

JP.NET: Lab01

Stanisław Nieradko 193044

1. Kompilacja

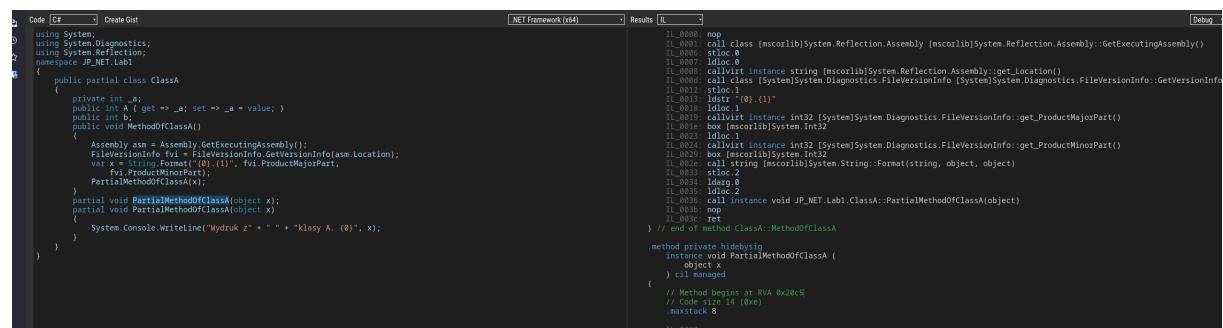
```
PS Z:\Lab01> csc.exe -t:library -out:JP_NET.Lab01a.dll .\ClassA.cs
Microsoft (R) Visual C# Compiler version 4.14.0-3.25412.6 (c167adef)
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PS Z:\Lab01> csc.exe -t:library -debug -out:JP_NET.Lab01a.Debug.dll .\ClassA.cs
Microsoft (R) Visual C# Compiler version 4.14.0-3.25412.6 (c167adef)
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PS Z:\Lab01> csc.exe -t:library -o -out:JP_NET.Lab01a.Optimized.dll .\ClassA.cs
Microsoft (R) Visual C# Compiler version 4.14.0-3.25412.6 (c167adef)
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PS Z:\Lab01> ildasm.exe /out=JP_NET.Lab01a.il .\JP_NET.Lab01a.dll
PS Z:\Lab01> ildasm.exe /out=JP_NET.Lab01a.Debug.il .\JP_NET.Lab01a.Debug.dll
PS Z:\Lab01> ildasm.exe /out=JP_NET.Lab01a.Optimized.il .\JP_NET.Lab01a.Optimized.dll
PS Z:\Lab01>
```

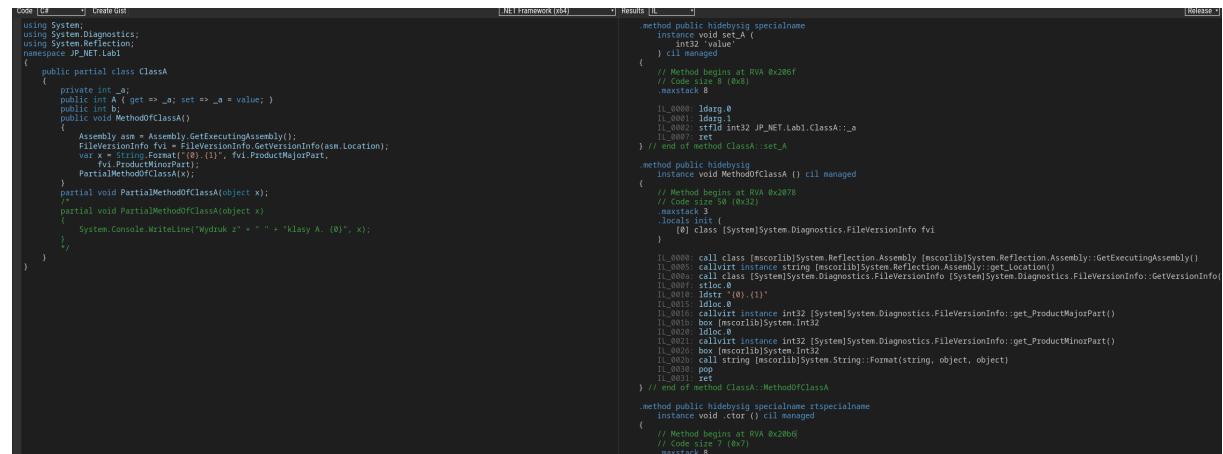
Przed zakomentowaniem definicji:



```
Code [IL] Create Gist .NET Framework (v4) Results [IL] Debug ...
b using System;
b using System.Diagnostics;
b using System.Reflection;
b namespace JP_NET.Lab01
{
    public partial class ClassA
    {
        private int _a;
        public int A { get => _a; set => _a = value; }
        public int b;
        public void MethodOfClassA()
        {
            Assembly asm = Assembly.GetExecutingAssembly();
            FileVersionInfo fvi = FileVersionInfo.GetVersionInfo(asm.Location);
            var x = string.Format("{0} ({1})", fvi.ProductMajorPart,
                fvi.ProductMinorPart);
            PartialMethodOfClassA(x);
        }
        partial void PartialMethodOfClassA(object x);
        partial void PartialMethodOfClassA(object x)
        {
            System.Console.WriteLine("Wydruk z" + " " + "klasy A. " + x);
        }
    }
}
```

The screenshot shows the IL Spy tool interface with the 'Code' tab selected. It displays the C# source code for ClassA. The assembly name is JP_NET.Lab01, and the class name is ClassA. The code includes a private field _a, a public property A, a public method MethodOfClassA that prints assembly information, and two partial methods PartialMethodOfClassA that print the value of x.

Po zakomentowaniu definicji:



```
Code [IL] Create Gist .NET Framework (v4) Results [IL] Debug ...
b using System;
b using System.Diagnostics;
b using System.Reflection;
b namespace JP_NET.Lab01
{
    public partial class ClassA
    {
        private int _a;
        public int A { get => _a; set => _a = value; }
        public void MethodOfClassA()
        {
            Assembly asm = Assembly.GetExecutingAssembly();
            FileVersionInfo fvi = FileVersionInfo.GetVersionInfo(asm.Location);
            var x = string.Format("{0} ({1})", fvi.ProductMajorPart,
                fvi.ProductMinorPart);
            PartialMethodOfClassA();
        }
        partial void PartialMethodOfClassA(object x);
        partial void PartialMethodOfClassA(object x)
        {
            System.Console.WriteLine("Wydruk z" + " " + "klasy A. " + x);
        }
    }
}
```

The screenshot shows the IL Spy tool interface with the 'Code' tab selected. The code is identical to the previous one, but the two partial methods have been commented out with '/* */'. The assembly name is JP_NET.Lab01, and the class name is ClassA.

Zgodnie z opisem zadania, program nie zawiera wywołań metod bez definicji. Ponadto w wygenerowanych plikach .il można zauważać różnice między normalną komplikacją, komplikacją w trybie Debug oraz z włączonymi optymalizacjami.

2. Referencja

```
PS Z:\Lab01\Part2> csc.exe -t:exe -out:JP_NET.Lab01App.exe -r:JP_NET.Lab01a.dll ./ProgA.cs
Microsoft (R) Visual C# Compiler version 4.14.0-3.25412.6 (c167adef)
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PS Z:\Lab01\Part2>
```

```
.class public auto ansi beforefieldinit JP_NET.Lab1.Program
    extends [mscorlib]System.Object
{
    .method public hidebysig static void Main() cil managed
    {
        .entrypoint
        // Code size     30 (0x1e)
        .maxstack  2
        .locals init (class [JP_NET.Lab01a]JP_NET.Lab1.ClassA V_0)
        IL_0000: nop
        IL_0001: newobj   instance void [JP_NET.Lab01a]JP_NET.Lab1.ClassA::ctor()
        IL_0006: stloc.0
        IL_0007: ldloc.0
        IL_0008: callvirt  instance void [JP_NET.Lab01a]JP_NET.Lab1.ClassA::MethodOfClassA()
        IL_000D: nop
        IL_000E: ldloc.0
        IL_000F: ldc.i4.1
        IL_0010: callvirt  instance void [JP_NET.Lab01a]JP_NET.Lab1.ClassA::set_A(int32)
        IL_0015: nop
        IL_0016: ldloc.0
        IL_0017: ldc.i4.2
        IL_0018: stfld     int32 [JP_NET.Lab01a]JP_NET.Lab1.ClassA::b
        IL_001d: ret
    } // end of method Program::Main
    .method public hidebysig specialname rtspecialname 
        instance void .ctor() cil managed
    {
        // Code size     8 (0x8)
    }
}
```

```
PS Z:\Lab01\Part2> csc.exe -t:exe -out:JP_NET.Lab01App.exe -r:JP_NET.Lab01a.dll ./ProgA.cs
Microsoft (R) Visual C# Compiler version 4.14.0-3.25412.6 (c167adef)
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PS Z:\Lab01\Part2> ildasm.exe /out=JP_NET.Lab01App.il .\JP_NET.Lab01App.exe
PS Z:\Lab01\Part2>
```

```
PS Z:\Lab01\Part2> .\JP_NET.Lab01App.exe
Wydruk z klasy A. 0.0
PS Z:\Lab01\Part2>
```

The screenshot shows a Visual Studio interface. On the left is a file tree for a project named 'JP_NET.Lab01a'. The tree includes files like 'JP_NET.Lab01a.Optimized.il', 'JP_NET.Lab01a.Optimized.res', 'Part2' (containing 'AssemblyInfo.cs', 'ClassA.cs', 'ProgA.cs'), and 'Scratches and Consoles'. On the right is a code editor displaying the following C# code:

```
11  public void Method0
12  {
13      Assembly asm =
14      FileVersionInfo
15      var x = String.
16          fvi.Product
17          PartialMethodOf
18      }
19      ◆ IL code
20      partial void Partia
21      ◆ IL code
22      partial void Partia
23      {
24          System.Console.
```

Below the code editor is a terminal window titled 'Terminal Local (3)'. It contains the following command-line session:

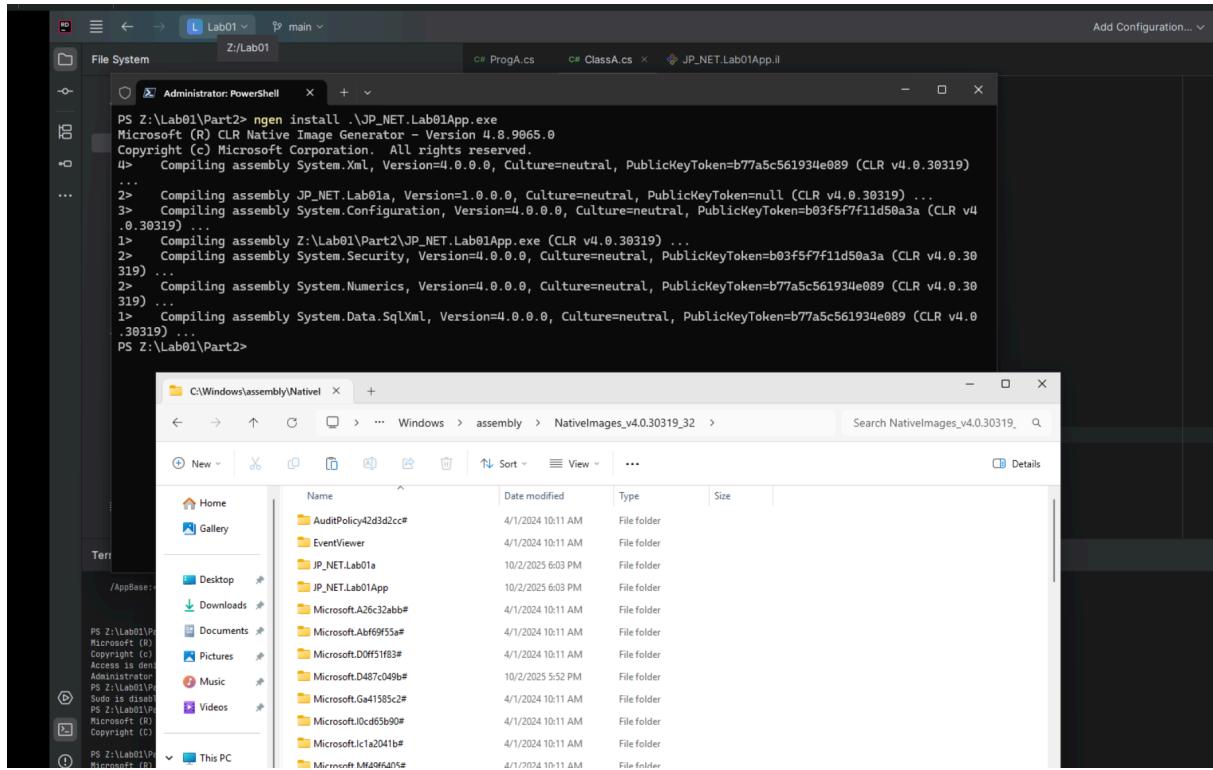
```
PS Z:\Lab01\Part2> csc.exe -t:exe -out:JP_NET.Lab01App.exe -r:JP_NET.Lab01a.dll ./ProgA.cs
Microsoft (R) Visual C# Compiler version 4.14.0-3.25412.6 (c167adef)
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PS Z:\Lab01\Part2> ildasm.exe /out=JP_NET.Lab01App.il ./JP_NET.Lab01App.exe
PS Z:\Lab01\Part2> csc.exe -t:exe -out:JP_NET.Lab01App.exe -r:JP_NET.Lab01a.dll ^C
PS Z:\Lab01\Part2> cd Part1
Set-Location: Cannot find path 'Z:\Lab01\Part2\Part1' because it does not exist.
PS Z:\Lab01\Part2> csc.exe -t:library -out:JP_NET.Lab01a.dll ./ClassA.cs ./AssemblyInfo.cs
Microsoft (R) Visual C# Compiler version 4.14.0-3.25412.6 (c167adef)
Copyright (C) Microsoft Corporation. All rights reserved.

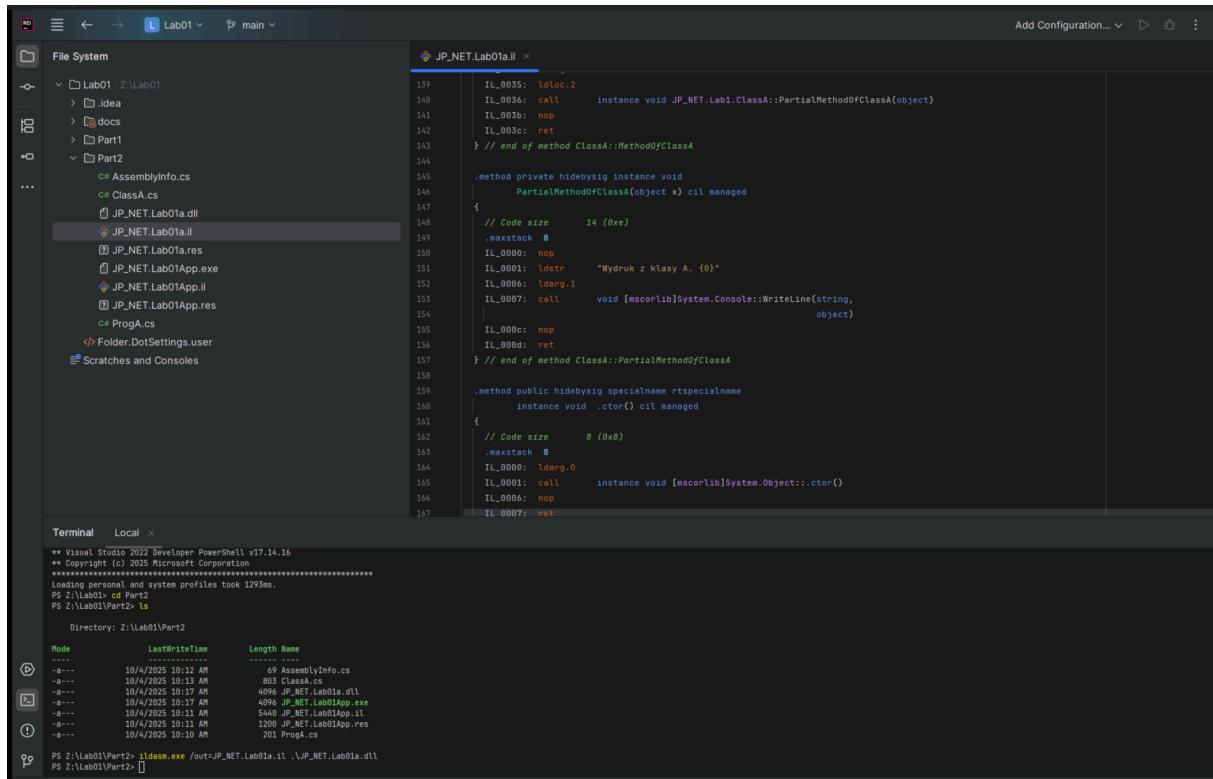
PS Z:\Lab01\Part2> csc.exe -t:exe -out:JP_NET.Lab01App.exe -r:JP_NET.Lab01a.dll ./ProgA.cs
Microsoft (R) Visual C# Compiler version 4.14.0-3.25412.6 (c167adef)
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PS Z:\Lab01\Part2> ./JP_NET.Lab01App.exe
Wydruk z klasy A. 1.0
PS Z:\Lab01\Part2>
```

3. NGEN



4. CIL



The screenshot shows the Visual Studio IDE interface. On the left, the 'File System' tree view displays the project structure under 'Lab01'. In the center, the code editor shows the IL (Intermediate Language) code for the assembly `JP_NET.Lab01a.il`. The code includes methods like `MethodOfClassA` and `PartialMethodOfClassA`, which prints "Wydruk z klasy A po komplikacji. {0}" to the console. Below the code editor is the 'Terminal' window, which shows the command `ilasm.exe /DLL /out:JP_NET.Lab01a.dll .\JP_NET.Lab01a.il` being run. The terminal output details the assembly process, including method definitions and the creation of a PE file.

This screenshot shows a terminal window with the command `PS Z:\Lab01\Part2> .\JP_NET.Lab01App.exe` being run. The output shows the application printing "Wydruk z klasy A po komplikacji. 0.0" to the console.

5. Moduły

This screenshot shows a terminal window demonstrating the creation of multiple .NET modules and their execution. It includes commands for creating `ClassA.netmodule`, `ClassB.netmodule`, and `JP_NET.Lab01App.exe` from their respective source files. Finally, it runs the application and prints "Wydruk z Klasy A. 0.0".

```
PS Z:\Lab01\Part5> csc.exe -t:module -out:ClassA.netmodule ./ClassA.cs
Microsoft (R) Visual C# Compiler version 4.14.0-3.25412.6 (c167adef)
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PS Z:\Lab01\Part5> csc.exe -t:module -out:ClassB.netmodule ./ClassB.cs
Microsoft (R) Visual C# Compiler version 4.14.0-3.25412.6 (c167adef)
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PS Z:\Lab01\Part5> csc.exe -t:exe -out:JP_NET.Lab01App.exe ./ProgA.cs ./ClassA.cs ./ClassB.cs
Microsoft (R) Visual C# Compiler version 4.14.0-3.25412.6 (c167adef)
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PS Z:\Lab01\Part5> .\JP_NET.Lab01App.exe
Wydruk z Klasy A. 0.0
PS Z:\Lab01\Part5>
```

Lab01

ClassB.cs JP.NET.Lab01App.il

```

11.0001:    instance void [mscorlib]System.Attribute::ctor()
11.0002:        nop
11.0003:        ldarg.1
11.0004:        ldarg.2
11.0005:        ldarg.3
11.0006:        ldarg.4
11.0007:        ldarg.5
11.0008:        ldarg.6
11.0009:        ldarg.7
11.000A:        ret
11.000B:    } // end of method Attribute::ctor
11.000C:  } // end of class System.Runtime.CompilerServices.RedSafetyRuleAttribute
11.000D:  class public auto ansi beforefieldinit JP.NET.Lab1.Program
11.000E:      extends [mscorlib]System.Object
11.000F:  {
11.0010:      .method public hidebyref static void Main() cil managed
11.0011:      {
11.0012:          // Code size     30 (0x1e)
11.0013:          .maxstack 2
11.0014:          .locals init class JP.NET.Lab1.ClassA V_0
11.0015:          IL_0000:    nop
11.0016:          IL_0001:    ldarg.0
11.0017:          IL_0002:    instance void [JP.NET.Lab1]JP.NET.Lab1.ClassA::ctor()
11.0018:          IL_0003:    stloc.0
11.0019:          IL_0004:    ldloc.0
11.001A:          IL_0005:    ldarg.1
11.001B:          IL_0006:    ldarg.2
11.001C:          IL_0007:    ldarg.3
11.001D:          IL_0008:    ldarg.4
11.001E:          IL_0009:    ldarg.5
11.001F:          IL_000A:    ldarg.6
11.001B:          IL_000B:    ldarg.7
11.001C:          IL_000C:    ldarg.8
11.001D:          IL_000D:    ldarg.9
11.001E:          IL_000E:    ldarg.10
11.001F:          IL_000F:    ldarg.11
11.001G:          IL_0010:    ldarg.12
11.001H:          IL_0011:    ldarg.13
11.001I:          IL_0012:    ldarg.14
11.001J:          IL_0013:    ldarg.15
11.001K:          IL_0014:    ldarg.16
11.001L:          IL_0015:    ldarg.17
11.001M:          IL_0016:    ldarg.18
11.001N:          IL_0017:    ldarg.19
11.001O:          IL_0018:    ldarg.20
11.001P:          IL_0019:    ldarg.21
11.001Q:          IL_001A:    ldarg.22
11.001R:          IL_001B:    ldarg.23
11.001S:          IL_001C:    ldarg.24
11.001T:          IL_001D:    ldarg.25
11.001U:          IL_001E:    ldarg.26
11.001V:          IL_001F:    ldarg.27
11.001W:          IL_001X:    ldarg.28
11.001Y:          IL_001Z:    ldarg.29
11.001A:          IL_001B:    ldarg.30
11.001C:          IL_001D:    ldarg.31
11.001E:          IL_001F:    ldarg.32
11.001G:          IL_001H:    ldarg.33
11.001I:          IL_001J:    ldarg.34
11.001K:          IL_001L:    ldarg.35
11.001M:          IL_001N:    ldarg.36
11.001O:          IL_001P:    ldarg.37
11.001Q:          IL_001R:    ldarg.38
11.001S:          IL_001T:    ldarg.39
11.001U:          IL_001V:    ldarg.40
11.001W:          IL_001X:    ldarg.41
11.001Y:          IL_001Z:    ldarg.42
11.001A:          IL_001B:    ldarg.43
11.001C:          IL_001D:    ldarg.44
11.001E:          IL_001F:    ldarg.45
11.001G:          IL_001H:    ldarg.46
11.001I:          IL_001J:    ldarg.47
11.001K:          IL_001L:    ldarg.48
11.001M:          IL_001N:    ldarg.49
11.001O:          IL_001P:    ldarg.50
11.001Q:          IL_001R:    ldarg.51
11.001S:          IL_001T:    ldarg.52
11.001U:          IL_001V:    ldarg.53
11.001W:          IL_001X:    ldarg.54
11.001Y:          IL_001Z:    ldarg.55
11.001A:          IL_001B:    ldarg.56
11.001C:          IL_001D:    ldarg.57
11.001E:          IL_001F:    ldarg.58
11.001G:          IL_001H:    ldarg.59
11.001I:          IL_001J:    ldarg.60
11.001K:          IL_001L:    ldarg.61
11.001M:          IL_001N:    ldarg.62
11.001O:          IL_001P:    ldarg.63
11.001Q:          IL_001R:    ldarg.64
11.001S:          IL_001T:    ldarg.65
11.001U:          IL_001V:    ldarg.66
11.001W:          IL_001X:    ldarg.67
11.001Y:          IL_001Z:    ldarg.68
11.001A:          IL_001B:    ldarg.69
11.001C:          IL_001D:    ldarg.70
11.001E:          IL_001F:    ldarg.71
11.001G:          IL_001H:    ldarg.72
11.001I:          IL_001J:    ldarg.73
11.001K:          IL_001L:    ldarg.74
11.001M:          IL_001N:    ldarg.75
11.001O:          IL_001P:    ldarg.76
11.001Q:          IL_001R:    ldarg.77
11.001S:          IL_001T:    ldarg.78
11.001U:          IL_001V:    ldarg.79
11.001W:          IL_001X:    ldarg.80
11.001Y:          IL_001Z:    ldarg.81
11.001A:          IL_001B:    ldarg.82
11.001C:          IL_001D:    ldarg.83
11.001E:          IL_001F:    ldarg.84
11.001G:          IL_001H:    ldarg.85
11.001I:          IL_001J:    ldarg.86
11.001K:          IL_001L:    ldarg.87
11.001M:          IL_001N:    ldarg.88
11.001O:          IL_001P:    ldarg.89
11.001Q:          IL_001R:    ldarg.90
11.001S:          IL_001T:    ldarg.91
11.001U:          IL_001V:    ldarg.92
11.001W:          IL_001X:    ldarg.93
11.001Y:          IL_001Z:    ldarg.94
11.001A:          IL_001B:    ldarg.95
11.001C:          IL_001D:    ldarg.96
11.001E:          IL_001F:    ldarg.97
11.001G:          IL_001H:    ldarg.98
11.001I:          IL_001J:    ldarg.99
11.001K:          IL_001L:    ldarg.100
11.001M:          IL_001N:    ldarg.101
11.001O:          IL_001P:    ldarg.102
11.001Q:          IL_001R:    ldarg.103
11.001S:          IL_001T:    ldarg.104
11.001U:          IL_001V:    ldarg.105
11.001W:          IL_001X:    ldarg.106
11.001Y:          IL_001Z:    ldarg.107
11.001A:          IL_001B:    ldarg.108
11.001C:          IL_001D:    ldarg.109
11.001E:          IL_001F:    ldarg.110
11.001G:          IL_001H:    ldarg.111
11.001I:          IL_001J:    ldarg.112
11.001K:          IL_001L:    ldarg.113
11.001M:          IL_001N:    ldarg.114
11.001O:          IL_001P:    ldarg.115
11.001Q:          IL_001R:    ldarg.116
11.001S:          IL_001T:    ldarg.117
11.001U:          IL_001V:    ldarg.118
11.001W:          IL_001X:    ldarg.119
11.001Y:          IL_001Z:    ldarg.120
11.001A:          IL_001B:    ldarg.121
11.001C:          IL_001D:    ldarg.122
11.001E:          IL_001F:    ldarg.123
11.001G:          IL_001H:    ldarg.124
11.001I:          IL_001J:    ldarg.125
11.001K:          IL_001L:    ldarg.126
11.001M:          IL_001N:    ldarg.127
11.001O:          IL_001P:    ldarg.128
11.001Q:          IL_001R:    ldarg.129
11.001S:          IL_001T:    ldarg.130
11.001U:          IL_001V:    ldarg.131
11.001W:          IL_001X:    ldarg.132
11.001Y:          IL_001Z:    ldarg.133
11.001A:          IL_001B:    ldarg.134
11.001C:          IL_001D:    ldarg.135
11.001E:          IL_001F:    ldarg.136
11.001G:          IL_001H:    ldarg.137
11.001I:          IL_001J:    ldarg.138
11.001K:          IL_001L:    ldarg.139
11.001M:          IL_001N:    ldarg.140
11.001O:          IL_001P:    ldarg.141
11.001Q:          IL_001R:    ldarg.142
11.001S:          IL_001T:    ldarg.143
11.001U:          IL_001V:    ldarg.144
11.001W:          IL_001X:    ldarg.145
11.001Y:          IL_001Z:    ldarg.146
11.001A:          IL_001B:    ldarg.147
11.001C:          IL_001D:    ldarg.148
11.001E:          IL_001F:    ldarg.149
11.001G:          IL_001H:    ldarg.150
11.001I:          IL_001J:    ldarg.151
11.001K:          IL_001L:    ldarg.152
11.001M:          IL_001N:    ldarg.153
11.001O:          IL_001P:    ldarg.154
11.001Q:          IL_001R:    ldarg.155
11.001S:          IL_001T:    ldarg.156
11.001U:          IL_001V:    ldarg.157
11.001W:          IL_001X:    ldarg.158
11.001Y:          IL_001Z:    ldarg.159
11.001A:          IL_001B:    ldarg.160
11.001C:          IL_001D:    ldarg.161
11.001E:          IL_001F:    ldarg.162
11.001G:          IL_001H:    ldarg.163
11.001I:          IL_001J:    ldarg.164
11.001K:          IL_001L:    ldarg.165
11.001M:          IL_001N:    ldarg.166
11.001O:          IL_001P:    ldarg.167
11.001Q:          IL_001R:    ldarg.168
11.001S:          IL_001T:    ldarg.169
11.001U:          IL_001V:    ldarg.170
11.001W:          IL_001X:    ldarg.171
11.001Y:          IL_001Z:    ldarg.172
11.001A:          IL_001B:    ldarg.173
11.001C:          IL_001D:    ldarg.174
11.001E:          IL_001F:    ldarg.175
11.001G:          IL_001H:    ldarg.176
11.001I:          IL_001J:    ldarg.177
11.001K:          IL_001L:    ldarg.178
11.001M:          IL_001N:    ldarg.179
11.001O:          IL_001P:    ldarg.180
11.001Q:          IL_001R:    ldarg.181
11.001S:          IL_001T:    ldarg.182
11.001U:          IL_001V:    ldarg.183
11.001W:          IL_001X:    ldarg.184
11.001Y:          IL_001Z:    ldarg.185
11.001A:          IL_001B:    ldarg.186
11.001C:          IL_001D:    ldarg.187
11.001E:          IL_001F:    ldarg.188
11.001G:          IL_001H:    ldarg.189
11.001I:          IL_001J:    ldarg.190
11.001K:          IL_001L:    ldarg.191
11.001M:          IL_001N:    ldarg.192
11.001O:          IL_001P:    ldarg.193
11.001Q:          IL_001R:    ldarg.194
11.001S:          IL_001T:    ldarg.195
11.001U:          IL_001V:    ldarg.196
11.001W:          IL_001X:    ldarg.197
11.001Y:          IL_001Z:    ldarg.198
11.001A:          IL_001B:    ldarg.199
11.001C:          IL_001D:    ldarg.200
11.001E:          IL_001F:    ldarg.201
11.001G:          IL_001H:    ldarg.202
11.001I:          IL_001J:    ldarg.203
11.001K:          IL_001L:    ldarg.204
11.001M:          IL_001N:    ldarg.205
11.001O:          IL_001P:    ldarg.206
11.001Q:          IL_001R:    ldarg.207
11.001S:          IL_001T:    ldarg.208
11.001U:          IL_001V:    ldarg.209
11.001W:          IL_001X:    ldarg.210
11.001Y:          IL_001Z:    ldarg.211
11.001A:          IL_001B:    ldarg.212
11.001C:          IL_001D:    ldarg.213
11.001E:          IL_001F:    ldarg.214
11.001G:          IL_001H:    ldarg.215
11.001I:          IL_001J:    ldarg.216
11.001K:          IL_001L:    ldarg.217
11.001M:          IL_001N:    ldarg.218
11.001O:          IL_001P:    ldarg.219
11.001Q:          IL_001R:    ldarg.220
11.001S:          IL_001T:    ldarg.221
11.001U:          IL_001V:    ldarg.222
11.001W:          IL_001X:    ldarg.223
11.001Y:          IL_001Z:    ldarg.224
11.001A:          IL_001B:    ldarg.225
11.001C:          IL_001D:    ldarg.226
11.001E:          IL_001F:    ldarg.227
11.001G:          IL_001H:    ldarg.228
11.001I:          IL_001J:    ldarg.229
11.001K:          IL_001L:    ldarg.230
11.001M:          IL_001N:    ldarg.231
11.001O:          IL_001P:    ldarg.232
11.001Q:          IL_001R:    ldarg.233
11.001S:          IL_001T:    ldarg.234
11.001U:          IL_001V:    ldarg.235
11.001W:          IL_001X:    ldarg.236
11.001Y:          IL_001Z:    ldarg.237
11.001A:          IL_001B:    ldarg.238
11.001C:          IL_001D:    ldarg.239
11.001E:          IL_001F:    ldarg.240
11.001G:          IL_001H:    ldarg.241
11.001I:          IL_001J:    ldarg.242
11.001K:          IL_001L:    ldarg.243
11.001M:          IL_001N:    ldarg.244
11.001O:          IL_001P:    ldarg.245
11.001Q:          IL_001R:    ldarg.246
11.001S:          IL_001T:    ldarg.247
11.001U:          IL_001V:    ldarg.248
11.001W:          IL_001X:    ldarg.249
11.001Y:          IL_001Z:    ldarg.250
11.001A:          IL_001B:    ldarg.251
11.001C:          IL_001D:    ldarg.252
11.001E:          IL_001F:    ldarg.253
11.001G:          IL_001H:    ldarg.254
11.001I:          IL_001J:    ldarg.255
11.001K:          IL_001L:    ldarg.256
11.001M:          IL_001N:    ldarg.257
11.001O:          IL_001P:    ldarg.258
11.001Q:          IL_001R:    ldarg.259
11.001S:          IL_001T:    ldarg.260
11.001U:          IL_001V:    ldarg.261
11.001W:          IL_001X:    ldarg.262
11.001Y:          IL_001Z:    ldarg.263
11.001A:          IL_001B:    ldarg.264
11.001C:          IL_001D:    ldarg.265
11.001E:          IL_001F:    ldarg.266
11.001G:          IL_001H:    ldarg.267
11.001I:          IL_001J:    ldarg.268
11.001K:          IL_001L:    ldarg.269
11.001M:          IL_001N:    ldarg.270
11.001O:          IL_001P:    ldarg.271
11.001Q:          IL_001R:    ldarg.272
11.001S:          IL_001T:    ldarg.273
11.001U:          IL_001V:    ldarg.274
11.001W:          IL_001X:    ldarg.275
11.001Y:          IL_001Z:    ldarg.276
11.001A:          IL_001B:    ldarg.277
11.001C:          IL_001D:    ldarg.278
11.001E:          IL_001F:    ldarg.279
11.001G:          IL_001H:    ldarg.280
11.001I:          IL_001J:    ldarg.281
11.001K:          IL_001L:    ldarg.282
11.001M:          IL_001N:    ldarg.283
11.001O:          IL_001P:    ldarg.284
11.001Q:          IL_001R:    ldarg.285
11.001S:          IL_001T:    ldarg.286
11.001U:          IL_001V:    ldarg.287
11.001W:          IL_001X:    ldarg.288
11.001Y:          IL_001Z:    ldarg.289
11.001A:          IL_001B:    ldarg.290
11.001C:          IL_001D:    ldarg.291
11.001E:          IL_001F:    ldarg.292
11.001G:          IL_001H:    ldarg.293
11.001I:          IL_001J:    ldarg.294
11.001K:          IL_001L:    ldarg.295
11.001M:          IL_001N:    ldarg.296
11.001O:          IL_001P:    ldarg.297
11.001Q:          IL_001R:    ldarg.298
11.001S:          IL_001T:    ldarg.299
11.001U:          IL_001V:    ldarg.300
11.001W:          IL_001X:    ldarg.301
11.001Y:          IL_001Z:    ldarg.302
11.001A:          IL_001B:    ldarg.303
11.001C:          IL_001D:    ldarg.304
11.001E:          IL_001F:    ldarg.305
11.001G:          IL_001H:    ldarg.306
11.001I:          IL_001J:    ldarg.307
11.001K:          IL_001L:    ldarg.308
11.001M:          IL_001N:    ldarg.309
11.001O:          IL_001P:    ldarg.310
11.001Q:          IL_001R:    ldarg.311
11.001S:          IL_001T:    ldarg.312
11.001U:          IL_001V:    ldarg.313
11.001W:          IL_001X:    ldarg.314
11.001Y:          IL_001Z:    ldarg.315
11.001A:          IL_001B:    ldarg.316
11.001C:          IL_001D:    ldarg.317
11.001E:          IL_001F:    ldarg.318
11.001G:          IL_001H:    ldarg.319
11.001I:          IL_001J:    ldarg.320
11.001K:          IL_001L:    ldarg.321
11.001M:          IL_001N:    ldarg.322
11.001O:          IL_001P:    ldarg.323
11.001Q:          IL_001R:    ldarg.324
11.001S:          IL_001T:    ldarg.325
11.001U:          IL_001V:    ldarg.326
11.001W:          IL_001X:    ldarg.327
11.001Y:          IL_001Z:    ldarg.328
11.001A:          IL_001B:    ldarg.329
11.001C:          IL_001D:    ldarg.330
11.001E:          IL_001F:    ldarg.331
11.001G:          IL_001H:    ldarg.332
11.001I:          IL_001J:    ldarg.333
11.001K:          IL_001L:    ldarg.334
11.001M:          IL_001N:    ldarg.335
11.001O:          IL_001P:    ldarg.336
11.001Q:          IL_001R:    ldarg.337
11.001S:          IL_001T:    ldarg.338
11.001U:          IL_001V:    ldarg.339
11.001W:          IL_001X:    ldarg.340
11.001Y:          IL_001Z:    ldarg.341
11.001A:          IL_001B:    ldarg.342
11.001C:          IL_001D:    ldarg.343
11.001E:          IL_001F:    ldarg.344
11.001G:          IL_001H:    ldarg.345
11.001I:          IL_001J:    ldarg.346
11.001K:          IL_001L:    ldarg.347
11.001M:          IL_001N:    ldarg.348
11.001O:          IL_001P:    ldarg.349
11.001Q:          IL_001R:    ldarg.350
11.001S:          IL_001T:    ldarg.351
11.001U:          IL_001V:    ldarg.352
11.001W:          IL_001X:    ldarg.353
11.001Y:          IL_001Z:    ldarg.354
11.001A:          IL_001B:    ldarg.355
11.001C:          IL_001D:    ldarg.356
11.001E:          IL_001F:    ldarg.357
11.001G:          IL_001H:    ldarg.358
11.001I:          IL_001J:    ldarg.359
11.001K:          IL_001L:    ldarg.360
11.001M:          IL_001N:    ldarg.361
11.001O:          IL_001P:    ldarg.362
11.001Q:          IL_001R:    ldarg.363
11.001S:          IL_001T:    ldarg.364
11.001U:          IL_001V:    ldarg.365
11.001W:          IL_001X:    ldarg.366
11.001Y:          IL_001Z:    ldarg.367
11.001A:          IL_001B:    ldarg.368
11.001C:          IL_001D:    ldarg.369
11.001E:          IL_001F:    ldarg.370
11.001G:          IL_001H:    ldarg.371
11.001I:          IL_001J:    ldarg.372
11.001K:          IL_001L:    ldarg.373
11.001M:          IL_001N:    ldarg.374
11.001O:          IL_001P:    ldarg.375
11.001Q:          IL_001R:    ldarg.376
11.001S:          IL_001T:    ldarg.377
11.001U:          IL_001V:    ldarg.378
11.001W:          IL_001X:    ldarg.379
11.001Y:          IL_001Z:    ldarg.380
11.001A:          IL_001B:    ldarg.381
11.001C:          IL_001D:    ldarg.382
11.001E:          IL_001F:    ldarg.383
11.001G:          IL_001H:    ldarg.384
11.001I:          IL_001J:    ldarg.385
11.001K:          IL_001L:    ldarg.386
11.001M:          IL_001N:    ldarg.387
11.001O:          IL_001P:    ldarg.388
11.001Q:          IL_001R:    ldarg.389
11.001S:          IL_001T:    ldarg.390
11.001U:          IL_001V:    ldarg.391
11.001W:          IL_001X:    ldarg.392
11.001Y:          IL_001Z:    ldarg.393
11.001A:          IL_001B:    ldarg.394
11.001C:          IL_001D:    ldarg.395
11.001E:          IL_001F:    ldarg.396
11.001G:          IL_001H:    ldarg.397
11.001I:          IL_001J:    ldarg.398
11.001K:          IL_001L:    ldarg.399
11.001M:          IL_001N:    ldarg.400
11.001O:          IL_001P:    ldarg.401
11.001Q:          IL_001R:    ldarg.402
11.001S:          IL_001T:    ldarg.403
11.001U:          IL_001V:    ldarg.404
11.001W:          IL_001X:    ldarg.405
11.001Y:          IL_001Z:    ldarg.406
11.001A:          IL_001B:    ldarg.407
11.001C:          IL_001D:    ldarg.408
11.001E:          IL_001F:    ldarg.409
11.001G:          IL_001H:    ldarg.410
11.001I:          IL_001J:    ldarg.411
11.001K:          IL_001L:    ldarg.412
11.001M:          IL_001N:    ldarg.413
11.001O:          IL_001P:    ldarg.414
11.001Q:          IL_001R:    ldarg.415
11.001S:          IL_001T:    ldarg.416
11.001U:          IL_001V:    ldarg.417
11.001W:          IL_001X:    ldarg.418
11.001Y:          IL_001Z:    ldarg.419
11.001A:          IL_001B:    ldarg.420
11.001C:          IL_001D:    ldarg.421
11.001E:          IL_001F:    ldarg.422
11.001G:          IL_001H:    ldarg.423
11.001I:          IL_001J:    ldarg.424
11.001K:          IL_001L:    ldarg.425
11.001M:          IL_001N:    ldarg.426
11.001O:          IL_001P:    ldarg.427
11.001Q:          IL_001R:    ldarg.428
11.001S:          IL_001T:    ldarg.429
11.001U:          IL_001V:    ldarg.430
11.001W:          IL_001X:    ldarg.431
11.001Y:          IL_001Z:    ldarg.432
11.001A:          IL_001B:    ldarg.433
11.001C:          IL_001D:    ldarg.434
11.001E:          IL_001F:    ldarg.435
11.001G:          IL_001H:    ldarg.436
11.001I:          IL_001J:    ldarg.437
11.001K:          IL_001L:    ldarg.438
11.001M:          IL_001N:    ldarg.439
11.001O:          IL_001P:    ldarg.440
11.001Q:          IL_001R:    ldarg.441
11.001S:          IL_001T:    ldarg.442
11.001U:          IL_001V:    ldarg.443
11.001W:          IL_001X:    ldarg.444
11.001Y:          IL_001Z:    ldarg.445
11.001A:          IL_001B:    ldarg.446
11.001C:          IL_001D:    ldarg.447
11.001E:          IL_001F:    ldarg.448
11.001G:          IL_001H:    ldarg.449
11.001I:          IL_001J:    ld
```

6. Podpisywanie



The screenshot shows the Visual Studio 2022 interface. On the left, the 'File System' tree view displays the project structure for 'JP-.NET.Lab01a'. It includes files like 'JP-.NET.Lab01a.dll', 'JP-.NET.Lab01a.il', 'JP-.NET.Lab01a.pdb', 'JP-.NET.Lab01a.res', 'JP-.NET.Lab01a\App.exe', 'JP-.NET.Lab01a\App.il', 'JP-.NET.Lab01a\App.res', 'ProgA.cs', 'ProgB.cs', 'Part5', 'Part6', 'AssemblyInfo.cs', 'ClassA.cs', 'ClassB.cs', and 'paraLuczy.snk'. The 'AssemblyInfo.cs' file is selected and its contents are shown in the main editor area:

```
1  using System.Reflection;
2  [assembly: AssemblyVersion("1.0.0.0")]
3  [assembly: AssemblyKeyFileAttribute("paraLuczy.snk")]
4
```

The 'Terminal' tab at the bottom shows a PowerShell window with the following output:

```
PowerShell 7.5.3
*****
** Visual Studio 2022 Developer PowerShell v17.14.16
** Copyright (c) 2025 Microsoft Corporation
*****
Loading personal and system profiles took 1942ms.
PS Z:\Lab01> cd Part6
PS Z:\Lab01\Part6> sn.exe -k paraLuczy.snk

Microsoft (R) .NET Framework Strong Name Utility Version 4.0.30319.0
Copyright (C) Microsoft Corporation. All rights reserved.

Key pair written to paraLuczy.snk
PS Z:\Lab01\Part6> csc.exe /library ... JP-.NET.Lab01a.dll ..\ClassA.cs ..\AssemblyInfo.cs
PS Z:\Lab01\Part6> (8) Visual C# Compiler version 4.14.0-3.25412.0 (c167adef)
Copyright (C) Microsoft Corporation. All rights reserved.

PS Z:\Lab01\Part6> .\JP-.NET.Lab01a\App.exe

Unhandled Exception: System.IO.FileLoadException: Could not load file or assembly 'JP-.NET.Lab01a, Version=1.0.0.0, Culture=neutral, PublicKeyToken=null' or one of its dependencies. The located assembly's manifest definition does not match the assembly reference. (Exception from HRESULT: 0x80131040)
   at JP-.NET.Lab01a.Program.Main()
PS Z:\Lab01\Part6>
```

```
PS Z:\Lab001\Part6> .\UP.NET.Lab01App.exe
Unhandled Exception: System.IO.FileLoadException: Could not load file or assembly 'UP.NET.Lab01a, Version=1.0.0.0, Culture=neutral, PublicKeyToken=null' or one of its dependencies. The located assembly's manifest definition does not match the assembly reference. (Exception from HRESULT: 0x80131040)
PS Z:\Lab001\Part6> UP.NET.Lab01a_Program.cs
PS Z:\Lab001\Part6> UP.NET.Lab01a.exe <--> UP.NET.Lab01App.exe ..\UP.NET.Lab01a.dll ..\ProgA.cs
Microsoft (R) Visual C# Compiler version 4.14.0-3.25412.6 (c167adef)
Copyright (C) Microsoft Corporation. All rights reserved.

PS Z:\Lab001\Part6> UP.NET.Lab01App.exe
Wydruk klasa 1.0
PS Z:\Lab001\Part6>
```

7. Rejestracja w GAC

```
Administrator: PowerShell
PS Z:\Lab01\Part7> gacutil.exe /i .\JP_NET.Lab01a.dll
Microsoft (R) .NET Global Assembly Cache Utility. Version 4.0.30319.0
Copyright (c) Microsoft Corporation. All rights reserved.

Assembly successfully added to the cache
PS Z:\Lab01\Part7> |
```

```
File System
Lab01
  idea
  docs
  Part1
  Part2
  ...
  Part6
  Part7
    AssemblyInfo.cs
    ClassA.cs
      JP.NET.Lab01App.exe
      JP.NET.Lab01AppNew.exe
      paraKlucz.snk
      ProgA.cs
      <>Folder.DotSettings.user
  Scratches and Consoles

AssemblyInfo.cs
public partial class ClassA
{
    public void MethodOfClassA()
    {
        fvi.ProductMinorPart();
        PartialMethodOfClassA(x);
    }
    ◆ IL code
    partial void PartialMethodOfClassA(object x);
    ◆ IL code
    partial void PartialMethodOfClassA(object x)
    {
        System.Console.WriteLine("Wydruk z nowej" + " " + "klasy A. {0}", x);
    }
}

ClassA.cs
6
11
16
17
18
19
20
21
22
23
24
25

Administrator: PowerShell
PS Z:\Lab01\Part7> gacutil.exe /i .\JP_NET.Lab01a.dll
Microsoft (R) .NET Global Assembly Cache Utility. Version 4.0.30319.0
Copyright (c) Microsoft Corporation. All rights reserved.

Assembly successfully added to the cache
PS Z:\Lab01\Part7> gacutil.exe /i .\JP_NET.Lab01a.dll
Microsoft (R) .NET Global Assembly Cache Utility. Version 4.0.30319.0
Copyright (c) Microsoft Corporation. All rights reserved.

Assembly successfully added to the cache
PS Z:\Lab01\Part7> gacutil /l JP.NET.Lab01a
Microsoft (R) .NET Global Assembly Cache Utility. Version 4.0.30319.0
Copyright (c) Microsoft Corporation. All rights reserved.

The Global Assembly Cache contains the following assemblies:
JP.NET.Lab01a, Version=1.0.0.0, Culture=neutral, PublicKeyToken=aa9bd31efbce0853, processorArchitecture=MSIL
JP.NET.Lab01a, Version=1.0.0.1, Culture=neutral, PublicKeyToken=aa9bd31efbce0853, processorArchitecture=MSIL

Number of items = 2
PS Z:\Lab01\Part7> |
```

```
File System
Lab01
  Part5
  Part6
    AssemblyInfo.cs
    ClassA.cs
    ClassB.cs
    JP.NET.Lab01a.dll
    JP.NET.Lab01App.exe
    JP.NET.Lab01AppNew.exe
    paraKlucz.snk
    ProgA.cs
    <>Folder.DotSettings.user
  Scratches and Consoles

AssemblyInfo.cs
public partial class ClassA
{
    public void MethodOfClassA()
    {
        fvi.ProductMinorPart();
        PartialMethodOfClassA(x);
    }
}

ClassA.cs
6
11
16
17
18
19
20
21
22
23
24
25

Administrator: PowerShell
PS Z:\Lab01\Part7> .\JP.NET.Lab01App.exe
Wydruk z Klasy A. 1.0
PS Z:\Lab01\Part7> .\JP.NET.Lab01AppNew.exe
Wydruk z nowej klasy A. 1.0
PS Z:\Lab01\Part7> |
```

C:\Windows\Microsoft.NET\assembly\GAC_MSIL\JP.NET.Lab01a>

Name	Date modified	Type	Size
v4.0_1.0.0._aa9bd31efbce0853	10/4/2025 10:42 AM	File folder	
v4.0_1.0.1._aa9bd31efbce0853	10/4/2025 10:44 AM	File folder	

8. ZTM API

```
• kanareklife@workstation:~/Projects/JP.NET$ cd Lab01/Part8
• kanareklife@workstation:~/Projects/JP.NET/Lab01/Part8$ make
Building project...
./build-dotnet.sh --target=Build
Running: dotnet cake build.cake --target=Build

=====
Clean
=====

=====
Restore-NuGet-Packages
=====
Restore complete (0.5s)

Build succeeded in 0.6s

=====
Build
=====
    OtwarterDane.Cli succeeded (0.3s) → OtwarterDane.Cli/bin/Release/net9.0/OtwarterDane.Cli.dll
    OtwarterDane.Tests succeeded (0.2s) → OtwarterDane.Tests/bin/Release/net9.0/OtwarterDane.Tests.dll

Build succeeded in 0.8s

Task          Duration
-----
Clean          00:00:00.0104291
Restore-NuGet-Packages 00:00:00.7173430
Build          00:00:00.2965500
-----
Total:        00:00:01.0042230
file:///home/kanareklife/Projects/JP.NET/Lab01/Part8/OtwarterDane.Cli/bin/Release
          /net9.0 (ctrl + click)
◆ kanareklife@workstation:~/Projects/JP.NET/Lab01/Part8$
```

```
kanareklife@workstation:~/Projects/JP.NET/Lab01/Part8$ ./publish/
Display all 200 possibilities? (y or n)
❷ kanareklife@workstation:~/Projects/JP.NET/Lab01/Part8$ ./publish/OtwarteDane.Cli
Required command was not provided.

Description:
    Narzędzie CLI do otwartych danych ZTM w Gdańsku

Usage:
    OtwarteDane.Cli [command] [options]

Options:
    --version      Show version information
    -?, -h, --help  Show help and usage information

Commands:
    departures <stopId>  Pobiera estymowane czasy odjazdów z przystanku
    search <query>        Wyszukuje przystanek po nazwie
    info <stopId>         Wyświetla szczegółowe informacje o przystanku

❸ kanareklife@workstation:~/Projects/JP.NET/Lab01/Part8$ ./publish/OtwarteDane.Cli departures 199
Pobieranie odjazdów dla przystanku ID: 199...

Ostatnia aktualizacja: 2025-10-04 09:33:28
Liczba odjazdów: 3
```

Linia	Kierunek	Rozkład	Estymowany	Opóźnienie	Status
155	Łostowice Św...	09:35	09:34	0 min	● Na żywo
155	Łostowice Św...	10:05	10:02	-2 min	● Na żywo
155	Łostowice Św...	10:35	10:35	---	● Rozkład

```
❹ kanareklife@workstation:~/Projects/JP.NET/Lab01/Part8$
```