

Assignment #1

(Due on November 25 at mid-night)

(This assignment can be done in teams of maximum 2 students – Please include a text files with your names and IDs in the submission)

In this assignment, run-length coding of gray-scale images is to be implemented. Therefore, you are asked to implement the following Python functions:

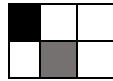
- imOpen
 - input: string representing the name of an image file (.bmp)
 - output: **Image**¹ object representing the opened image file after turning it to grayscale
- toStrH
 - input: Image object representing a grayscale image
 - output: a string representing row-wise run-length code (horizontal runs)
- toStrV
 - input: Image object representing a grayscale image
 - output: a string representing column-wise run-length code (vertical runs)
- toFile
 - inputs:
 - a string representing the name of a .txt file
 - note that the string will also include the extension (e.g. 'f1.txt')
 - a string representing the run-length code of an image, to be written to a text file
 - output: a .txt file with the given name containing the given run-length code
 - note that this file is written to the workspace, not returned by the function
- toImg
 - input: a string representing the name of a .txt file (with extension) containing run-length code of an image
 - output: Image object representing the grayscale image generated from the given run-length code

The expected format of the string containing the run-length code will be as follows:

- The string contains multiple lines
- Coding is done for all grayscale intensities (i.e. pixel values 0-> 255)
- All indices are zero-based
- The first line has only exactly three tokens:
 - 'V' or 'H', denoting vertical and horizontal run directions, respectively
 - a number representing the width of the image (# of columns)
 - a number representing the height of the image (# of rows)
- Every new line contains the set of runs in exactly one row/column, depending on code direction ('V' or 'H')
- Number of lines (after the first line) represents the number of rows/columns in the image, depending on direction ('V' or 'H')

1: <https://pillow.readthedocs.io/en/stable/reference/Image.html>

- All tokens are separated by a single whitespace
- Runs are expressed as triplets of tokens
 - pixelValue firstElement lastElement
- Sample: coding horizontally, this image will be represented as the following string:



```
"H 3 2
  0 0 0 255 1 2
  255 0 0 128 1 1 255 2 2"
```

After implementing the above functions, your task is to test them using the input files provided in **Inputs.zip**

- Import the extracted files into your workspace
- Use your implemented functions `imOpen()`, `toStrH()`, `toStrV()`, and `toFile()` to save text files to your workspace containing horizontal and vertical run-length codes of both **Bars.bmp** and **Bars2.bmp**. For **each** image, do the following:
 - Use "H.txt" and "V.txt" for horizontal and vertical codes, respectively (append numbers to differentiate between files produced from different images, e.g. "V1.txt")
 - Print the number of characters in each of the vertical and horizontal run-length codes
 - Include a markdown cell containing your comment on the result in terms of compression effectiveness for each of the horizontal and vertical run-length codes (this comment will be graded, so take the time to express your thoughts carefully)
- Use your function `tolmg()` to read the run-length code in **Mystery1.txt** and **Mystery2.txt**, turning both into images and displaying them

General guidelines:

- Submission will be on the MET website. Submit a .zip file containing your code (for example, notebook) and a text file containing the names, IDs and tutorial numbers of group members
- Assignment will be done in groups of maximum (2) students. **The students must be from groups of the same TA**
- Refer to the video of tutorial 1 on CMS for suggested code logic and structure
- Predefined libraries and functions are not allowed with the exception of those mentioned in tutorial 1 on CMS
- Late submissions will not be considered
- Plagiarism and cheating are absolutely prohibited