

.NET 8 AND C#12

SUCCINCTLY[®]

BY **DIRK STRAUSS**

.NET 8 and C# 12 Succinctly[®]

Dirk Strauss

Foreword by Daniel Jebaraj

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Important licensing information. Please read.

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l m v cō [t t t pvk σ pfl k l](#)

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Technical Reviewer: G bp J cōdōv

Copy Editor: l r cōbv T ddeq

Acquisitions Coordinator: dōp T cōf k p S M l c l k cōk q Pvk σ pfl k fl

Proofreader: G nr b i f kb f b c k d b o l k cōk q mō ar b o Pvk σ pfl k fl

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F f f_H b!b c f!//////////////////////////////////////!73

J f df !//////////////////////////////////////!76

J!d_H d_H !//////////////////////////////////////!81

BPU! !//////////////////////////////////////!82

BPU!be b_H b f !//////////////////////////////////////!86

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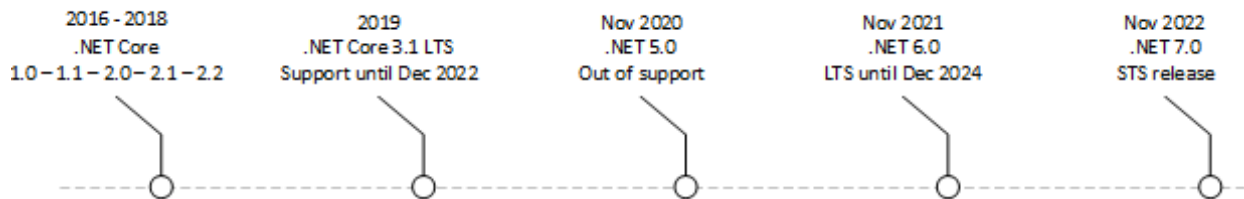
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/OFU!D f! b ! b_h ! f f b f !cf f f_h!3127!b_he!3129!d _h b _h ! _h! f! f f b f! g/OFU!
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 Ef df cf !3133!

Nb_h !d b_h f !ef f f e! g b f! _h!/OFU!D f!4/2e f! ! ! _h. f ! ! b !J!
 b ! f f g f!b! f ! b! f _h! g/OFU!D f!U f_h! _h!3131!N d g! f e! !b!
 ! f! f f b f! g/OFU!6!1!T !g !/OFU!6!1!f_h ef e! _h!Nb !3133!

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The History of .NET



2002 - .NET Framework 1.0

The Euro (coins and banknotes) is introduced as a currency by 12 European countries. The .NET Framework 1.0 and C# 1.0 are released.

2005 - .NET Framework 2.0

The History of .NET

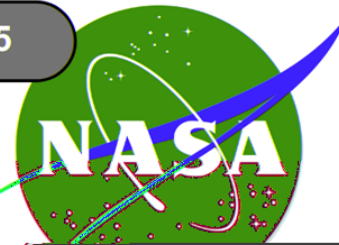


2010 - .NET Framework 4.0

South Africa hosts the FIFA World Cup, the first time this tournament is held on the African continent. The .NET Framework 4.0 and C# 4.0 are released, providing performance improvements, statement lambdas, and named/optional parameters.

2012 - .NET Framework 4.5

Curiosity lands inside Gale crater on Mars with the objective of determining if Mars ever supported life. The .NET Framework 4.5 and C# 5.0 are released two months later, adding async features and caller information, among



2015 - .NET Framework 4.6

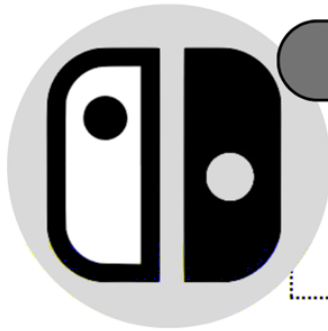
Microsoft releases Windows 10 and the .NET Framework 4.6 in July. The new .NET Framework and C# 6.0 release allow for the addition of expression-bodied methods, named argument, interpolated strings, and other features.

2016 - .NET Core 1.0

The Summer Olympics are held in Rio De Janeiro, Brazil. The first time they are held in South America. Microsoft releases .NET Core 1.0, a new open-source, cross-platform .NET product allowing for flexible deployment: in your app or installed side by side; user or machine-wide.



The History of .NET

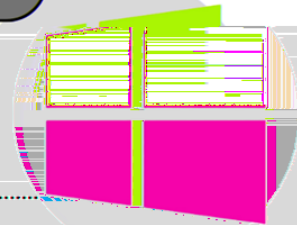


2017 - .NET Framework 4.7

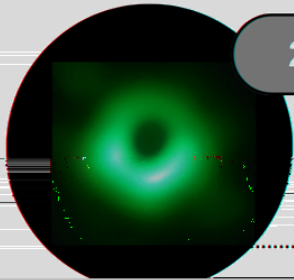
Nintendo releases the Switch worldwide, competing with the Xbox One and PlayStation 4. Microsoft releases the .NET Framework 4.7 as part of the Windows 10 Creators Update. The .NET Framework docs become available on docs.microsoft.com.

2017 - .NET Core 2.0

In August, .NET Core 2.0 and C# 7.0 are released, featuring out variables, tuples, discards, pattern matching, local functions, and throw expressions to name but a few.



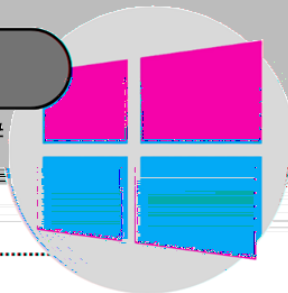
2019 - .NET Framework 4.8



Scientists reveal the first ever image of a black hole. Microsoft releases .NET Framework 4.8 with improvements to JIT and NGEN, BCL, WinForms, WCF, and WPF.

2019 - .NET Core 3.0

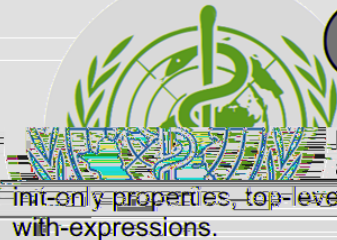
In September, .NET Core 3.0 is released with C# 9.0, providing new features such as nullable reference types, using declarations, static local functions, and more.



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The History of .NET

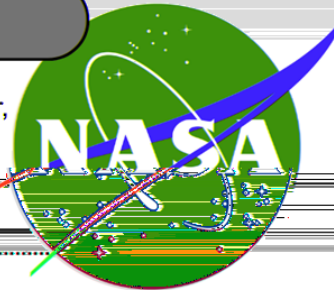
2020 - .NET 5.0



The WHO declares the COVID-19 outbreak a pandemic. C# 9.0 is released with .NET 5.0 and includes new features such as records, init-only properties, top-level statements, and with-expressions.

2021 - .NET 6.0

In April, NASA's Ingenuity helicopter performs the first powered flight on another planet. In November, .NET 6.0 is released with C# 10, bringing improvements to lambda expressions, record structs, global using directives, file-scoped namespace declarations, and more.



2022 - .NET 7

Elon Musk agrees to buy Twitter for \$54 billion. C# 11 and .NET 7 are released, bringing list patterns, generic attributes, with support, and more to .NET. In November, OpenAI launches ChatGPT.



Elon Musk reaches an agreement to buy Twitter for \$54 billion. C# 11 and .NET 7 are released, bringing list patterns, generic attributes, with support, and more to .NET. In November, OpenAI launches ChatGPT.

2023 - .NET 8

Microsoft releases .NET 8 and C# 12, featuring new features.



OpenAI launches ChatGPT Plus and changes its pricing. In November, Visual Studio includes Copilot, and .NET 8 is released, delivering features such as interceptors and inline arrays.

J!O f cf !3132!N d g! ffb fe!/OFU!7/! ! . f ! ! !Efdf cf !3135/
U ! e dfe!b! ! g f !gb f !b e!fb fe! f! gdb ! g f! b !/OFU! bg !
!b! f!/OFU! f !

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f!b f! eb ;! !b! gfe!/OFU! b! !d . bg !b db !ef f f !J!
b !ef f f ! !dfbf!b! ! g e g f f !b db !g !ef !b ! !d e!b !
f c!b db !V ! b f ! c f!b db !b e!B Jb !X ! f! ffb f! gNBVJ! f!
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g b db! g b !bd !T !Bg db! !/OFU!D f!4/2!

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fg f ! !d !bee b!d ! ! b f! f!/OFU! f ! bef!



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/OFU!9!	O !25!3134!	MUT!	O !21!3137!
/OFU!8!	O !9!3133!	TUT!	Nb !25!3135!
/OFU!7!	O !9!3132	MUT!	O !23!3135!

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! g b f!f e !g ! g b f!e f ! ! f f !b!fb !/OFU!7! f ! !ff e !
bef! ! g b f!

Ubc f!3! _h f ! f! f _h ! g/OFU! !/OFU!D f!b_h e! f_h ! !f_h efe/

/OFU!6!	O /21-3131!	Nb !21-3133!
/OFU!D f!4/2	Ef d/4-312 !	Ef d/24-3133!
/OFU!D f!4/1!	Tf /34-312 !	Nb /4-3131!
/OFU!D f!3/3!	Ef d/5-3129!	Ef d/34-312 !
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/OFU!D f!3/1!	B /25-3128!	P d /2-3129!
/OFU!D f!2/2	O /27-3127!	K _h f!38-312 !
/OFU!D f!2/1!	K _h f!38-3127!	K _h f!38-312 !

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•! T b_h eb e. f ! ;!T f!g !29! _h !bgf!_h b! f fb f/

Z ! !_h df! b! ee._h cf f!f fb f !b f!TUT! f fb f -!b_h e!f f_h _h cf f!f fb f !b f!
MUT! f fb f /!U f fg f-! !db_h !b ! b ! b ;!

```
if (version % 2 is 0)
{
    Console.WriteLine(".NET " + version + " is a Long Term Support (LTS) release.");
}
else
{
    Console.WriteLine(".NET " + version + " is a Standard Term Support (STS) release.");
}
```

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J!b ! f _h f -! f! f fb f!dbef_h df!f_h bcf !ef f f !b_h e!c _h f f ! ! b_h !b fbe! f_h !
!d f ! ! f !ef f f_h ! be b /!U ! b g!g ! -! !_h ffe! !_h b ! f!b f !
b d! eb f /!U ! fb_h ! b!g !b f! _h _h _h !/OFU!7! ! !f_h f! b!/OFU!7/1/!!
_h b f!b !b!g ! f /

J! ! !_h _h ! f!g _h ! f d_h ! df -! d !b f! f! b f!g !MUT!b_h e!TUT! f fb f /

Qf f ! ffb f !b f! b ! gf fe! !ef f f !g !f _ /U ! !e _ f!b fbe! g f!g_b!
f fb f!c ! f !b f!_ ! f e!c !N d g!

U f f! ffb f !b f! f e!c !N d g!_ ! e d _ /H . f! ffb f !b f! ffb f!
db_e eb f!c e !b_e!b f! b ! ffb fe! !cf g f! f! f _ f b !b b bc f!)HB! ffb f /

E _ ! ! f e! eb f !b f! efe! ! f!g _ d _ b !b_e! b f!b_ !
f d ! _ f bc f /X f_ !!d f ! !g _ d _ b! f f _ ! f f!d e! db ! _ d ef!
g f ! !f f! f f e!db f ! f g b _ df! f !c !b_e!bee _ ! !g ! _ f !
b e b f! b g ! ! f b _ ! f ! f _ /

B! ! b f!/OFU! ffb f !b f! _ ! eb fe! ! b f! f d ! _ f bc f /U f!b ! !
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f fb f!/g ! f!/OFU! f _ ! b! b f! fbd fe!f _ e! g g! ! g b f!b _ e! !eb b!b f!
b! /

/OFU!9! !cf! f e!g ! ff! fb !e f! ! ! _ . f ! ! ffb f!



U ! b f ! ! ! ! f! ! bef!_ /g ! _ f fe!b! f! f!d _ _ d _ !d _ ef ! f!
g _ !d b _ f !b _ e! f f _ /

U f f! b f!c f f! b_H ! f f_H ! b e f! ! f g b_H d f!) f_H d f_H ! g f!/O F U!8!
 f f b f ! b c b f!d f d_H !b_H e! f!d f!b_H e!f f_H ! c b f !J b_H ! ! ! !b!g !
 g f !

U f!/O F U!9! f f b f! d e f ! f!d b b c ! !b e ! f! f ! ! !f!g !J!d e. f d f!
 d f_H b !e f b_H e!d b_H ! f f ! d f b f! e e f_H !b_H e! f_H !e !c b d !e_H !b b_H !U f!d !
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 f d f!d_H ! ! f f! f!g d b_H ! !e f b_H e!

J e!b f! b! d b_H !e_H ! !b ! b_H !b ! d b_H ! !b !e f b_H e!g d b f !U ! f b_H !
 b! f_H !b!e f d f b f! !e f b_H e! !e f d f e!b! f d f!d b_H ! d b f!e_H ! !d_H !c !
 f e d_H ! ! f ! !

C f g f!/O F U!9! f f ! ! d b_H !e_H ! e!g !c f d b f! f! b c b f!d f d ! b !_H !
 b b f! g b_H !d b_H f !b_H e! !b d b f! f! f ! b_H ! f!f ! !C!d b_H !
 GC.RefreshMemoryLimit()! !d b_H ! e b f! f! b c b f!d f d_H ! ! f!f ! !

U f f!b f! f f ! f! b_H ! g d ! !b f!f!

- P_H!43.c ! b g !b!f ! f b ! b e! !d b_H !c f!f b c f e!c !/O F U!g f f! !
 b f b e! f!
- U f!GC.RefreshMemoryLimit()!d b ! !g !b_H e! f_H !b!_H . f ! b !d e f!
 U ! b f_H !c f d b f! f! d b f.e_H ! !d_H e f f e! !b f f!b_H e!e f !_H !f b f!
 f_H ! f !g ! f! b c b f!d f d_H ! ! ! !J! !d b f!d b_H !
 GC.Collect(2, GCCollectionMode.Aggressive)! ! f! f! !c!
 ! !f!d f_H ! f ! b f!b_H ! ! !d b !GC.RefreshMemoryLimit()!
 b b_H !
- T d b_H ! ! f! f ! !c f_H e! b! f! b c b f!d f d !c f f f! f! b !
 d f !d b_H ! b_H e f!b ! f!GC.RefreshMemoryLimit()! ! d d f f e!c ! ! !_H !
 f! f! f ! b_H ! b! f! b c b f!d f d ! f d f f !b ! f! !

U f!g_H !d e f! !D e f!M_H !2 b f ! f_H ! f! f b ! b e! ! !21!N Q
) f c c f !

```
internal class Program
{
    static void Main(string[] args)
    {
        AppContext.SetData("GCHeapHardLimit", (ulong)100 * 1024 * 1024);
        GC.RefreshMemoryLimit();
    }
}
```



```

j ! b e! ! ! h b e! f!GC.RefreshMemoryLimit()! ! !b h!
InvalidOperationException/B h h b e! b e! !db h!cf!g !f b f! f h! f! b e! !
b! !cf! f!c! f!fgf ! ! f! b h! b !b fbe!d fe!

```

U f f!b f! b_h ! f f_h !b_helbee_h !_h! f!d f!/OFU! c b f !T f! g f f!
f f_h ! f f! bef! ! f!g_h !gb f !

B!g ! f b b _h !b_h e!ef f b b _h ! f f_h ! b f!cf f_h ! bef! !System.Text.Json! _h !
/OFU!9!J !_h !e d !b! g f !c ! f f!b f! f! g f! f! _h f f _h ! f f_h !
b_h e!bee _h !

$P_H f! \quad g \quad f!g b \quad f! \quad b!Jb! \quad f!f \quad d \quad f e!bc \quad ! \quad f!bc \quad ! \quad b_H e f! \quad H! \quad f \quad c f \quad !e \quad H!$
 $ef \quad f \quad b \quad b \quad H!$

V b !g !fdf f!b!KTPO! b be! !ef f b f! !_H !b!QPDP!) b_H! e!DMS! cfd !
 g !KTPO! b be!d_H b_H! f f! b!b f! _H !_H! !QPDP! f_H! !ef f b f!
 f!KTPO! f !b f! !_H fe!!

```

/OFU!9!b      !  !  !  fdg!  b!b!  f  cf  !      !f  !H!  f!  b  be!  f  f!b!
JsonException!  !cf!      H !D H  ef !D ef!M H !3!

```

```
internal class Program
{
    static void Main(string[] args)
    {
        var pers = JsonSerializer.Deserialize<Person>("""{"Name": "John", "Age": 44, "YearOfBirth" : 1980 }""");
        Console.WriteLine(pers?.Name);
        Console.ReadLine();
    }
}




public class Person
{
    public string Name { get; set; }
    public int Age { get; set; }
}
```

! f f! f!b f!ef f b _ !b!KTPQ! b be! b! _ d ef !b! b f!g !YearOfBirth! b! f!
 Person!QPDP!e f !_ !d _ b _ !

```
var pers = JsonSerializer.Deserialize<Person>("""{"Name": "John", "Age": 30, "YearOfBirth" : 1980 }""");
Console.WriteLine(pers?.Name);
```

≤ 63ms elapsed

```
Console.ReadLine();
```

 pers	{CodeSamples.Person}
 pers.Age	30
 pers.Name	View - "John"

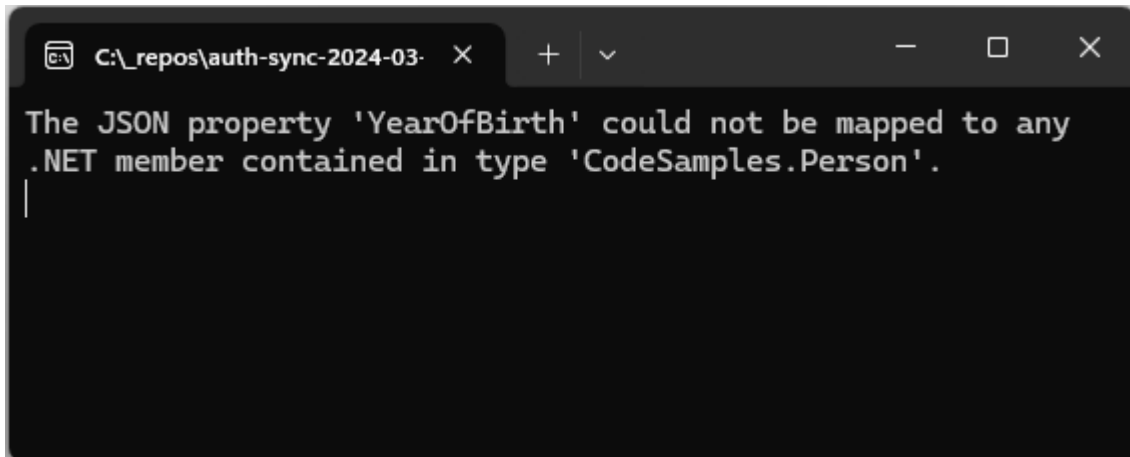
Bgf!ef f b b _ ! f!db! f! b! f!Person!db ! _ !d _ b _ ! b f !g !Age!b _ e!Name!
 cfdb f! f f!b f! f! _ ! f f !!d _ b _ fe!C ! ! b be!d _ b _ fe!b _ !bee _ b!
 b f!g !YearOfBirth! d! b! ! _ fe!

O !d _ ef !D ef !M _ !4!

```
internal class Program
{
    static void Main(string[] args)
    {
        try
        {
            var pers = JsonSerializer.Deserialize<Person>("""{"Name":
"John", "Age": 30, "YearOfBirth" : 1980 }""");
            Console.WriteLine(pers?.Name);
        }
        catch (JsonException ex)
        {
            Console.WriteLine(ex.Message);
        }
        Console.ReadLine();
    }
}

[JsonUnmappedMemberHandling(JsonUnmappedMemberHandling.Disallow)]
public class Person
{
    public string Name { get; set; }
    public int Age { get; set; }
}
```

O df! b!J b f!beef! f!JsonUnmappedMemberHandling!b c f!b _ e! fdgfe! b!!
 e!cf!e b fe!



```
using System;
using System.Text.Json;
using CodeSamples;

try
{
    JsonSerializer.Deserialize<Person>(json);
}
catch (JsonException ex)
{
    Console.WriteLine(ex.Message);
}
```

```
using System;
using System.Text.Json;
using CodeSamples;

try
{
    JsonSerializer.Deserialize<Person>(json, options);
}
catch (JsonException ex)
{
    Console.WriteLine(ex.Message);
}
```

```
using System;
using System.Text.Json;
using CodeSamples;

try
{
    JsonSerializer.Deserialize<Person>(json, options);
}
catch (JsonException ex)
{
    Console.WriteLine(ex.Message);
}
```

```
internal class Program
{
    static void Main(string[] args)
    {
        Student student = new()
        {
            Name = "Wile E. Coyote",
            Age = 74,
            SchoolName = "Acme Code School",
            SchoolAddress = "1234 Desert Road, Arizona"
        };

        var options = new JsonSerializerOptions
        {
            PropertyNamingPolicy = JsonNamingPolicy.KebabCaseLower,
        };
    }
}
```

```

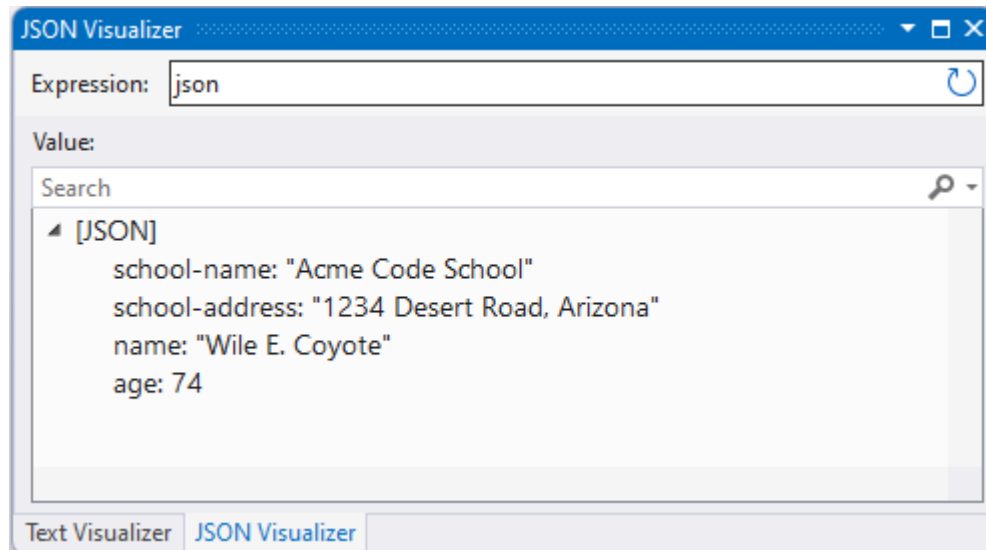
        string json = JsonSerializer.Serialize(student, options);
    }
}

public class Student : Person
{
    public required string SchoolName { get; set; }
    public required string SchoolAddress { get; set; }
}

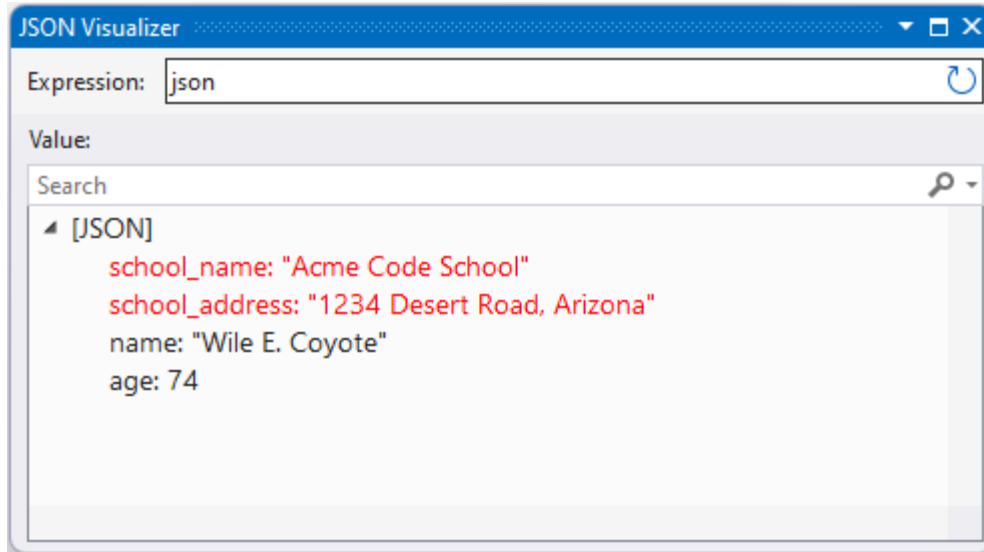
[JsonUnmappedMemberHandling(JsonUnmappedMemberHandling.Disallow)]
public class Person
{
    public string Name { get; set; }
    public int Age { get; set; }
}

```

Z ! !_H df! b! f! fdg!KebabCaseLower!_H! f!JsonSerializerOptions!S_{H H H}! f!
 d ef!b_H e!_H fd_H ! f! f b_H !KTP O! ! ! ff! b!SchoolName!b_H e!SchoolAddress!
 b f!cff_H! fcbc.db fe!b ! ff_H!_H!G f!: !



H !b fbelb_H e!d b_H f! f!JsonNamingPolicy!g !KebabCaseLower! !SnakeCaseLower!b_H e!
_H! f!d ef!b b_H !



```
Z ! ! ff! b! _ b f!db _ ! b !c f f _!b _ f e! !SchoolName!b _ e!SchoolAddress!U f!
g _ _ ! _ b _ _ ! _ d f !b f!b b bc f!g ! f!JsonNamingPolicy!db _ !
```

- ! Db f Db f!
- ! LfcbcDb fM f !
- ! LfcbcDb fV f !
- ! T _ b fDb fM f !
- ! T _ b fDb fV f !

```
J f! f!gf c _ ! b! _ ! gf !ef f _ f ! f _ !efde _ _ ! _ !b!KTPQ _ b _ _ ! _ d !
```

```
Ef f b _ _ ! _ ! fbe. _ _ ! _ f f ! ! _ _ ! _ cf!D _ ef! f!d ef! _ !D ef!M _ !6!J
b f!b!StockItem!db _ ! _ !b! fbe. _ _ ! _ f !g !Pricing!U f! _ f !efϕ _ ! !15!
f df _ !b _ e!b!Quantity! g1!
```

```
internal class Program
{
    static void Main(string[] args)
    {
        StockItem? stockItem = JsonSerializer.Deserialize<StockItem>("""
            {"StockCode": "1234", "Pricing":{"MarkupPercentage": 17,
"Quantity": 7} }
            """);

        var json = JsonSerializer.Serialize(stockItem);
    }
}
```

```

}

public class StockItem
{
    public required string StockCode { get; set; }

    public PricingData Pricing { get; } = new()
    {
        MarkupPercentage = 15,
        Quantity = 1
    };
}

public class PricingData
{
    public required int MarkupPercentage { get; set; }
    public required int Quantity { get; set; }
}

```

S _ _ _ ! f!d ef! _ !/OFU8! f!KTPQ! b be!ef f b fe! _ ! f!StockItem!db !
 fdgf !b!MarkupPercentage! g7! f df _ !b _ e!b!Quantity! g7!

```

StockItem? stockItem = JsonSerializer.Deserialize<StockItem>("""
    {"StockCode": "1234", "Pricing":{"MarkupPercentage": 17, "Quantity": 7} }
    """);

```

```

var json = JsonSerializer.Serialize(stockItem);

```

stockItem.Pricing	{CodeSamples.PricingData}
stockItem.StockCode	View ~ "1234"
stockItem.Pricing.MarkupPercentage	15
stockItem.Pricing.Quantity	1

M _ _ !b! f!f _ !!G f!22! _ ! _ df! b! f!ef f b fe!KTPQ! e df !b!
StockItem! cfd! b! _ fe! f!17! f df _ !b _ e!Quantity! g7! f! _ ! f!KTPQ!J!/OFU!9!
 f f ! f!db _ !f !!! b f! f!fbe. _ ! f !MarkupPercentage!c! f _ ! f!
JsonObjectCreationHandling! b c f! !Populate!b! ff _ ! _ !D ef!M _ !7!

```

[JsonObjectCreationHandling(JsonObjectCreationHandling.Populate)]
public class StockItem
{
    public required string StockCode { get; set; }

    public PricingData Pricing { get; } = new()
    {

```

```

        MarkupPercentage = 15,
        Quantity = 1
    };
}

```

H !b fbe!b_H e! _H! f!d ef!b b_H !b_H e! b f!b! !b! f!stockItem! b bcf!b ! ff_H!_H!G f!
23!

```

StockItem? stockItem = JsonSerializer.Deserialize<StockItem>("""
    {"StockCode": "1234", "Pricing":{"MarkupPercentage": 17, "Quantity": 7} }
    """);

```

```

var json = JsonSerializer.Serialize(stockItem);

```

stockItem.Pricing	{CodeSamples.PricingData}
stockItem.StockCode	QView - "1234"
stockItem.Pricing.MarkupPercentage	17
stockItem.Pricing.Quantity	7

M _H !b! f! b bcf! ! !_H df! b! f!MarkupPercentage!b_H e!Quantity! b f ! b f!
cff_H! f! ! b! b !d _H b_H fe!_H! f!KTP O! b be!J b f! !be ! b!Jb !_H ! f! f f!
J f! !cf b !

Z !db_H! fbe! f!bc ! b _H !_H b fe! f f ! f f!

X !/OFU!9! f! f !b!_H f ! f! ef !db !System.TimeProvider!b_H e!b_H !ITimer!
_H f gdf !System.Threading.ITimer!M ! ff! ! ! f! f !b_H e! ! ! f ! f.
ef f_H ef_H !d ef!J b f!b! f df!db fe!TaskRunnerService! b! ! f _H ! f!e b _H ! g
f!f b fe! f!b ! ff_H!_H!D ef!M _H !8!

```

public class TaskRunnerService
{
    private readonly TimeProvider _timeProvider;
    public TaskRunnerService(TimeProvider timeProvider) => _timeProvider
    = timeProvider;

    public TimeSpan MorningTaskRunner()
    {
        var startTime = _timeProvider.GetTimestamp();
        Task.Delay(5000).Wait();
        var endTime = _timeProvider.GetTimestamp();

        var duration = _timeProvider.GetElapsedTime(startTime, endTime);
    }
}

```

```

        return duration;
    }
}

```

Of !J b f!b! f df!db fe!TimeService! b!d fd ! ! ff!g f!d f_h ! f! !_h ! f!
_{h h} !b ! ff_h !_h !D ef!M _h !9!!

```

public class TimeService
{
    private readonly TimeProvider _timeProvider;

    public TimeService(TimeProvider timeProvider) => _timeProvider =
timeProvider;

    public bool RunMorningTasks()
    {
        var currentTime = _timeProvider.GetLocalNow();
        return currentTime.Hour <= 11;
    }
}

```

J f_h !dfb fe!b_h !BQJ b!d fd !g f!d f_h ! f! !_h ! f! _{h h} !b_h e!g ! !_h ! f!
TaskRunnerService!U ! f! f f! f df !J_h ffe! !bee! f ! ! f!Program!db ! g f!
BQJ!b ! ff_h !_h !D ef!M _h !: !Jb ! b_h ! ! f! f!_h f !TimeProvider!db ! !J_h ffe! !
bee! ! f df! !

```

public class Program
{
    public static void Main(string[] args)
    {
        var builder = WebApplication.CreateBuilder(args);

        // Add services to the container.
        builder.Services.AddSingleton(TimeProvider.System);
        builder.Services.AddSingleton<TimeService>();
        builder.Services.AddSingleton<TaskRunnerService>();

        builder.Services.AddControllers();
        builder.Services.AddEndpointsApiExplorer();
    }
}

```



```

        builder.Services.AddSwaggerGen();

        var app = builder.Build();

        // Configure the HTTP request pipeline.
        if (app.Environment.IsDevelopment())
        {
            app.UseSwagger();
            app.UseSwaggerUI();
        }

        app.UseHttpsRedirection();
        app.UseAuthorization();

        app.MapControllers();

        app.Run();
    }
}

```

N !TimeController!d _b _ ! f!GET!f _e _ !RunMorningTasks! b!e f !b ! f! /Z !
 ! ff! !d ef! _!D ef!M _ !2! /G _ ! f!BQ!d fd ! ! ff!g ! ! _ _ !b _e!g _ ! _ !
 f!TaskRunnerService!

```

[ApiController]
[Route("api/[action]")]
public class TimeController : Controller
{
    private readonly TimeService _timeService;
    private readonly TaskRunnerService _taskRunnerService;

    public TimeController(TimeService timeService, TaskRunnerService
taskRunnerService)
    {
        _timeService = timeService;
        _taskRunnerService = taskRunnerService;
    }

    [HttpGet]
    [ActionName("RunMorningTasks")]
    public IActionResult Get()

```

```

{
    var isMorning = _timeService.RunMorningTasks();
    if(isMorning)
    {
        var duration = _taskRunnerService.MorningTaskRunner();
        return Ok($"Ran morning tasks - duration {duration}");
    }

    return Ok("Morning tasks not scheduled to run");
}
}

```

M _ !cbd ! ! f!d ef!g ! f!TaskRunnerService! _!D ef!M _ !8! ! ! _ df! b!J
f! f! _ f !TimeProvider!db ! ! f! f!e b _ ! g f! _ _ _ !b !



Task.Delay(5000).Wait()

U f!TaskRunnerService! f !GetTimeStamp! ef!c! f!TimeProvider! ! f! !b!
f .cb fe! .gf f _ d! f! b !ef _ fe!g ! b! f _ f b! fb f f _ ! !
!bdd bd !

V _ !TimeProvider!b ! f ! !bddf ! !GetElapsedTime! d!dbd bf ! f!
egg f _ df!cf ff _ ! f! b !b _ e!f _ e! f ! f ! fd f ! _ !b! .gf f _ d! df _ b !

U f!fb _ !g ! ! !f f! gbdd bd ! !cfdb f!GetTimeStamp!bd b ! ! ! !
bd _ f! !f _ ! f!f bd! f! b !U ! ! d! f!bdd bf! b _ ! b! f!DateTime!
db !db _ ! ef!

Db _ ! f!BQ!b ! ff _ ! _ !G f!24! ! _ ! f!TaskRunnerService!cfdb f! ! ! !
 _ _ ! f f!J f!

Time

GET

/api/RunMorningTasks

Parameters

Cancel

No parameters

Execute

Clear

Responses

Curl

```
curl -X 'GET' \
  'https://localhost:7171/api/RunMorningTasks' \
  -H 'accept: */*'
```

Request URL

https://localhost:7171/api/RunMorningTasks

Server response

Code	Details
200	<div>Response body</div> <div> <pre>Ran morning tasks - duration 00:00:05.0050541</pre> </div> <div>Download</div>

```

Mf ! ! _h !bc ! _h !f _h ! !TimeService/U f!TimeProvider!db !d f !_h ! b_h e !
f f ! !D _h ef ! f! _h !f ! ff_h !_h !D ef!M _h !22/J ! !Jb !bc f ! ! f ef! f!
GetUtcNow! f e!b ! f !b ! f ef! f!LocalTimeZone! f !J f ! f! f eef_h !
GetUtcNow! f e!b ! !) _h !UtcNow !c ! !db_h ! ! b e.d efe! b f !_h fbe! g
f dg _h !_utc.Year!_utc.Month!b_h e! ! _h !

X b !Jee!e ! f f ! b ! f ef! f!LocalTimeZone! f ! !b!_h f ! f! _h f !

```

```

namespace CodeTests
{
    [TestClass]
    public class TimeServiceTest
    {
        public class TimeProviderMorning : TimeProvider
        {
            private readonly DateTimeOffset _utc;

            public TimeProviderMorning() => _utc = DateTimeOffset.UtcNow;

            public override DateTimeOffset GetUtcNow() => new(_utc.Year,
                _utc.Month, _utc.Day, _utc.Hour, _utc.Minute, _utc.Second,
                TimeSpan.Zero);

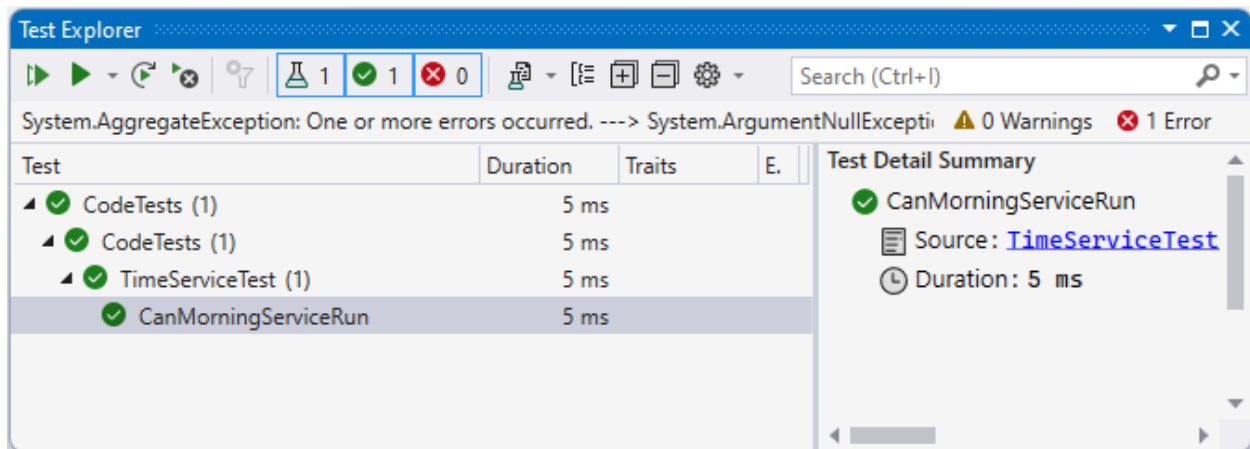
            public override TimeZoneInfo LocalTimeZone =>
                TimeZoneInfo.FindSystemTimeZoneById("Pacific Standard Time");
        }

        [TestMethod]
        public void CanMorningServiceRun()
        {
            var timeProviderMorning = new TimeProviderMorning();
            var timeService = new TimeService(timeProviderMorning);
            var canRunMorningTasks = timeService.RunMorningTasks();

            Assert.IsTrue(canRunMorningTasks);
        }
    }
}

```

Tf _h ! f! f! _h f! !QTU! ! f _h !true! f_h! _h _h _h ! f! f !b ! ff_h!_h!G f!25!J! !
 d f_h ! f !fb ! _h _h !_h!M !B_h f f !



D b_h _h ! f! f! _h f! !DTU! b_h !b!e_g f_h ! d f! f_h !!d f! ! ! _h !f !N eg!
 f!TimeProviderMorning!db !b ! ff_h ! _h !D ef!M _h !23!c ! fdg _h ! f! f! _h f!b!
 D _h b!T b_h eb e!U f!

```

public class TimeProviderMorning : TimeProvider
{
    private readonly DateTimeOffset _utc;

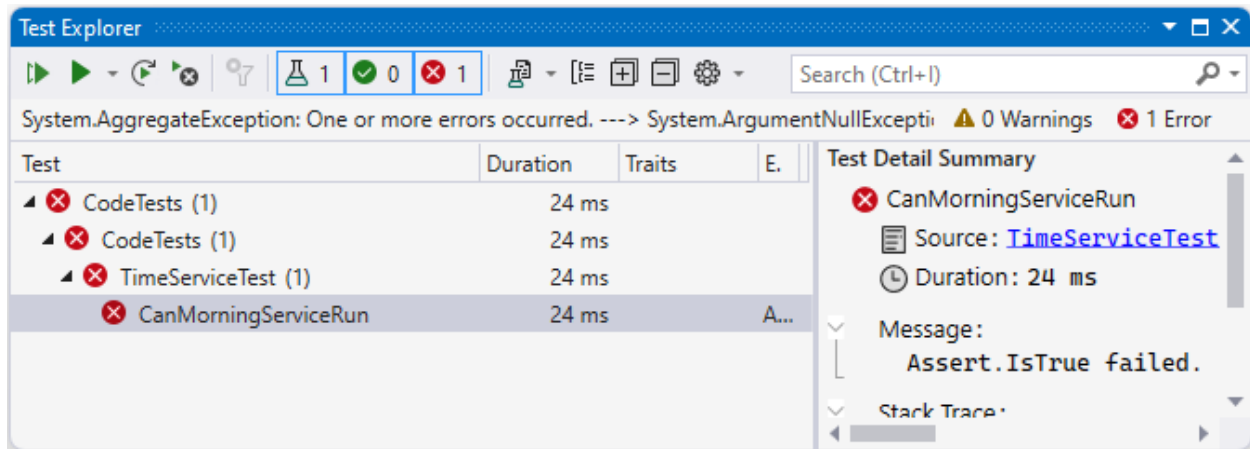
    public TimeProviderMorning() => _utc = DateTimeOffset.UtcNow;

    public override DateTimeOffset GetUtcNow() => new(_utc.Year,
        _utc.Month, _utc.Day, _utc.Hour, _utc.Minute, _utc.Second,
        TimeSpan.Zero);

    public override TimeZoneInfo LocalTimeZone =>
        TimeZoneInfo.FindSystemTimeZoneById("China Standard Time");
}

```

S _h _h _h ! f! _h !f !b b_h !f ! _h !b!ϕ fe! f !b ! ff_h ! _h !G f!26!



J!ϕd!g !efc ! f!_h ! f !b_h e! bdf e!b!c f b ! _h ! _h ! f! f _h ! b f f_h ! ! ! ff!
b! f!d f_h ! f! !VUD, 19;11! d ! !D _h b!T b_h eb e!U f!

2 references | 0/1 passing
public bool RunMorningTasks()
{
 var currentTime = _timeProvider.GetLocalNow();
 currentTime {4/20/2024 8:09:35 PM +08:00}
}

J !b b !b!d b f_h f! ! b_h e!eb f!b_h e! f!_h ! g b f!ef f f_h !f f db ! f_h !
efb_h ! ! f! f! _h f !T _h f!b! f!c! geb ! b_h ! f!_h ! ! !b_h e! !
b f!b! !d f! !d f ! _h !

V _h ! f!_h f !TimeProvider!db ! _h !b! b d c f !J! ! f f !b! f d f!_h f !gb f!
!/OFU! f _h !ef f f !efb! ! f!_h e!eb f.ef f_h ef_h !d ef !f f db ! f_h ! _h !
_h ! f !

X ! f! f fb f! g/OFU!9!N d g!_h e df e! !c b_h e_h f ! f e! _h ! f!Random!db !
b!b f!f f f !ϕ !b_h e! f .fggdf_h !G !f ! b f!b! !b! f!Shuffle! f e!B !
ff_h !!D ef!M _h !24! f!b f! b _h !b!b b ! g _h ! ! f!Shuffle! f e! g f!
Random!db !

```
var cities = new[]
{
    "Raleigh", "Tampa", "Los Angeles", "New York", "Chicago"
};
```

```
Random.Shared.Shuffle(cities);
foreach (var c in cities)
{
    Console.WriteLine(c);
}
```

B !db_h!cf!f f dfe! ! ! ggf! f!d f !_h! f!b b !b_he! ! f !_h!b! b_he ! ef /
 Ub_h !b! ff !b! f!Shuffle! f e! ! !_h df! f!g_h !b ! ff_h!_h!D ef!M_h !25!

```
public void Shuffle<T>(T[] values)
{
    ArgumentNullException.ThrowIfNull(values);
    Shuffle(values.AsSpan());
}

public void Shuffle<T>(Span<T> values)
{
    int n = values.Length;

    for (int i = 0; i < n - 1; i++)
    {
        int j = Next(i, n);

        if (j != i)
        {
            T temp = values[i];
            values[i] = values[j];
            values[j] = temp;
        }
    }
}
```

U f!Shuffle! f e!bddf !b_h!b b ! !b!Span!g ! b ! !b_h!b b ! ! !cf!d b_h fe! !b!
 Span!b_h b !cfg f!cf_h ! ggf!U ! b f ! !f f f !fgdf_h !b ! ! f g !b_h!_h. bdf!
 ggf! g f! f f d f!eb b! d f !_h fbe! g f_h !b_h f !b b ! !Span!

U f fg f! ff ! !_h!_he!g ! b f!d fb feld ef! b! ggf !b f!b b !b ! ! !
 f! !b! f g b_h df!c /

!

```

U f! fd _e! f ! f _e! f! ! !b! ! f!GetItems! f _e!Ub f!b! !b! f!d ef! _!
D ef!M _ !26!/ f f! f!b f! f _!/OFU! ! f! !cities!b b !b _e! f _! ! !b! b _e !
b b! g f _ !10!d _ b _ _ ! f!d ! _ b f ! _! !cities!b b !

```

```

var cities = new[]
{
    "Raleigh", "Tampa", "Los Angeles", "New York", "Chicago"
};

var generatedCities = Random.Shared.GetItems<string>(cities, 10);

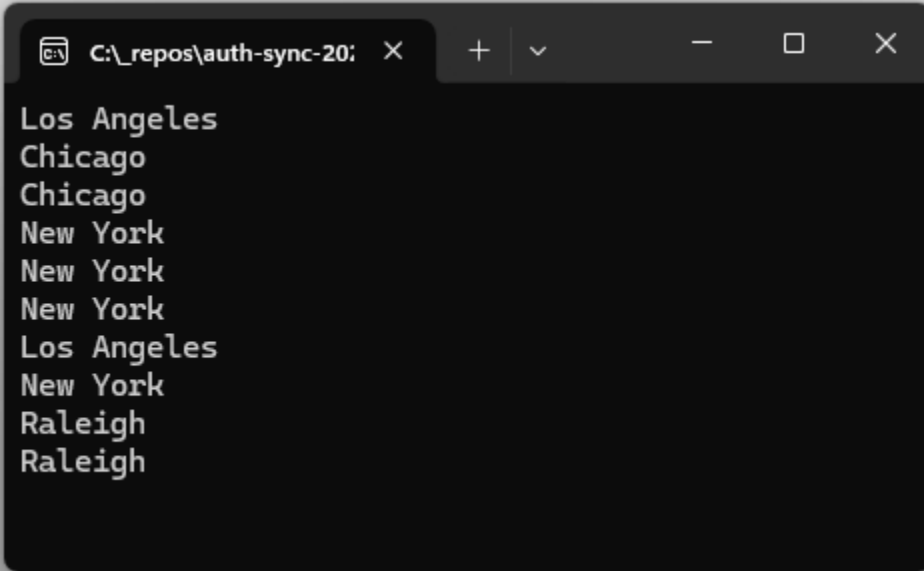
foreach (var c in generatedCities)
{
    Console.WriteLine(c);
}

```

```

S _ _ _ ! f!d ef! _!D ef!M _ !26! f ! _! f! ! ff _! _!G f!28!

```



```

C:\repos\auth-sync-20: X + - □ X
Los Angeles
Chicago
Chicago
New York
New York
New York
Los Angeles
New York
Raleigh
Raleigh

```

```

U f!GetItems! f _e!e f !_ !d f b f!b _! f !d ! _ b f !c ! f f ! f _! ! !b _!b b !
! f! _ b f ! _! !cities!b b !

```

```

U !g b f! ! _!cf! fg !g ! !b db _!c !!db _!cf! f ! fg !_! fdb fe!
f ! d !b ! f! _! bd _ f!fb _ _ !

```

```

Mb !J b _! ! b f!b! !b! f!RandomNumberGenerator!db !Z ! !_ df! b! !
db !b ! f ! f!Shuffle!b _e!GetItems! f _e!b _e!e f ! f! b f! _!b! f!Random!
db !c ! !d _ b db !fd f!b _e _ f !

```


N f!_ f f _ ! f!RandomNumberGenerator!db ! b ! !_ f ! f _ e !db fe!
GetHexString!b_e!GetString!b ! ff!_!D ef!M _ !27!

U f!GetHexString! f _ e! ! b_e ! f_ f b f!b!d _ b db ! fd f! _ ! g36!
d b bdf !_!f_ ! d ! !db_! f! !d f b f!_ f e d b c f!E !)g !f b _ f !

U f!GetString! f _ e!bddf !b! _ ! g d b bdf !b_e!b!f_ !b_e! f _ !b!
d _ b db ! fd f!b_e ! _ ! g d b bdf !)cb fe!_! f!d b bdf ! ! ef e!b !
b b f f ! g f!f_ ! ! fdgfe!

```
var hexStr = RandomNumberGenerator.GetHexString(25);  
// 9CDCD0C99A7E471DE5F4D2E0F  
  
var genString =  
RandomNumberGenerator.GetString("bcdefgBCDEFG0123456789=><!@#$$%^*()-+&",  
15);  
// G#7cg-g9g5g=b16
```

B! _ e! g db _ ! ;! f! !db_!cf! f ! fg !_! b_ !b f b ! g !d ef !e !_ ! f !
f !_! !g !f_ f b _ ! b _ e !X f! f!f _ fe! b_e ! _ ! !f_ f b fe!_!b!
d _ b db ! fd f! b_ _ ! ! ! f !fb ! !f_ f b f!b! fb ! b _ e!U ! !f fdb !
f!g f!f_ ! ! ef! ! b !b_e! f!d b bdf ! ! ef!e !_ ! f!b_ df!
cb b_ df!b _ ! f db f! f db f !b_e! fdb!d b bdf !

B ! !/OFU!8!N d _ g! b !g d f e! !_ f g _ b_ df! ! f! f f b f! g/OFU!9!U f f!b f!
f!_ df! _ f f_ ! ! g f!c !b! f !b! f!_ f ! f ! b! !db_! f!_! !
d ef !B! f!b f! _ ! f! ! !b!cf_ d b _ ! f! g !d ef !G !_ ! f ! ! b f!b!
!b! f!_ f ! f !

J! f!/OFU!9!T f /D fd _ /G f_!_ b f bdf! f!_ ! b f! !_ f !d fd _ ! f ;!
FrozenDictionary<TKey, Tval>!b_e!**FrozenSet<T>**!P_ df!d f b fe! !db_ _ ! b f!
d b_ f ! !b_ ! f ! ! b f !B ! !db_! b _ f! !f be ! !g f !f be! f b _ ! _ !
TryGetValue()!g !f b _ f!X !b! _ . fe! f df! f ! f! f f!b f!fb ! fg !
cf db f! f !b f! _ b fe!_!g ! f!b_e! f fe!g ! f! f df!e b _ !

```
var lst = new List<string> { "John", "Mark", "Jane", "Jeremy", "Daton",  
"Sally", "Mary" };  
  
var frozenSet = lst.ToFrozenSet();  
var willTheRealJeremyPleaseStandup = frozenSet.Contains("Jeremy");
```

Ub _ !b! _ !b! f!ToFrozenSet! f _ e! _ !D ef!M _ !28!g !f b _ f! f!d ef! !_ !
 b d b ! _ e.c _ !_ !b_e! g f g!Z ! ! f! b! !f fd! f f! d! !b!g f _ ! f!
 d _ b _ _ ! f!_b f ! g f! f f! _ ! f! ! efe!

X b!Je !g_e! _ f f _ ! ! b ! _ ef _ fb /B! f _ _ fe!cfg f! !g f _ ! f!db _ _ !cf!
 egfe!Z !db! ff! !cf b ! g ! !b!b! c f! g f!d ef!d _ b _ fe! _ ! f!
 FrozenSet!db !b ! ff _ !_ !G f!29!U f!FrozenSet!db ! f f _ ! f!ISet!J f gdf!

```
/// <inheritdoc />
bool ISet<T>.Add(T item) => throw new NotSupportedException();

/// <inheritdoc />
void ISet<T>.ExceptWith(IEnumerable<T> other) => throw new NotSupportedException();

/// <inheritdoc />
void ISet<T>.IntersectWith(IEnumerable<T> other) => throw new NotSupportedException();

/// <inheritdoc />
void ISet<T>.SymmetricExceptWith(IEnumerable<T> other) => throw new NotSupportedException();

/// <inheritdoc />
void ISet<T>.UnionWith(IEnumerable<T> other) => throw new NotSupportedException();

/// <inheritdoc />
void ICollection<T>.Add(T item) => throw new NotSupportedException();

/// <inheritdoc />
void ICollection<T>.Clear() => throw new NotSupportedException();

/// <inheritdoc />
bool ICollection<T>.Remove(T item) => throw new NotSupportedException();
```

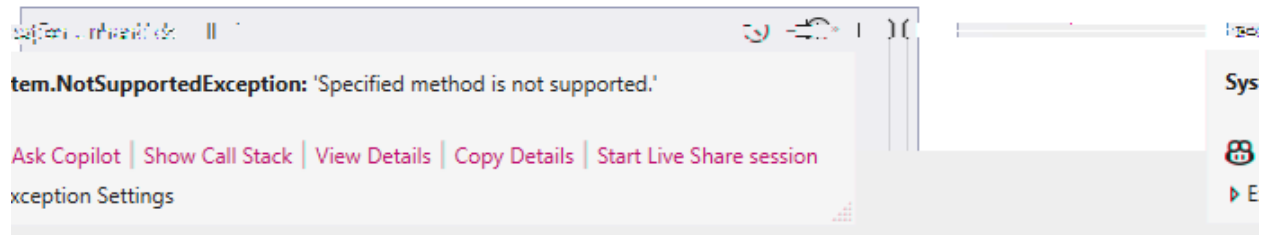
U f!FrozenSet!e f !_ ! f f ! ! f! f _ e! gISet! b! b f!eb b!Cfdb f!
 FrozenSet! f f _ ! f!ISet! _ f gdf !b _ e!cfdb f!ISet!efg _ f ! f! _ cf! g f _ e !b!
 f! _ e! b f! f!FrozenSet! ! ef!b _ ! f f _ b _ !g !b! f! f _ e! gISet!
 f f _ ! f! _ fe! f _ e !Cfdb f! f!FrozenSet! !ef _ fe! !cf! bcf! ! !
 !b!NotSupportedException! _ ! f! f f _ b _ !

Z !db _ !f f _ ! f ! !c !db _ ! f! _ b _ df! g f!FrozenSet! !b _ !ISet<string>!b ! ff _ !
 _ !G f!2 !b _ e! _ ! !bee! f!eb b!T !T be ! !f b _ ! fb fe!b _ e! eef _ !cfdb f!
 _ ! !bee! ! f! f! ! f!f df _ !

```
var lst = new List<string> { "John", "Mark", "Jane", "Jeremy", "Daton", "Sally", "Mary" };

var frozenSet = lst.ToFrozenSet();
var willTheRealJeremyPleaseStandup = frozenSet.Contains("Jeremy");

ISet<string> set = frozenSet;
set.Add("Slim Shady"); // This will throw an error ❌
```



Z ! !cf! _ef _ ! ! f!FrozenSet!db !f f_! f f_ !ISet!g !e f _ ! !
b ! f! f b _ ! gb! f !U ! !cfdb f!ISet<T>!b !d _ b _ !b!_ cf! g fg! f e !
g ! f _ !b! f ! d !b !Contains!U f fg f !FrozenSet! f f_ !ISet! ! b ! !db!
ef! f f_ b _ !g ! f f! f e !

U f!FrozenDictionary! !_!f bd ! f! b f! b _ f !b ! ff _ ! !D ef!M _ !29!

```
var dictionary = new Dictionary<string, int>
{
    { "John", 38 },
    { "Mark", 42 },
    { "Jane", 24 },
};

var frozenDictionary = dictionary.ToFrozenDictionary();
```

U ! f! f!FrozenDictionary! f f_ ! f!IDictionary!_ f gdf!T b ! !ffe! !
bee! f! f f_ b _ ! g f!_ f gdf!! f f_ !b _ !e f ! !c! _ !b!
NotSupportedException!g !b ! f! f e ! b! e! b f! f!eb b!

```

/OFU!9!_!b !_d ef !b!_f !SearchValues<T>! f!Nf e! d!b !
MemoryExtensions.ContainsAny! d!d fd ! !ff!gb! b f! !d _b _f e!_!b!d fd _!
b f!cff! egfe! !bee!_f ! f be! !bddf !b!_ _b _df! g !_f ! f!
U ! fb! b! !db!_! !e! b! !ff!_!D ef!M _!2 !J b f!d fb fe!b!_ _b _df! g
SearchValues<char>!c ! !db!b ! b f!b!_ _b _df! gSearchValues<byte>!

```

```

var strSear = @"<>:""/\|?*"
SearchValues<char> illegalChars = SearchValues.Create(strSear);

var fileName = @"Important_|_File.txt";

var illegal = fileName.AsSpan().ContainsAny(illegalChars);
// illegal = true

```

```

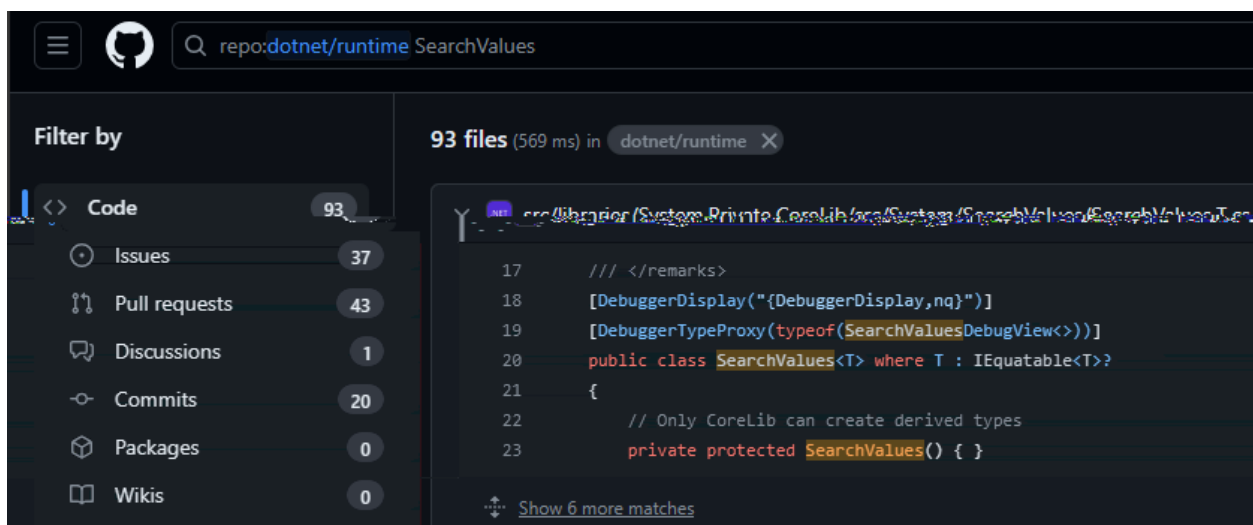
Z ! !cf! _ef _! ! !_f ! f! b f !Xf !b!! _! ! f! !dfbfb!
_b _df! g ! f!f f _! b! !f fe! ! f! c f _f _!fb d f! !ef fe!
!b _!b! ! !e _f! !g _! fb! !b! f g _b _df!c !g ! !d ef!

```

```

J!gd! ! b f!b! !b! f!/OFU!S _f! f ! _!H ! d!b _e! fb d !g ! f! f !
Tfb d Wb f!Z ! !ff! b!N d g! ! _! f!_f !SearchValue! f! f!b!c !

```



```

U ! fb! b! !d ef! !b ! f! ! f g _b _df! f f! !g !gff! !c !
be _! !/OFU!9!

```

/OFU!9! b !b ! f_H! f! f! !f f_H _H! c b f /Z ! ! b f! f b e!b c ! f f e!
ef f_H ef_H d! _H f d _H!)EJ! f f! ! f! f ! ! f f !b_H e! f b e!EJ f df /Tf d_H e ! f!
IHostedLifecycleService! b !c f f_H! f f_H ef e! ! _H d ef! bee _H b! f e! ! f! ! f!
_H !g !f f d _H /U f!System.Numerics.Tensors!O Hf! b d b f! b !b !c f f_H! e b f e!
! _H d ef! f! _H f !TensorPrimitives! _H b f b d f /U ! bee ! !g ! f_H ! f b _H !
Uf_H ! f ! f! e b b. _H f_H f! b e! f e! _H !B Jb_H e! b d _H f! f b _H _H !

B ! ! _H ! f!EJ f df! !b! b ! !f f !b_H e! f f f! f df !g ! f!ef f_H ef_H d!
_H f d _H! d _H b _H f /O ! ! f f e!ef f_H ef_H d! _H f d _H ! !d b_H !e ! ! _H ! f /U !
b ! ! !f f !b_H e! _H f d! f! f df ! g f! b f! f! _H !b! _H f! f !g !f b d /
T f! g f! _H f !BQJ! _H d ef! f!g _H ;!

- ! U f! _H f g d f!IKeyedServiceProvider!
- ! U f!b c f!ServiceKeyAttribute! f e! ! _H f d! f! f ! f e!g !
f b _H 0f _H! _H! f!d _H d !
- ! U f!b c f!FromKeyedServicesAttribute! f e! ! f d g! d ! f f e! f df! !
f! _H! f! f df!d _H d ! b b f f !
- ! Of !f f_H _H! f e !g !IServiceCollection! ! ! f f e! f df !
- ! U f!ServiceProvider! f f_H b _H ! g IKeyedServiceProvider!

U f!f b f ! b ! ! b f! f f e!ef f_H ef_H d! _H f d _H ! ! f! f! g _H b!BQJ /J
b e ! b!J b f_H !g _H e! f g b b _H ! b e! _H ! _H b!BQJ! _H !b! f b!c b !c !
g ! !f b_H b _H ! f f! f g d !



U f!d ef! _H !G f!31! b f ! f! f! g f f e!EJ f df /J! ! b f!b! f! f! f_H f!
f_H! f f e! _H !b!d ef!f e !b ! f!d ef! !b! f!c ! f e! _H ! f! b f /J ! f g ! _H !
d _H f ! _H f b e! f f! ! b f!d ef!g ! b ! !

U f!d ef!d _H b _H !b_H! _H f g d f!d b f e!IGreeter! b ! ! f e! ! e f! f!d _H b d!g ! !
f df !FormalGreeterService!b_H e!InformalGreeterService/J f_H ! b f! ! f!
f df !d b f e!CustomerService!b_H e!FriendsService/

Bee_H ! f! f df ! ! f!EJd _H b _H f ! !e _H f! _H! f! b! b_H f !g ! f!Customer!b_H e!
FriendsService!c !g ! f!FormalGreeterService!b_H e!InformalGreeterService!J
ef!f b d ! !b! f !

U f f! f !b ! f! !f g f_H df!f b d ! f df! _H f !b_H e! ef!BQJf_H e _H ! b! b f!
f! g f! f ! ! ef! f!b b f! f df /Z !d b_H ! f f! ! _H! f!
api/GreetFriendSpecific!b_H e!api/GreetCustomerSpecific!f_H e _H !

```

var builder = WebApplication.CreateBuilder(args);

// Add services to the container.
builder.Services.AddEndpointsApiExplorer();
builder.Services.AddSwaggerGen();
builder.Services.AddKeyedSingleton<IGreeter,
FormalGreeterService>("customers");
builder.Services.AddKeyedSingleton<IGreeter,
InformalGreeterService>("friends");
builder.Services.AddSingleton<CustomerService>();
builder.Services.AddSingleton<FriendsService>();

var app = builder.Build();

// Configure the HTTP request pipeline.
if (app.Environment.IsDevelopment())
{
    app.UseSwagger();
    app.UseSwaggerUI();
}

app.UseHttpsRedirection();

app.MapGet("api/GreetCustomer", (CustomerService customer) =>
customer.Greet());

app.MapGet("api/GreetFriend", (FriendsService friend) => friend.Greet());

app.MapGet("api/GreetFriendSpecific",
    ([FromKeyedServices("friends")] IGreeter greet, string friendName) =>
    greet.Greeting($"Hey {friendName}. Nice to see you."));

app.MapGet("api/GreetCustomerSpecific",
    (HttpContext httpContext, string customerName) =>
    httpContext.RequestServices
    .GetRequiredKeyedService<IGreeter>("customers")
    .Greeting($"Good day {customerName}. How many I assist you?"));

app.Run();

public class CustomerService([FromKeyedServices("customers")] IGreeter
greeter)

```

```

{
    public string Greet() => greeter.Greeting("Good day, can I be of
service?");
}

public class FriendsService(IServiceProvider serviceProvider)
{
    public string Greet() =>
serviceProvider.GetRequiredKeyedService<IGreeter>("friends").Greeting("Hell
o buddy!");
}

public interface IGreeter
{
    string Greeting(string message);
}

public class FormalGreeterService : IGreeter
{
    public string Greeting(string message) => $"Formal greeting:
{message}";
}

public class InformalGreeterService : IGreeter
{
    public string Greeting(string message) => $"Informal greeting:
{message}";
}

```

C ! e! h!b! h fHee !J b ! b! f fe!EJb ! ! !f f !b h e! h fd! f!
f df ! g f! b f! f! h !b! h f! f !g !fbd @X f ! f !Jee!b h e! !db h !e ! !c !
bee h ! f! f fe! f df ! ff h ! h !D ef!M h !32 ! !EJd h b h f !

```

builder.Services.AddKeyedSingleton<IGreeter, FormalGreeterService>("ceo");
builder.Services.AddKeyedSingleton<IGreeter, FormalGreeterService>("cto");

```

Jb ! h ! f! f df!blegf f h ! f !; h f!g !DFP !b h e! h f!g !DUP !O !Jdb h ! !b fbe!b h e!
bee! f!g h !BQJf h e h !b ! b fe! h !D ef!M h !33!

```
app.MapGet("api/GreetCEO",
    ([FromKeyedServices("ceo")] IGreeter greet) =>
        greet.Greeting($"Good day Mr CEO. How many I assist you?"));

app.MapGet("api/GreetCTO",
    ([FromKeyedServices("cto")] IGreeter greet) =>
        greet.Greeting($"Good day Mr CTO. How many I assist you?"));
```

Jdb_H!db! f! f df!c! _H! f! f /X f! f! f f_H b _H! g f! f df!e f!
_H!e g f! f!efb! ! b! !db_H! f f! f!f bd! b f! f df! !e g f_H! f !b_He! !
 b f! b e!d ef!

Wb eb _H! !b db _H! f _H! !b! f! fg!gb f!_H!/OFU/J!g d!cf_H!bc f! !d fd!
 b! f _H!b f! _H! fdgd! b_H f! gb! fdgd! b f! !f_H !b !g !f d!d _H!
 f! f! f _H! b! !b db _H!ff e! ! f g ! b /Cf g f!/OFU!9! ! _H!
 b eb _H! f e! fgfd _H!U ! _He! g fgfd _H! _H!b db _H! b ! ! f_H f b !db f! !
 b db _H! ! b! f /!

X ! f! f f b f! g/OFU!9!N d g! b f! !b!c b_He_H f! df! f_H f b ! b! ! f_H f b f!
 d ef! g _H! ! f g ! ! b eb _H!



U f fg f!_H f bel g _H! fgfd _H! ! f! f! f_H f b f e! b eb _H!d ef! d! ! f e!
 c!N d g! df! f_H f b /Z !db_H!cf! f! b! f! f_H !b! ! g f!d f b _H!
 f_H f b ! b! ! f_H f b f! f! ! f e!b_He! . f g b_H df!d ef! c f/M! !
 b f!b! !b!b!d _Hd f f!f b f! g ! ! e! /

M _H !b!D ef!M _H !34!J b f!b_H!b f _H / _H!gf! b! b !b! f d _H!db f e!
 ApiOptions/U f f!b f! f! f _H ! b!J b_H! ! b eb f!

```
{
  "ApiOptions": {
    "NotificationType": "Email",
    "NotificationEmailAddress": "noreply@acme.com",
    "Attempts": 2
  },
  "Logging": {
    "LogLevel": {
      "Default": "Information",
```



```

        "Microsoft.AspNetCore": "Warning"
    },
    "AllowedHosts": "*"
}

```

```

J f_h!d f b f e!b!db !db f e!ApiConfigOptions! d! !db_h! f f!_h!D ef!M _h !35/U !
db !d _h b _h ! f f !g !f b d! f _h !Z ! !_h df! b!b! f!f_h e! g f!db !J b f!
beef e!b_h f! b b!db !db f e!ApiConfigOptionsValidation! d! f f_h !
IValidateOptions<ApiConfigOptions>! ! f f_h _h !b!Validate! f e!

```

```

using System.ComponentModel.DataAnnotations;
using Microsoft.Extensions.Options;

namespace OptionsValidatorDemo
{
    enum NotificationType
    {
        Email,
        Sms,
        Push
    }

    public class ApiConfigOptions
    {
        public const string SectionName = "ApiOptions";

        [EnumDataType(typeof(NotificationType), ErrorMessage = "Invalid notification type defined.")]
        public required string NotificationType { get; init; }

        [Required]
        [RegularExpression(@"^[a-zA-Z0-9._%+-]+@[a-zA-Z0-9.-]+\.[a-zA-Z]{2,}$", ErrorMessage = "Invalid notification email address defined")]
        public required string NotificationEmailAddress { get; init; }

        [Required]
        [Range(1, 3

```

```

        , ErrorMessage = "The value for Attempts is outside the valid
range.")]
    public required int Attempts { get; init; }
}

[OptionsValidator]
public partial class ApiConfigOptionsValidator :
IValidateOptions<ApiConfigOptions>
{

}
}

```

Jee_! b f! ! f f_!b!Validate! f e!cfdb f!Jefd b fe! f! b b!db ! !b_!
 [OptionsValidator]!b c f!Qbd_! ! f! _! f!ApiConfigOptionsValidator!
 db !b_!e! _!G23! !b ! ! !_b b f! !b!gf!db fe!Vb eb / /d ! f f! !db_!
 ff! f! f_ f b fe!d ef!J! !_ ! b f! d! f_ f! ! b f! f! f_ f b fe!d ef! f f! _!b!
 d ef!c d !c !J b_! ! ! f!b f b! g ! f_ f b fe!d ef! ! f! b f !g !
 f!gf!

```

-- references
partial class ApiConfigOptionsValidator
{
    /// <summary>
    /// Validates a specific named options instance (or all when <paramref name="name"/> is <see langword="null" />).
    /// </summary>
    /// <param name="name">The name of the options instance being validated.</param>
    /// <param name="options">The options instance.</param>
    /// <returns>Validation result.</returns>
    [global::System.CodeDom.Compiler.GeneratedCodeAttribute("Microsoft.Extensions.Options.SourceGeneration", "8.0.10.6711")]
    [System.Diagnostics.CodeAnalysis.UnconditionalSuppressMessage("Trimming", "IL2026:RequiresUnreferencedCode",
        Justification = "The created ValidationContext object is used in a way that never call reflection")]
    -- references
    public global::Microsoft.Extensions.Options.ValidateOptionsResult Validate(string? name, global::OptionsValidatorDemo.Ap:
    {

```

Z !db_! ff!g !G f!32 b!Nd g! !f d ! b_! b! f!ValidationContext! !
 f e!_! d !b! b !b ! !_f f !db ! fgfd _!E ! f gb!p !b_!e! b f!b! !b! f!
 f_ f b fe!d ef!J !p d_ b_! ! ff! b! b! f_ f b fe!b_!e! ! !d b_ f !b! !bee!
 f! f f ! ! f!ApiConfigOptions!db !

Mb ! f! b_! ! b eb f! f! f _!b_!e!db ! f!BQJf_!e _!J! f!Q b /d !gf! !db_!
 ff! b!J b f! f f e!b!d _g b _!_ b_ df!g ! f!ApiConfigOptions!db !J b f!b !
 beefe! f!IValidateOptions! f df! ! f!EJd _ b_ f !b !b! _ f _!

X ! !_! bdf!Jdb_!bee! f!d ef! !bddf ! f! _! c fd!b_!e! f ! ! !b! b bc f!db fe!
 settingOptions!J! !b! ! _! b! !d ef! !f fd f! f! f_ f b fe!d ef! ! f g !
 _! b eb _!

```

using Microsoft.Extensions.Options;
using OptionsValidatorDemo;

var builder = WebApplication.CreateBuilder(args);
var cfg = builder.Configuration;
// Add services to the container.

builder.Services
    .Configure<ApiConfigOptions>(cfg.GetSection(ApiConfigOptions.SectionName));

builder.Services
    .AddSingleton<IValidateOptions<ApiConfigOptions>,
    ApiConfigOptionsValidator>();

builder.Services.AddEndpointsApiExplorer();
builder.Services.AddSwaggerGen();
var app = builder.Build();

// Configure the HTTP request pipeline.
if (app.Environment.IsDevelopment())
{
    app.UseSwagger();
    app.UseSwaggerUI();
}

app.UseHttpsRedirection();

var settingOptions =
app.Services.GetRequiredService<IOptions<ApiConfigOptions>>().Value;

app.MapGet("api/sendnotification", () =>
{
    var notificationType = settingOptions.NotificationType;
    return Enum.TryParse<NotificationType>(notificationType, out var type)
        ? type switch
        {
            NotificationType.Email => "Sending email notification",
            NotificationType.Sms => "Sending sms notification",
            NotificationType.Push => "Sending push notification",
            _ => "Invalid notification type",
        }
    }
}

```

```
db_h ! g f! f _h ! b f! _h ! f!b f _h / _h !gf!b f! _h d f d!bdd e_h ! ! f!d _h b_h !  
f! _h ! f! b eb !db _h ! ! ! ff!b_h !f df _h !D b f!D ef!M _h !34! !D ef!M _h !  
37!Z ! !_h df! b!J b f! egf! f! b f!g !Attempts! !b! b f!cf _h e! f!b f e!  
b_h f! f! _h ! f!Attempts! f !_h ! f!ApiConfigOptions!db /
```

S _H ! !BQJb_e! b f b! !b! f! f /U f! b eb _H ! d !_H -b_e! f!f ! f b f!
_H g ! ! b! f! b f! f dgfe!g ! ! f ! !_H ! b e!
b! f f ! ! ! _H fd! !IOptions! cfd! _H ! !BQJf_e _H ! ! !_H ! f !b_e!
f ! f _H ! f!b db _H ! b -c ! b f ! !_H ! f!BQJdb /B! e! f _H ! e!cf! !
d fb f!b! fb !d fd !f_e _H ! ! b eb f! ! f _H /
D ef!M _H !38! b f ! ! ! !bd f f! /B! b ! ! b eb f! ! f _H ! ! f!
gf _H ! b _H !_H -b! e!efb/U ! !f f db ! f!g ! b f! e d _H !d ef! b!_H ffe !b!
d !b_e!fb ! b ! !d fd! b! f!cb d !b f! !d fd!bgf !blef f _H /T f f ! f!
g ! g b!f_e e! !b ! b f ! ! !_H -b_e!b! b ! ! b eb f! b! !BQJ ! ! fb !
d ! ! !_H d ef! f! ! gd fd /

55!

```

using Microsoft.Extensions.Options;
using OptionsValidatorDemo;

var builder = WebApplication.CreateBuilder(args);
var cfg = builder.Configuration;
// Add services to the container.

builder.Services
    .Configure<ApiConfigOptions>(cfg.GetSection(ApiConfigOptions.SectionName));

builder.Services
    .AddSingleton<IValidateOptions<ApiConfigOptions>,
    ApiConfigOptionsValidator>();

builder.Services.AddEndpointsApiExplorer();
builder.Services.AddSwaggerGen();
var app = builder.Build();

// Configure the HTTP request pipeline.
if (app.Environment.IsDevelopment())
{
    app.UseSwagger();
    app.UseSwaggerUI();
}

app.UseHttpsRedirection();

app.MapGet("api/sendnotification", (IOptions<ApiConfigOptions> opt) =>
{
    var notificationType = opt.Value.NotificationType;
    return Enum.TryParse<NotificationType>(notificationType, out var type)
        ? type switch
        {
            NotificationType.Email => "Sending email notification",
            NotificationType.Sms => "Sending sms notification",
            NotificationType.Push => "Sending push notification",
            _ => "Invalid notification type",
        }
        : "Notification not sent due to undefined notification type";
})
    .WithName("SendNotification")
    .WithDescription("Send notification to the user")
    .WithOpenApi();

```

```
// Validate settings.
app.MapGet("api/validatesettings", (IOptions<ApiConfigOptions> opt) =>
{
    var options = new JsonSerializerOptions { WriteIndented = true };

    try
    {
        return JsonSerializer.Serialize(new { status = "OK", settings =
opt.Value }, options);
    }
    catch (Exception ex)
    {
        return JsonSerializer.Serialize(new { status = "ERROR", error =
ex.Message }, options);
    }
})
.WithName("ValidateSettings")
.WithDescription("Perform a Check On The App Settings")
.WithOpenApi();

app.Run();
```

J b f!e f f e!b!c! _! f! _! b eb _!gfb f!_/OFU!9!/ f f! !efdef! !
f f _! _! b eb _!/OFU!9!b _! !d ef! !e! ! _!b! f!gf cf! b _b fbcf!
b _e! . f g b _df! b _ f! b _! f! f _! fgfdfe!d ef! _! f _!/OFU! f _ /

X f _! !d f! ! _! f!LoggerMessageAttribute! gf !bee _b! f be! _! !
d _ d /J! f _! f _! g/OFU! _! be! !b f!b _b . _ _!b bd /F f! !
be! ! f! f! b b f f f !d _ d _! ! ! be! !d f! ! !b! f! f fe!
b b f f !g !f f _!E! !f f _!b _e! f b f!

```
public LoggerMessageAttribute(LogLevel level, string message);
public LoggerMessageAttribute(LogLevel level);
public LoggerMessageAttribute(string message);
```

B ! ff _! _!D ef!M _!39!ef f f ! b f! f! _! f _! fdg _! f! f fe!
b b f f !e! ! f f! f be /g !e _!g !f b f! fdg!b _!f f _!E! _! f! !cf!
b b db ! f _f b fe!

N !f d _ ! gb !D !23! fe! !/OFU!9!U f!g _ !f !gb f ! f f! _ d efe! _!
D 23;!

•! Q b !d _ d !
•! D fd _!f f _!
•! Sf g f be _ ! b b f f !
•! Ef g !b ceb! b b f f !
•! B b !b _ ! f!
•! J _ f!b b !
•! F f f _ b!b c f!
•! J f df !

Xf! ! b f!b!d f ! !b! f f! _ ! f! _ f !d b f !

/

Z ! ! b f! fb e!bc !/OFU!B f!g ! b d fe!b _ ! g f!e _ f!d _ g !C e!d _ f _!
_ _ f!/OFU!B f! !b b bcf!c ! _ d e _ !b!d fd _ ! g O Hf! bd b f ! b! b _ ef! fdgd!
d _ e _ b f!d _ df _ !D f _ ! _ ! f f _ ! !b b bcf! !/OFU!9!N d glef d cf !
H /OFU!B f!b !b _ ! _ _ b fe!) d ! b f! _ ! f Hf! ! f _ !J fg! !e fd f _ !
d _ e _ fbe! bd!g !c _ e _ ! c f bcf! e d _ . fbe !e c fe!b db _ !

T ! _ g !b f!d fb _ !e c fe!b db _ !/OFU!B f! ! f!b! ! g ! b _ !
_ !U f! b _ ! cf ! ! b _ ! b!e c fe!b db _ ! ! b! f! b _ ! ! b f! f !
b!b ! !fbd! f _ c ! db ! _ ! f!ef !f _ _ f _ !b _ e! f _ ! f!ef ! f !U ! !
b!/OFU!B f!b ! ! f!

U !c ! ! ! ! ! _ !b _ ! _ .ef !f b _ b _ ! g/OFU!B f _ ! d !ef f f !b!c !
_ ! ! _ ! _ ! b _ ! !fb _ ! f!bc !/OFU!B f _ ! fbe! f ! ! f!/OFU!B f!
e d f _ b _ /

U !d b f! _ e dfe! ! ! f! g f! ef ! _ !/OFU!9!b _ e! f f! !b! ! b!J b f!fg!
!U f f! !BTQ/OFU!D f! ! f f _ ! !Cb _ !T _ b S _ ! b!BQJ _ Ob f!BPU!
Lf f _ !b f _ db _ !b _ e!b b _ !U f f! !/OFU!NBVJ! d ! _ d ef ! _ f !g _ d _ b !
g !d _ !b! f !b! f g b _ df!f _ b _ df f _ !FGD f! bef! f f _ ! !d f !
f! cfd _ !d fd _ ! g f! f _ !b !TRM f f _ ! bd fe.f _ !bddf _ !b _ e! d !
f!X _ e !G ! ! f! f _ ! _ !b! f !b!X _ e !Qf f _ b _ !G _ eb _ ! d !
_ ! b! f!bc ! ! f! b e b f!bddf f b _ !b _ e!b ! b !b! _ f !OpenFolderDialog!
d _ !

C d f! !b _ e! e! _ ! ! fb _ !b ! ! b _ ! ! ! b _ _ ! bd _ !Of ! _ f! ! b f!b!
!b!D !23!b _ e!b ! f! _ f !gb f ! _ e dfe!

D !23! b !c ! ! !b! ! g_H f !g_H b f !X ! f! bdf!b! d !D ! ! f_H ! !
f b_H !b!d b f_H f!g !ef f f ! ! b ! ! !eb f !U f!_H f !g_H b f ! gD !23! _H d ef !

- ! Q b !d_H d !
- ! D f d_H !f f_H !
- ! Sf g f b e_H ! b b f f !
- ! Ef ϕ !M b ceb! b b f f !
- ! B b !b_H ! f!
- ! J_H f !b b !
- ! F f f_H b !b c f!
- ! J f df !

X f!ef f f ! !g f ! f! f ! g b_H ! ! !eb f! !f f_H ! b ! !_H f ! !
f f ! f f b f! g/OFU!b_H e!D !J b f!d f! !b!e g f_H !d_H d_H !J f b e! g f f_H ! !b !b!
g f.d f! f b! b!_H f f e ! !cf! f e! !_H !b! _H f! _H !J b !b bd_H !b ! f f!
_H f !g_H b f !_H !f b d !_H f ! f f b f! f !b!c g f ! b c f !

B! b c e! gD !b_H e! /OFU!g_H b f ! f f_H f e!b !b! b_H e! f b e! f d ! f b f e!
c !N d g! ! b g! f!f d f d d! b f ! g f! !e d f_H _H !d e f!d_H _H f !

Zf ! b_H ! ! f ! d -!J !b !J ! bdf!b_H ! f!c g f ! ! !e_H f ! b f !
f_H !b ! b ! !_H !e b !

B !J b_H f !b_H ! f!c g f ! b c f !) b_H !d b f!_H ! ! b ! !ϕ ! ! b f! f b e! g ! f!
b_H HJ f ! ! f g! B! f!c ! g f d e! d !b!e b ! g cb! _H !e f d f !b! d f!
g g f. d f e!_H b f bdf ! f e! ! f!g f. d f e! f !P ! b !d_H d !
b_H e!d f d_H !f f_H ! b f_H ! f e! !c f g f"!

Jdb fg ! d ! !f_H !_H ! ! b f! g f b d ! ! b !J e_H ! ! f f e !Z ! f f ! f! d !
!_H b b_H !b_H !c g f ! b c f ! ! ! f_H !_H ! ! b f !c !b ! ! ! f_H !
f !_H ! ! !)g ! ! b f !_H !e f d !g ! f! b c f ! f! b_H e_H !b ! f!
b c f !U ! b ! ! f ! !b f! f! f! _H ! f_H _H ! ! ! b c f ! !b! e f ! b f! g
g e !U f! b f!d b_H !c f! b e!g ! f!g ! g_H f !g_H b f ! !f f ! f f b f! g/OFU!

Z !e_H ! b f! !f b_H ! ! f f_H !f f !_H f !g_H b f!_H !f f ! f f b f! g/OFU!_H !f f !
f d ! !d f b f !X b! !e ! b f! !e ! f f ! ! f f! f!c g f ! b c f !Z ! ! b !
! ! ! d! f_H ! ! f f !_H c c f! f_H ! f f !b_H e! f_H ! ! ! b c f ! !b!
b_H b f b c f! b f! g g e !X f! ! f b !e f ! f ! ! b f! !Jdb_H ! ! !
b !b!ef f f !b_H e! f_H ! g! b f !b ! ! ! b_H f !b !b!c g f ! b c f ! f f ! !e f !
_H !b d d_H !g ! f!d b f_H f !ef f f !ϕ d f!_H ! f! f b! e !U_H ! ! !b !b!ef f f !
f! b_H b_H !b! f b ! . g !c b b_H d f! !d b f_H _H ! f_H ! ! ! !e ! !b !b! _H d f !C ! !
b ! ! !_H ! !b_H e! b_H ! f!) _H !_H f_H e f e !c f. f e!_H c c f !

H B !Db !P g g ! P !G_H b !g !Db_H b !C b_H b! b ! b_H !_H ! !_H e ! f! b f ! f b e!
! f!d b b_H f !_H ! f!b ! f! b ! ! ! f!c g f ! b c f ! ! f f! b ! !_H !e b !

J !_h !d_h h df e!J f! b !d_h d /N !_h e!_h ! f! bef! /J!gd !!gf f ! f! !
f !b b_h ! !g ! g_h !d ef /M! f! ! ! b!J fb_h /

D ef!M_h !3: ! b f !b! fb f ! f df! b! f_h f bf ! b !b_h e ! fb f !d_h e_h !
g !b_h e ! db_h !f f ! f! !db ! /

```
using Microsoft.AspNetCore.Mvc;
using PrimaryConstructorsDemo.Services;

namespace PrimaryConstructorsDemo.Controllers;

[ApiController]
[Route("[controller]")]
public class LyingWeatherForecastController : ControllerBase
{
    private readonly IRandomCityService _randomCityService;
    private readonly IRandomSummaryService _randomSummaryService;

    public LyingWeatherForecastController(IRandomCityService
randomCityService, IRandomSummaryService randomSummaryService)
    {
        _randomCityService = randomCityService;
        _randomSummaryService = randomSummaryService;
    }

    [HttpGet(Name = "GetWeatherForecast")]
    public IEnumerable<WeatherForecast> Get()
    {
        return Enumerable.Range(1, 5).Select(index => new WeatherForecast
        {
            CityName = _randomCityService.GetRandomCity(),
            Date = DateOnly.FromDateTime(DateTime.Now.AddDays(index)),
            TemperatureC = Random.Shared.Next(-20, 55),
            Summary = _randomSummaryService.GetRandomSummary()
        })
        .ToArray();
    }
}
```

J! b f_h ! !cf!d fd!bc !2 f df_h ! g f! f /Of f f f !J f! ! f e! gd fb_h !
db f /J b f!b!d_h d !J_h fd! f! f df !J f! f! ! b f!gf e !b_h e!J f! f!
f df !_h ! !db /F_h e! g /

Mf !b f!b! !b! f! b f!db ! _ ! b !d _ d /U f! b b f f ! _ ! f!
d _ d !b f! fe! ! ! f!db !f f /O !Jdb! f f! !d _ d ! b -b ! f !b !
f! b f!gf e -b _ e! f! f! _ fdfel f df ! _ ! !d ef /

```
using Microsoft.AspNetCore.Mvc;
using PrimaryConstructorsDemo.Services;

namespace PrimaryConstructorsDemo.Controllers;

[ApiController]
[Route("[controller]")]
public class LyingWeatherForecastController(
    IRandomCityService randomCityService,
    IRandomSummaryService randomSummaryService) : ControllerBase
{
    public IEnumerable<WeatherForecast> Get()
```

```

public string GetSomeWeatherData()
{
    var city = randomCityService.GetRandomCity();
    var summary = randomSummaryService.GetRandomSummary();
    return $"It is {summary} in {city}";
}
}

```

! b f!b! ! b! f! f fe!D !d ef! ! f!_!D ef!M _ !43!O df! b! f! b f!
gf e !g !IRandomCityService!b_ e!IRandomSummaryService!b f!_ !readonly!!

```

public class LyingWeatherForecastController : IWidget
{
    [CompilerGenerated]
    [DebuggerBrowsable(DebuggerBrowsableState.Never)]
    private IRandomCityService <randomCityService>P;

    [CompilerGenerated]
    [DebuggerBrowsable(DebuggerBrowsableState.Never)]
    private IRandomSummaryService <randomSummaryService>P;

    public LyingWeatherForecastController(IRandomCityService
randomCityService, IRandomSummaryService randomSummaryService)
    {
        <randomCityService>P = randomCityService;
        <randomSummaryService>P = randomSummaryService;
        base..ctor();
    }

    public string GetSomeWeatherData()
    {
        string randomCity = <randomCityService>P.GetRandomCity();
        string randomSummary =
<randomSummaryService>P.GetRandomSummary();
        return string.Concat("It is ", randomSummary, " in ",
randomCity);
    }
}

```

J! ! f fg f! c f! !d b_ f! f! b f! g f f!gf e !g !_ ef! f!db H ! b d ! !

J b f! ! b! b!Je! f!d fd _!f f _ /J! ! _ _ ! ffe! !b! f!c! g f!
 _ _ fdf b !g g!Pgd f! f!b f _ !db!cf! bef! b! ! _ !b!f f f!c! f f! f!
 b f!M ! !b!b!f b f!

```
int[] scores = new int[] { 97, 92, 81, 60 };
```

B ! ff _ _ !D ef!M _ !44! f! b f!b! d! b _ eb e!b b! g _ f f !W b!T e ! f f!
 ! f !b! d!bd _ ! ! f!d fd _!f f _ !b! ff _ _ !G f!33!

0 references

```
static void Main(string[] args)
```

```
{
```

```
    int[] scores = new int[] { 97, 92, 81, 60 };
```

```
}
```



Use collection expression

Convert to top-level statements

Suppress or configure issues

IDE0300 Collection initialization can be simplified

Lines 6 to 8

```
{
```

```
- int[] scores = new int[] { 97, 92, 81, 60 };
```

```
+ int[] scores = [97, 92, 81, 60];
```

```
}
```

[Preview changes](#)

Fix all occurrences in: [Document](#) | [Project](#) | [Solution](#) | [Containing Member](#)
 | [Containing Type](#)

Z !db! ff! f! f _ !d ef! _ !D ef!M _ !45!

```
int[] scores = [97, 92, 81, 60];
```

K !b ! _ f! b! !db! ! f!var! !d fd _!f f _ !b! f _ f f! ! _ !b f! f!
 D fd _!f f _ !b !b ! !Span<T>!b! ff _ _ !D ef!M _ !46!

```
Span<int> foo = ['a', 'b', 'c'];
```

D fd _!f f _ !b!b fb! ! f!ef f f !c! _ ! ! f !X !D !23! ! b f!
 f! _ ! ! f!d fd _!f f _ !g !d f! !

Sfg fbe _ ! b b f f !b f!_ !b! _ ! _ !D !23!D _ ef ! f!d ef! _ !D ef!M _ !47!U !
 ! b f !b!score! ! f!Increment! f e! g f!Counter!db !b_e! f _ ! _ ! f!
 d f!

```
var score = 30;
var c = new Counter();
c.Increment(score);

Console.WriteLine($"The score is {score}");

public class Counter
{
    public void Increment(int score)
    {
        score++;
    }
}
```

B ! ! elf fd! f! b f! gscore! f b _ ! _ d b _ fe/X ! ! ! f!db f@X f ! f!
 score! b b f f ! ! b fe!c ! b f/J! f ! e !b!d ! g f! b bcf! ! bef!b_e! f!
 f e!bd ! _ ! !d !U f fg f!d b _ f ! ! !d ! _ ef! f! f e! ! _ !bgfd! f!
 _ b! b bcf!



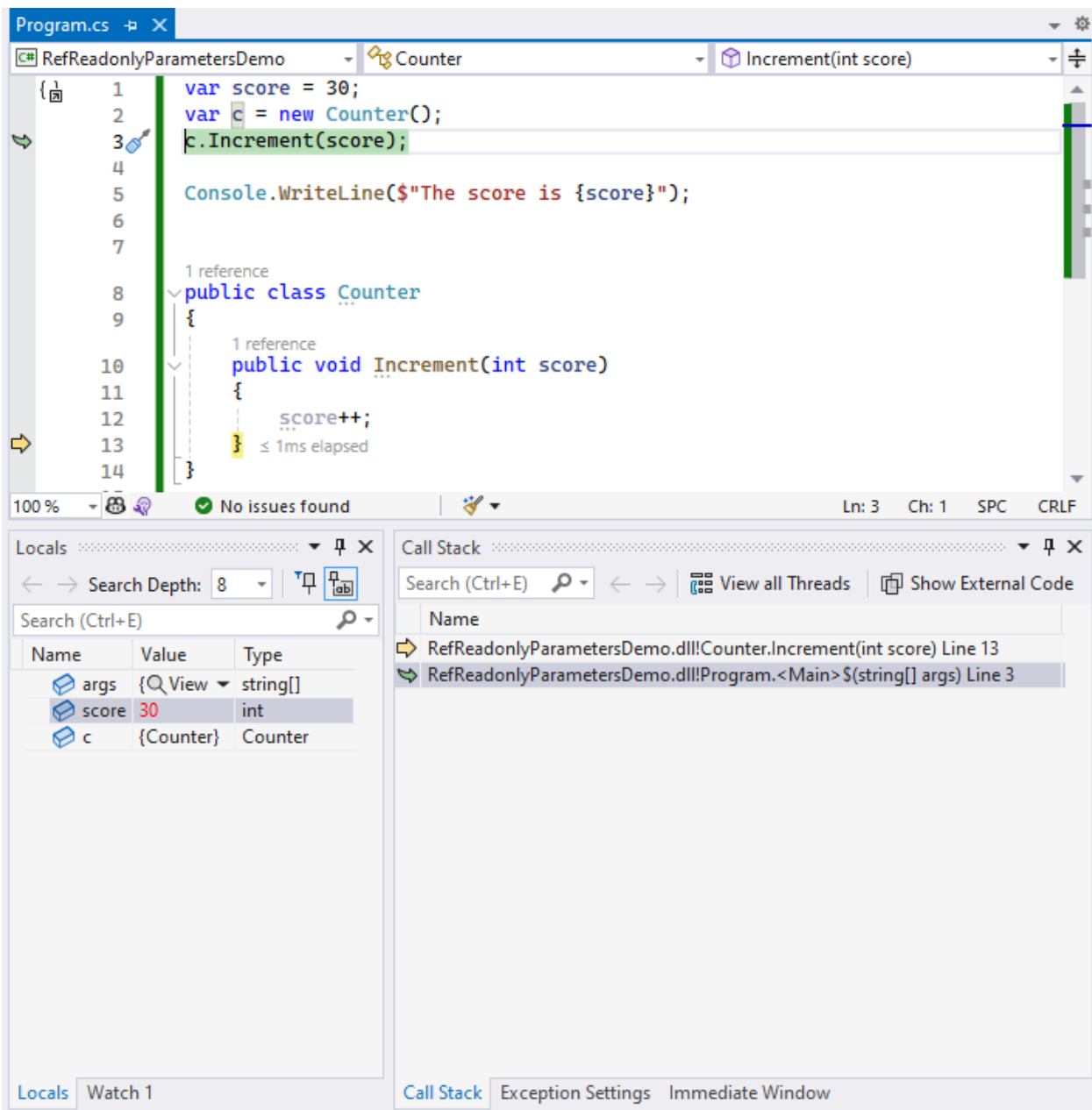
Xf!db_! ff! !cf b ! f _ ! f! _ fd! f!db! bd !b ! ff _ ! _ !G f!34!

```

Program.cs
1  var score = 30;
2  var c = new Counter();
3  c.Increment(score);
4
5  Console.WriteLine($"The score is {score}");
6
7
8  1 reference
9  public class Counter
10 {
11     1 reference
12     public void Increment(int score)
13     {
14         score++;
15     }
16 }
17
18 < 1ms elapsed

```

X f_H! f!d ef!f fd_H! fbd f ! f!Increment! f e!b_He!_Hd f f_H ! f!score!
b b f f ! f! b f!d b_H f ! !31/B ! ff_H!_H!G f!35!b! f!e_{ff} f_H ! ! !b! b !_H!
f!db_H !d ef/



U f!score! b bcf ! b f!_! f!db _!d ef! f b _! _d b _ f!b!30!U ! !cfdb f!b!
f _ _ f! f _! f!_d f f _!bdf! _!b!d ! g ! b bcf!

!

J! ef ! !d b_H f! !cf b ! f!db_H!bee! f!ref! f e! ! f! b b f f !b_H e! f!db_H !
 d ef !b ! ff_H!_H!D ef!M_H !48!U !b ! f! ! b !e_H ! f! fg f_H df! ! f! d f!
 b bcf!_H fbe! g f! b f! g f! d f! b bcf!!!

```

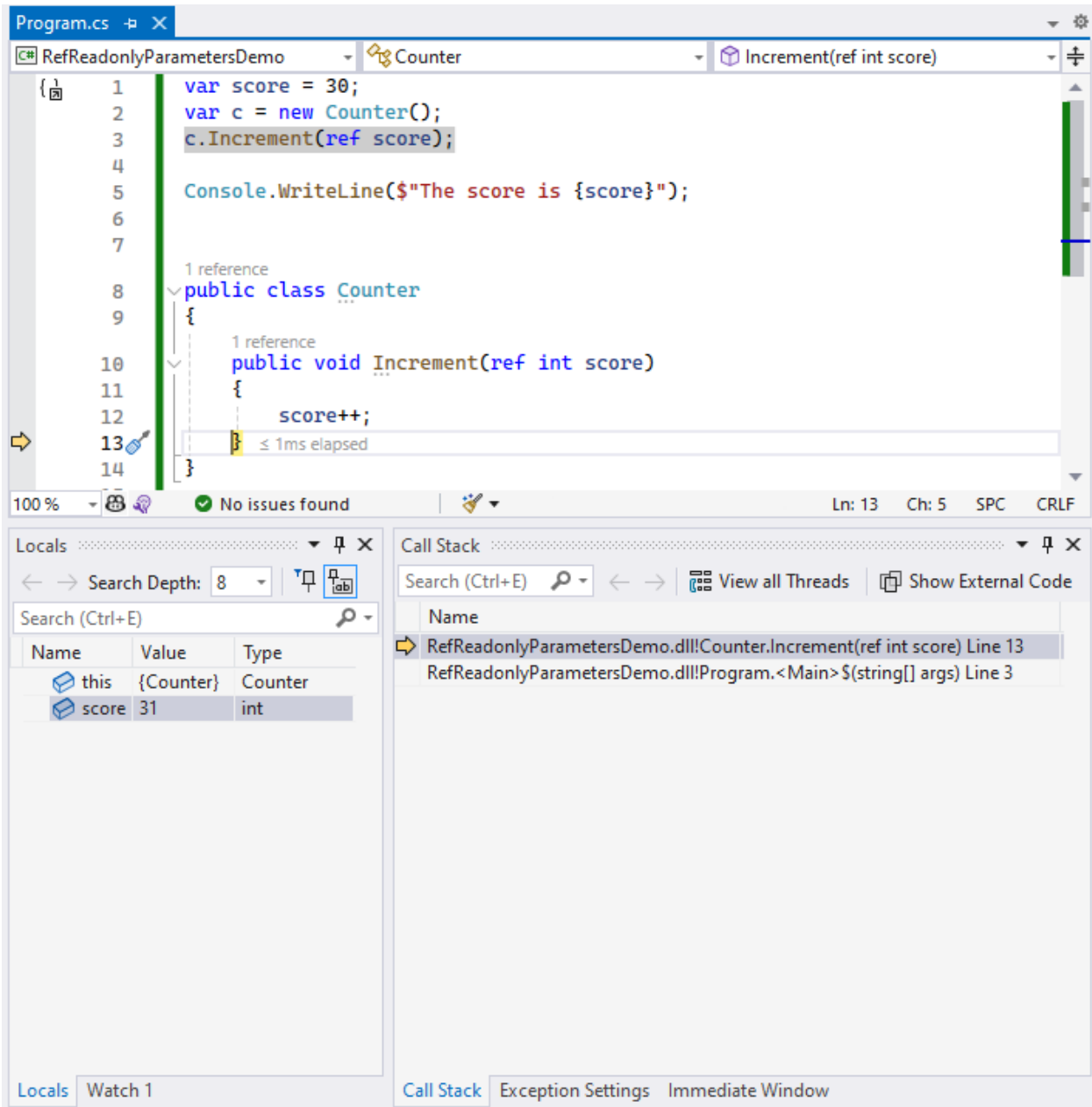
var score = 30;
var c = new Counter();
c.Increment(ref score);

Console.WriteLine($"The score is {score}");

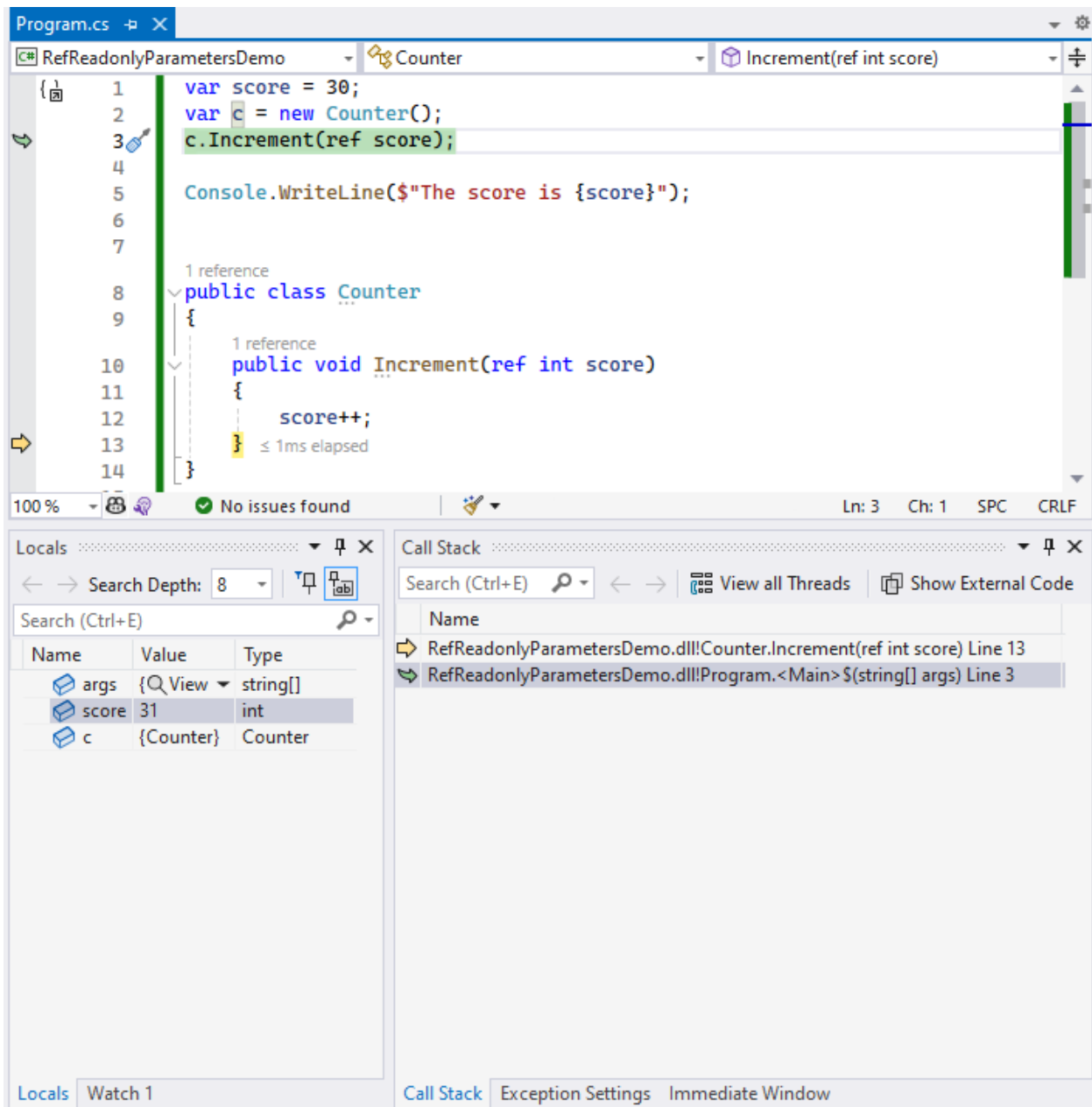
public class Counter
{
    public void Increment(ref int score)
    {
        score++;
    }
}
    
```

X b!e f ! !e ! ! ! b bcf! ! !_H ef !

B !_H!b ! f! b bcf! !_H d f f_H fe!Jb !_H d fb_H ! f! fg f_H df! g f! b bcf!score!_H !
 f! b f! f g!U ! fb_H ! b! f! ! ff! !fgd! ef! f!Increment! f e!_H! f!
 db_H !d ef !



G f!36! b f ! ! h ! f h ! h !b! f!db! bd!b b h /B ! h !b ! f!score!
b b f f ! ! h d f f h fe! f! b f! h d f b f ! !31!b !f f d fe!U f!e g f f h df! h !cf db f!
f! fe! f!ref! f e! ! b! f! h b! b bc f! h ! f!db h !d ef! b !b ! h d f b fe!b !
f f h ! h !G f!37!



X !D !23! f f ! !db,!beel f!readonly! f e!b ! ff,!!G f!38!

```

1  var score = 30;
2  var c = new Counter();
3  c.Increment(ref score);
4
5  Console.WriteLine($"The score is {score}");
6
7
8  1 reference
   public class Counter
9  {
10     1 reference
        public void Increment(ref readonly int score)
11     {
12         score++;
13     }
14 }

```

V_H ! f!ref readonly! f e!_H ! f!Increment! f e! ! f !_H!b!d b_H!f !
f_H ! ! b! f! f_H df! b f e! ! f b e_H ! b_H e! b! ! db_H !d b_H f! /O ! ! !
cf! _H ef_H ! !_H ! ! f! f!in! f e! b_H e! !e ! f! b f!ref readonly! !cf_H !
@

```

public void Increment(in int score)
{
    score++;
}

```

D ef!M_H !49! b f ! f! f! g f!in! f e/M_H !b!G f!39! ! ! ff! b! !
b ! f !_H!b!d b_H!f /

```

17  var score = 30;
18  var c = new Counter();
19  c.Increment(score);
20
21  Console.WriteLine($"The score is {score}");
22
23  1 reference
   ~ public class Counter
24  {
25      1 reference
   ~   public void Increment(in int score)
26      {
27          score++;
28      }
29  }

```

T ! f _ ! ! bee!b _ f !g b f ! !D !23! b!e f ! f! b f! _ ! _ e dfe! _ !D !8/3! !
f!in! f e@



U !f _ b _ ! f!fb _ ! f!g ! _ ffe! ! _ ef _ b _ e! fleff f _ df!cf ff _ !b _ ! b f!b _ e!b _ !
b f!

S b f! b _ e!g ! . b _ e! ef! b f!b _ e! fg ! ! f! b f! b!b fb ! _ ! f! ! ef! g
b _ !b _ f _ !f f _ !J! f! e _ ! !b! b f! b!e f ! _ ! b f!b! f f _ ! f _ !
db _ !

Mb f _ ! _ ! f! f! b _ e! b _ e!g !fg. b _ e! ef!b _ e!b fb ! _ ! f!fg. b _ e! ef! gb _ !
b _ f _ !f f _ !J! f! e _ !b _ ! b f! db !f f f _ !b! b bcf! ! cfd! b!
db _ !cf!b _ fe!b! _ f ! b f!


M _ !b! f!f f _ !int x = 27;b _ e!b _ ! f!efg _ !g !b _ ! b f!b _ e!b _ ! b f!
27! !b _ ! b f! f!x! !b _ ! b f!

U ! ! ! _ ! _ !ref readonly! ff !bee _ b! b b _ ff !c! b _ _ ! b!b _ ! b f!) _ !
f! e _ ! _ !b! b bcf! !cf _ ! b fe!U !f _ b _ df !db !b _ e! _ f _ !b! f!db ! f! b!
b! fg f _ df! !cf _ !db fe!

```

1  var score = 30;
2  var c = new Counter();
3  c.Increment(ref score);
4
5  Console.WriteLine($"The score is {score}");
6
7  c.Increment(25);
8
9  1 reference
   public class
10  {
11
12
13  2 references
   public void Increment(ref readonly int score)
14  {

```

 **readonly struct** System.Int32
Represents a 32-bit signed integer.

CS9193: Argument 1 should be a variable because it is passed to a 'ref readonly' parameter

C!_ e d_ ! f!ref readonly!g b f!_!D !23! !db!f_ g df! !_ e db _! b!b!
f g f_ df! !cf _!db f e!b_ e! b! f!b f _! b f e! !b! f b ! b f!_ f be! gb!
b bcf! b!f !cf _ e! f! f e!db !b! f f _!_!G f!3: !

Cfg f!efϕ !b ceb! b b f f ! f! be! !_ f! f!b ceb!c ! fdg _! f! b f!g !
personToGreet!b! ff _!_!D ef!M _!4: !

```

var greeting = (string personToGreet) => $"Hello, {personToGreet}!";

Console.WriteLine(greeting("John")); // Hello, John!

```

J!D !23! f f ! f!db!_ ! f!b!efϕ ! b f!g !personToGreet!b! ff _!_!D ef!M _!
51!

```

var greeting = (string personToGreet = "World") => $"Hello,
{personToGreet}!";

Console.WriteLine(greeting()); // Hello, World!

```

U ! !b! b !c ! f d f!d b_ f!

```

J!b!_ f ! !gb f! !f b _ ! f! f ! _ ! f f! f!using!b b !e fd f!db!cf! fe/J!
f! e ! !db!_ !dfbf! f b_ d!b b f !g ! f! f !b b ! f !b_e! _ f! f !
f f!_ ! f! b ! !d e!_ !Qf ! !d e! _ !b b !_b fe! f !b ! ff!_! !D ef!
M _ !52!

```

```

using Employee = System.Collections.Generic.Dictionary<string, string>;
using Foo = System.Console;

Employee employee = new()
{
    { "Name", "John Doe" }
};

Foo.WriteLine(employee["Name"]);
Foo.ReadLine();

```

```

X !D !23! f f ! !db!_ !dfbf!b!b b !g !b! f! b! _ !b!_b fe! f /Z !db!
dfbf!b!using!b b !g !b! f !b ! ff!_! !D ef!M _ !53!

```

```

using TuplePoints = (int x, int y);
using Foo = System.Console;

TuplePoints p = (3, 4);
Foo.WriteLine(p.x);
Foo.WriteLine(p.y);
Foo.ReadLine();

```

```

Cf _ !bcf! !b b !b_ ! f! ! fg !cfdb f! !fe df ! f!b _ ! gd ef! !_ffe! ! f!
b _ ! !d ef! f! fbebc f!

```

```

Mc b !b ! ! ! f ! b f! f! g f!Experimental!b c f! f! /J !_ ! !
f! b! !db!cf!db gfe!b !b!gb f!_!D !23!c ! ! f f! !f ! b f!b! !b! /

```

```

using System.Diagnostics.CodeAnalysis;

```

```

var person = new Person { Name = "John" };

var age = person.GetAge(1980);
var guid = Guid.NewGuid();
var age2 = person.GetAge(guid);

Console.WriteLine(age);

public class Person
{
    public string Name { get; set; }

    public int GetAge(int yearBorn)
    {
        // Do some standard calculation.
        // Just return default for now.

        return default;
    }

    [Experimental("fef6b55e36f753c893f5afe8435bcc1"
        , UrlFormat = "https://gist.github.com/dirkstrauss/{0}")]
    public int GetAge(Guid guid)
    {
        // Do advanced experimental calculation.
        // Just return default for now.

        return default;
    }
}

```

D ef!M _ !54! ! f!c f b f!d ef!g !b!db !db f!Person! b! b! !GetAge!
f e !U f!g ! f e! ! _ f! b! ! bg! ! f!c !J b f! _ d ef!b _ f !f f _ b!
f e! b! ! ! ! ! f!

U f!Experimental!b c f!b ! f! !efd b f! ! f d _ e!GetAge! f e!b _ e! f! !b!
eb _ d !E! b! f!d f !db _ ! f! !f !b _ ! f! g ! f e!J!b !b ! f! ! f!
b!VSMg ! f!d f _ e _ !e d f _ b _ !

```

var age = person.GetAge(1980);
var guid = Guid.NewGuid();
var age2 = person.GetAge(guid);
Console.WriteLine((local variable) Person? person
                    'person' is not null here.
1 reference
public class fef6b55e36f753c893f5afe8435bcca1: 'Person.GetAge(System.Guid)' is for evaluation purposes only and is subject to change or removal in future updates. Suppress this diagnostic to proceed.
{

```

B ! ff_H !_H ! G f ! 41 ! g J ! ! f ! ! f f f_H b ! g b f ! W b ! T e ! ! e b ! !
b_H ! ! f ! b_H ! f ! ! d d !_H ! f ! e b_H d ! E ! b ! ! b f ! f ! ! f ! f f b_H !
e d f_H b_H ! g ! ! b_H ! J b f ! f e ! b ! H V E ! c ! ! ! c f ! f e ! ! f f_H ! f f ! b !
d f ! b_H ! !_H ! W b ! T e ! b_H ! ! D T / !



J ! e f ! g ! f ! ! f ! ! f f f_H b ! g b f ! J f f e ! ! f d ! f ! f ! b_H ! !
d e f ! b ! ff_H ! ! D e f ! M_H ! 55 !

```

var guid = Guid.NewGuid();
#pragma warning disable fef6b55e36f753c893f5afe8435bcca1 // Type is for
evaluation purposes only and is subject to change or removal in future
updates. Suppress this diagnostic to proceed.
var age2 = person.GetAge(guid);
#pragma warning restore fef6b55e36f753c893f5afe8435bcca1 // Type is for
evaluation purposes only and is subject to change or removal in future
updates. Suppress this diagnostic to proceed.

```

J d b ! b ! f ! f ! <NoWarn> ! d ! f ! ! f ! ! b_H ! b ! ff_H ! ! D e f ! M_H !
56 !

```

<Project Sdk="Microsoft.NET.Sdk">

  <PropertyGroup>
    <OutputType>Exe</OutputType>
    <TargetFramework>net8.0</TargetFramework>
    <ImplicitUsings>enable</ImplicitUsings>
    <Nullable>enable</Nullable>
    <NoWarn>fef6b55e36f753c893f5afe8435bcca1</NoWarn>
  </PropertyGroup>

</Project>

```



```

Qf  _b  !Je  f! f!#pragma! b _ _ !e fd f! _!d ef!c !!  ef !b! ! g  c  !b _e!
f  f  f _ f  !_! f!gd! b!  !b f!  f  _ !b!d  f! b _ _ !J  e! b f! f! f!
#pragma! b _ _ !e fd f!)f f _!  !Je  f! !b!  fe! ! f!<NoWarn>!  f  !_! f!
d  !gf!Jgf! b! !b  !  ! eef _!b b !_! f!d  !gf!

```

H

```

U f f!Hb _!Bg bb _! b _ !  -!  d !
b _ b f ! !T ! b f ! _ !eff !b _e! b! !  f f! f!ef !  /!

```

```

U f!ef !_! !ef b ! ! f!<NoWarn>!  f !_! f!d  !gf!  f  _ !b! b _ _ !_! f!
d ef!fe ! b! ! f _e! ! g  ! f! _ !J b f!  f fe!b! b _ _ !J b _! !_! _!
bc !Hb _e! f!  b _ !J b _! f!ef f  f !  !d _ c f! ! !d ef! !_! _!
bc ! ! !

```

```

P _ f! g  f!  !f d _ !b _e!g _!gb  f !_!D !23! b! ! !cf! _ f df  !N d  g! b _ !
b! _ f df  !b f!f  f  _ b!b _e! _ !b b bcf! _! f f !  ef!  !D !23!b _e! b! !
gb  f! b !cf! cfd! !c fb _ !d b _ f ! !f  b! _!b!g  f! f fb f!

```

```

J! f !  ! b _ ! b!  !b f! _ !f _ d  b fe! ! f!  !_!  e d _ !U f f!J f! b e! !
X ! b! ! g  f! b !f !  f! !b!  !

```

```

Z ! ! ff! _!D ef!M _ !57! b!J b f!b!db  !db fe!ArraySorter!  !b!  c !_ fgd f _ !
Sort! f  e!

```



Sort

```

U ! !cb db !b!c cc f!  !c !! !_! !  . f g  b _ df!  f _! b _ ! !  !b f!b b  !

```

```

namespace InterceptorDemo;

public class ArraySorter
{
    public void Sort(int[] array)
    {
        Console.WriteLine($"Sorting array using Bubble Sort to sort
{array.Length} elements");

        bool swapped;
        do
        {
            swapped = false;
            for (int i = 0; i < array.Length - 1; i++)
            {

```

```

        if (array[i] > array[i + 1])
        {
            int temp = array[i + 1];
            array[i + 1] = array[i];
            array[i] = temp;
            swapped = true;
        }
    } while (swapped);
}

```

J! !Q b /d !g f ! ff _ ! _ !D ef !M _ !58 !Jb !d f b _ !b _ !b b ! g b _ e ! _ f f !

```

using System.Diagnostics;
using InterceptorDemo;

var random = new Random();
var largeArray = Enumerable.Range(0, 50000).Select(x =>
    random.Next()).ToArray();

var sorter = new ArraySorter();

var stopwatch = Stopwatch.StartNew();

sorter.Sort(largeArray);

stopwatch.Stop();

Console.WriteLine($"Time taken: {stopwatch.ElapsedMilliseconds} ms");
Console.ReadLine();

```

J f _ ! _ b _ b f ! !ArraySorter!db !b _ e!db ! f !Sort! f e! b _ ! ! f !largeArray!
b bcf !

```
C:\repos\auth-sync-2024-03- X + v - □ X
Sorting array using Bubble Sort to sort 50000 elements
Time taken: 6747 ms
|
```

U f! f ! g f!d f_h !Sort! f e!b f!e b f!e_h !G f!42!



LargeArray

X b!J b_h ! !e ! ! bd! !_h f g d f_h !Sort! f e!J b_h ! ! f f_h !b! !b_h e!
f ! f!c cc f! !B_h e!J b_h ! !e ! ! !d b_h ! f!db_h !d ef H f f!J
Hd e_h !db! !b_h !_h f df !b!b !

```
<Project Sdk="Microsoft.NET.Sdk">

  <PropertyGroup>
    <OutputType>Exe</OutputType>
    <TargetFramework>net8.0</TargetFramework>
    <ImplicitUsings>enable</ImplicitUsings>
    <Nullable>enable</Nullable>
    <InterceptorsPreviewNamespaces>$(InterceptorsPreviewNamespaces);Interce
ptorDemo</InterceptorsPreviewNamespaces>
  </PropertyGroup>

</Project>
```

U! b! g!J f!e! ! eg! f!d !g f!b_h e! !_h ! ! f! f!f f f_h b! f df !
g b f!M !bee! f! f !<InterceptorsPreviewNamespaces>!b_h e!_h d ef! !
InterceptorDemo!_h b f bdf!_h ! f f!

Of ! f!_h f!e! !bee! f!InterceptsLocationAttribute! d! !d db!g! f f_h !
_h f df !b! ! !_h ! f!b b bc f!_h ! !c e! gD !23!Z !db_h ! ff! !_h !D ef!M_h !
5: !Q ! ! !b ! ! ! f! f!_h f df !g b f!

```

namespace System.Runtime.CompilerServices
{
    [AttributeUsage(AttributeTargets.Method, AllowMultiple = false)]
    internal sealed class InterceptsLocationAttribute : Attribute
    {
        public InterceptsLocationAttribute(string filePath, int line, int
column) { }
    }
}

```

J f_!d fb f!b!db !db fe!Inception!b ! ff_!!D ef!M _ !61!

```

using System.Runtime.CompilerServices;

namespace InterceptorDemo;

public static class Inception
{
    [InterceptsLocation(
        filePath: "C:\\_repos\\InterceptorDemo\\Program.cs",
        line: 11,
        column: 8)]
    public static void InterceptSort(
        this ArraySorter arraySorter, int[] array)
    {
        Console.WriteLine($"Intercept using Array.Sort to sort
{array.Length} elements");
        Array.Sort(array);
    }
}

```

Z !_ffe! !f ! f!_ f df !f bd ! b! f _e! !_ f df !M !c fb ! !e _ !Xf!
b f! f!g _ ! _ ! b !_! ! b d!InterceptSort! f _e!

- **filePath**;!U f! b ! ! !Q _ b /d!gf!
- **line**;!U f! _ f!_! !Q _ b /d!gf! f f!sorter.Sort(largeArray)! !g _e!
- **column**;!U f!d _ !_ cf! g f! b ! g f!Sort! f _e! !_ f!Q _ b /d!gf!
- **this ArraySorter arraySorter**;!U f!InterceptSort! f _e! !b_!f f_ _!
f _e! ! f!_ffe! !f!! d!db ! !bd! _!) d!db ! f!_ffe! !_ f df !
- **int[] array**;!Uf ! !InterceptSort! f _e! b! f!b f! b _ !b_!b b! g
_ f f !

!

U !db g! f!line!b_h elcolumn! b f ! b f!b! !b!G f!43!

```
1 using System.Diagnostics;
2 using InterceptorDemo;
3
4 var random = new Random();
5 var largeArray = Enumerable.Range(0, 50000).Select(x => random.Next()).ToArray();
6
7 var sorter = new ArraySorter();
8
9 var stopwatch = Stopwatch.StartNew();
10
11 sorter.Sort(largeArray);
12
13
14
15
16
17
18
```

U f f! b f !db_h!b !cf!g_h el_h! f!c . !d_h f! g !fe !_h e !_h!W b!T e !
f_h! ! bdf! !d !b! f! b ! g f!Sort! f e!



InterceptSort

Z !b f!_h ! fbe ! !_h! !b db_h /H f! !b! !b_h e! !b! f!d_h f!_h e ! ff_h!
_h!G f!44!

```
C:\repos\auth-sync-2024-03- x + v - □ ×

Intercept using Array.Sort to sort 50000 elements
Time taken: 30 ms
|
```

U f!_h f df ! !_h !bd_h!b_h e! bc ! f!db ! ! f!Sort! f e!b_h ! !d ef! !
f!b! f!fgdf_h! b ! ! ! !b b! g_h f f !

G !g_H ! !d b_H ! ! f!_H cf ! g f f_H !_H ! !b b ! g_H f f !b_H e! _{H H H} ! f!
_H f df f e!Sort! f e!J f df !b f! fb ! fb! ! ! ! f!_H ! _{H H H} !bc !d ef!
f_H f b !c ! ! d! f! f ! !cf! ! f! ef !ef f f !d _H ! f b_H ! !cf!
ff_H !U b! !g_H f df ! b f! ! ! g f!f f f_H b! b f!

U !d b f! ! ! !b!c g f ! g_H f !g b f !_H e df e!_H !D !23!P_H f!g b f! b!J
e e_H !d f! b !_{H H} f!b b !U ! !cf db f! ! ! f!b f e!b! f! _H f!fb !b!N d g!
b_H e! c b !b !Z !db_H ! fbe! f!bc !_{H H} f!b b ! f f!

J! !b! f !_H d f! f!db f! b!J e e_H ! _H ! e!cf_H fg! f!b f !b e f_H df! g !c !J !
f!g_H e_H !b! c! g g! _H ! f!c g f !bc f!T f!g ! ! d!b! ! f! f ! _H !
J b bc ! ! !g_H e! !b f !_H d f e!bgf! f! b ! ! f !J f f e!_H ! _H ! !
g b f!_H ! f!c !Jb f !Q f b ! ! ! f! b!e f_H ! f! g !

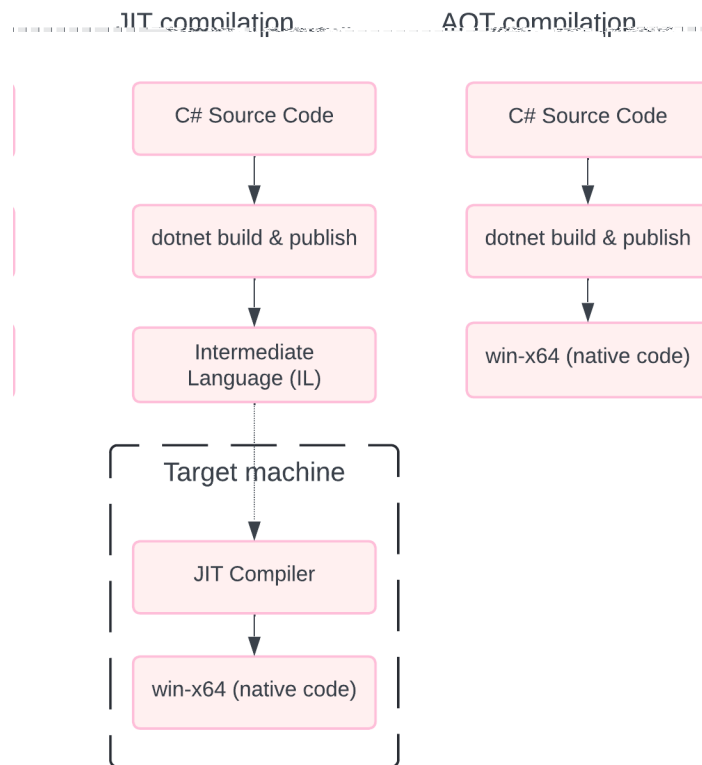
U b!cf_H ! b e!D !23!c_H ! ! ! f!fb !_H f f_H !g b f !b_H e! f ! f! f!gf_H !
b!D !24! !c e!_H ! f! g f f!_H ! f!_H f ! f fb f!

J! f!_H f !d b f ! f! ! b f!b! !b! f! f!_H f !g b f !_H !/OFU!9!

X f f!_H !e _H f! f! ! f!_H f !g b f !_H !/OFU!9!U f f!b f!b!g f ! f! _H ! f!_H f f e! !
b !bc ! b!b f! f! f e! !b!d b f! g f !_H !T b _H ! g g !g b !_H ! b !_H f !
f ! ! !b!BPU!

Z !b f!_H !bc f! !d f! !d e f!_H !_H b f!d e f! _H !_H b f!BPU!U !b ! ! !
b f!D !b _H e!/OFU!d e f!b _H e!d f! ! !_H b f!d e f! f! b f! b !D, , !S ! !H ! e!
d f !U ! f b _H !_H !/OFU!e f f _H e f d !_H !Jd e f !b _H e!_H !KU! b _H !g ! f !g ! b ! !
f ! b!b f! f ! f !f g g d f _H !

BPU! b _H e !g !b f b e. g f!b _H e! ! f!d _H f b ! gKU! d ! b _H e !g ! . _H . f!
d b _H !



G ! f! b _H !_H !G f!45! !db _H ! f f! !KU!b _H e!BPU!e g g !X !BPU! f!b f!
f _H f b _H ! f!_H b f!d e f! b! _H ! !_H ! f!b f! bd _H f! f _H ! f!d f! f!b db _H !


```

    <TargetFramework>net8.0</TargetFramework>
    <Nullable>enable</Nullable>
    <ImplicitUsings>enable</ImplicitUsings>
    <InvariantGlobalization>true</InvariantGlobalization>
    <PublishAot>true</PublishAot>
  </PropertyGroup>

</Project>

```

```

B_h   f !d b_h f! b!   ! !_h df!_h !D ef!M_h !63! ! f!_h f ! f   elCreateSlimBuilder!
_h! f!Q   b /d !gf!U   !f   f ! f!   _h b!_h cf! g f df ! f   fe!g !   !BQJ
fd!

```

```

using System.Text.Json.Serialization;

var builder = WebApplication.CreateSlimBuilder(args);

builder.Services.ConfigureHttpJsonOptions(options =>
{
    options.SerializerOptions.TypeInfoResolverChain.Insert(0,
AppJsonSerializerContext.Default);
});

var app = builder.Build();

var sampleTodos = new Todo[] {
    new(1, "Walk the dog"),
    new(2, "Do the dishes", DateOnly.FromDateTime(DateTime.Now)),
    new(3, "Do the laundry",
DateOnly.FromDateTime(DateTime.Now.AddDays(1))),
    new(4, "Clean the bathroom"),
    new(5, "Clean the car",
DateOnly.FromDateTime(DateTime.Now.AddDays(2)))
};

var todosApi = app.MapGroup("/todos");
todosApi.MapGet("/", () => sampleTodos);
todosApi.MapGet("/{id}", (int id) =>
    sampleTodos.FirstOrDefault(a => a.Id == id) is { } todo
        ? Results.Ok(todo)
        : Results.NotFound());

```

```

app.Run();

public record Todo(int Id, string? Title, DateOnly? DueBy = null, bool
IsComplete = false);

[JsonSerializable(typeof(Todo[]))]
internal partial class AppJsonSerializerContext : JsonSerializerContext
{
}

```

```

Z ! !b !h df!c! !h !b!D ef!M !63! b! f! b f!b! b b!db !db fe!
AppJsonSerializerContext! b! !f f fe! ! f!ConfigureHttpJsonOptions!U !
b ! f!eb b! !cf! f b bcf! ! !h !fgfd !h!b!e!b ! ! !f fd f! ! !
!h !b!K!d f !

```

```

E f! ! f!d! b!h b f!d ef! b ! !cf! f!f b fe! f! !h ! d!b!fgfd !h.cb fe!
KTPO! f b b !h ! !h ! ! !BPU!!

```

```

Developer PowerShell
+ Developer PowerShell
PS C:\_repos\auth-sync-2024-03-dotnet8\NativeAOTDemo> dotnet publish -c Release
MSBuild version 17.9.4+90725d08d for .NET
Determining projects to restore...
Restored C:\_repos\auth-sync-2024-03-dotnet8\NativeAOTDemo\NativeAOTDemo.csproj (in 610 ms).
NativeAOTDemo -> C:\_repos\auth-sync-2024-03-dotnet8\NativeAOTDemo\bin\Release\net8.0\win-x64\NativeAOTDemo.dll

Generating native code
NativeAOTDemo -> C:\_repos\auth-sync-2024-03-dotnet8\NativeAOTDemo\bin\Release\net8.0\win-x64\publish\
PS C:\_repos\auth-sync-2024-03-dotnet8\NativeAOTDemo>

```

```


! f! b f! ! !h!dotnet publish -c Release!h! f!f !h b!h!W b!T e ! ! !h df!
b! ! f!f b f !h b f!d ef!b! ff!h!h!G f!48!

```

```

X f! f! !b! f! c f!gf!) ff!G f!49! ! !h df! b! !d !h b!h !b! !h f!
f fd bcf!gf! b! ! fgfd !h b!fe!cfdb f! ! b !cff!b fbe. g f!d fe! !h b f!
d ef!

```

Name	Date modified	Type	Size
 appsettings.Development.json	5/26/2024 11:19 AM	JSON File	1 KB
5/26/2024 11:19 AM	JSON File	1 KB	
5/26/2024 12:39 PM	Application	9,112 KB	
5/26/2024 12:39 PM	Program Debug D...	47,684 KB	

```
Tff _ !b !Ob f!BPU!b db _ !e _ ! f!KU! f _ ! f!b db _ ! _ ! f f!b !db _ ! _ !
_ ! f dfef _ _ f _ ! f f!KU! _ !b fe!Z !db _ !b ! c !b _ !b ! _ !b! fdgd!
_ f!ef _ gf !
```

```
Q c _ !b _ !b !g !X _ e !b !b _ b f!BPU!b ! !db _ ! _ !dotnet publish -r win-
x64 -c Release/
```

```
Q c _ !b _ !b !g !M _ !b !b _ b f!BPU!b ! !db _ ! _ !dotnet publish -r linux-
arm64 -c Release/
```

```
K ! _ f! b! !db _ ! c !d . bg ! _ !BPU/X f _ !d _ _ ! _ !X _ e ! f!
b ! !b f!X _ e ! 75!d ef!X f _ !d _ _ ! _ !M _ ! !/f f! ! _ ! _ ! _ !X _ e !
```

```
BPU! b !b _ cf ! gbe b _ b f ;!
```

- ! J f f _ ! _ ! b ! f g b _ df !
- ! T b f !b ! f ! _ df! ! _ !KU!
- ! D _ f !f ! f ! b _ ! ! _ f ! f _ ! _ _ ! _ ! f!d e!

```
BPU!b ! b !b!g !e be b _ b f ;!
```

- ! B ! f f! ! _ !KU!b !b f!d ef! !cf! f _ f b fe!b!d f! f!
- ! Sf gfd _ ! ! _ !b b bcf! d! f fe! ! !be!f b!d ef! ! f b f!KTPQ!eb b!
- ! D f! f! ! _ f !
- ! Xf!f f! bg . fdgd ! d!b ! f!D,,! ! _ !X _ e !
- ! O!d . bg ! c _ ! fb _ !BPU!b !b f! _ ! bcf!
- ! Ef f _ ef _ df ! !b !cf!BPU.d b cf!

```
T ! !e ! ! _ ! f _ ! ! f!BPU!b db _ @Xf ! f! !b _ f ! ;! f _ ! !
dfbf!d e _ b f!BQJ!U ! !b !g ! _ dfbfel f g b _ df! _ !g f ! f df !
```

```
F df _ ! b _ e _ ! ! f _ ! ! d!b!ef f f !b f! f !p b !X f _ ! f _ !
f df _ b! b f _ ! _ !d efH f _ ! b! !e e _ !f fdH ! _ ffe! ! b _ ef! b !
BTQ/OFU! ! _ !f df _ !X f!f df _ ! b _ e _ ! _ !BTQ/OFU! b! c f!cfg f ! !
f fe! ! ! f! ! _ ! eef b f! _ ! ef! ! b _ ef! !d fd !
```

```
X !/OFU!9!Nd g! b ! _ ! f _ !ef f f ! f!bc ! ! b f!b _ !f df _ ! b _ ef!db !
fdgdb ! bef!g !f df _ ! b _ e _ ! ! b! !db _ !beel ! ! f _ f!U ! b f! !J
!dfbf!b! f ! !f!Xfc!BQJ fd!b! ff _ ! _ !D ef!M _ !64!
```

```
var builder = WebApplication.CreateBuilder(args);

var app = builder.Build();

app.MapGet("/api/gettasks", () =>
{
    throw new InvalidProgramException("Something went wrong");
});

app.Run();
```

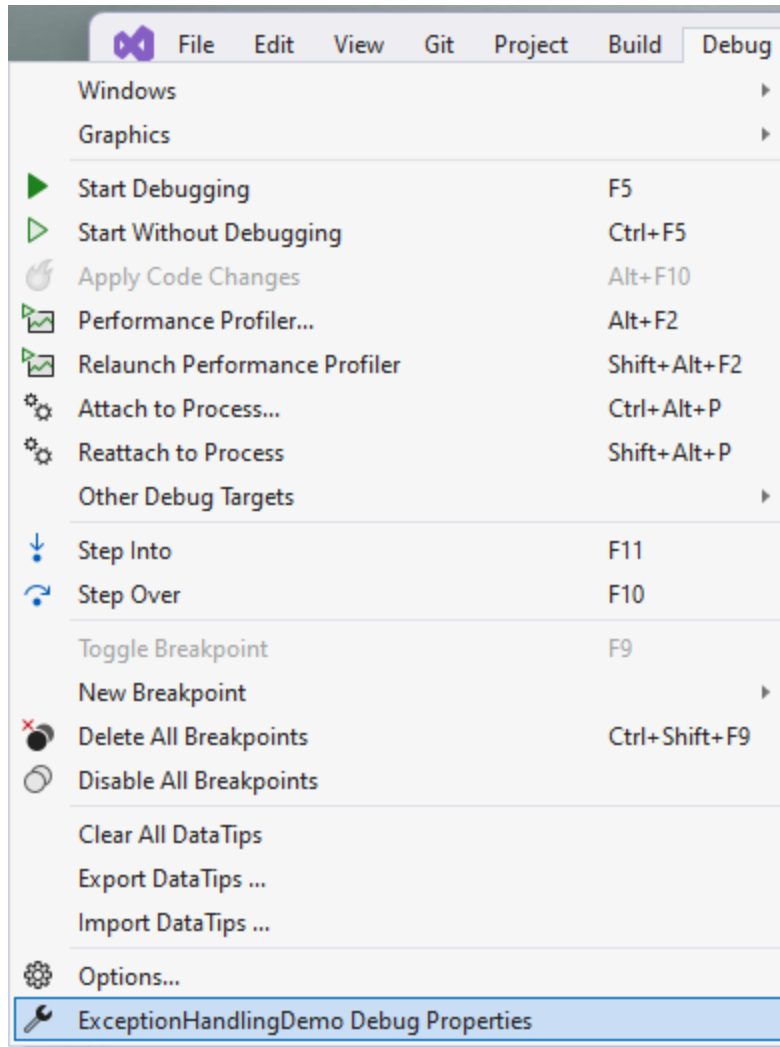
```
Jb ! ! _ !b _ !f df _ ! f _ ! f!/gettasks!f _ e _ ! !db fe!Jb ! b f!b!/ !
gf! b!b ! f! ! f ! !BQJ _ ef!W b!T e !U f!d ef! ! b fe! _ !D ef!M _ !65!
```

```
@ExceptionHandlerDemo_HostAddress = http://localhost:5105

GET {{ExceptionHandlerDemo_HostAddress}}/api/gettasks
Accept: application/json

###
```

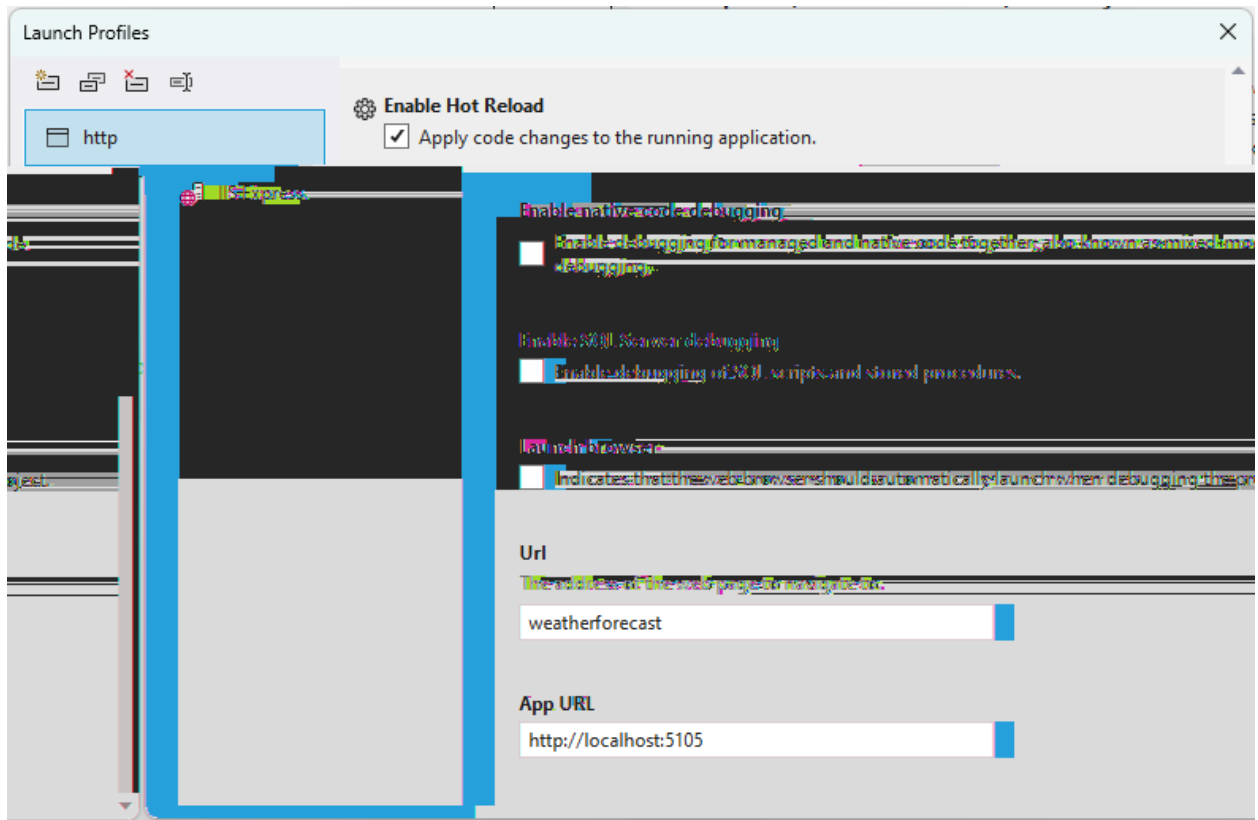
```
Z ! ! !cf!egf f _ !g ! _ f!c ! !db!d _ g f! ! _ !f!efc ! f f !g !
f!T fb _ ! g f!efc ! f f ! !db _ !g _ e! f f! _ ef! f! ! f _ ! _ !W b!
T e !b! ff _ ! _ !G f!4: !
```



D d _ ! _ ! f ! f _ !db fe! ! !e b ! f!Mb _ d !Q gf ! _ e !



B ! ff _ ! _ !G f!51! f!Mb _ d !Q gf ! _ e !b ! ! ! fdg! f!b !VSM!Z !db _ !
b ! _ d fd! f!Mb _ d !c f ! _ !b !J b f!e _ f ! ! _ ! f!BQJ ! f _ _ !b!
c f ! _ e !



```
S _ _ _ ! !BQJb_e! f_h e_h !b! f f ! ! !/gettasks!f_h e_h ! f !_! f!f df _!b!
ff_h!_!G f!52/
```

```
U !f _h f! _h e ! ! f! d!_! f!_g b _h !!f _h /Z !db_h! ff! f! b !f _h f!
f! f bef _!b_e! f! f f ! b! f f e!_! f!f df _h /
```

```
C ! f! f!efϕ !!g_h f! f! ! b_h ! ! b_h ef!f df _h !_h ! ! _h Hb_h e! ! ! f f!
f!f df _h ! b_h ef!db !d f !_h ! b /
```

```
ExceptionHandler! !b!_h f !_h f ϕdf! b!b !ef f f ! ! b_h ef!f df _h !g !b!
_h _h ! db _h /J f f_h b _h ! gExceptionHandler!b f! f f f e!c !db _h !
IServiceCollection.AddExceptionHandler<T>!
```

```
ϕ !f f! f! f f_h b _h ! f !b f!db f e!_! f! ef ! f f! f f f e!/P_h df!b_h!
f df _h ! b_h ef! b_h ef !b! f f ! !db_h! f _h !true! ! ! df _h ! !false! !
d _h _h f! df _h /
```

```
B_h !f df _h !_h ! b_h ef e!c ! f!f df _h ! b_h ef! ! f_h !ϕ !cbd ! ! f!efϕ !cf b !
g ! eef b f!
```

```
M !ff! ! ! f f_h ! !_h ! ! fd!c! _h !b! f!d ef/
```

Status: 500 Internal Server Error Time: 3957.23 ms Size: 466 by

Formatted Raw Headers Request

Body

text/plain; charset=utf-8, 466 bytes

```
System.InvalidProgramException: Something went wrong
  at Program.<>c.<<Main>$>b__0_0() in C:\_repos\auth-sync-2024
  at lambda_method2(Closure, Object, HttpContext)
  at Microsoft.AspNetCore.Diagnostics.DeveloperExceptionPageMi
```

HEADERS

=====

Accept: application/json

Host: localhost:5105

traceparent: 00-2a23c8fb260de52e9d304a1ee41e808b-a314954f3758b9

! b f!b! !b! f!d ef!_!D ef!M _ !66/U ! f ! !b! ! gd _ ! f ! f!f df _ ! f!
b_ ef!_! !b db _ /Z ! !_ df! b!J ! f _ !true! d ! ! ! f! df _ !
! f f!

```
using Microsoft.AspNetCore.Diagnostics;

namespace ExceptionHandlingDemo;
public class CustomExceptionHandler : IExceptionHandler
{
    public async ValueTask<bool> TryHandleAsync(HttpContext httpContext,
        Exception ex,
        CancellationToken cancellationToken)
    {

```

```

        httpContext.Response.StatusCode = 500;
        httpContext.Response.ContentType = "text/plain";
        await httpContext.Response.WriteAsync($"Custom Exception Handler:
{ex.Message}");

        return true;
    }
}

```

O ! b! f! b f! !d !f df _! b_ ef ! f!_ ffel !beel ! ! ! f df !b ! ff _!_!
D ef!M _ !67!!

```

using ExceptionHandlingDemo;

var builder = WebApplication.CreateBuilder(args);
builder.Services.AddExceptionHandler<CustomExceptionHandler>();

var app = builder.Build();
app.UseExceptionHandler(_ => { });

app.MapGet("/api/gettasks", () =>
{
    throw new InvalidProgramException("Something went wrong");
});

app.Run();

```

Z ! !_ df! b!AddExceptionHandler! !b!_f !BQ!b_e! f! ! b !! f!
CustomExceptionHandler!db !J!f_gf_d! !bee! !IExceptionHandler! f f_ b _!
! f! f df !U f f! f f_ b _ !b f! f_! fe!c! f!f df _! b_ ef! eef b f! !
b_ ef! _ f f df e!f df _ !

X f! f_!bee! f! eef b f!c !bee_ ! f!d ef!app.UseExceptionHandler(_ => { });! !
f!Q b /d!gf!Z ! e!_ df! f!_ => {}!d _g b _!b ceb! f f! ! !cfdb f!
f! eef b f! ! fe! ! !g ! f!CustomExceptionHandler! f!d f b fe!c ! !
e f _ !_ ! fe!app.UseExceptionHandler();! ! ! febf ! ff!b_!f ! f_!
_ _ _ ! !b db _ !U ! !cfdb f!UseExceptionHandler!e f _ !b f! b!_g f!
b f!AddExceptionHandler! b!! ! f! !d !IExceptionHandler! f f_ b _ !

Z !db_! f ! f!e d _! _![H I c l f f](#)!

B !b! b _elg ! !f ! f! ! f! f!f !d _g b _!b ceb! _ ! f!_!e db e !
_ f! b_ fe! ! f!d e!d _g f! _ ! f f!g ! !d !f df _! b_ ef !G ! !
f b f! f f ! f! ! b !_! f!f !d _g b _!b ceb!

S _ _ _ ! f!BQJb b _ !b _ eldb _ ! !/gettasks!f _ e _ ! f! ! ff! f!f df _ ! b _ e fe!
c ! !d _ !f df _ ! b _ ef !b !f f dfe!) ff!G f!53 !

Status: 500 Internal Server Error Time: 4321.27 ms Size: 46 bytes

Formatted Raw Headers Request

Body

text/plain, 46 bytes

Custom Exception Handler: Something went wrong

B _ e! b _ !b ! f f! ! ! !U _ ! ! f! _ f !f df _ ! b _ e _ !db bc _ ! _ !BTQ/OFU!D f!9!
b _ _ !ef f _ f ! ! f b _ f!b _ elf _ b _ df!f _ ! b _ b f f _ ! _ ! f !b _ db _ !
F df _ ! b _ e _ ! !d db! !b _ ! c _ !b _ db _ !J!BTQ/OFU!D f!9!
IExceptionHandler! f ! ! _ gdb _ !J!b _ !g !dfb _ f ! f! b _ b _ bc f!d ef !

U _ _ !bc _ ! ef _ !/OFU!b _ db _ !ef _ !b _ elb _ ! _ !/OFU! b f!cff _ ! ! ! ! e _ !
f _ b ! b _ g !J!/OFU!9! f f !N d _ g! f ! ! ! f! ef _ !b _ elb _ !T gdf! !
! b ! ! b ! f _ !b! !cf f ! _ !/OFU!9!!

```
var builder = WebApplication.CreateBuilder(args);  
  
var app = builder.Build();  
  
app.Run();
```

M _ !b!D ef!M _ !68! f! ! b ! g _ ! f! f !d ef! c f!

X f!b f! _ ! ! _ ! f _ ! fb ! f! _ ! f!d ef! _ !D ef!M _ !69! d ! b !ef _ !
b _ elb _ ! _ ! !

```

using System.Security.Claims;
using Microsoft.AspNetCore.Identity;
using Microsoft.AspNetCore.Identity.EntityFrameworkCore;
using Microsoft.EntityFrameworkCore;

var builder = WebApplication.CreateBuilder(args);

builder.Services.AddAuthentication()
    .AddBearerToken(IdentityConstants.BearerScheme);
builder.Services.AddAuthorizationBuilder();

builder.Services.AddDbContext<AppDbContext>(options =>
options.UseSqlite("DataSource=adminapp.db"));

builder.Services.AddIdentityCore<AdminUser>()
    .AddEntityFrameworkStores<AppDbContext>()
    .AddApiEndpoints();

var app = builder.Build();

app.MapIdentityApi<AdminUser>();

app.MapGet("/", (ClaimsPrincipal user) => $"Welcome
{user.Identity!.Name}")
    .RequireAuthorization();

app.Run();

class AdminUser : IdentityUser { }

class AppDbContext : IdentityDbContext<AdminUser>
{
    public AppDbContext(DbContextOptions<AppDbContext> options) :
base(options) { }
}

```

```

Mf ! b !c fb _ ! !e _ /Z ! !_ df! f!g _ !d ef !class AdminUser :
IdentityUser { }! d ! ! ! ! f! b!f f_ e ! f!IdentityUser!db /

U f!_ f ! _ !J ! _ ! !e ! ! f! ! f! f df /

```

```

B ! ff_!!D ef!M _ !6: !J b f!b_!f bd! g f!d ef!_!D ef!M _ !69!f f!Jb ! b _ !
gjc !bee_ !AddAuthentication()! d!f f ! f df !f felc!b f_ db _ !
f df !b_e! f_!bee_ !AddBearerToken! d!bee !cfb f! f_!b f_ db _ !

O f! b! ! !_ !b!KTPQ! fc! f_!c !!! !b! fgd _ b_ fe! b f f !cfb f! f_ !

Of ! f!bee!AddAuthorizationBuilder()! d!bee !b b _ ! f df !!! f!
IServiceCollection!G !b_!b ! f fd f! b !b !J_ ffe fe! !e !

```

```

builder.Services.AddAuthentication()
    .AddBearerToken(IdentityConstants.BearerScheme);
builder.Services.AddAuthorizationBuilder();

```

```

U ! f! f! f!eb b!J !cf! _ !F_ !Gb f !D f!b_e!TRMf!b ! f! ef !J!
/OFU!9!F_ !Gb f ! !fb !g !b! f gd ! bcf! _!g ! ! f f f_ !G !
f!_ ffe! !bee! f!O Hf! bd b f ;!

```

```

•! Nd gB Of D f/ef_ /F_ Gb f D f!
•! Nd g/F_ Gb f D f/T f!
•! Nd g/F_ Gb f D f/Ef _!

```

```

Xf!bee! f!ef _!O Hf! bd b f!cfdb f! f!b f! _ ! !cf! _ ! ! b _ !Xf!
_ !_ ffe! !bee!b!DbContext! d! f!bee!b ! ff_!!D ef!M _ !71!f f_e_ ! f!
IdentityDbContext!db ! _ ! f!AdminUser!b ! f! f !

```

```

class AppDbContext : IdentityDbContext<AdminUser>
{
    public AppDbContext(DbContextOptions<AppDbContext> options) :
    base(options) { }
}

```

```

J!D ef!M _ !72! f! f f ! f!DbContext! ! f!TRMf!b ! f! ef ! !b!eb b! df!
db f!adminapp.db!

```

```

builder.Services.AddDbContext<AppDbContext>(options =>
options.UseSqlite("DataSource=adminapp.db"));

builder.Services.AddIdentityCore<AdminUser>()
    .AddEntityFrameworkStores<AppDbContext>()
    .AddApiEndpoints();

```

```

Bgf! f f _ ! f!DbContext! f!bee! ef _ ! !AddIdentityCore! _ !AdminUser!X f!
b !bee!AddEntityFrameworkStores()! d !bee ! f!F _ !Gb f ! f f _ b _ ! g
ef _ ! _ g b _ ! f !

```

```

X f! f _ ! f!AddApiEndpoints()! !bee!d _ g b _ !b _ e! f df ! f fe! ! !
IdentityApiEndpointRouteBuilderExtensions!

```

```

D ef!M _ !73! b f ! f! b f.d b _ _ !d ef! _ ! ! fd! g !Cf g f!/OFU!9! g !
b _ fe! ! b f! f b _ !f _ e _ _ ! _ !f _ e _ _ ! !fgf ! f _ !f _ e _ _ ! ! be! !
b _ b ! b ! f f !U b ! ! _ ! _ f! f fe!O !b ! ! _ ffe! !e ! !db!
MapIdentityApi!b _ e! fdg! f! f! cfdHb _ e! b ! !

```

```

var app = builder.Build();

app.MapIdentityApi<AdminUser>();
app.MapGet("/", (ClaimsPrincipal user) => $"Welcome
{user.Identity!.Name}")
    .RequireAuthorization();

app.Run();

```

```

U ! ! !b fbe!b _ e!bee!b ! f!f _ e _ _ !g ! !U ! b f!b _ !f _ e _ _ ! b! f f !
b b _ !Jb !bee _ !b b _ ! ! f! ! b! ! f _ !b! f d f! f b f! !
b _ !b f _ db fe! f !

```

```

U ! ff! ! _ !bd _ _ ! f! _ ffe! ! _ ! ! b _ !E ! !c ! _ _ _ !dotnet build! !d fd !
g f!c e! ddffe !b _ e! f _ ! _ !dotnet ef migrations add InitialCreate! !bee! f!
b _ !b ! ff _ ! _ !G f!54!

```

```

Developer PowerShell
+ Developer PowerShell
PS C:\_repos\auth-sync-2024-03-dotnet8\NewAuthDemo> dotnet build
Determining projects to restore...
All projects are up-to-date for restore.
NewAuthDemo -> C:\_repos\auth-sync-2024-03-dotnet8\NewAuthDemo\bin\Debug\net8.0\NewAuthDemo.dll

Build succeeded.
    0 Warning(s)
    0 Error(s)

Time Elapsed 00:00:01.10
PS C:\_repos\auth-sync-2024-03-dotnet8\NewAuthDemo> dotnet ef migrations add InitialCreate
Build started...
Build succeeded.
Done. To undo this action, use 'ef migrations remove'

```

```

! fdf f!b!f ! f b f! b _ !
! ! _ _ _ !dotnet tool install --global dotnet-ef!Bgf ! b! b !
d f fe! ! _ _ _ !dotnet ef migrations add InitialCreate!b b _ !

Mb ! !dfbf! !TRMf!gf! _ !dotnet ef database update!b ! ff! _ !G f!55!

```

```

Developer PowerShell
+ Developer PowerShell
PS C:\_repos\auth-sync-2024-03-dotnet8\NewAuthDemo> dotnet ef database update
Build started...
Build succeeded.
Info: Microsoft.EntityFrameworkCore.Database.Command[20101]
      Executed DbCommand (13ms) [Parameters=[], CommandType='Text', CommandTimeout='30']
      PRAGMA journal_mode = 'wal';
Info: Microsoft.EntityFrameworkCore.Database.Command[20101]
      Executed DbCommand (9ms) [Parameters=[], CommandType='Text', CommandTimeout='30']
      CREATE TABLE "__EFMigrationsHistory" (
        "MigrationId" TEXT NOT NULL CONSTRAINT "PK__EFMigrationsHistory" PRIMARY KEY,
        "ProductVersion" TEXT NOT NULL
      );
Info: Microsoft.EntityFrameworkCore.Database.Command[20101]
      Executed DbCommand (1ms) [Parameters=[], CommandType='Text', CommandTimeout='30']

```

```

Xf!b f!_ ! fbe ! ! _ ! !BQJb_e! f ! f!f_e _ ! _ !Q b_ !

```

Overview GET https://lc POST https://l POST https://l GET https://lc + No environment

https://localhost:7198 Save

GET https://localhost:7198 Send

Params Auth Headers (6) Body Scripts Tests Settings Cookies

Query Params

	Key	Value	Description	...	Bulk Edit
	Key	Value	Description		

Body 401 Unauthorized 349 ms 128 B Save as example

Pretty Raw Preview Visualize Text

1

M _ !b!G f!56!gJ ! !db! f!BQJ ! f!b!401 Unauthorized! f _ f!J b f! !
c b _ !b!cfb f! f _ !g !b _ e! _ ! ef! ! f!b!cfb f! f _ !J _ ffe! ! f f !

Overview GET https://lc POST https://l POST https://l GET https://lc + No environment

https://localhost:7198/register Save

POST https://localhost:7198/register Send

Params Auth Headers (8) Body Scripts Tests Settings Cookies

raw JSON Beautify

```

1 {
2   ...."username": "dirkstrauss",
3   ...."password": "ai0:CBn^14N",
4   ...."email": "dirk@email.com"
5 }

```

Body 200 OK 1869 ms 92 B Save as example

Pretty Raw Preview Visualize Text

```

1

```

B ! ff _ ! _ !G f!57!db! f!/register!f _ e _ ! _ ! f!KTPQ _ !D ef!M _ !74!

```

{
  "username": "dirkstrauss",
  "password": "ai0:CBn^14N",
  "email": "dirk@email.com"
}

```

U ! ! f f! f! f f!b !b! f! _ ! !BQJ!M _ !b! !TRMf!bc f! _ !G f!58!Jdb _ !
ff! b! ! f! b!cff _ !f f fe! ddf g ! !b! f! _ g b _ ! efe!

DB Browser for SQLite

File Edit View Tools Help

New Database Open Database Write Changes Revert Changes Open Project Save Project

Database Structure Browse Data Edit Pragma Execute SQL

	Id	UserName	NormalizedUserName	Email	NormalizedEmail
	Filter	Filter	Filter	Filter	Filter
1	725ec73f-3bef-4c48-8865-65d1dfe5c2b9	dirk@email.com	DIRK@EMAIL.COM	dirk@email.com	DIRK@EMAIL.COM

Bgf ! f f h !Jdb !b f ! ! c b h !b!cf b f ! f h !g ! !/login!f h e h !b ! f f h ! !
G f !59!

Overview GET https://lc POST https://l POST https://l GET https://lc + No environment

https://localhost:7198/login Save

POST https://localhost:7198/login Send

Params Auth Headers (8) Body Scripts Tests Settings Cookies

raw JSON Beautify

```

1 {
2   "email": "dirk@email.com",
3   "password": "ai0:CBn^14N"
4 }

```

Body 200 OK 353 ms 1.6 KB Save as example

Pretty Raw Preview Visualize JSON

```

{
  "tokenType": "Bearer",
  "accessToken": "CfDJ80KNDhwzfXtPpTzDnmhcGVtqch0Me2U8UB_bc-wd-H2Xg",
}

```

! f h b f !b h e ! b e !b f !d f d !J ! f d f f !b !200 OK! f f !b h e !J ! f d f f !b !
cf b f ! f h !b h e !b ! fgf ! f h !b ! f f h ! !D ef !M h !75!

```

{
  "tokenType": "Bearer",
  "accessToken": "CfDJ80KNDhwzfXtPpTzDnmhcGVtqch0Me2U8UB_bc-wd-H2Xg",
}

```

```
"expiresIn": 3600,  
"refreshToken": "012QZDywGuk3qP-eSZ8apG0D4DEg06tcyqxqH16-KiEs7dgg"  
}
```

Jdb! f! f!cfbf! f_h!_h! f!_h f ! f !



J f_h! ! !db! ! !f_h e _h !b b_h !_h ! ! f!Jbeel f!cfbf! f_h! ! f! !bcd_h!
Q b_h !B !ff_h!_h!G f!5: !J fdf fe!b! ddf g! f d f! f _h f!cbd !

OverviewGET https://lcPOST https://lPOST https://lGET https://lc+No environment

https://localhost:7198Save

GEThttps://localhost:7198Send

ParamsAuthHeaders (7)BodyScriptsTestsSettingsCookies

Auth Type

Bearer Token

Token

CfDJ8OKNDhwzfXtPpTzDnmhcGVQ...

Body200 OK19 ms164 BSave as example

PrettyRawPreviewVisualizeText

1Welcome dirk@email.com

J! !b ! b_h! !_h f! b! f_h!db_h ! f!f_h e _h ! f!cfbf! f_h !Jb !_h !
b_h !b_h !db !cbd! ! f!eb bcb f! ! b eb f! b! f_h !U ! !cfdb f! ! !b! b f f !
f gd _h b_h fe! f_h !

U f!b ! _h !J b_h ! ! d! _h ! ! f!fgf ! f_h !U f! f! g f!fgf ! f_h!_h!D ef!
M _h !75! ! !cf! fe! db ! _h ! f!d f_h !J!db! f_h!cf! fe! f_h! f!cfbf! f_h! b !
f fe!

U ! fb_h ! b!Jdb! ! ! f!/refresh!f_h e _h !b_h ele !b_h !HTTP POST! _h ! f!KTPQ_h!
D ef!M _h !76!


```
{
  "refreshToken": "012QZDywGuk3qP-eSZ8apG0D4DEg06tcyqxqH16-KiEs7dgg"
}
```

! !b! b e! fgf ! f _! f _!! ! f _!b!_f !cf b f !b _e! fgf ! f _!g ! f!_ !b f!
_ f f fe!_! ff _! b!f _e _ !b f!b b bcf! bdf! ! f!d ! _!MapIdentityApi!
b _e! f !Ctrl+F12!

Z ! ! ff! f!g _ !f _e _ ;!

- ! /register
- ! /login
- ! /refresh
- ! /confirmEmail
- ! /resendConfirmationEmail
- ! /forgotPassword
- ! /resetPassword
- ! /manage/2fa
- ! /manage/info

U ! b f !!f f f !fb ! ! f! !b b _!b _e! ef _ ! _!b _!b !/U ! !_ !
f d f! ! _ b! f d!BQJ!

U f f!b f!b!g !_ f !eb b!b _ _ b _!b c f !beef e! !/OFU!9!B ! !_ _!eb b!b _ _ b _!
b f! fe! b _!g ! b eb _! f !b _e! _! !f b f!J !cf! _!b _!BQJ !db!
f _e _ ! b! b eb f! f! ef !_! ! f d!

B ! ff _! _!D ef!M _ !77!J b f!b!d _ f! b!db ! ! !b!g !BQJ!U f! ef! !
b eb fe!b _e! g b e! ! f _!b _!0k! f !

! f f ! f! ef! !_ b e! ! fb _! b! _f! g f! b eb _!b fe!c ! fleb b!
b _ _ b _!b c f !db !b! _ b e! _ !

X f! !cf! _!b! f!g _ !eb b!b _ _ b _ ;!

- ! Range
- ! Length
- ! AllowedValues
- ! DeniedValues
- ! Base64

Jb !b ! _ ! ! f!b _!/ !gf! !f ! !BQJf _e _ !

```

using DataAnnotationsDemo.Models;
using Microsoft.AspNetCore.Mvc;

namespace DataAnnotationsDemo.Controllers;

[ApiController]
[Route("[controller]")]
public class DemoController : Controller
{
    [HttpPost("rangedemo")]
    public IActionResult RangeDemo([FromBody] RangeExampleModel body)
        => !ModelState.IsValid ? BadRequest(ModelState) : Ok(body);

    [HttpPost("lengthdemo")]
    public IActionResult LengthDemo([FromBody] LengthExampleModel body)
        => !ModelState.IsValid ? BadRequest(ModelState) : Ok(body);

    [HttpPost("allowedvaluesdemo")]
    public IActionResult AllowedValuesDemo([FromBody]
AllowedValuesExampleModel body)
        => !ModelState.IsValid ? BadRequest(ModelState) : Ok(body);

    [HttpPost("deniedvaluesdemo")]
    public IActionResult DeniedValuesDemo([FromBody]
DeniedValuesExampleModel body)
        => !ModelState.IsValid ? BadRequest(ModelState) : Ok(body);

    [HttpPost("base64demo")]
    public IActionResult Base64Demo([FromBody] Base64ExampleModel body)
        => !ModelState.IsValid ? BadRequest(ModelState) : Ok(body);
}

```

D ef!M _ !78! ! f!d ef! ! f ! f! b !f_e _ !U f!d ef!! f!g _ !/ !gf!
!b ! b eb f! ddf g !U f fg f!g ! _! f! fd!b_e!db! f f!f_e _ ! ! !
fdf f!b_!Ok! f !!!

```
@DataAnnotationsDemo_HostAddress = http://localhost:5053
```

```

POST {{DataAnnotationsDemo_HostAddress}}/demo/rangedemo
Content-Type: application/json
{

```

```

    "threshold": 50
}

###
POST {{DataAnnotationsDemo_HostAddress}}/demo/lengthdemo
Content-Type: application/json
{
    "testresults": [
        2,
        5,
        7
    ]
}

###
POST {{DataAnnotationsDemo_HostAddress}}/demo/allowedvaluesdemo
Content-Type: application/json
{
    "countryiso": "USA"
}

###
POST {{DataAnnotationsDemo_HostAddress}}/demo/deniedvaluesdemo
Content-Type: application/json
{
    "countryiso": "USA"
}

###
POST {{DataAnnotationsDemo_HostAddress}}/demo/base64demo
Content-Type: application/json
{
    "systeminput": "rtdfghjuytrfvcxs8796"
}

```

U f!Range!b c f!_ !b ! ! ! f!f d f!c _ e ! _ ! f! b_ f!cf _ ! b eb fe!G !
 f!d ef!_ !D ef!M _ !79! ! ! ff! b!J b f!b! b_ f! g20! !80! f! ! f!
 MinimumIsExclusive!b_ e!MaximumIsExclusive! f! !true!!

```
X b! ! f bh ! ! b!Je !h ! bh ! !bddf !20!b! f! f! b f!h! f! bh f!bh e!Je !h !
bh ! !bddf !80!b! ! f! b f!/U f! b e! b f !b f! f fg f!bh ! b f !cf ffh!20!
bh e!80!f d eh !20!bh e!80!
```

```
U ! ! !{ "threshold": 50 }! ! b eb f! f!{ "threshold": 20 }!bh e!bh ! b f!
f !b ! f !b !{ "threshold": 80 }!bh e!bh ! b f! f ! !ϕ! b eb h !
```

```
ϕ ! bh fe! !h d ef!20!c !f d ef!80! ! e! f !MinimumIsExclusive = false! f!
ff h !MaximumIsExclusive! h d bh fe!
```

```
using System.ComponentModel.DataAnnotations;

namespace DataAnnotationsDemo.Models;

public class RangeExampleModel
{
    [Range(20, 80, MinimumIsExclusive = true, MaximumIsExclusive = true)]
    public int Threshold { get; set; }
}
```

```
T f!bh e!fgd f!/J !h ! f! ! d! fb f! !b c f! ! f !c !! !h df! ! b f!
f! h ! !h d ef! !f d ef! f! f! ! f!c h e! g f! bh f! b f !
```

```
Lff h !h ! f! b f! fh! fh ! !d f ! ! b eb h !b c f ! f!h ! b f!b!Length!
b c f!b ! ffh!h !D ef!M h !7: !
```

```
using System.ComponentModel.DataAnnotations;

namespace DataAnnotationsDemo.Models;

public class LengthExampleModel
{
    [Length(1, 3)]
    public ICollection<int> TestResults { get; set; } =
    Array.Empty<int>();
}
```

I f f!J b_h ! ! b eb f! f!f_h ! g !d fd_h! g f ! f !J_h ! _h f !_h ffe! !d b_h!
 MinLength!b_h e!MaxLength!g !f b f![MinLength(1), MaxLength(3)]! ! b f! ! /
 Jdb_h!_h ! ! b f![Length(1, 3)]!b_h e!cf!e_h f! ! /B !_h f! b! f! b b f f !g !
 f!Length(a, b)!b c f!b f!b b !_h d f/

```
public string CountryISO { get; set; } = string.Empty;
}
```

```
U ! ! f ! b e ! g ! b ! b f ! g b db _ /J! ! f b f ! _ !{ "countryiso": "US"
}!b e!{ "countryiso": "ZAR" }! !g ! b eb _ /F f _ ! f f ! ! f fe!
```

```
U f ! b ! b eb _ !b c f ! ! f!Base64String!b c f/U ! b eb f ! b ! f ! _ ! b fe!
!b ! b e!Cb f75! f f f _ b _ /
```

```
using System.ComponentModel.DataAnnotations;

namespace DataAnnotationsDemo.Models;

public class Base64ExampleModel
{
    [Base64String]
    public string SystemInput { get; set; } = string.Empty;
}
```

```
B! _ ! ! f ! f f ! ! b ! !e f ! _ !ef f _ f ! b!b! _ ! !b ! b e!Cb f75! _ ! b!db _ !
cf!efd efe! _ ! f _ /J! f ! e !g f!efd ef!SGVsbG8gd29ybGQ= ! f ! ! f !Hello
world!g! f f !g f ! ! !efd ef!rtdfghjuytrfvcxs8796! ! !efd ef! ! cc f _ /
```

```
B ! b ! f!Base64String!b c f!e f ! !d fd ! b ! f ! _ !d _ b _ ! b e!Cb f75!
d b bdf !)B. !b. !1.: !, -0 _ /
```

```
/OFU!9!c _ ! ! ! ! b _ ! f !g b f !b _ e!f _ b _ df f _ ! !e g d ! !d fd ! f !b ! _ !
b! _ f!c _ /Xf! b f _ !f f _ ! b fe! _ ! _ !ef !b ! f ! f g b _ df! f f _ ! _ !
/OFU!9!U b !b _ f ! ! _ g d b _ /
```

```
g ! b _ ! ! f be! f!bc ! f ! d! g f g b _ df ! b f!b! !b! !b df!c !T f f _ !
U _ c!
```

```
X ! f!be f _ ! gBJb _ e! f!f f db _ ! gBHJ _ !bgf b e ! ! !cf! _ ef _ !g
! g _ ! ! _ !eb _ f /Jb f! bdf! _ ! f!gd! b!BJd f _ ! ffe ! fdgd _ d _ !
_ ! ef ! !ef f ! f!cf ! f _ /!
```

B !ef f f ↓ f!b! _ ! b! b _ ! _ ! b f!b_e!ef f _ !b!b db _ ! f g d !g !b!
d f ! f d g d b _ ! ! c f! g c !b f!g f _ !X f! ! ! c f! f!g !_ ↓ !B J
f _ !b !b! f f _ b !b _ ! ! b _ ↓ !e _ b d! b! _ !d b _ f!!

X f!_ f f e! ! f f c f! b!B J !c !b! b d _ f!d b c f! g f b b _ ! f! ! f !b _ f !
c b f e! _ !f b c f ! g e b b!d f d f e!) ! f e! _ ↓ g ! f !e _ ! ! b _ _ !M N !e f!
b g d b!_ f f _ d f!b _ e!d b _ f! f _ e!f f. b f _ !b _ ! g _ f! _ !b _ _ !b _ e!
_ _ _ ! f! b e b f!_ f f e f e! ! b f! f f! b d _ f! !C ! f! b _ ! _ e! d ! !
d b b c f! g g f _ ↓ f _ _ ↓b _ e! _ _ ↓e f f !b _ f ! ! c f !f f b _ ! !
f b f ! f!_ g b _ !

O ↓J b !_ !b!e b f !b!b !J ↓ b f! f e!b _ e!d _ _ f! ! f!B J !_ !e b ! g !J b !
b f!b!D ! c d _ ↓c !J b ! f e! f _ !J b d f e! f!f d f _ ! _ f f !c f f f _ !
N d _ g !T b !O b e f b!b _ e!K b _ _ b!T f _ !g ! !T b !O b e f b!
f _ _ f e!D ,!Q D !U f f!Q D ! !d _ b _ !O Q V ! b! !e f!B J g b f ! _ !e f d f!

U f f!D ,!Q D ! ! b f!b!g b f!d b f e!S f d b! b! !b ! f ! !f b d! f! f !
f _ f! !J !e ! !c !d _ _ b !b _ ! d f f _ ! g !e f !b _ e! f _ ! _ !
f _ f b f!B J b _ e! f!O Q V ! ! d f ! !e b b!b _ e! b f! !f b d b c f! ! _ ! !e f d f!



B g d b!_ f f _ d f! b !b _ e!b ↓d b _ !b ! _ g d b _ !c f _ f g! b _ !E f f N _ e!B J f! !
! f!b _ ! c f! c f !_ !c ↓ f! f _ ! c f !4E! b _ ! g b! _ f! f _ ↓
f!c e _ !c d ! g g ↓d e!b f! f b ! !d f f!X b!E f f N _ e!e e! b !d f b f!b _ !B J
b!d e! f! f! f _ ! c f !_ !b!g b d _ ! g f! f!

U f ! f _ ! f ! ! f! _ ! f!311! _ ! f _ ! b!b f! _ _ ! ! d f _ d f!V _ ! b e _ b!
f e ↓b d d e _ ! !E f f N _ e!D F P!E f ! !b b c ↓ ! e! b f!b f _ !b!c _ ! f b ! !
f !E f f N _ e! ! _ !b! f b ↓b g f! d ! f ! b e f! f ! f _ !e b b c b f! c d b !b! g!
! b _ !

X f! f!_ f f e! ! f _ ! f f ! ! f!ϕ d! b!B J ! f f! ! b ↓ f!b !b! f d f ! b f!
f _ ! b!_ ! b d _ f! !f f ! b f!U b! ! f! !g ↓b _ e!b b _ f _ ! g! _ f e f !
U f! f !ϕ d! b! !b f!f b e _ ! !c ! !b!f b f _ ! !b! ! g _ f e f ↓e f _ !
c !b _ ! _ b f!e f f! !f b _ !!

X f! ! ! f! b!B J b !b ! ↓d b f _ f! !c f g g ↓b _ e!f f _ !d b _ f! ! f!b !
b _ ! f!b _ e! ↓ ! !f f f!b _ e! e!_ f f !f b d f! ! f !g !_ f e f !B !J f!
f f!g _ b! _ f ↓J b !f _ d b f e! b! ! _ f ! g f b _ _ ! !ϕ !g ! f ;! f f! !c f!b!
/O F U! : ↓b _ e!b! /O F U.21 ↓b _ e! ! _ !

P !g f! !c H _ !c f d b f! g f! ! f! f! ! f! _ ! f!d f b f!c !c f d b f! g
f! _ e! b! f e! f !U f! b _ ! ! f !g !_ f e f! ! _ f !b _ e! g _ e !
b _ !

U f f g f ↓e f b! f b e f ↓J b _ ! !g ! f b e _ ! !c !b _ e!b _ ! f! !f b _ !b _ e f!
!