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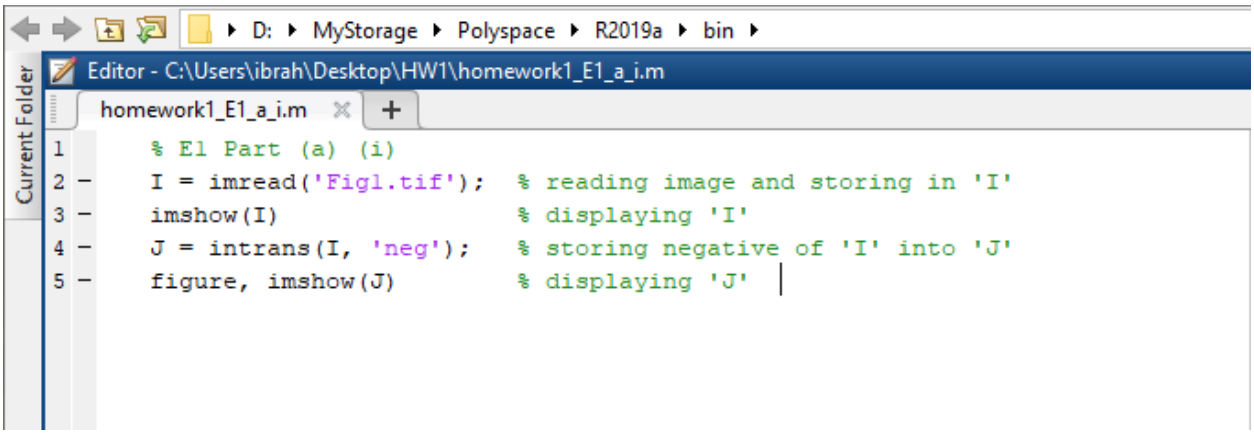
CS443

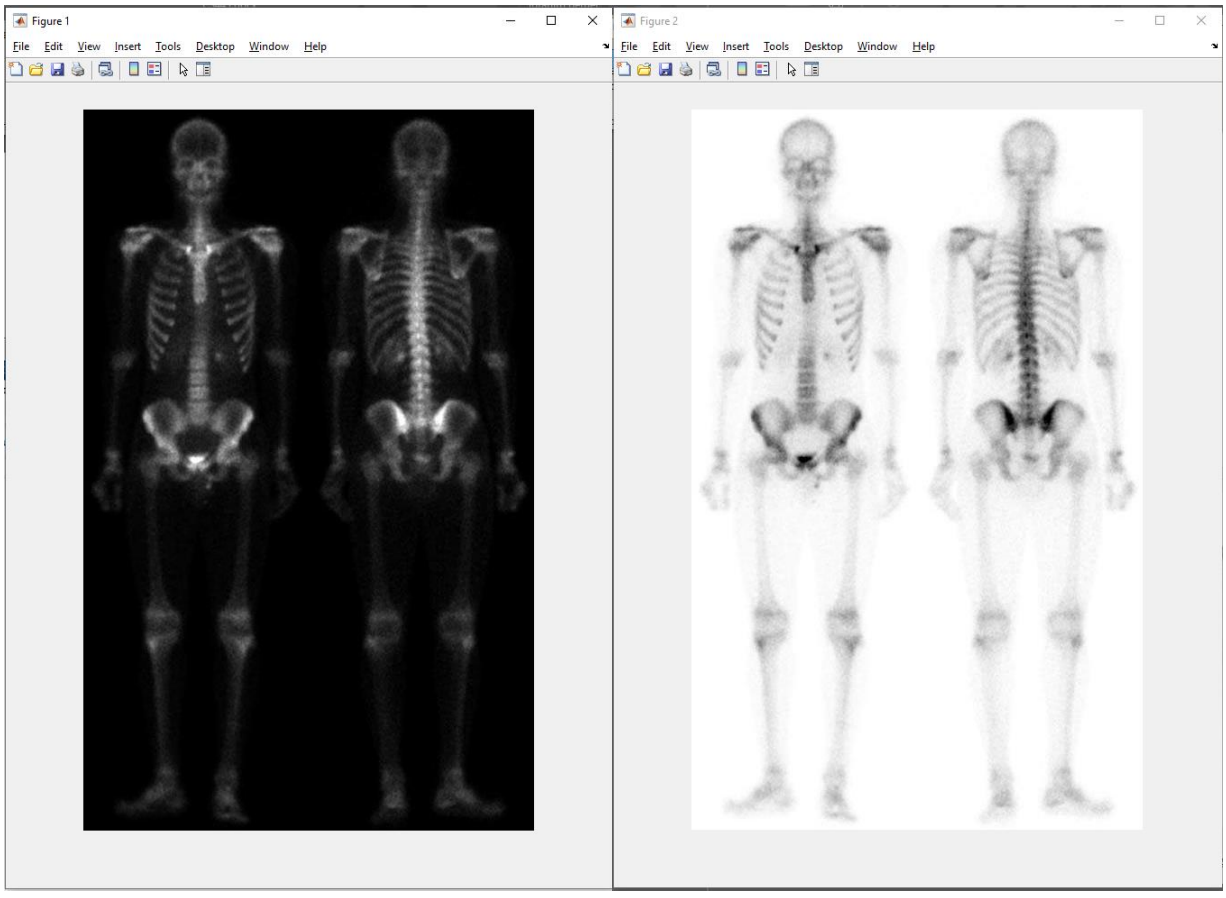
Digital Image Processing

Assignment #1

E1 Part (a) (i)



MATLAB Code 1: Image negative on **`Fig1`** with **`intrans`** function



(a) **(b)**

Figure 1: Original image (a) and Image negative (b)

(ii)

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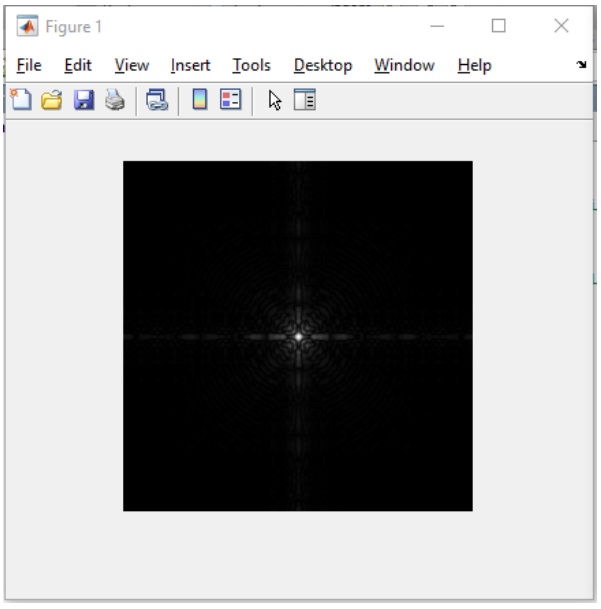
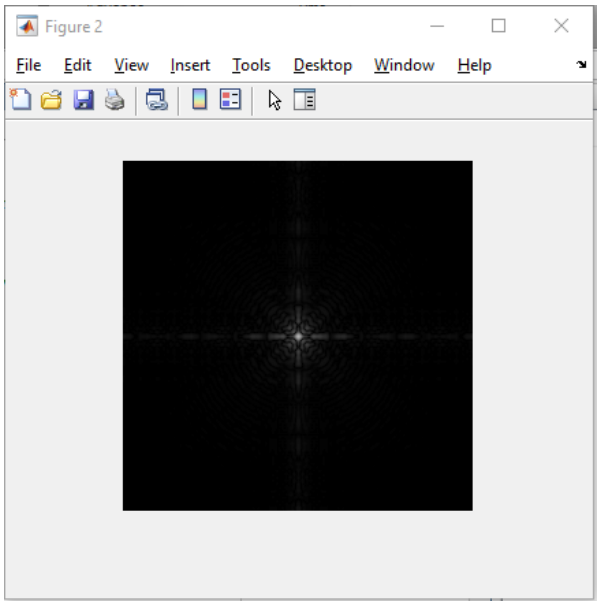
homework1_E1_a_ii.m

```
% E1 Part (a) (ii)

I = imread('Fig2.tif');      % reading image and storing in 'I'
imshow(I)                    % displaying 'I'

% applying logarithmic transform with parameters of 1, 4 and 8
J1 = intrans(I, 'log', 1);
J2 = intrans(I, 'log', 4);
J3 = intrans(I, 'log', 8);

% displaying J1, J2 and J3
figure, imshow(J1)
figure, imshow(J2)
figure, imshow(J3)
```

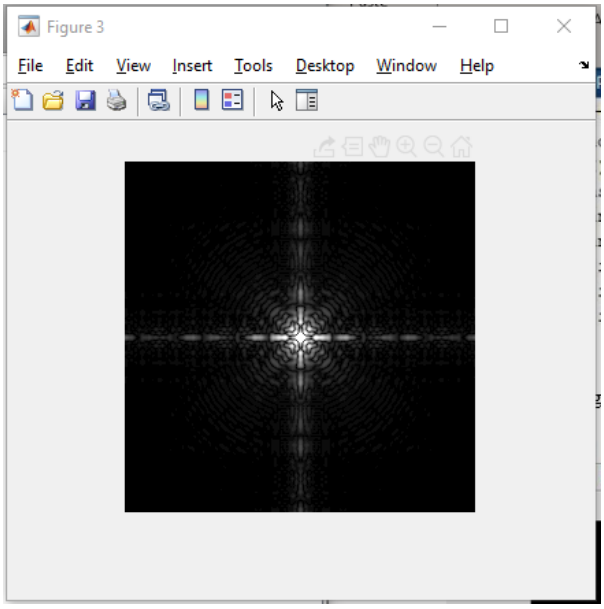
MATLAB Code 2: Log transformation on **`Fig2`** with **`intrans`** function

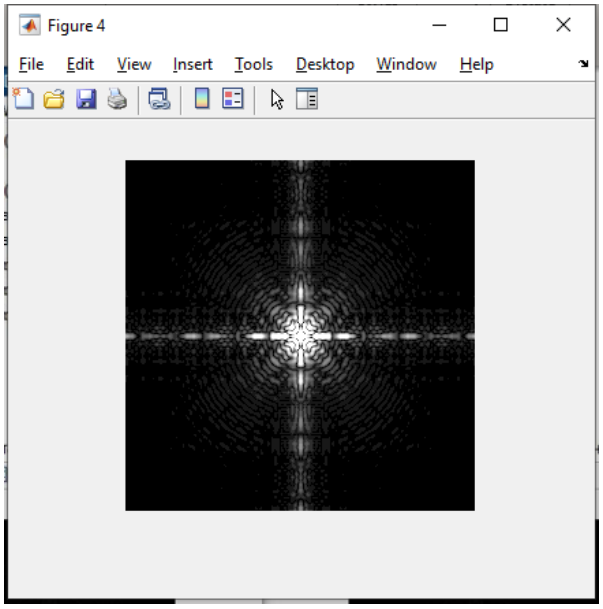


(a)



(b)

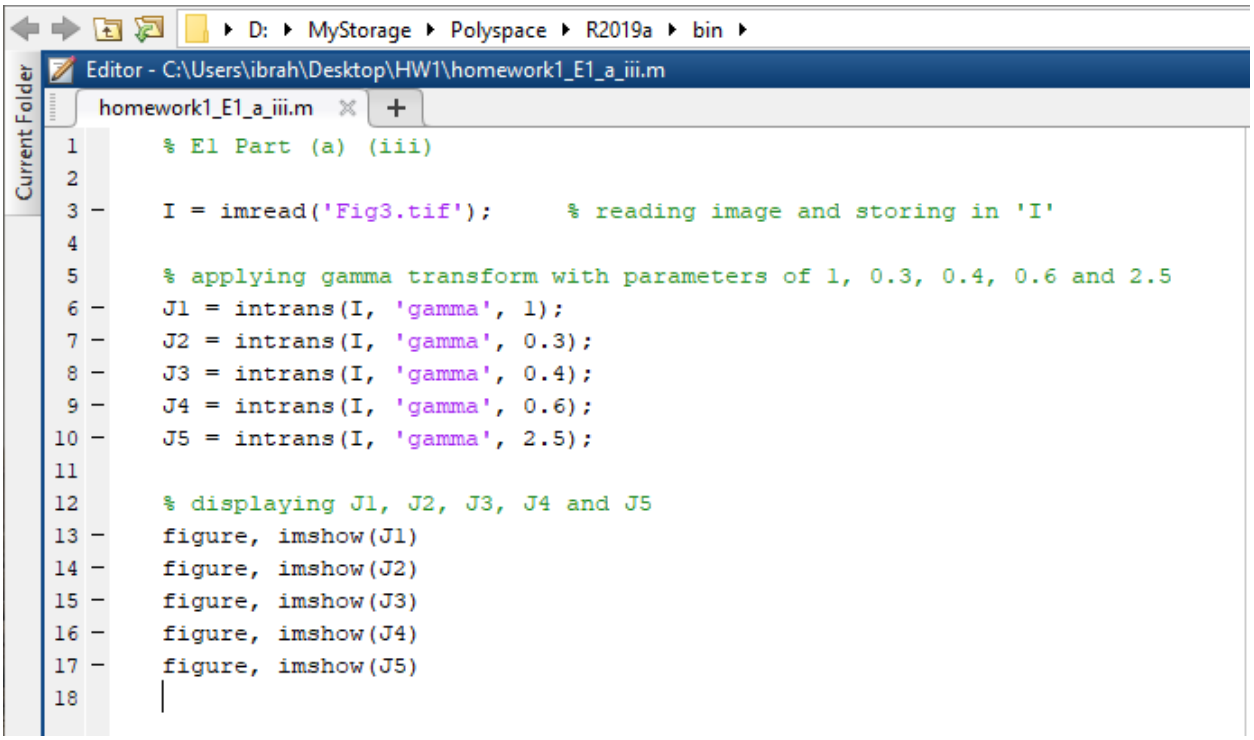




(c) **(d)**

Figure 2: Original image (a),
Logarithmic transform with parameter **c = 1** (b),
Logarithmic transform with parameter **c = 4** (c) and
Logarithmic transform with parameter **c = 8** (d)

(iii)



MATLAB Code 3: Gamma transformation on **Fig3** with **intrans** function having given parameters for gamma

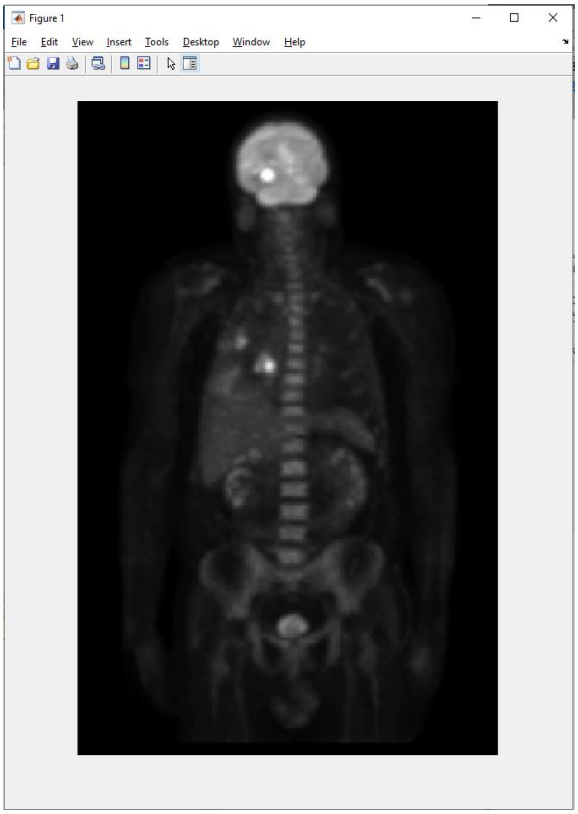


Figure 1
File Edit View Insert Tools Desktop Window Help

(a)


Figure 2
File Edit View Insert Tools Desktop Window Help

(b)


Figure 3
File Edit View Insert Tools Desktop Window Help

(c)

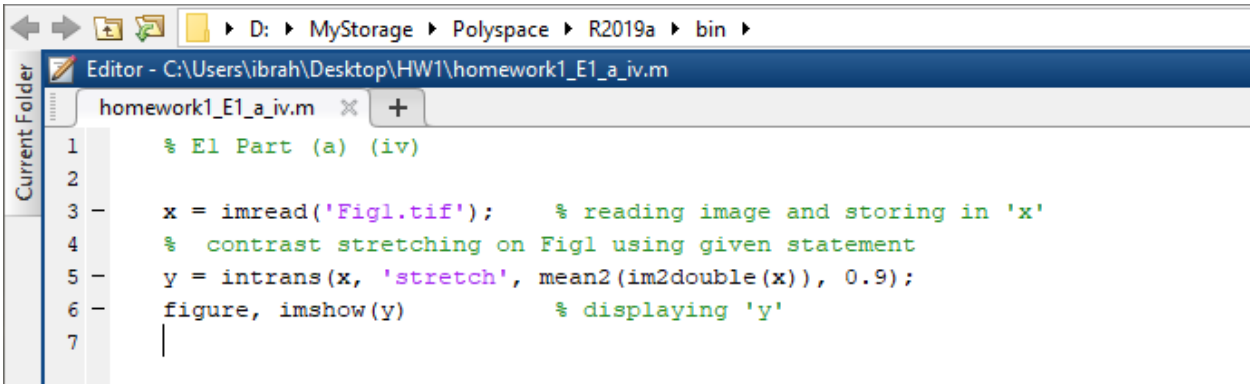

Figure 4
File Edit View Insert Tools Desktop Window Help

(d)

(e)

Figure 3: Original image (**γ = 1**) (a),
Gamma transform with parameter **γ = 0.3** (b),
Gamma transform with parameter **γ = 0.4** (c),
Gamma transform with parameter **γ = 0.6** (d) and
Gamma transform with parameter **γ = 2.5** (e),

(iv)



MATLAB Code 4: Contrast stretching on **`Fig1`** with **`intrans`** function

(a) **(b)**

Figure 4: Original image (a) and Contrast stretched image (b)

E1 Part (b)

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homework1_E1_b.m

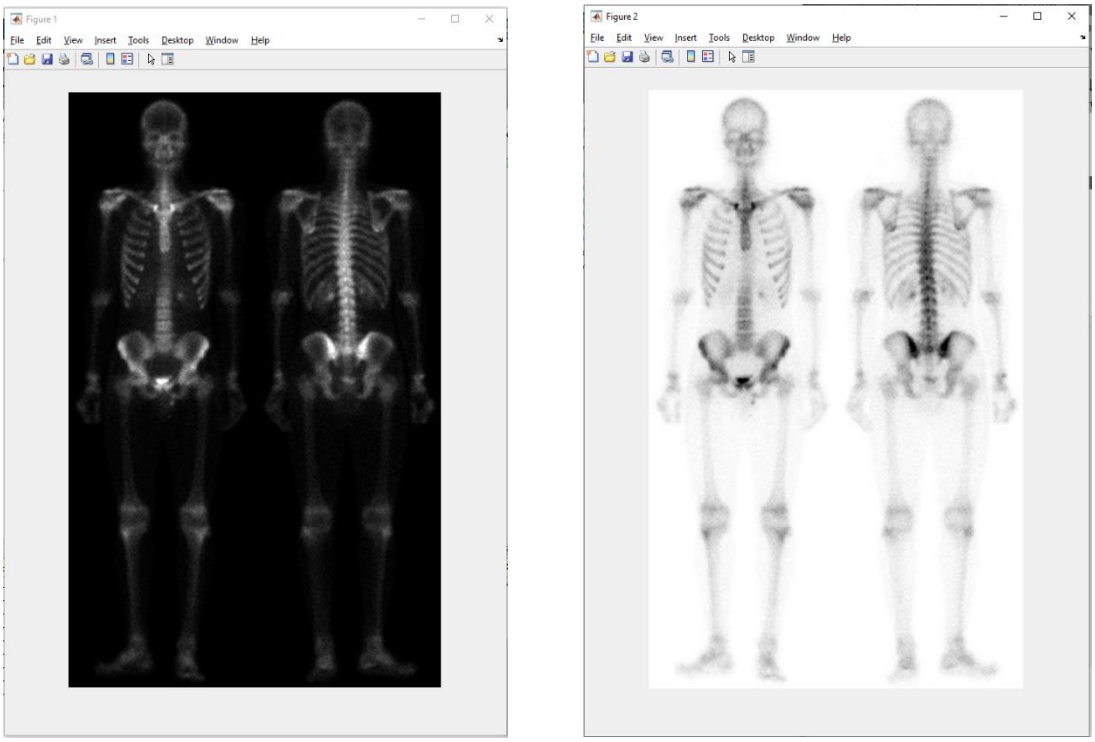
```
% E1 Part (b)

I = imread('Fig1.tif');          % reading image and storing in 'I'
J = imadjust(I, [0 1], [1 0]);   % taking negative with 'imadjust'

% displaying 'I' and 'J'
imshow(I)
figure, imshow(J)

```

MATLAB Code 5: Performing image negative on **`Fig1`** with **`imadjust`** function



(a) **(b)**

Figure 5: Original image (a) and image negative image (b)

E2 Part (a)

Fig316a.tif

```
% E2 Part (a)

I = imread('Fig316a.tif');   % reading image and storing in 'I'

% displaying  'imhist', 'bar', 'stem' and 'plot' of x
x = imhist(I);
figure, imhist(I);
figure, bar(x);
figure, stem(x);
figure, plot(x);
```

MATLAB Code 6: Displaying **imhist**, **bar**, **stem** and **plot** operations on **Fig316a.tif**

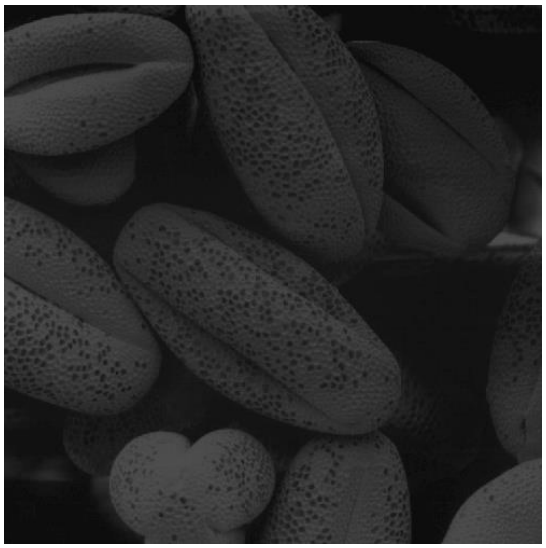


Figure 6.1: Image file **Fig316a.tif**

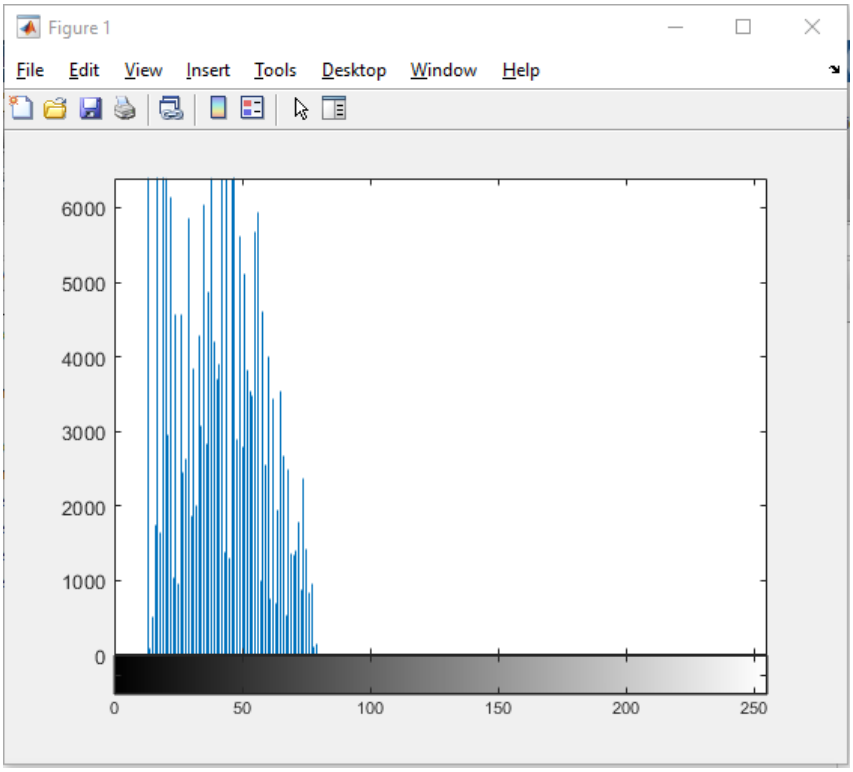


Figure 6.2: **imhist** of **Fig316a.tif**

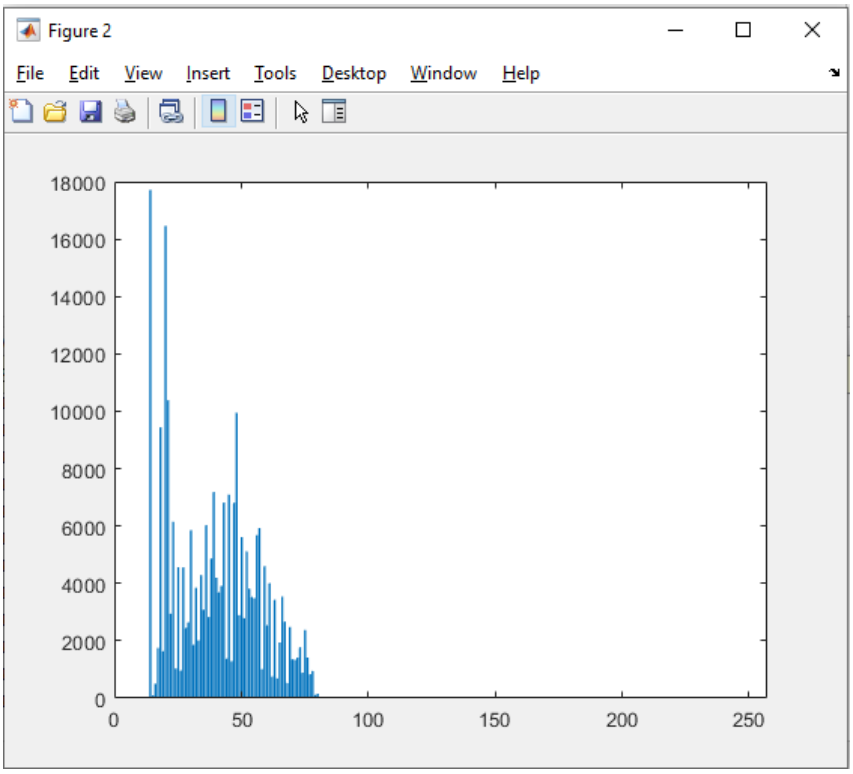


Figure 6.3: **bar** of **Fig316a.tif**

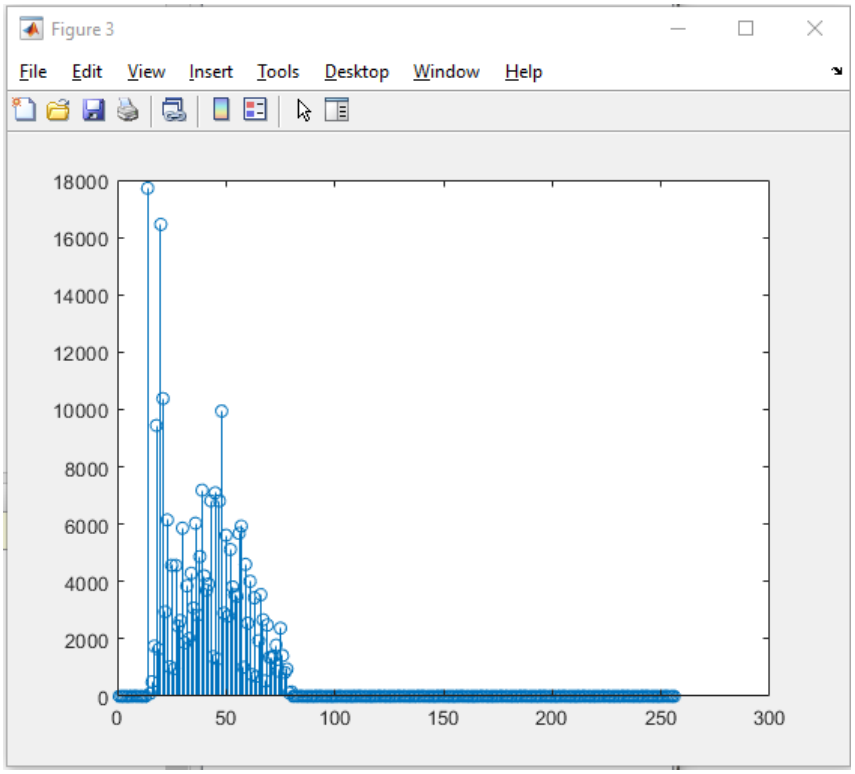


Figure 6.4: **stem** of **Fig316a.tif**

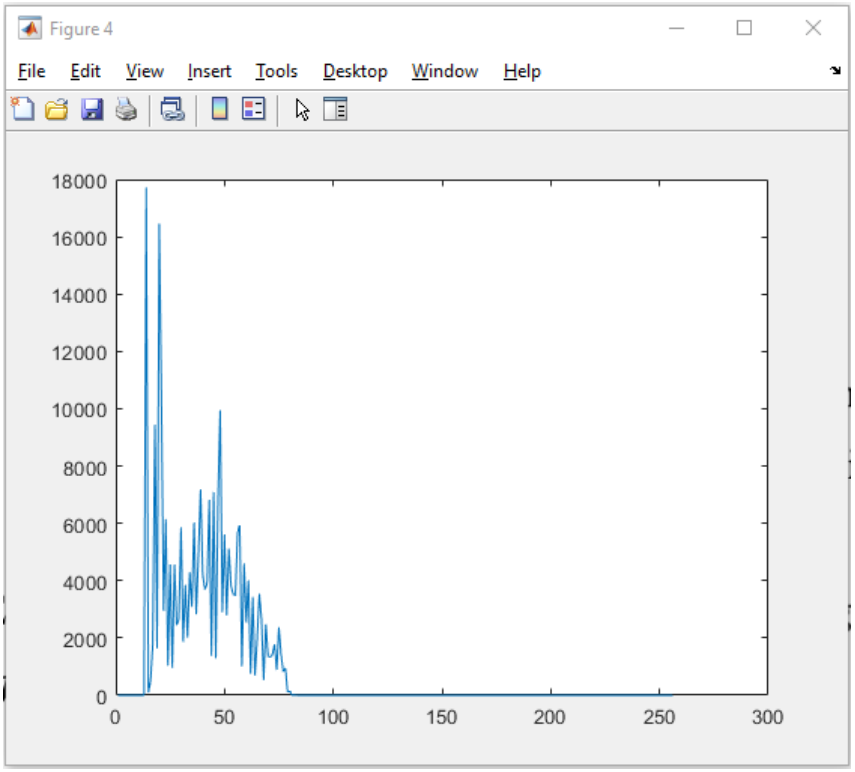


Figure 6.5: **plot** of **Fig316a.tif**

Fig316b.tif

```
% E2 Part (b)

I = imread('Fig316b.tif');   % reading image and storing in 'I'

% displaying  'imhist', 'bar', 'stem' and 'plot' of x
x = imhist(I);
figure, imhist(I);
figure, bar(x);
figure, stem(x);
figure, plot(x);
```

MATLAB Code 7: Displaying **imhist**, **bar**, **stem** and **plot** operations on **Fig316b.tif**

Figure 7.1: Image file **Fig316b.tif**

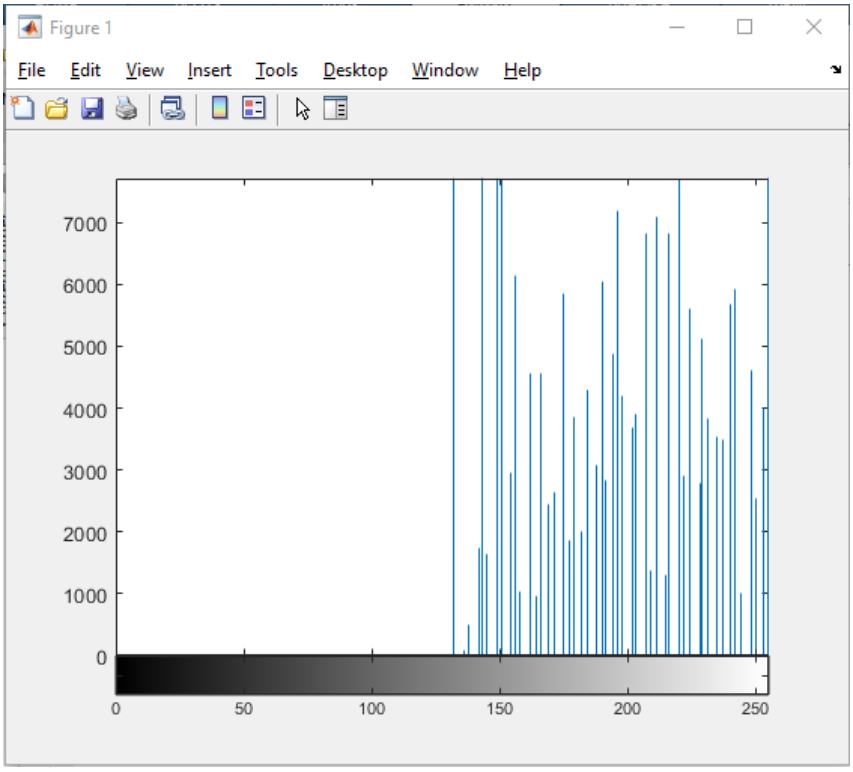


Figure 7.2: **imhist** of **Fig316b.tif**

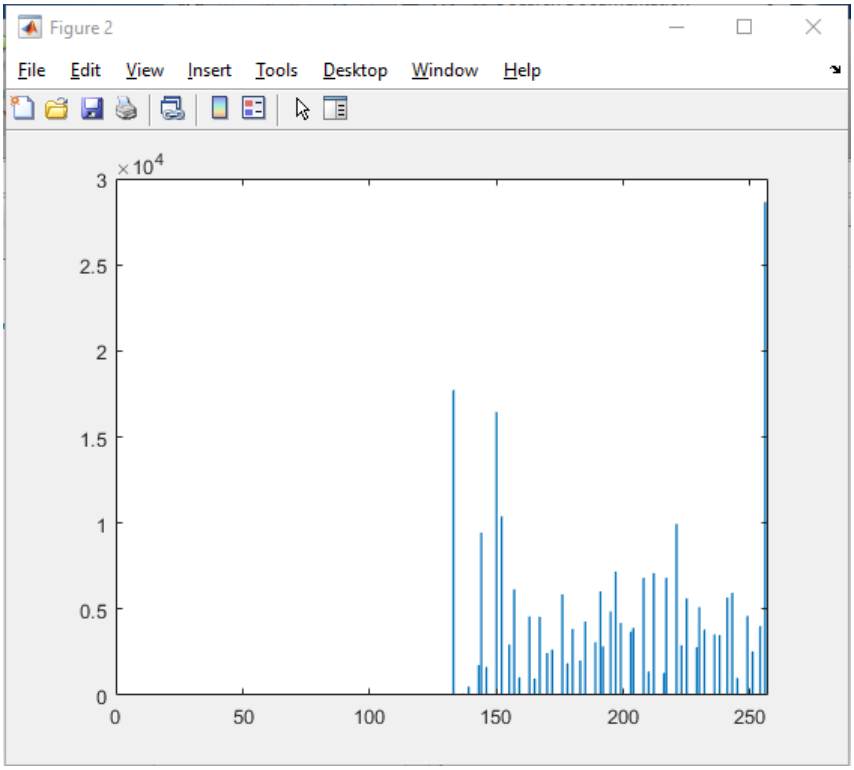


Figure 7.3: **bar** of **Fig316b.tif**

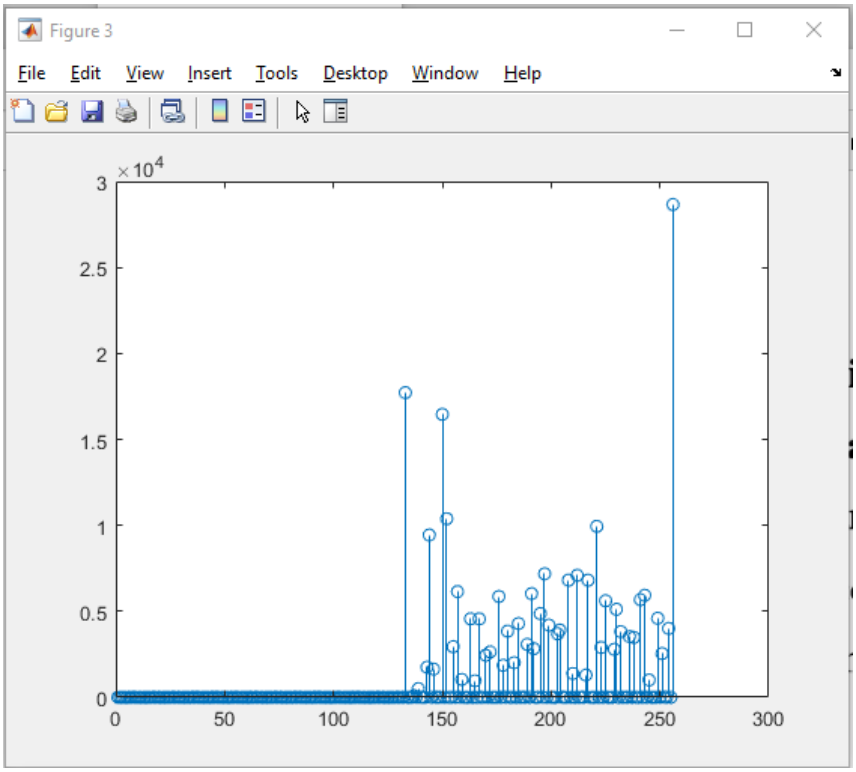


Figure 7.4: **`stem`** of **`Fig316b.tif`**

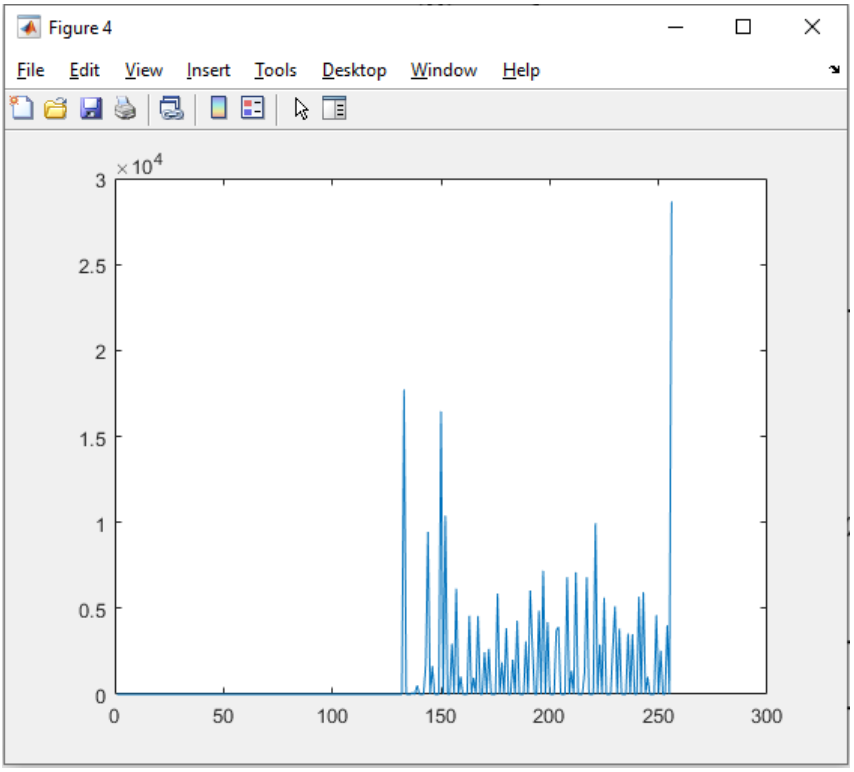


Figure 7.5: **`plot`** of **`Fig316b.tif`**

Fig316c.tif

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homework1_E2_c.m

```
1     % E2 Part (c)
2
3 -   I = imread('Fig316c.tif');   % reading image and storing in 'I'
4
5     % displaying  'imhist', 'bar', 'stem' and 'plot' of x
6 -   x = imhist(I);
7 -   figure, imhist(I);
8 -   figure, bar(x);
9 -   figure, stem(x);
10 -  figure, plot(x);
11
```

MATLAB Code 8: Displaying **imhist**, **bar**, **stem** and **plot** operations on **Fig316c.tif**

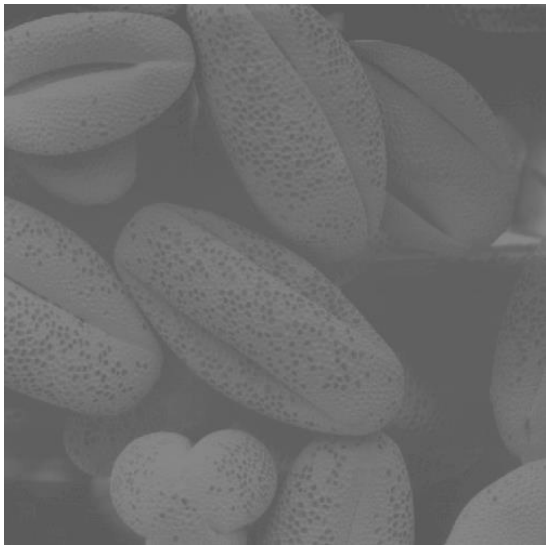

Figure 8.1: Image file **Fig316c.tif**

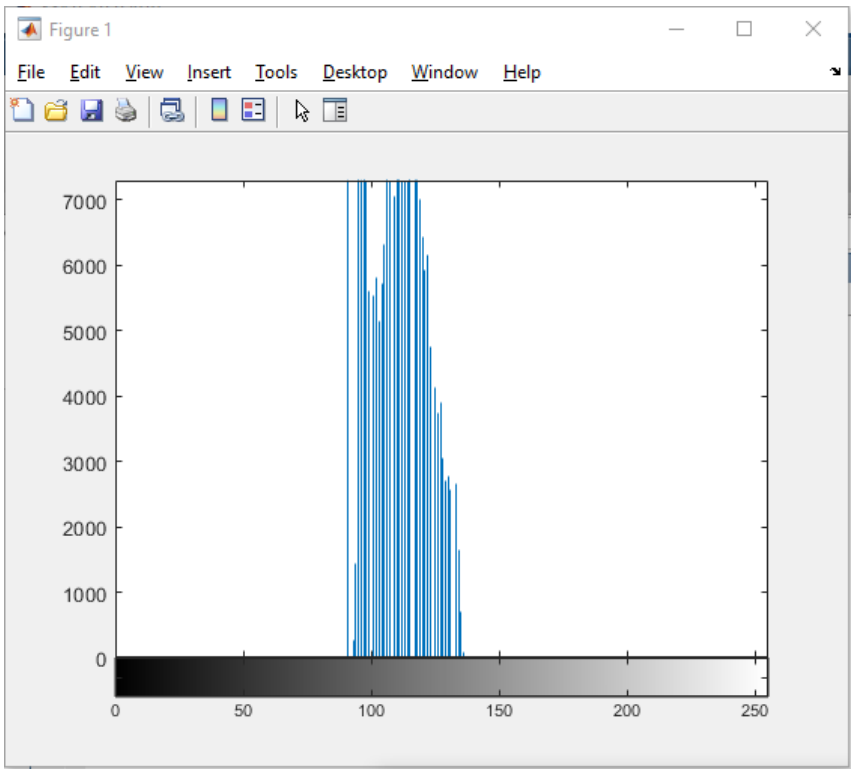

Figure 8.2: **`imhist`** of **`Fig316c.tif`**

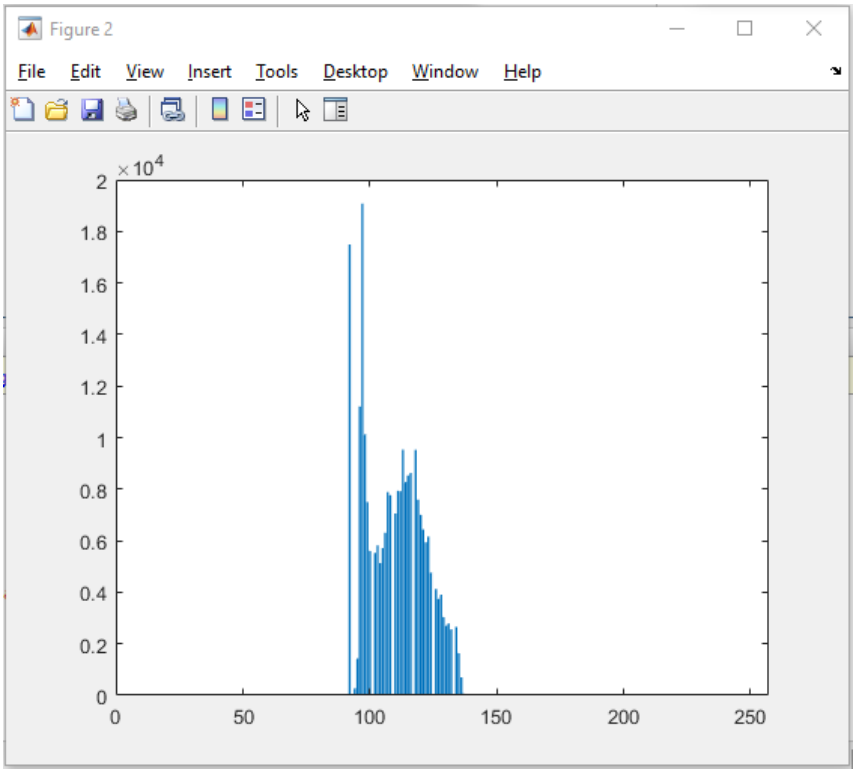

Figure 8.3: **`bar`** of **`Fig316c.tif`**

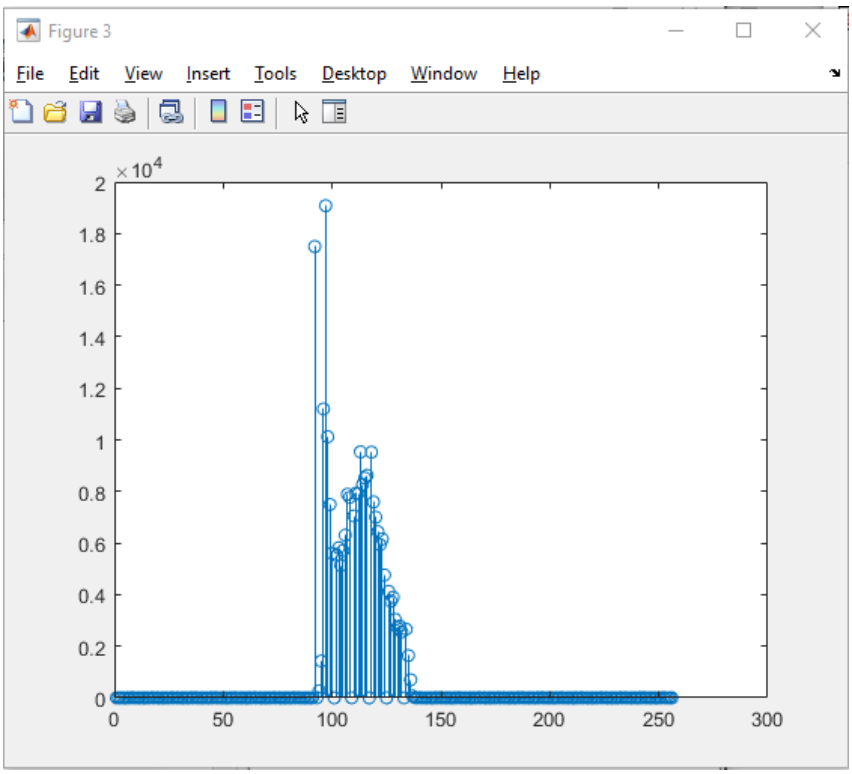

Figure 8.4: **`stem`** of **`Fig316c.tif`**

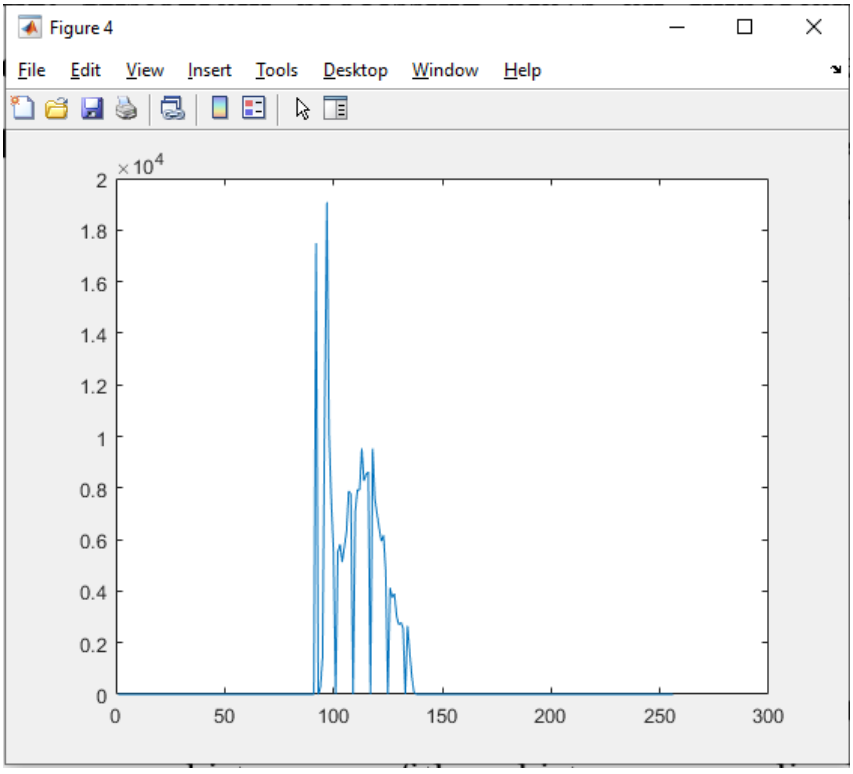

Figure 8.5: **`plot`** of **`Fig316c.tif`**

Fig316d.tif

```
% E2 Part (d)

I = imread('Fig316d.tif');   % reading image and storing in 'I'

% displaying  'imhist', 'bar', 'stem' and 'plot' of x
x = imhist(I);
figure, imhist(I);
figure, bar(x);
figure, stem(x);
figure, plot(x);
```

MATLAB Code 9: Displaying **imhist**, **bar**, **stem** and **plot** operations on **Fig316d.tif**

Figure 9.1: Image file **Fig316d.tif**

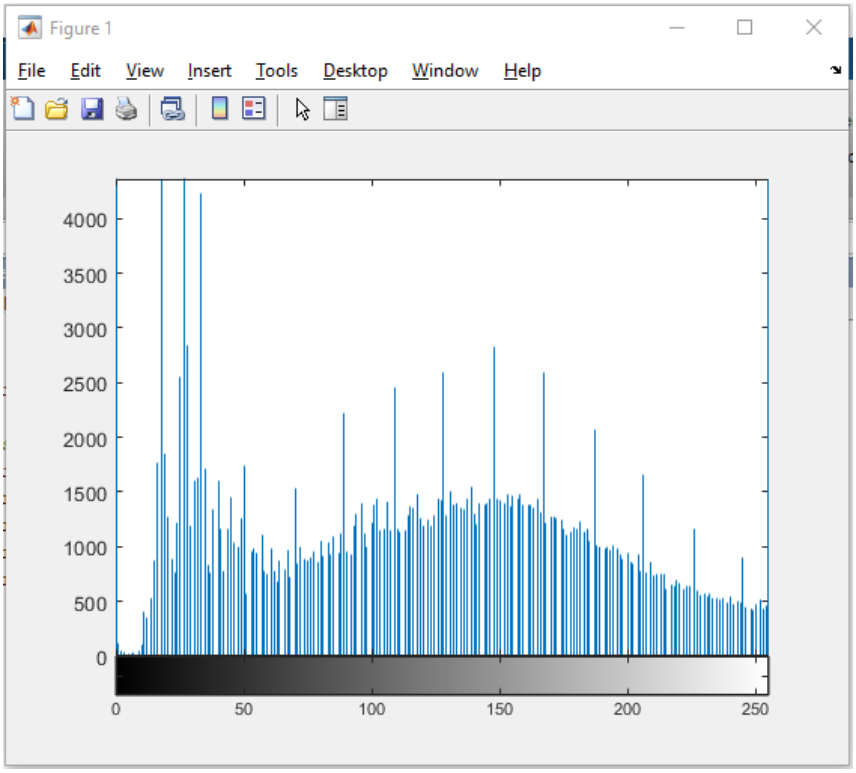

Figure 9.2: **imhist** of **Fig316d.tif**

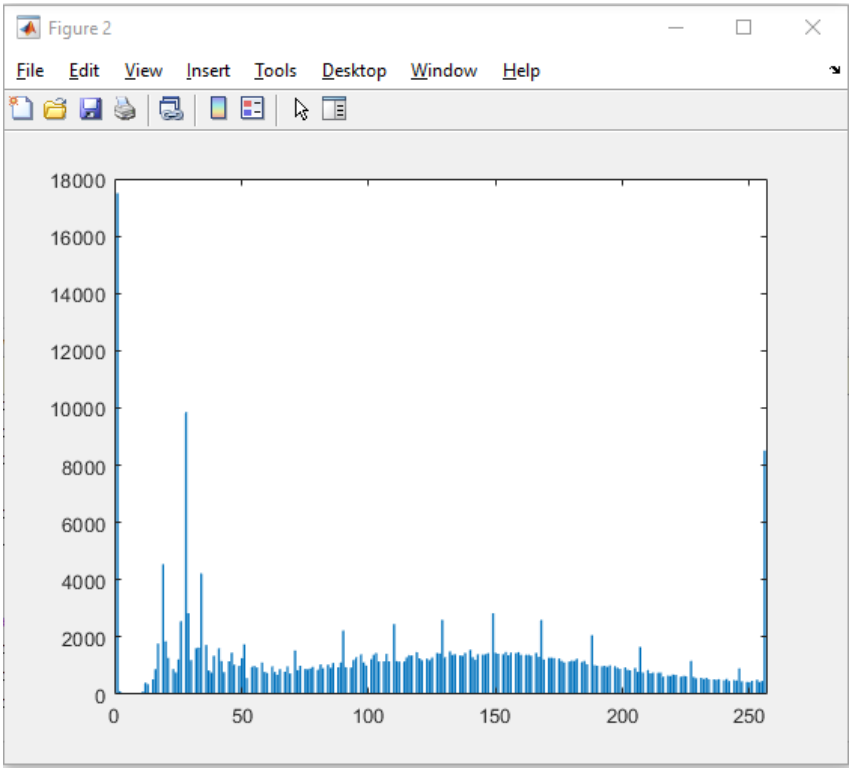

Figure 9.3: **bar** of **Fig316d.tif**

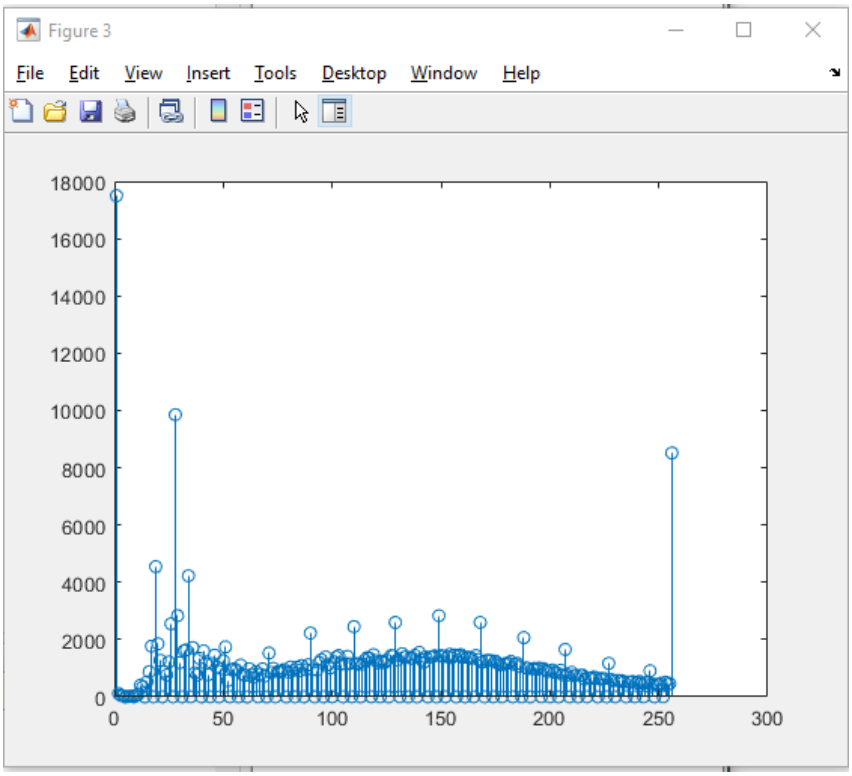

Figure 9.4: **`stem`** of **`Fig316d.tif`**

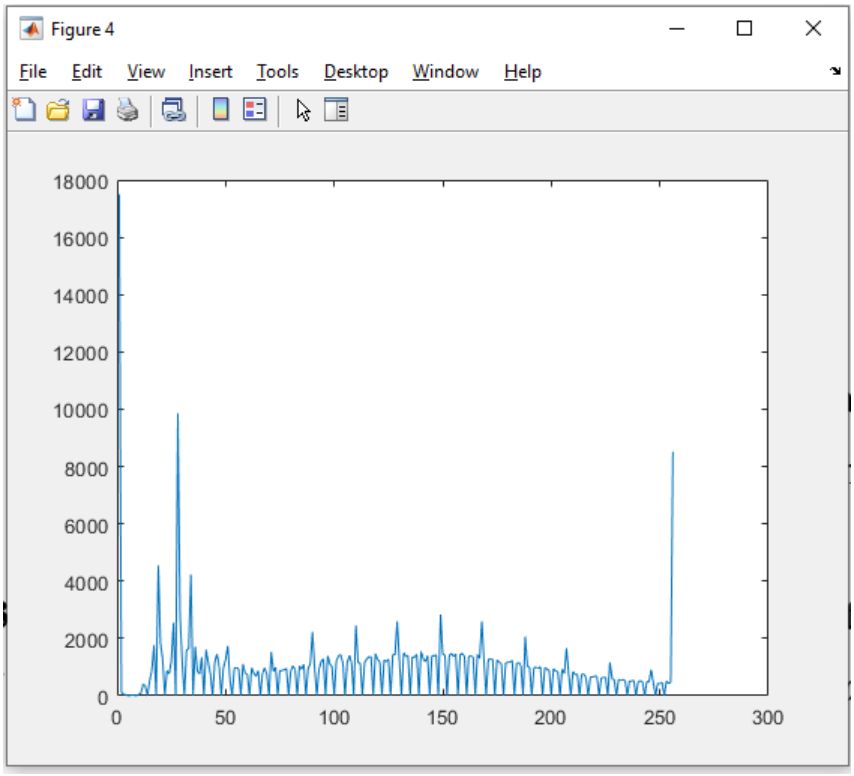

Figure 9.5: **`plot`** of **`Fig316d.tif`**

E2 Part (b)

Fig316a.tif Equalization

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homework1_E2_B_a.m

```
% E2 Part (b) Fig316a Equalization

I = imread('Fig316a.tif');   % reading image and storing in 'I'

x = histeq(I);  % applying 'histeq' to 'I'

% displaying  'I', 'x' and their 'imhist'
figure, imshow(I);
figure, imhist(I);
figure, imshow(x);
figure, imhist(x);
```

MATLAB Code 10: Displaying histogram equalization with **histeq**, and **imhist** operations on **Fig316a.tif**

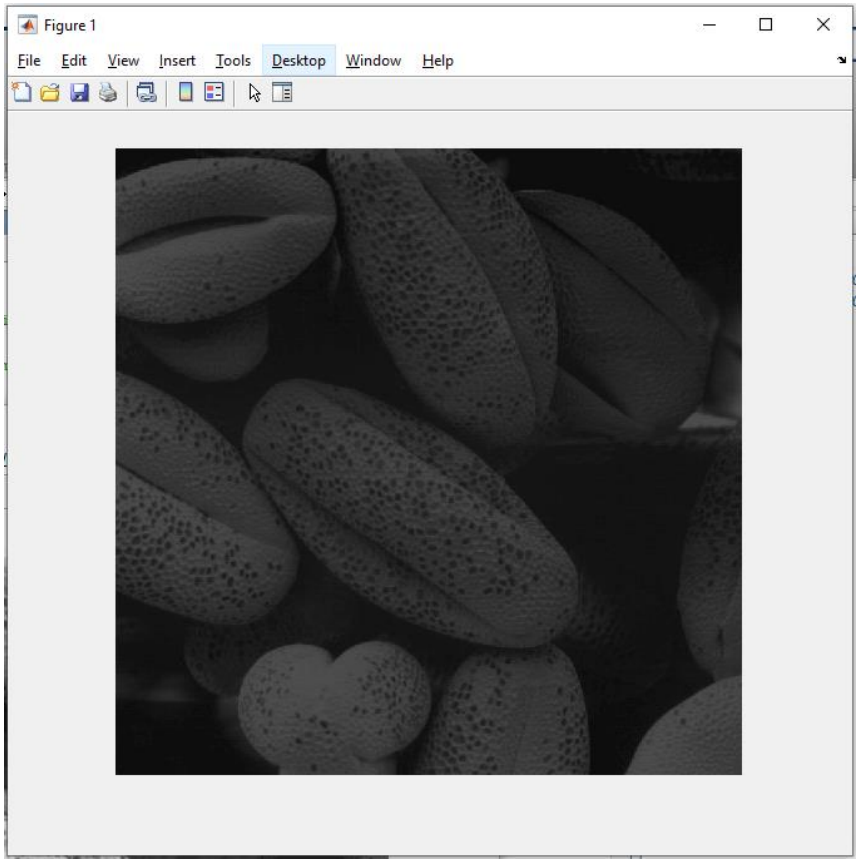

Figure 10.1: Image file **Fig316a.tif**

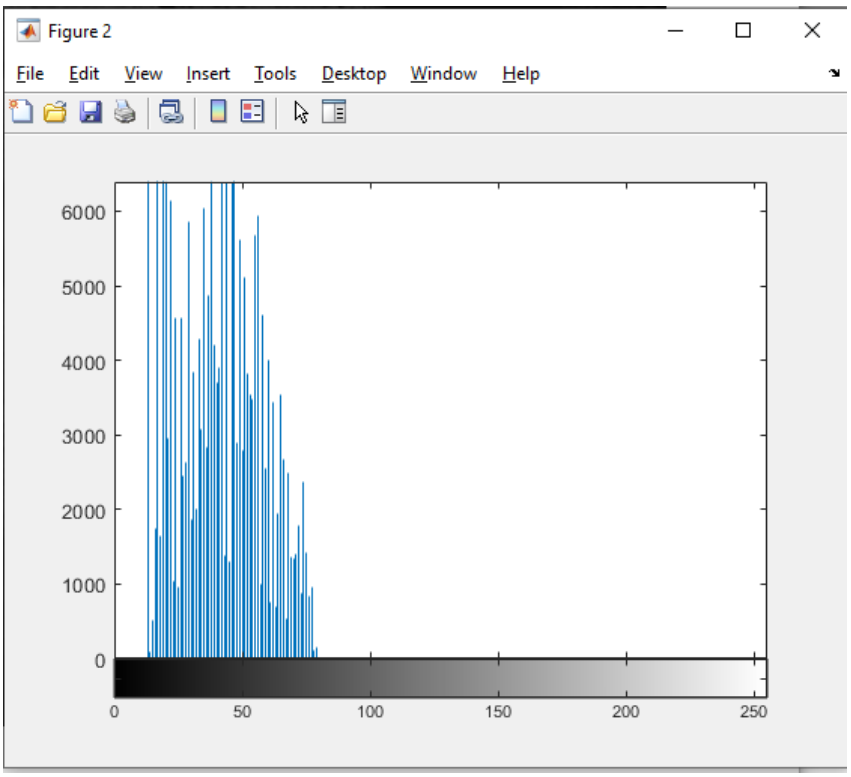

Figure 10.2: Histogram plot of **`Fig316a.tif`**

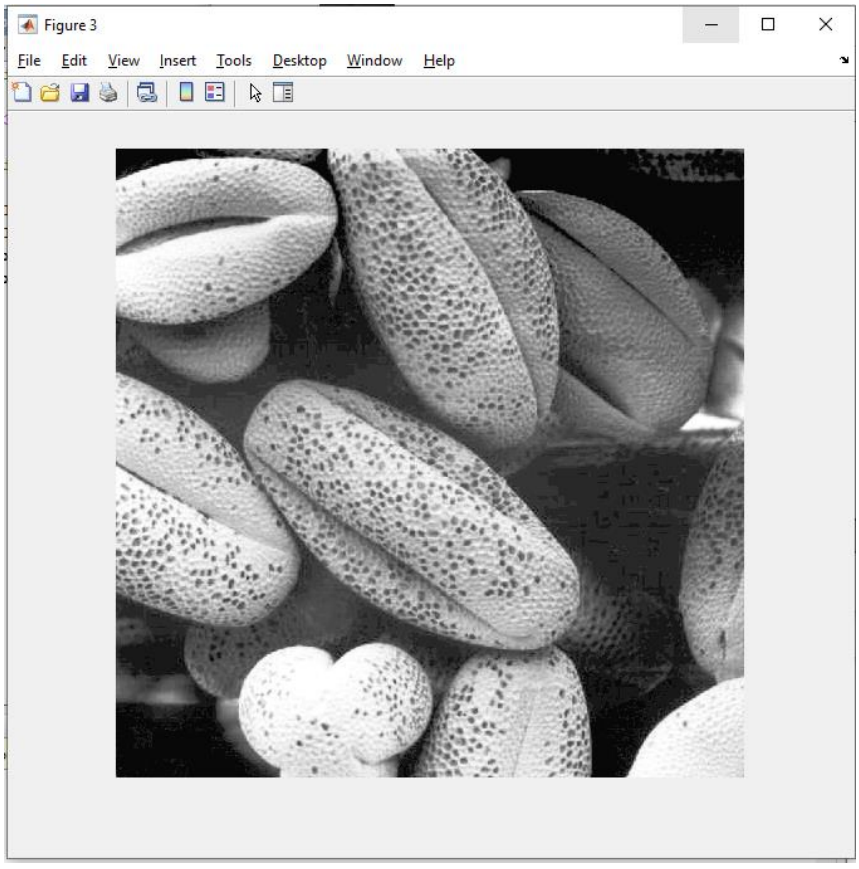

Figure 10.3: Histogram equalized image of **`Fig316a.tif`**

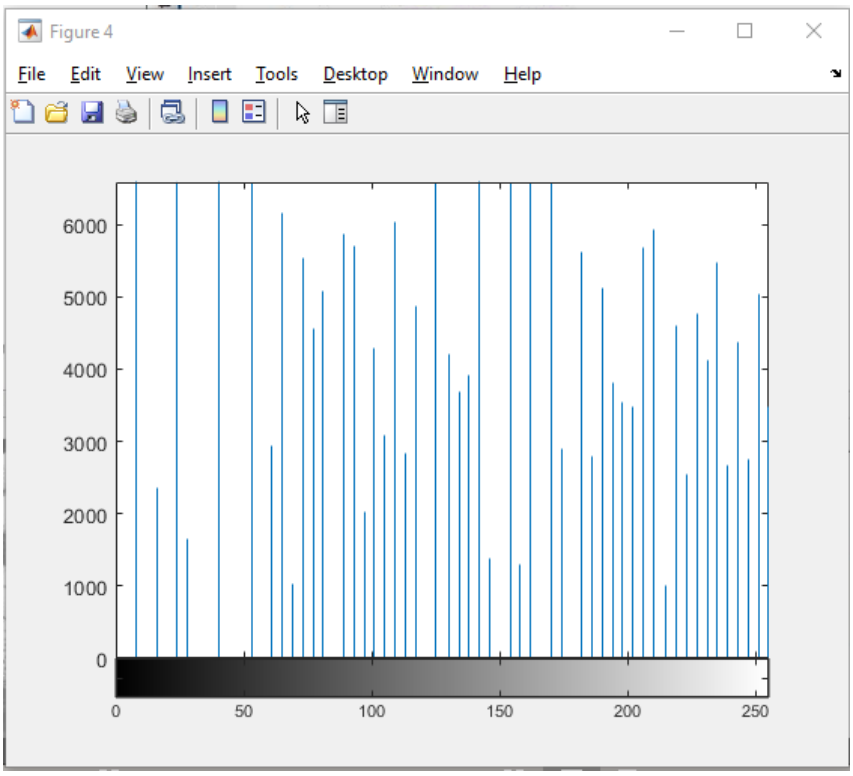

Figure 10.4: Histogram of Histogram equalized image of **`Fig316a.tif`**

Fig316b.tif Equalization

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homework1_E2_B_a.m | homework1_E2_B_b.m

```
% E2 Part (b) Fig316b Equalization

I = imread('Fig316b.tif');   % reading image and storing in 'I'

x = histeq(I);  % applying 'histeq' to 'I'

% displaying  'I', 'x' and their 'imhist'
figure, imshow(I);
figure, imhist(I);
figure, imshow(x);
figure, imhist(x);
```

MATLAB Code 11: Displaying histogram equalization with **histeq**, and **imhist** operations on **Fig316b.tif**

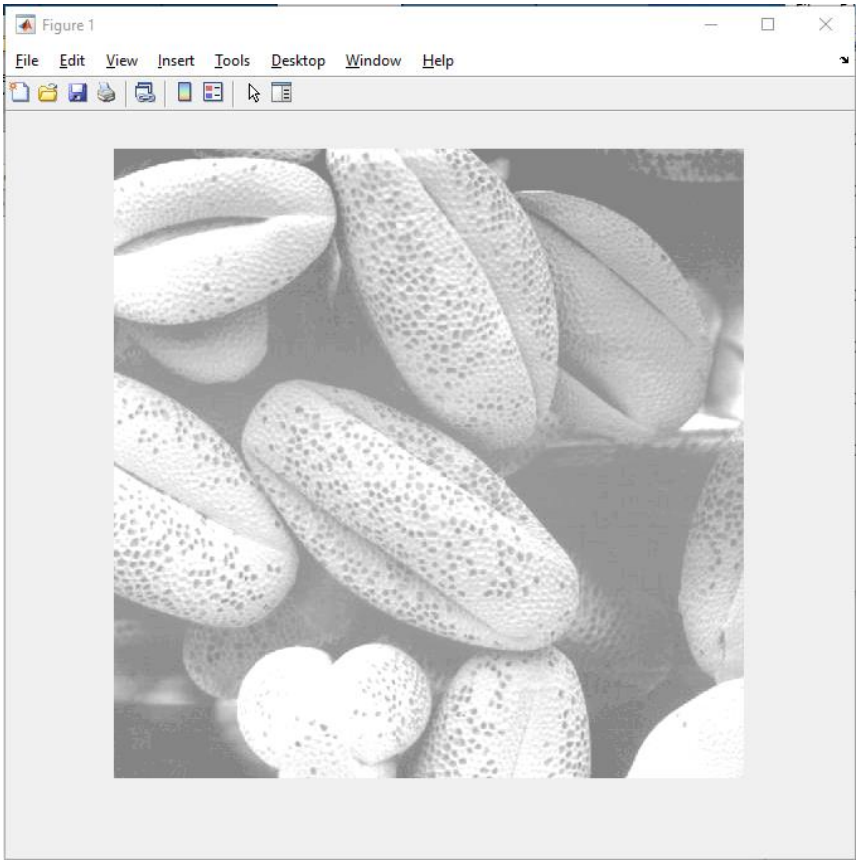

Figure 11.1: Image file **Fig316b.tif**

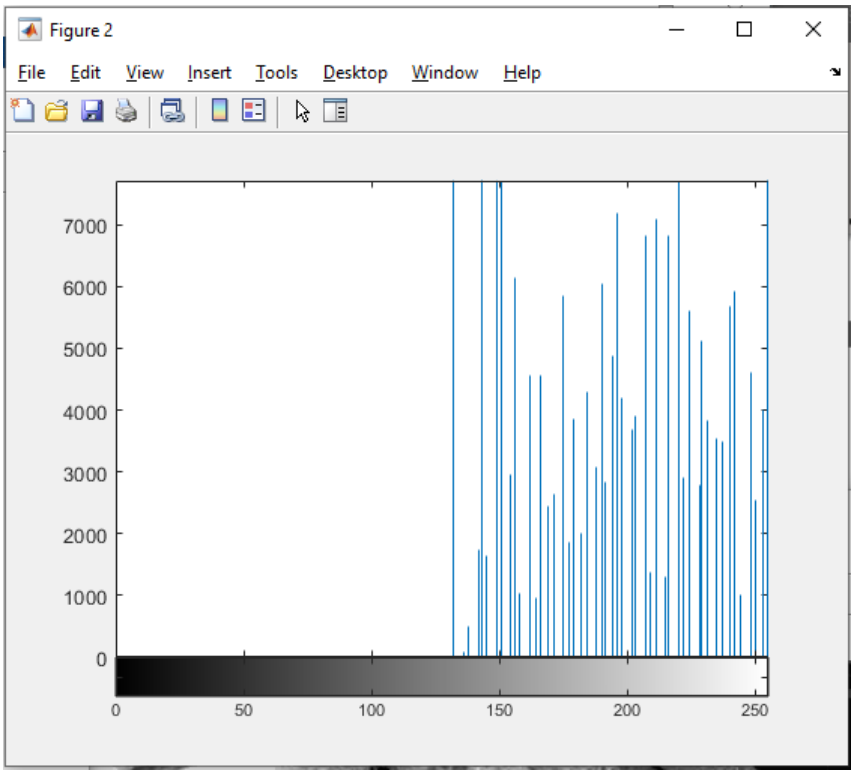

Figure 11.2: Histogram plot of **`Fig316b.tif`**

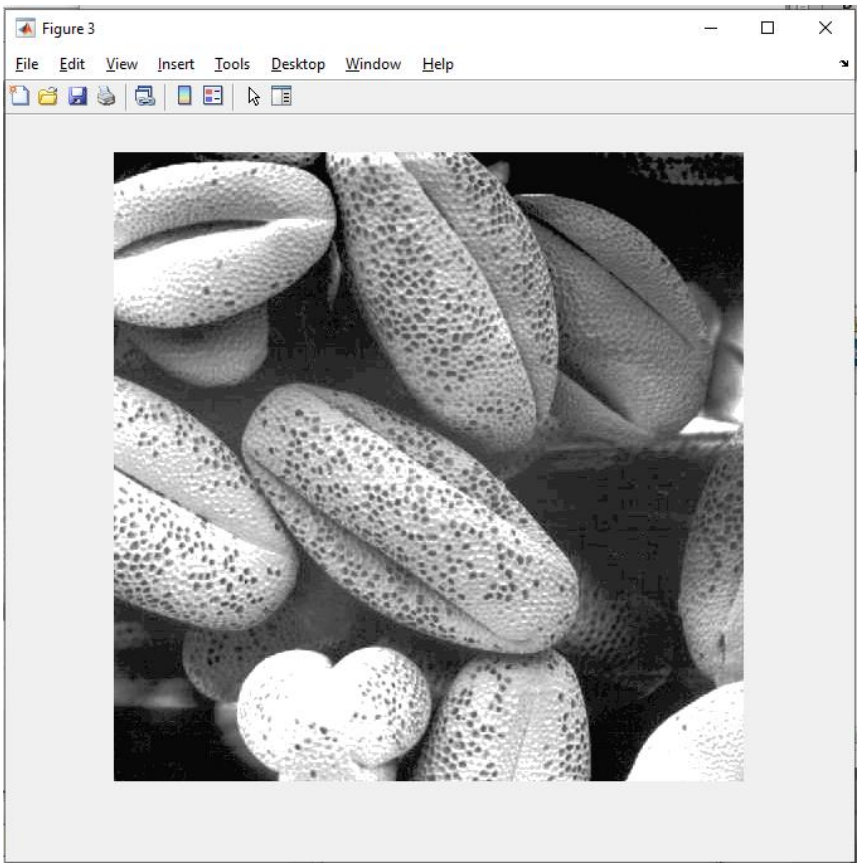

Figure 11.3: Histogram equalized image of **`Fig316b.tif`**

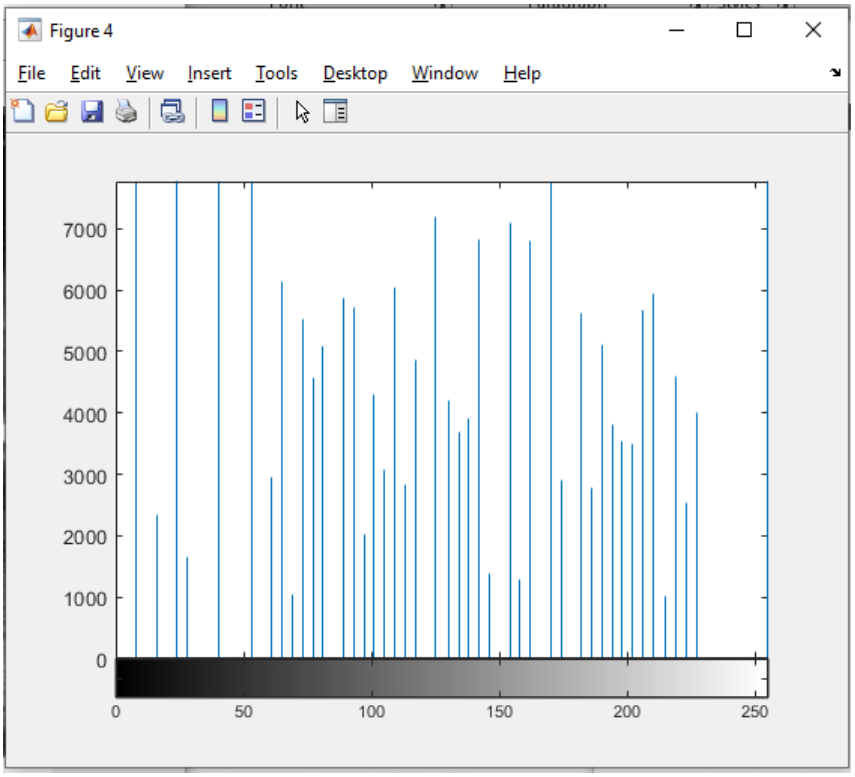

Figure 11.4: Histogram of Histogram equalized image of **`Fig316b.tif`**

Fig316c.tif Equalization

```
% E2 Part (b) Fig316c Equalization

I = imread('Fig316c.tif');   % reading image and storing in 'I'

x = histeq(I);  % applying 'histeq' to 'I'

% displaying  'I', 'x' and their 'imhist'
figure, imshow(I);
figure, imhist(I);
figure, imshow(x);
figure, imhist(x);
```

MATLAB Code 12: Displaying histogram equalization with **histeq**, and **imhist** operations on **Fig316c.tif**

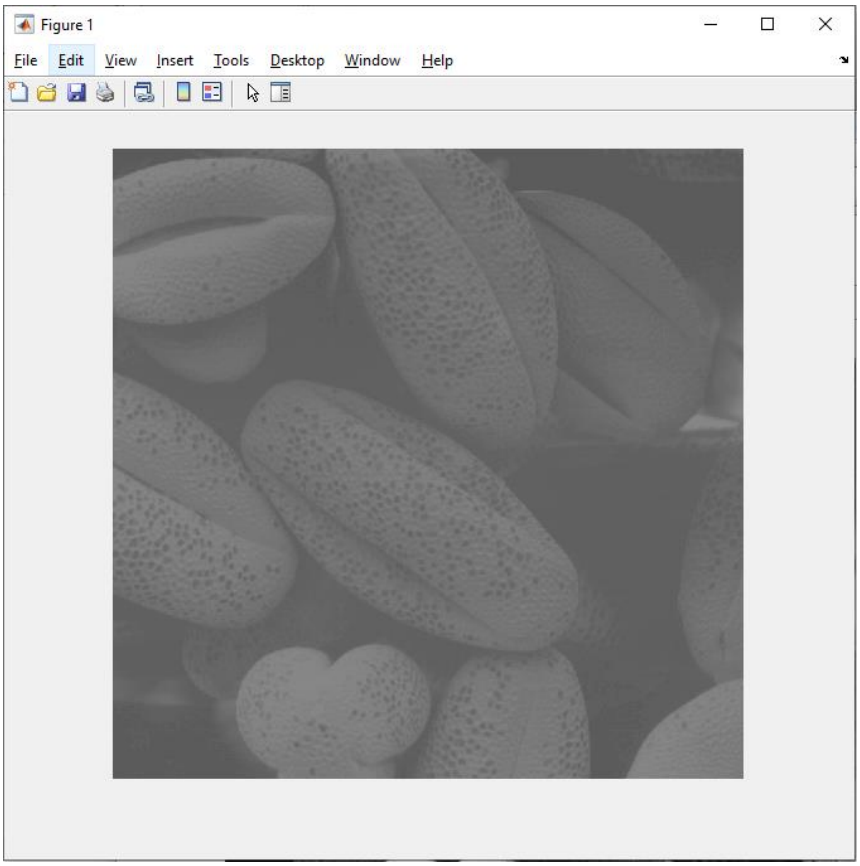

Figure 12.1: Image file **Fig316c.tif**

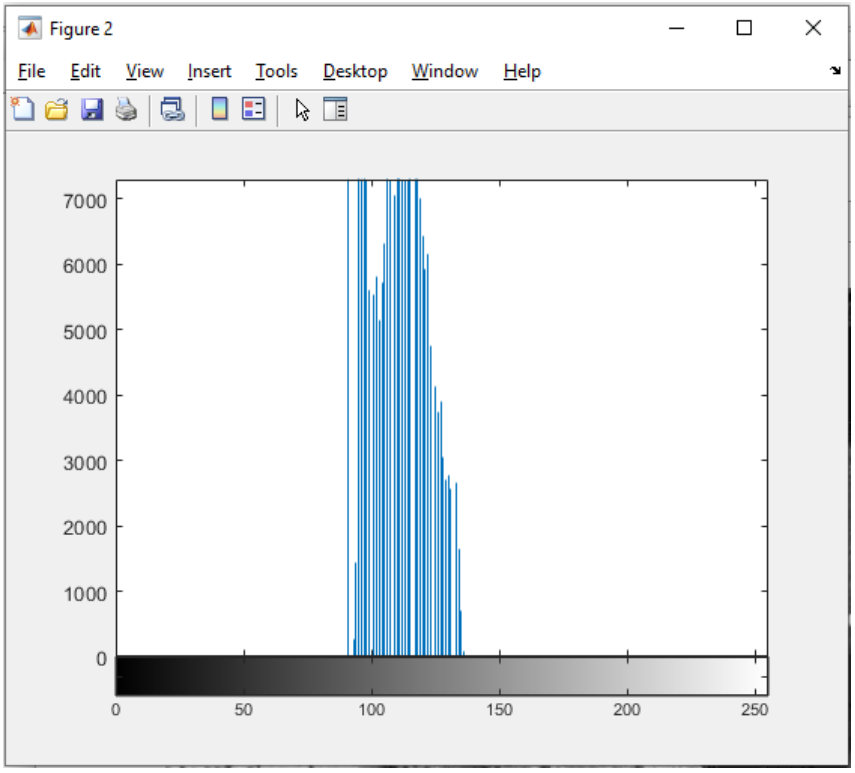

Figure 12.2: Histogram plot of **`Fig316c.tif`**

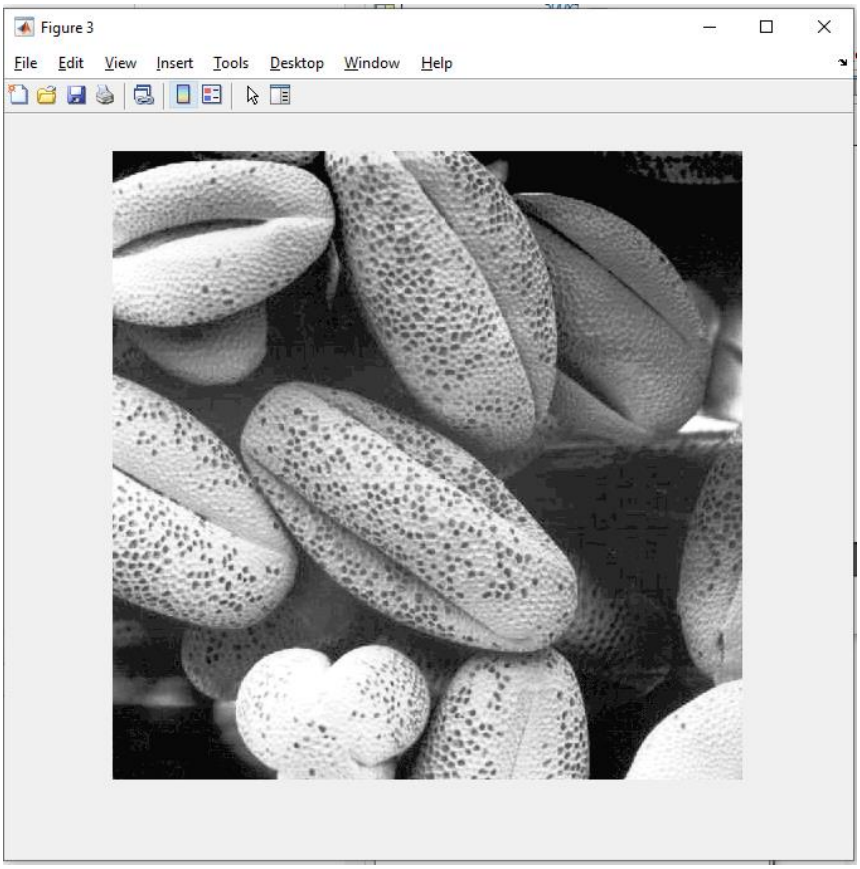

Figure 12.3: Histogram equalized image of **`Fig316c.tif`**

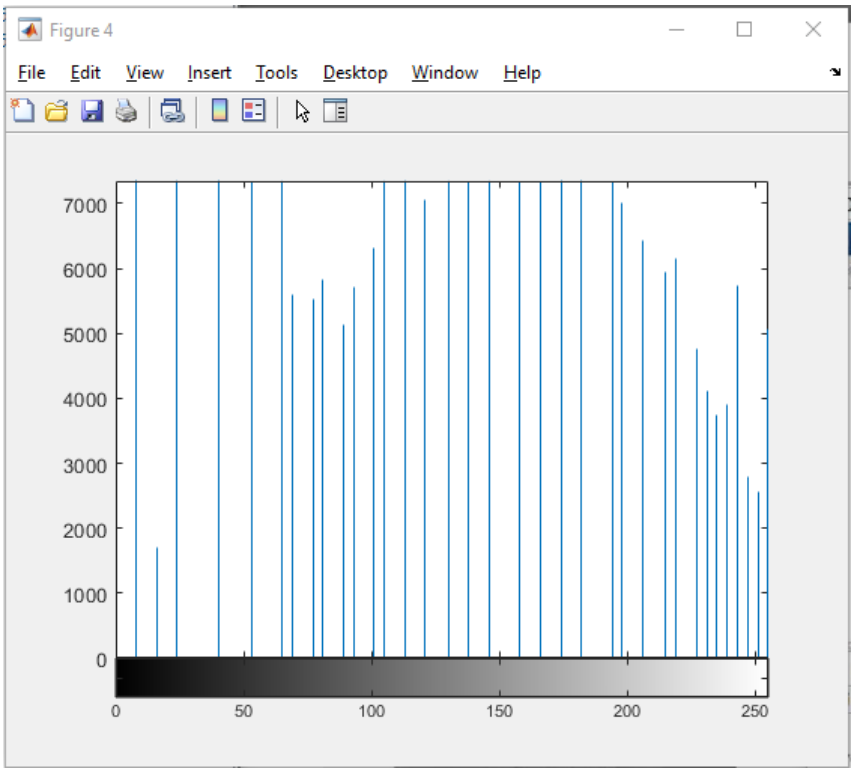

Figure 12.4: Histogram of Histogram equalized image of **`Fig316c.tif`**

Fig316d.tif Equalization

```
% E2 Part (b) Fig316d Equalization

I = imread('Fig316d.tif');   % reading image and storing in 'I'

x = histeq(I);  % applying 'histeq' to 'I'

% displaying  'I', 'x' and their 'imhist'
figure, imshow(I);
figure, imhist(I);
figure, imshow(x);
figure, imhist(x);
```

MATLAB Code 13: Displaying histogram equalization with **histeq**, and **imhist** operations on **Fig316d.tif**

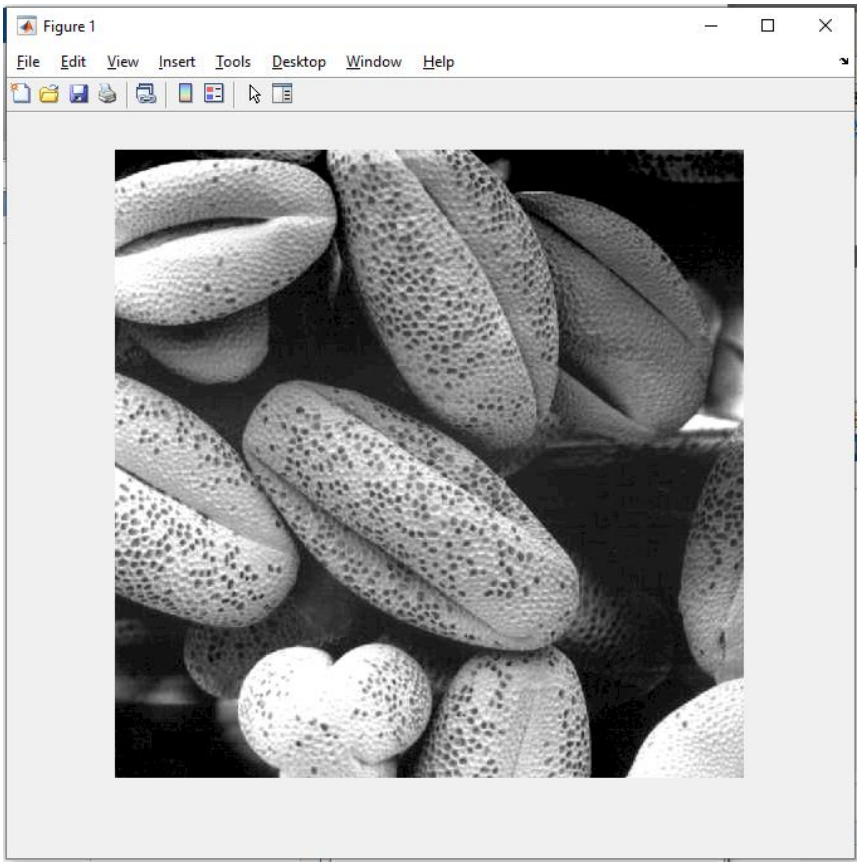

Figure 13.1: Image file **Fig316d.tif**

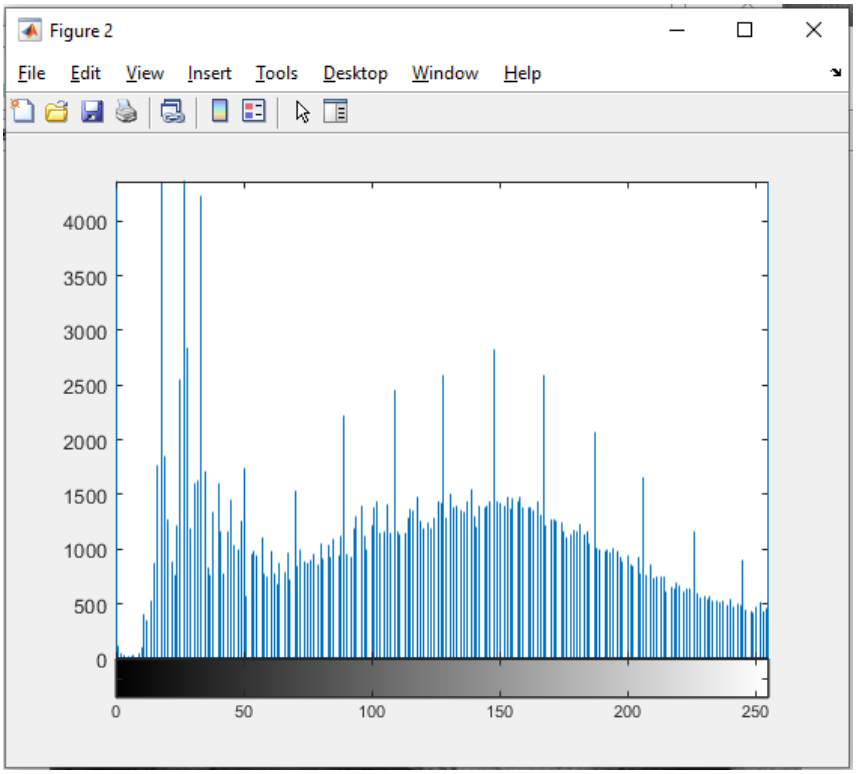

Figure 13.2: Histogram plot of **`Fig316d.tif`**

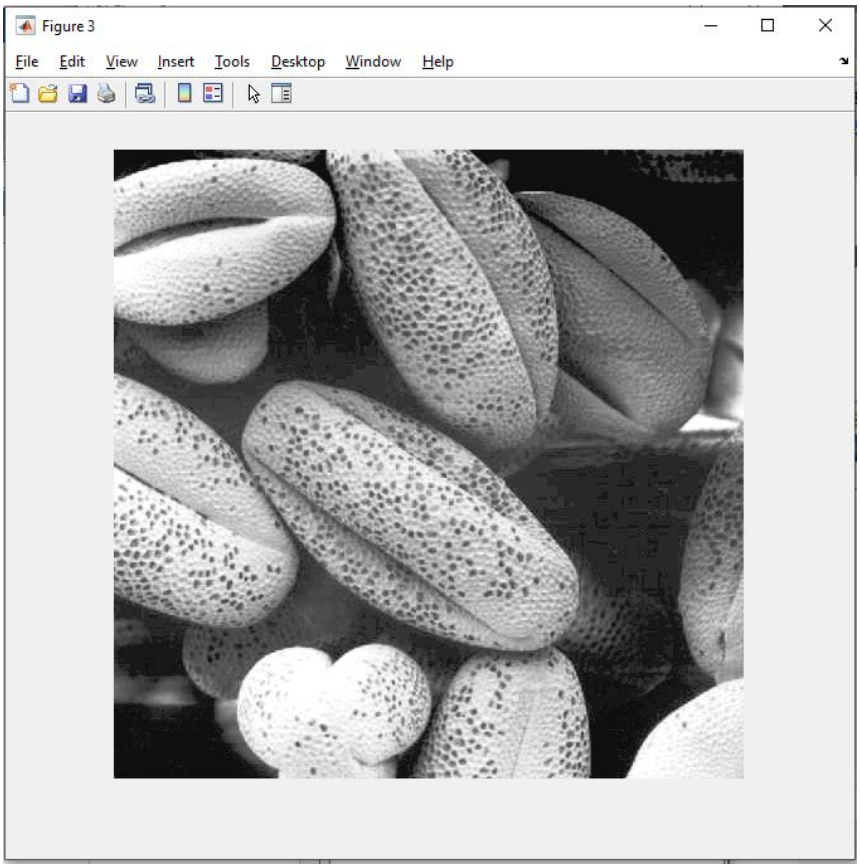

Figure 13.3: Histogram equalized image of **`Fig316d.tif`**

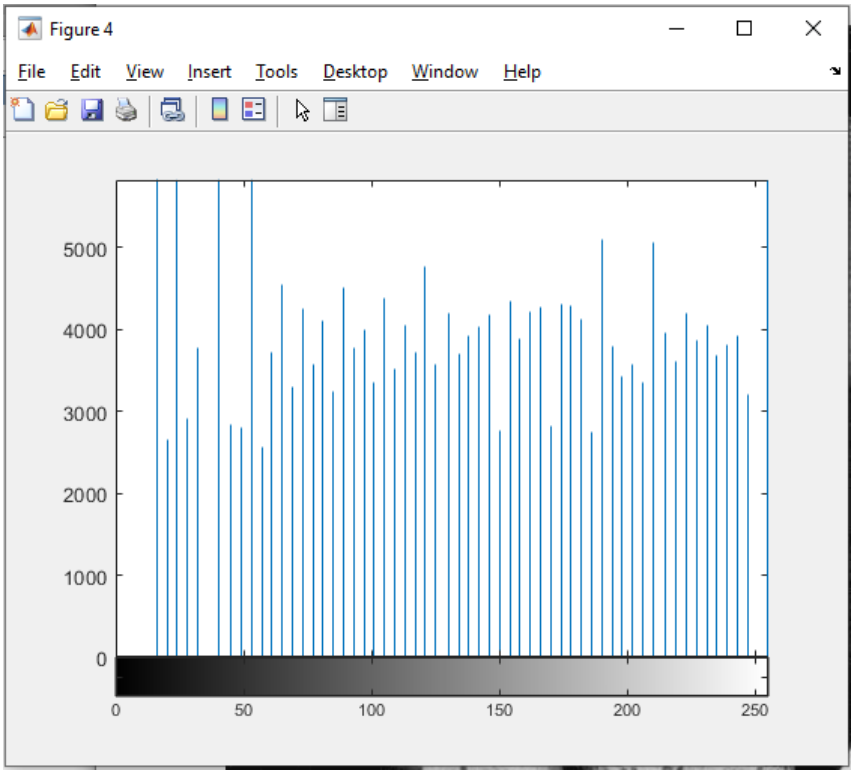

Figure 13.4: Histogram of Histogram equalized image of **`Fig316d.tif`**

E3

Discussion of E1

Part (a)

(i)

Given image **Fig1.tif** has been converted into its *negative* version using the **intrans** function with parameter of 'neg', in image processing toolbox in **MATLAB**. What this function does is that for each and every pixel, their grayscale value will be transformed into corresponding negative value.

(ii)

This part requires the use of *log transformation* on **Fig2.tif**, and this can be accomplished with use of **intrans** function having **log** in the second parameter. Here, the logarithmic transform is applied for values of **1**, **4** and **8**. As seen in the Figure 2, increase in **c** value yields brighter image. Comparing high and low values, some of the details in high **c** values makes the details possible to see.

(iii)

For the file **Fig3.tif**, it is asked to apply *gamma transformation*, and this can be done by use of **intrans** with parameter of **gamma**. The values of gamma will either brighten or darken the image depending on its value being greater than or less than **1**. As it is shown in Figure 3, gamma values of **1**, **0.3**, **0.4**, **0.6** and **2.5** is applied and the corresponding image results confirm that as values gets lower than **1**, image becomes brighter and vice versa.

(iv)

Here, the given code has been executed, which performs contrast stretching operation on **Fig1.tif**. this will result in having more intense values for white areas. The details such as legs and arms become visible in the processed image.

Part (b)

Here, the negative of the image has been obtained with **imadjust**. This operation converts white areas into black and vice versa. Processed image will look as the same as the one in E1 part a i.

Discussion of E1

Part (a)

For a given image, **imhist**, **bar**, **stem** and **plot** operations has been performed for files **Fig316a.tif**, **Fig316b.tif**, **Fig316c.tif** and **Fig316d.tif**

- The **Fig316a.tif** file is darkened which resulted in the histograms located towards left.
- The **Fig316b.tif** file is lightened which resulted in the histograms located towards right.

The darkened image contains a greater number of pixels which has darker value and lightened image contains a grater number of pixels which has lighter value.

- The **Fig316c.tif** file have lower contrast which resulted in the histograms to be shrinked.
- The **Fig316d.tif** file have good contrast level as well as proper brightness which resulted in the histograms having distributed properly.

If the image has lower contrast, as in **Fig316c.tif**, then pixels of that image contains values that are close to each other.

If the image has higher contrast, as in **Fig316d.tif**, then pixels of that image contains values that are not close to each other.

Part (b)

For images **Fig316a.tif**, **Fig316b.tif**, **Fig316c.tif** and **Fig316d.tif**, the operation of **histeq** and **imhist** are applied. As a result, their distribution of histogram has become more evenly distributed and the quality of the images have been enhanced.