

C#.NET @ Sunbeam Infotech

Trainer: Nilesh Ghule



Enterprise Technologies

1. Java - 3 + 3 + 1.5
2. MERN - 3
3. .NET - 2

Career ->

.NET

```
class Program {  
    public static void Main(String[] args) {  
        Console.WriteLine("Hello");  
    }  
}
```



C# .NET @ Sunbeam Infotech

Trainer: Nilesh Ghule

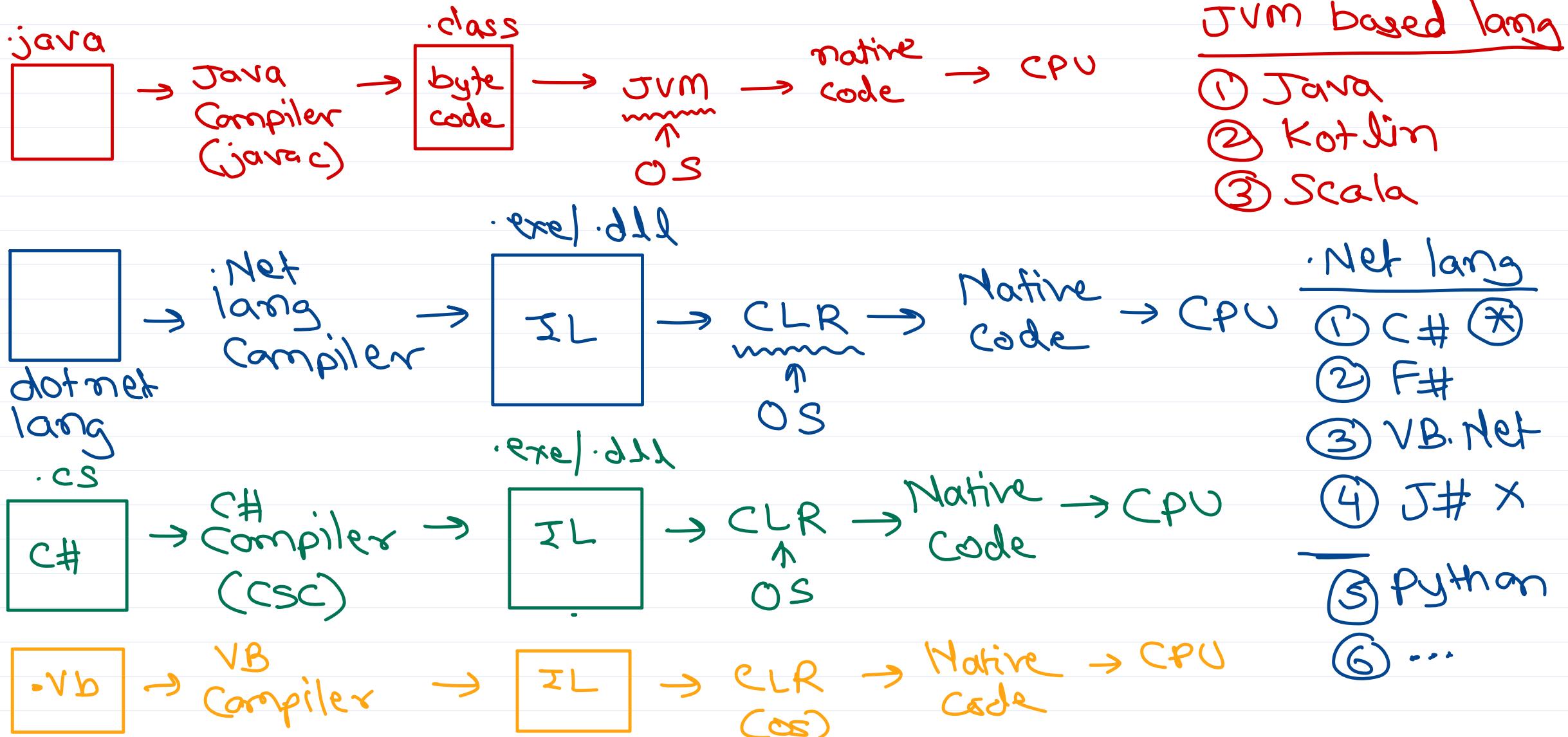


Agenda

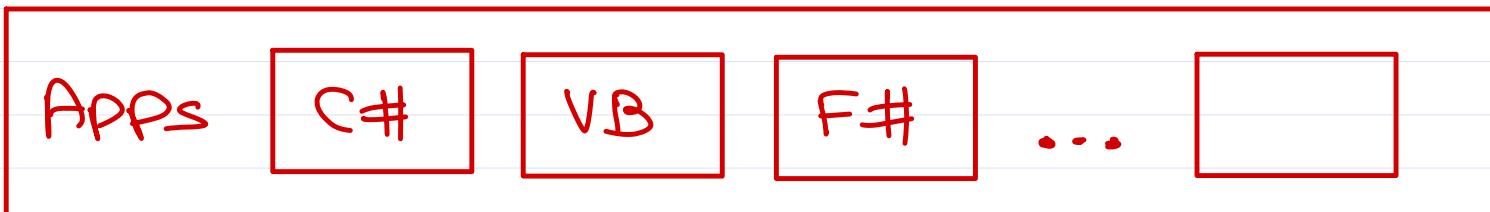
- ① Java code compilation vs .Net lang code compilation
- ② C# code vs VB .Net code compilation
- ③ .Net framework & versions.
- ④ CTS, CLS, CLR (JIT, GC, ...)
- ⑤ Installations - on client machine vs on dev machine
- ⑥ Hello world appln (using Visual Studio) Console app
Class Lib
- ⑦ .Net assembly (structure, exe execution) ildasm,
sharpLab.io,...
- ⑧ Class libs & Namespaces
- ⑨ C# classes (fields, methods, properties, constructor, destructor,...)



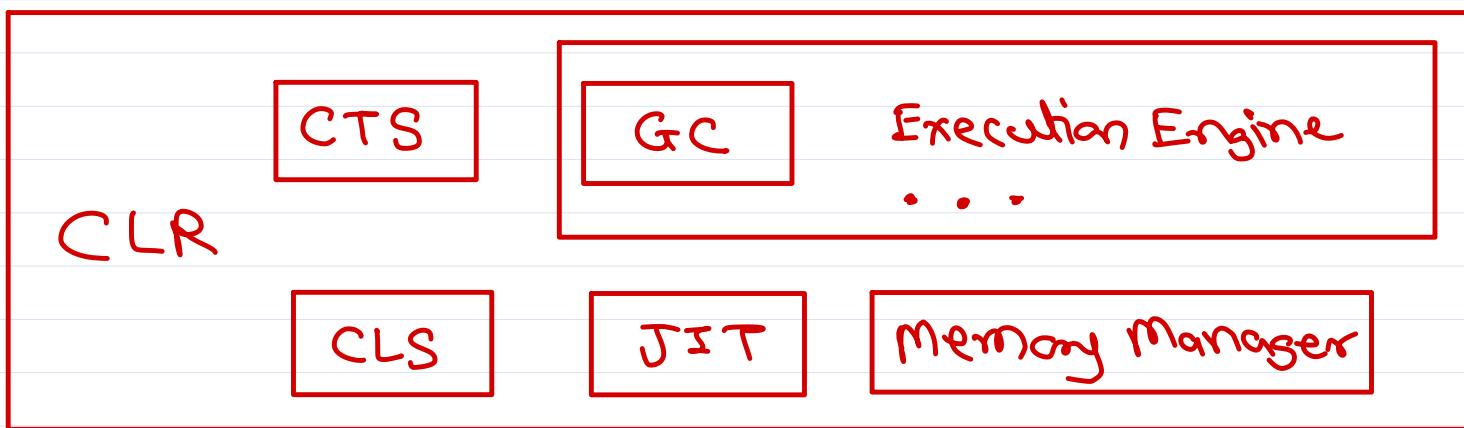
.Net - Compilation



.Net Framework



BCL (types, classes) - mscorelib.dll



client machine setup

- Net framework
 - ↳ CLR + BCL + FCL

Dev machine setup

.Net framework SDK

- Net framework
 - ↳ CLR + BCL + FCL

+ Dev tools

- ↳ Lang Compilers + Debugger
- + tools (ildasm, cts, ...)

+ IDE (RAD tools) + ...

Visual Studio 2022

Community
Professional
Enterprise



File Edit View

Create a new project

Recent project templates

- Console App
- Windows Forms App
- Console App (.NET Framework)
- Class Library (.NET Framework)
- Blank Solution

Search for templates (Alt+S)

C# Windows Console

Console App
A project for creating a command-line application that can run on .NET on Windows, Linux and macOS
C# Linux macOS Windows Console

Console App (.NET Framework)
A project for creating a command-line application
C# Windows Console

Not finding what you're looking for?
[Install more tools and features](#)

Output

Show output from

Error List Output

Next

Git Changes

Ready

Search ENG US 08:38 23-06-2025

itHub Copilot Notifications

File Edit View GitHub Copilot Notifications

Configure your new project

Console App (.NET Framework) C# Windows Console

Project name: HelloWorld

Location: D:\Nilesh\Feb25\DAC\dotnet\day01\

Solution name: HelloWorld

Place solution and project in the same directory

Framework: .NET Framework 4.8

Project will be created in "D:\Nilesh\Feb25\DAC\dotnet\day01\HelloWorld\"

Output

Show output from: Output

Error List Output

Classic .NET framework

Solution Info -> .sln file

Project Info -> .csproj file

For very simple project
1 soln -> only 1 project
Solution

Project

Solution = Group of related projects
e.g. Business logic, Win App, Web App.

Back Create Git Changes

Ready

Search

08:40 23-06-2025 ENG US

File Edit View Git Project Build Debug Test Analyze Tools Extensions Window Help | Search | HelloWorld

GitHub Copilot

Program.cs

HelloWorld

HelloWorld.Program

Main(string[] args)

6

7 namespace HelloWorld

8 {

9 internal class Program

10 {

11 static void Main(string[] args)

12 {

13 Console.WriteLine("Hello, DAC!");

14 }

15 }

16 }

17 }

18 }

Entry-point fn

built-in static method class

(from System namespace)

Solution

Project

config (xml)

Source code

89 %

No issues found

Output

Show output from:

Error List Output

Solution Explorer Git Changes

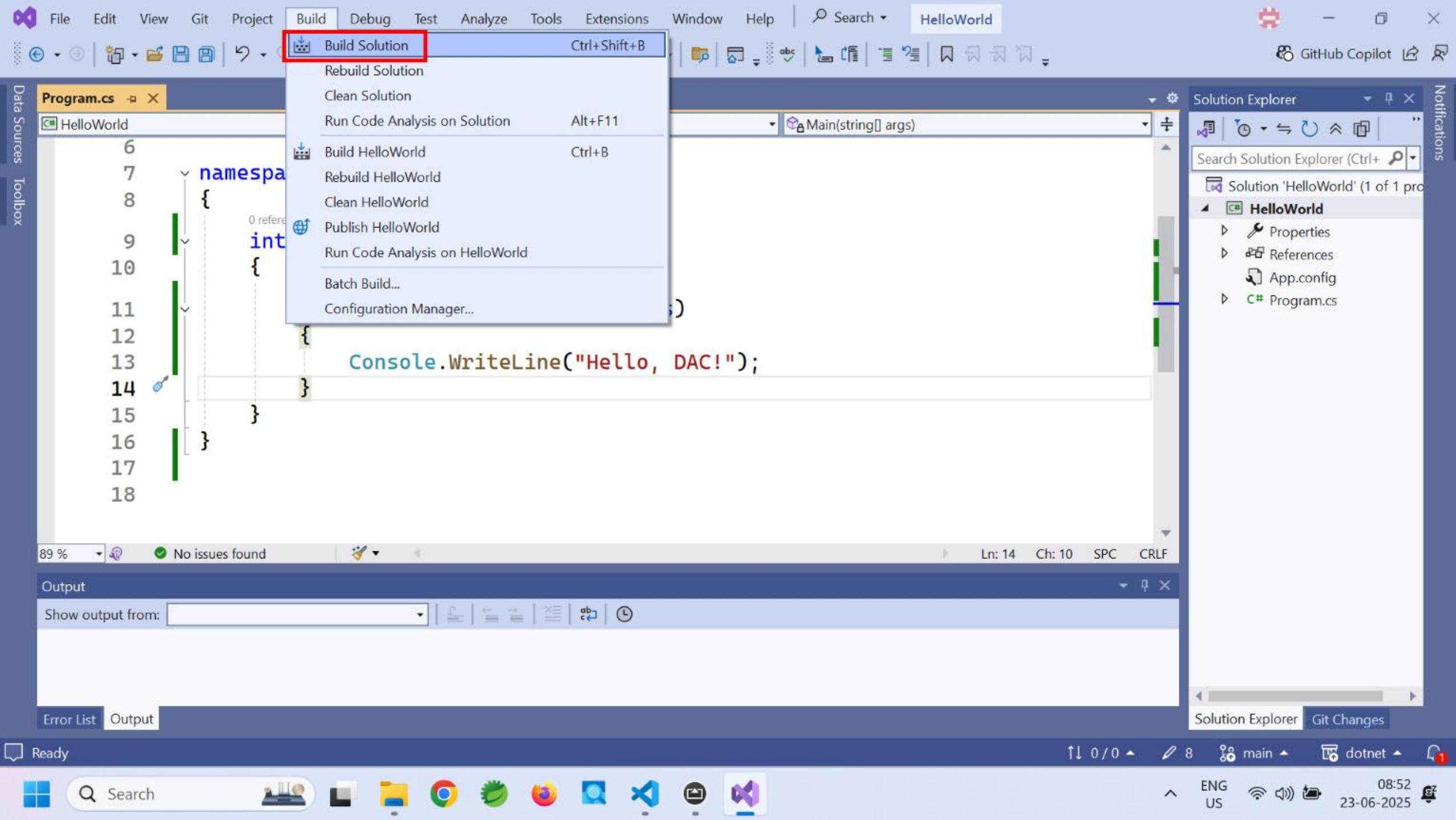
Item(s) Saved

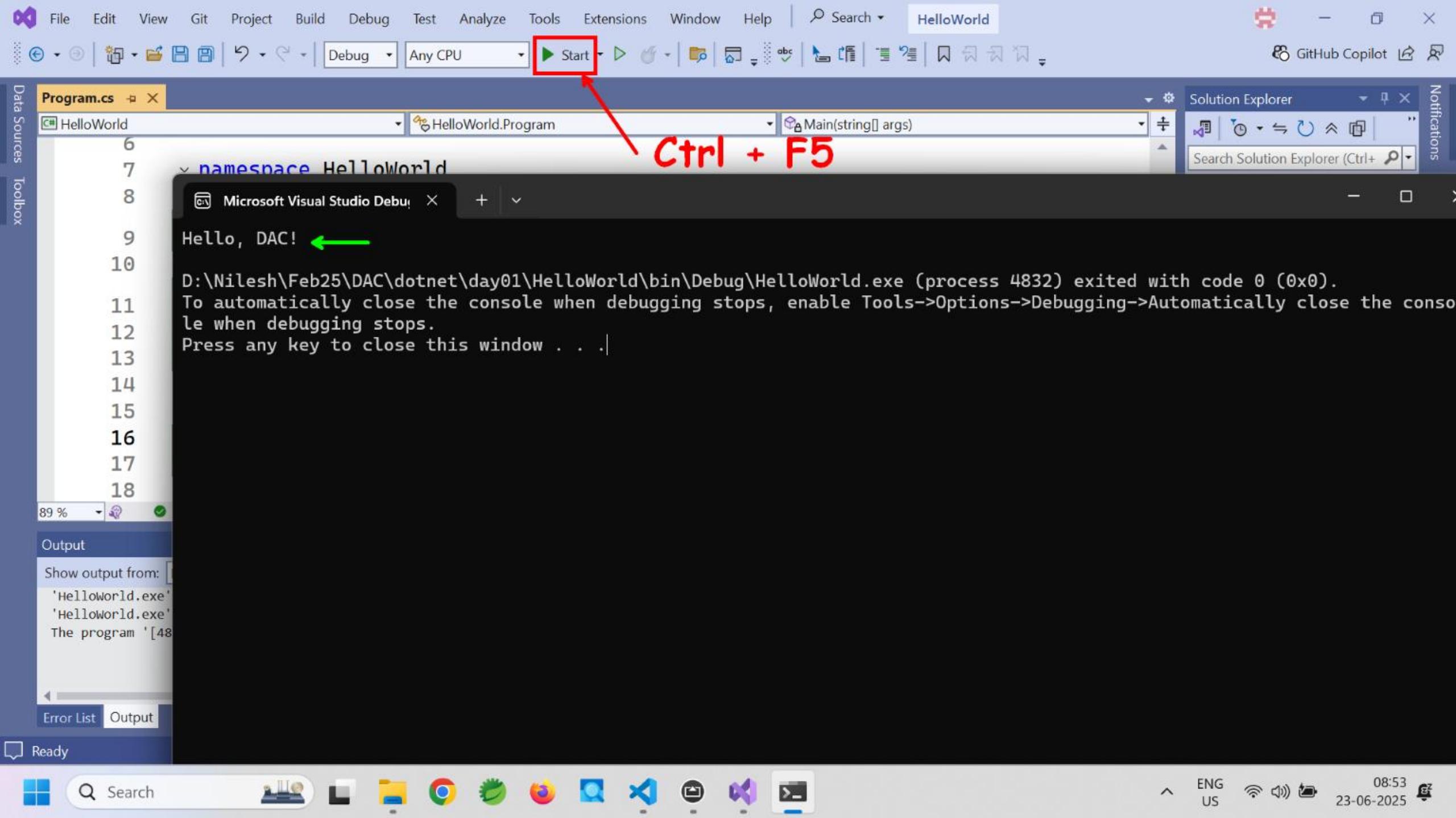
0 / 0 main dotnet 1

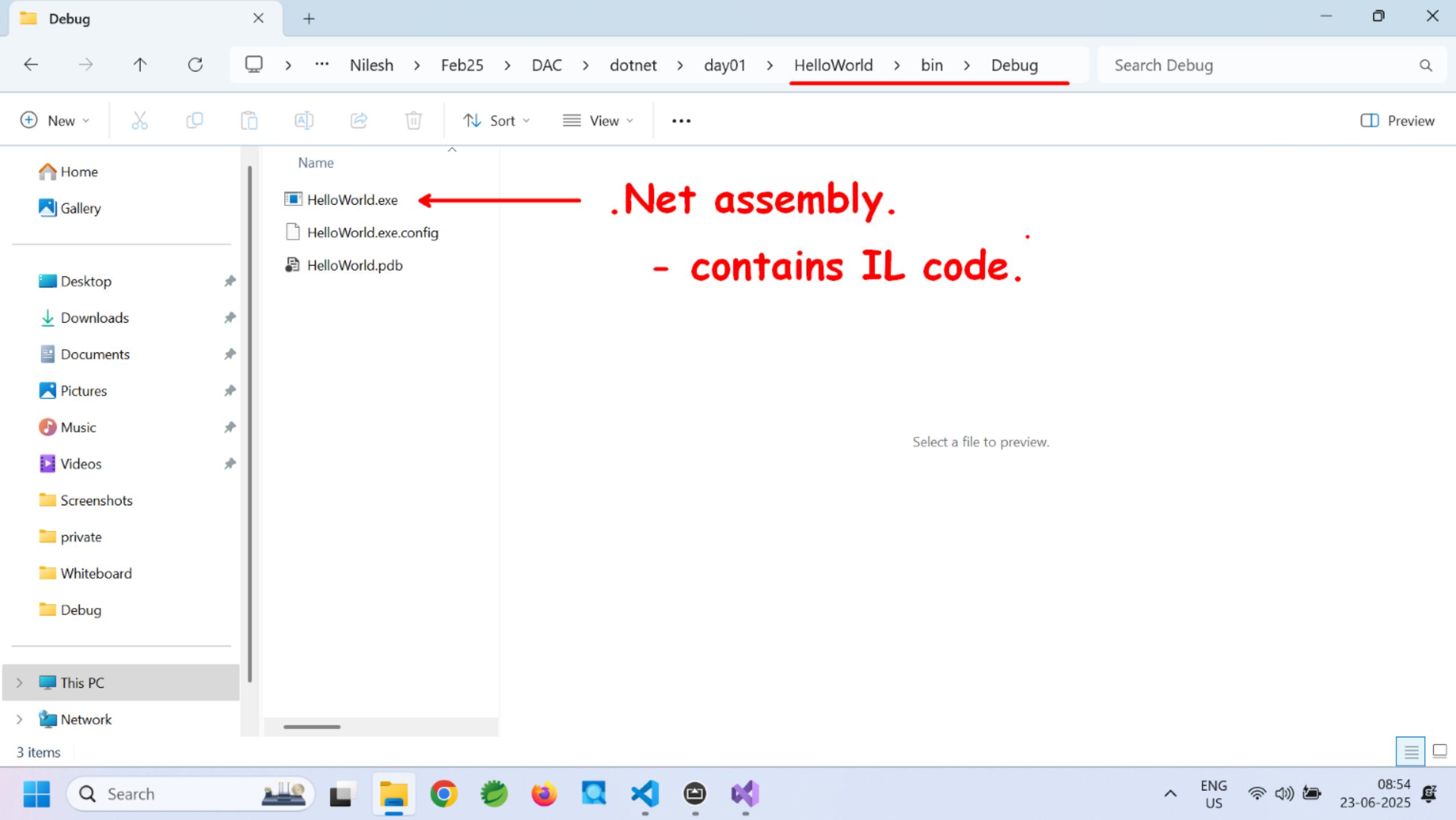
Search

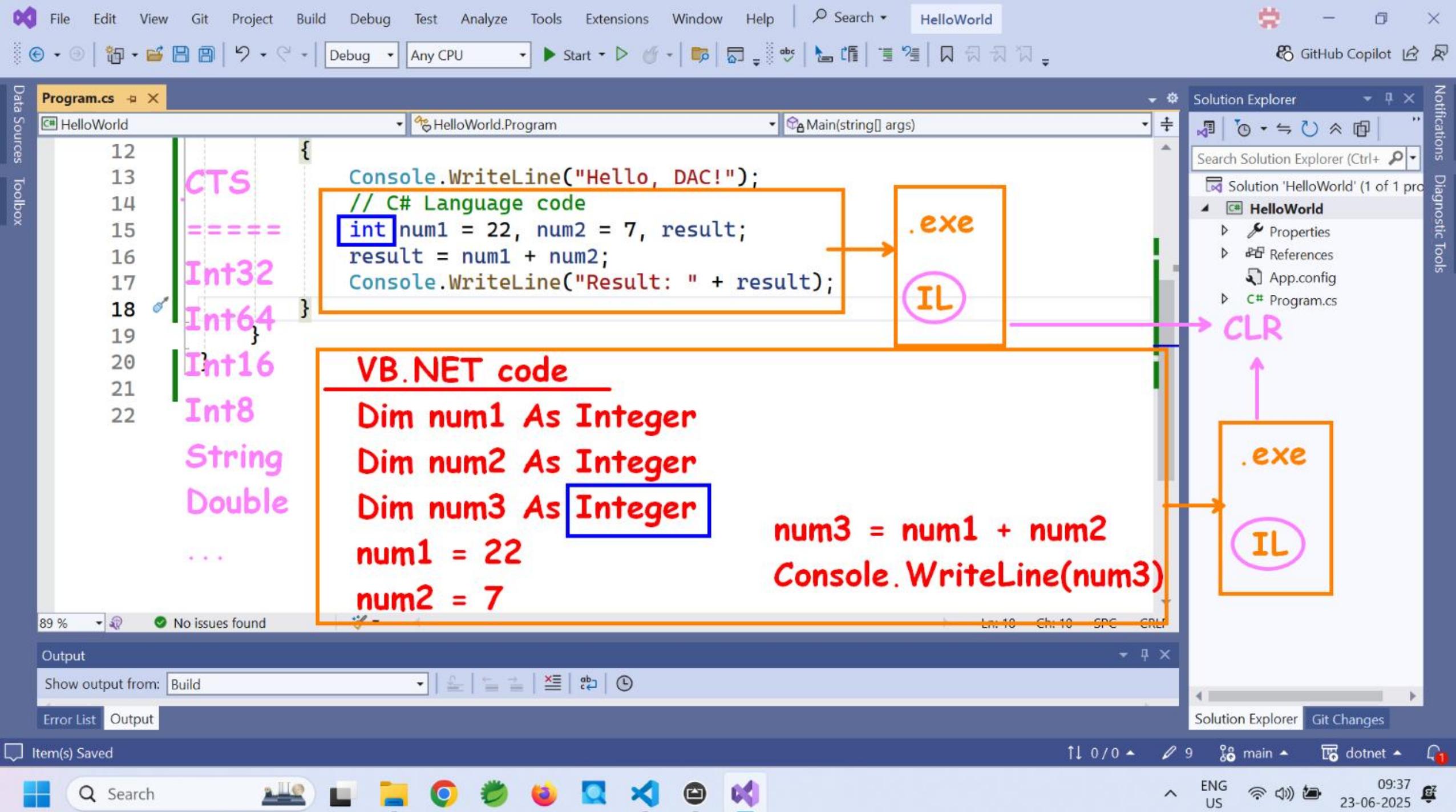
ENG US

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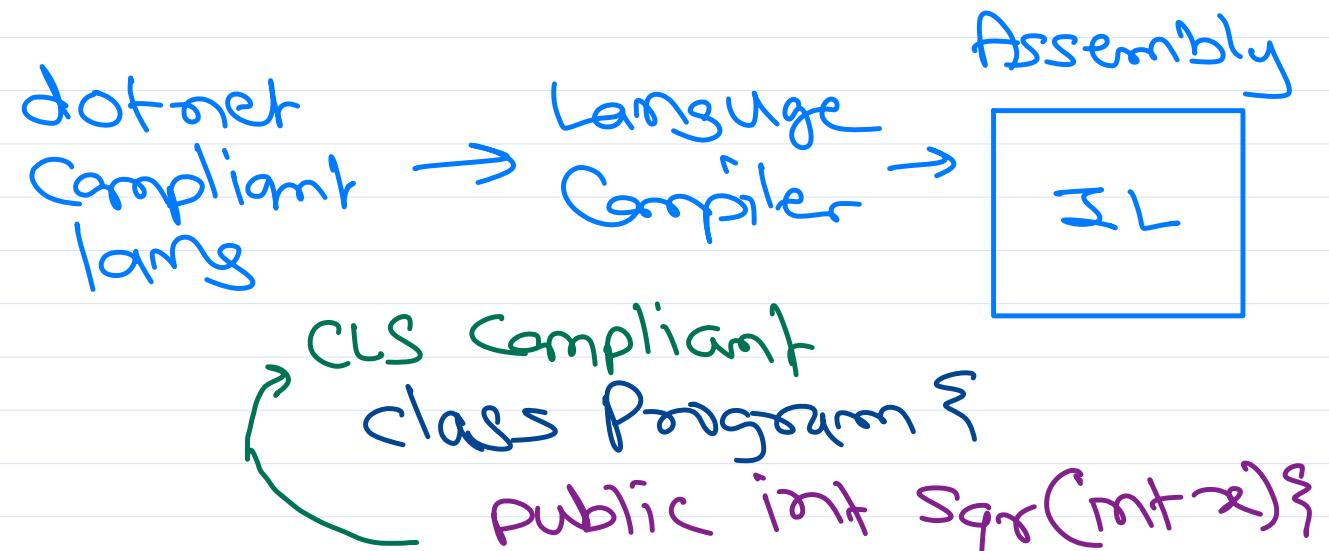
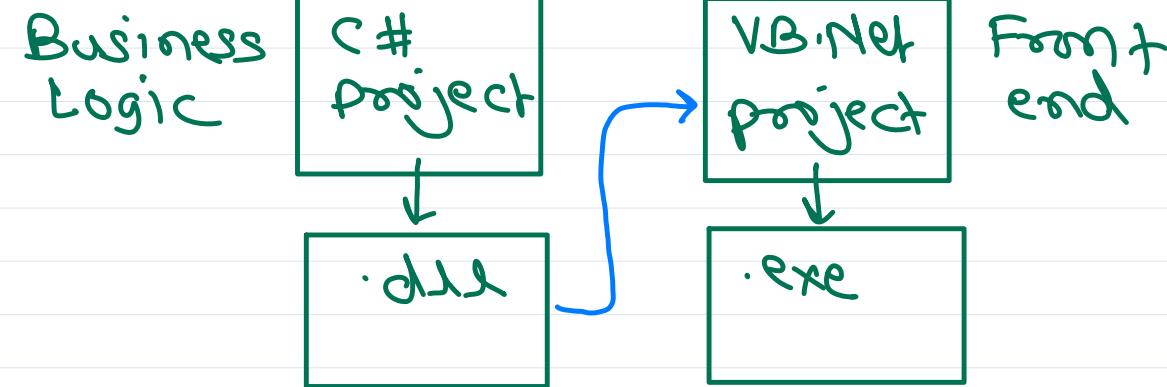






CLR – CTS & CLS

* Language interoperability



* Languages must follow certain rules.

→ .Net Compliant lang → lang Compiler

→ lang rules → CLS

→ objects allocated using new

→ only signed types

→ stack based execution

CLS Non-compliant



CLR – CTS & CLS

Common Type System → Types in IL → understood by CLR

CTS types

→ Value Types → represent value

- ① Int16
- ② Int32
- ③ Int64
- ④ Single
- ⑤ Double
- ⑥ Decimal
- ⑦ Boolean
- ⑧ Char

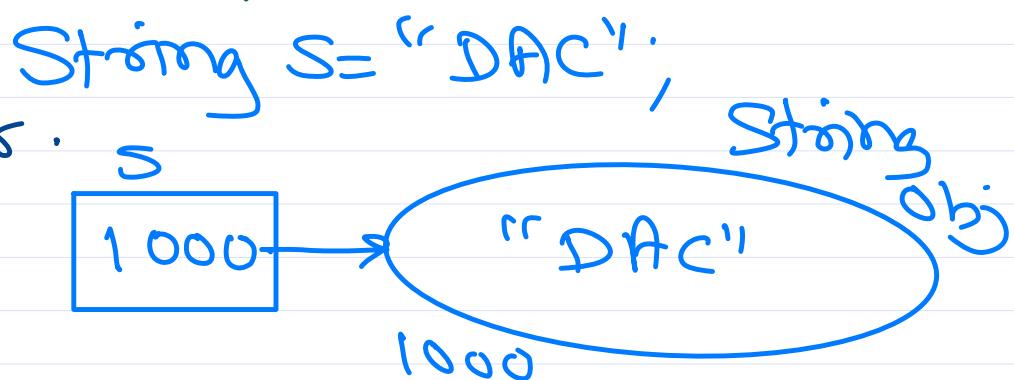
Int32 a=123; a 123

* Typically on stack (locals)
* If part/field in some obj
→ on Heap.

User defined → Structure
→ Enum

→ Reference Types → represent ref / addr.

- ① Class (e.g. String, ...)
- ② Interface
- ③ Array
- ④ Delegate
- ⑤ Object



Debug

bin > Debug

Search Debug

Preview

developer PowerShell for VS 2022

All Apps Documents Web Settings Folders Photos G ...

Best match

Developer PowerShell for VS 2022 App

Apps

Visual Studio 2022

Developer Command Prompt for VS 2022

Windows Software Development Kit

Search the web

deve - See more search results

Settings (7+)

Documents (1+)

Developer PowerShell for VS 2022

App

Select a file to preview.

Open

Run as Administrator

Run ISE as Administrator

Windows PowerShell ISE

Search bar: developer PowerShell for VS 2022

Search results:

- Developer PowerShell for VS 2022 (App)
- Visual Studio 2022
- Developer Command Prompt for VS 2022 (highlighted with a red box)
- Windows Software Development Kit

Context menu for Developer Command Prompt for VS 2022:

- Open
- Run as Administrator
- Run ISE as Administrator
- Windows PowerShell ISE

System tray icons: Search, File Explorer, Google Chrome, Firefox, Task View, Visual Studio, and a battery icon.

Bottom right corner: ENG US, 10:23, 23-06-2025

Debug

Search Debug

New

Home

Gallery

Developer Command Prompt

** Visual Studio 2022 Developer Command Prompt v17.14.3
** Copyright (c) 2022 Microsoft Corporation

C:\Program Files\Microsoft Visual Studio\2022\Community>cd D:\Nilesh\Feb25\DAC\dotnet\
C:\Program Files\Microsoft Visual Studio\2022\Community>D:
D:\Nilesh\Feb25\DAC\dotnet\day01\HelloWorld\bin\Debug>ildasm.exe HelloWorld.exe
D:\Nilesh\Feb25\DAC\dotnet\day01\HelloWorld\bin\Debug> **path of assembly.**

assembly metadata

class members - IL code.

class (metadata + IL)

File View Help

HelloWorld.exe - IL DASM

HelloWorld.exe

MANIFEST

HelloWorld

HelloWorld.Program

.class private auto ansi beforefieldinit

.ctor : void()

Main : void(string[])

.assembly HelloWorld

{

.ver 1:0:0:0

Search

10:25

ENG US

23-06-2025

Debug

Search Debug

New

Home

Gallery

Developer Command Prompt

** Visual Studio 2022 Developer Command Prompt v17.14.3
** Copyright (c) 2022 Microsoft Corporation

C:\Program Files\Microsoft Visual Studio\2022\Community>cd D:
C:\Program Files\Microsoft Visual Studio\2022\Community>D:
D:\Nilesh\Feb25\DAC\dotnet\day01\HelloWorld\bin\Debug>ildasm.
D:\Nilesh\Feb25\DAC\dotnet\day01\HelloWorld\bin\Debug>

HelloWorld.exe - IL DASM

File View Help

HelloWorld.exe

MANIFEST

HelloWorld

HelloWorld.Program

.ctor : void()

Main : void(string[])

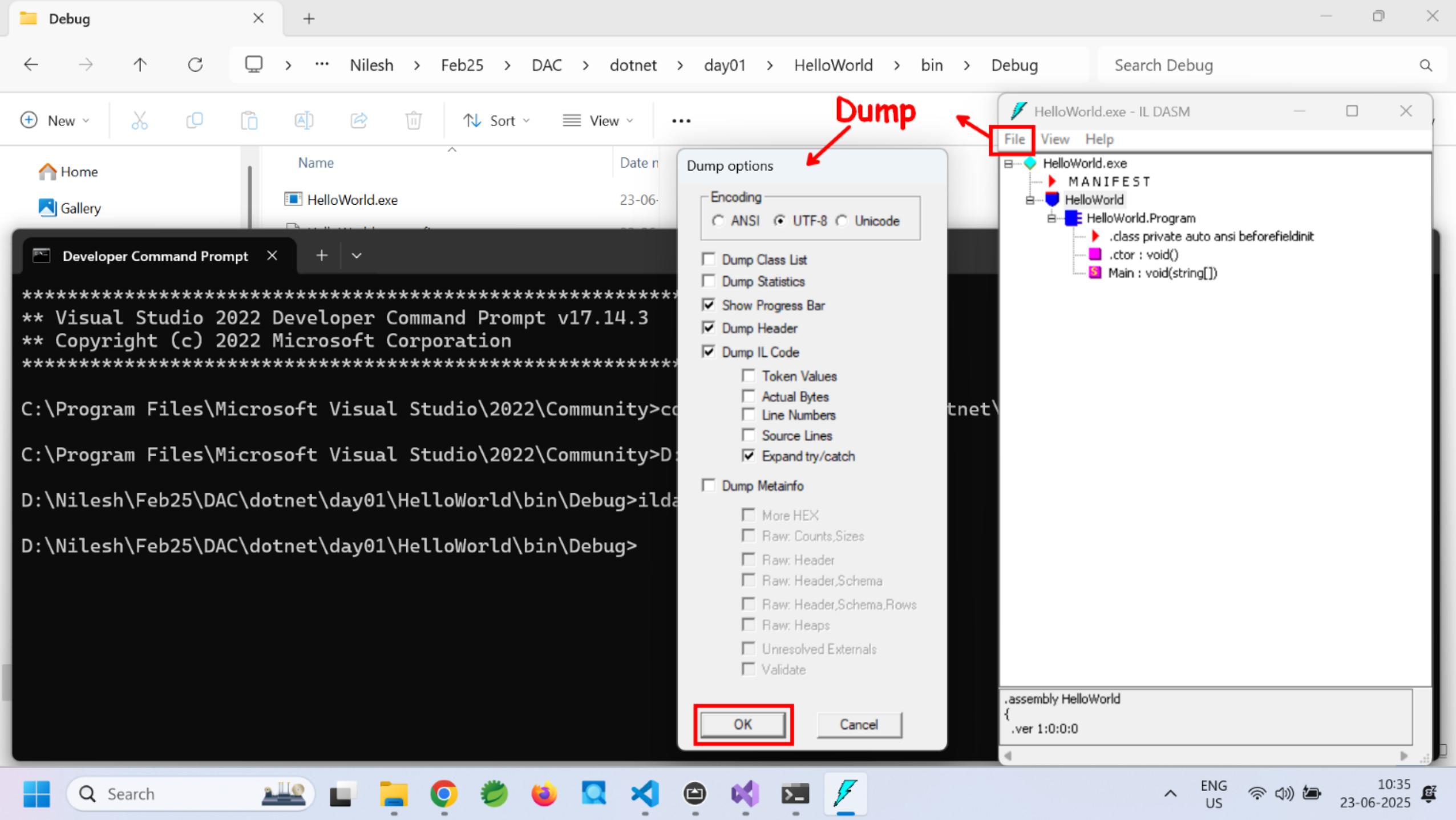
Find Find Next

// Code size | 45 (0x2d)
.maxstack 2
.locals init ([0] int32 num1,
[1] int32 num2,
[2] int32 result)
IL_0000: nop
IL_0001: ldstr "Hello, DAC!"
IL_0006: call void [mscorlib]System.Console::WriteLine(string)
IL_000b: nop
IL_000c: ldc.i4.s 22 ← num1 = 22
IL_000e: stloc.0 ← num2 = 7
IL_000f: ldc.i4.7
IL_0010: stloc.1
IL_0011: ldloc.0
IL_0012: ldloc.1
IL_0013: add ← num1 + num2
IL_0014: stloc.2
IL_0015: ldstr "Result:"
IL_001a: ldloca.s result
IL_001c: call instance string [mscorlib]System.Int32::ToString()
IL_0021: call string [mscorlib]System.String::Concat(string,
string)
IL_0026: call void [mscorlib]System.Console::WriteLine(string)

local vars on stack
C# int -> IL Int32
num1 = 22
num2 = 7
num1 + num2

Search

10:31 23-06-2025 ENG US



CLR – JIT

* JIT

- ✓ IL code → JIT → Native code
- ✓ Does conversion Method by Method.
- ✓ Frequently called methods - native code - Cached.
- ✓ JIT types

① Standard JIT (Part of CLR) - all devices.

② Economy JIT - on small devices (phones, embedded);
- .Net compact framework - outdated.

③ Pre-JIT (AOT - Ahead of Time):

- all IL code → Pre-JIT → Native code ↴
→ ngen.exe

Before
Execution



* GC → auto deallocate
unreferenced objects

- Mark - Sweep - Compact algorithm.

* Execution Engine

↳ GC
↳ Security

* Memory Manager

- ↳ allocates memory for
 - class loading
 - stack
 - cache
 - ...

.Net Assemblies

File Extensions

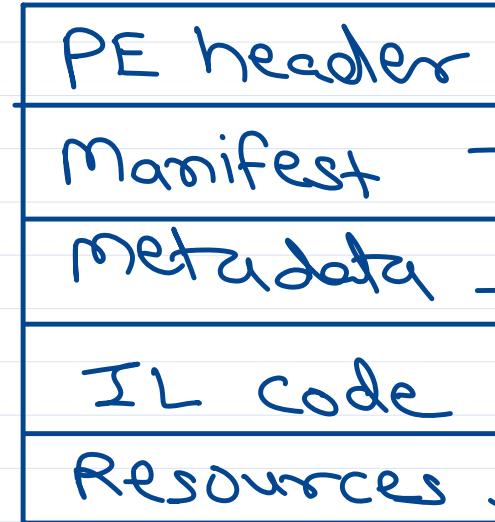
① .exe

- executable file
- OS creates process when end user starts execution.

② .dll

- lib of classes (reuse)
- dependent executable
- loaded in calling process memory, when its classes accessed in that process.

Assembly Structure



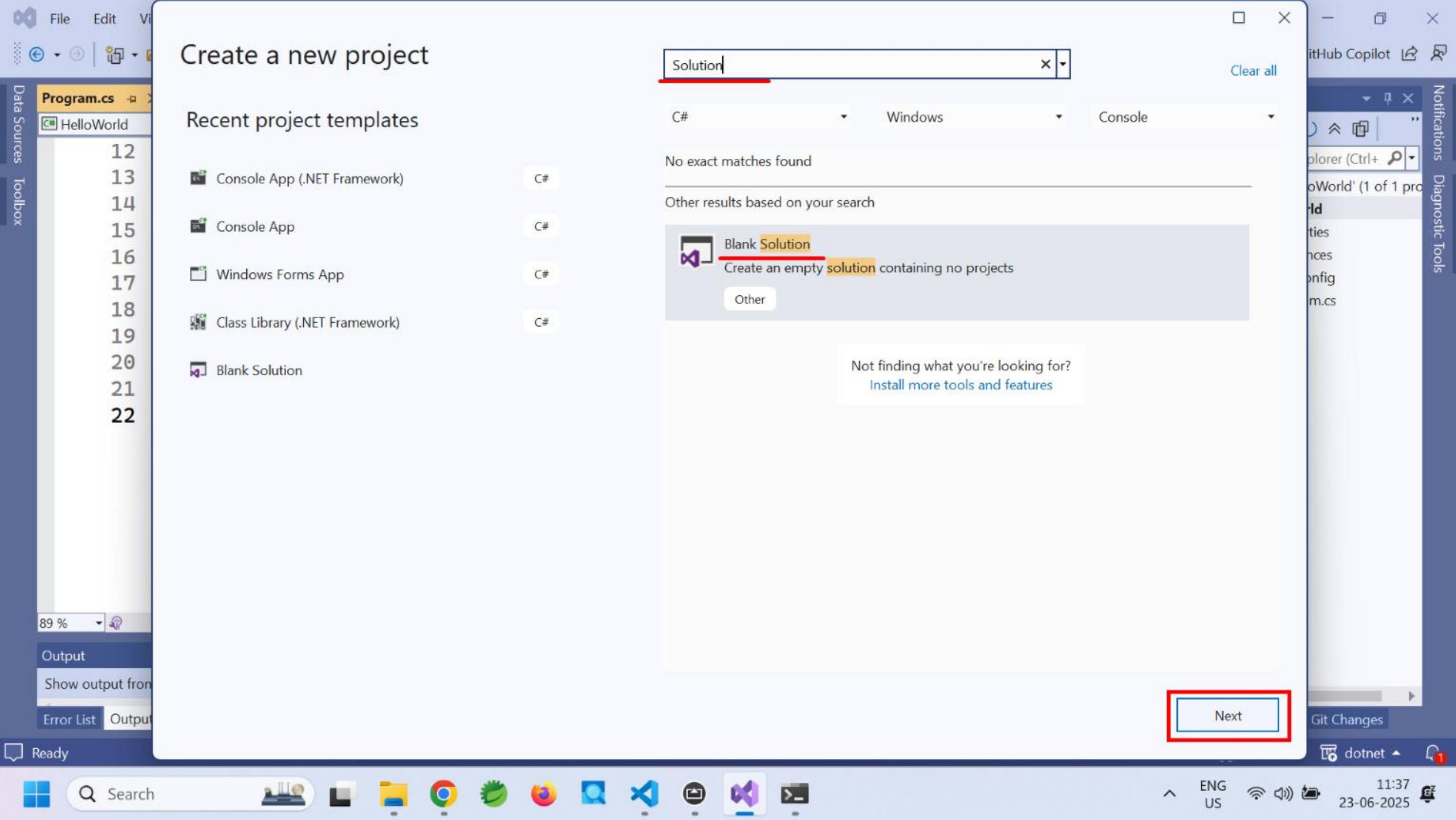
→ CLR info, referenced assemblies info, versions, ...

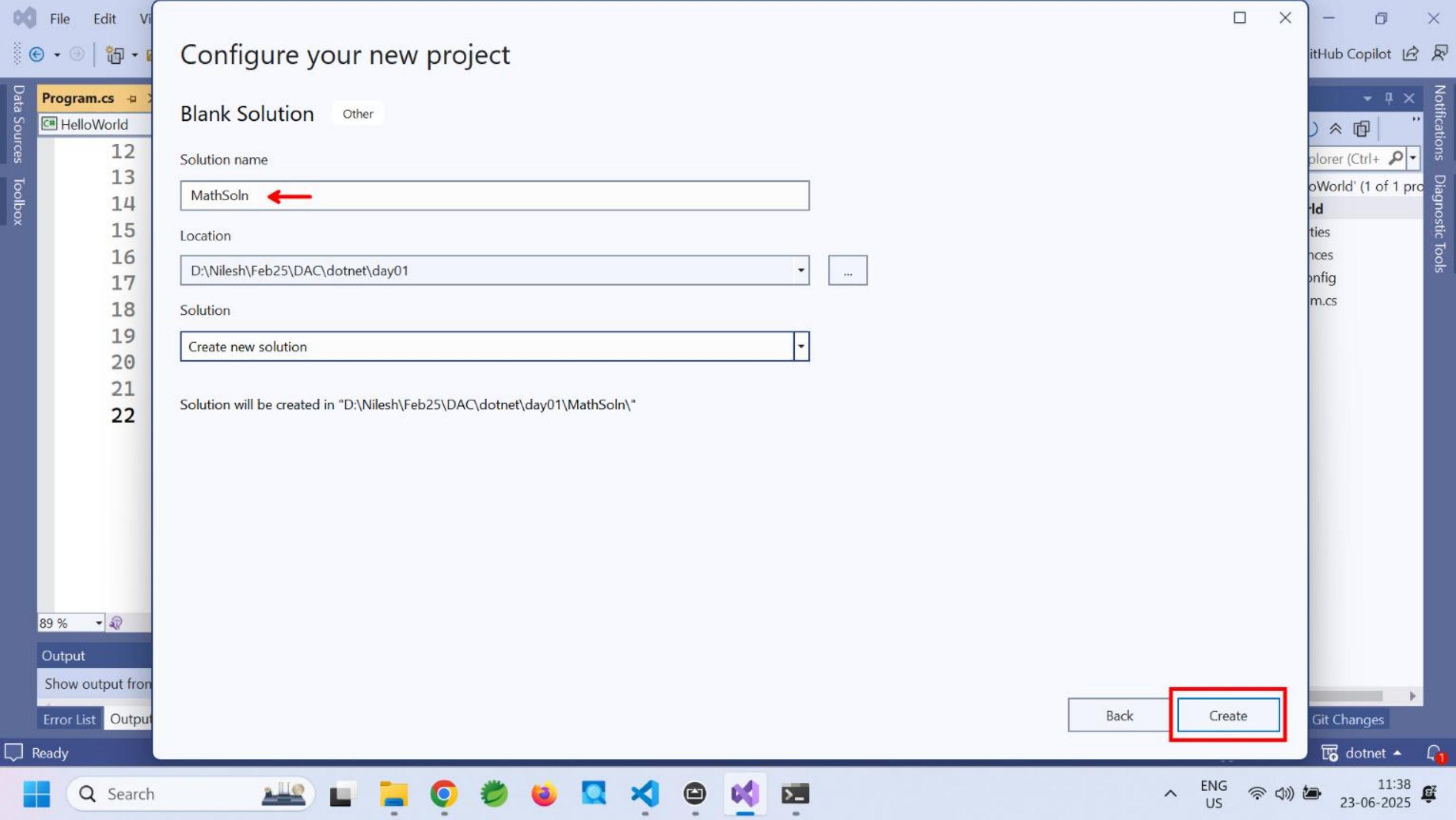
a.k.a. assembly metadata

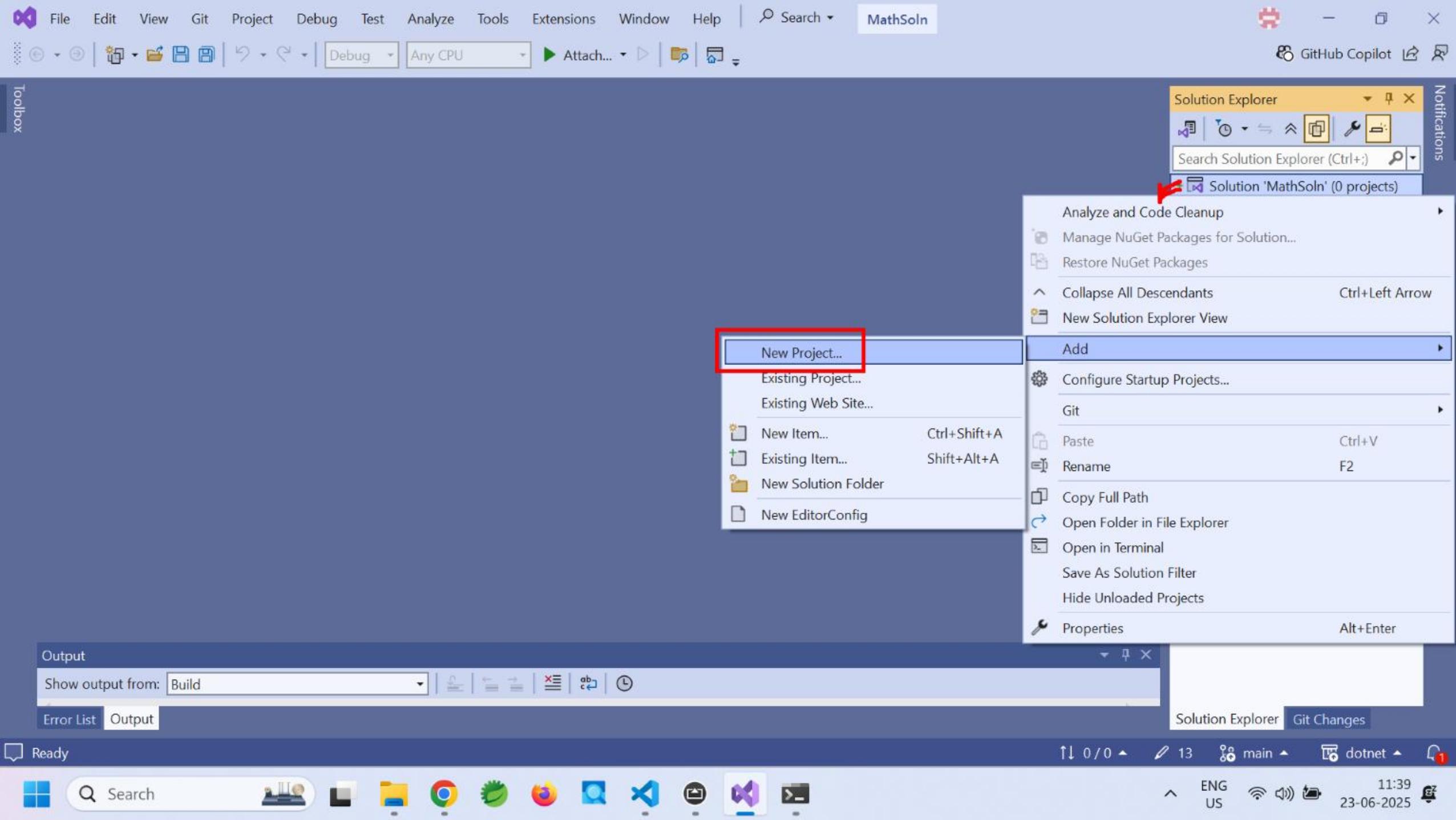
type metadata - type name, fields, methods, ctors, ...

images, config files, ...









File Edit View

Add a new project

Recent project templates

- Console App (.NET Framework)
- Console App
- Windows Forms App
- Class Library (.NET Framework)

Search for templates (Alt+S) Clear all

C# Windows Library

C# Linux macOS Windows Library Web

WPF Class Library
A project for creating a class library that targets a .NET WPF Application
C# Windows Desktop Library

WPF Custom Control Library
A project for creating a custom control library for .NET WPF Applications
C# Windows Desktop Library

WPF User Control Library
A project for creating a user control library for .NET WPF Applications
C# Windows Desktop Library

Class Library (.NET Framework)
A project for creating a C# class library (.dll)
C# Windows Library

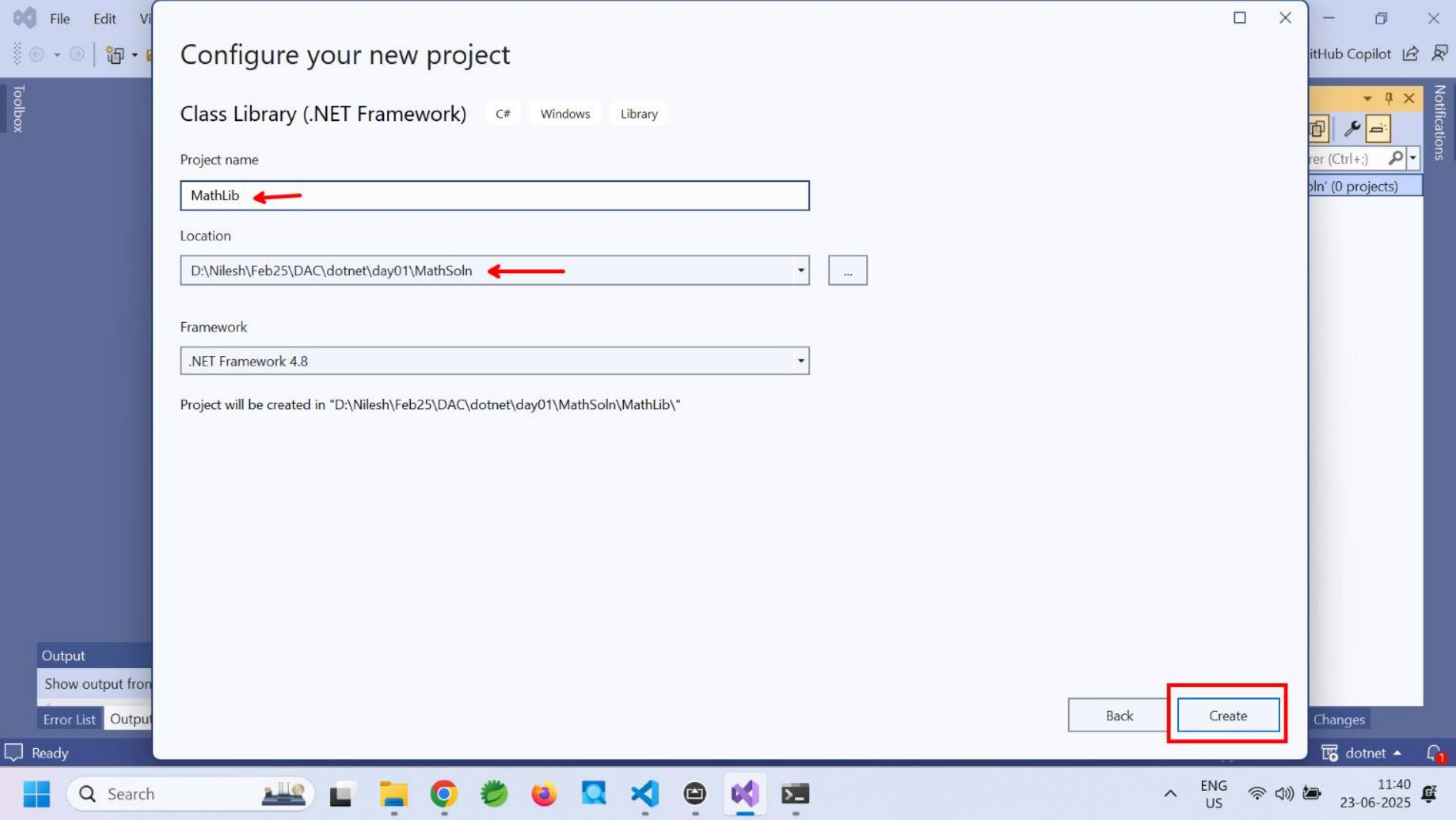
WPF Custom Control Library (.NET Framework)
Windows Presentation Foundation custom control library
C# XAML Windows Desktop Library

Next Changes dotnet 1

Output Show output from Error List Output Ready

Search ENG US 11:40 23-06-2025

Notifications GitHub Copilot



File Edit View Git Project Build Debug Test Analyze Tools Extensions Window Help | Search | MathSoln

GitHub Copilot

MyMath.cs

MathLib

MathLib.MyMath

Subtract(int x, int y)

public classes are accessible outside the current project i.e. assembly.

```
6  namespace MathLib
7  {
8  0 references
9  public class MyMath
10 {
11    0 references
12    public int Add(int x, int y)
13    {
14      return x + y;
15    }
16    0 references
17    public int Subtract(int x, int y)
18    {
19      return x - y;
20    }
21    0 references
22    public int Multiply(int x, int y)
23    {
24      return x * y;
25    }
26  }
```

89 % No issues found

Ln: 29 Ch: 1 SPC CRLF

Output

Show output from: Build

Error List Output Solution Explorer Git Changes

Item(s) Saved

18 main dotnet 1

Search

11:42 23-06-2025

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GitHub Copilot

MyMath.cs

MathLib

MathLib.MyMath

Subtract(int x, int y)

right click and Build Project

Solution Explorer

Search Solution Explorer (Ctrl+Shift+F)

Solution 'MathSoln' (1 of 1 project)

+ MathLib

+ Properties

+ References

+ C# MyMath.cs

89 % No issues found

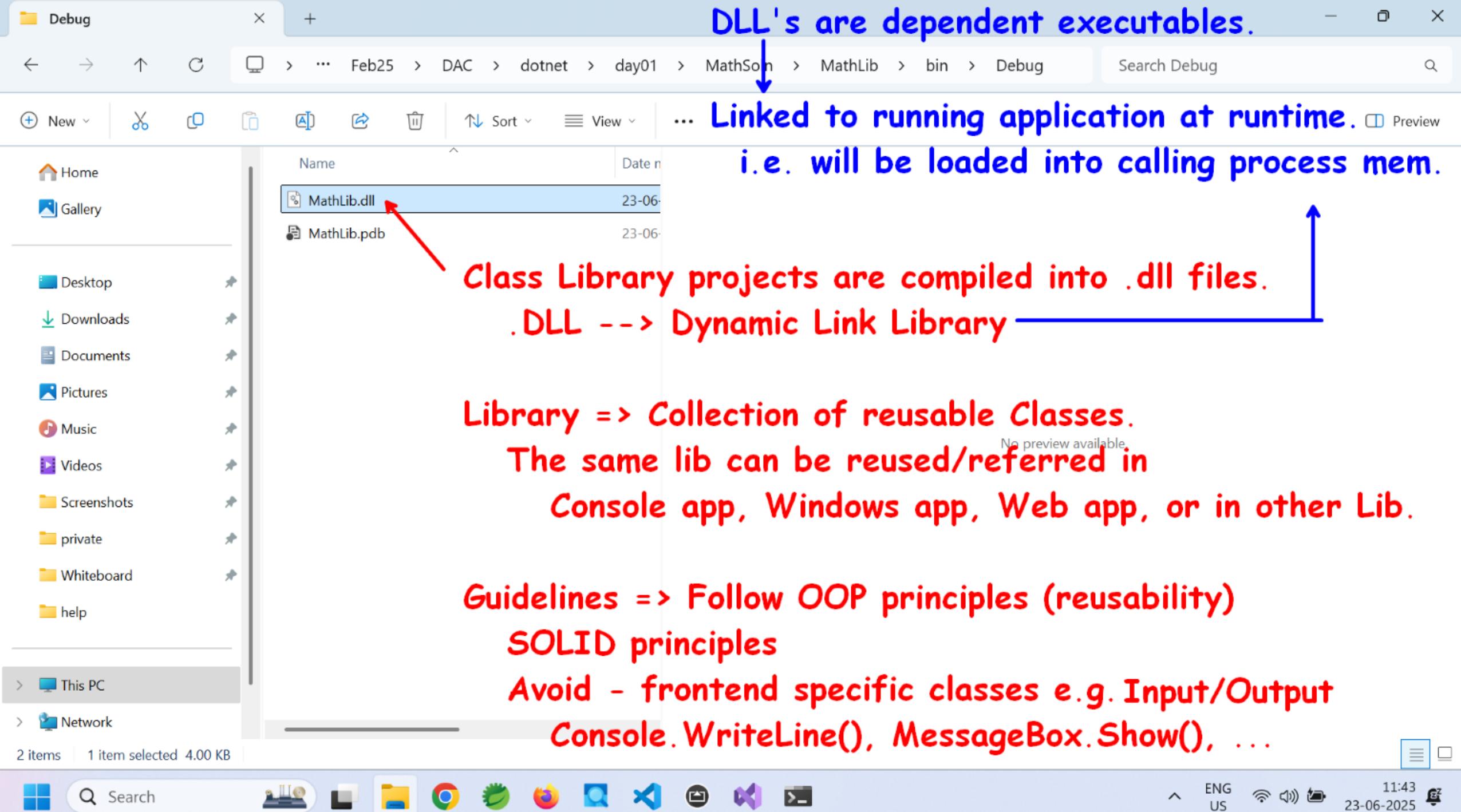
Ln: 29 Ch: 1 SPC CRLF

Output

Show output from: Build

Error List Output Solution Explorer Git Changes

Build succeeded





MyMath.cs

MathLib

MathLib.MyMath

Subtract(int x, int y)

```
6
7     namespace MathLib
8 {
9         public class MyMath
10        {
11            public int Add(int x, int y)
12            {
13                return x + y;
14            }
15            public int Subtract(int x, int y)
16            {
17                return x - y;
18            }
19        }
20    }
```

0 references

0 references

0 references

0 references

89 %

No issues found

New Project...

Existing Project...

Existing Web Site...

New Item... Ctrl+Shift+A

Existing Item... Shift+Alt+A

New Solution Folder

New EditorConfig

Build Solution

Rebuild Solution

Clean Solution

Analyze and Code Cleanup

Batch Build...

Configuration Manager...

Manage NuGet Packages for Solution...

Restore NuGet Packages

Collapse All Descendants Ctrl+Left Arrow

New Solution Explorer View

Add

Sync Namespaces

Configure Startup Projects...

Git

Paste Ctrl+V

Rename F2

Copy Full Path

Open Folder in File Explorer

Open in Terminal

Save As Solution Filter

Hide Unloaded Projects

Properties Alt+Enter

Output

Show output from: Build

Error List Output

This item does not support previewing

Search

File Edit View Git Project Build Debug Test Analyze Tools Extensions Window Help

MathSoln

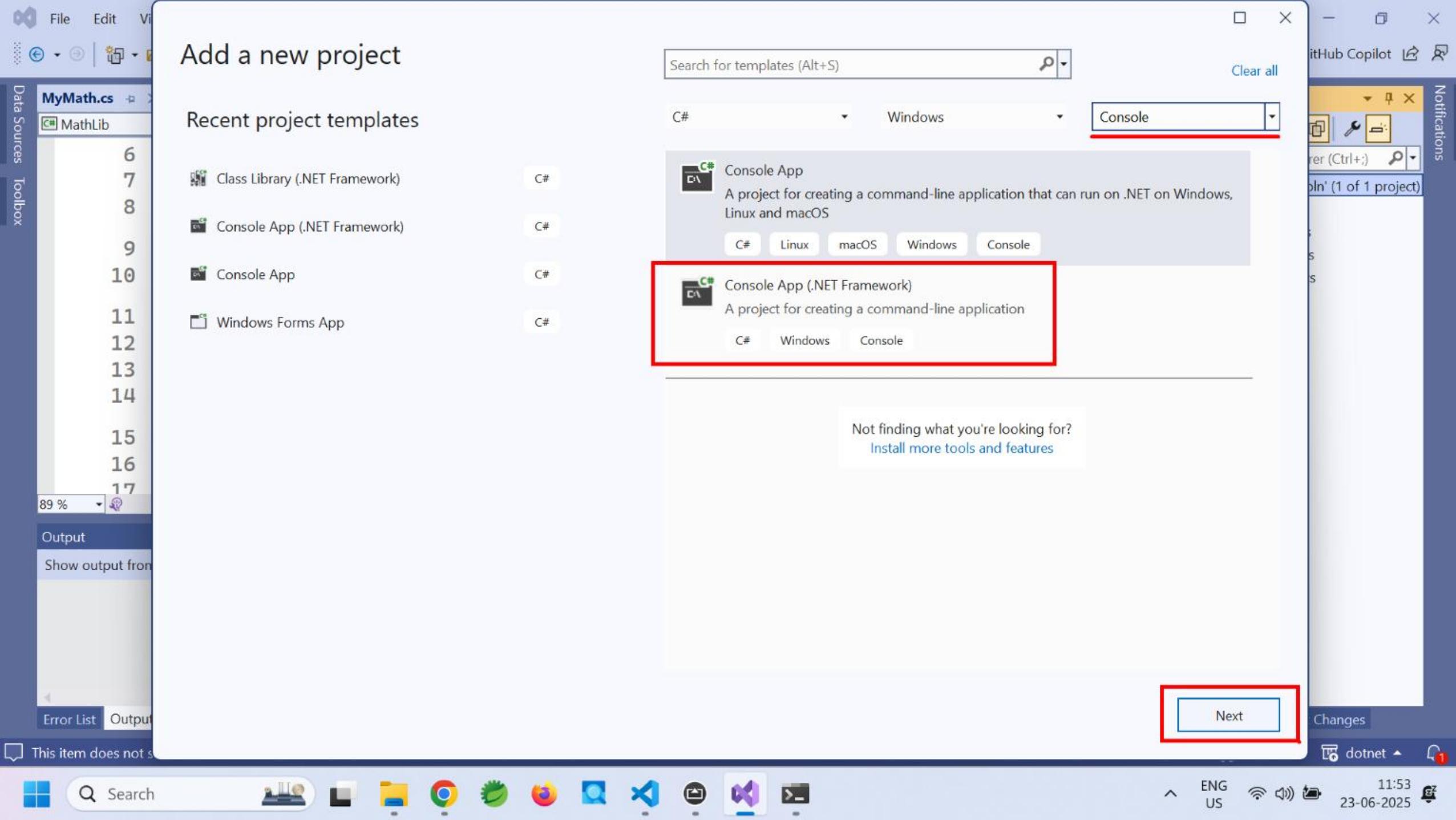
G GitHub Copilot

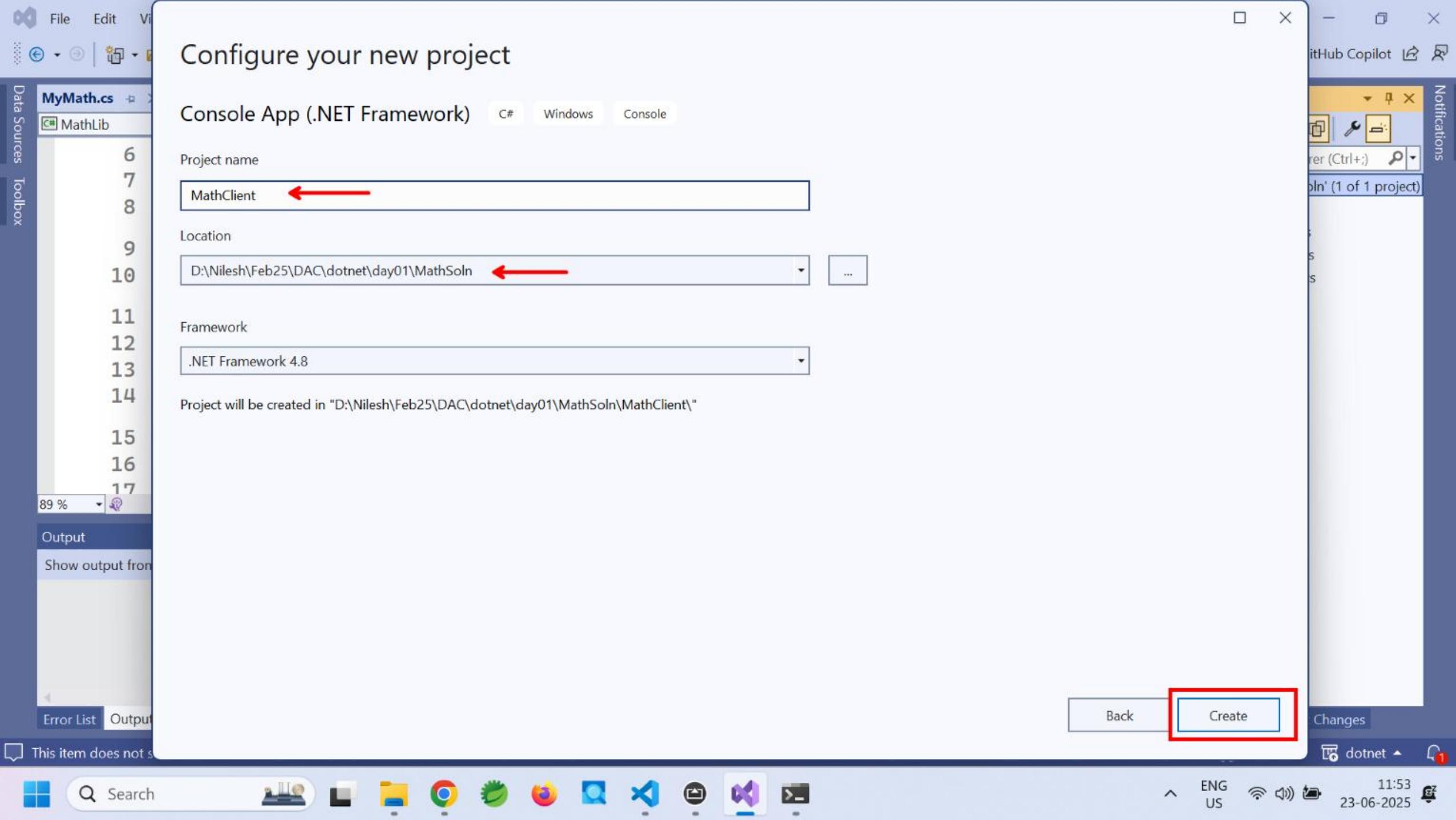
Data Sources Toolbox

Solution Explorer Notifications

Search Solution Explorer (Ctrl+F) Ctrl+Shift+B

11:53 23-06-2025 ENG US





File Edit View Git Project Build Debug Test Analyze Tools Extensions Window Help | Search | MathSln

Build Rebuild Clean Analyze and Code Cleanup Publish... Publish as Azure WebJob... Upgrade Collapse All Descendants Scope to This New Solution Explorer View Build Dependencies Add Manage NuGet Packages... Configure Startup Projects... Set as Startup Project Debug Initialize Interactive with Project Git Cut Ctrl+X Paste Ctrl+V Remove Del Rename F2 Unload Project Load Direct Dependencies Load Entire Dependency Tree Copy Full Path Open Folder in File Explorer

In MathClient (Consoleapp)
add ref of MathLib.

```
1 using System;
2 using System.Collections.Generic;
3 using System.Linq;
4 using System.Text;
5 using System.Threading.Tasks;
6
7 namespace MathClient
8 {
9     0 references
10    internal class Program
11    {
12        0 references
13        static void Main(string[] args)
14        {
15        }
16    }
17}
```

No issues found

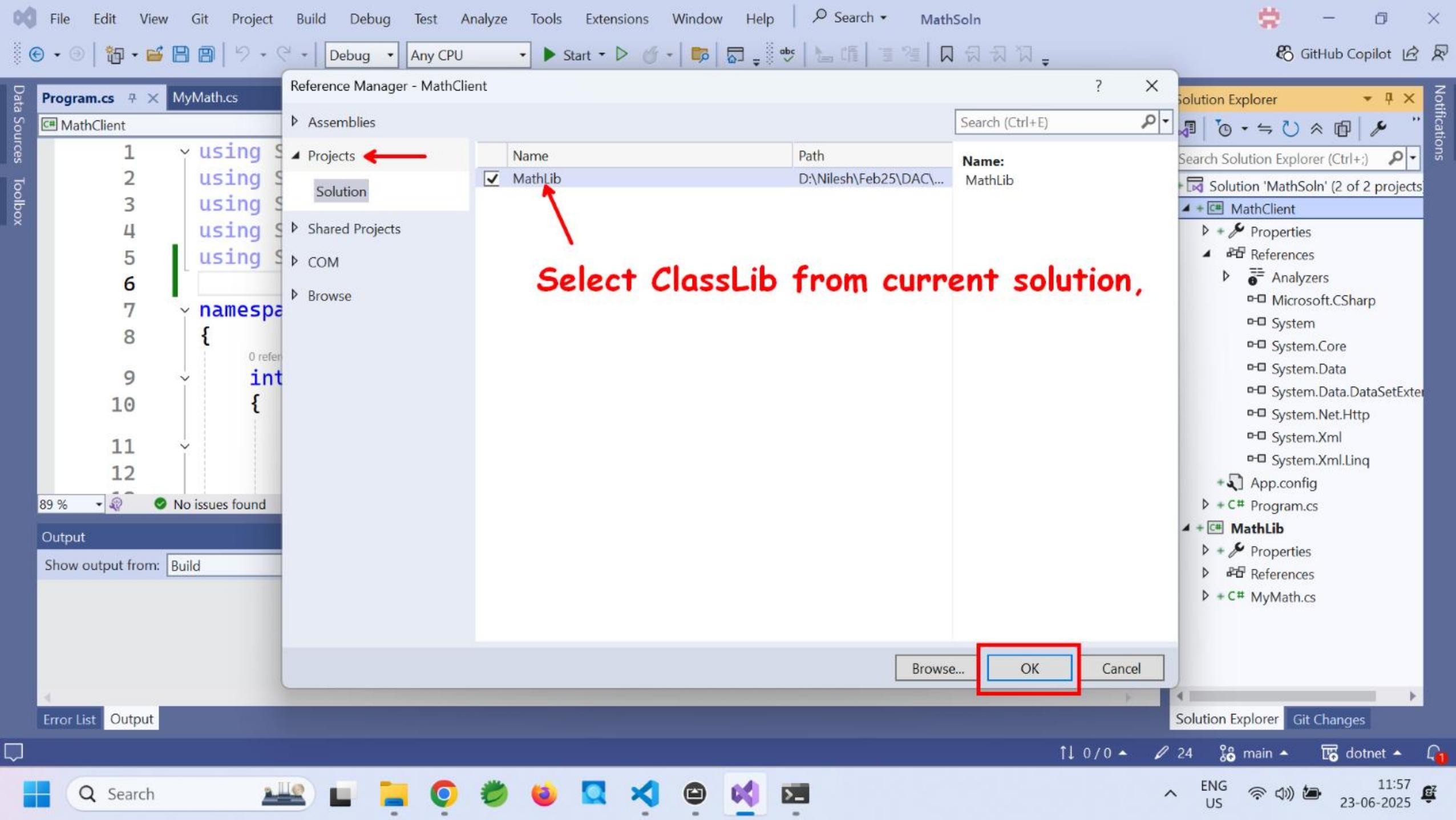
Output Show output from: Build

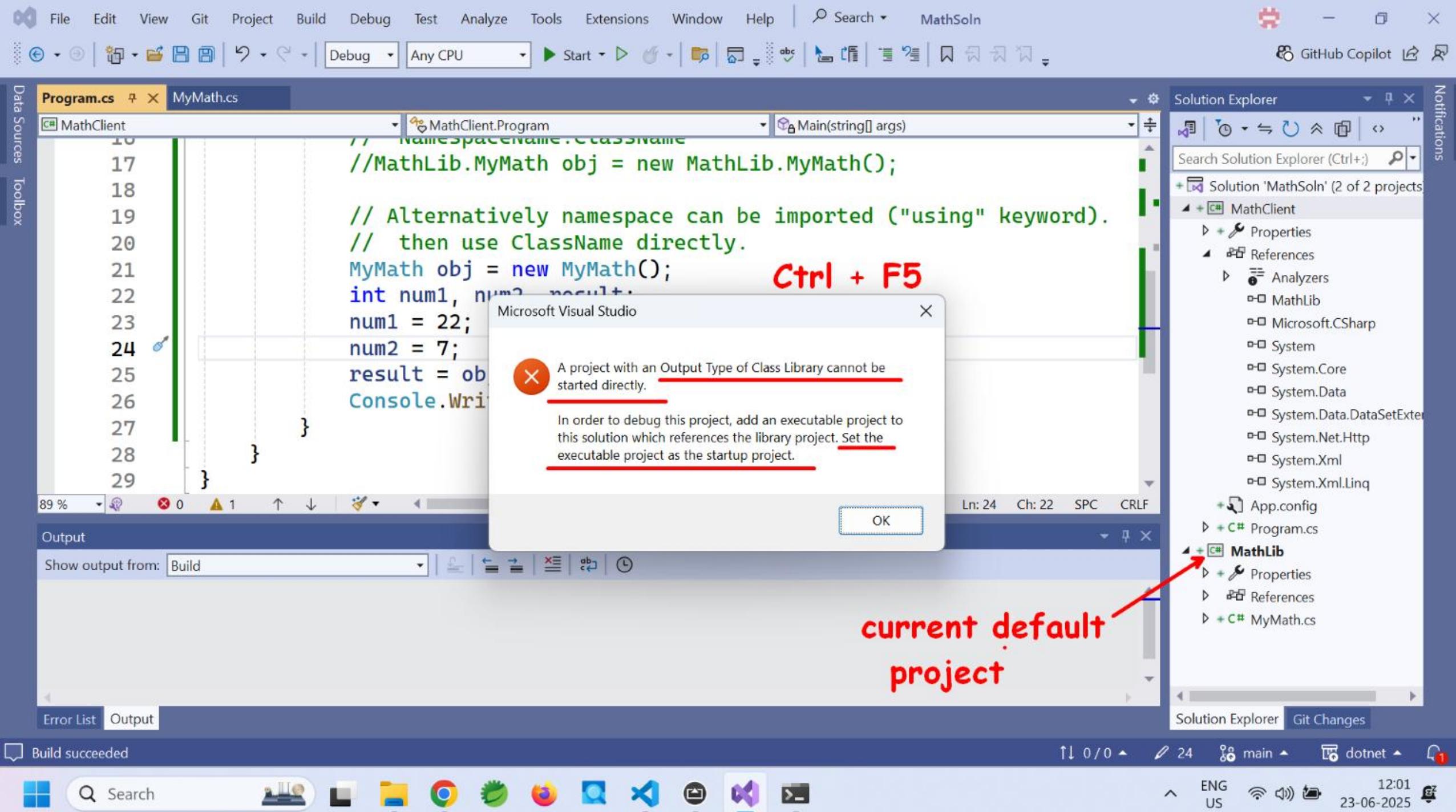
Error List Output

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Search

11:55 23-06-2025 ENG US





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Build Rebuild Clean Analyze and Code Cleanup Publish... Publish as Azure WebJob... Upgrade Collapse All Descendants Scope to This New Solution Explorer View Build Dependencies Add Manage NuGet Packages... Configure Startup Projects... Set as Startup Project Debug Initialize Interactive with Project Git Cut Ctrl+X Paste Ctrl+V Remove Del Rename F2 Unload Project Load Direct Dependencies Load Entire Dependency Tree Copy Full Path Open Folder in File Explorer

Ctrl+Left Arrow

MathClient proj

Program.cs MyMath.cs

C# MathClient

```
// Namespacename.Classname
//MathLib.MyMath obj = new MathLib.MyMath();

// Alternatively namespace can be imported ("using" keyword)
// then use ClassName directly.
MyMath obj = new MyMath();
int num1, num2, result;
num1 = 22;
num2 = 7;
result = obj.Multiply(num1, num2);
Console.WriteLine("Result: " + result);
```

89 % 0 1 Ln: 24 Ch: 22

Output

Show output from: Build

Error List Output

This item does not support previewing

Search

12:02 23-06-2025 ENG US

File Edit View Git Project Build Debug Test Analyze Tools Extensions Window Help | Search | MathSoln

GitHub Copilot

Program.cs MyMath.cs

C# MathClient MathClient.Program Main(string[] args)

```
6 using System.Threading.Tasks;
7 using MathLib;
8
9 namespace MathClient
10 {
11     internal class Program
12     {
13         static void Main(string[] args)
14         {
15             // Object can be created using fully qualified class name
16             // NamespaceName.ClassName
17             //MathLib.MyMath obj = new MathLib.MyMath();
18         }
19     }
20 }
```

"internal" types are accessible in current project i.e. current assembly only -- in this example MathClient.exe

Solution Explorer

Search Solution Explorer (Ctrl+Shift+F)

Solution 'MathSoln' (2 of 2 projects)

- MathClient
 - Properties
 - References
 - Analyzers
 - MathLib
 - Microsoft.CSharp
 - System
 - System.Core
 - System.Data
 - System.Data.DataSetExtensions
 - System.Net.Http
 - System.Xml
 - System.Xml.Linq
 - App.config
 - Program.cs
 - MathLib
 - Properties
 - References
 - MyMath.cs

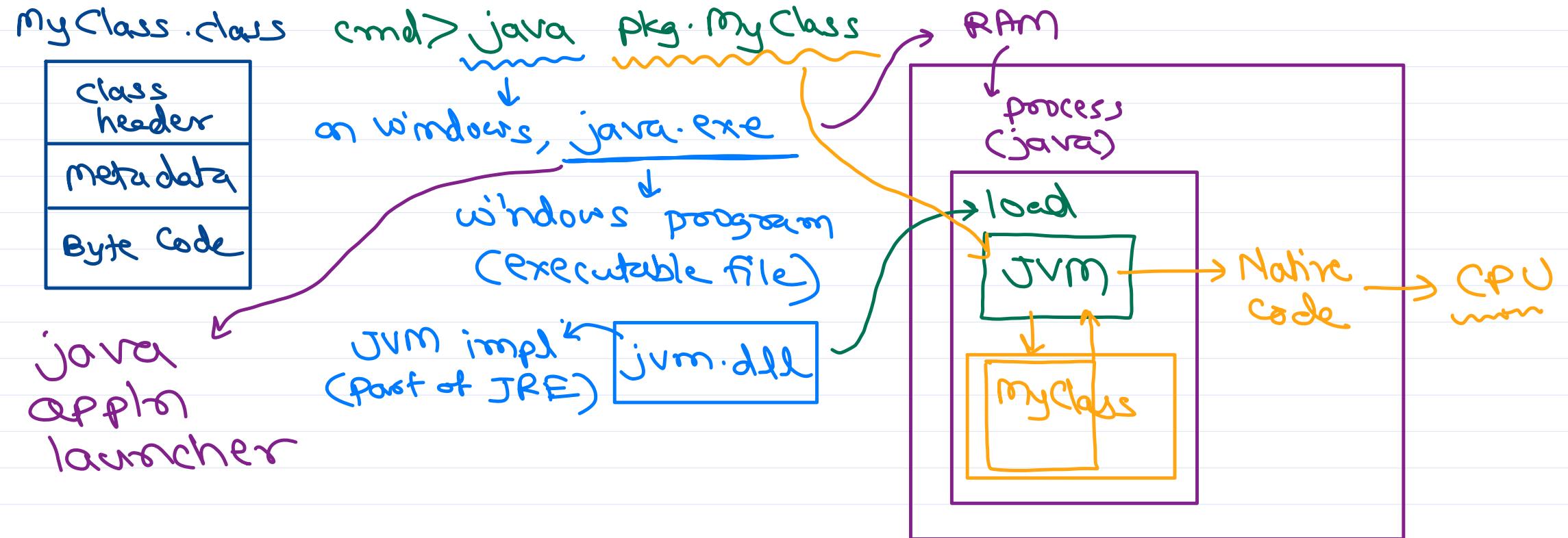
Output

Show output from: Build

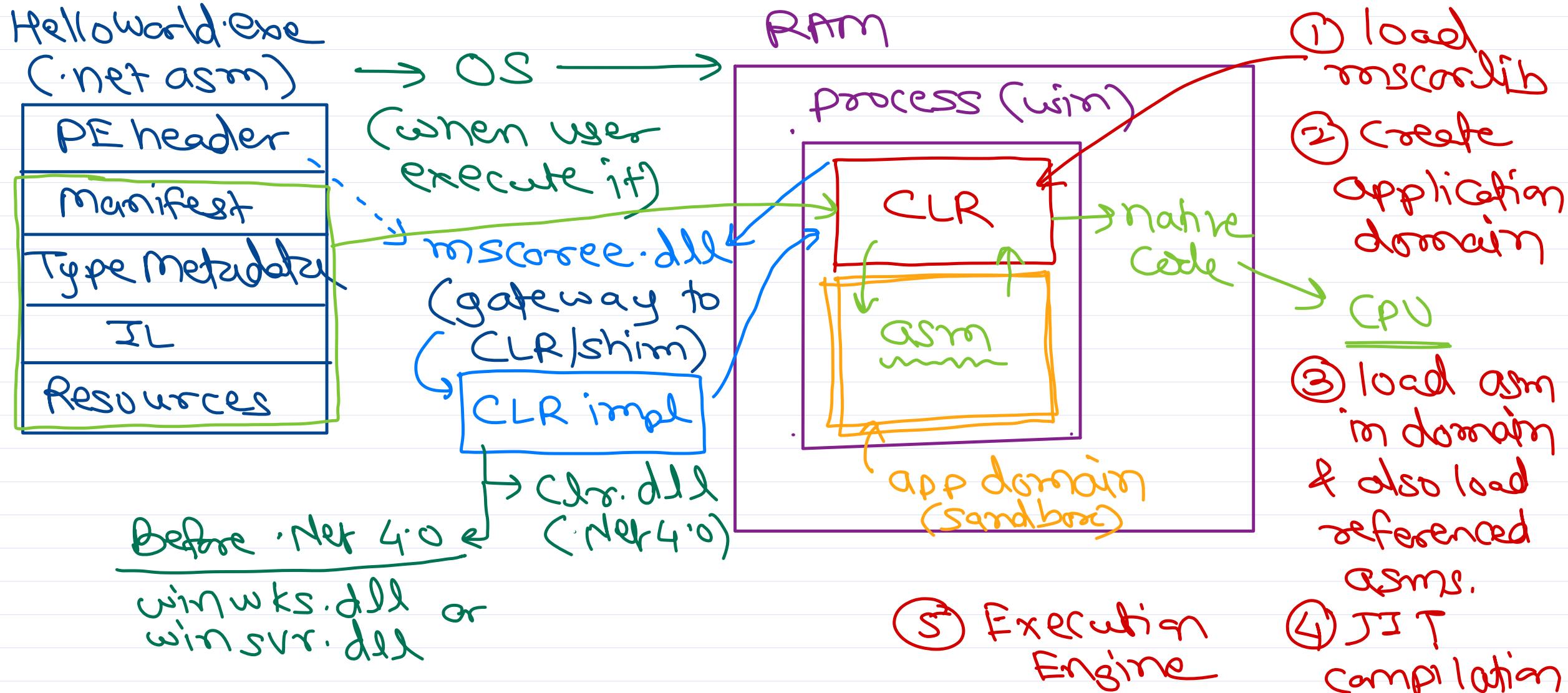
Error List Output

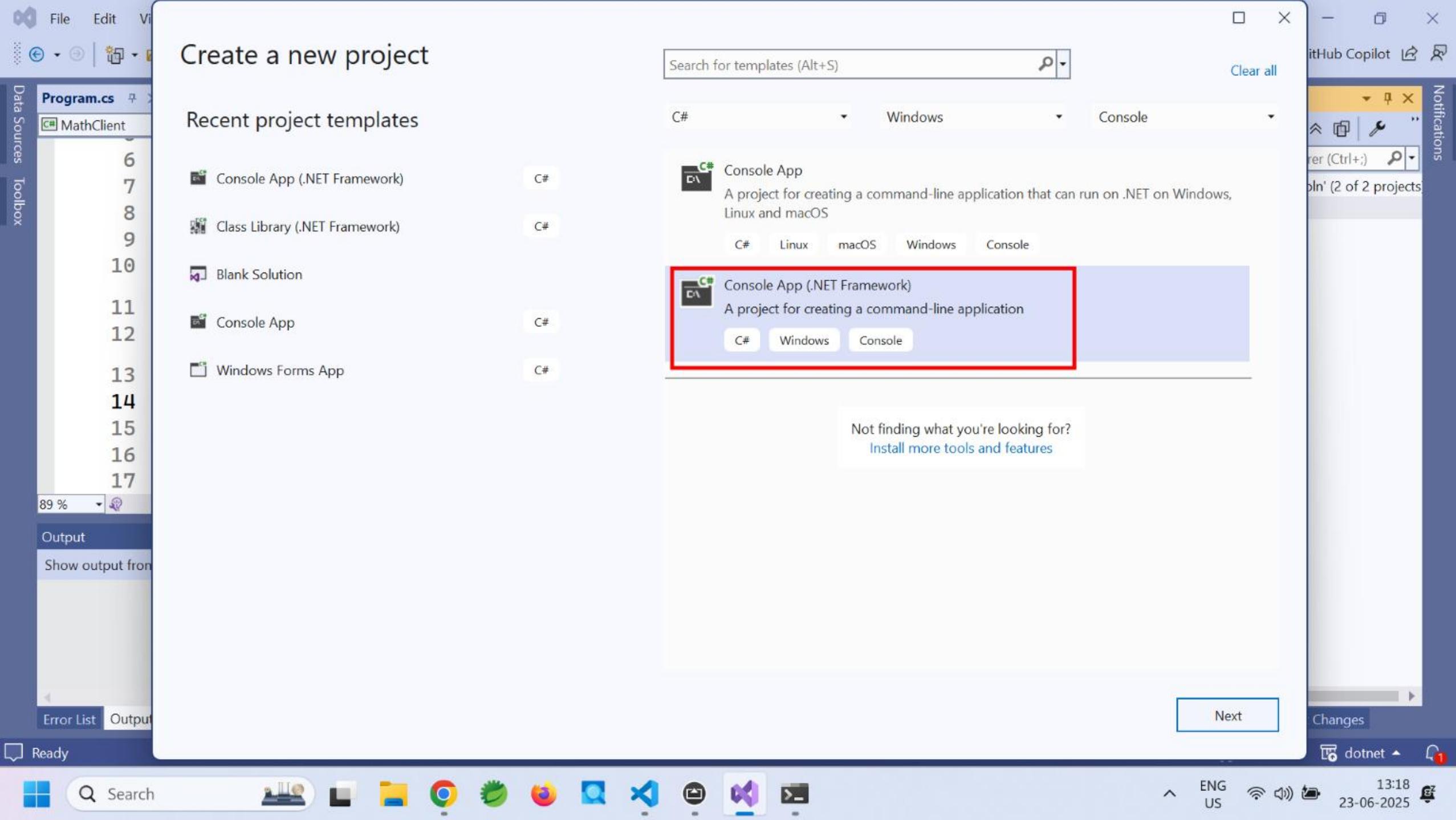
Solution Explorer Git Changes

Java execution



.Net program execution







Program.cs

ClassDemo

```
9     class Person
10    {
11        // fields
12        private int age;
13        private string name;
14        private string addr;
15        // constructors
16        public Person() : this(0, "", "")
17        {
18            // if not initialized explicitly,
19            // the fields will have default values of respective types.
20            // e.g. age - int (0), name - string (null), addr - string (nul
21        }
22        public Person(int age, string name, string addr)
23        {
24            this.age = age;
25            this.name = name;
26            this.addr = addr;
27        }
28        // methods
```

constructor chaining

89 % No issues found

Solution Explorer Git Changes

Ready

11 0/0 61 main dotnet 1



Search



ENG
US



13:24

23-06-2025



Thank you!

Nilesh Ghule <nilesh@sunbeaminfo.com>