C#
Generics, Collections, Iterators, and Regular Expressions

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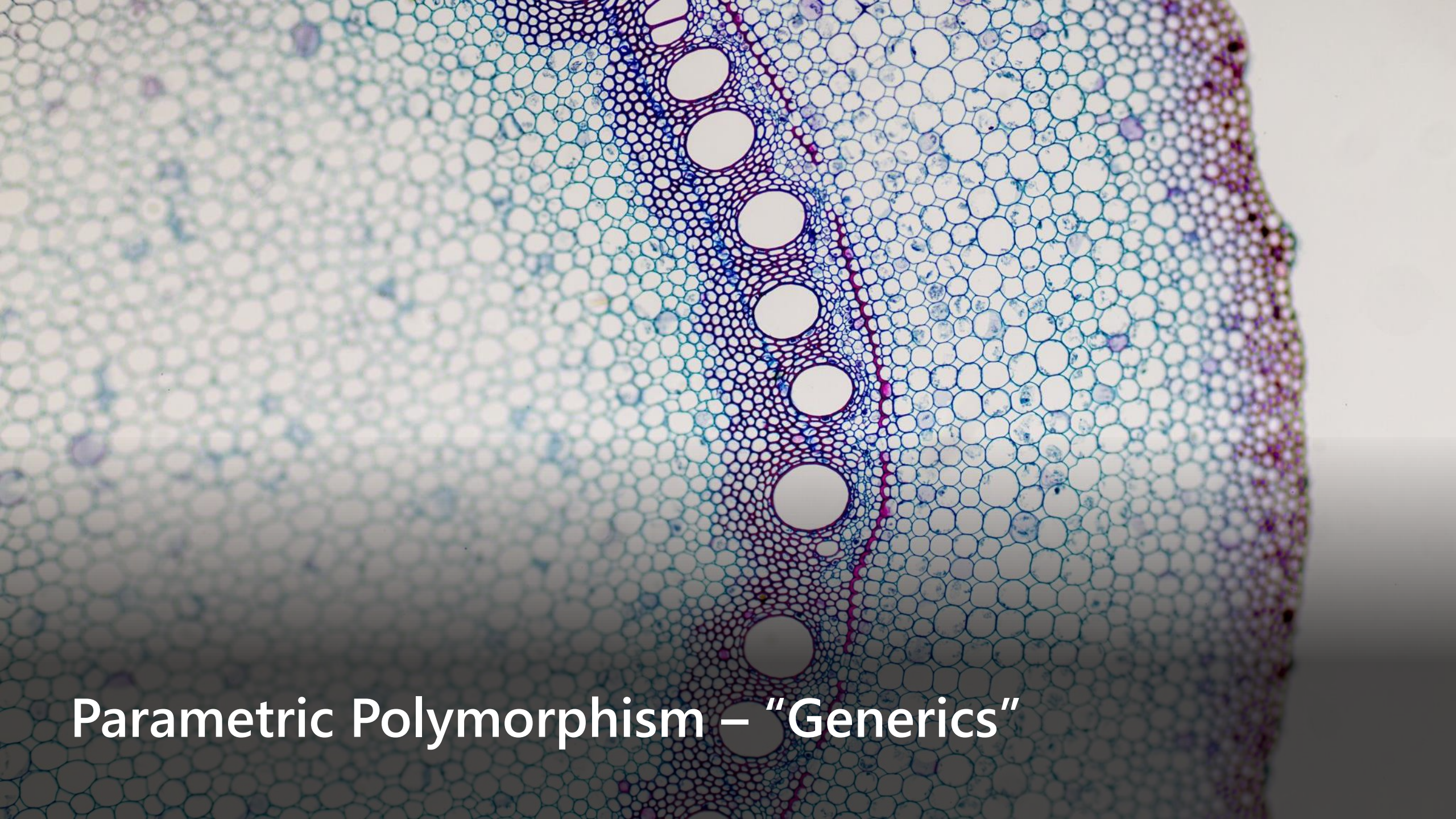


Parametric Polymorphism – “Generics”

Generics

Built-in

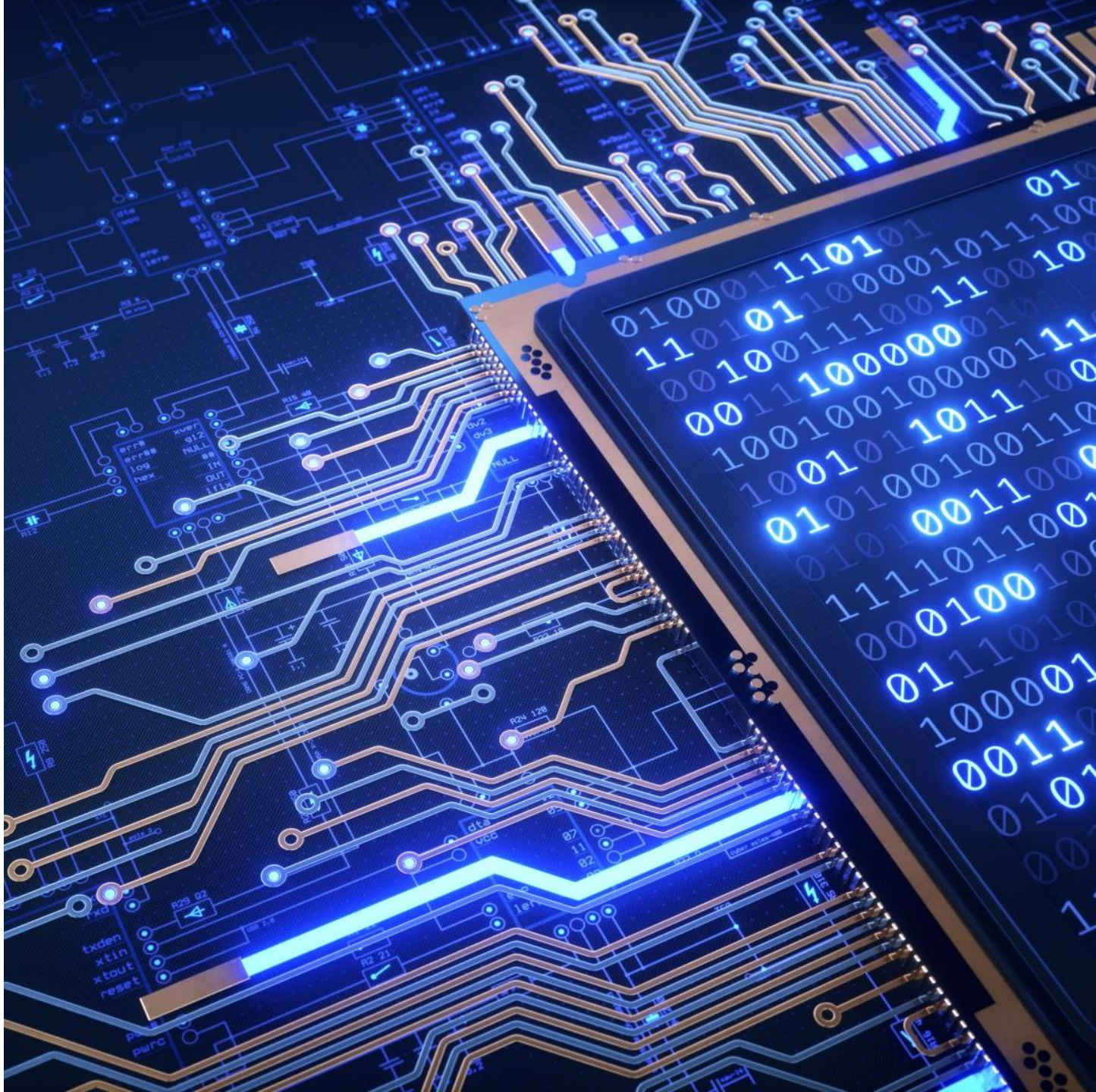
Iterators

Collections

Create your own?

Type Constraints

(Co- and contravariance)

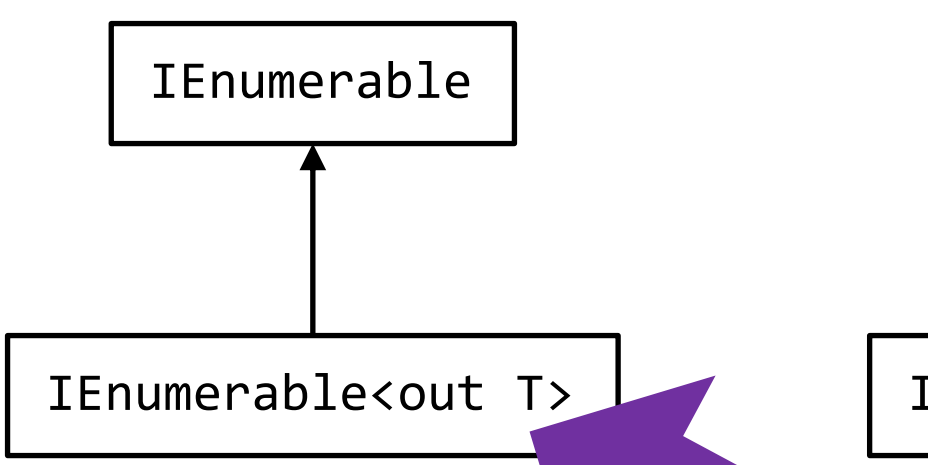


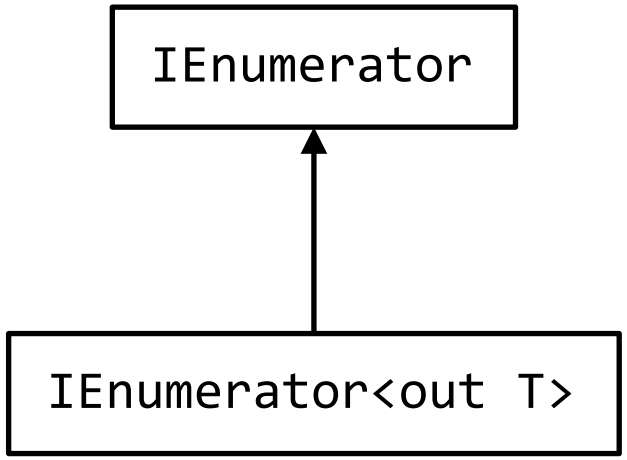
ArrayList → List<T>

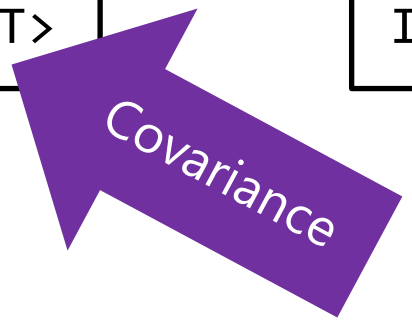
```
// Non-generic
IList list = new ArrayList();
list.Add("hello");
var s = (string)list[0];

// Generic
IList<string> list = new List<string>();
list.Add("hello");
var s = list[0];
```

Iterators

Iterators








```
yield return T;
```

```
yield break;
```

Producer

Building block for LINQ

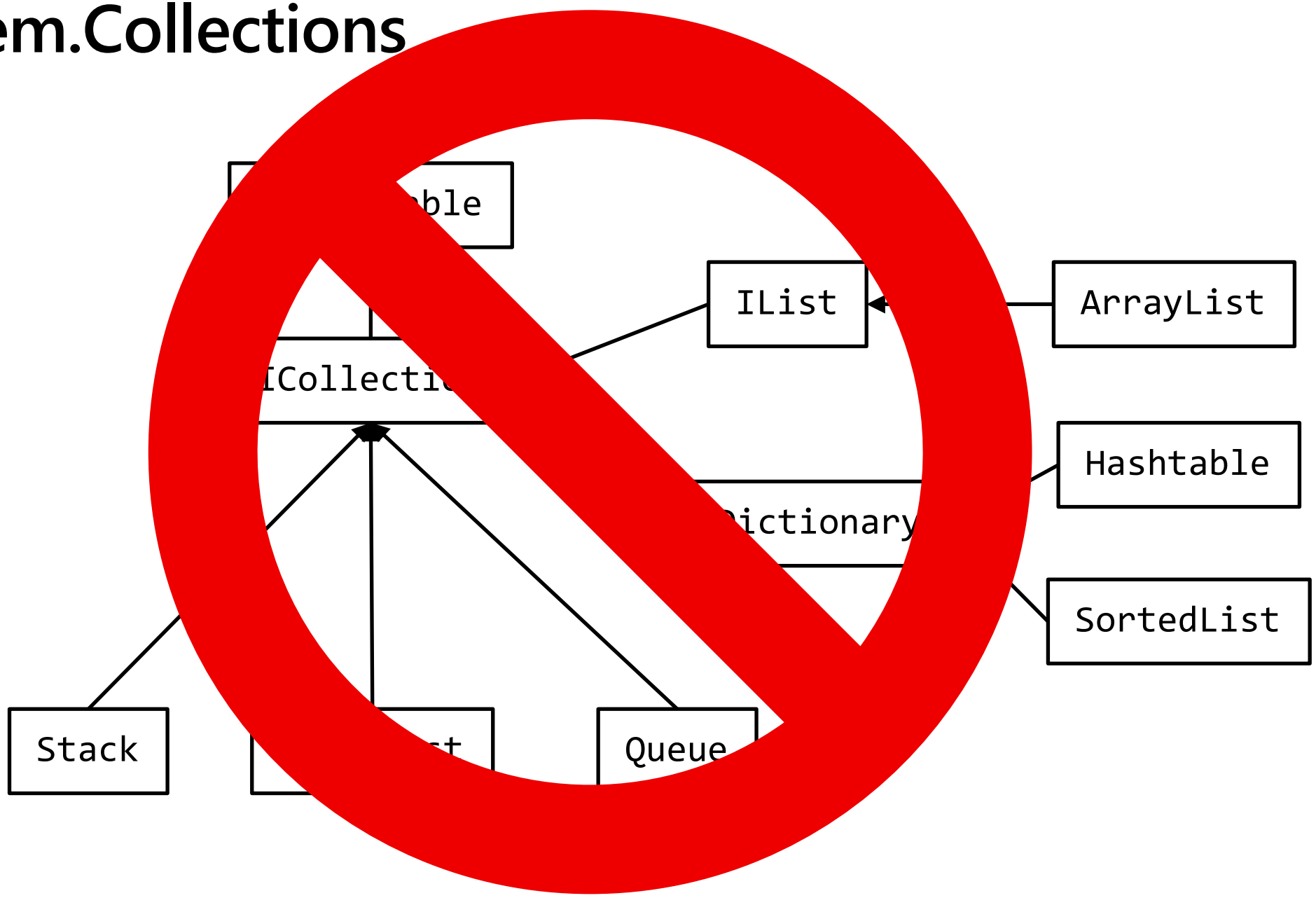
```
foreach (var item in items)
{
}
```

Iterators

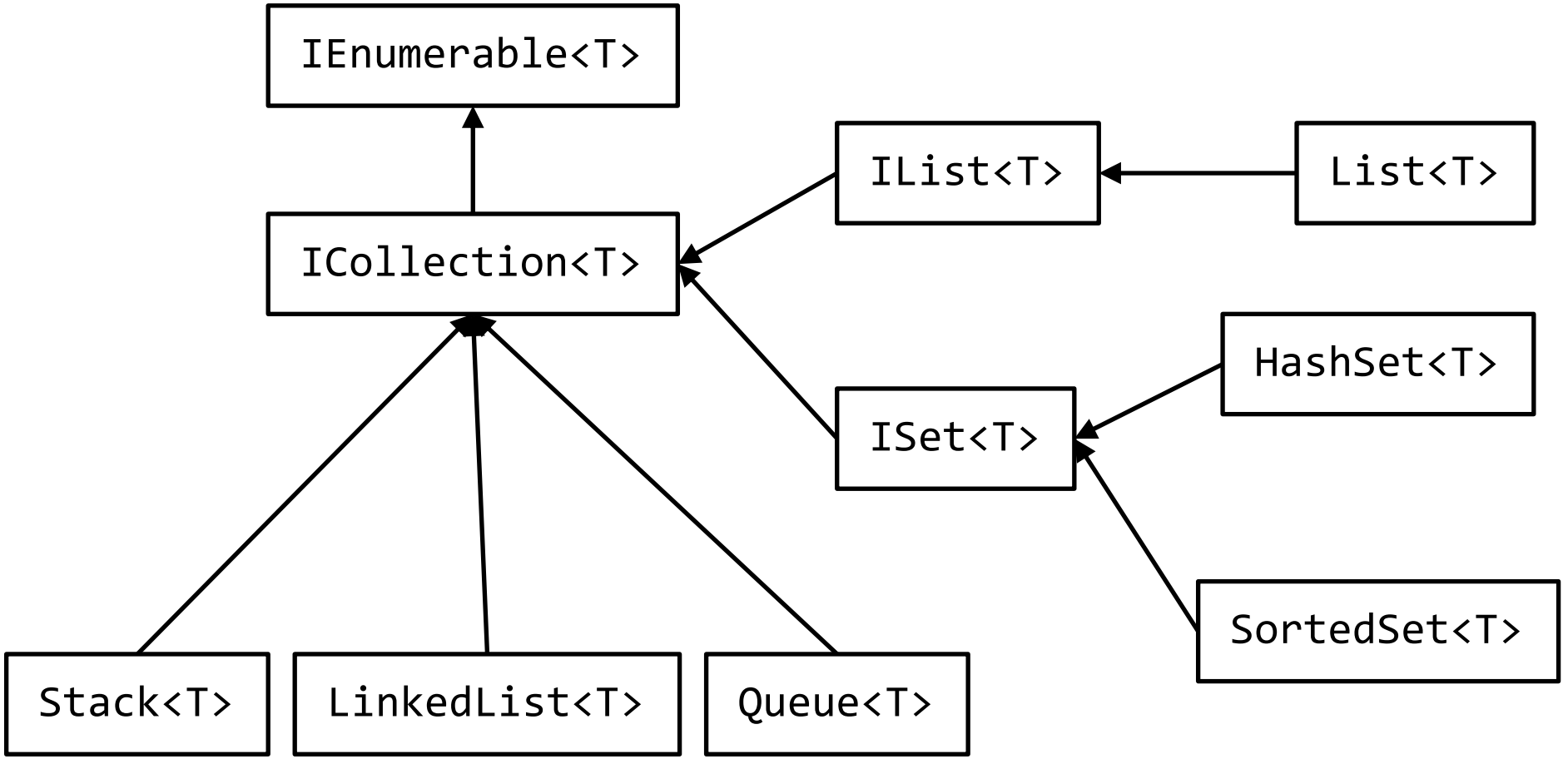
Demo

Generic collections

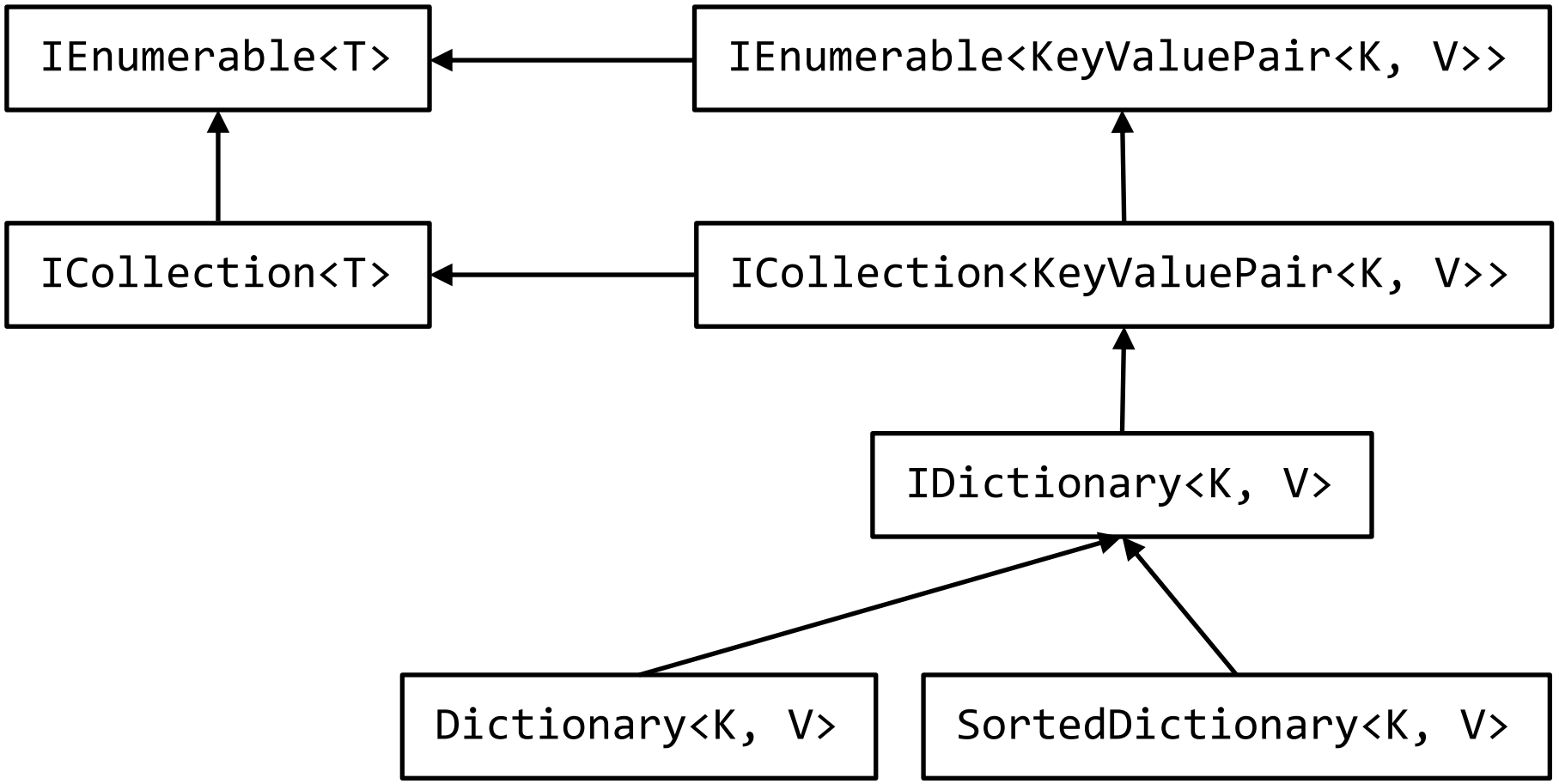
System.Collections



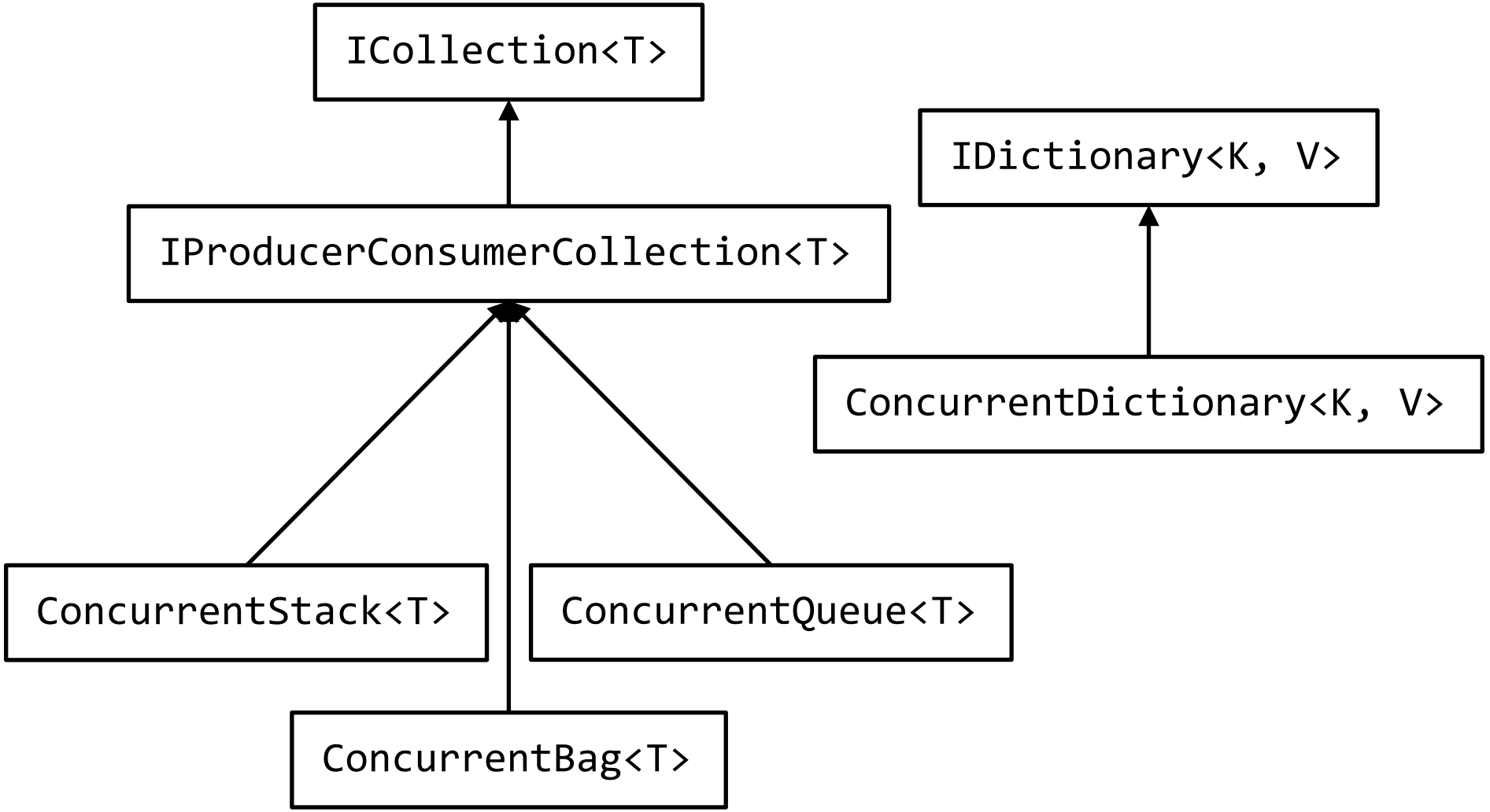
System.Collections.Generic



System.Collections.Generic 2



System.Collections.Concurrent



Generic Collections

Demo

Create your own generic class 2

```
class MyMap<TKey, TValue>
{
    void Add(TKey key, TValue value) { }
    bool ContainsKey(TKey key) { }
    bool ContainsValue(TValue key) { }
    TValue this[TKey key] { get; set; }
}
```

Create your own generic method

```
public string Serialize<T>(T obj) {}

public T2 Convert<T1, T2>(T1 obj) { }
```

Type constraints

```
public class MyConstrainedGenericClass<T>
    where T : class, new() { }

public class MyConstrainedGenericClass<T>
    where T : struct { }

public class MyConstrainedGenericClass<T1, T2>
    where T1 : Foo
    where T2 : IBar { }

public T2 MyConstrainedMethod<T1, T2>(T1 item)
    where T1 : Foo
    where T2 : IBar, new() { }
```

Custom Generics

Demo

Covariance – Contravariance – Invariance?

Variance

Covariance

Enables you to use a more derived type than originally specified.

You can assign an instance of `IEnumerable<Derived>` to a variable of type `IEnumerable<Base>`.

Contravariance

Enables you to use a more generic (less derived) type than originally specified.

You can assign an instance of `Action<Base>` to a variable of type `Action<Derived>`.

Invariance

Means that you can use only the type originally specified. An invariant generic type parameter is neither covariant nor contravariant.

You cannot assign an instance of `List<Base>` to a variable of type `List<Derived>` or vice versa.

https://docs.microsoft.com/en-us/dotnet/standard/generics/covariance-and-contravariance

Built-in generics

```
public interface IComparer<in T>
{
    int Compare(T x, T y);
}

public interface IEnumerable<out T> : IEnumerable
{
    IEnumerator<T> GetEnumerator();
}
```

https://docs.microsoft.com/en-us/dotnet/standard/generics/covariance-and-contravariance

Covariance and Contravariance

Demo

Enumeration Types

Enumeration Types

Demo

https://docs.microsoft.com/en-us/dotnet/csharp/language-reference/builtin-types/enum

Regular Expressions

Regular expressions 1

*	Zero or more times the previous character
+	Once or more times the previous character
?	Zero or one time the previous character
.	Any single character (not \n)
\s	Any whitespace character (e.g. tab)
\S	Any non-whitespace character
\b	Word boundary
\B	Any non-word boundary position
\w	Any word character (a-z, A-Z, 0-9)
\W	Any non-word character
^	Start of the input text
$	End of the input text

Regular expressions 2

`[1c]`	matches character ‘1’ or ‘c’
`[a-z]`	matches all lower-case letters
`[a-zA-Z]`	matches all letters
`[0-9]+`	matches integer numbers
`[0-9]+\.[0-9]+`	matches a floating point
`[0-2][0-9]:[0-5][0-9]`	matches a time e.g. 12:34

https://docs.microsoft.com/en-us/dotnet/standard/base-types/regular-expression-language-quick-reference

Regular expressions 3

`[^abc]`	matches character not in ‘a’, ‘b’, or ‘c’
`(capture) (?:non) (?<name>name)`	capturing group, non-capturing group, named capturing group
`[a-z]+(\d{5})`	matches a standard Danish license plate where the numeric part is a capturing group
`(?<given_name>\w+) (?<surname>\w+)`	matching a given name followed by a surname (named capturing groups)
`(?:Jane|John) (\w+) (?:Doe)`	matching the middle name of Jane or John Doe

https://docs.microsoft.com/en-us/dotnet/standard/base-types/grouping-constructs-in-regular-expressions

Regular Expressions

Demo


Thank you