> списка
    → меньше первого неравного элемента <paramref name="right" /> списка.</description>
47     /// </item>
48     /// <item>
49     /// <term>Ноль</term>
50     /// <description>Все элементы <paramref name="left" /> списка равны всем
    → элементам <paramref name="right" /> списка.</description>
51     /// </item>
52     /// <item>
53     /// <term>Больше нуля</term>
54     /// <description>Первый не равный элемент <paramref name="left" /> списка
    → больше первого неравного элемента <paramref name="right" /> списка.</description>
55     /// </item>
56     /// </list>
57     /// </para>
58     /// </returns>
59     [MethodImpl(MethodImplOptions.AggressiveInlining)]
60     public int Compare(IList<T> left, IList<T> right) => left.CompareTo(right);
61 }
62 }

```

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

```

1  using System.Collections.Generic;
2  using System.Runtime.CompilerServices;
3
4  namespace Platform.Collections.Lists
5  {
6      public class IListEqualityComparer<T> : IEqualityComparer<IList<T>>
7      {
8          /// <summary>
9          /// <para>Compares two lists for equality.</para>
10         /// <para>Сравнивает два списка на равенство.</para>
11         /// </summary>
12         /// <param name="left"><para>The first compared list.</para><para>Первый список для
            → сравнения.</para></param>
13         /// <param name="right"><para>The second compared list.</para><para>Второй список для
            → сравнения.</para></param>
14         /// <returns>
15         /// <para>If the passed lists are equal to each other, true is returned, otherwise
            → false.</para>
16         /// <para>Если переданные списки равны друг другу, возвращается true, иначе же
            → false.</para>
17         /// </returns>
18         [MethodImpl(MethodImplOptions.AggressiveInlining)]
19         public bool Equals(IList<T> left, IList<T> right) => left.EqualTo(right);
20
21         /// <summary>
22         /// <para>Generates a hash code for the entire list based on the values of its
            → elements.</para>
23         /// <para>Генерирует хэш-код всего списка, на основе значений его элементов.</para>
24         /// </summary>
25         /// <param name="list"><para>Hash list.</para><para>Список для
            → хеширования.</para></param>
26         /// <returns>
27         /// <para>The hash code of the list.</para>
28         /// <para>Хэш-код списка.</para>
29         /// </returns>
30         [MethodImpl(MethodImplOptions.AggressiveInlining)]
31         public int GetHashCode(IList<T> list) => list.GenerateHashCode();
32     }
33 }

```

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      public static class IListExtensions
8      {
9          /// <summary>
10         /// <para>Gets the element from specified index if the list is not null and the index is
            → within the list's boundaries, otherwise it returns default value of type T.</para>
11         /// <para>Получает элемент из указанного индекса, если список не является null и индекс
            → находится в границах списка, в противном случае он возвращает значение по умолчанию
            → типа T.</para>

```

```

12  /// </summary>
13  /// <typeparam name="T"><para>The list's item type.</para><para>Тип элементов
    ↳ списка.</typeparam>
14  /// <param name="list"><para>The checked list.</para><para>Проверяемый
    ↳ список.</para></param>
15  /// <param name="index"><para>The index of element.</para><para>Индекс
    ↳ элемента.</para></param>
16  /// <returns>
17  /// <para>If the specified index is within list's boundaries, then - list[index],
    ↳ otherwise the default value.</para>
18  /// <para>Если указанный индекс находится в пределах границ списка, тогда - list[index],
    ↳ иначе же значение по умолчанию.</para>
19  /// </returns>
20  [MethodImpl(MethodImplOptions.AggressiveInlining)]
21  public static T GetElementOrDefault<T>(this IList<T> list, int index) => list != null &&
    ↳ list.Count > index ? list[index] : default;
22
23  /// <summary>
24  /// <para>Checks if a list is passed, checks its length, and if successful, copies the
    ↳ value of list [index] into the element variable. Otherwise, the element variable has
    ↳ a default value.</para>
25  /// <para>Проверяет, передан ли список, сверяет его длину и в случае успеха копирует
    ↳ значение list[index] в переменную element. Иначе переменная element имеет значение
    ↳ по умолчанию.</para>
26  /// </summary>
27  /// <typeparam name="T"><para>The list's item type.</para><para>Тип элементов
    ↳ списка.</typeparam>
28  /// <param name="list"><para>The checked list.</para><para>Список для
    ↳ проверки.</param>
29  /// <param name="index"><para>The index of element.</para><para>Индекс
    ↳ элемента.</param>
30  /// <param name="element"><para>Variable for passing the index
    ↳ value.</para><para>Переменная для передачи значения индекса.</param>
31  /// <returns>
32  /// <para>True on success, false otherwise.</para>
33  /// <para>True в случае успеха, иначе false.</para>
34  /// </returns>
35  [MethodImpl(MethodImplOptions.AggressiveInlining)]
36  public static bool TryGetElement<T>(this IList<T> list, int index, out T element)
37  {
38      if (list != null && list.Count > index)
39      {
40          element = list[index];
41          return true;
42      }
43      else
44      {
45          element = default;
46          return false;
47      }
48  }
49
50  /// <summary>
51  /// <para>Adds a value to the list.</para>
52  /// <para>Добавляет значение в список.</para>
53  /// </summary>
54  /// <typeparam name="T"><para>The list's item type.</para><para>Тип элементов
    ↳ списка.</typeparam>
55  /// <param name="list"><para>The list to add the value to.</para><para>Список в который
    ↳ нужно добавить значение.</param>
56  /// <param name="element"><para>The item to add to the list.</para><para>Элемент который
    ↳ нужно добавить в список.</param>
57  /// <returns>
58  /// <para>True value in any case.</para>
59  /// <para>Значение true в любом случае.</para>
60  /// </returns>
61  [MethodImpl(MethodImplOptions.AggressiveInlining)]
62  public static bool AddAndReturnTrue<T>(this IList<T> list, T element)
63  {
64      list.Add(element);
65      return true;
66  }
67
68  /// <summary>
69  /// <para>Adds the value with first index from other list to this list.</para>
70  /// <para>Добавляет в этот список значение с первым индексом из другого списка.</para>
71  /// </summary>

```

```

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

```

```

134  /// <typeparam name="T"><para>The list's item type.</para><para>Тип элементов
    → списка.</para></typeparam>
135  /// <param name="list"><para>The list to add the values to.</para><para>Список в который
    → нужно добавить значения.</para></param>
136  /// <param name="elements"><para>The list of values to add.</para><para>Список значений
    → которые необходимо добавить.</para></param>
137  /// <returns>
138  /// <para>True value in any case.</para>
139  /// <para>Значение true в любом случае.</para>
140  /// </returns>
141  [MethodImpl(MethodImplOptions.AggressiveInlining)]
142  public static bool AddSkipFirstAndReturnTrue<T>(this IList<T> list, IList<T> elements)
143  {
144      list.AddSkipFirst(elements);
145      return true;
146  }
147
148  /// <summary>
149  /// <para>Adds values to the list skipping the first element.</para>
150  /// <para>Добавляет значения в список пропуская первый элемент.</para>
151  /// </summary>
152  /// <typeparam name="T"><para>The list's item type.</para><para>Тип элементов
    → списка.</para></typeparam>
153  /// <param name="list"><para>The list to add the values to.</para><para>Список в который
    → нужно добавить значения.</para></param>
154  /// <param name="elements"><para>List of values to add.</para><para>Список значений
    → которые необходимо добавить.</para></param>
155  [MethodImpl(MethodImplOptions.AggressiveInlining)]
156  public static void AddSkipFirst<T>(this IList<T> list, IList<T> elements) =>
    → list.AddSkipFirst(elements, 1);
157
158  /// <summary>
159  /// <para>Adds values to the list skipping a specified number of first elements.</para>
160  /// <para>Добавляет в список значения пропуская определенное количество первых
    → элементов.</para>
161  /// </summary>
162  /// <typeparam name="T"><para>The list's item type.</para><para>Тип элементов
    → списка.</para></typeparam>
163  /// <param name="list"><para>The list to add the values to.</para><para>Список в который
    → нужно добавить значения.</para></param>
164  /// <param name="elements"><para>List of values to add.</para><para>Список значений
    → которые необходимо добавить.</para></param>
165  /// <param name="skip"><para>Number of elements to skip.</para><para>Количество
    → пропускаемых элементов.</para></param>
166  [MethodImpl(MethodImplOptions.AggressiveInlining)]
167  public static void AddSkipFirst<T>(this IList<T> list, IList<T> elements, int skip)
168  {
169      for (var i = skip; i < elements.Count; i++)
170      {
171          list.Add(elements[i]);
172      }
173  }
174
175  /// <summary>
176  /// <para>Reads the number of elements in the list.</para>
177  /// <para>Считывает число элементов списка.</para>
178  /// </summary>
179  /// <typeparam name="T"><para>The list's item type.</para><para>Тип элементов
    → списка.</para></typeparam>
180  /// <param name="list"><para>The checked list.</para><para>Список для
    → проверки.</para></param>
181  /// <returns>
182  /// <para>The number of items contained in the list or 0.</para>
183  /// <para>Число элементов содержащихся в списке или же 0.</para>
184  /// </returns>
185  [MethodImpl(MethodImplOptions.AggressiveInlining)]
186  public static int GetCountOrZero<T>(this IList<T> list) => list?.Count ?? 0;
187
188  /// <summary>
189  /// <para>Compares two lists for equality.</para>
190  /// <para>Сравнивает два списка на равенство.</para>
191  /// </summary>
192  /// <typeparam name="T"><para>The list's item type.</para><para>Тип элементов
    → списка.</para></typeparam>
193  /// <param name="left"><para>The first compared list.</para><para>Первый список для
    → сравнения.</para></param>

```

```

194  /// <param name="right"><para>The second compared list.</para><para>Второй список для
    → сравнения.</para></param>
195  /// <returns>
196  /// <para>If the passed lists are equal to each other, true is returned, otherwise
    → false.</para>
197  /// <para>Если переданные списки равны друг другу, возвращается true, иначе же
    → false.</para>
198  /// </returns>
199  [MethodImpl(MethodImplOptions.AggressiveInlining)]
200  public static bool EqualTo<T>(this IList<T> left, IList<T> right) => EqualTo(left,
    → right, ContentEqualTo);
201
202  /// <summary>
203  /// <para>Compares two lists for equality.</para>
204  /// <para>Сравнивает два списка на равенство.</para>
205  /// </summary>
206  /// <typeparam name="T"><para>The list's item type.</para><para>Тип элементов
    → списка.</para></typeparam>
207  /// <param name="left"><para>The first compared list.</para><para>Первый список для
    → проверки.</para></param>
208  /// <param name="right"><para>The second compared list.</para><para>Второй список для
    → сравнения.</para></param>
209  /// <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>
210  /// <returns>
211  /// <para>If the passed lists are equal to each other, true is returned, otherwise
    → false.</para>
212  /// <para>Если переданные списки равны друг другу, возвращается true, иначе же
    → false.</para>
213  /// </returns>
214  [MethodImpl(MethodImplOptions.AggressiveInlining)]
215  public static bool EqualTo<T>(this IList<T> left, IList<T> right, Func<IList<T>,
    → IList<T>, bool> contentEqualityComparer)
216  {
217      if (ReferenceEquals(left, right))
218      {
219          return true;
220      }
221      var leftCount = left.GetCountOrZero();
222      var rightCount = right.GetCountOrZero();
223      if (leftCount == 0 && rightCount == 0)
224      {
225          return true;
226      }
227      if (leftCount == 0 || rightCount == 0 || leftCount != rightCount)
228      {
229          return false;
230      }
231      return contentEqualityComparer(left, right);
232  }
233
234  /// <summary>
235  /// <para>Compares each element in the list for identity.</para>
236  /// <para>Сравнивает на равенство каждый элемент списка.</para>
237  /// </summary>
238  /// <typeparam name="T"><para>The list's item type.</para><para>Тип элементов
    → списка.</para></typeparam>
239  /// <param name="left"><para>The first compared list.</para><para>Первый список для
    → сравнения.</para></param>
240  /// <param name="right"><para>The second compared list.</para><para>Второй список для
    → сравнения.</para></param>
241  /// <returns>
242  /// <para>If at least one element of one list is not equal to the corresponding element
    → from another list returns false, otherwise - true.</para>
243  /// <para>Если как минимум один элемент одного списка не равен соответствующему элементу
    → из другого списка возвращает false, иначе - true.</para>
244  /// </returns>
245  [MethodImpl(MethodImplOptions.AggressiveInlining)]
246  public static bool ContentEqualTo<T>(this IList<T> left, IList<T> right)
247  {
248      var equalityComparer = EqualityComparer<T>.Default;
249      for (var i = left.Count - 1; i >= 0; --i)
250      {
251          if (!equalityComparer.Equals(left[i], right[i]))
252          {
253              return false;

```

```

254     }
255 }
256 return true;
257 }
258
259 /// <summary>
260 /// <para>Creates an array by copying all elements from the list that satisfy the
    → predicate. If no list is passed, null is returned.</para>
261 /// <para>Создаёт массив, копируя из списка все элементы которые удовлетворяют
    → предикату. Если список не передан, возвращается null.</para>
262 /// </summary>
263 /// <typeparam name="T"><para>The list's item type.</para><para>Тип элементов
    → списка.</para></typeparam>
264 /// <param name="list"><para>The list to copy from.</para><para>Список для копирования.</para></param>
265 /// <param name="predicate"><para>A function that determines whether an element should
    → be copied.</para><para>Функция определяющая должен ли копироваться
    → элемент.</para></param>
266 /// <returns>
267 /// <para>An array with copied elements from the list.</para>
268 /// <para>Массив с скопированными элементами из списка.</para>
269 /// </returns>
270 [MethodImpl(MethodImplOptions.AggressiveInlining)]
271 public static T[] ToArray<T>(this IList<T> list, Func<T, bool> predicate)
272 {
273     if (list == null)
274     {
275         return null;
276     }
277     var result = new List<T>(list.Count);
278     for (var i = 0; i < list.Count; i++)
279     {
280         if (predicate(list[i]))
281         {
282             result.Add(list[i]);
283         }
284     }
285     return result.ToArray();
286 }
287
288 /// <summary>
289 /// <para>Copies all the elements of the list into an array and returns it.</para>
290 /// <para>Копирует все элементы списка в массив и возвращает его.</para>
291 /// </summary>
292 /// <typeparam name="T"><para>The list's item type.</para><para>Тип элементов
    → списка.</para></typeparam>
293 /// <param name="list"><para>The list to copy from.</para><para>Список для
    → копирования.</para></param>
294 /// <returns>
295 /// <para>An array with all the elements of the passed list.</para>
296 /// <para>Массив со всеми элементами переданного списка.</para>
297 /// </returns>
298 [MethodImpl(MethodImplOptions.AggressiveInlining)]
299 public static T[] ToArray<T>(this IList<T> list)
300 {
301     var array = new T[list.Count];
302     list.CopyTo(array, 0);
303     return array;
304 }
305
306 /// <summary>
307 /// <para>Executes the passed action for each item in the list.</para>
308 /// <para>Выполняет переданное действие для каждого элемента в списке.</para>
309 /// </summary>
310 /// <typeparam name="T"><para>The list's item type.</para><para>Тип элементов
    → списка.</para></typeparam>
311 /// <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>
312 /// <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>
313 [MethodImpl(MethodImplOptions.AggressiveInlining)]
314 public static void ForEach<T>(this IList<T> list, Action<T> action)
315 {
316     for (var i = 0; i < list.Count; i++)
317     {
318         action(list[i]);
319     }
320 }

```

```

319     }
320 }
321
322 /// <summary>
323 /// <para>Generates a hash code for the entire list based on the values of its
    → elements.</para>
324 /// <para>Генерирует хэш-код всего списка, на основе значений его элементов.</para>
325 /// </summary>
326 /// <typeparam name="T"><para>The list's item type.</para><para>Тип элементов
    → списка.</para></typeparam>
327 /// <param name="list"><para>Hash list.</para><para>Список для
    → хеширования.</para></param>
328 /// <returns>
329 /// <para>The hash code of the list.</para>
330 /// <para>Хэш-код списка.</para>
331 /// </returns>
332 /// <remarks>
333 /// Based on http://stackoverflow.com/questions/263400/what-is-the-best-algorithm-for-an-
    → overridden-system-object-gethashcode
334 /// </remarks>
335 [MethodImpl(MethodImplOptions.AggressiveInlining)]
336 public static int GenerateHashCode<T>(this IList<T> list)
337 {
338     var hashAccumulator = 17;
339     for (var i = 0; i < list.Count; i++)
340     {
341         hashAccumulator = unchecked((hashAccumulator * 23) + list[i].GetHashCode());
342     }
343     return hashAccumulator;
344 }
345
346 /// <summary>
347 /// <para>Compares two lists.</para>
348 /// <para>Сравнивает два списка.</para>
349 /// </summary>
350 /// <typeparam name="T"><para>The list's item type.</para><para>Тип элементов
    → списка.</para></typeparam>
351 /// <param name="left"><para>The first compared list.</para><para>Первый список для
    → сравнения.</para></param>
352 /// <param name="right"><para>The second compared list.</para><para>Второй список для
    → сравнения.</para></param>
353 /// <returns>
354 /// <para>
355 ///     A signed integer that indicates the relative values of <paramref name="left" />
    → and <paramref name="right" /> lists' elements, as shown in the following table.
356 ///     <list type="table">
357 ///         <listheader>
358 ///             <term>Value</term>
359 ///             <description>Meaning</description>
360 ///         </listheader>
361 ///         <item>
362 ///             <term>Is less than zero</term>
363 ///             <description>First non equal element of <paramref name="left" /> list is
    → less than first not equal element of <paramref name="right" /> list.</description>
364 ///         </item>
365 ///         <item>
366 ///             <term>Zero</term>
367 ///             <description>All elements of <paramref name="left" /> list equals to all
    → elements of <paramref name="right" /> list.</description>
368 ///         </item>
369 ///         <item>
370 ///             <term>Is greater than zero</term>
371 ///             <description>First non equal element of <paramref name="left" /> list is
    → greater than first not equal element of <paramref name="right" /> list.</description>
372 ///         </item>
373 ///     </list>
374 /// </para>
375 /// <para>
376 ///     Целое число со знаком, которое указывает относительные значения элементов
    → списков <paramref name="left" /> и <paramref name="right" /> как показано в
    → следующей таблице.
377 ///     <list type="table">
378 ///         <listheader>
379 ///             <term>Значение</term>
380 ///             <description>Смысл</description>
381 ///         </listheader>
382 ///         <item>

```



```

383     /// <term>Меньше нуля</term>
384     /// <description>Первый не равный элемент <paramref name="left" /> списка
    → меньше первого неравного элемента <paramref name="right" /> списка.</description>
385     /// </item>
386     /// <item>
387     /// <term>Ноль</term>
388     /// <description>Все элементы <paramref name="left" /> списка равны всем
    → элементам <paramref name="right" /> списка.</description>
389     /// </item>
390     /// <item>
391     /// <term>Больше нуля</term>
392     /// <description>Первый не равный элемент <paramref name="left" /> списка
    → больше первого неравного элемента <paramref name="right" /> списка.</description>
393     /// </item>
394     /// </list>
395     /// </para>
396     /// </returns>
397     [MethodImpl(MethodImplOptions.AggressiveInlining)]
398     public static int CompareTo<T>(this IList<T> left, IList<T> right)
399     {
400         var comparer = Comparer<T>.Default;
401         var leftCount = left.GetCountOrZero();
402         var rightCount = right.GetCountOrZero();
403         var intermediateResult = leftCount.CompareTo(rightCount);
404         for (var i = 0; intermediateResult == 0 && i < leftCount; i++)
405         {
406             intermediateResult = comparer.Compare(left[i], right[i]);
407         }
408         return intermediateResult;
409     }
410
411     /// <summary>
412     /// <para>Skips one element in the list and builds an array from the remaining
    → elements.</para>
413     /// <para>Пропускает один элемент списка и составляет из оставшихся элементов
    → массив.</para>
414     /// </summary>
415     /// <typeparam name="T"><para>The list's item type.</para><para>Тип элементов
    → списка.</para></typeparam>
416     /// <param name="list"><para>The list to copy from.</para><para>Список для
    → копирования.</para></param>
417     /// <returns>
418     /// <para>If the list is empty, returns an empty array, otherwise - an array with a
    → missing first element.</para>
419     /// <para>Если список пуст, возвращает пустой массив, иначе - массив с пропущенным
    → первым элементом.</para>
420     /// </returns>
421     [MethodImpl(MethodImplOptions.AggressiveInlining)]
422     public static T[] SkipFirst<T>(this IList<T> list) => list.SkipFirst(1);
423
424     /// <summary>
425     /// <para>Skips the specified number of elements in the list and builds an array from
    → the remaining elements.</para>
426     /// <para>Пропускает указанное количество элементов списка и составляет из оставшихся
    → элементов массив.</para>
427     /// </summary>
428     /// <typeparam name="T"><para>The list's item type.</para><para>Тип элементов
    → списка.</para></typeparam>
429     /// <param name="list"><para>The list to copy from.</para><para>Список для
    → копирования.</para></param>
430     /// <param name="skip"><para>The number of items to skip.</para><para>Количество
    → пропускаемых элементов.</para></param>
431     /// <returns>
432     /// <para>If the list is empty, or the number of skipped elements is greater than the
    → list, returns an empty array, otherwise - an array with the specified number of
    → missing elements.</para>
433     /// <para>Если список пуст, или количество пропускаемых элементов больше списка -
    → возвращает пустой массив, иначе - массив с указанным количеством пропущенных
    → элементов.</para>
434     /// </returns>
435     [MethodImpl(MethodImplOptions.AggressiveInlining)]
436     public static T[] SkipFirst<T>(this IList<T> list, int skip)
437     {
438         if (list.IsNullOrEmpty() || list.Count <= skip)
439         {
440             return Array.Empty<T>();

```

```

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

```

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     public class ListFiller<TElement, TReturnConstant>
7     {
8         protected readonly List<TElement> _list;

```

```

9         protected readonly TReturnConstant _returnConstant;
10
11     /// <summary>
12     /// <para>Initializes a new instance of the ListFiller class.</para>
13     /// <para>Инициализирует новый экземпляр класса ListFiller.</para>
14     /// </summary>
15     /// <param name="list"><para>The list to be filled.</para><para>Список который будет
16     → заполняться.</para></param>
17     /// <param name="returnConstant"><para>The value for the constant returned by
18     → corresponding methods.</para><para>Значение для константы возвращаемой
19     → соответствующими методами.</para></param>
20     [MethodImpl(MethodImplOptions.AggressiveInlining)]
21     public ListFiller(List<TElement> list, TReturnConstant returnConstant)
22     {
23         _list = list;
24         _returnConstant = returnConstant;
25     }
26
27     [MethodImpl(MethodImplOptions.AggressiveInlining)]
28     public ListFiller(List<TElement> list) : this(list, default) { }
29
30     /// <summary>
31     /// <para>Adds an item to the end of the list.</para>
32     /// <para>Добавляет элемент в конец списка.</para>
33     /// </summary>
34     /// <param name="element"><para>Element to add.</para><para>Добавляемый
35     → элемент.</para></param>
36     [MethodImpl(MethodImplOptions.AggressiveInlining)]
37     public void Add(TElement element) => _list.Add(element);
38
39     /// <summary>
40     /// <para>Adds an item to the end of the list and return true.</para>
41     /// <para>Добавляет элемент в конец списка и возвращает true.</para>
42     /// </summary>
43     /// <param name="element"><para>Element to add.</para><para>Добавляемый
44     → элемент.</para></param>
45     /// <returns>
46     /// <para>True value in any case.</para>
47     /// <para>Значение true в любом случае.</para>
48     /// </returns>
49     [MethodImpl(MethodImplOptions.AggressiveInlining)]
50     public bool AddAndReturnTrue(TElement element) => _list.AddAndReturnTrue(element);
51
52     /// <summary>
53     /// <para>Adds a value to the list at the first index and return true.</para>
54     /// <para>Добавляет значение в список по первому индексу и возвращает true.</para>
55     /// </summary>
56     /// <param name="element"><para>Element to add.</para><para>Добавляемый
57     → элемент.</para></param>
58     /// <returns>
59     /// <para>True value in any case.</para>
60     /// <para>Значение true в любом случае.</para>
61     /// </returns>
62     [MethodImpl(MethodImplOptions.AggressiveInlining)]
63     public bool AddFirstAndReturnTrue(ICollection<TElement> elements) =>
64     → _list.AddFirstAndReturnTrue(elements);
65
66     /// <summary>
67     /// <para>Adds all elements from other list to this list and returns true.</para>
68     /// <para>Добавляет все элементы из другого списка в этот список и возвращает
69     → true.</para>
70     /// </summary>
71     /// <param name="elements"><para>List of values to add.</para><para>Список значений
72     → которые необходимо добавить.</para></param>
73     /// <returns>
74     /// <para>True value in any case.</para>
75     /// <para>Значение true в любом случае.</para>
76     /// </returns>
77     [MethodImpl(MethodImplOptions.AggressiveInlining)]
78     public bool AddAllAndReturnTrue(ICollection<TElement> elements) =>
79     → _list.AddAllAndReturnTrue(elements);
80
81     /// <summary>
82     /// <para>Adds values to the list skipping the first element.</para>
83     /// <para>Добавляет значения в список пропуская первый элемент.</para>
84     /// </summary>
85     /// <param name="elements"><para>The list of values to add.</para><para>Список значений
86     → которые необходимо добавить.</para></param>

```

```

76     /// <returns>
77     /// <para>True value in any case.</para>
78     /// <para>Значение true в любом случае.</para>
79     /// </returns>
80     [MethodImpl(MethodImplOptions.AggressiveInlining)]
81     public bool AddSkipFirstAndReturnTrue(IList<TElement> elements) =>
82         _list.AddSkipFirstAndReturnTrue(elements);
83
84     /// <summary>
85     /// <para>Adds an item to the end of the list and return constant.</para>
86     /// <para>Добавляет элемент в конец списка и возвращает константу.</para>
87     /// </summary>
88     /// <param name="element"><para>Element to add.</para><para>Добавляемый
89     <para>→ элемент.</para></param>
90     /// <returns>
91     /// <para>Constant value in any case.</para>
92     /// <para>Значение константы в любом случае.</para>
93     /// </returns>
94     [MethodImpl(MethodImplOptions.AggressiveInlining)]
95     public TReturnConstant AddAndReturnConstant(TElement element)
96     {
97         _list.Add(element);
98         return _returnConstant;
99     }
100
101     /// <summary>
102     /// <para>Adds a value to the list at the first index and return constant.</para>
103     /// <para>Добавляет значение в список по первому индексу и возвращает константу.</para>
104     /// </summary>
105     /// <param name="element"><para>Element to add.</para><para>Добавляемый
106     <para>→ элемент.</para></param>
107     /// <returns>
108     /// <para>Constant value in any case.</para>
109     /// <para>Значение константы в любом случае.</para>
110     /// </returns>
111     [MethodImpl(MethodImplOptions.AggressiveInlining)]
112     public TReturnConstant AddFirstAndReturnConstant(IList<TElement> elements)
113     {
114         _list.AddFirst(elements);
115         return _returnConstant;
116     }
117
118     /// <summary>
119     /// <para>Adds all elements from other list to this list and returns constant.</para>
120     /// <para>Добавляет все элементы из другого списка в этот список и возвращает
121     <para>→ константу.</para>
122     /// </summary>
123     /// <param name="elements"><para>List of values to add.</para><para>Список значений
124     <para>→ которые необходимо добавить.</para></param>
125     /// <returns>
126     /// <para>Constant value in any case.</para>
127     /// <para>Значение константы в любом случае.</para>
128     /// </returns>
129     [MethodImpl(MethodImplOptions.AggressiveInlining)]
130     public TReturnConstant AddAllAndReturnConstant(IList<TElement> elements)
131     {
132         _list.AddAll(elements);
133         return _returnConstant;
134     }
135
136     /// <summary>
137     /// <para>Adds values to the list skipping the first element and return constant
138     <para>→ value.</para>
139     /// <para>Добавляет значения в список пропуская первый элемент и возвращает значение
140     <para>→ константы.</para>
141     /// </summary>
142     /// <param name="elements"><para>The list of values to add.</para><para>Список значений
143     <para>→ которые необходимо добавить.</para></param>
144     /// <returns>
145     /// <para>constant value in any case.</para>
146     /// <para>Значение константы в любом случае.</para>
147     /// </returns>
148     [MethodImpl(MethodImplOptions.AggressiveInlining)]
149     public TReturnConstant AddSkipFirstAndReturnConstant(IList<TElement> elements)
150     {
151         _list.AddSkipFirst(elements);
152         return _returnConstant;
153     }

```

```

145     }
146 }
147 }

```

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     public class CharSegment : Segment<char>
12     {
13         [MethodImpl(MethodImplOptions.AggressiveInlining)]
14         public CharSegment(IList<char> @base, int offset, int length) : base(@base, offset,
15             ↪ length) { }
16
17         [MethodImpl(MethodImplOptions.AggressiveInlining)]
18         public override int GetHashCode()
19         {
20             // Base can be not an array, but still IList<char>
21             if (Base is char[] baseArray)
22             {
23                 return baseArray.GenerateHashCode(Offset, Length);
24             }
25             else
26             {
27                 return this.GenerateHashCode();
28             }
29
30             [MethodImpl(MethodImplOptions.AggressiveInlining)]
31             public override bool Equals(Segment<char> other)
32             {
33                 bool contentEqualityComparer(IList<char> left, IList<char> right)
34                 {
35                     // Base can be not an array, but still IList<char>
36                     if (Base is char[] baseArray && other.Base is char[] otherArray)
37                     {
38                         return baseArray.ContentEqualTo(Offset, Length, otherArray, other.Offset);
39                     }
40                     else
41                     {
42                         return left.ContentEqualTo(right);
43                     }
44                 }
45                 return this.EqualTo(other, contentEqualityComparer);
46             }
47
48             public override bool Equals(object obj) => obj is Segment<char> charSegment ?
49                 ↪ Equals(charSegment) : false;
50
51             [MethodImpl(MethodImplOptions.AggressiveInlining)]
52             public static implicit operator string(CharSegment segment)
53             {
54                 if (!(segment.Base is char[] array))
55                 {
56                     array = segment.Base.ToArray();
57                 }
58                 return new string(array, segment.Offset, segment.Length);
59             }
60
61             [MethodImpl(MethodImplOptions.AggressiveInlining)]
62             public override string ToString() => this;
63     }

```

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     public class Segment<T> : IEquatable<Segment<T>>, IList<T>
13     {
14         public IList<T> Base
15         {
16             [MethodImpl(MethodImplOptions.AggressiveInlining)]
17             get;
18         }
19         public int Offset
20         {
21             [MethodImpl(MethodImplOptions.AggressiveInlining)]
22             get;
23         }
24         public int Length
25         {
26             [MethodImpl(MethodImplOptions.AggressiveInlining)]
27             get;
28         }
29
30         [MethodImpl(MethodImplOptions.AggressiveInlining)]
31         public Segment(IList<T> @base, int offset, int length)
32         {
33             Base = @base;
34             Offset = offset;
35             Length = length;
36         }
37
38         [MethodImpl(MethodImplOptions.AggressiveInlining)]
39         public override int GetHashCode() => this.GenerateHashCode();
40
41         [MethodImpl(MethodImplOptions.AggressiveInlining)]
42         public virtual bool Equals(Segment<T> other) => this.EqualTo(other);
43
44         [MethodImpl(MethodImplOptions.AggressiveInlining)]
45         public override bool Equals(object obj) => obj is Segment<T> other ? Equals(other) :
46             ↪ false;
47
48         #region IList
49         public T this[int i]
50         {
51             [MethodImpl(MethodImplOptions.AggressiveInlining)]
52             get => Base[Offset + i];
53             [MethodImpl(MethodImplOptions.AggressiveInlining)]
54             set => Base[Offset + i] = value;
55         }
56
57         public int Count
58         {
59             [MethodImpl(MethodImplOptions.AggressiveInlining)]
60             get => Length;
61         }
62
63         public bool IsReadOnly
64         {
65             [MethodImpl(MethodImplOptions.AggressiveInlining)]
66             get => true;
67         }
68
69         [MethodImpl(MethodImplOptions.AggressiveInlining)]
70         public int IndexOf(T item)
71         {
72             var index = Base.IndexOf(item);
73             if (index >= Offset)
74             {
75                 var actualIndex = index - Offset;
76                 if (actualIndex < Length)
77                 {
78                     return actualIndex;
79                 }
80             }
81             return -1;
82         }
83
84         [MethodImpl(MethodImplOptions.AggressiveInlining)]
85         public void Insert(int index, T item) => throw new NotSupportedException();
86

```

```

87     [MethodImpl(MethodImplOptions.AggressiveInlining)]
88     public void RemoveAt(int index) => throw new NotSupportedException();
89
90     [MethodImpl(MethodImplOptions.AggressiveInlining)]
91     public void Add(T item) => throw new NotSupportedException();
92
93     [MethodImpl(MethodImplOptions.AggressiveInlining)]
94     public void Clear() => throw new NotSupportedException();
95
96     [MethodImpl(MethodImplOptions.AggressiveInlining)]
97     public bool Contains(T item) => IndexOf(item) >= 0;
98
99     [MethodImpl(MethodImplOptions.AggressiveInlining)]
100    public void CopyTo(T[] array, int arrayIndex)
101    {
102        for (var i = 0; i < Length; i++)
103        {
104            array.Add(ref arrayIndex, this[i]);
105        }
106    }
107
108    [MethodImpl(MethodImplOptions.AggressiveInlining)]
109    public bool Remove(T item) => throw new NotSupportedException();
110
111    [MethodImpl(MethodImplOptions.AggressiveInlining)]
112    public IEnumerator<T> GetEnumerator()
113    {
114        for (var i = 0; i < Length; i++)
115        {
116            yield return this[i];
117        }
118    }
119
120    [MethodImpl(MethodImplOptions.AggressiveInlining)]
121    IEnumerator IEnumerable.GetEnumerator() => GetEnumerator();
122
123    #endregion
124 }
125 }

```

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      public abstract class AllSegmentsWalkerBase
6      {
7          public static readonly int DefaultMinimumStringSegmentLength = 2;
8      }
9  }

```

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      public abstract class AllSegmentsWalkerBase<T, TSegment> : AllSegmentsWalkerBase
9          where TSegment : Segment<T>
10     {
11         private readonly int _minimumStringSegmentLength;
12
13         [MethodImpl(MethodImplOptions.AggressiveInlining)]
14         protected AllSegmentsWalkerBase(int minimumStringSegmentLength) =>
15             ↪ _minimumStringSegmentLength = minimumStringSegmentLength;
16
17         [MethodImpl(MethodImplOptions.AggressiveInlining)]
18         protected AllSegmentsWalkerBase() : this(DefaultMinimumStringSegmentLength) { }
19
20         [MethodImpl(MethodImplOptions.AggressiveInlining)]
21         public virtual void WalkAll(ICollection<T> elements)
22         {
23             for (int offset = 0, maxOffset = elements.Count - _minimumStringSegmentLength;
24                 ↪ offset <= maxOffset; offset++)
25             {
26                 for (int length = _minimumStringSegmentLength, maxLength = elements.Count -
27                     ↪ offset; length <= maxLength; length++)
28                 {
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60
61
62
63
64
65
66
67
68
69
70
71
72
73
74
75
76
77
78
79
80
81
82
83
84
85
86
87
88
89
90
91
92
93
94
95
96
97
98
99
100
101
102
103
104
105
106
107
108
109
110
111
112
113
114
115
116
117
118
119
120
121
122
123
124
125
126
127
128
129
130
131
132
133
134
135
136
137
138
139
140
141
142
143
144
145
146
147
148
149
150
151
152
153
154
155
156
157
158
159
160
161
162
163
164
165
166
167
168
169
170
171
172
173
174
175
176
177
178
179
180
181
182
183
184
185
186
187
188
189
190
191
192
193
194
195
196
197
198
199
200
201
202
203
204
205
206
207
208
209
210
211
212
213
214
215
216
217
218
219
220
221
222
223
224
225
226
227
228
229
230
231
232
233
234
235
236
237
238
239
240
241
242
243
244
245
246
247
248
249
250
251
252
253
254
255
256
257
258
259
260
261
262
263
264
265
266
267
268
269
270
271
272
273
274
275
276
277
278
279
280
281
282
283
284
285
286
287
288
289
290
291
292
293
294
295
296
297
298
299
300
301
302
303
304
305
306
307
308
309
310
311
312
313
314
315
316
317
318
319
320
321
322
323
324
325
326
327
328
329
330
331
332
333
334
335
336
337
338
339
340
341
342
343
344
345
346
347
348
349
350
351
352
353
354
355
356
357
358
359
360
361
362
363
364
365
366
367
368
369
370
371
372
373
374
375
376
377
378
379
380
381
382
383
384
385
386
387
388
389
390
391
392
393
394
395
396
397
398
399
400
401
402
403
404
405
406
407
408
409
410
411
412
413
414
415
416
417
418
419
420
421
422
423
424
425
426
427
428
429
430
431
432
433
434
435
436
437
438
439
440
441
442
443
444
445
446
447
448
449
450
451
452
453
454
455
456
457
458
459
460
461
462
463
464
465
466
467
468
469
470
471
472
473
474
475
476
477
478
479
480
481
482
483
484
485
486
487
488
489
490
491
492
493
494
495
496
497
498
499
500
501
502
503
504
505
506
507
508
509
510
511
512
513
514
515
516
517
518
519
520
521
522
523
524
525
526
527
528
529
530
531
532
533
534
535
536
537
538
539
540
541
542
543
544
545
546
547
548
549
550
551
552
553
554
555
556
557
558
559
560
561
562
563
564
565
566
567
568
569
570
571
572
573
574
575
576
577
578
579
580
581
582
583
584
585
586
587
588
589
590
591
592
593
594
595
596
597
598
599
600
601
602
603
604
605
606
607
608
609
610
611
612
613
614
615
616
617
618
619
620
621
622
623
624
625
626
627
628
629
630
631
632
633
634
635
636
637
638
639
640
641
642
643
644
645
646
647
648
649
650
651
652
653
654
655
656
657
658
659
660
661
662
663
664
665
666
667
668
669
670
671
672
673
674
675
676
677
678
679
680
681
682
683
684
685
686
687
688
689
690
691
692
693
694
695
696
697
698
699
700
701
702
703
704
705
706
707
708
709
710
711
712
713
714
715
716
717
718
719
720
721
722
723
724
725
726
727
728
729
730
731
732
733
734
735
736
737
738
739
740
741
742
743
744
745
746
747
748
749
750
751
752
753
754
755
756
757
758
759
760
761
762
763
764
765
766
767
768
769
770
771
772
773
774
775
776
777
778
779
780
781
782
783
784
785
786
787
788
789
790
791
792
793
794
795
796
797
798
799
800
801
802
803
804
805
806
807
808
809
810
811
812
813
814
815
816
817
818
819
820
821
822
823
824
825
826
827
828
829
830
831
832
833
834
835
836
837
838
839
840
841
842
843
844
845
846
847
848
849
850
851
852
853
854
855
856
857
858
859
860
861
862
863
864
865
866
867
868
869
870
871
872
873
874
875
876
877
878
879
880
881
882
883
884
885
886
887
888
889
890
891
892
893
894
895
896
897
898
899
900
901
902
903
904
905
906
907
908
909
910
911
912
913
914
915
916
917
918
919
920
921
922
923
924
925
926
927
928
929
930
931
932
933
934
935
936
937
938
939
940
941
942
943
944
945
946
947
948
949
950
951
952
953
954
955
956
957
958
959
960
961
962
963
964
965
966
967
968
969
970
971
972
973
974
975
976
977
978
979
980
981
982
983
984
985
986
987
988
989
990
991
992
993
994
995
996
997
998
999

```

```

25         {
26             Iteration(CreateSegment(elements, offset, length));
27         }
28     }
29 }
30
31 [MethodImpl(MethodImplOptions.AggressiveInlining)]
32 protected abstract TSegment CreateSegment(ICollection<T> elements, int offset, int length);
33
34 [MethodImpl(MethodImplOptions.AggressiveInlining)]
35 protected abstract void Iteration(TSegment segment);
36 }
37 }

```

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     public abstract class AllSegmentsWalkerBase<T> : AllSegmentsWalkerBase<T, Segment<T>>
9     {
10         [MethodImpl(MethodImplOptions.AggressiveInlining)]
11         protected override Segment<T> CreateSegment(ICollection<T> elements, int offset, int length)
12             => new Segment<T>(elements, offset, length);
13     }
14 }

```

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     public static class AllSegmentsWalkerExtensions
8     {
9         [MethodImpl(MethodImplOptions.AggressiveInlining)]
10         public static void WalkAll(this AllSegmentsWalkerBase<char> walker, string @string) =>
11             walker.WalkAll(@string.ToCharArray());
12
13         [MethodImpl(MethodImplOptions.AggressiveInlining)]
14         public static void WalkAll<TSegment>(this AllSegmentsWalkerBase<char, TSegment> walker,
15             string @string) where TSegment : Segment<char> =>
16             walker.WalkAll(@string.ToCharArray());
17     }
18 }

```

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     public abstract class DictionaryBasedDuplicateSegmentsWalkerBase<T, TSegment> :
10         DuplicateSegmentsWalkerBase<T, TSegment>
11         where TSegment : Segment<T>
12     {
13         public static readonly bool DefaultResetDictionaryOnEachWalk;
14
15         private readonly bool _resetDictionaryOnEachWalk;
16         protected IDictionary<TSegment, long> Dictionary;
17
18         [MethodImpl(MethodImplOptions.AggressiveInlining)]
19         protected DictionaryBasedDuplicateSegmentsWalkerBase(IDictionary<TSegment, long>
20             dictionary, int minimumStringSegmentLength, bool resetDictionaryOnEachWalk)
21             : base(minimumStringSegmentLength)
22         {
23             Dictionary = dictionary;
24             _resetDictionaryOnEachWalk = resetDictionaryOnEachWalk;
25         }
26
27         [MethodImpl(MethodImplOptions.AggressiveInlining)]

```



```

26     protected DictionaryBasedDuplicateSegmentsWalkerBase(IDictionary<TSegment, long>
    ↪ dictionary, int minimumStringSegmentLength) : this(dictionary,
    ↪ minimumStringSegmentLength, DefaultResetDictionaryOnEachWalk) { }
27
28     [MethodImpl(MethodImplOptions.AggressiveInlining)]
29     protected DictionaryBasedDuplicateSegmentsWalkerBase(IDictionary<TSegment, long>
    ↪ dictionary) : this(dictionary, DefaultMinimumStringSegmentLength,
    ↪ DefaultResetDictionaryOnEachWalk) { }
30
31     [MethodImpl(MethodImplOptions.AggressiveInlining)]
32     protected DictionaryBasedDuplicateSegmentsWalkerBase(int minimumStringSegmentLength,
    ↪ bool resetDictionaryOnEachWalk) : this(resetDictionaryOnEachWalk ? null : new
    ↪ Dictionary<TSegment, long>(), minimumStringSegmentLength, resetDictionaryOnEachWalk)
    ↪ { }
33
34     [MethodImpl(MethodImplOptions.AggressiveInlining)]
35     protected DictionaryBasedDuplicateSegmentsWalkerBase(int minimumStringSegmentLength) :
    ↪ this(minimumStringSegmentLength, DefaultResetDictionaryOnEachWalk) { }
36
37     [MethodImpl(MethodImplOptions.AggressiveInlining)]
38     protected DictionaryBasedDuplicateSegmentsWalkerBase() :
    ↪ this(DefaultMinimumStringSegmentLength, DefaultResetDictionaryOnEachWalk) { }
39
40     [MethodImpl(MethodImplOptions.AggressiveInlining)]
41     public override void WalkAll(ICollection<T> elements)
42     {
43         if (_resetDictionaryOnEachWalk)
44         {
45             var capacity = Math.Ceiling(Math.Pow(elements.Count, 2) / 2);
46             Dictionary = new Dictionary<TSegment, long>((int)capacity);
47         }
48         base.WalkAll(elements);
49     }
50
51     [MethodImpl(MethodImplOptions.AggressiveInlining)]
52     protected override long GetSegmentFrequency(TSegment segment) =>
    ↪ Dictionary.GetOrDefault(segment);
53
54     [MethodImpl(MethodImplOptions.AggressiveInlining)]
55     protected override void SetSegmentFrequency(TSegment segment, long frequency) =>
    ↪ Dictionary[segment] = frequency;
56 }
57 }

```

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     public abstract class DictionaryBasedDuplicateSegmentsWalkerBase<T> :
    ↪ DictionaryBasedDuplicateSegmentsWalkerBase<T, Segment<T>>
9     {
10         [MethodImpl(MethodImplOptions.AggressiveInlining)]
11         protected DictionaryBasedDuplicateSegmentsWalkerBase(IDictionary<Segment<T>, long>
    ↪ dictionary, int minimumStringSegmentLength, bool resetDictionaryOnEachWalk) :
    ↪ base(dictionary, minimumStringSegmentLength, resetDictionaryOnEachWalk) { }
12
13         [MethodImpl(MethodImplOptions.AggressiveInlining)]
14         protected DictionaryBasedDuplicateSegmentsWalkerBase(IDictionary<Segment<T>, long>
    ↪ dictionary, int minimumStringSegmentLength) : base(dictionary,
    ↪ minimumStringSegmentLength, DefaultResetDictionaryOnEachWalk) { }
15
16         [MethodImpl(MethodImplOptions.AggressiveInlining)]
17         protected DictionaryBasedDuplicateSegmentsWalkerBase(IDictionary<Segment<T>, long>
    ↪ dictionary) : base(dictionary, DefaultMinimumStringSegmentLength,
    ↪ DefaultResetDictionaryOnEachWalk) { }
18
19         [MethodImpl(MethodImplOptions.AggressiveInlining)]
20         protected DictionaryBasedDuplicateSegmentsWalkerBase(int minimumStringSegmentLength,
    ↪ bool resetDictionaryOnEachWalk) : base(minimumStringSegmentLength,
    ↪ resetDictionaryOnEachWalk) { }
21
22         [MethodImpl(MethodImplOptions.AggressiveInlining)]
23         protected DictionaryBasedDuplicateSegmentsWalkerBase(int minimumStringSegmentLength) :
    ↪ base(minimumStringSegmentLength, DefaultResetDictionaryOnEachWalk) { }

```

```

24     [MethodImpl(MethodImplOptions.AggressiveInlining)]
25     protected DictionaryBasedDuplicateSegmentsWalkerBase() :
26         ↪ base(DefaultMinimumStringSegmentLength, DefaultResetDictionaryOnEachWalk) { }
27 }
28 }

```

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      public abstract class DuplicateSegmentsWalkerBase<T, TSegment> : AllSegmentsWalkerBase<T,
8          ↪ TSegment>
9          where TSegment : Segment<T>
10     {
11         [MethodImpl(MethodImplOptions.AggressiveInlining)]
12         protected DuplicateSegmentsWalkerBase(int minimumStringSegmentLength) :
13             ↪ base(minimumStringSegmentLength) { }
14
15         [MethodImpl(MethodImplOptions.AggressiveInlining)]
16         protected DuplicateSegmentsWalkerBase() : base(DefaultMinimumStringSegmentLength) { }
17
18         [MethodImpl(MethodImplOptions.AggressiveInlining)]
19         protected override void Iteration(TSegment segment)
20         {
21             var frequency = GetSegmentFrequency(segment);
22             if (frequency == 1)
23             {
24                 OnDuplicateFound(segment);
25             }
26             SetSegmentFrequency(segment, frequency + 1);
27         }
28
29         [MethodImpl(MethodImplOptions.AggressiveInlining)]
30         protected abstract void OnDuplicateFound(TSegment segment);
31
32         [MethodImpl(MethodImplOptions.AggressiveInlining)]
33         protected abstract long GetSegmentFrequency(TSegment segment);
34
35         [MethodImpl(MethodImplOptions.AggressiveInlining)]
36         protected abstract void SetSegmentFrequency(TSegment segment, long frequency);
37     }
38 }

```

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      public abstract class DuplicateSegmentsWalkerBase<T> : DuplicateSegmentsWalkerBase<T,
6          ↪ Segment<T>>
7      {
8      }
9  }

```

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      public static class ISetExtensions
9      {
10         [MethodImpl(MethodImplOptions.AggressiveInlining)]
11         public static void AddAndReturnVoid<T>(this ISet<T> set, T element) => set.Add(element);
12
13         [MethodImpl(MethodImplOptions.AggressiveInlining)]
14         public static void RemoveAndReturnVoid<T>(this ISet<T> set, T element) =>
15             ↪ set.Remove(element);
16
17         [MethodImpl(MethodImplOptions.AggressiveInlining)]
18         public static bool AddAndReturnTrue<T>(this ISet<T> set, T element)
19         {
20
21         }
22     }
23 }

```

```

19         set.Add(element);
20         return true;
21     }
22
23     [MethodImpl(MethodImplOptions.AggressiveInlining)]
24     public static bool AddFirstAndReturnTrue<T>(this ISet<T> set, IList<T> elements)
25     {
26         AddFirst(set, elements);
27         return true;
28     }
29
30     [MethodImpl(MethodImplOptions.AggressiveInlining)]
31     public static void AddFirst<T>(this ISet<T> set, IList<T> elements) =>
32         ↪ set.Add(elements[0]);
33
34     [MethodImpl(MethodImplOptions.AggressiveInlining)]
35     public static bool AddAllAndReturnTrue<T>(this ISet<T> set, IList<T> elements)
36     {
37         set.AddAll(elements);
38         return true;
39     }
40
41     [MethodImpl(MethodImplOptions.AggressiveInlining)]
42     public static void AddAll<T>(this ISet<T> set, IList<T> elements)
43     {
44         for (var i = 0; i < elements.Count; i++)
45         {
46             set.Add(elements[i]);
47         }
48     }
49
50     [MethodImpl(MethodImplOptions.AggressiveInlining)]
51     public static bool AddSkipFirstAndReturnTrue<T>(this ISet<T> set, IList<T> elements)
52     {
53         set.AddSkipFirst(elements);
54         return true;
55     }
56
57     [MethodImpl(MethodImplOptions.AggressiveInlining)]
58     public static void AddSkipFirst<T>(this ISet<T> set, IList<T> elements) =>
59         ↪ set.AddSkipFirst(elements, 1);
60
61     [MethodImpl(MethodImplOptions.AggressiveInlining)]
62     public static void AddSkipFirst<T>(this ISet<T> set, IList<T> elements, int skip)
63     {
64         for (var i = skip; i < elements.Count; i++)
65         {
66             set.Add(elements[i]);
67         }
68     }
69
70     [MethodImpl(MethodImplOptions.AggressiveInlining)]
71     public static bool DoNotContains<T>(this ISet<T> set, T element) =>
72         ↪ !set.Contains(element);
73 }

```

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     public class SetFiller<TElement, TReturnConstant>
9     {
10         protected readonly ISet<TElement> _set;
11         protected readonly TReturnConstant _returnConstant;
12
13         [MethodImpl(MethodImplOptions.AggressiveInlining)]
14         public SetFiller(ISet<TElement> set, TReturnConstant returnConstant)
15         {
16             _set = set;
17             _returnConstant = returnConstant;
18         }
19
20         [MethodImpl(MethodImplOptions.AggressiveInlining)]
21         public SetFiller(ISet<TElement> set) : this(set, default) { }
22     }

```

```

23     [MethodImpl(MethodImplOptions.AggressiveInlining)]
24     public void Add(TElement element) => _set.Add(element);
25
26     [MethodImpl(MethodImplOptions.AggressiveInlining)]
27     public bool AddAndReturnTrue(TElement element) => _set.AddAndReturnTrue(element);
28
29     [MethodImpl(MethodImplOptions.AggressiveInlining)]
30     public bool AddFirstAndReturnTrue(IList<TElement> elements) =>
31         => _set.AddFirstAndReturnTrue(elements);
32
33     [MethodImpl(MethodImplOptions.AggressiveInlining)]
34     public bool AddAllAndReturnTrue(IList<TElement> elements) =>
35         => _set.AddAllAndReturnTrue(elements);
36
37     [MethodImpl(MethodImplOptions.AggressiveInlining)]
38     public bool AddSkipFirstAndReturnTrue(IList<TElement> elements) =>
39         => _set.AddSkipFirstAndReturnTrue(elements);
40
41     [MethodImpl(MethodImplOptions.AggressiveInlining)]
42     public TReturnConstant AddAndReturnConstant(TElement element)
43     {
44         _set.Add(element);
45         return _returnConstant;
46     }
47
48     [MethodImpl(MethodImplOptions.AggressiveInlining)]
49     public TReturnConstant AddFirstAndReturnConstant(IList<TElement> elements)
50     {
51         _set.AddFirst(elements);
52         return _returnConstant;
53     }
54
55     [MethodImpl(MethodImplOptions.AggressiveInlining)]
56     public TReturnConstant AddAllAndReturnConstant(IList<TElement> elements)
57     {
58         _set.AddAll(elements);
59         return _returnConstant;
60     }
61
62     [MethodImpl(MethodImplOptions.AggressiveInlining)]
63     public TReturnConstant AddSkipFirstAndReturnConstant(IList<TElement> elements)
64     {
65         _set.AddSkipFirst(elements);
66         return _returnConstant;
67     }
68 }

```

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      public class DefaultStack<TElement> : Stack<TElement>, IStack<TElement>
9      {
10         public bool IsEmpty
11         {
12             [MethodImpl(MethodImplOptions.AggressiveInlining)]
13             get => Count <= 0;
14         }
15     }
16 }

```

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      public interface IStack<TElement>
8      {
9         bool IsEmpty
10         {
11             [MethodImpl(MethodImplOptions.AggressiveInlining)]
12             get;
13         }
14     }
15 }

```

```

13     }
14
15     [MethodImpl(MethodImplOptions.AggressiveInlining)]
16     void Push(TElement element);
17
18     [MethodImpl(MethodImplOptions.AggressiveInlining)]
19     TElement Pop();
20
21     [MethodImpl(MethodImplOptions.AggressiveInlining)]
22     TElement Peek();
23 }
24 }

```

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     public static class IStackExtensions
8     {
9         [MethodImpl(MethodImplOptions.AggressiveInlining)]
10        public static void Clear<T>(this IStack<T> stack)
11        {
12            while (!stack.IsEmpty)
13            {
14                _ = stack.Pop();
15            }
16        }
17
18        [MethodImpl(MethodImplOptions.AggressiveInlining)]
19        public static T PopOrDefault<T>(this IStack<T> stack) => stack.IsEmpty ? default :
20            ↪ stack.Pop();
21
22        [MethodImpl(MethodImplOptions.AggressiveInlining)]
23        public static T PeekOrDefault<T>(this IStack<T> stack) => stack.IsEmpty ? default :
24            ↪ stack.Peek();
25    }
26 }

```

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     public interface IStackFactory<TElement> : IFactory<IStack<TElement>>
8     {
9     }
10 }

```

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     public static class StackExtensions
9     {
10        [MethodImpl(MethodImplOptions.AggressiveInlining)]
11        public static T PopOrDefault<T>(this Stack<T> stack) => stack.Count > 0 ? stack.Pop() :
12            ↪ default;
13
14        [MethodImpl(MethodImplOptions.AggressiveInlining)]
15        public static T PeekOrDefault<T>(this Stack<T> stack) => stack.Count > 0 ? stack.Peek()
16            ↪ : default;
17    }
18 }

```

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     public static class StringExtensions
10    {
11        [MethodImpl(MethodImplOptions.AggressiveInlining)]
12        public static string CapitalizeFirstLetter(this string @string)
13        {
14            if (@string.IsNullOrEmpty(@string))
15            {
16                return @string;
17            }
18            var chars = @string.ToCharArray();
19            for (var i = 0; i < chars.Length; i++)
20            {
21                var category = char.GetUnicodeCategory(chars[i]);
22                if (category == UnicodeCategory.UppercaseLetter)
23                {
24                    return @string;
25                }
26                if (category == UnicodeCategory.LowercaseLetter)
27                {
28                    chars[i] = char.ToUpper(chars[i]);
29                    return new string(chars);
30                }
31            }
32            return @string;
33        }
34
35        [MethodImpl(MethodImplOptions.AggressiveInlining)]
36        public static string Truncate(this string @string, int maxLength) =>
37            ↪ @string.IsNullOrEmpty(@string) ? @string : @string.Substring(0,
38            ↪ Math.Min(@string.Length, maxLength));
39
40        [MethodImpl(MethodImplOptions.AggressiveInlining)]
41        public static string TrimSingle(this string @string, char charToTrim)
42        {
43            if (!@string.IsNullOrEmpty(@string))
44            {
45                if (@string.Length == 1)
46                {
47                    if (@string[0] == charToTrim)
48                    {
49                        return "";
50                    }
51                    else
52                    {
53                        return @string;
54                    }
55                }
56                else
57                {
58                    var left = 0;
59                    var right = @string.Length - 1;
60                    if (@string[left] == charToTrim)
61                    {
62                        left++;
63                    }
64                    if (@string[right] == charToTrim)
65                    {
66                        right--;
67                    }
68                    return @string.Substring(left, right - left + 1);
69                }
70            }
71            else
72            {
73                return @string;
74            }
75        }
76    }
77 }

```

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     public class Node
10    {
11        private Dictionary<object, Node> _childNodes;
12
13        public object Value
14        {
15            [MethodImpl(MethodImplOptions.AggressiveInlining)]
16            get;
17            [MethodImpl(MethodImplOptions.AggressiveInlining)]
18            set;
19        }
20
21        public Dictionary<object, Node> ChildNodes
22        {
23            [MethodImpl(MethodImplOptions.AggressiveInlining)]
24            get => _childNodes ?? (_childNodes = new Dictionary<object, Node>());
25        }
26
27        public Node this[object key]
28        {
29            [MethodImpl(MethodImplOptions.AggressiveInlining)]
30            get => GetChild(key) ?? AddChild(key);
31            [MethodImpl(MethodImplOptions.AggressiveInlining)]
32            set => SetChildValue(value, key);
33        }
34
35        [MethodImpl(MethodImplOptions.AggressiveInlining)]
36        public Node(object value) => Value = value;
37
38        [MethodImpl(MethodImplOptions.AggressiveInlining)]
39        public Node() : this(null) { }
40
41        [MethodImpl(MethodImplOptions.AggressiveInlining)]
42        public bool ContainsChild(params object[] keys) => GetChild(keys) != null;
43
44        [MethodImpl(MethodImplOptions.AggressiveInlining)]
45        public Node GetChild(params object[] keys)
46        {
47            var node = this;
48            for (var i = 0; i < keys.Length; i++)
49            {
50                node.ChildNodes.TryGetValue(keys[i], out node);
51                if (node == null)
52                {
53                    return null;
54                }
55            }
56            return node;
57        }
58
59        [MethodImpl(MethodImplOptions.AggressiveInlining)]
60        public object GetChildValue(params object[] keys) => GetChild(keys)?.Value;
61
62        [MethodImpl(MethodImplOptions.AggressiveInlining)]
63        public Node AddChild(object key) => AddChild(key, new Node(null));
64
65        [MethodImpl(MethodImplOptions.AggressiveInlining)]
66        public Node AddChild(object key, object value) => AddChild(key, new Node(value));
67
68        [MethodImpl(MethodImplOptions.AggressiveInlining)]
69        public Node AddChild(object key, Node child)
70        {
71            ChildNodes.Add(key, child);
72            return child;
73        }
74
75        [MethodImpl(MethodImplOptions.AggressiveInlining)]
76        public Node SetChild(params object[] keys) => SetChildValue(null, keys);
77
78        [MethodImpl(MethodImplOptions.AggressiveInlining)]
79        public Node SetChild(object key) => SetChildValue(null, key);
80
81        [MethodImpl(MethodImplOptions.AggressiveInlining)]
82        public Node SetChildValue(object value, params object[] keys)
83        {
84            var node = this;
85            for (var i = 0; i < keys.Length; i++)

```

```

86         {
87             node = SetChildValue(value, keys[i]);
88         }
89         node.Value = value;
90         return node;
91     }
92
93     [MethodImpl(MethodImplOptions.AggressiveInlining)]
94     public Node SetChildValue(object value, object key)
95     {
96         if (!ChildNodes.TryGetValue(key, out Node child))
97         {
98             child = AddChild(key, value);
99         }
100         child.Value = value;
101         return child;
102     }
103 }
104 }

```

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

```

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

```

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

```

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

```



```

33     });
34 }
35
36 [Fact]
37 public static void BitParallelNotTest()
38 {
39     TestToOperationsWithSameMeaning((x, y, w, v) =>
40     {
41         x.ParallelNot();
42         w.Not();
43     });
44 }
45
46 [Fact]
47 public static void BitParallelVectorNotTest()
48 {
49     TestToOperationsWithSameMeaning((x, y, w, v) =>
50     {
51         x.ParallelVectorNot();
52         w.Not();
53     });
54 }
55
56 [Fact]
57 public static void BitVectorAndTest()
58 {
59     TestToOperationsWithSameMeaning((x, y, w, v) =>
60     {
61         x.VectorAnd(y);
62         w.And(v);
63     });
64 }
65
66 [Fact]
67 public static void BitParallelAndTest()
68 {
69     TestToOperationsWithSameMeaning((x, y, w, v) =>
70     {
71         x.ParallelAnd(y);
72         w.And(v);
73     });
74 }
75
76 [Fact]
77 public static void BitParallelVectorAndTest()
78 {
79     TestToOperationsWithSameMeaning((x, y, w, v) =>
80     {
81         x.ParallelVectorAnd(y);
82         w.And(v);
83     });
84 }
85
86 [Fact]
87 public static void BitVectorOrTest()
88 {
89     TestToOperationsWithSameMeaning((x, y, w, v) =>
90     {
91         x.VectorOr(y);
92         w.Or(v);
93     });
94 }
95
96 [Fact]
97 public static void BitParallelOrTest()
98 {
99     TestToOperationsWithSameMeaning((x, y, w, v) =>
100    {
101        x.ParallelOr(y);
102        w.Or(v);
103    });
104 }
105
106 [Fact]
107 public static void BitParallelVectorOrTest()
108 {
109     TestToOperationsWithSameMeaning((x, y, w, v) =>
110    {

```

```

111         x.ParallelVectorOr(y);
112         w.Or(v);
113     });
114 }
115
116 [Fact]
117 public static void BitVectorXorTest()
118 {
119     TestToOperationsWithSameMeaning((x, y, w, v) =>
120     {
121         x.VectorXor(y);
122         w.Xor(v);
123     });
124 }
125
126 [Fact]
127 public static void BitParallelXorTest()
128 {
129     TestToOperationsWithSameMeaning((x, y, w, v) =>
130     {
131         x.ParallelXor(y);
132         w.Xor(v);
133     });
134 }
135
136 [Fact]
137 public static void BitParallelVectorXorTest()
138 {
139     TestToOperationsWithSameMeaning((x, y, w, v) =>
140     {
141         x.ParallelVectorXor(y);
142         w.Xor(v);
143     });
144 }
145
146 private static void TestToOperationsWithSameMeaning(Action<BitString, BitString,
147     ↪ BitString, BitString> test)
148 {
149     const int n = 5654;
150     var x = new BitString(n);
151     var y = new BitString(n);
152     while (x.Equals(y))
153     {
154         x.SetRandomBits();
155         y.SetRandomBits();
156     }
157     var w = new BitString(x);
158     var v = new BitString(y);
159     Assert.False(x.Equals(y));
160     Assert.False(w.Equals(v));
161     Assert.True(x.Equals(w));
162     Assert.True(y.Equals(v));
163     test(x, y, w, v);
164     Assert.True(x.Equals(w));
165 }
166 }

```

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

```

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

```

```

21         const string testString = "test test";
22         var testArray = testString.ToCharArray();
23         var first = new CharSegment(testArray, 0, 4);
24         var second = new CharSegment(testArray, 5, 4);
25         Assert.True(first.Equals(second));
26     }
27 }
28 }

```

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

```

1  using System.Collections.Generic;
2  using Xunit;
3  using Platform.Collections.Lists;
4
5
6  namespace Platform.Collections.Tests
7  {
8      public class ListTests
9      {
10         [Fact]
11         public void GetElementTest()
12         {
13             var nullList = (IList<int>)null;
14             Assert.Equal(0, nullList.GetElementOrDefault(1));
15             Assert.False(nullList.TryGetElement(1, out int element));
16             Assert.Equal(0, element);
17             var list = new List<int>() { 1, 2, 3 };
18             Assert.Equal(3, list.GetElementOrDefault(2));
19             Assert.True(list.TryGetElement(2, out element));
20             Assert.Equal(3, element);
21             Assert.Equal(0, list.GetElementOrDefault(10));
22             Assert.False(list.TryGetElement(10, out element));
23             Assert.Equal(0, element);
24         }
25     }
26 }

```

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

```

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

```

Index

- ./csharp/Platform.Collections.Tests/ArrayTests.cs, 56
- ./csharp/Platform.Collections.Tests/BitStringTests.cs, 56
- ./csharp/Platform.Collections.Tests/CharsSegmentTests.cs, 58
- ./csharp/Platform.Collections.Tests/ListTests.cs, 59
- ./csharp/Platform.Collections.Tests/StringTests.cs, 59
- ./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, 4
- ./csharp/Platform.Collections/Arrays/ArrayString.cs, 6
- ./csharp/Platform.Collections/Arrays/CharArrayExtensions.cs, 6
- ./csharp/Platform.Collections/Arrays/GenericArrayExtensions.cs, 8
- ./csharp/Platform.Collections/BitString.cs, 14
- ./csharp/Platform.Collections/BitStringExtensions.cs, 29
- ./csharp/Platform.Collections/Concurrent/ConcurrentQueueExtensions.cs, 29
- ./csharp/Platform.Collections/Concurrent/ConcurrentStackExtensions.cs, 30
- ./csharp/Platform.Collections/EnsureExtensions.cs, 30
- ./csharp/Platform.Collections/ICollectionExtensions.cs, 31
- ./csharp/Platform.Collections/IDictionaryExtensions.cs, 31
- ./csharp/Platform.Collections/Lists/CharIListExtensions.cs, 32
- ./csharp/Platform.Collections/Lists/IListComparer.cs, 33
- ./csharp/Platform.Collections/Lists/IListEqualityComparer.cs, 34
- ./csharp/Platform.Collections/Lists/IListExtensions.cs, 34
- ./csharp/Platform.Collections/Lists/ListFiller.cs, 42
- ./csharp/Platform.Collections/Segments/CharSegment.cs, 45
- ./csharp/Platform.Collections/Segments/Segment.cs, 45
- ./csharp/Platform.Collections/Segments/Walkers/AllSegmentsWalkerBase.cs, 47
- ./csharp/Platform.Collections/Segments/Walkers/AllSegmentsWalkerBase[T, TSegment].cs, 47
- ./csharp/Platform.Collections/Segments/Walkers/AllSegmentsWalkerBase[T].cs, 48
- ./csharp/Platform.Collections/Segments/Walkers/AllSegmentsWalkerExtensions.cs, 48
- ./csharp/Platform.Collections/Segments/Walkers/DictionaryBasedDuplicateSegmentsWalkerBase[T, Segment].cs, 48
- ./csharp/Platform.Collections/Segments/Walkers/DictionaryBasedDuplicateSegmentsWalkerBase[T].cs, 49
- ./csharp/Platform.Collections/Segments/Walkers/DuplicateSegmentsWalkerBase[T, TSegment].cs, 50
- ./csharp/Platform.Collections/Segments/Walkers/DuplicateSegmentsWalkerBase[T].cs, 50
- ./csharp/Platform.Collections/Sets/ISetExtensions.cs, 50
- ./csharp/Platform.Collections/Sets/SetFiller.cs, 51
- ./csharp/Platform.Collections/Stacks/DefaultStack.cs, 52
- ./csharp/Platform.Collections/Stacks/IStack.cs, 52
- ./csharp/Platform.Collections/Stacks/IStackExtensions.cs, 53
- ./csharp/Platform.Collections/Stacks/IStackFactory.cs, 53
- ./csharp/Platform.Collections/Stacks/StackExtensions.cs, 53
- ./csharp/Platform.Collections/StringExtensions.cs, 53
- ./csharp/Platform.Collections/Trees/Node.cs, 54