**CS 10 - Assignment 4: Cipher**

**Collaboration Policy**

We encourage collaboration on various activities such as lab, codelab, and textbook exercises. However, **no collaboration between students is allowed on the programming assignments**. Please be sure to read and understand our full policy at: [Full Collaboration Policy](https://docs.google.com/document/d/1WyzL3qvKLrC1UCRf178b_wYWQmEZlhDObFNFb79U63I/edit?usp=sharing)

**Submission Instructions**

Submit to [R’Sub](https://galah.cs.ucr.edu) testing, feedback and grading.

**Assignment Specifications**

Decryption and encryption is a very useful activity to hide messages or data. Encryption is utilized to store passwords, store user information and in many other means when the sender does not want the message to be easily readable to anyone other than the intended reader.

**Your Assignment**

You did several portions of this assignment last week, copy your completed code into a new file. This week, you will finish the Cipher assignment. Your implementation should translate entire strings in addition to performing both encryption and decryption.

You must write a program that can both decrypt and encrypt a single word that is entered by the user. The initial choice of encryption and decryption is left up to the user. Additionally, the user will enter a value to be utilized when determining how to translate the character.

**Alphabetic Positions**

Positions start at zero. If the letter is 'a' then its position in the alphabet is 0 and if the letter is 'c' the position is 2 and so on through 'z'.

**Algorithm**

* Acquire the method to perform (encryption or decryption).
  + Check whether the method specified is valid.
* Acquire the translation map
  + If keyword default is entered, utilize the default map.
    - default map: "zyxwvutsrqponmlkjihgfedcba"
  + Validate the size of the map (26 characters)
* Acquire the word to encrypt or decrypt, validate depending on method
  + Validate whether the word can be encrypted
    - All characters in word must be lowercase letters
  + Validate whether the the word can be decrypted
    - All characters in word exist in map
* Perform encryption or decryption
  + Encryption: Convert all characters in word to a character in the map
    - Given a character in the word, calculate its position in the alphabet
    - Replace the character in the word with the character in map at that position.
  + Decryption: Convert all characters in the word by utilizing the discovered map index
    - Given a character in the word, determine its index in the map string
      * This is the position of the character in the alphabet!
    - Add the position to the first character in range of valid characters for a word
      * What is the range of valid characters? Check the validation step. What is the first character in that range?

**Hints/Tips**

* Implement the algorithm in the order that is specified.
* If you get to an error point, immediately exit the program (within main just return 0;)
* Use only a single map variable, assigning a proper value based the value of user input.

**Encryption Example**

If your map is "0987654321abcdefghijklmnop" and your word is "abc", then you need to convert the 'a' to '0', 'b' to '9', and 'c' to '8'; because 'a' is the first letter in the alphabet, so it gets converted to the first character in the map.

**Output Requirements**

* A bad method choice should result in an error line.
* Output results should utilize one of the three following key phrases:
  + Error
  + Decrypted word
  + Encrypted word

**Potential Errors**

* invalid method choice.
* invalid translation map size.
* encryption cannot be performed.
* decryption cannot be performed.

**Example Runs** (User input has been **bolded and underlined** to help differentiate typed input from program output.)

$ g++ cipher.cpp -o cipher

$ run cipher.out

What is the method (encryption or decryption)? **encryption**

What is the translation map (type 'default' to use default): **default**

What is the single word to translate: **hello**

Encrypted word: svool

$

$ run cipher.out

What is the method (encryption or decryption)? **decryption**

What is the translation map (type 'default' to use default): **default**

What is the single word to translate: **zyx**

Decrypted word: abc

$

$ run cipher.out

What is the method (encryption or decryption)? **google**

Error: invalid method choice.

$