CMPEN/EE455: Digital Image Processing I
Fall 2019
Project #5

assigned: 18 November 2019
due: Friday, 6 December 2019

reading assignment: G&W 9.1—9.3, 9.5 (up to page 711)), 9.6 (up to page 729),
10 (up to page 692), 10.3 (up to page 809).

Morphological Image Processing and the Median Filter

For this project, you may **NOT** use MATLAB's built-in morphological functions.

1. MEDIAN FILTERING — Apply a 3×3 median filter to the following images on CANVAS:

   (a) image "proj5" — This image contains some black text on a white background corrupted by two "line" streaks and by a thin grid.

   (b) image "wheelpepper" — This is the "wheel" image corrupted by pepper noise, as used in "L21-NonlinearFiltering."

   Use the MATLAB command below for generating your results:

   ```
   fnew = medfilt2(f3,[3 3]);
   ```

   Give the original images and filtered images in your report, along with their histograms.

   What do you observe? Does median filtering improve the image somehow?

2. MORPHOLOGICAL IMAGE PROCESSING — Consider the image "proj5" on CANVAS.

   (a) Image "proj5" is not binary-valued. Thus, to begin, you must first threshold "proj5" appropriately, so that it becomes a true binary-valued image, where black ("0") constitutes the foreground and white ("255") constitutes the background.

   (b) Using the binary-valued image as input, devise a sequence of morphological and set operations that produce a new image with the following properties:
   (i) all corruptions are reduced;
   (ii) all letters are deleted except the tall letters in the set { D , P , l , I }.
   Give step-by-step results and explain the rationale for your method. Note: you will need to use morphological reconstruction to extract the letters — see the discussion for G&W Figure 9.31 to understand how to do this (G&W Sect. 9.6).

   (c) Edge Detection — Using morphological operations, find the edges of the detected letters in your processed image of (b).