<u>**Course**</u> **:** **OO Programming with C#.NET**
<u>**Date**</u>**:** **10/26/ 2022**
<u>**Student**</u> **Name:**

Homework No.3

Problem 1.

The **Route Cipher** is a transposition cipher where the key is which route to follow when reading the ciphertext from the block created with the plaintext. The plaintext is written in a grid, and then read off following the route chosen.

Encryption

First we write the plaintext in a block of reasonable size for the plaintext. Part of your key is the size of this grid, so you need to decide on either a number of columns or number of rows in the grid before starting. Once the plaintext is written out in the grid, you use the Route assigned. This could be spiraling inwards starting from the top left corner in a counterclockwise direction, or spiraling inwards starting from the bottom left right corner in a counterclockwise direction.

As an example, lets encrypt the plaintext "abort the counterclockwise he mission, you have been spotted". First we need to decide on the number of columns we are going to use, lets say 5.

A	B	O	R	T
T	H	E	M	I
S	S	I	O	N
Y	O	U	H	A
V	E	B	E	E
N	S	P	O	T
T	E	D	X	X

Therefore the plaintext is written in a grid with 5 columns Notice how we have filled the last cells of the grid with the single 'X' character to make a nice rectangle.

Next, we choose which route we want to use to encrypt the message. Assume the key is a signed integer value, whose absolute value defines the number of the columns. If it is a positive number the inward spiral starts from the top left corner of the grid. Otherwise, the spiral starts from the lower right corner of the grid. Because the selected key 5 is a positive number we get the ciphertext:

"ATSYVNTEDXXTEANITROBHSOESPOEHOMEIUB".

In case we have selected -5 as a cipher code then the spiraling inwards counterclockwise from the bottom right we get: "XTEANITROBATSYVNTEDXOEHOMEHSOESPBUI".

Decryption

To decrypt a message received that has been encoded with the Route Cipher, we need to know the route used and the width or height of the grid. We then start by constructing a blank grid of the right size, and then place the ciphertext letters in the grid following the route specified.

For example, to decrypt the ciphertext "TIEIXTXXEAHSIHSPNTLT" with the route spiral inwards counter-clockwise from the top right, with a grid width of 4, we follow the process shown below to obtain the text THISISTHEPLAINTEXT.

Programming assignment

Write a **C# Console application** to **implement the encryption and decryption process for the Route Cipher** <u>using</u> the *String.toCharArray()* method and arrays of *char* datatype as in the following example

> **string cipherText = "**abort the mission, you have been spotted**";**
>
> **char [] cipherTextChars = cipherText.ToCharArray(); // to char array**
>
> **string text = new String(cipherTextChars);   // to string**

DO NOT USE ANY OTHER String METHODS!

The cipher key should be a signed integer number, whose absolute value is equal to the number of columns in the grid used in the Route cipher. In case the key is positive then route for encrypting and decrypting starts from the first cell in the upper left corner of the grid. Otherwise, the route for encrypting and decrypting starts from and the lower right corner.

Use **OO design** and define a **class RouteCipher** with respective data, constructors and methods, allowing you to implement the above encryption/ decryption functionality. In particular use the following OO model for **class RouteCipher**

```
RouteCipher

-key: int
..............................................................................
+<constuctor>RouteCipher(key: int)
+Key{get;set;}: int
+Encrypt(plainText : string): string
+Decrypt(ciphertext: string): string
+ToString():String
```

Test encryption / decryption of a string using different cipher keys with a **class RouteCipherTest**.

Hint: Read https://stackoverflow.com/questions/726756/print-two-dimensional-array-in-spiral-order and implement an algorithm to iterate through the elements of a rectangular array in a spiral pattern.