Assignment 1 – Assembly Analyzing and Basic C# Programing

Part A – Sherlock Holmes

Goals

- Absorption of the basic concepts of software development using the .NET framework
  - PE
  - Assembly
  - MSIL
  - Metadata
- Familiarizing and working with the ILDASM tool (which is part of the set of development and analyzing tools that comes with the .NET framework)
- Familiarizing with and exposure to MSIL / CIL code
- Familiarizing with and exposure to Assembly Manifest
- Understanding the pros and cons of managed code

Required Knowledge

- Familiarity with the structure and content of a .NET assembly and the rest of the basic concepts
- Working with ILDASM – Intermediate Language Disassembler
- Video Tutorials (watch by this order):
  - **01 - Cross Platform .NET Framework Summary, NET Assembly Summary, MSIL and Metadata** https://youtu.be/GfP6u5dph-E
  - **02 - The Process of Managed Execution:** https://youtu.be/7V8238ZZydg

Prepared in advance

- The .zip file, which contains this very document, also contains another file called Ex01.exe
- A computer with the .NET framework installed (so Ex01.exe can be executed and analyzed with ILDASM)

The Assignment:

You are given a file named Ex01.exe, which is a .NET executable application (which is in fact a sort of implementation of some of the programing tasks from the second part of this assignment, and some extras, in one program.

- Analysis of binary series
- Advanced hourglass

When you run the file you will be asked to enter a user name and password to continue the program.

The username and password can be revealed by a simple detective operations on the file using the assembly analysis tool called ILDASM

Reminder:

In order to run the ILDASM tool, you'll need to run the Developer Command Prompt (Console Window) for Visual Studio, which you can look for by typing "Developer Command" in windows search box.
Full instructions can be found here.

In the Console window, you can navigate to the folder in which the Ex01.exe resides (by using the 'CD' command as demonstrated in class) and typing the following command:

```
[the dir of the exe file]\>ildasm Ex01.exe
```

Othewise, you can just run the ILDASM tool from any folder location and dragging the Ex01.exe file into the ILDASM window..

More on the next page..

<u>After running ILDASM and opening Ex01.exe with it, answer the following questions:</u>

1. **Is Ex01.exe a .NET Assembly? (Yes/No) – Mark the correct answer.**
2. **Is Ex01.exe a .NET PE? (Yes/No) – Mark the correct answer.**

Please provide a short explanation that supports your answers:

_____

_____

_____

._____

Please provide the following info about the Assembly which is contained in Ex01.exe

a. Name: _____

b. Version: _____

c. In which section in the assembly you can find the answers to the previous questions (a, b)? _____

d. Which assemblies are being referenced by this assembly?

Name: _____ Version: _____

Name: _____ Version: _____

Name: _____ Version: _____

Name: _____ Version: _____

3. **Analyzing the Metadata and MSIL**

Please provide a full Metadata description about all the Types in the assembly:

a. **The type of the Type (class, struct, enum, etc..)**

b. **The name of the type**

c. **List of members (data members / methods) declared in the Type, and for each one: Name, Type, static/instance, Access Modifier (public / private), Return Value Type (if it's a method), List of Parameter Types and Names (if it's a method).**

Provide your answer in a table like such:

Type (Struct/Class/Enum)	**Name**	**Members (methods, fields)**
Class	SomeClass	• public static int SomeMethod(float) • …
		• .. •

4. What is the Username and Password that should be typed in order to run the application? (a small detective task..)
5. Run the application and get a general understanding of what is expected from you in the next section of the assignment

Part B – Basic C# Programing

Goals

- Developing a basic .NET/C# application using Visual Studio
- Practicing programing using basic C# syntax and I/O operations using Console
- Familiarizing with types and classes like string, int, float, char, math, StringBuilder

Required Knowledge

- Using Microsoft Visual Studio IDE
- Basic C# syntax and .NET Types
  - Classes
  - Namespace
  - Static Methods
  - Method Parameters
  - Value Types (int, bool, etc.)
  - System.Console class
- Video Tutorials (mandatory watch by this order):
  - **03 - Using Visual Studio and Debugger**
    https://youtu.be/RwxwrPDTwOA
  - **04 – My First VS App**
    https://youtu.be/aFK-f_gzUkQ
  - **05 - String Concatention vs String Formatting:**
    https://youtu.be/Wa_izcnjCS0
  - **06 – Namesapces:**
    https://youtu.be/ECe81t3vY0A

Prepared in advance

- Visual Studio installed

The Assignment

Create an **empty** Visual Studio **solution** (Use the naming instructions as described in the Assignments Submission Instruction document that can be found in the course's web site), and then add Visual Studio Projects to the solution.

Meaning, in Visual Studio, first create a blank solution:

File→New→Project→Other Project Types→Visual Studio Solutions→Blank Solution

And then, for each one of the following tasks, add an empty project to the solution:

[Right-Click on the solution node in the tree] → Add → New Project... → C# → Windows → Empty Project

Project name format should be B18_Ex01_XX (while XX stands for the task number)

- **Please read the elaborated document about creating VS projects or this assignment that can be found in the courses web site, named "VisualStudio_Instructions_B18_English.pdf"**

1. **Task 1: Binary Series**

Create a C# Console Application that takes **3 positive integers** from the user, in a Binary format, **9 digits each**, separated by 'enter' hits (after each integer, the user hits 'enter').

You Must prompt the user upon illegal input.

The application will then convert the integers to decimal representation and will display the decimal representations to the user as output.

In addition, the application will display the following info regarding these numbers:

- The average number of 0/1 digits (bits) in the binary representation of the numbers
- How many of the integers are a power of 2
- How many of the integers consist of digits which are a "strictly monotonically decreasing sequence" (i.e. 541)
- The average value of the integers

Provide execution examples using the following inputs:

a. **011010000 ,110100101 ,110011000**

   The numbers are 208, 421, 408, none of them are power of 2, one of them consists of digits which are a "strictly monotonically decreasing sequence" (i.e. 421)

b. **000100110 ,000100000 ,000101000**

c. **010111101 ,011001101 ,001101001**

2. **Task 2 - Sand clock for beginners**

Create a C# Console application that displays the following Sand Clock made of asterisks:

```
*****
 ***
  *
 ***
*****
```

Obviously there are several implementations for this task, one of them is to pre-prepare 5 strings of asterisks in advance, but your implementation should call Console.WriteLine **only once and not inside a loop.**

3. **Task 3 – Advanced Sand Clock**

Create a C# Console application that displays the a Sand Clock made of asterisks, with any requested height (as input from the user). **Prompt the user upon every Illegal input.**

Try implement it by referencing the project form Task 2.

Provide execution examples using the following inputs: 4, 5, 7, 8

(Treat even inputs by adding an addition raw of asterisks or by adding 1 to the even input)

4. **Task 4 - Text analyzing**

Create a C# Console application that takes a string from the user, that consists of 8 characters (i.e. **abctabab**) and provides the following info the user as output:

1. Is the string a Palindrome

2. If the input is a number, is it an Even or an Odd number.
3. If the string is in English, the number of non-capital letters in the string

Note: The input should consist of English letters only or digits only! (i.e. ab45bbr6 is illegal)

5. Task 5 – Numeric Statistics

Create a C# Console application that takes an integer from the user that consists of 6 digits (i.e. **45665478**) and provides the following info the user as output:

1. The largest digit
2. The smallest digit
3. Howe many digits are Even
4. The number of digits that are lesser than the units digit

Note:

1. You **Must** use the following classes / methods:
    a. StringBuilder (needs self-research)
    b. string.Format
    c. int.TryParse (needs self-research. A code example is available in the course's site)
    d. Math (needs self-research)
    e. Char (needs self-research)
    f. Any relevant method of class string.
2. A relevant code example is available in the course's site
3. Task 1 should be implemented without using any existing method that converts from binary rep. to a decimal rep. The conversion should be implemented manually.
4. We have not yet discussed topics that relate to using classes and creating objects / instances in C# and therefore, at this point, you should implement the tasks using **static** methods only, and without separating your code into several classes, but rather create one 'Program' class for each project for each task, containing all the relevant methods.
    DO NOT implement the entire login in the Main method but rather separate your implementation into methods, that will be called from the Main method etc.
    The sole role of the Main method is to be the Entry Point to the program.

Submission

- Submit your assignment by Monday, April 9th 2018, 22:00
- Send your submission to the email address as described in the "Ex_Submit_Instructions_DN_IDC_18B_English.pdf" document, which can be found in the course's site. Points will be redacted for not following the instructions carefully.
- Do not add any XML code documentation
- Execution examples should be provided by pasting the screenshots of the console into the Word document which you submit as the solution for Part A of this assignment.

Place the Word document in the same folder of the .sln file of your solution.

The document name should be: Ex01_SolutionAndScreenShots.docx

- You must use ALL coding standards and naming conventions instructions, as described in the "CodingStandards.pdf" document which can be found in the courses site.

  Points will be redacted for not following the instructions carefully.
- Any delay in submission will result in 4 Points reduction per-day
- You are advised to use the course's private Facebook group for any questions regarding the assignment -

  https://www.facebook.com/groups/dn.course.idc.B18
- Avoid cheating (Do not use other students assignments as a basis for yours. Refrain from copying the work of fellow students from your group or previous semesters. Cheaters will be caught and punished. Work independently!)

Good Luck!