Practical List 1. Write program to read and display digital image using MATLAB or SCILAB

a. Become familiar with SCILAB/MATLAB Basic commands
b. Read and display image in SCILAB/MATLAB
c. Resize given image
d. Convert given color image into gray-scale image
e. Convert given color/gray-scale image into black & white image
f. Draw image profile
g. Separate color image in three R G & B planes
h. Create color image using R, G and B three separate planes
i. Flow control and LOOP in SCILAB
j. Write given 2-D data in image file

2. To write and execute image processing programs using point processing method

a. Obtain Negative image
b. Obtain Flip image
c. Thresholding
d. Contrast stretching

3. To write and execute programs for image arithmetic operations

a. Addition of two images
b. Subtract one image from other image
c. Calculate mean value of image

4. To write and execute programs for image logical operations

a . AND operation between two images
b. OR operation between two images
c. Calculate intersection of two images
d. NOT operation (Negative image)

5. To write a program for histogram calculation and equalization using

a. Standard MATLAB function
b. Program without using standard MATLAB functions

6. To write and execute program for geometric transformation of image

a. Translation
b. Scaling
c. Rotation
d. Shrinking

e. Zooming

7. To understand various image noise models and to write programs for
a. image restoration
b. Remove Salt and Pepper Noise
c. Minimize Gaussian noise
d. Median filter

8. Write and execute programs to use spatial low pass and high pass filters

9. Write and execute programs for image frequency domain filtering
a. Apply FFT on given image
b. Perform low pass and high pass filtering in frequency domain
c. Apply IFFT to reconstruct image

10. Write a program in C and MATLAB/SCILAB for edge detection using different edge detection mask

11. Write and execute program for image morphological operations erosion and dilation.

Question 1: Write program to read and display digital image using MATLAB or SCILAB

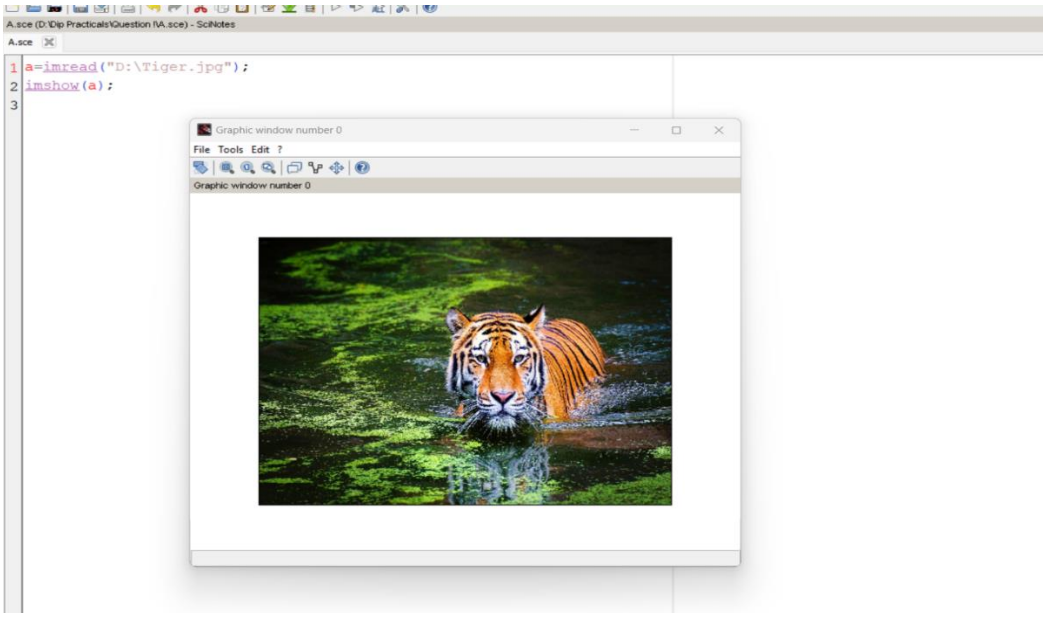
a. Become familiar with SCILAB/MATLAB Basic commands
b. Read and display image in SCILAB/MATLAB
c. Resize given image
d. Convert given color image into gray-scale image
e. Convert given color/gray-scale image into black & white image
f. Draw image profile
g. Separate color image in three R G & B planes
h. Create color image using R, G and B three separate planes
i. Flow control and LOOP in SCILAB
j. Write given 2-D data in image file

Solution:

Code -

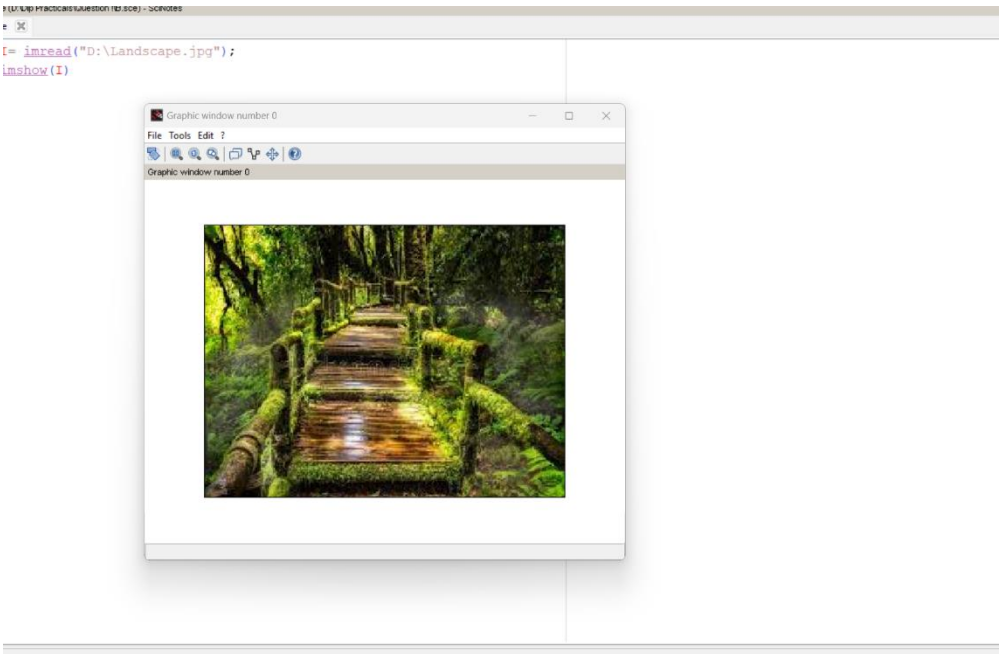
(a)

```
a=imread("D:\ Tiger.jpg ");
imshow(a);
title("original image");
```



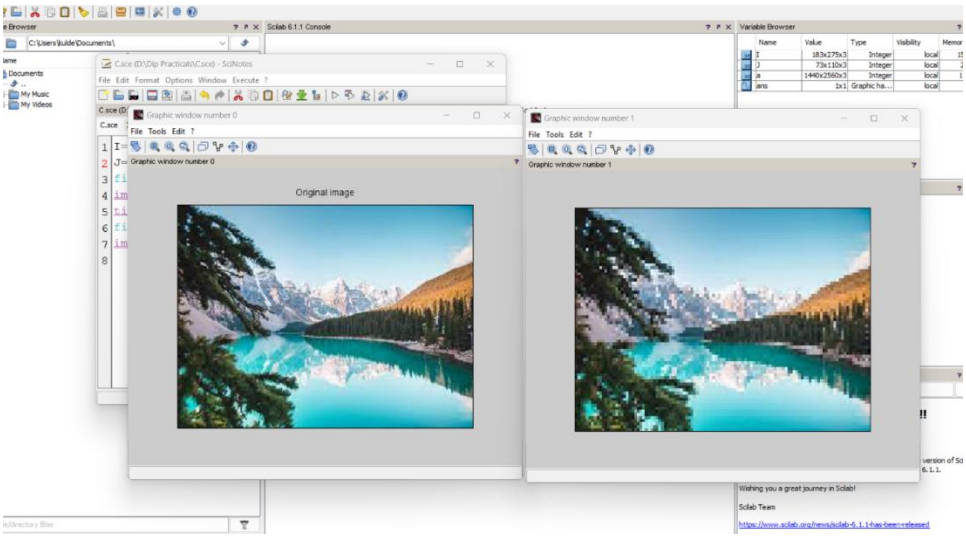
(b)

```
a=imread("D:\ Landscape.jpg ");
imshow(a);
title("original image");
```



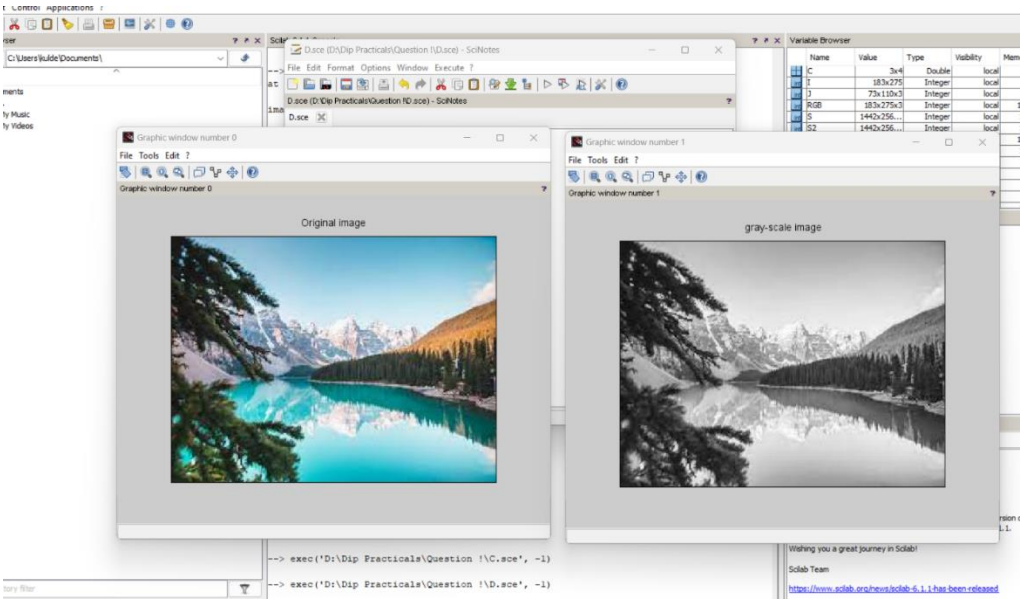
(c)

```
I= imread("D:\ Pic.jpg");
J= imresize(I,0.4);
figure
imshow(I);
title("Original image");
figure
imshow(J);
title("Resized image");
```



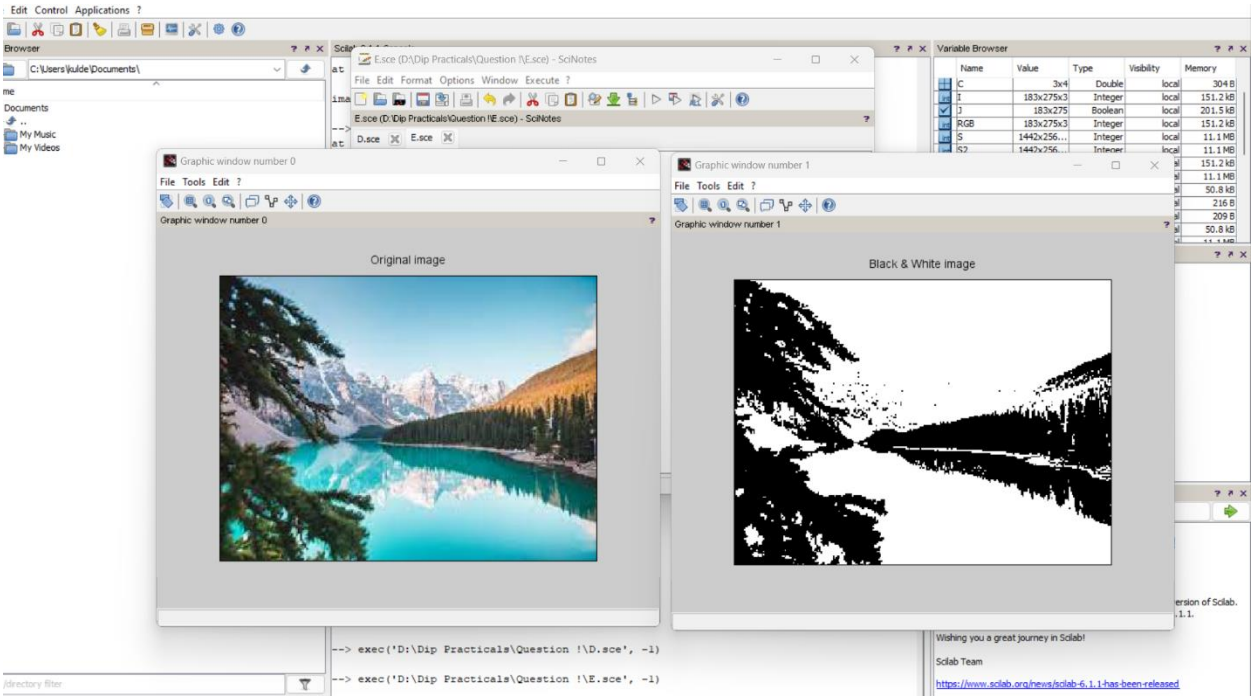
(d)

```
RGB = imread("D:\ Pic.jpg");
figure
imshow(RGB);
title("Original image");
I = rgb2gray(RGB);
figure
imshow(I);
title("gray-scale image");
```



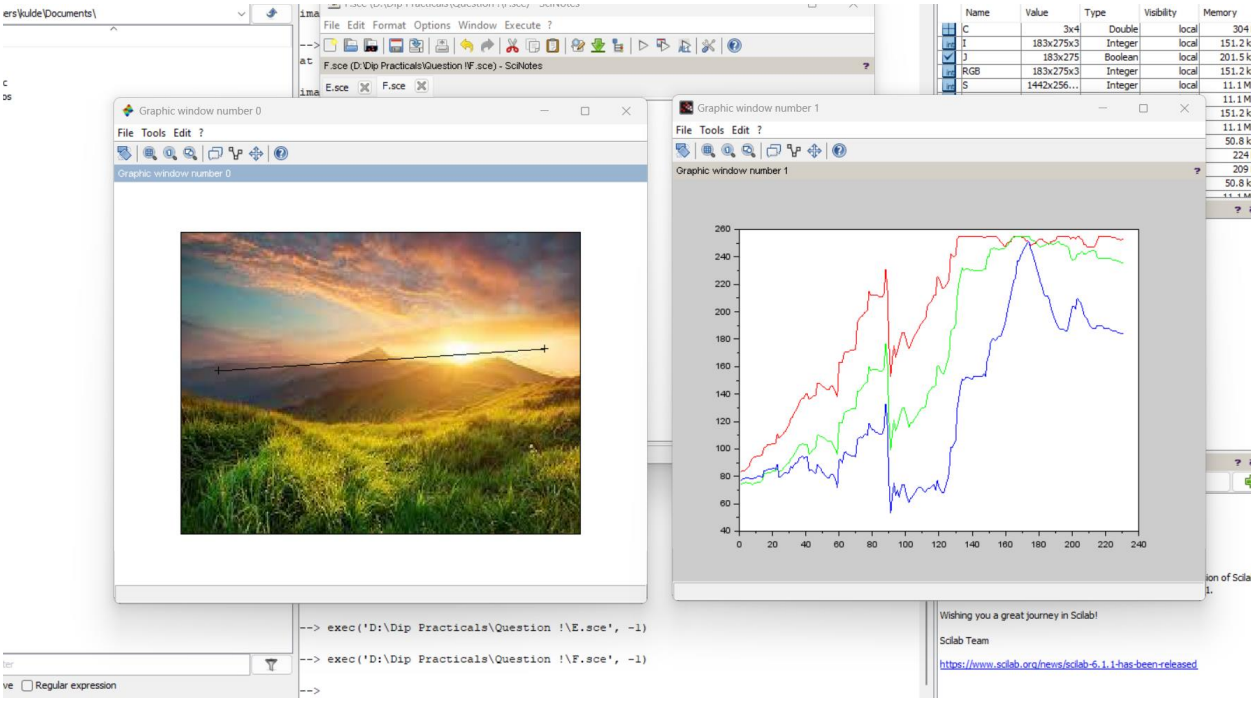
(e)

```
I = imread("D:\ Pic.jpg ");
figure
imshow(I);
title("Original image");
J = im2bw(I,0.5);
figure
imshow(J);
title("Black & White image");
```



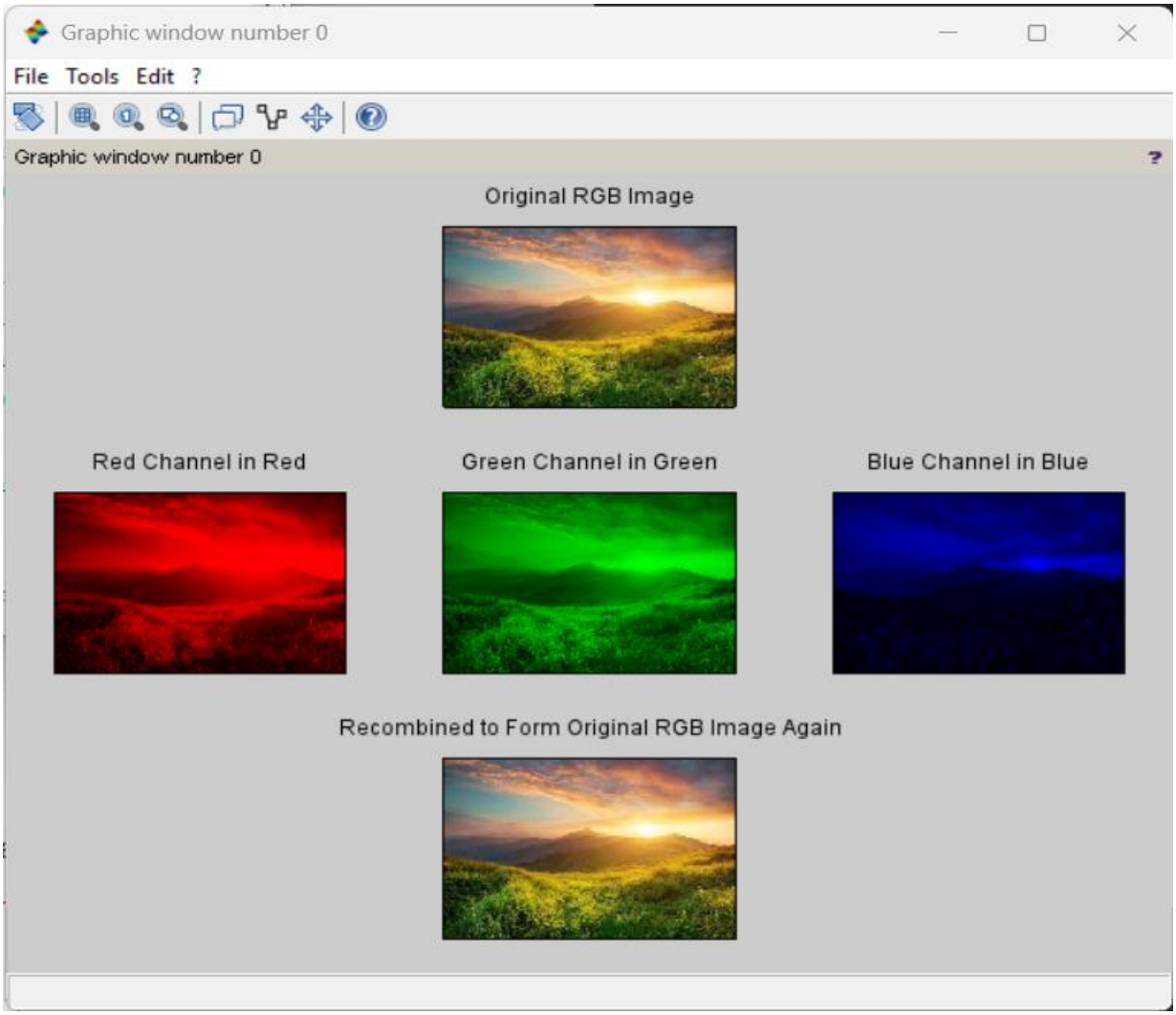
(f)

```
i = imread("D:\ Nature.jpg ");
improfile(i);
```



(g),(h)

```
i = imread("D:\Nature.jpg ");
redChannel = i(:,:,1); // Red channel
greenChannel = i(:,:,2); // Green channel
blueChannel = i(:,:,3); // Blue channel
// Create an all black channel.
allBlack = zeros(size(i, 1), size(i, 2), 'uint8');
// Create color versions of the individual color channels.
just_red = cat(3, redChannel, allBlack, allBlack);
just_green = cat(3, allBlack, greenChannel, allBlack);
just_blue = cat(3, allBlack, allBlack, blueChannel);
// Recombine the individual color channels to create the original RGB image again.
recombinedRGBImage = cat(3, redChannel, greenChannel, blueChannel);
// Display them all.
figure
subplot(3, 3, 2);
imshow(i);
fontSize = 2;
title('Original RGB Image', 'FontSize', fontSize)
subplot(3, 3, 4);
imshow(just_red);
title('Red Channel in Red', 'FontSize', fontSize)
subplot(3, 3, 5);
imshow(just_green)
title('Green Channel in Green', 'FontSize', fontSize)
subplot(3, 3, 6);
imshow(just_blue);
title('Blue Channel in Blue', 'FontSize', fontSize)
subplot(3, 3, 8);
imshow(recombinedRGBImage);
title('Recombined to Form Original RGB Image Again', 'FontSize', fontSize)
```



(i)

```
num = input("Enter a Number  ");
% Flow Control
% Program to find a Number is even or Odd
if  mod(num,2) == 0
          disp('The Number is Even');
       elseif mod(num,2) ~=0
        disp('The Number is Odd');
        else
        disp('Invalid Number');
end
% Loop
% Program to generate  Bipolar signal  +1 / -1
 mat = rand(1,10,'single');
```

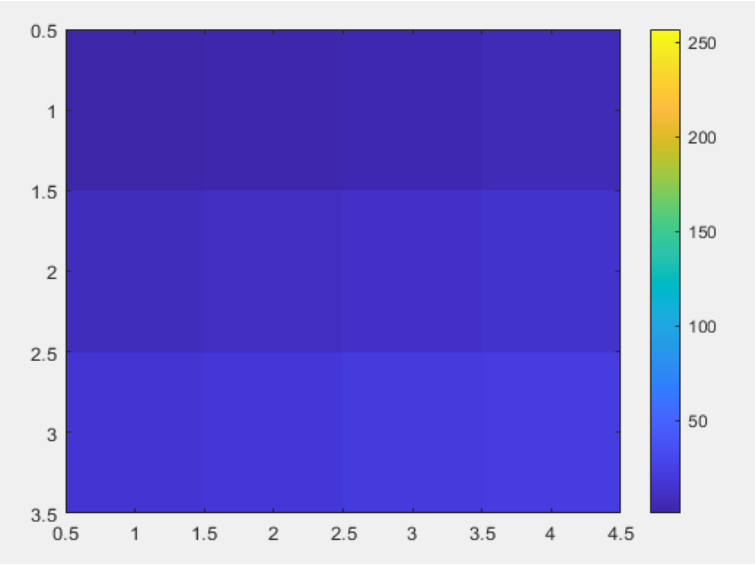
```
binary =zeros(size(mat));
for  count = 1:1:length(mat)
   if mat(count) >= 0
      binary(count) =1;
   else
      binary(count)  =-1;
   end
end
disp("Bipolar Signal ")
disp(binary)
```

Output :

```
>> ques1i
Enter a Number  4
The Number is Even
Bipolar Signal
     1     1     1     1     1     1     1     1     1     1
```

(j)

```
C = [0 2 4 6; 8 10 12 14; 16 18 20 22];
image(C)
colorbar
```



Question 2: To write and execute image processing programs using point processing method

a. Obtain Negative image
b. Obtain Flip image
c. Thresholding
d. Contrast stretching

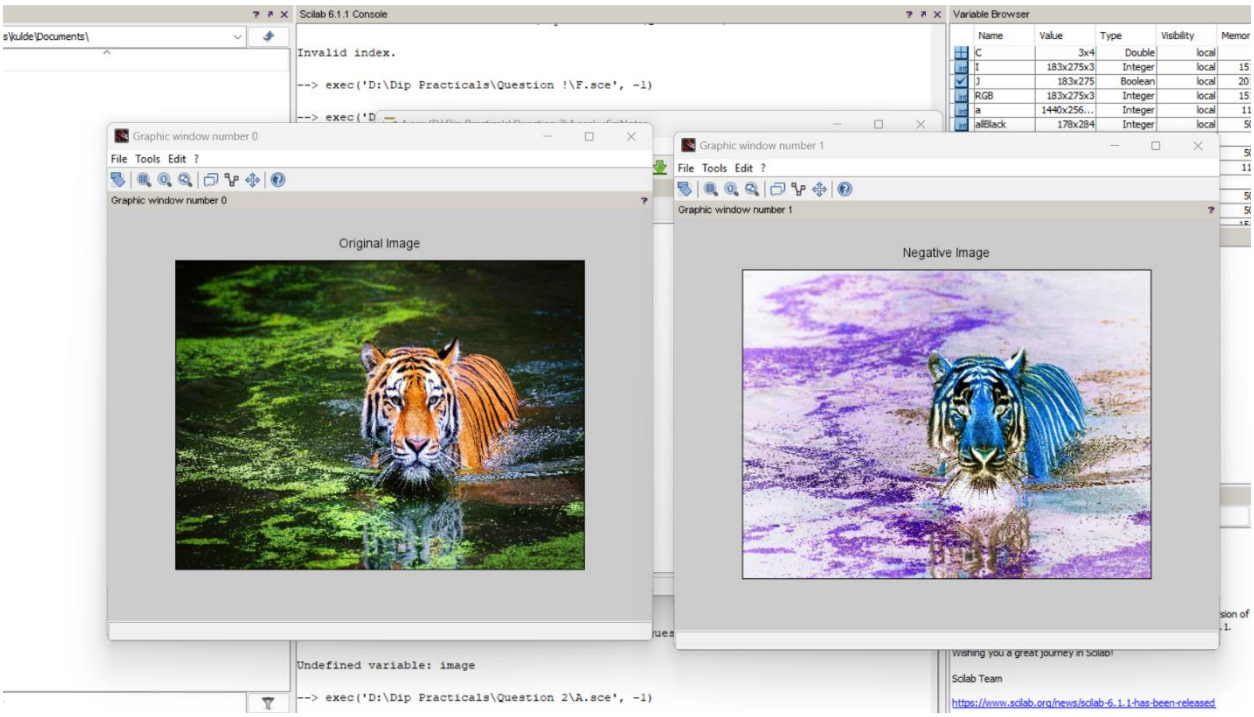
Solution:

Code -

(a)

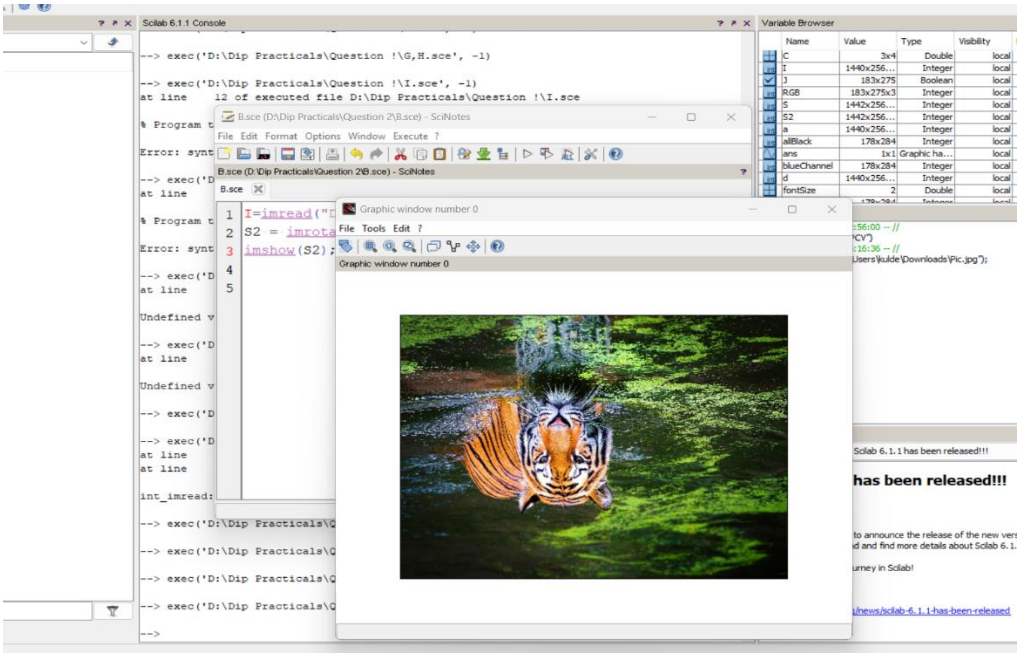
```
a=imread("D:\Tiger.jpg");
figure
imshow(a);
title("Original Image")
d=255-a;
figure
```

```
imshow(d);
title("Negative Image")
```



(b)

```
I=imread("D:\Tiger.jpg ");
S2 = imrotate(I,180);
imshow(S2);
```



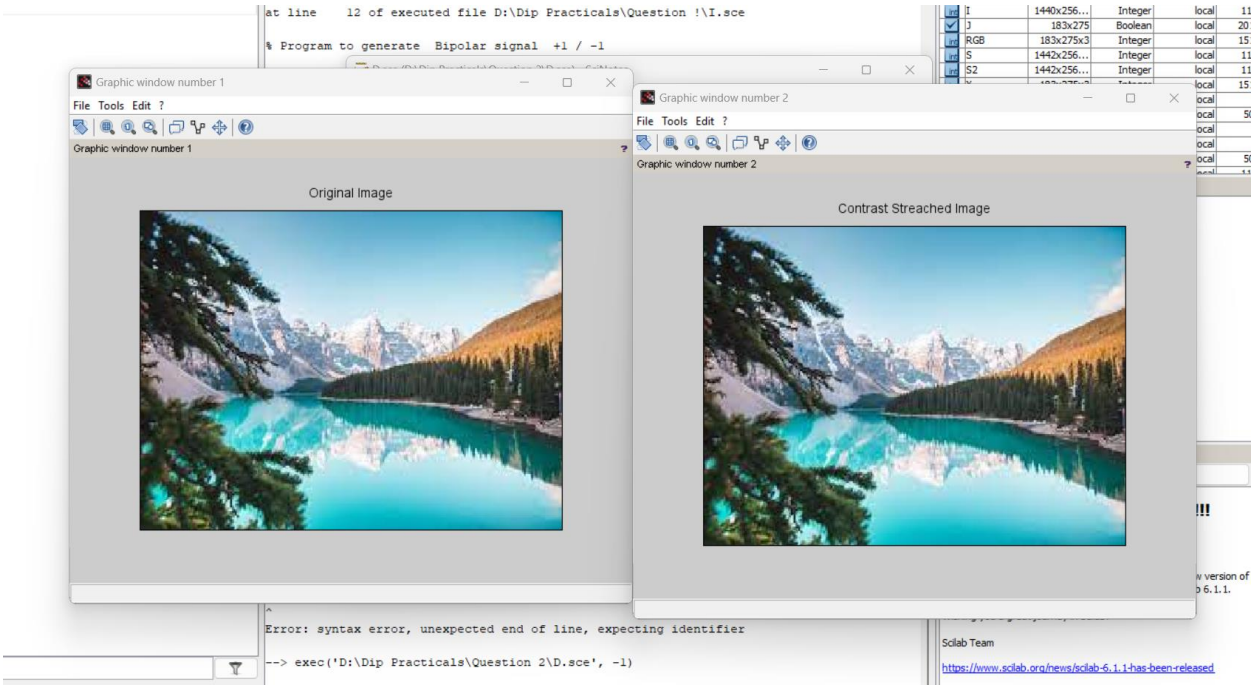
(c)

```
I = imread("D:\einstein.jpg");
% Convert the image into a binary image.
BW = imbinarize(I);
% Display the original image next to the binary version.
figure
imshowpair(I,BW,'montage')
```

(d)

```
X=imread("D:\Pic.jpg");
//X = imread('image.jpg'); //%reading a grayscale image
figure(1);
imshow(X);
```

```
title('Original Image')
a = min(X(:)); // %minimum pixel of image X
b = max(X(:)); //%maximum pixel of image X
X= (X-a).*(255/(b-a)); //%just using the formula above
figure(2);
imshow(X);
title('Contrast Streached Image')
```



Question 3: To write and execute programs for image arithmetic operations

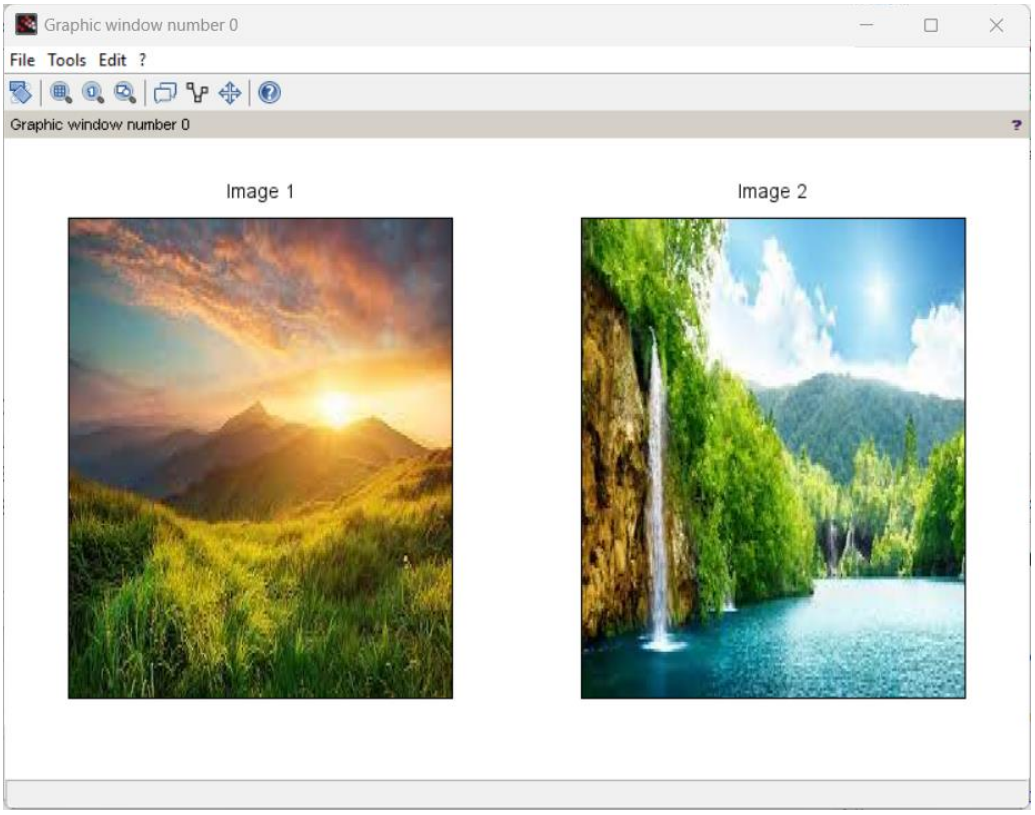
a. Addition of two images
b. Subtract one image from other image
c. Calculate mean value of image

Solution:

Code -

(a)

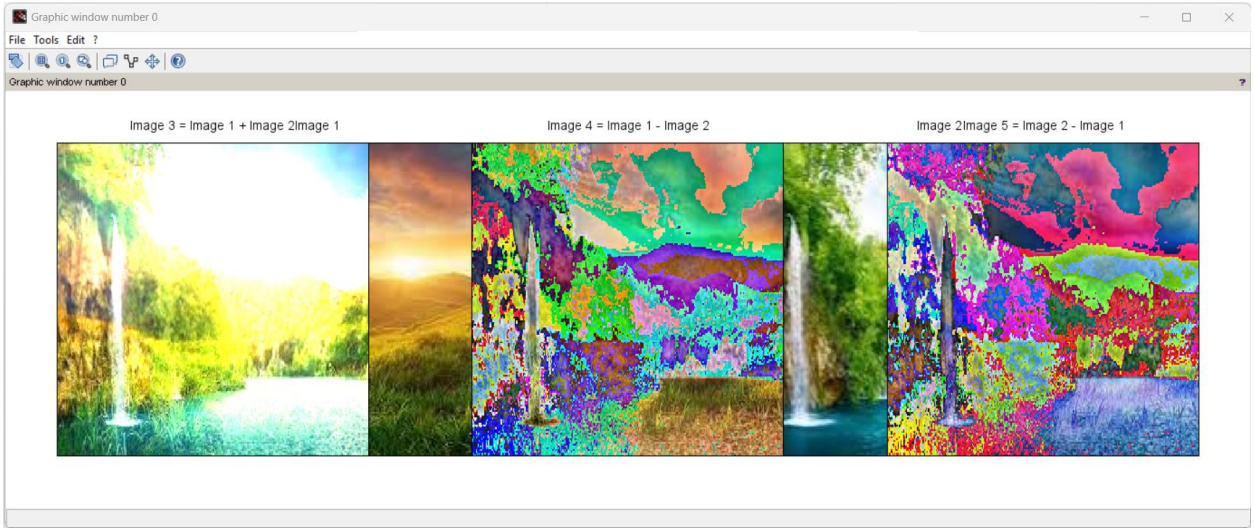
```
 %Read two grayscale uint images into the workspace.
im1=imread("D:\Nature.jpg");
im2=imread("D:\Nature1.jpg");

subplot(1,2,1), title('Image 1'), imshow(im1);
subplot(1,2,2), title('Image 2'), imshow(im2);

im3 = imadd(im1, im2);
imshow(im3);
```



(b)

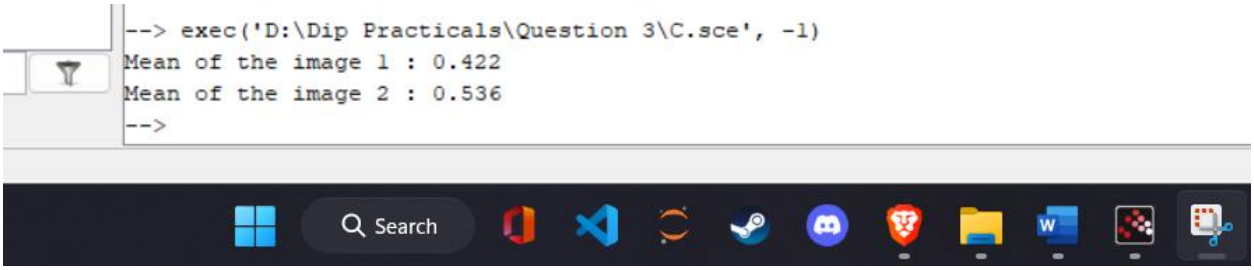
```
im4 = im1 - im2;
im5 = im2 - im1;
```

```
subplot(1,3,1), title('Image 3 = Image 1 + Image 2'), imshow(im3);
subplot(1,3,2), title('Image 4 = Image 1 - Image 2'), imshow(im4);
subplot(1,3,3), title('Image 5 = Image 2 - Image 1'), imshow(im5);
```



(c)

```
printf('Mean of the image 1 : %.3f\n',mean(im2double(im1)));
printf('Mean of the image 2 : %.3f',mean(im2double(im2)));
```



Question 4: To write and execute programs for image logical operations

a. AND operation between two images
b. OR operation between two images
c. Calculate intersection of two images

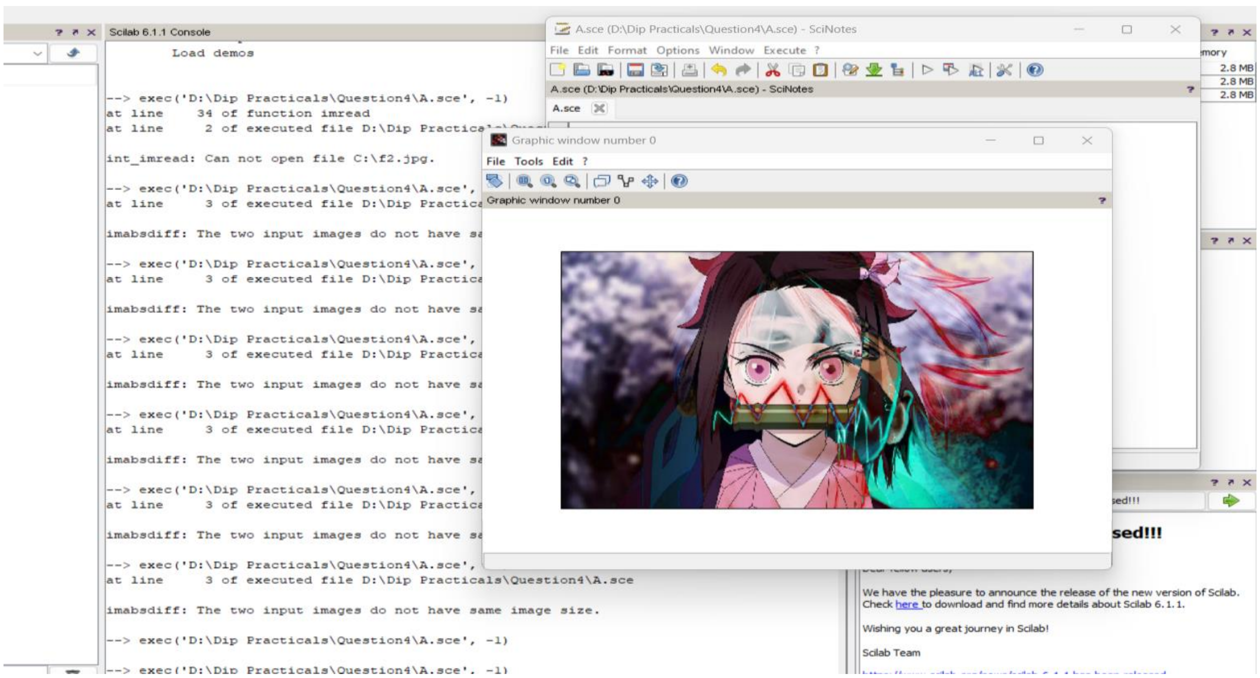
d. NOT operation (Negative image)

Solution:

Code -

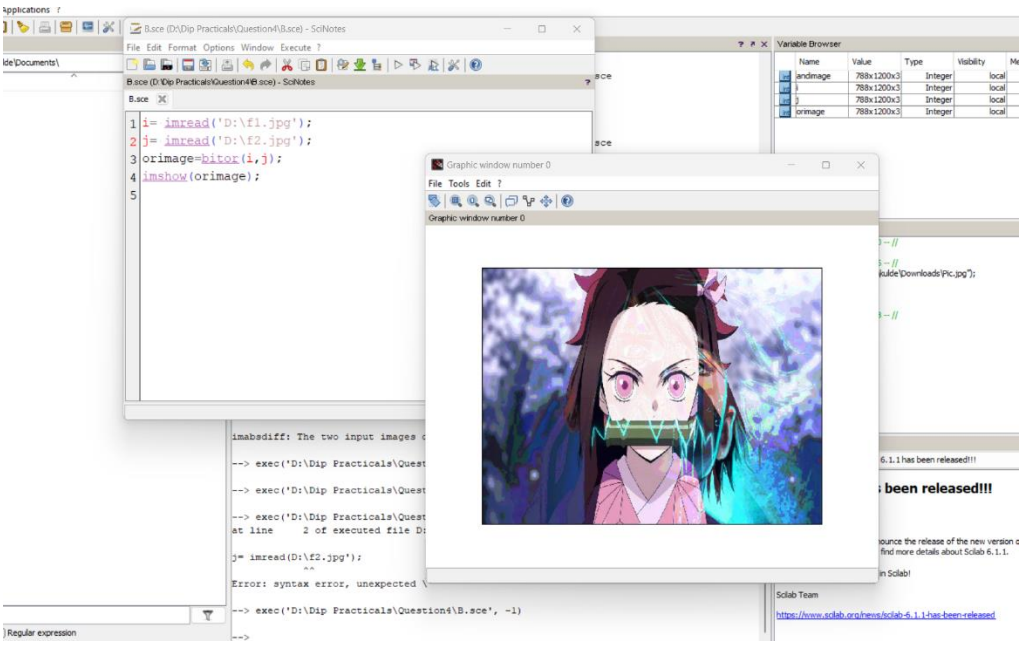
(a)

i= imread('D:\f1.jpg');
j= imread('D:\f2.jpg');
andimage=imabsdiff(i,j);
imshow(andimage);



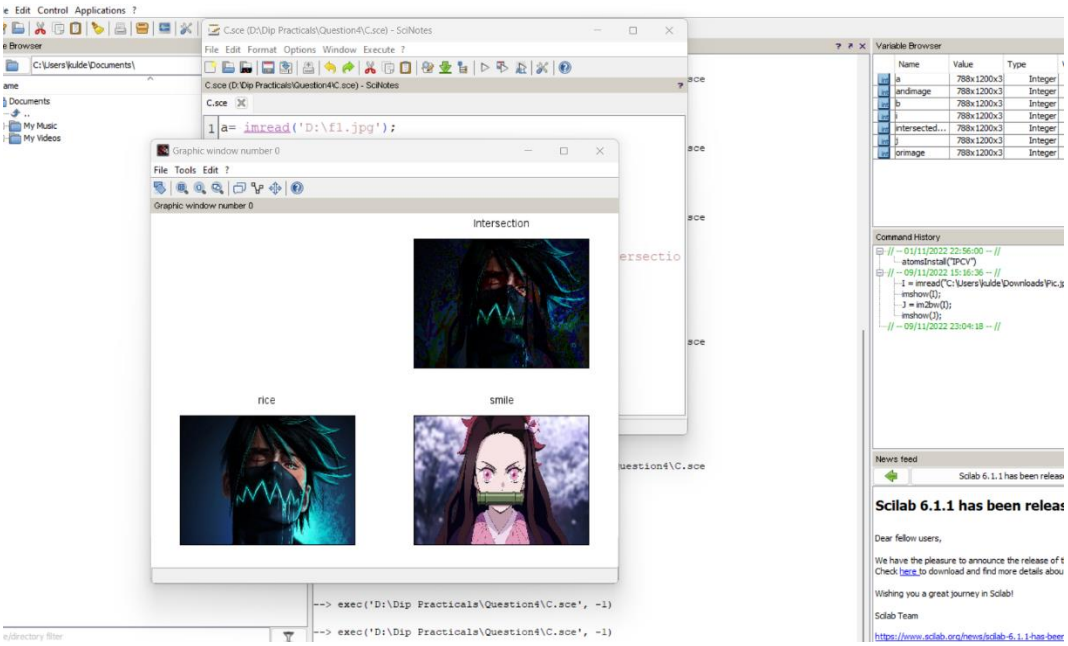
(b)

i= imread('D:\f1.jpg');
j= imread('D:\f2.jpg');
orimage=bitor(i,j);
imshow(orimage);



(c)

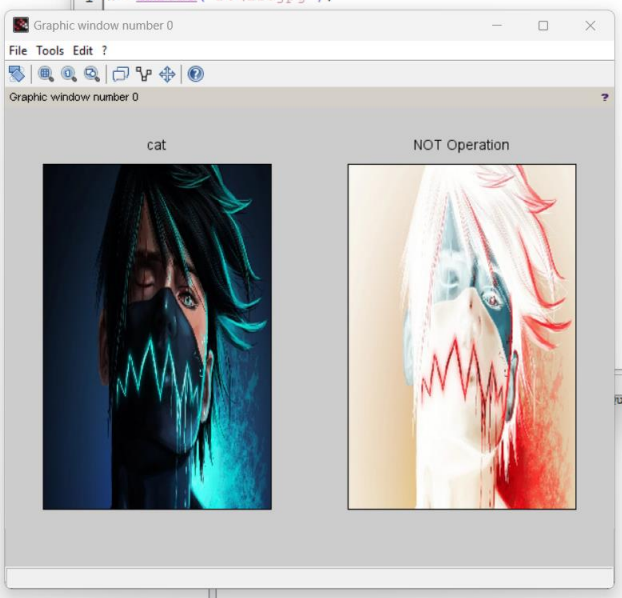
```
a= imread('D:\f1.jpg');

b=imread(D:\f2.jpg');

intersectedImage=bitand(a,b);
subplot(2,2,3), imshow(a), title('rice');
subplot(2,2,4), imshow(b), title('smile');
subplot(2,2,2), imshow(intersectedImage), title('Intersection');
```



(d)

```
W= imread('D:\f1.jpg');
NotW= bitcmp(W);
figure
subplot(1,2,1)
imshow(W)
title("cat")
subplot(1,2,2)
imshow(NotW)
title("NOT Operation")
```

```
1  W= imread('D:\f1.jpg');
```




```
--> exec('D:\Dip Practicals\Question4\C.sce', -1)
--> exec('D:\Dip Practicals\Question4\D.sce', -1)
```

Question 5: To write a program for histogram calculation and equalization using

a. Standard MATLAB function

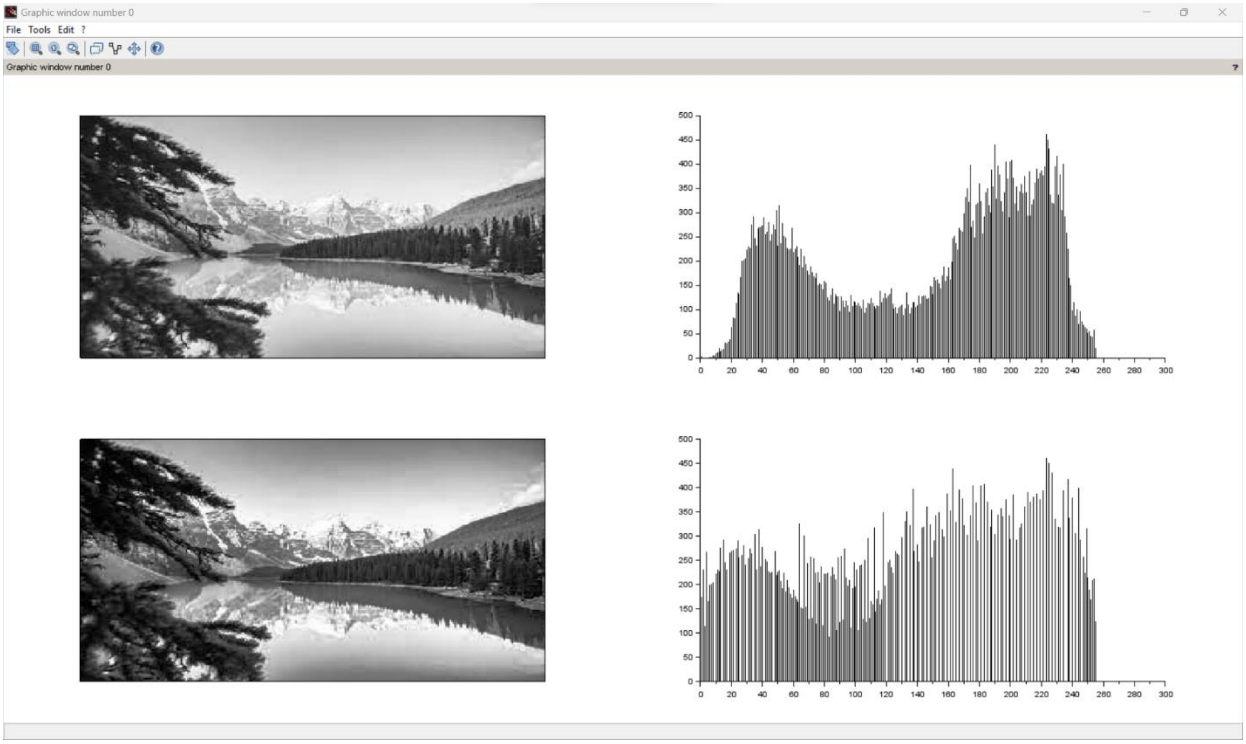
b. Program without using standard MATLAB functions

Solution:

Code -

(a)

```
I= rgb2gray(imread("D:\Pic.jpg"));
subplot(2,2,1);
imshow(I);
subplot(2,2,2);
imhist(I,[],1);
J=imhistequal(I);
subplot(2,2,3);
imshow(J);
subplot(2,2,4);
imhist(J,[], 1);
```

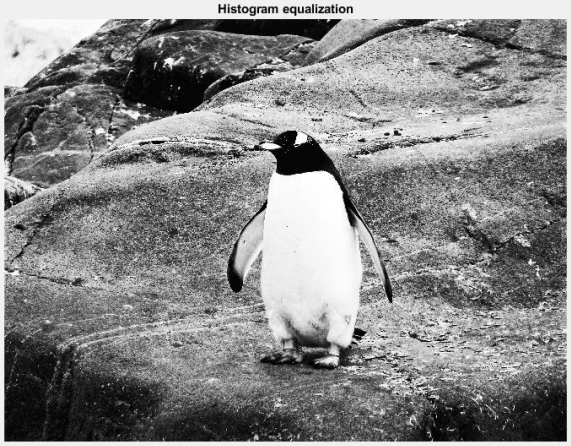


(b)

```
GIm=imread('D:\penguin.jpg');
numofpixels=size(GIm,1)*size(GIm,2);
figure
imshow(GIm);
title('Original Image');
HIm=uint8(zeros(size(GIm,1),size(GIm,2)));
freq=zeros(256,1);
probf=zeros(256,1);
probc=zeros(256,1);
cum=zeros(256,1);
output=zeros(256,1);
//freq counts the occurrence of each pixel value.
//The probability of each occurrence is calculated by probf.
for i=1:size(GIm,1)
    for j=1:size(GIm,2)
        value=GIm(i,j);
        freq(value+1)=freq(value+1)+1;
        probf(value+1)=freq(value+1)/numofpixels;
    end
end
sum=0;
no_bins=255;
//The cumulative distribution probability is calculated.
for i=1:size(probf)
   sum=sum+freq(i);
   cum(i)=sum;
   probc(i)=cum(i)/numofpixels;
   output(i)=round(probc(i)*no_bins);
end
for i=1:size(GIm,1)
    for j=1:size(GIm,2)
            HIm(i,j)=output(GIm(i,j)+1);
    end
end
figure,imshow(HIm);
title('Histogram equalization');
```

Original Image

Histogram equalization



Question 6: To write and execute program for geometric transformation of image

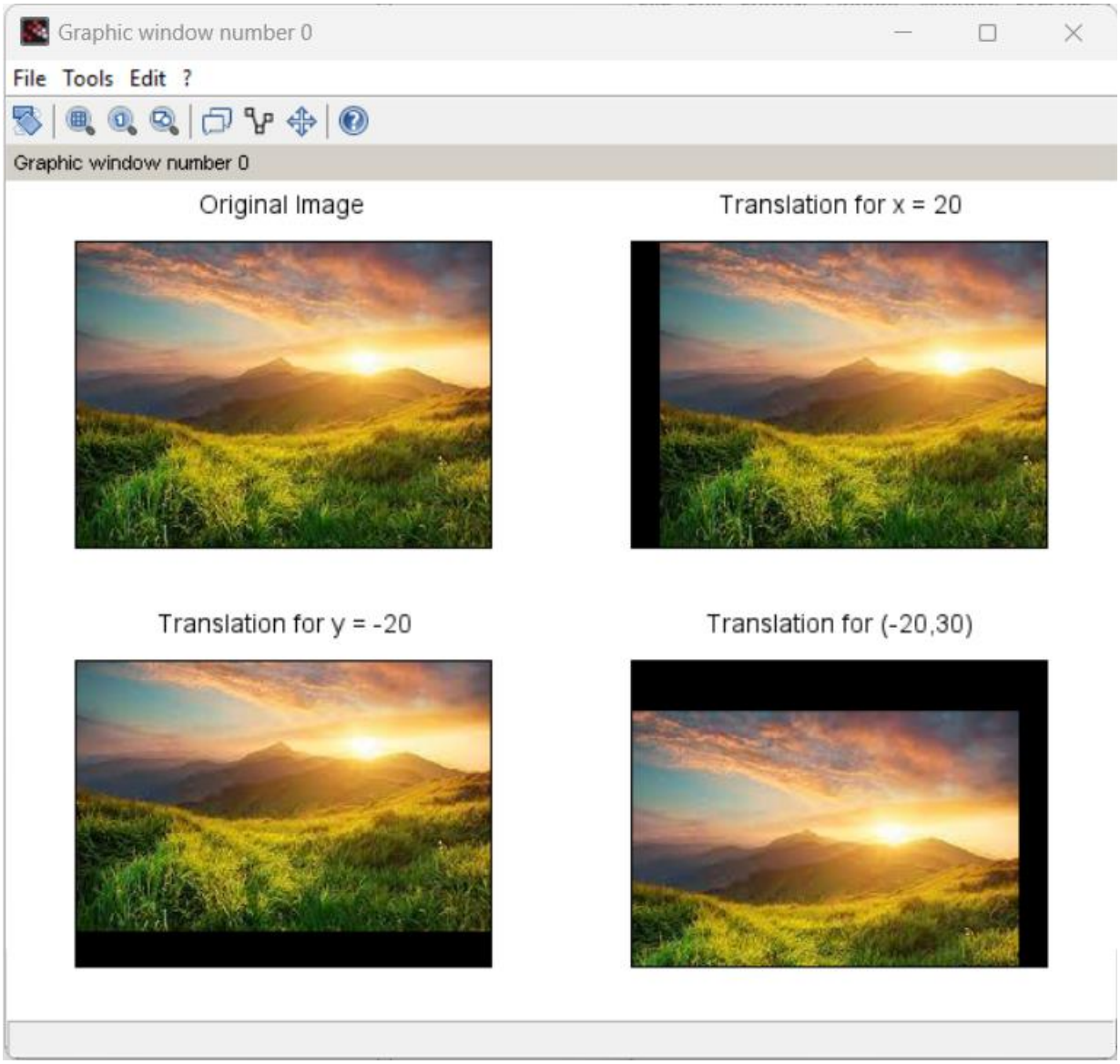
a. Translation
b. Scaling
c. Rotation
d. Shrinking
e. Zooming

Solution:

Code -

(a)

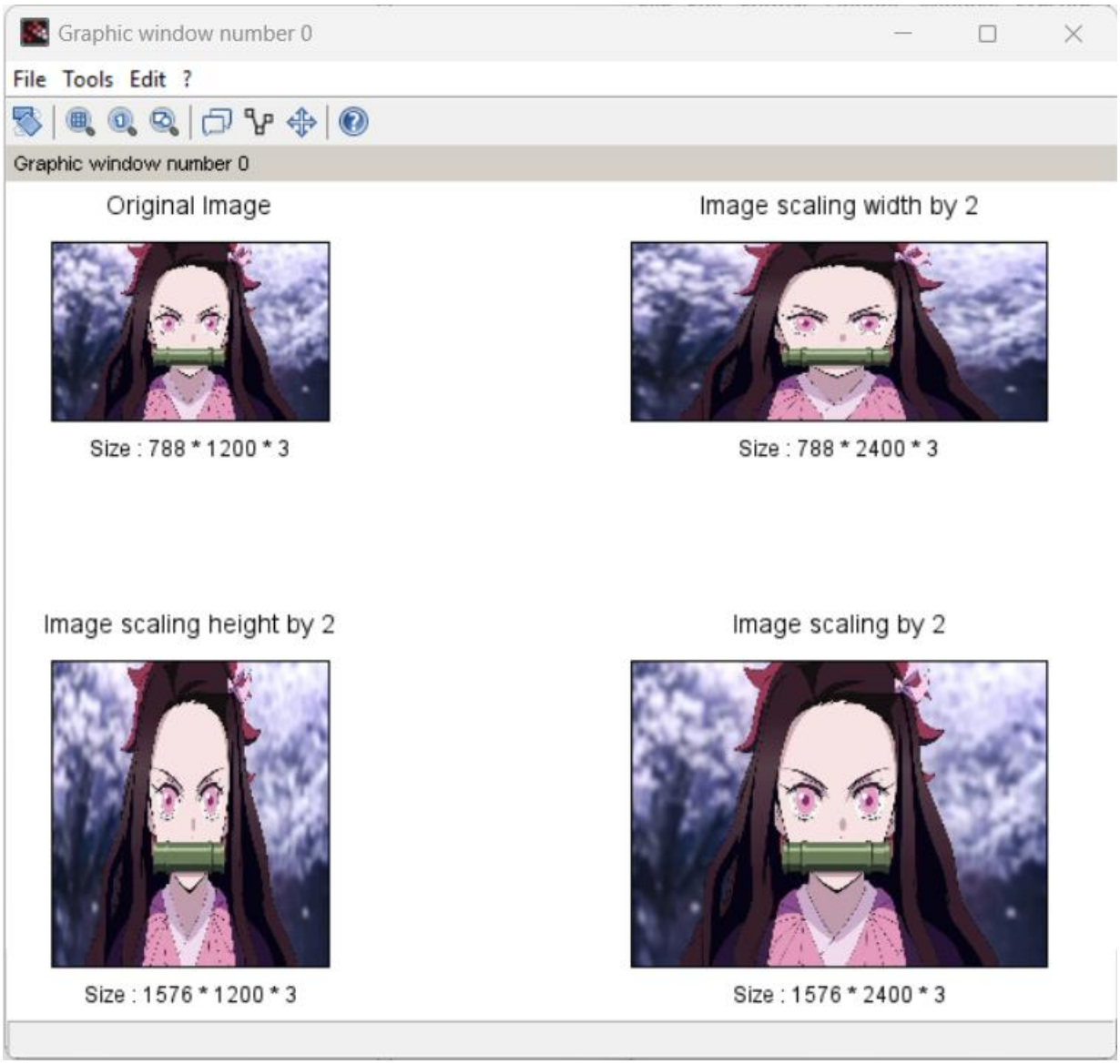
```
S1=imread("D:\Nature.jpg");


mat = [  1 0 0;...
         0 1 0;...
        20 0 1];
S2 = imtransform(S1,mat,'affine');


mat = [  1 0 0;...
         0 1 0;...
        0 -20 1];
S3 = imtransform(S1,mat,'affine');


mat = [  1 0 0;...
         0 1 0;...
       -20 30 1];
S4 = imtransform(S1,mat,'affine');

subplot(2,2,1), title('Original Image'), imshow(S1);
subplot(2,2,2), title('Translation for x = 20'), imshow(S2);
subplot(2,2,3), title('Translation for y = -20'), imshow(S3);
subplot(2,2,4), title('Translation for (-20,30)'), imshow(S4);
```



(b)

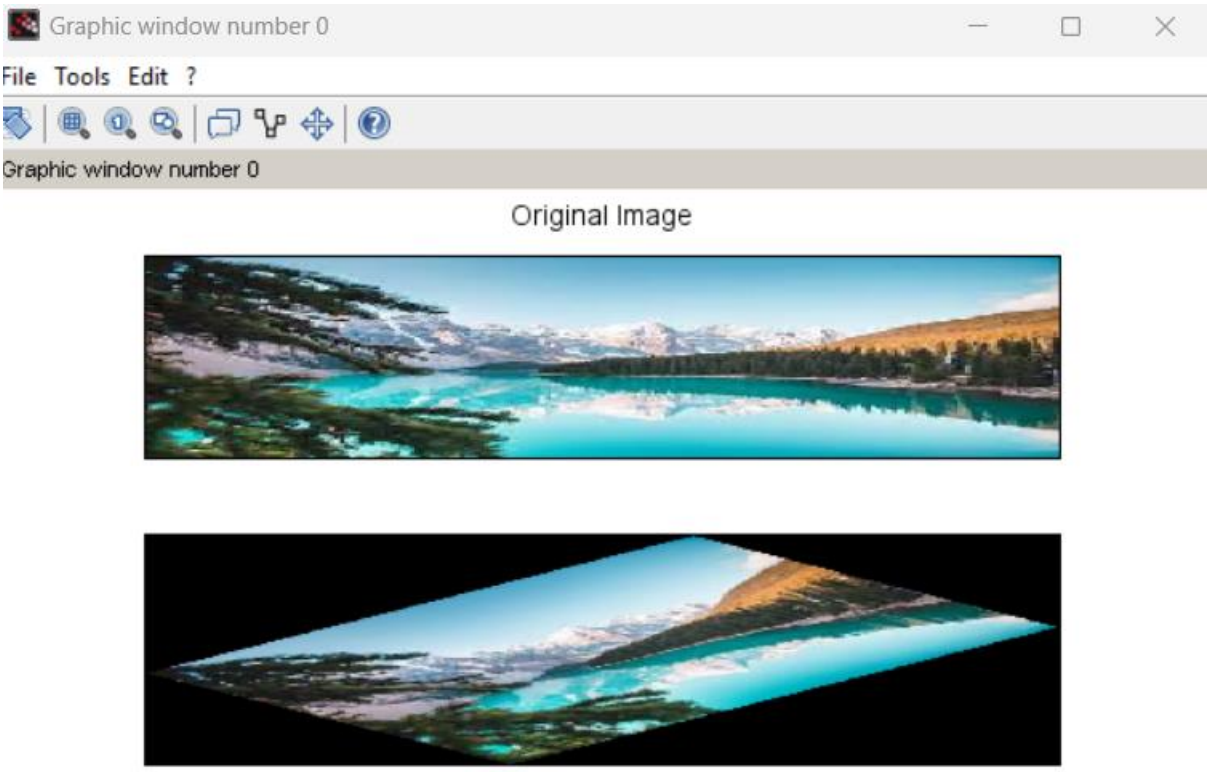
```
s_img=imread("D:\f2.jpg ");

width = size(s_img, 'c');
height = size(s_img, 'r');

w = 2;
h = 1;
```

```
mat = [ w 0;
        0 h;
        0 0];

sc1 = imtransform(s_img, mat, 'affine', width*w, height*h);


w = 1;
h = 2;

mat = [ w 0;
        0 h;
        0 0];

sc2 = imtransform(s_img, mat, 'affine', width*w, height*h);


w = 2;
h = 2;

mat = [ w 0;
        0 h;
        0 0];

sc3 = imtransform(s_img, mat, 'affine', width*w, height*h);

function s = str(img)
   s = 'Size : ' + strcat(string(size(img)), ' * ');
endfunction;

subplot(3,3,1), title('Original Image'), xlabel(str(s_img)), imshow(s_img);
subplot(3,2,2), title('Image scaling width by 2'),xlabel(str(sc1)), imshow(sc1);
subplot(2,3,4), title('Image scaling height by 2'),xlabel(str(sc2)), imshow(sc2);
subplot(2,2,4), title('Image scaling by 2'),xlabel(str(sc3)), imshow(sc3);
```



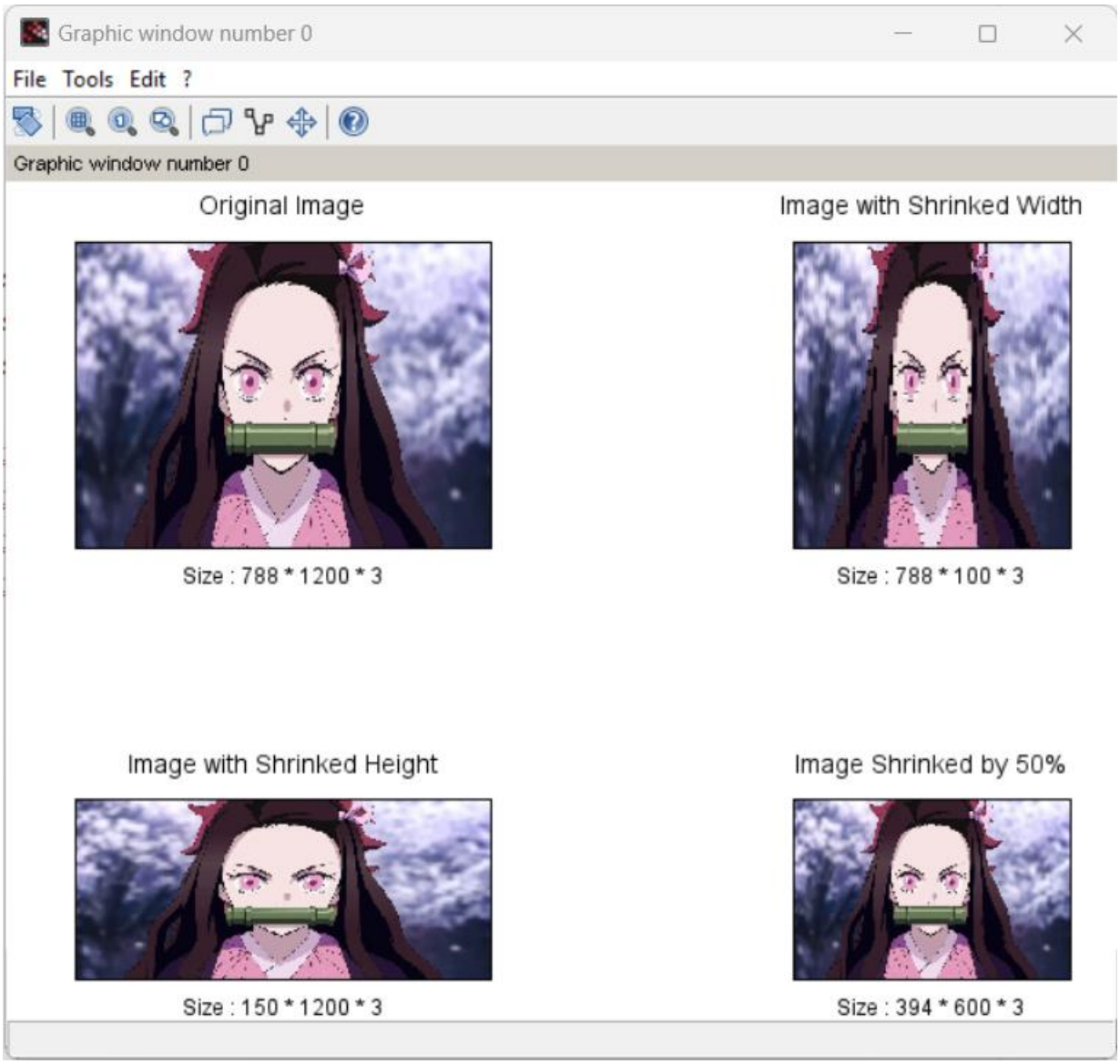
(c)

```
img1 =imread("D:\Pic.jpg");
i =imrotate(img1,[45]);
//%Original image
subplot(3,1,1);
imshow(img1);
title("Original Image");
subplot(3,1,2);
imshow(i);
title("Rotate Image");
```



(d)

```
im_50 = imresize(s_img, 0.5);
im_sw = imresize(s_img, [height, 100]);
im_sh = imresize(s_img, [150, width]);

subplot(2,2,1), title('Original Image'), xlabel(str(s_img)), imshow(s_img);
subplot(2,3,3), title('Image with Shrinked Width'),xlabel(str(im_sw)), imshow(im_sw);
subplot(3,2,5), title('Image with Shrinked Height'),xlabel(str(im_sh)), imshow(im_sh);
subplot(3,3,9), title('Image Shrinked by 50%'),xlabel(str(im_50)), imshow(im_50);
```



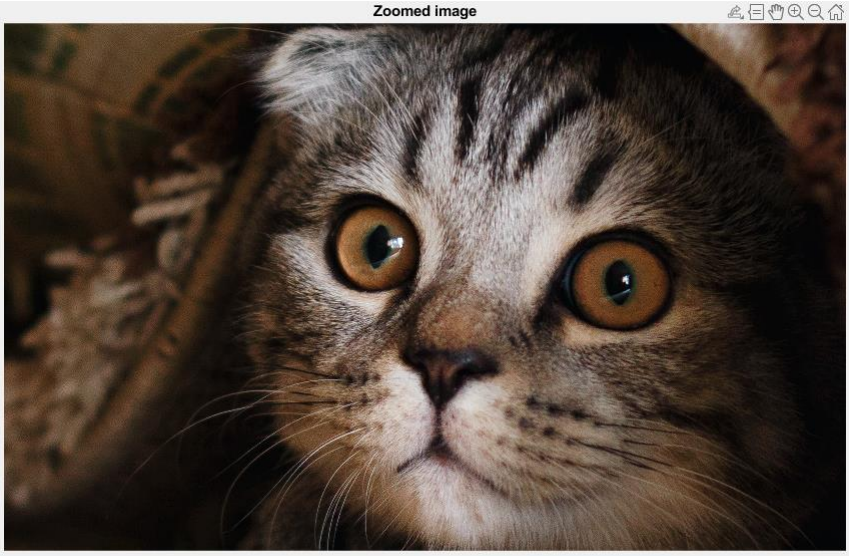
(e)

```
img6=imread("D:\Cat.jpg");
[m,n,colormap]=size(img6);
if colormap==3
x=img6(:,:,1);
y=img6(:,:,2);
z=img6(:,:,3);
end

c=[];
k =1;
```

```
l =1;
f =input('Enter the replication factor by which the image is to be Zoomed:');
for i=1:m
for t=1:f
for j=1:n
for t=1:f
if colormap==3
c1(k,l)=x(i,j);
c2(k,l)=y(i,j);
c3(k,l)=z(i,j);
else
c(k,l)=b(i,j);
end
l=l+1;
end
end
l=1;
k=k+1;
end
end

if colormap==3
c1(:,:,1)=c1;
c2(:,:,2)=c2;
c3(:,:,3)=c3;
end

//%Original image
figure;
imshow(img6);
title("Original Image(256,256)");

//%Zoomed image
figure;
imshow(c);
title('Zoomed Image(512,512)');
```

Original image

Zoomed image



Question 7: To understand various image noise models and to write programs for

a. image restoration
b. Remove Salt and Pepper Noise
c. Minimize Gaussian noise
d. Median filter

Solution:

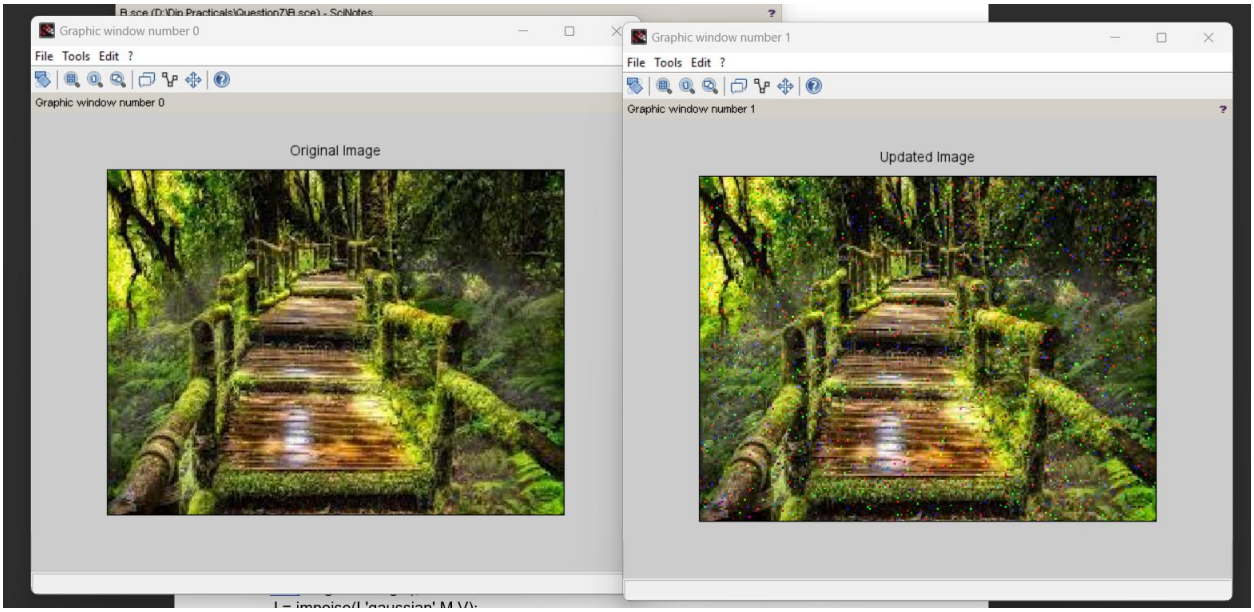
Code -

(a)

```
im1=imread("D:\lava.jpg");
im= imresize(im1,[125 125]);
S= convn(im1,ones(125,125)/15625,'same');
[Dx,Dy]=gradient(S);
figure,imshow(im1);
title("Original Image");
figure,imshow(im);
title("Restored Image");
```

(b)

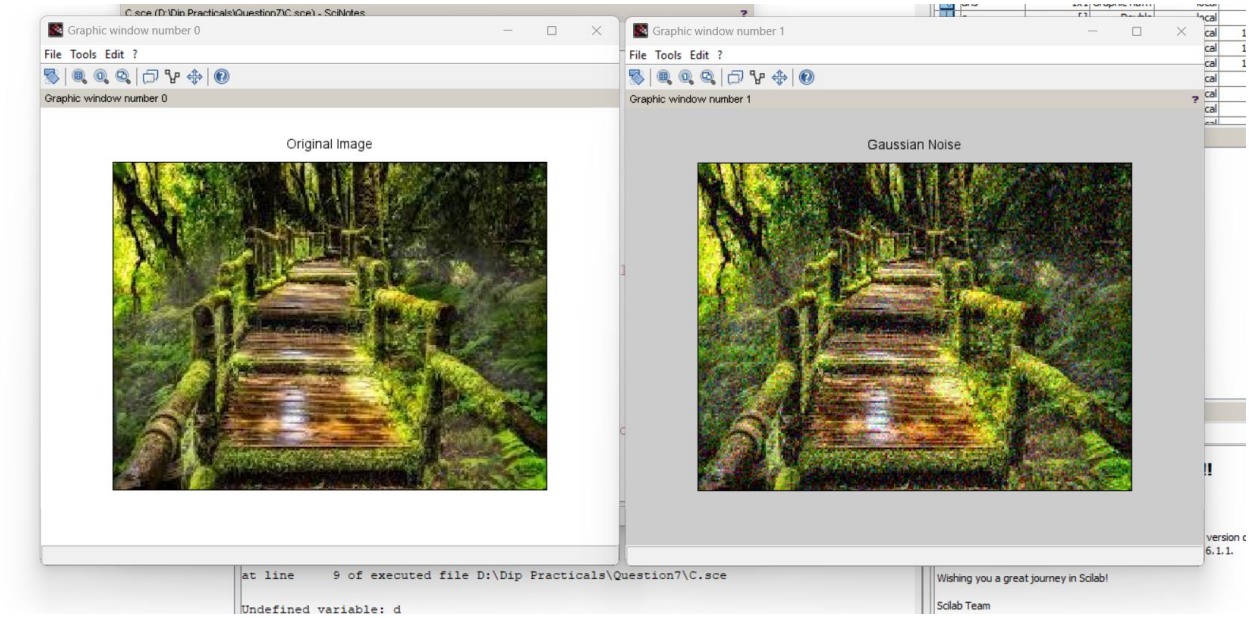
```
I=imread(“D:\Landscape.jpg");
figure
imshow(I)
title("Original Image")
J = imnoise(I,'salt & pepper',0.02);
figure
imshow(J)
title("Updated Image")
```



(c)

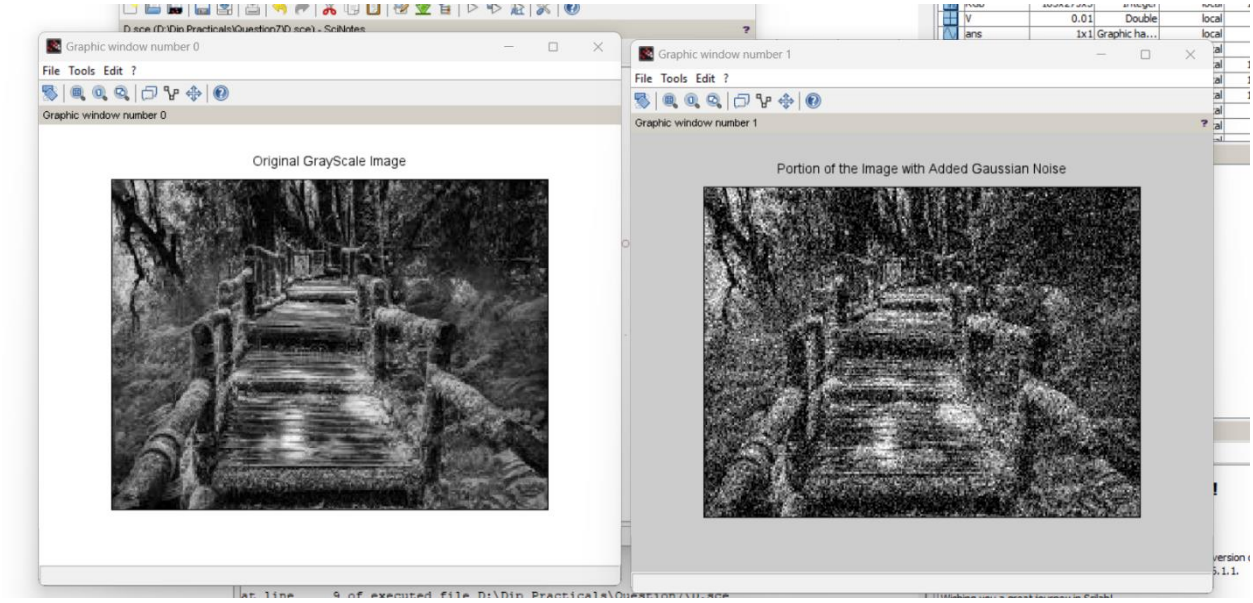
```
I=imread("D:\Landscape.jpg");
M =0;
V=0.01;
imshow(I);
```

```
title('Original Image');
J = imnoise(I,'gaussian',M,V);
figure,imshow(J);
title('Gaussian Noise');
```



(d)

```
RGB=imread("D:\Landscape.jpg");
I = rgb2gray(RGB);
imshow(I);
title('Original GrayScale Image');
J = imnoise(I,'gaussian',0,0.025);
figure();
imshow(J);
title('Portion of the Image with Added Gaussian Noise');
K = wiener2(J,[5 5]);
figure();
imshow(K);
title('Portion of the Image with Noise Removed by Wiener Filter');
```

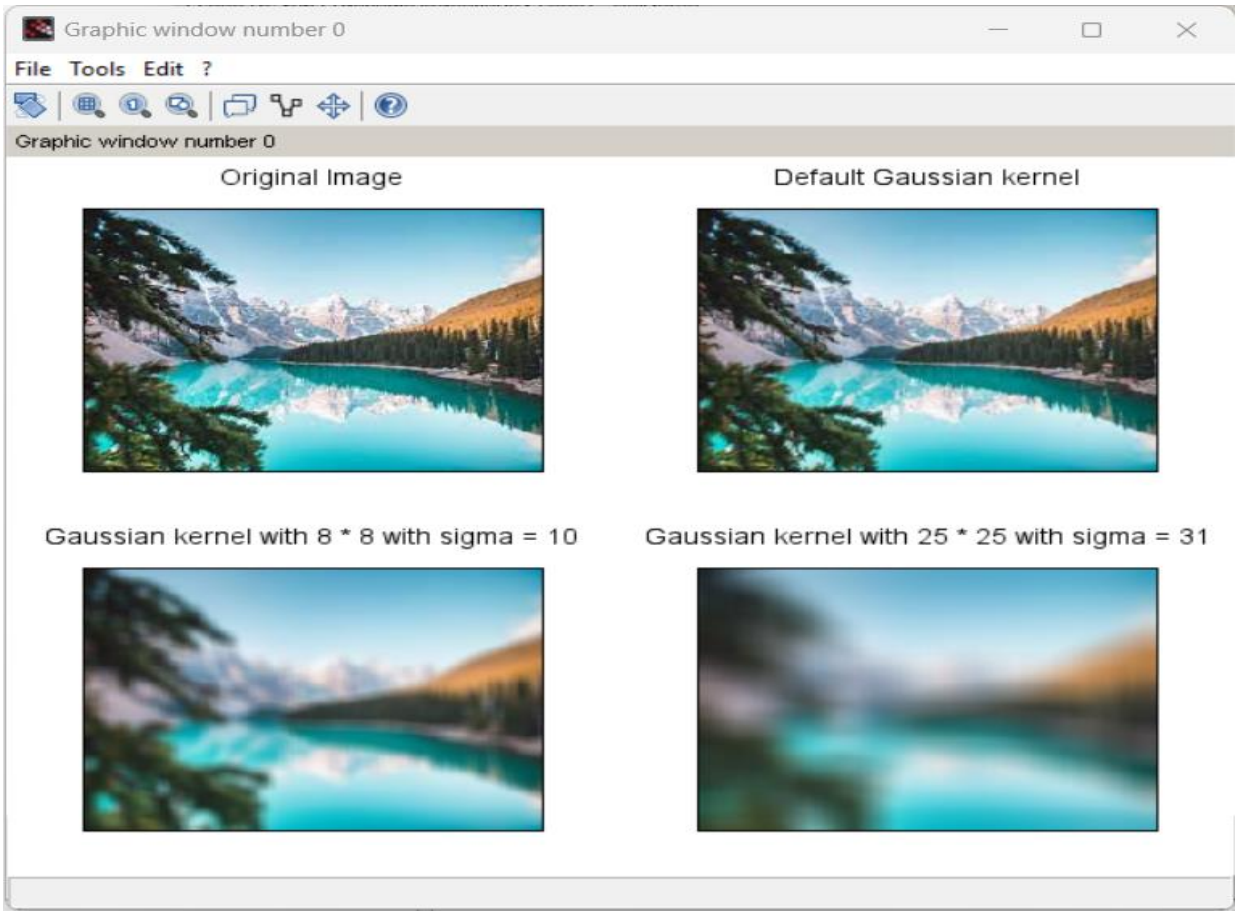

Graphic window number 0
File Tools Edit ?
Graphic window number 0
Original GrayScale Image
Graphic window number 1
File Tools Edit ?
Graphic window number 1
Portion of the Image with Added Gaussian Noise

Question 8: Write and execute programs to use spatial low pass and high pass filters.

Solution:

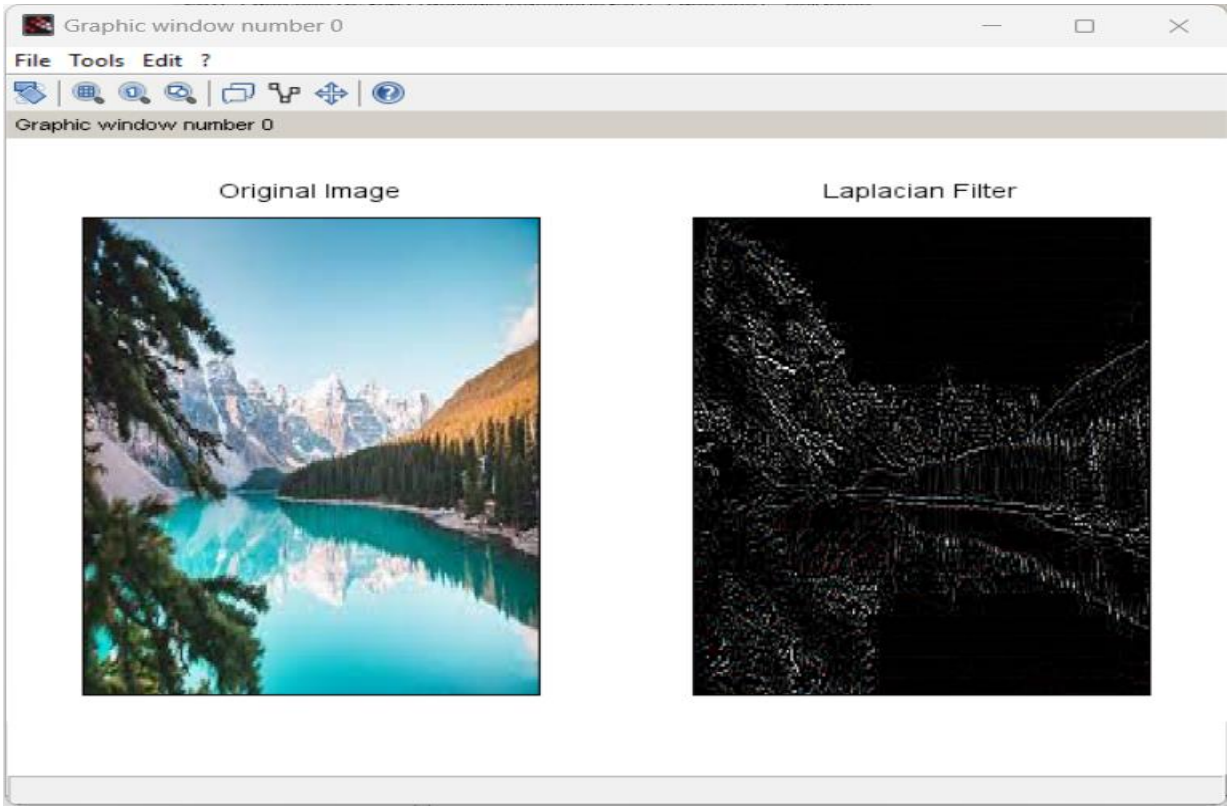
Code -

```
 //High pass
i1= imread('D:\Pic.jpg');
g_filter = fspecial('gaussian');
i2 = imfilter(i1, g_filter);
g_filter2 = fspecial('gaussian', [8,8], 10);
i3 = imfilter(i1, g_filter2);
g_filter3 = fspecial('gaussian',[25,25], 31);
i4 = imfilter(i1, g_filter3);
subplot(2,2,1), title('Original Image'), imshow(i1);
subplot(2,2,2), title('Default Gaussian kernel'), imshow(i2);
subplot(2,2,3), title('Gaussian kernel with 8 * 8 with sigma = 10'), imshow(i3);
subplot(2,2,4), title('Gaussian kernel with 25 * 25 with sigma = 31'), imshow(i4);
```



//low pass

```
i1=imread("D:\Pic.jpg");

l_filter = fspecial('laplacian');
i2 = imfilter(i1, l_filter);

subplot(1,2,1), title('Original Image'), imshow(i1);
subplot(1,2,2), title('Laplacian Filter'), imshow(i2);
```



Question 9: Write and execute programs for image frequency domain filtering

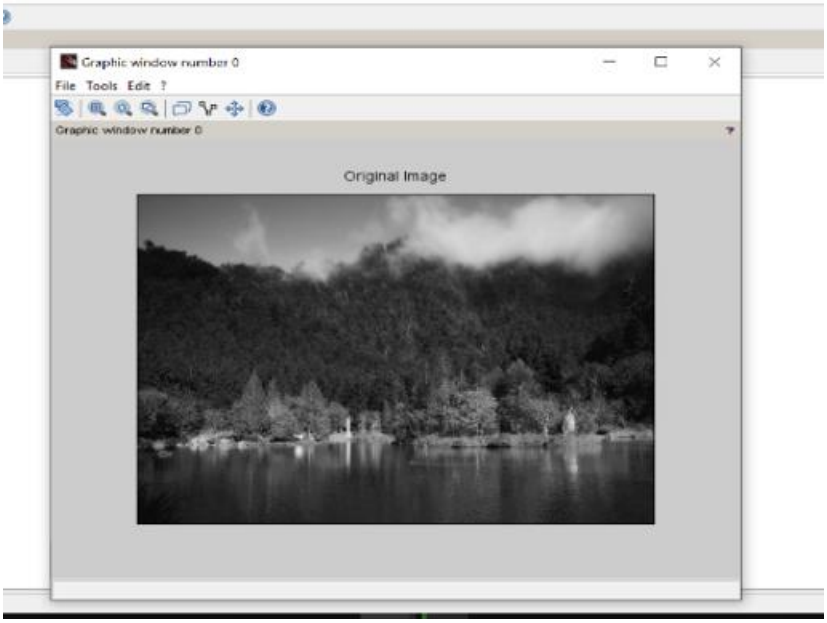
a. Apply FFT on given image
b. Perform low pass and high pass filtering in frequency domain
c. Apply IFFT to reconstruct image

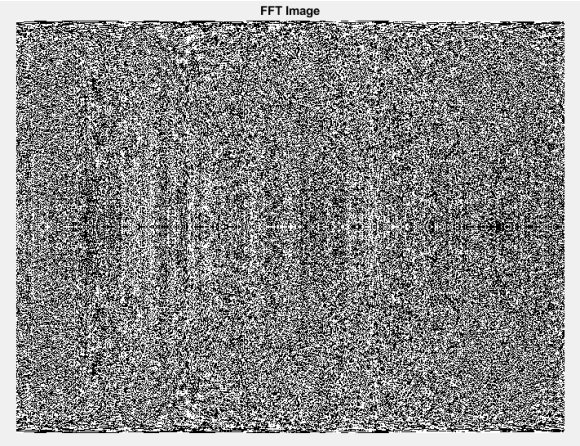
Solution:

Code -

(a)

```
// Read in image.
I=imread("D:\Nature1.jpg");
grayImage = rgb2gray(I);
figure,imshow(grayImage);
title("Original Image");
FF = fft(grayImage);
figure,imshow(FF);
title("FFT Image");
```



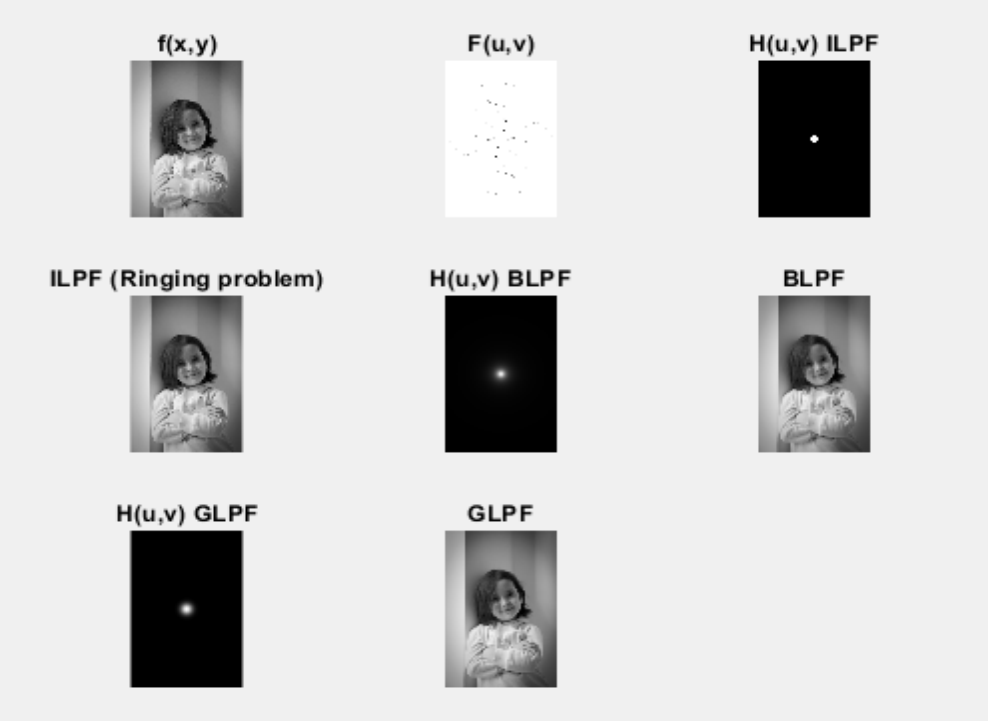


(b)

(i) Low Pass Filtering

```
img=imread("D:\girl.jpg");
gimg=rgb2gray(img);
subplot(331)
imshow(gimg)
title('f(x,y)')
//%% Ideal low pass
P=size(gimg);
M=P(1);N=P(2);
F=fft2(gimg,M,N);
subplot(332)
```

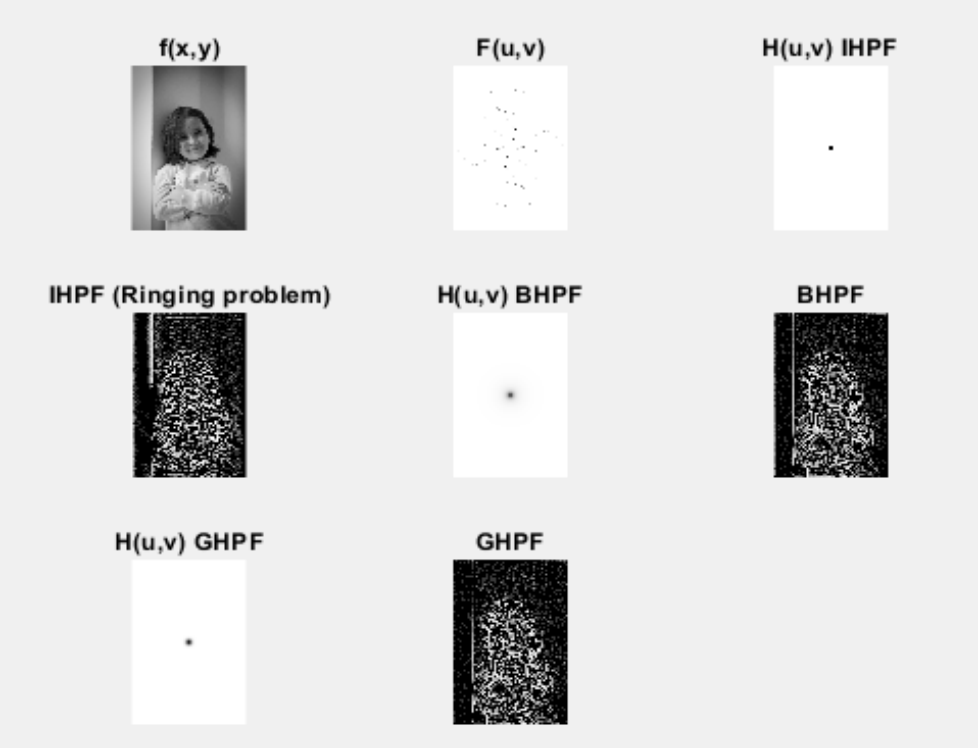
```
//%imshow(uint8(abs(fftshift(F))));
imshow(uint8(abs((F))));
title('F(u,v)')
 (u>M/2);
u(idx)=u(idx)-M;
idy=find(v>N/2);
v(idy)=v(idy)-N; u0=100; %remove freq greater than u0
u=0:(M-1);
v=0:(N-1);
idx=find
[V,U]=meshgrid(v,u);
D=sqrt(U.^2+V.^2);
H=double(D<=u0);
//% display
subplot(333)
imshow(abs(fftshift(H)),[]);
title('H(u,v) ILPF')
subplot(334)
G=H.*F;
g=(ifft2(G));
```



(ii) High Pass Filtering

```
img=imread('girl.jpg');
gimg=rgb2gray(img);
subplot(331)
imshow(gimg)
title('f(x,y)')
%% Ideal high pass
P=size(gimg);
M=P(1);N=P(2);
F=fft2(gimg,M,N);
subplot(332)
%imshow(uint8(abs(fftshift(F))));
imshow(uint8(abs(F)));
title('F(u,v)')
u0=50; %remove freq greater than u0
u=0:(M-1);
v=0:(N-1);
idx=find(u>M/2);
u(idx)=u(idx)-M;
idy=find(v>N/2);
v(idy)=v(idy)-N;
[V,U]=meshgrid(v,u);
D=sqrt(U.^2+V.^2);
H=1-double(D<=u0);
% display
subplot(333)
imshow(abs(fftshift(H)),[]);
title('H(u,v) IHPF')
subplot(334)
G=H.*F;
g=(ifft2(G));
imshow(histeq(uint8(g)),[])
title('IHPF (Ringing problem)')
%% Butterworth high pass
n=1; %Butterworth filter of order n
H=1-(1./(1 + (D./u0).^(2*n)));
subplot(335)
imshow(abs(fftshift(H)));
title('H(u,v) BHPF')
subplot(336)
G=H.*F;
```

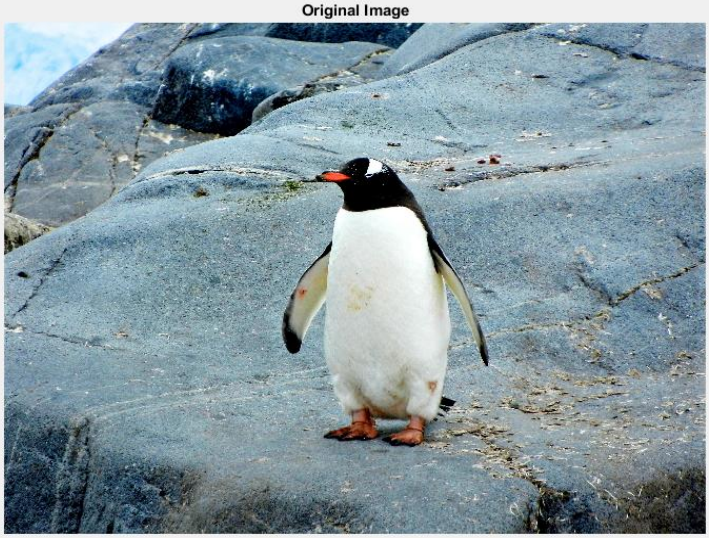
```
g=(ifft2(G));
imshow(histeq(uint8(g)),[])
title('BHPF')
%% Gaussian high pass filter
H =1- (exp(-(D.^2)./(2*(u0^2))));
subplot(337)
imshow(abs(fftshift(H)));
title('H(u,v) GHPF')
subplot(338)
G=H.*F;
g=(ifft2(G));
imshow(histeq(uint8(g)),[])
title('GHPF')
```



(c)

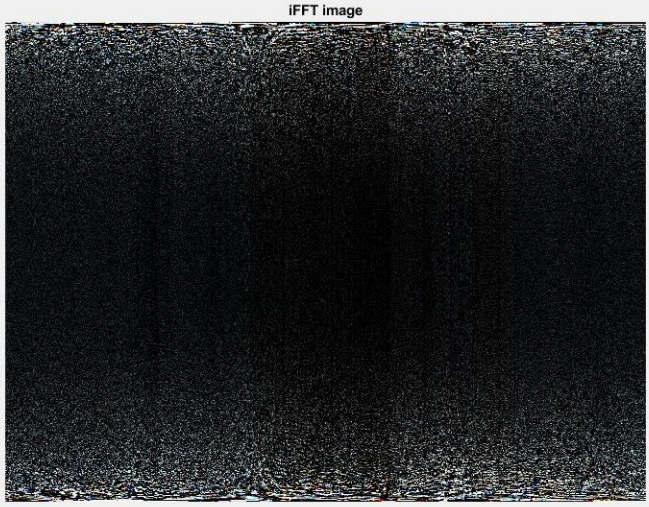
```
//Read in the image you want

I = imread('penguin.jpg');
figure, imshow(I);
title("Original Image")
//Extract and binarize the relevant colour channels

redChannel=imbinarize(I(:,:,1), 0.8);
greenChannel=imbinarize(I(:,:,2), 0.4);
//Filter the image

filtered = medfilt2(redChannel+greenChannel);
//Convert to binary mask

mask=imbinarize(filtered,0.3);
//Apply the mask to the colour channels
Ir = I(:,:,1); Ir(~mask)=0;
Ig = I(:,:,2); Ig(~mask)=0;
Ib = I(:,:,3); Ib(~mask)=0;
//Compile the output image
I_coloured(:,:,1) = Ir;
I_coloured(:,:,2) = Ig;
I_coloured(:,:,3) = Ib;
figure
imshow(I_coloured)
title("Reconstructed Image")
 Finding IFFT
IFF = ifft(I_coloured);
figure,imshow(IFF)
title("iFFT image")
```

Original Image



Reconstructed Image

iFFT image

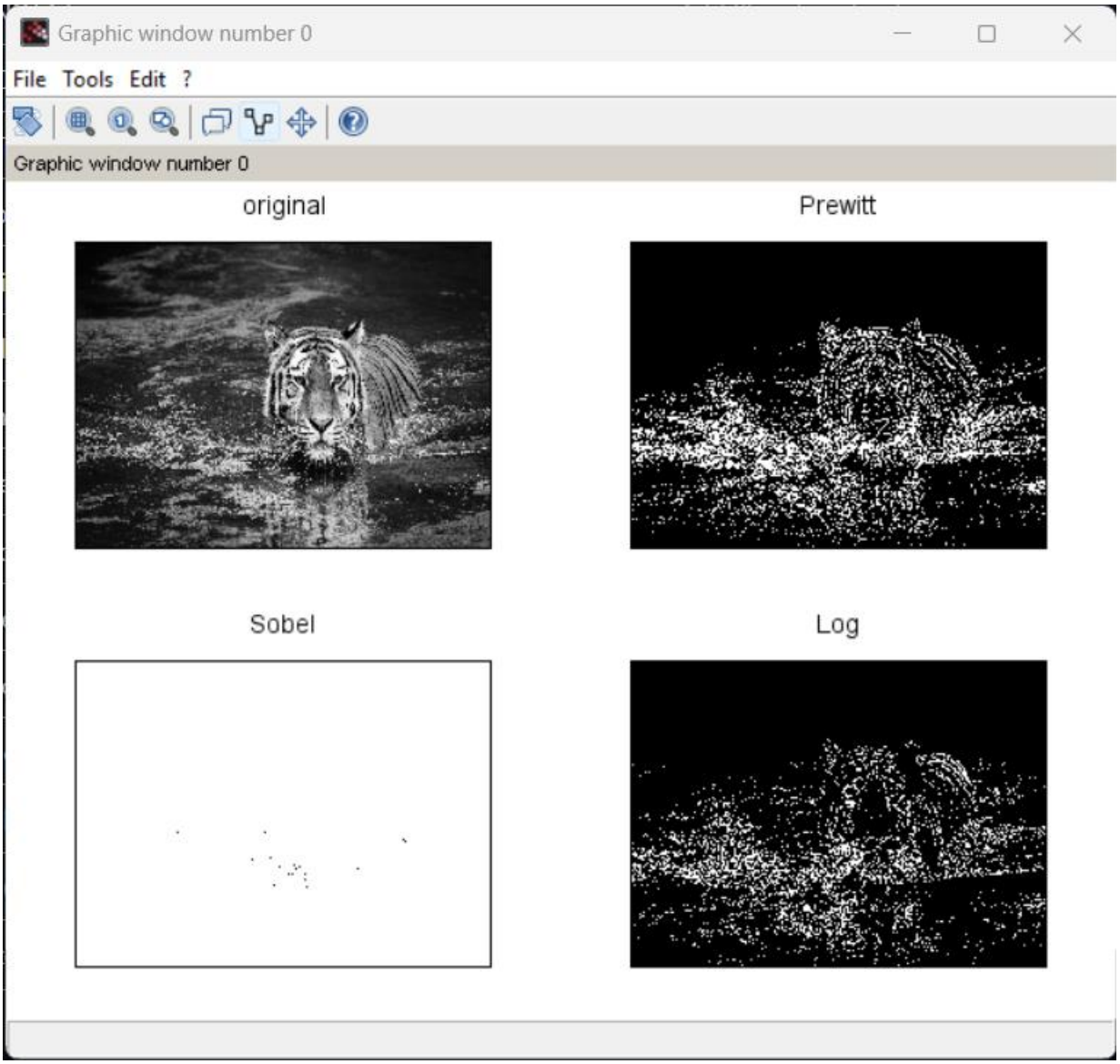


Question 10: Write a program in C and MATLAB/SCILAB for edge detection using different edge
detection mask.

Solution:

Code -

```
i= imread('D:\Tiger.jpg');
I=rgb2gray(i);
BW1=edge(I,"prewitt");
BW2=edge(I,"sobel");
BW3=edge(I,"roberts");
subplot(2,2,1);
imshow(I);
title("original");
subplot(2,2,2);
imshow(BW1);
title("Prewitt");
subplot(2,2,3);
imshow(BW2);
title("Sobel");
subplot(2,2,4);
imshow(BW3);
title("Roberts");
```

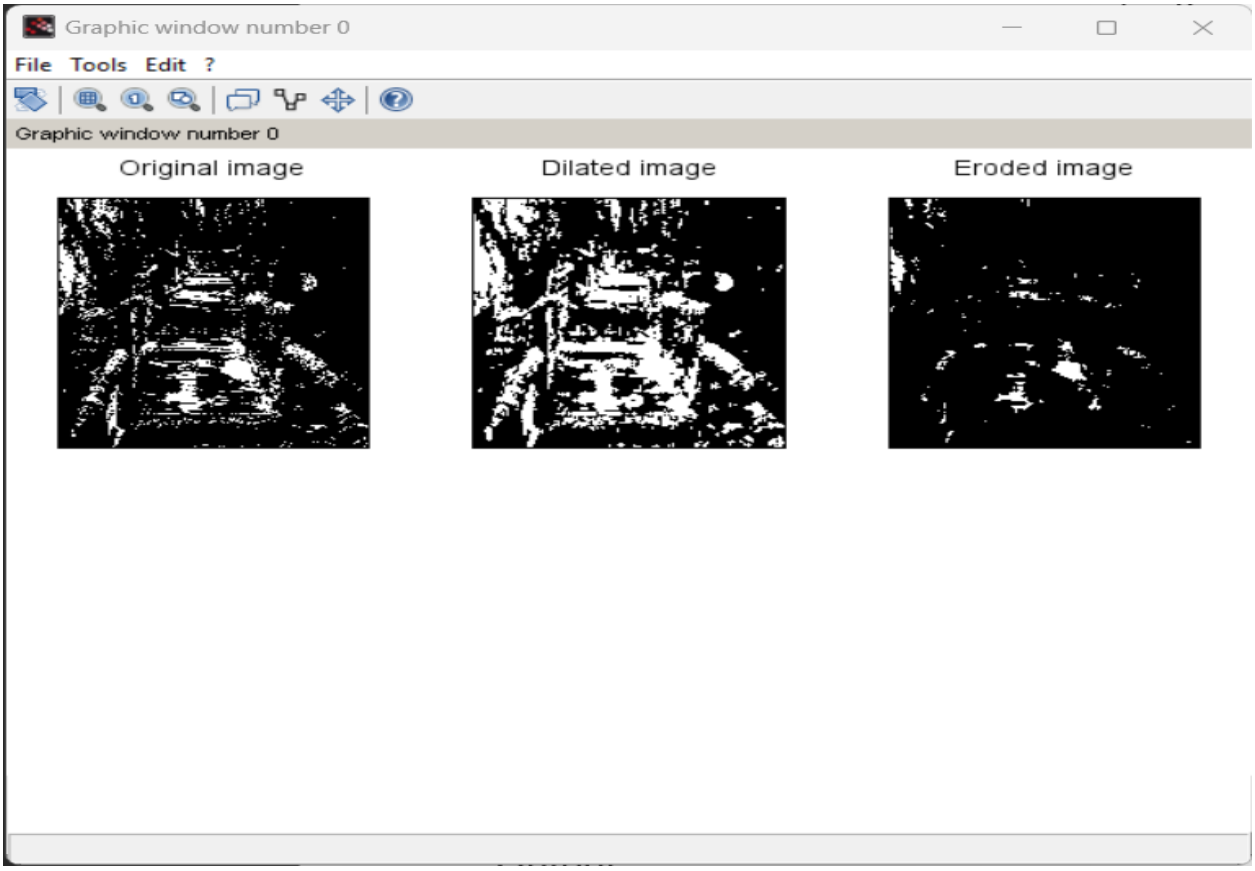

Graphic window number 0
File Tools Edit ?
Graphic window number 0
original
Prewitt
Sobel
Log

Question 11: Write and execute a program for image morphological operations erosion and dilation.

Solution:

Code -

```
I1= imread('D:\Landscape.jpg');
I=im2bw(I1,0.5);
se=imcreatese('cross',3,3);
subplot(2, 3, 1);
imshow(I);
title("Original image");

dilate = imdilate(I, se);
subplot(2, 3, 2);
imshow(dilate);
title("Dilated image");

erode = imerode(I, se);
subplot(2, 3, 3);
imshow(erode);
title("Eroded image");
```


Graphic window number 0
File Tools Edit ?
Graphic window number 0
Original image
Dilated image
Eroded image