ENGG1330 Computer Programming

Tutorial 8

Aims and Objective:

1. Demonstrate working knowledge on string operation
2. Solve problem with String

1. Write a program that read a list of positive numbers, either in decimal or hexadecimal, and convert them into decimal. The hexadecimal number is always started with 0x and all numbers are separated by comma ",". Output all the numbers in a single line and ended with a space (not newline character)

   Note: To covert a hexadecimal x into decimal, use function "int(x, 16)"

Case	Input	Output
1	56,20,0x23,11,0x11	56 20 35 11 17
2	1,2,30,50,90,7	1 2 30 50 90 7
3	0x20	32

2. Modify your program in (1) such that it can handle extra space and missing leading 0 in hexadecimal number.

Case	Input	Output
1	56, 20 , x23, 11, 0x11	56 20 35 11 17
2	1, 2, 30,50, 90,7	1 2 30 50 90 7
3	x20	32

3. A Farmer, Peter, wants to have a secret communication with his friend. The following table (in green colour) is his codebook to encrypt his message. For each alphabet letter in his message, he first divides its position by 10 and obtains a reminder. The reminder acts as an index to locate a row in the table. The alphabet value of the letter will then determine the column index to locate the code of the letter from the table. Letter 'a' will be mapped to the first column and letter 'b' will be mapped to the second column.

```
  abcdefghijklmnopqrstuvwxyz
0 yhspqedirgvxwlukzofjambntc
1 rlhpndkqgjvszobmfiaeutcyxw
2 lizncrmbtouhdxsfapeqjvwkyg
3 kqlhazijdusvcrwnoxfpytebgm
4 gpfersjxwlokqacznutdhvbmyi
5 hjplgsdyxmoubnftqczawvkire
6 vmpeysukjtlwichdfobaqngzrx
7 yujmdqvtegrinhsolkwazfbpxc
8 mzgfoherplkuaxbicdjtnsvqwy
9 openjagrvqtxhdwzblcuiysfmk
```

For example, to encrypt word "Peter":

To encrypt the first letter 'P', row 0 will be first selected:

```
  abcdefghijklmnopqrstuvwxyz
0 yhspqedirgvxwlukzofjambntc
```

The letter 'p', after ignore its case, should map to 'k' .

To encrypt the second letter 'e', row 1 will be selected:

```
  abcdefghijklmnopqrstuvwxyz
0 yhspqedirgvxwlukzofjambntc
1 rlhpndkqgjvszobmfiaeutcyxw
```

The letter 'e', after ignore its case, should map to 'n' .

The final cipher text should be "Knqau"

Currently Peter encrypts and decrypts his messages manually, which is very time-consuming. He wishes you can help him automate this process with computer program. His codebook is stored in a file "key.txt"

The first character of the input is either 'e' or 'd' followed by the message (without line break nor space). If the first character is 'e' the message should be encrypted, and if the first character is 'd', the message should be decrypted.

Case	Input	Output
1	eDear Mary, how are you	Pnlx Bvkw, qse hod muu
2	dR lc sjho	I am fine
3	djrhs ah wwa hkdgo	talk to you later

Hints:

1. Create a 2D character array
    a. Copy the codebook from file "key.txt" (available in course Moodle) to your program
    b. Fill the 2D array with the characters from "key.txt"
    c. (you may print the content of 2D array to see if the function work properly)

```
for i in range(10):
    for j in range(26):
        print(codebook[i][j],end="")
    print()
```

2. Write a function to encrypt the message: It should
    a. Accepts the 2D character array (codebook), a character array that contain the message to be encrypted as parameters
    b. Encrypt the message and write back to the character array

3. Write a function to decrypt the message: It should
    a. Accepts the 2D character array (codebook), a character array that contain the ciphertext to be decrypted as parameters
    b. Decrypt the ciphertext and write back to the character array

You may encrypt a message and then decrypt it to plain text to verify your program.

Appendix: 2D array

To create a 2D list in python, we can firstly create a list, and then append a list to the first list. For example:

```
a=[]                        #first list

for i in range(10):
    b=[]                    #second list
    for j in range(10):
        b.append(j*i)       #set data to b[j]

    a.append(b)             #put the second list to a[i]


for i in range(10):
    for j in range(10):
        print(f"{a[i][j]:3}",end=" ")

    print()
```