Girls' Programming Network

# *Cryptography*
# *2*

*Create a Vigenère Cipher encryptor and decryptor!*

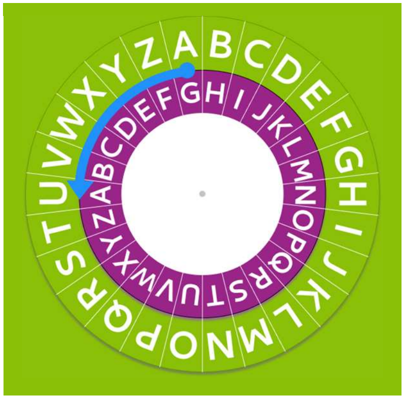
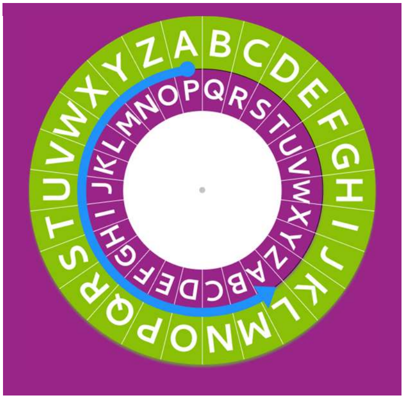
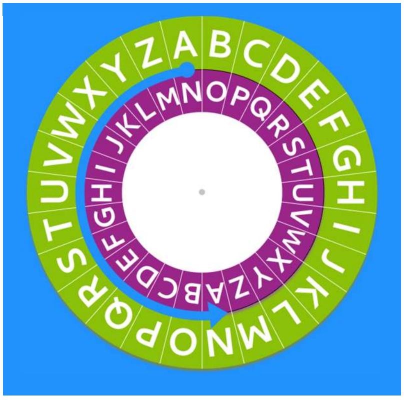
## TUTORS ONLY

# Part 0: Vigenère Ciphers

A Vigenère cipher is like several Caesar ciphers combined.

For **Vigenère ciphers** we use several rotations. Instead of having the same rotation for each letter, we take turns using different rotations for different letters in the message we are encrypting.

Instead of one rotation key number we have a **keyword**, for instance our keyword might be **“gpn”**. “gpn” is a way of telling you the different rotations, 6, 15 and 13.

| Keyword | | |
|---|---|---|
| g | p | n |
| 6 | 15 | 13 |
|  |  |  |

So if we want to encrypt a secret message we take turns at using the different rotations.
**This is what it looks like if we encrypt the message “this is a secret message”:**

| | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| t | h | i | s | | i | s | | a | | s | e | c | r | e | t | | m | e | s | s | a | g | e |
| ↓ | ↓ | ↓ | ↓ | | ↓ | ↓ | | ↓ | | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| g | p | n | g | | p | n | | g | | p | n | g | p | n | g | | p | n | g | p | n | g | p |
| 6 | 15 | 13 | 6 | | 15 | 13 | | 6 | | 15 | 13 | 6 | 15 | 13 | 6 | | 15 | 13 | 6 | 15 | 13 | 6 | 15 |
| ↓ | ↓ | ↓ | ↓ | | ↓ | ↓ | | ↓ | | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| z | w | v | y | | x | f | | g | | h | r | i | g | r | z | | b | r | y | h | n | m | t |

## Task 0.1: Hide this message

**Encrypt** “can you keep this hidden” using the key **“code”**.
We’ve done some of the work for you. .

| c | a | n |
|---|---|---|
| ↓ | ↓ | ↓ |
| c | o | d |
| 2 | 14 | 3 |
| ↓ | ↓ | ↓ |
| e | o | q |

| y | o | u |
|---|---|---|
| ↓ | ↓ | ↓ |
| e | c | o |
| 4 | 2 | 14 |
| ↓ | ↓ | ↓ |
| c | q | i |

| k | e | e | p |
|---|---|---|---|
| ↓ | ↓ | ↓ | ↓ |
| d | e | c | o |
| 3 | 4 | 2 | 14 |
| ↓ | ↓ | ↓ | ↓ |
| n | i | g | d |

| t | h | i | s |
|---|---|---|---|
| ↓ | ↓ | ↓ | ↓ |
| d | e | c | o |
| 3 | 4 | 2 | 14 |
| ↓ | ↓ | ↓ | ↓ |
| w | l | k | g |

| h | i | d | d | e | n |
|---|---|---|---|---|---|
| ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| d | e | c | o | d | e |
| 3 | 4 | 2 | 14 | 3 | 4 |
| ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| k | m | f | r | h | r |

## Task 0.2: Hide another

**Encrypt** “hide this message” using the key **“key”**.

| h | i | d | e |
|---|---|---|---|
| ↓ | ↓ | ↓ | ↓ |
| k | e | y | k |
| 10 | 4 | 24 | 10 |
| ↓ | ↓ | ↓ | ↓ |
| r | m | b | o |

| t | h | i | s |
|---|---|---|---|
| ↓ | ↓ | ↓ | ↓ |
| e | y | k | e |
| 4 | 24 | 10 | 4 |
| ↓ | ↓ | ↓ | ↓ |
| x | f | s | w |

| m | e | s | s | a | g | e |
|---|---|---|---|---|---|---|
| ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| y | k | e | y | k | e | y |
| 24 | 10 | 4 | 24 | 10 | 4 | 24 |
| ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| k | o | w | q | k | k | c |

## *Hint*

Counting the wheel can take a long time. You can use this table to look up the indexes of the letters:

| A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S | T | U | V | W | X | Y | Z |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 |

You might also like to write these numbers under the letters on the inner (purple) circle of your wheel. You can use them to quickly turn your purple wheel for a particular key.

### Use your cipher wheel to decrypt these Vigenère encrypted messages

Just like your Caesar cipher codes, use the negative of each letter in the key to decrypt the message.

To use your cipher wheel to decrypt the first letter in the message below:

- rotate inner purple wheel -7 (i.e. clockwise 7) (green H should line up with purple A)
- find the letter you are decrypting on the green outer wheel (F)
- get its matching letter on the purple inner wheel (Y) - this is the decrypted letter - write it in the first space below

## Task 0.3: Uncover the message

Can you **decrypt** this message using the key **"hack"**.
We've done some of the work for you. .

| | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| f | o | w | | m | y | a | e | u | l | d | | v | r | l | | c | q | n | l |
| ↓ | ↓ | ↓ | | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | | ↓ | ↓ | ↓ | | ↓ | ↓ | ↓ | ↓ |
| h | a | c | | k | h | a | c | k | h | a | | c | k | h | | a | c | k | h |
| -7 | 0 | -2 | | -10 | -7 | 0 | -2 | -10 | -7 | 0 | | -2 | -10 | -7 | | 0 | -2 | -10 | -7 |
| ↓ | ↓ | ↓ | | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | | ↓ | ↓ | ↓ | | ↓ | ↓ | ↓ | ↓ |
| y | o | u | | c | r | a | c | k | e | d | | t | h | e | | c | o | d | e |

## Task 0.4: Crack another

Can you **decrypt** this message using the key **"bug"**.

| | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| u | b | k | | f | u | m | m | y | | n | b | m | | r | b | h | j | f | x |
| ↓ | ↓ | ↓ | | ↓ | ↓ | ↓ | ↓ | ↓ | | ↓ | ↓ | ↓ | | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| b | u | g | | b | u | g | b | u | | g | b | u | | g | b | u | g | b | u |
| -1 | -20 | -6 | | -1 | -20 | -6 | -1 | -20 | | -6 | -1 | -20 | | -6 | -1 | -20 | -6 | -1 | -20 |
| ↓ | ↓ | ↓ | | ↓ | ↓ | ↓ | ↓ | ↓ | | ↓ | ↓ | ↓ | | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| t | h | e | | e | a | g | l | e | | h | a | s | | l | a | n | d | e | d |

# Part 1: Key questions

## Task 1.3: Ask the user for a message

Ask the user for the **message** they want to encrypt. Store it in a variable.

## Task 1.4: Ask the user for a keyword

Ask the user for the **keyword** they want to use to encrypt the message. Store it in a variable.

## ☑ CHECKPOINT ☑

**If you can tick all of these off, you can go to Part 2:**

□ You have asked for and stored a message

□ You have asked for and stored a keyword

□ Run your code.

## Solution

**The code should look like this (no bonuses):**

```
# <the student's name>
print('Welcome to Vigenere Cipher')
message = input('What do you want to encrypt? ')
key = input('What is the encryption key? ')
```

## ★ BONUS 1.4: Customised Welcome

**Waiting for the next lecture? Try adding this bonus feature!!**

1. Ask the user for their name
2. Print a customised message for the user using their name.

## Bonuses: Solution

**The code should look like this (with bonuses):**

```
# <the student's name>
name = input('What is your name? ')
print('Welcome to the Vigenere Cipher, ' + name)
message = input('What do you want to encrypt? ')
key = input('What is the encryption key? ')
```

# Part 2: Calculating Keys!

## Task 2.1: Lots of keys, lots of maths

This part can be a little tricky, so let's do it by hand first so that we know what the computer should be doing and we can check that it's doing the right thing!

First we have to take the keyword that we are using - let's use **gpn** for an example. We need to turn it into a bunch of number keys. We do this by finding how far each letter in the key is from the letter A! That's its rotation number!

| | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S | T | U | V | W | X | Y | Z |
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 |

**1**

| **Keyword** | **c** | **o** | **d** | **i** | **n** | **g** |
|---|---|---|---|---|---|---|
| **Keynums** | 2 | 14 | 3 | 8 | 13 | 6 |

**2**

| **Keyword** | **m** | **y** | **k** | **e** | **y** |
|---|---|---|---|---|---|
| **Keynums** | 12 | 24 | 10 | 4 | 24 |

## Task 2.2: Create the alphabet

1. Create a variable called `alphabet` to store the letters a-z as a string

```
abcdefghijklmnopqrstuvwxyz
```

*This variable should be the same as the one that you made in the caesar cipher*

### TUTOR TIPS

```
alphabet = 'abcdefghijklmnopqrstuvwxyz'
```

Encourage them to put their alphabet variable at the top of their code. This is the standard place to put global variables like this. It will make sure it's available when they need to use it in the code rather than it getting lost and in the wrong place in their code.

## Task 2.3: Create a list for keys

Store the keys in a list

1. **Make an empty list** called `key_nums`.

### *Solution*

```
key_nums = []
```

## Task 2.4: Get loopy

We're going to want to find the index of every letter in our key.
Create a `for loop` that loops through the letters in our key. Store the current letter as you loop through in a variable called `current_key_letter`.

### *Solution*

```
for current_key_letter in key:
```

## Task 2.5: The index is the rotation!

Let's get the index for each letter.

1. Go to the line below your for loop line, we're going to add code in an indented block here.
2. Our for loop looks at the key letters one at a time. **Find the index** of the `current_key_letter`. **Store it** in a variable called `current_key_num`.

### *Hint*

```
for current_key_letter in key:
    current_key_num = alphabet.index(current_key_letter)
```

### TUTOR TIPS

You can find the index of a character in a string by using `.index` like this:

```
alphabet.index(current_key_letter)
```

## Task 2.6: Keep the keys!

add the `current_key_num` to our list.

1. Go to the line below where you got `current_key_num`, make sure you are still indented inside the loop.
2. Add the `current_key_num` to the list of `key_nums`.

### *Solution*

```
for current_key_letter in key:
    current_key_num = alphabet.index(current_key_letter)
    key_nums.append(current_key_num)
```

## Task 2.7: Print the keys!

To make sure this worked, `print` out **`key_nums`** to confirm that the numbers are what you expect.

## ☑ CHECKPOINT ☑

### If you can tick all of these off you can go to Part 3:

□ You have the alphabet stored

□ You used a for loop to loop through the letters in the key

□ You found the index of each key and stored it in a list

□ You checked your list by printing it out

□ Run your code

## Full code Lesson 2

### The code should look like this:

```
alphabet = 'abcdefghijklmnopqrstuvwxyz'
key_nums = []

name = input('What is your name? ')
print('Welcome to the Vigenere Cipher, ' + name)
message = input('What do you want to encrypt? ')
key = input('What is the encryption key? ')

for current_key_letter in key:
       current_key_num = alphabet.index(current_key_letter)
       key_nums.append(current_key_num)
print(key_nums)
```

# Part 3: Encrypt!

Let's turn some of our Caesar cipher code into a function that helps us do Caesar cipher encryption for one letter for any key we give it.

## Task 3.1: Write the scaffold

Now it's time to write our function. Let's put it right after our alphabet variable.

1. Name it `encrypt_letter`
2. Make it take two parameters:
   - The **letter** we want to encrypt
   - The **key** we will use to encrypt it.
3. For now, make it `return` the letter without doing anything to it.

### *Solution*

```
def encrypt_letter(letter, key_num):
        return letter
```

## Task 3.2: Make it work

Now we need to make our function do something. Let's make our function do Caesar cypher encryption on a letter using a given key

In the body of your function we need to:

1. Find the index of the current letter
2. Calculate the rotated index of the current letter
3. Find the encrypted letter based on the rotated index

### *Solution*

```
def encrypt_letter(letter, key_num):
        current_index = alphabet.index(letter)
        new_index = (current_index + key_num) % 26
        new_letter = alphabet[new_index]
```

## Task 3.3: Return

1. Update your `return` line to return the new encrypted letter

### *Solution*

```
def encrypt_letter(letter, key_num):
        current_index = alphabet.index(letter)
        new_index = (current_index + key_num) % 26
        new_letter = alphabet[new_index]
        return new_letter
```

## Task 3.4: Test it!

Now that your function is running some code, you can test it!
Just below where you print **`key_nums`**, call your function using ‘a’ as the letter parameter and 1 as the key parameter.

### *Solution*

```
result = encrypt_letter('a', 1)
print(result)
```

## ☑ CHECKPOINT ☑

### If you can tick all of these off you can go to Part 4:

☐ You wrote a function for encrypting letters

☐ Your function returns the encrypted letter

☐ You tested the function by calling it and looking at the result

## Full code Lesson 3

Test of their function with parameters (‘a’,1) should return (and print) ‘b’ - a shifted by 1 is b

### The code should look like this:

```
# <the student's name>
alphabet = 'abcdefghijklmnopqrstuvwxyz'
key_nums = []

def encrypt_letter(letter, key_num):
        current_index = alphabet.index(letter)
        new_index = (current_index + key_num) % 26
        new_letter = alphabet[new_index]
        return new_letter

name = input('What is your name? ')
print('Welcome to the Vigenere Cipher, ' + name)
message = input('What do you want to encrypt? ')
key = input('What is the encryption key? ')

for current_key_letter in key:
        current_key_num = alphabet.index(current_key_letter)
        key_nums.append(current_key_num)

result = encrypt_letter('a', 1)
print(result)
```

# Part 4: Matching messages to keys

Normally our message is longer than our key. We saw at the start that we use the same key over and over again by rotating through using the different letters.
To make the computer do this we'll need to give it a way to keep count of which key we are up to. This way we won't ask for a position in the key that doesn't exist and get an error!

## How do we do that?

1. **We keep count of which letter we are up to in our message:**

| Message | s | e | c | r | e | t |
|---|---|---|---|---|---|---|
| **Count** | **0** | **1** | **2** | **3** | **4** | **5** |

2. **Find a way for those numbers to wrap around to match the number of letters in the key.** Since our key is GPN we only want to use numbers 0, 1, 2.

   **We can use remainders to wrap around!** (remember module (%) from earlier)

   **These are the remainders when we divide the count for each position by 3:**

   0 ÷ 3 = 0 remainder 0
   1 ÷ 3 = 0 remainder 1
   2 ÷ 3 = 0 remainder 2

   3 ÷ 3 = 1 remainder 0
   4 ÷ 3 = 1 remainder 1
   5 ÷ 3 = 1 remainder 2

   **Look all the remainders are 0, 1 or 2!**

3. **Put those remainders in the table and find the matching letter from that position in the keyword:**

| Message | s | e | c | r | e | t |
|---|---|---|---|---|---|---|
| **Count** | **0** | **1** | **2** | **3** | **4** | **5** |
| **Remainder** | 0 | 1 | 2 | 0 | 1 | 2 |
| **Key letter** | g | p | n | g | p | n |

## Task 4.1: Counting keys

Let's use the keyword "**code**"

What number should we use to divide and find the remainder? 4

Use this number to fill in the Remainder line
Fill in the Key Letter line using the keyword

| Message | c | r | y | p | t | o | g | r | a | p | h | y |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Count** | **0** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** |
| **Remainder** | 0 | 1 | 2 | 3 | 0 | 1 | 2 | 3 | 0 | 1 | 2 | 3 |
| **Key Letter** | c | o | d | e | c | o | d | e | c | o | d | e |

## Task 4.2: Start counting

We need somewhere to count how far we are through the secret keyword.

1. Go to your code after the loop
2. Remove (or comment out) the three lines we used to test previous steps (printing key_nums, calling your function using ('a', 1) and printing the returned function value)
3. Create a variable called `count` and set it to 0

### *Solution*

```
count = 0
```

## Task 4.3: How long is the key

We need to know how long the key is so we'll be able to work out when to loop around.

1. Use **`len`** to find the length of the `key`. Store it in a variable called `key_len`.

### *Hint*

```
key_len = len(key)
```

## Task 4.4: Looping through message letters

It's time to take a look at the message one letter at a time!

1. Create a `for` loop that loops through the letters in the  message. Store the current letter in a variable called `current_letter`.

### *Hint*

```
for current_letter in message:
```

## Task 4.5: Getting the right key

We need to use `count` and `key_len` to get the correct key to use for the current letter!

1. You can use `count % key_len` to get which position you are up to in the key. Store this in a variable called `key_position`.
2. Get the key number that corresponds to the `key_position`. You'll need to look up the `key_position` in your `keys_nums` list, store it in a variable called `current_key_num`.

## TUTOR TIPS

This is probably one of the hardest parts of the workbook both logically and in terms of python knowledge.

It has a complex combination of numbers and indexes.
We are looking for these lines:

```
# finds the position in the key number list that we will need
key_position = count % key_len

# Goes and gets the key number out of the list
current_key_num = key_nums[key_position]
```

## Task 4.6: Call the function

You now have the `current_letter` and the `current_key_num`. We can encrypt!

1. Go to the spot below where you get the `current_key_num`. Make sure you are still inside the loop.
2. Call your `encrypt_letter` function for the `current_letter` and `current_key_num`.
3. Store the result and print it out. Don't forget to make it print on one line!

## *Solution*

```
result = encrypt_letter(current_letter, current_key_num)
      print(result, end='')
```

## Task 4.7: Keep counting

Finally we are finished with this letter!

1. After you have printed the encrypted letter, add a new line inside the loop.
2. Add 1 to `count` to get ready for the next position in the message.
3. Run your code again to print your encrypted message on one line.

## ☑ CHECKPOINT ☑

**If you can tick all of these off you can go to Part 5:**

□ Your code loops through the positions in the key

□ Your code encrypts all the letters in the message

□ You printed out your encrypted message on one line.

□ Run the code!

## Full code Lesson 4

**The code should look like this:**

```
# <the student's name>
alphabet = 'abcdefghijklmnopqrstuvwxyz'
key_nums = []

def encrypt_letter(letter, key_num):
        current_index = alphabet.index(letter)
        new_index = (current_index + key_num) % 26
        new_letter = alphabet[new_index]
        return new_letter

name = input('What is your name? ')
print('Welcome to the Vigenere Cipher, ' + name)
message = input('What do you want to encrypt? ')
key = input('What is the encryption key? ')

for current_key_letter in key:
        current_key_num = alphabet.index(current_key_letter)
        key_nums.append(current_key_num)

count = 0
key_len = len(key)

for current_letter in message:
        key_position = count % key_len
        current_key_num = key_nums[key_position]

        result = encrypt_letter(current_letter, current_key_num)
        print(result, end='')

        count += 1
        # print(key_position)
```

# Part 5: Space Ace

## Task 5.1: Testing With A Space!

1. Test your code with 2 words now instead of one, what happens?
2. What about something with an exclamation mark?

**Did you get an error? Good!**
At the moment, your code can encrypt any letter of the alphabet start but doesn't know what to do with spaces and other funny characters!

## Task 5.2: Check for funny characters

We can see that our program tries to encrypt all characters but sometimes it breaks. We only want to encrypt letters in the alphabet variable we set-up earlier.

1. Create an **if statement** as the first line inside the message for loop you just added in Task 4.4.
2. Your **if statement** should check if the `current_letter` is in the `alphabet`.
3. Indent all your code about getting the `current_key`, calling your `encrypt_letter` function and increasing `count`, inside the if statement. This code only runs if `current_letter` is in the `alphabet`.

## *Solution*

```
for current_letter in message:
        if current_letter in alphabet:
```

**Why put the count inside the if statement?**
Spaces and other non-alphabet characters don't count! We only increase the count for letters in the alphabet, that way we don't mix up which key we are up to

## Task 5.3: Ignore the spaces

1. Create an `else` statement to handle when characters are not in the alphabet.
2. Inside the else statement, `print` the character you are on, but don't encrypt it. Make sure they print on the same line too.

## *Solution*

```
else:
                print(current_letter,end='')
```

## ☑ CHECKPOINT ☑

### If you can tick all of these off you can go to Part 6:

□ You only encrypt letters of the alphabet

□ Spaces and non-alphabet characters print out unencrypted

## Full code Lesson 5

### The code should look like this:

```
alphabet = 'abcdefghijklmnopqrstuvwxyz'
key_nums = []

def encrypt_letter(letter, key_num):
       current_index = alphabet.index(letter)
       new_index = (current_index + key_num) % 26
       new_letter = alphabet[new_index]
       return new_letter

name = input('What is your name? ')
print('Welcome to the Vigenere Cipher, ' + name)
message = input('What do you want to encrypt? ')
key = input('What is the encryption key? ')

for current_key_letter in key:
       current_key_num = alphabet.index(current_key_letter)
       key_nums.append(current_key_num)

count = 0
key_len = len(key)

for current_letter in message:
       if current_letter in alphabet:
             key_position = count % key_len
             current_key_num = key_nums[key_position]

             result = encrypt_letter(current_letter, current_key_num)
             print(result, end='')
             count += 1
       else:
             print(current_letter,end='')
```

# Part 6: Decrypt!

So far we've only been able to encrypt, but what if we've received a secret message and need to decrypt it?

## Task 6.1: To decrypt, or not to decrypt - that is the question

1. Just like in our Caesar cipher, ask the user whether they want to encrypt or decrypt - e or d
2. Store the answer in a variable called mode
3. Have a look at the words you used in Task 1.2 and 1.3 to ask the user for the message and key word they wanted to use for the **encryption**. If you used the word 'encrypt', how could you change the words so it makes more sense to the user if they entered 'd' in response to our new question we added in (1) above. Thinking about things like this makes our code more 'user friendly'.

## Task 6.2: Create the decryption key

Just like our Caesar Cipher, if we rotate by the negative of the rotation we can decrypt. We just need to do that for all of our key numbers!

1. Go to the part of your code where you loop through the letters of the keyword to find the key numbers. Go to the line after where you got the `current_key_number`.
2. On the next line add an if statement that checks what mode the user entered. We want to check if we are in decrypting mode.
3. If we are in decrypting mode we want to multiply the `current_key_number` by `-1`. Overwrite the current value with this new value.
4. Make sure your `append` **is not** inside the `if` statement
5. Try using encryption mode to encrypt a message and then decrypt mode to decrypt it (using the same keyword). Do you get back to your original message?

## ☑ CHECKPOINT ☑

**If you can tick all of these off you can go to the Extensions:**

□ Your code now has two modes, encrypt or decrypt

□ Your code can now decrypt an encrypted message

## TUTOR TIPS

Students may forget to use == in if statements

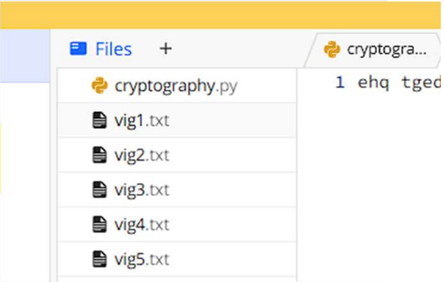
**The code should look like this:**

```
# <the student's name>
alphabet = 'abcdefghijklmnopqrstuvwxyz'
key_nums = []

def encrypt_letter(letter, key_num):
        current_index = alphabet.index(letter)
        new_index = (current_index + key_num) % 26
        new_letter = alphabet[new_index]
        return new_letter

name = input('What is your name? ')
print('Welcome to the Vigenere Cipher, ' + name)
mode = input('Do you want to encrypt or decrypt - e or d? ')
# there are many ways they can change the messages depending on if
# e or d entered
if mode == ‘e’:
   message = input('What do you want to encrypt? ')
    key = input('What is the encryption key? ')
else:
    message = input('What do you want to decrypt? ')
    key = input('What is the decryption key? ')


for current_key_letter in key:
        current_key_num = alphabet.index(current_key_letter)
        if mode == 'd':
            current_key_num *= -1
        key_nums.append(current_key_num)

count = 0
key_len = len(key)

for current_letter in message:
        if current_letter in alphabet:
              key_position = count % key_len
              current_key_num = key_nums[key_position]

              result = encrypt_letter(current_letter, current_key_num)
              print(result, end='')

              count += 1
        else:
              print(current_letter,end='')
```

# Extension 7: Files!

## Task 7.1: Read the text!

1. Remove the line where you asked the user for a `message`
2. At that same location, get python to open the file
3. Read the contents of the file
4. Store that file data in a variable called `message`



```
ehq tged
```

### Solution

```
f = open('vig1.txt', 'r')
message = f.read()
```

## Task 7.2: Encrypting  files

1. You should also be able to use your code to encrypt a file.
2. Create your own .txt file and fill it with a message to be encrypted

## TUTOR TIPS

```
alphabet = 'abcdefghijklmnopqrstuvwxyz'
key_nums = []

def encrypt_letter(letter, key_num):
       current_index = alphabet.index(letter)
       new_index = (current_index + key_num) % 26
       new_letter = alphabet[new_index]
       return new_letter

name = input('What is your name? ')
print('Welcome to the Vigenere Cipher, ' + name)
mode = input('Do you want to encrypt or decrypt - e or d? ')
if mode == ‘e’:
      key = input('What is the encryption key? ')
else:
   key = input('What is the decryption key? ')

f = open('message.txt', 'r')
message = f.read()

for current_key_letter in key:
       current_key_num = alphabet.index(current_key_letter)
       if mode == 'decrypt':
            current_key_num *= -1
       key_nums.append(current_key_num)
count = 0
key_len = len(key)

for current_letter in message:
       if current_letter in alphabet:
            key_position = count % key_len
            current_key_num = key_nums[key_position]

            result = encrypt_letter(current_letter, current_key_num)
            print(result, end='')

            count += 1
       else:
            print(current_letter,end='')
```