IF100
Nested Loops - Practice #2

Introduction

The aim of this example is to practice sequences (i.e. list, string, range) and loops (for and while statements, and nested loops). The use of sequences and loops is due to the nature of the problem; that is, you cannot finish this practice assignment without using sequences and loops.

Description

Cryptography is the practice and study of techniques for secure communication in the presence of third parties called adversaries. In classical cryptography, one of the main cipher types is the substitution cipher, which systematically replaces letters with other letters. Following is one such cipher: you can take the alphabet and map it to its reverse so that the first letter becomes the last letter, the second letter becomes the second to last letter, and so on (see *Figure 1* and *Figure 2* below). For example, when you encrypt "duygu" using this cipher, you will end up with "wfbtf", or if you encrypt "inanc", you will get "rmzmx". In this particular cipher, the decryption method is the same as the encryption method; for each letter, you just need to find the respective mapped letter. In this example, you will write a Python program that either encrypts a plaintext or decrypts a ciphertext using the above-mentioned algorithm.

Your program will start by displaying a menu of options, where the user can select to (1) encrypt a plaintext, (2) decrypt a ciphertext, or (3) exit. Then, your program will prompt for the choice of the user and check the validity of this input. At this point, the user is expected to enter either "1", "2" or "3". Any other value entered by the user should be considered as an incorrect input. If the user enters an invalid input, your program should repeatedly display the menu and prompt for a choice until the user enters a valid value as his/her choice.

When the user enters a valid input, if (s)he selects the last option, then your program will display a goodbye message and terminate its execution. Otherwise, your program will prompt for either the plaintext or ciphertext, depending on the choice of the user. Once your program gets the text to be encrypted or decrypted, it will then perform the respective operation by following the algorithm of the cipher described above and display the result of the required encryption or decryption. The text provided by the user may contain any characters, but only the English letters (either lowercase or uppercase) should be encrypted or decrypted, the rest (digits, empty space, punctuations or any other characters) should simply be repeated in the encrypted/decrypted version of the given text. In other words, the characters

other than English uppercase/lowercase letters should stay the same with the encrypted/decrypted version.
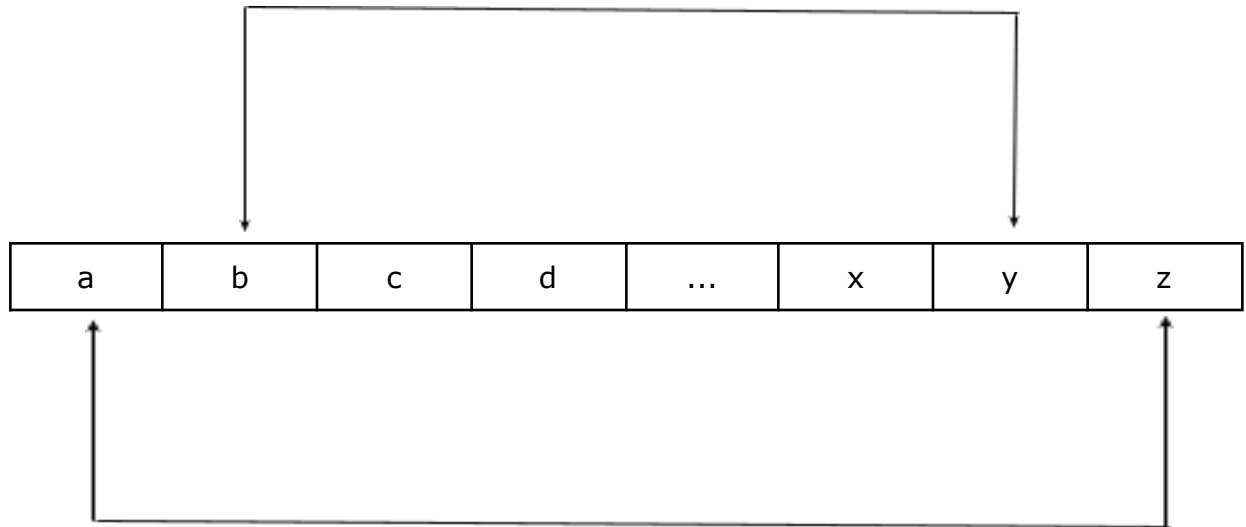
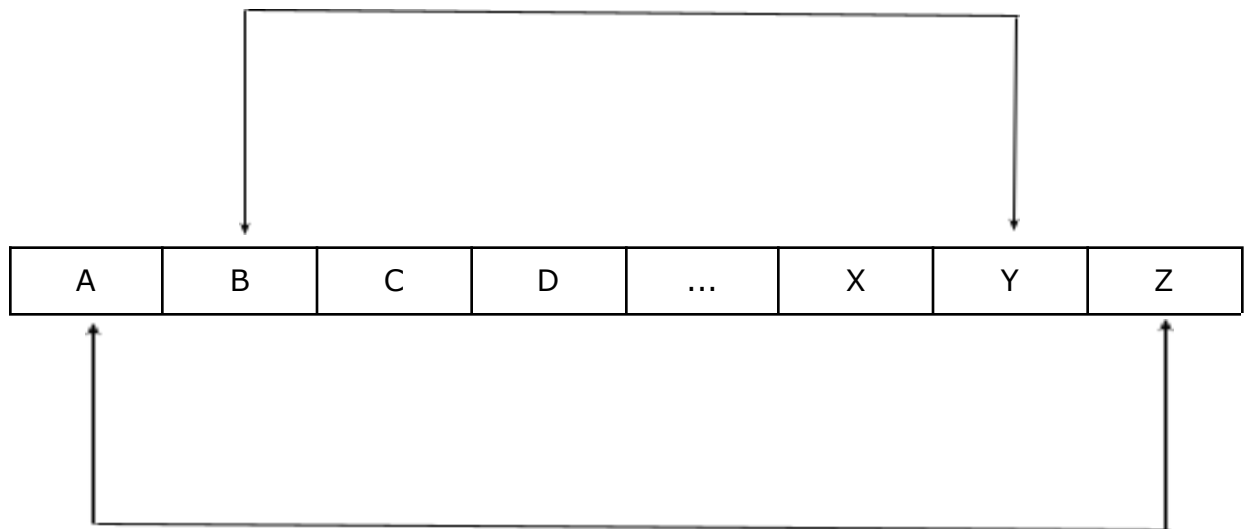| a | b | c | d | ... | x | y | z |

Figure 1

| A | B | C | D | ... | X | Y | Z |

Figure 2

Thereafter, your program should re-display the menu of options, re-prompt for the choice of the user and continue its execution as described above until the user selects to exit the program.

Please see "Sample Runs" section in order to understand the flow of the program, the inputs and outputs in a better way.

Inputs and Outputs

The inputs of the program and their order are explained below. Please see "Sample Runs" section for some examples.

There are two inputs to your program, in the order given below:

1. Choice of the user
2. Text to be encrypted/decrypted

The prompts of the input statements to be used has to be exactly the same as the prompts of the "Sample Runs".

Your program should perform input check for its first input as given below:

- Choice of the user must be either "1", "2", or "3".

If the user enters an invalid input, then your program should display an appropriate error message (specifically, "*Invalid input!*") and prompt for the same input again until the user enters a valid value.

When the user provides a valid choice, then there will only be one output of your program at a specific iteration: result of the requested encryption/decryption. Hence, the output can be one of the following:

- *Encryption of '<u>text</u>' is '<u>result</u>'.*
- *Decryption of '<u>text</u>' is '<u>result</u>'.*

Sample Runs

Below, we provide some sample runs of the program that you will develop. The *italic* and **bold** phrases are inputs taken from the user. You may <u>not</u> change any of the prompt sentences. Your program should be presented exactly like these sample runs.

Sample runs are not %100 comprehensive. You are required to read the whole documentation and decide on what other cases you might try your program with.

Sample Run 1

```
Please select one of the options below:
1-Encrypt the text
2-Decrypt the text
3-Exit
Enter your choice: a
Invalid input!

Please select one of the options below:
1-Encrypt the text
2-Decrypt the text
3-Exit
Enter your choice: A
Invalid input!

Please select one of the options below:
1-Encrypt the text
2-Decrypt the text
3-Exit
Enter your choice: AA
Invalid input!

Please select one of the options below:
1-Encrypt the text
2-Decrypt the text
3-Exit
Enter your choice: 10
Invalid input!

Please select one of the options below:
1-Encrypt the text
2-Decrypt the text
3-Exit
Enter your choice: 0
Invalid input!

Please select one of the options below:
1-Encrypt the text
2-Decrypt the text
3-Exit
Enter your choice: 3
Bye…
```

Sample Run 2

```
Please select one of the options below:
1-Encrypt the text
2-Decrypt the text
3-Exit
Enter your choice: 1
Please enter the plaintext: duygu
Encryption of 'duygu' is 'wfbtf'.

Please select one of the options below:
1-Encrypt the text
2-Decrypt the text
3-Exit
Enter your choice: 1
Please enter the plaintext: Duygu ve Inanc
Encryption of 'Duygu ve Inanc' is 'Wfbtf ev Rmzmx'.

Please select one of the options below:
1-Encrypt the text
2-Decrypt the text
3-Exit
Enter your choice: 1
Please enter the plaintext: Inanc1907
Encryption of 'Inanc1907' is 'Rmzmx1907'.

Please select one of the options below:
1-Encrypt the text
2-Decrypt the text
3-Exit
Enter your choice: 3
Bye…
```

Sample Run 3

```
Please select one of the options below:
1-Encrypt the text
2-Decrypt the text
3-Exit
Enter your choice: 2
Please enter the ciphertext: wfbtf
Decryption of 'wfbtf' is 'duygu'.

Please select one of the options below:
1-Encrypt the text
```

```
2-Decrypt the text
3-Exit
Enter your choice: 2
Please enter the ciphertext: Wfbtf ev Rmzmx
Decryption of 'Wfbtf ev Rmzmx' is 'Duygu ve Inanc'.

Please select one of the options below:
1-Encrypt the text
2-Decrypt the text
3-Exit
Enter your choice: 2
Please enter the ciphertext: Rmzmx1907
Decryption of 'Rmzmx1907' is 'Inanc1907'.

Please select one of the options below:
1-Encrypt the text
2-Decrypt the text
3-Exit
Enter your choice: 3
Bye...
```

Sample Run 4

```
Please select one of the options below:
1-Encrypt the text
2-Decrypt the text
3-Exit
Enter your choice: 3
Bye...
```

Sample Run 5

```
Please select one of the options below:
1-Encrypt the text
2-Decrypt the text
3-Exit
Enter your choice: 1
Please enter the plaintext: 12345
Encryption of '12345' is '12345'.

Please select one of the options below:
1-Encrypt the text
2-Decrypt the text
3-Exit
Enter your choice: if100
```

```
Invalid input!

Please select one of the options below:
1-Encrypt the text
2-Decrypt the text
3-Exit
Enter your choice: 3
Bye...
```

Sample Run 6

```
Please select one of the options below:
1-Encrypt the text
2-Decrypt the text
3-Exit
Enter your choice: 2
Please enter the ciphertext: abc ?! DEF .. ghi, JKL ++ mno & PQR ( stu
vwx) YZ*
Decryption of 'abc ?! DEF .. ghi, JKL ++ mno & PQR ( stu vwx) YZ*' is
'zyx ?! WVU .. tsr, QPO ++ nml & KJI ( hgf edc) BA*'.

Please select one of the options below:
1-Encrypt the text
2-Decrypt the text
3-Exit
Enter your choice: 3
Bye...
```

Sample Run 7

```
Please select one of the options below:
1-Encrypt the text
2-Decrypt the text
3-Exit
Enter your choice: 1
Please enter the plaintext: IF100 is an easy course.
Encryption of 'IF100 is an easy course.' is 'RU100 rh zm vzhb
xlfihv.'.

Please select one of the options below:
1-Encrypt the text
2-Decrypt the text
3-Exit
Enter your choice: 2
Please enter the ciphertext: RU100 rh zm vzhb xlfihv.
```

```
Decryption  of  'RU100  rh  zm  vzhb  xlfihv.'  is  'IF100  is  an  easy
course.'.

Please select one of the options below:
1-Encrypt the text
2-Decrypt the text
3-Exit
Enter your choice: 3
Bye...
```

Programming and Coding Advice

You can decompose the problem into smaller and easier subproblems in two different ways. In the first way, you can (1) form the loop that will enable the user to enter his/her choice continuously until (s)he selects to exit, and (2) extend the code so that when the user enters a valid choice, the program proceeds with the requested operation. In the second way, you can (1) write the code of the cipher algorithm, obtain the text from the user and encrypt/decrypt the given text, and (2) extend the code so that it works continuously until the user wants to exit.