MA3111: Mathematical Image Processing
Homework 1

To submit, zip the followings into mipXXXXX.zip where XXXXX is your student ID:

- **report file: contains answers to all questions, including the requested figures.**
- **imeq.m: your code**

In this assignment, you will implement image histogram equalization discussed in class, make a tweak to it, then observe what happens.

Given a gray level input image with intensity in the range $[0, L-1]$, let p_k be the proportion of pixels with intensity k where $k = 0, 1, \ldots, L-1$ i.e. $\sum_{k=0}^{L-1} p_k = 1$. With a new parameter $s \in \mathbb{N}$ meaning **step**, the tweaked transfer function $T(k)$ that maps the input intensity k to output intensity $T(k)$ is given by

$$T(k) = round\left(\frac{L-1}{s}\sum_{i=0}^{k} p_k\right)s, 0 \leq k \leq L-1.$$

When $s = 1$, it is identical to the algorithm for image histogram equalization discussed in class.

Things to do:

1. Fill in the missing computation of `T` representing T and output image `im` in the provided `imeq.m`. Note that because MATLAB array's index starts from `1` rather than `0`, use `T(1)` to represent $T(0)$, `T(2)` to represent $T(1)$, ..., and `T(L)` to represent $T(L-1)$, respectively. For this problem you can assume $L = 256$.
2. Place the provided image `aerialview-washedout.tif` or any other grayscale image in your working directory.
3. Test your code by typing `clear; imeq('aerialview-washedout.tif', s)` for some $s \leq 64$. You should see figures of original image, output image, original histogram, output histogram, and transfer function T show up.
4. Answer these in the report:
   (a) What happens when s increases?
   (b) What is the downside of a large s? Why?
   (c) Attach the figures generated in step 3 for $s = 1, 8, 64$ in the report.