

COMP3001 Foundations of Computer Programming

Coursework 1 (25% of module mark)
Deadline: Friday 29th April 2022

The Problem

Encryption is the process of encoding messages (or plaintext) in such a way that only those that are authorized can read. Each message is encrypted using an algorithm, turning it into unreadable ciphertext, usually with an encryption key. Unauthorized parties should not be able to determine the original message from the ciphertext, but authorized parties can decode it using a decryption algorithm that usually also requires a secret decryption key.

Many encryption algorithms break the message into blocks which are encoded separately using the same key. In this coursework, you will implement a simple shift encryption algorithm that uses your student number as an encryption and decryption key for each block of 8 letters in messages. So for example, if your student number were **11223344** then the message **aabbccdd** would be encrypted to **bbddffhh**. Here, each character of the message has been shifted the corresponding digit to the right to write the encrypted character. If the result of shifting the key to the character is no longer a letter, then the letter wraps round, so for example **aaaavvyy** would be encrypted to **bbccyycc** with the key **11223344**. For messages that are longer than 8 digits, each block of 8 letters is encoded separately using the 8 digit key, working from left to right and ignoring the blank spaces, and characters that are not in the alphabet. So for example,

“This is a secret message!!” with the key **12345678**

is encrypted to

Ujlw ny h afeuiy slaticji!!

Your task

In this assignment you will be asked to write some functions that will allow you to encrypt and decrypt words. You have to implement each of these functions, test cases for each function can be found in Replit. At the end you will use this function to implement the program that will encrypt text of any length.

You will lose marks if you do not use the functions appropriately when they are needed. All the functions will need to be implemented without using any of the built-in functions in Python unless you are told otherwise.

Please read the specification carefully and make sure that a function works before attempting the next one.

Coursework Specification

Question 1: code_char [2 marks]

Write a Python function called `code_char(c, key)` that takes a letter and a digit as input, and returns the letter shifted key positions to the right in the alphabet. The function should work with standard letters (uppercase or lowercase). You can assume that parameter `c` is always a letter from the alphabet.

Note: A version of this function has already been implemented and it is one of your portfolio exercises.

Example:

```
>>> code_char('a', 2)
'c'
>>> code_char('U', 6)
'A'
```

You may need to use the following Python built-in function:

- `chr` that given an ASCII code returns the corresponding character

```
>>> chr(90)
'Z'
```
- `ord` given a character returns its ASCII code

```
>>> ord('j')
106
```

Question 3: encrypt an 8-letter word [5 marks]

Now you need to implement a function called `code_block(word, key)` that takes an 8-letter word and an 8-digit key as parameters and encrypt each letter of the word with the corresponding digit of the key. The function `code_block` must call the function `code_char` that you have implemented in question 1.

```
>>> code_block('abcdefgh', '12121212')
'bddffhhj'
>>> code_block('xxyyxxaa', '44556677')
'bbddddhh'
```

- You will need to use the string concatenation operator + for joining up strings.

```
>>> 'a'+'b'
'ab'
```

- The key used to encrypt the message is a string so you will need the built-in function int to convert an ASCII digit into its corresponding number

```
>>> int('4')
4
```

Question 5: is a letter? [2 marks]

Write a function that given a character returns true if it is a letter otherwise returns false

```
>>> isletter('b')
True
>>> isletter('!')
False
```

You have to implement this function from scratch, you cannot use the string methods such as: isalpha

Question 6: Encryption [6 marks]

Now you have to write the function encrypt that receives a string of any length and 8-digit key and encrypts the message. This function only encrypts letters and ignores blank spaces, punctuation marks, digits and other characters. You should use some of the functions that have been implemented in the previous questions (functions in questions 1 and 5).

```
>>> encrypt("This is a secret message!!", "12345678")
Uj!w ny h afeuiy slaticji!!
```

Test your function with two different texts and show that your function works by comparing the expected result with the actual result.

Question 8: Main Program [10 marks]

Write a program that asks the user the encryption key (e.g. your student number) reads the text that is stored in the file ('message.txt') encrypts it and write it down in the files called 'secret.txt')

Total 25 marks