**Lab 2: Breaking without Brute Force**

**Deadline: 31 May 2023 11:59PM**

* [Lab 2: Breaking without Brute Force](https://github.com/istd50042/lab2022_student/blob/main/lab2/README.md#lab-2-breaking-without-brute-force)
  + [Objectives](https://github.com/istd50042/lab2022_student/blob/main/lab2/README.md#objectives)
  + [Introduction](https://github.com/istd50042/lab2022_student/blob/main/lab2/README.md#introduction)
  + [Part I: Substitution Cipher](https://github.com/istd50042/lab2022_student/blob/main/lab2/README.md#part-i-substitution-cipher)
  + [Part II: Compromising OTP Integrity](https://github.com/istd50042/lab2022_student/blob/main/lab2/README.md#part-ii-compromising-otp-integrity)
  + [Submission](https://github.com/istd50042/lab2022_student/blob/main/lab2/README.md#submission)
    - [eDimension Submission](https://github.com/istd50042/lab2022_student/blob/main/lab2/README.md#edimension-submission)

**Objectives**

* Break a substitution cipher using frequency analysis and write the decryption function in Python
* Encrypt and decrypt using One-Time Pad (OTP)
* Compromise the integrity of a OTP-encrypted message (if knowing the plain text)

**Introduction**

In this lab, you will be

* breaking a **substitution cipher** via frequency analysis. You are **not** allowed to use other methods to break the cipher.
* manipulating an OTP encrypted message so that it decrypts to a message of your choosing

**Part I: Substitution Cipher**

You are provided with a passage that is encrypted with a substitution cipher. You only know a few things about it:

1. It is in "normal" English.
2. Spaces (" ") are preserved (the words are intact).
3. Punctuation may not be preserved.
4. It may consist of any characters included the string.printable set
5. You will recognise it when it is decrypted correctly.

The cipher text is provided in this folder (story\_cipher.txt).

Clues:

* [Wikipedia: Frequency analysis](https://en.wikipedia.org/wiki/Frequency_analysis)
* [Hints for Frequency Analysis](http://www.thiagi.com/instructional-puzzles-original/2015/2/13/cryptograms)
* [The frequency of the letters of the alphabet in English Dictionary](https://www3.nd.edu/~busiforc/handouts/cryptography/letterfrequencies.html)
* [SAS: The frequency of letters in an English corpus](https://blogs.sas.com/content/iml/2014/09/19/frequency-of-letters.html)

Practical hints:

* You can use Python's string replace function.
* If you are stuck halfway, visually inspect your current cipher, and see if you recognise any words that are only partially decrypted.
* Make sure you keep track of the replacements to ensure you do not "double replace". All the characters in the cipher are upper-case by design to make it easier for you. You can gradually replace them with your hypothesis of the correct lower-case characters and visually inspect the result.

Write a Python script to decrypt the cipher text, and submit it together with your decrypted plain text.

**Part II: Compromising OTP Integrity**

In this section, we aim to change an encrypted message **without being able to decrypt it**.

For example, we can change Student ID 100XXXX gets a total of 0 points! to any message of our choosing.

Your aim is to get change the **decrypted plain text response** to say you have gotten **4** points, without decrypting it yourself.

For example, the text should say Student ID 100XXXX gets a total of 4 points! after decryption.

In other words, you manipulate the **cipher text** , so that it decrypts to a plain text of your choosing.

Thus, you are compromising the integrity of the encrypted message.

Hints:

* The ciphertext is encrypted with a OTP. You do not know what the OTP is, it is randomly generated.
* **You do not need to know anything about the OTP for this exercise.**

You are provided with ex2.py in this folder. Complete it to show that you can change the encrypted message without knowledge of the OTP.

**Submission**

**eDimension Submission**

Submission rules:

* Please rename the file to: lab2\_name\_studentid

**Lab 2 submission:**

Upload a **zip file** with the following:

* ex1.py, your python script to perform decryption of the substitution cipher (story\_cipher.txt)
* Decrypted plain text for Part I as solution.txt
* ex2.py, your python script to change the OTP message, you can based it on ex2.py
* Report is required

**You will not get the grade if your submission is not runnable.** **Deadline: 31 May 2023 11:59PM**