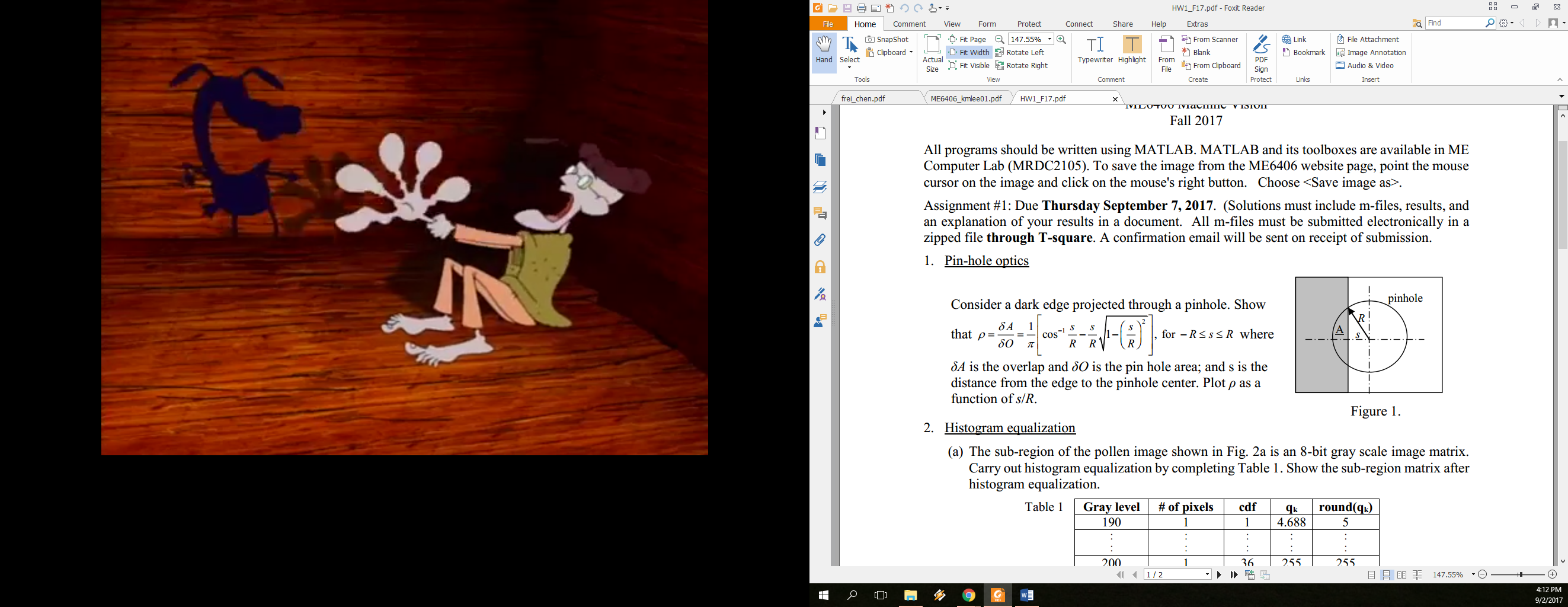
**ME6406 HW1 Thanakorn Khamvilai Report**

Problem 1: Pin-Hole Optics

Solution:

 Pin-hole area

Consider the right triangle

R

sR

The angle

and the area

A1

R

R

A2

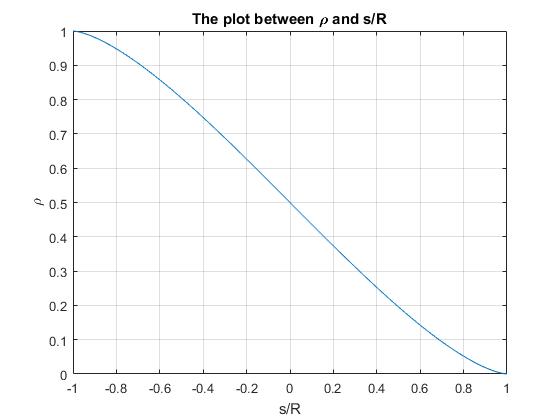
Consider the Sector

The area

Then the overlap area

Therefore,

Plot ρ as a function of s/R using MATLAB (HW1\_1.m)

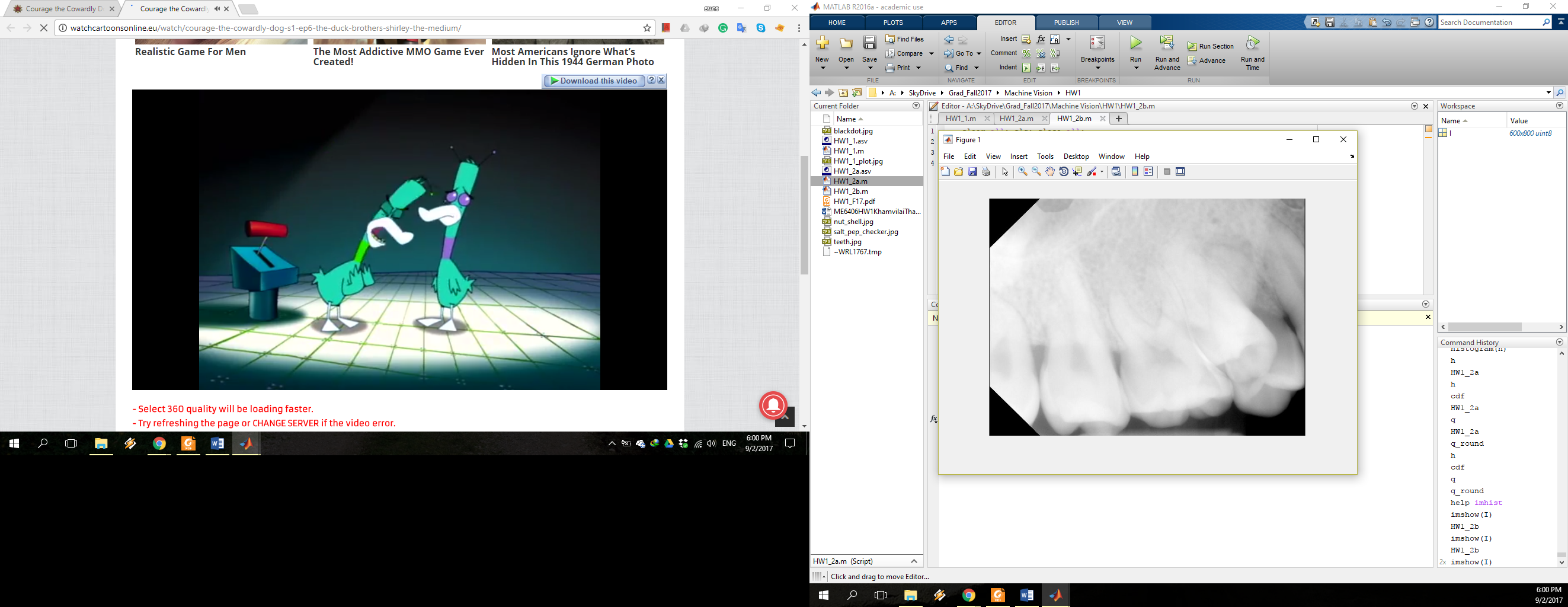


Problem 2: Histogram Equalization

2a) Solution: The table below was done using MATLAB (HW1\_2a.m)

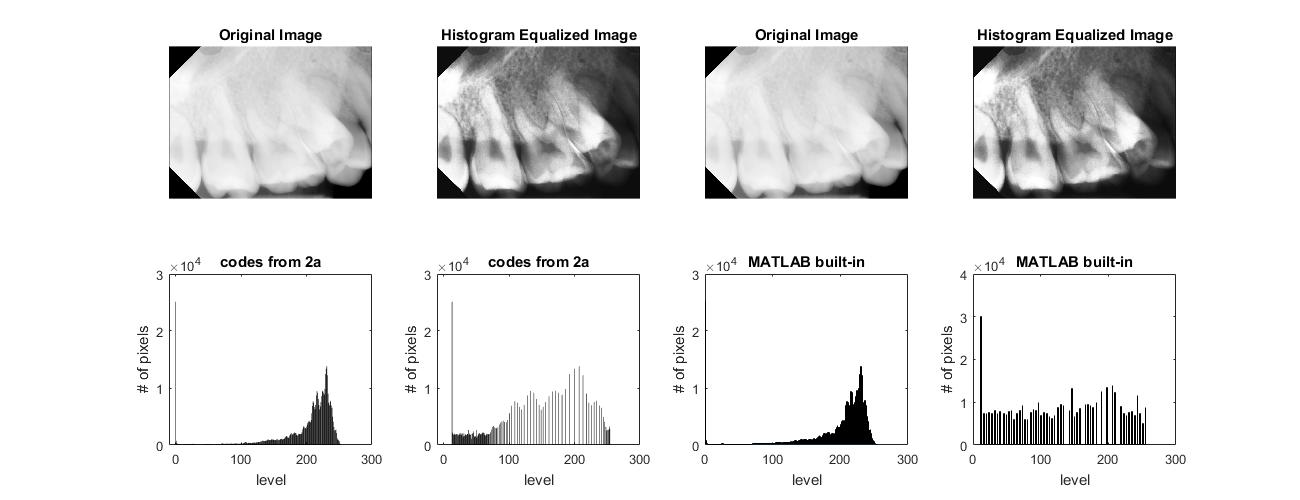
|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Gray Level** | **# of pixels** | **cdf** | **qk** | **round(qk)** |
| 190 | 1 | 1 | 7.0833 | 7 |
| 191 | 5 | 6 | 42.5000 | 43 |
| 192 | 3 | 9 | 63.7500 | 64 |
| 193 | 5 | 14 | 99.1667 | 99 |
| 194 | 4 | 18 | 127.5000 | 128 |
| 195 | 7 | 25 | 177.0833 | 177 |
| 196 | 6 | 31 | 219.5833 | 220 |
| 197 | 2 | 33 | 233.7500 | 234 |
| 198 | 1 | 34 | 240.8333 | 241 |
| 199 | 1 | 35 | 247.9167 | 248 |
| 200 | 1 | 36 | 255.0000 | 255 |

2b) Solution: I. Read in and display the ‘teeth.jpg’ (HW1\_2b.m)

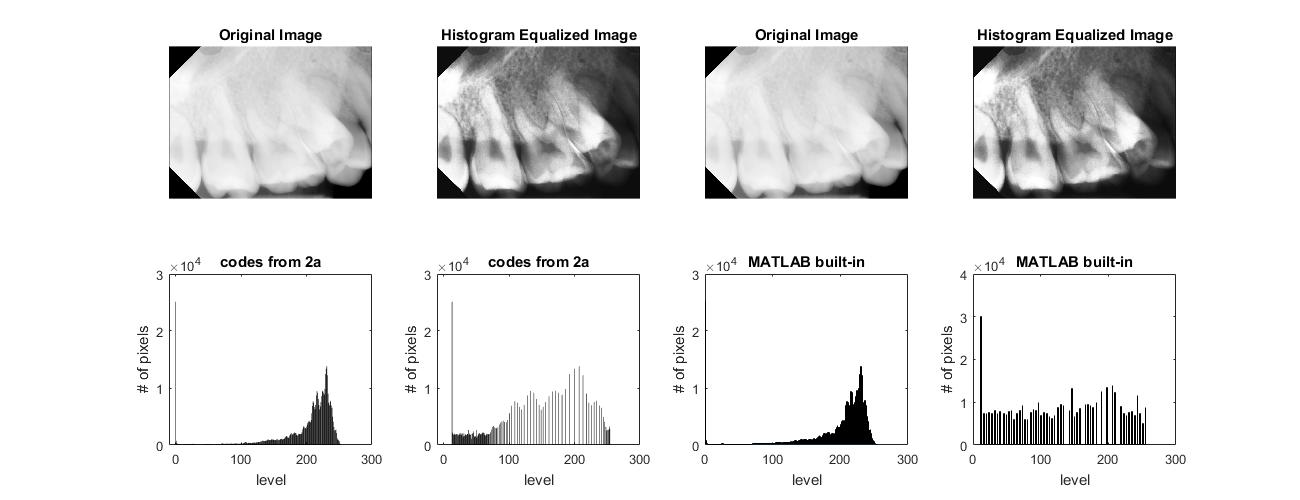


II. Compare by displaying the original and processed images and their histograms. (HW1\_2b.m)

By using codes from 2a)



By using MATLAB built-in commands



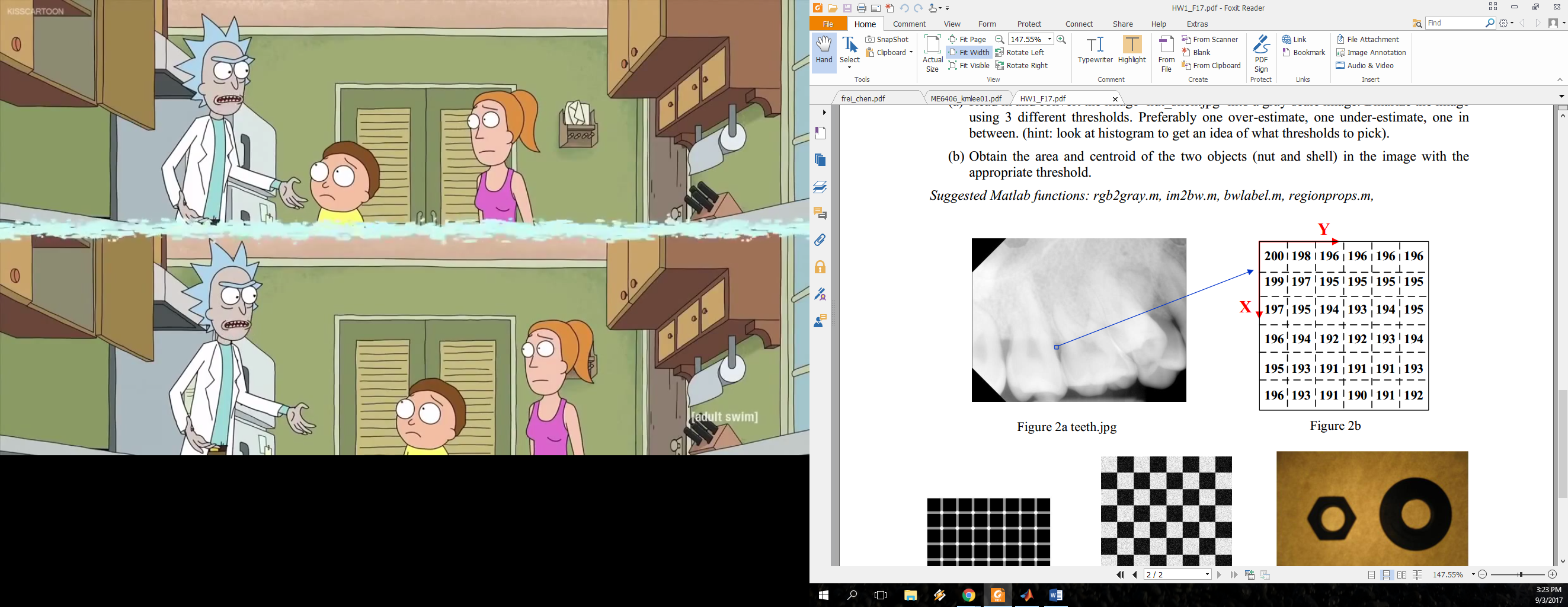
There is a little difference in pixel intensity obtained from these two approaches even if both equalized images look pretty similar; thus, the plots of histogram equalization are difference.

Problem 3: Filtering Masks

3a) Solution:

Magnitude

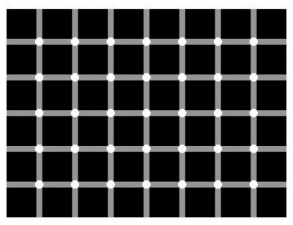
Direction



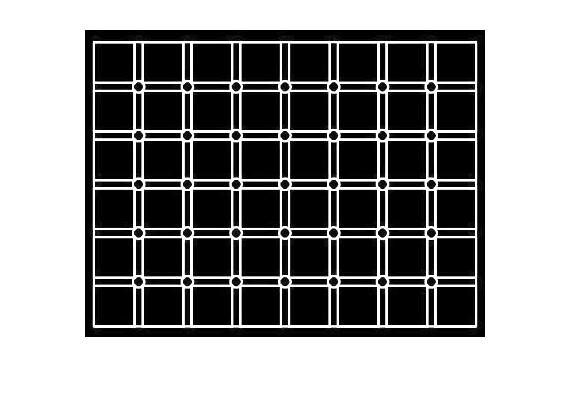
**229.3987o**

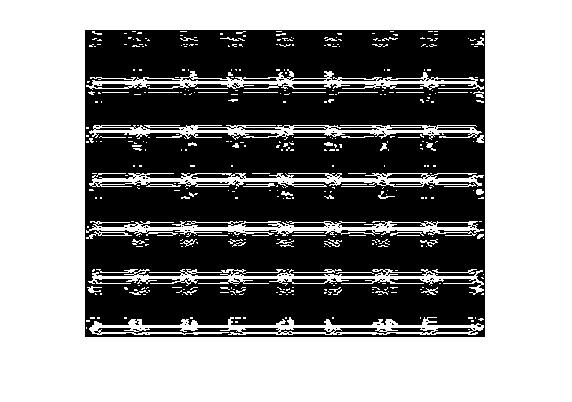
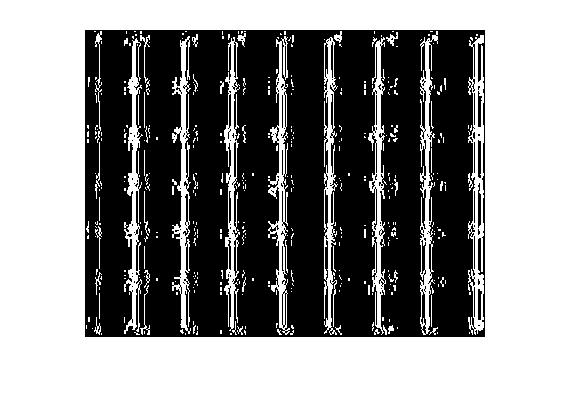
3b) Solution: This problem was done using MATLAB (HW1\_3b.m)

Original Image

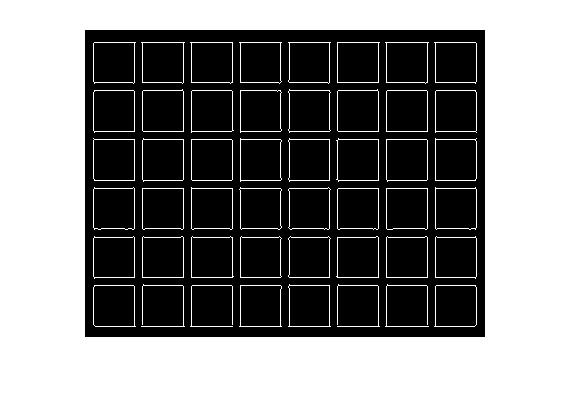


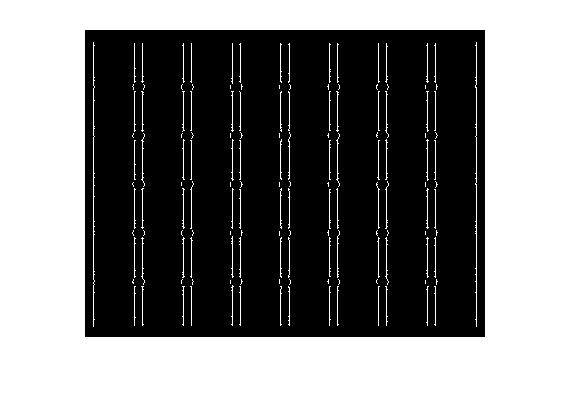
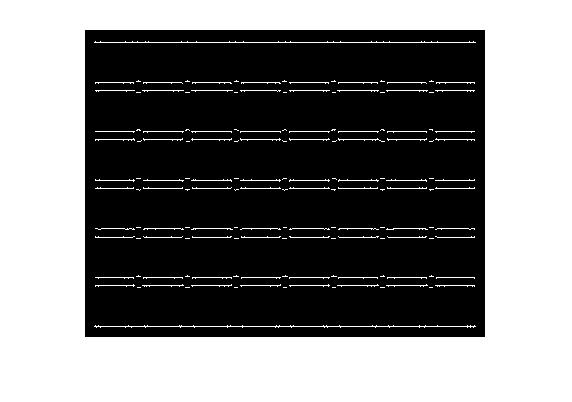
Using the same calculation as 3a)

 Both Direction Vertical Direction Horizontal Direction



Using the MATLAB built-in command with the default threshold

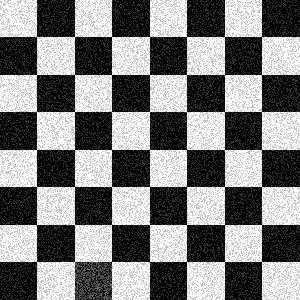
 Both Direction Vertical Direction Horizontal Direction



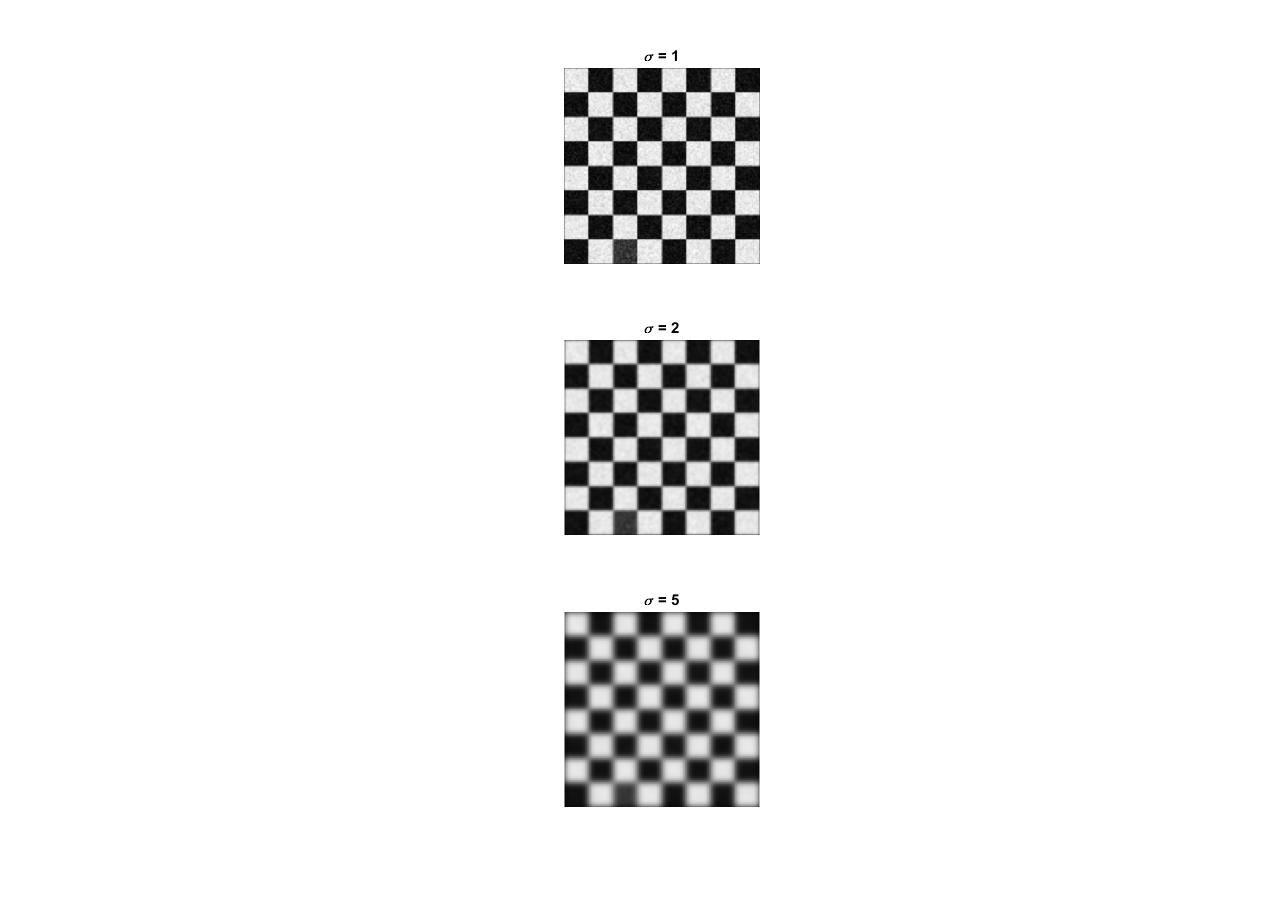
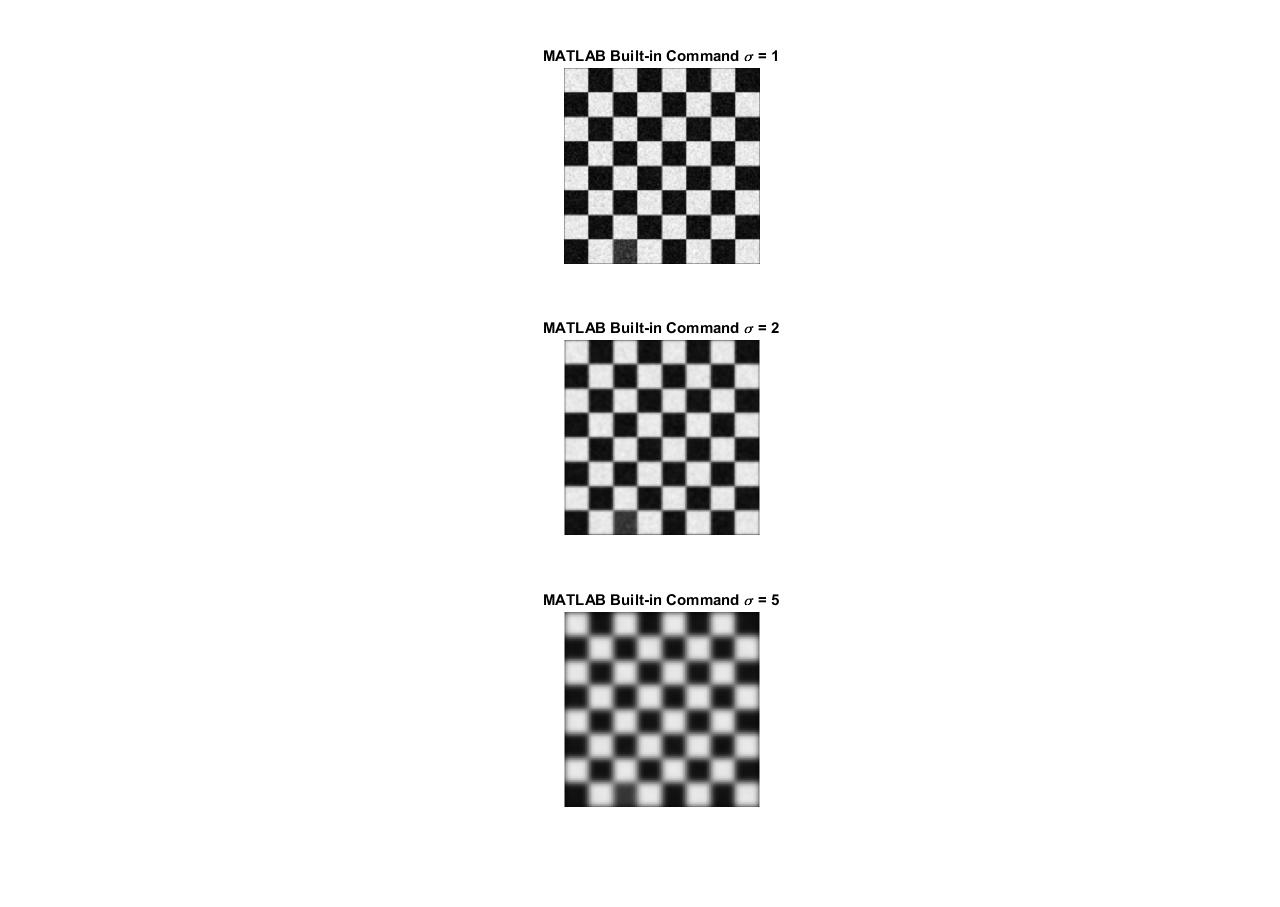
Because of using the default threshold in built-in *edge* command, the results from these two approaches have some differences.

3c) Solution: This problem was done using MATLAB with 3Std Gaussian Filter i.e.7x7 for σ = 1 (3\*1\*2 + 1), 13x13 for σ = 2 (3\*3\*2 + 1), and 31x31 for σ = 5 (3\*5\*2 + 1) (HW1\_3c.m)

Original Image



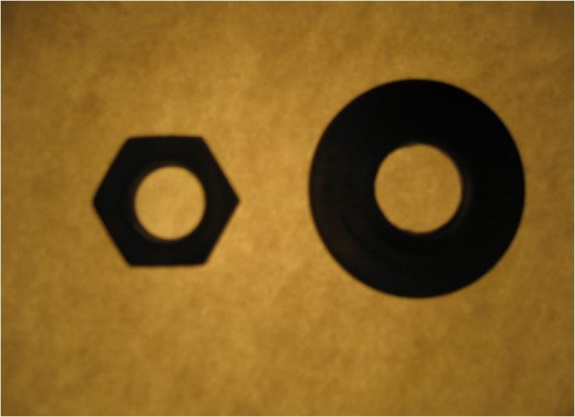
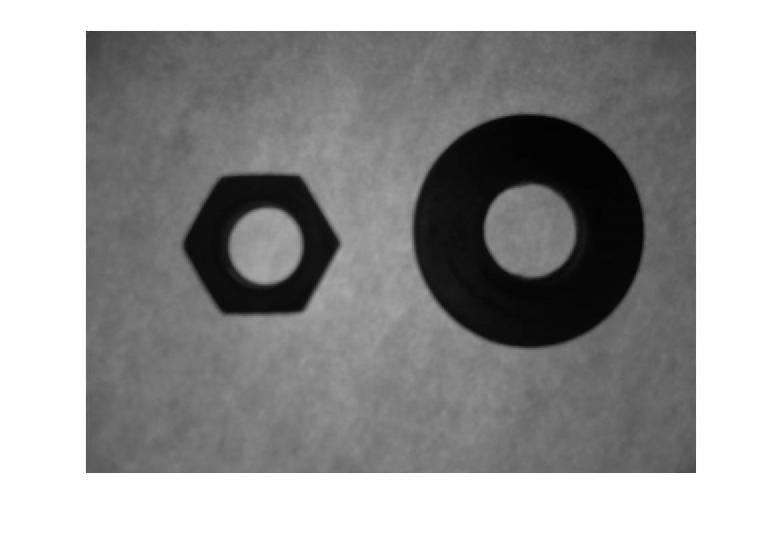
Analytical Implement MATLAB Built-In Command



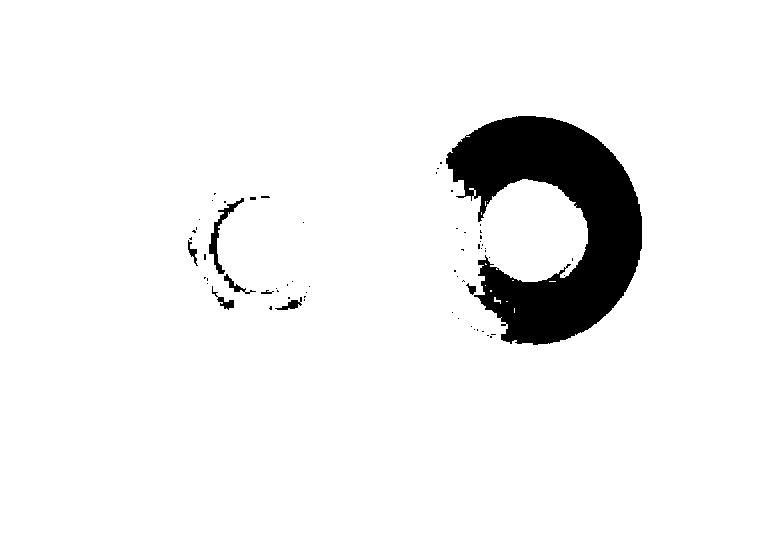
Problem 4: Low-Level Information Processing

4a) Solution: This problem was done using MATLAB (HW1\_4a.m)

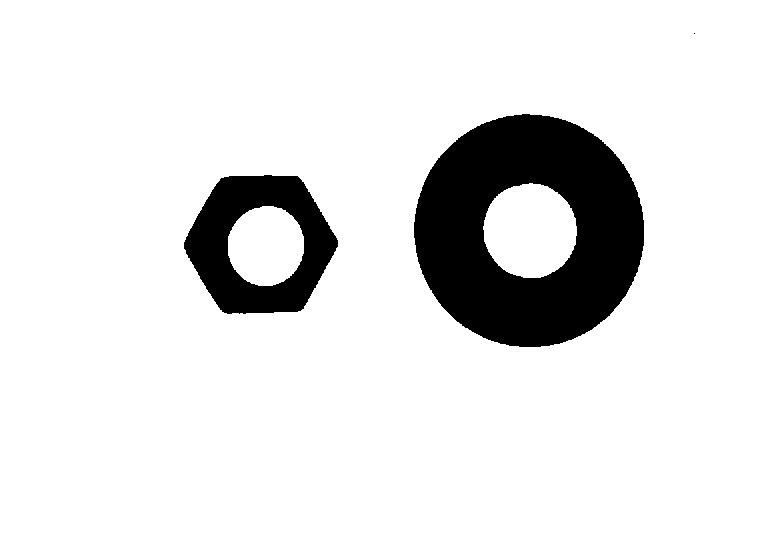
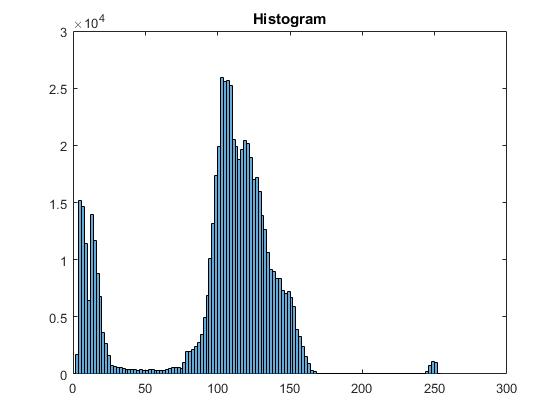
Original Image Grayscale Image

Over-Estimated Threshold Under-Estimated Threshold

Appropriated Threshold Histogram

The values of over-estimated threshold, under-estimate threshold, and appropriated threshold are chosen to be 127.5, 12.75, and 51, respectively; hence, the values 0.5 (127.5/255), 0.05 (12.75/255), and 0.2 (51/255) are used in *im2bw* function for over-estimated threshold, under-estimate threshold, and appropriated threshold, respectively.

4b) Solution: This problem was done using MATLAB (HW1\_4b.m)



The directions of axes, the locations of centroids, and the areas of each nut are already labeled on the above figure.