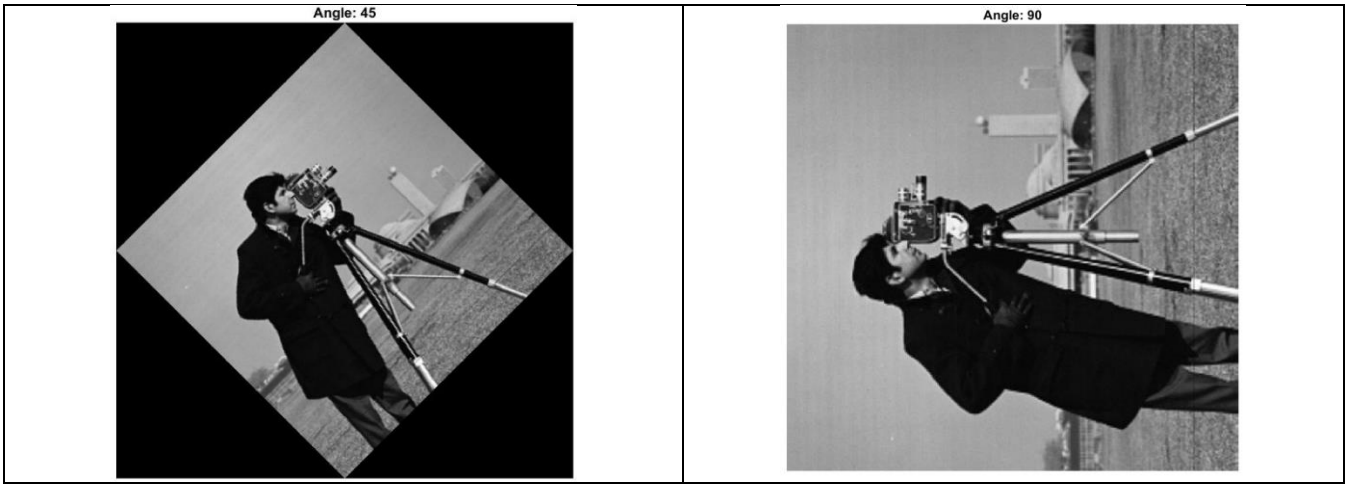
Que 1. Rotation

a. myrotate.m

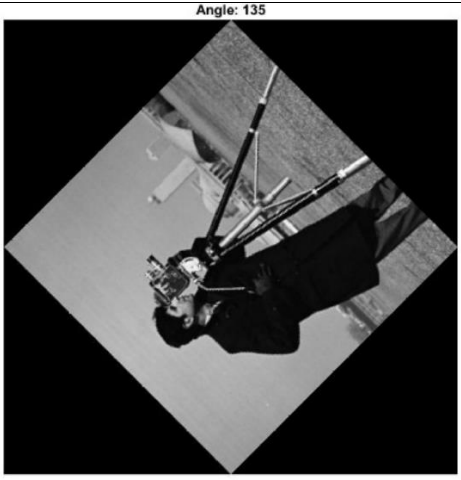
```
function y = myrotate(x, t)
    xc = double(x);
    sz = length(x);
    in = sz/2;
    for i=1:2*sz
        for j=1:2*sz
            a = round((i-in).*cosd(t)+(j-in).*sind(t)+in);
            b = round(-(i-in).*sind(t)+(j-in).*cosd(t)+in);
            if (a>0) && (a<=sz) && (b>0) && (b<=sz)
                  y(i,j,:) = uint8(xc(a,b,:));
            end
        end
    end
end
```

b. Results.m

```
im = imread('Cameraman Image.jpg');

for k=1:8
    angle = k*45;
    xd = myrotate(im,angle);
    figure(k);
    imshow(xd);
    title(['Angle: ',num2str(angle)]);
end
```

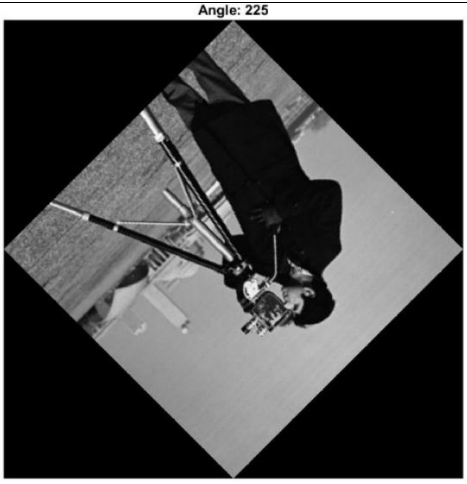


Angle: 135



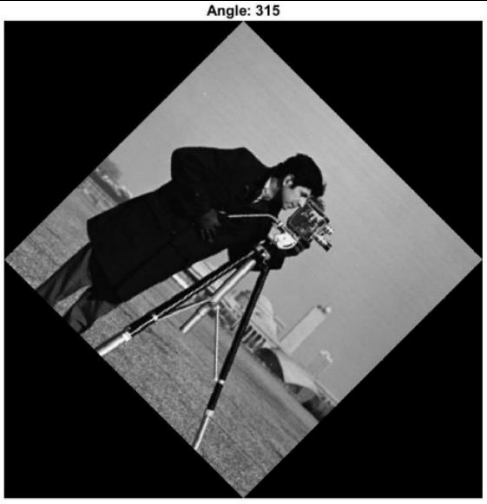
Angle: 180

Angle: 225



Angle: 270

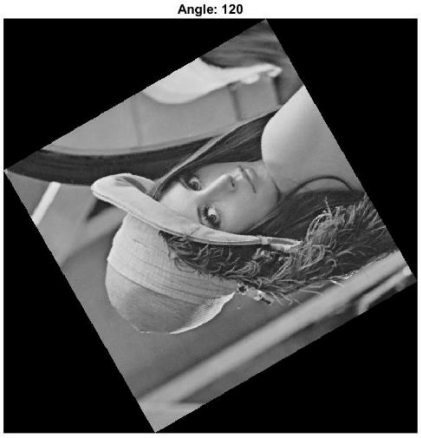
Angle: 315

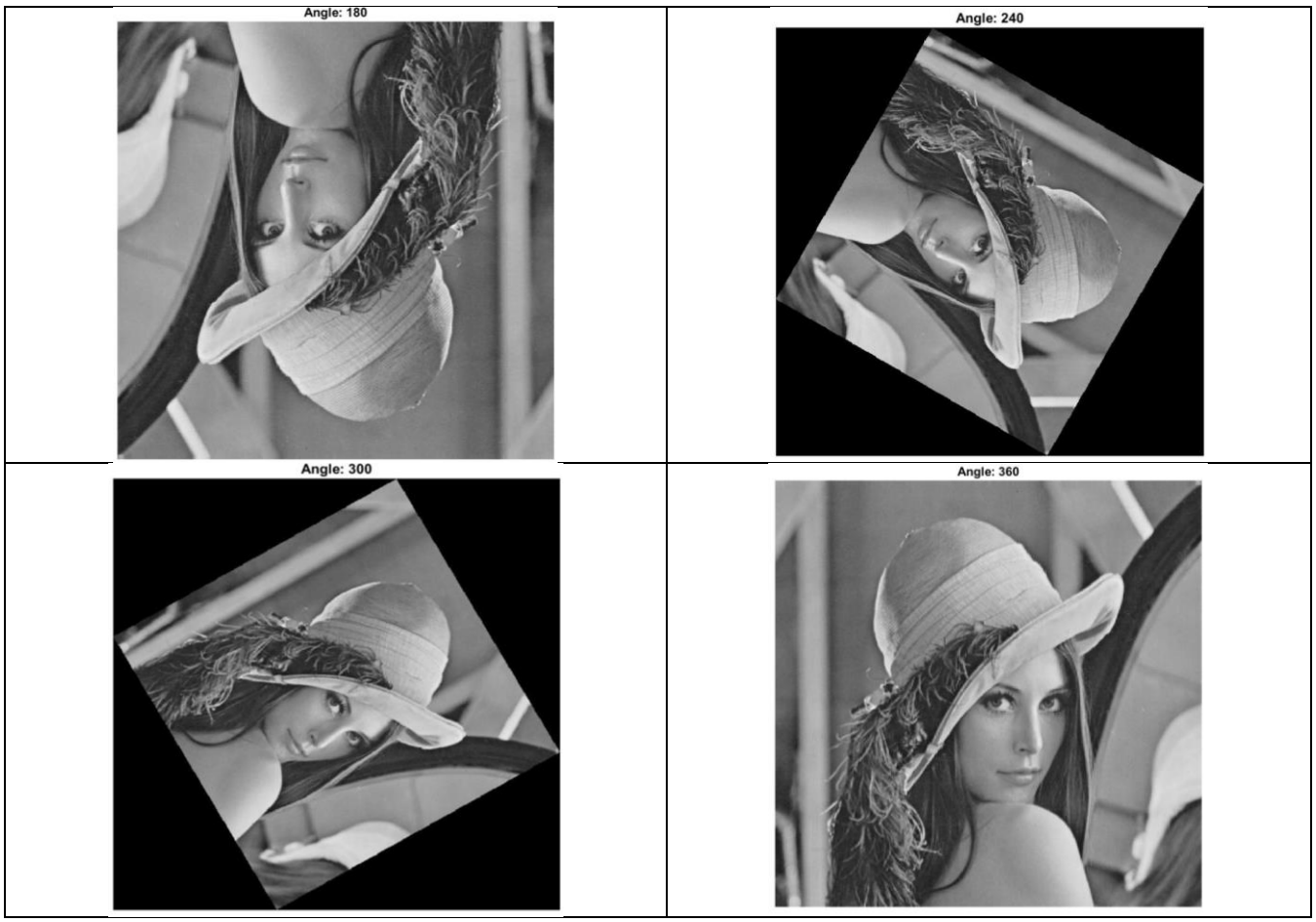


Angle: 360

Angle: 60

Angle: 120





Que 2. Translation

a. translate.m

```
function y = translate(x,a,b)
   sz = size(x);
   y = zeros(sz(1) + a, sz(2) + b);
   for i=1:sz(1)
      for j=1:sz(2)
         y(i+a,j+b) = x(i,j);
      end
   end
end
```

Before

After

Que 3. Shear

```
shear = 75;
x = imread('lenaTest1.jpg');
[sz1,sz2] = size(x);

xdim = round((0:sz2-1)./tand(shear));

for i=1:sz2
    x1(i,xdim(sz2-i+1)+1:xdim(sz2-i+1)+sz2) = x(i,:);
    x2(i,xdim(i)+1:xdim(i)+sz2) = x(i,:);
end

figure(1);
imshow(x1);
title(['Angle -',num2str(shear)]);

figure(2);
imshow(x2);
title(['Angle ',num2str(shear)]);
```

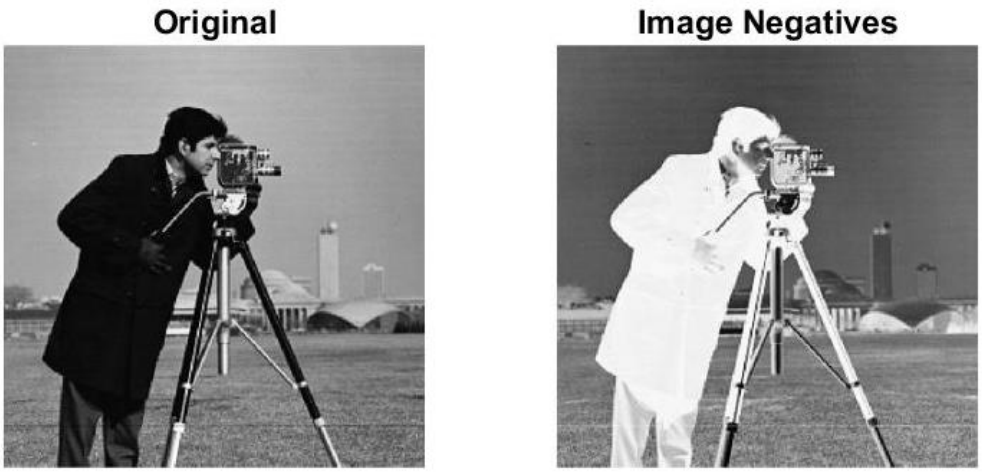
Angle -75

Angle 75

Que 5. Image Enhancement

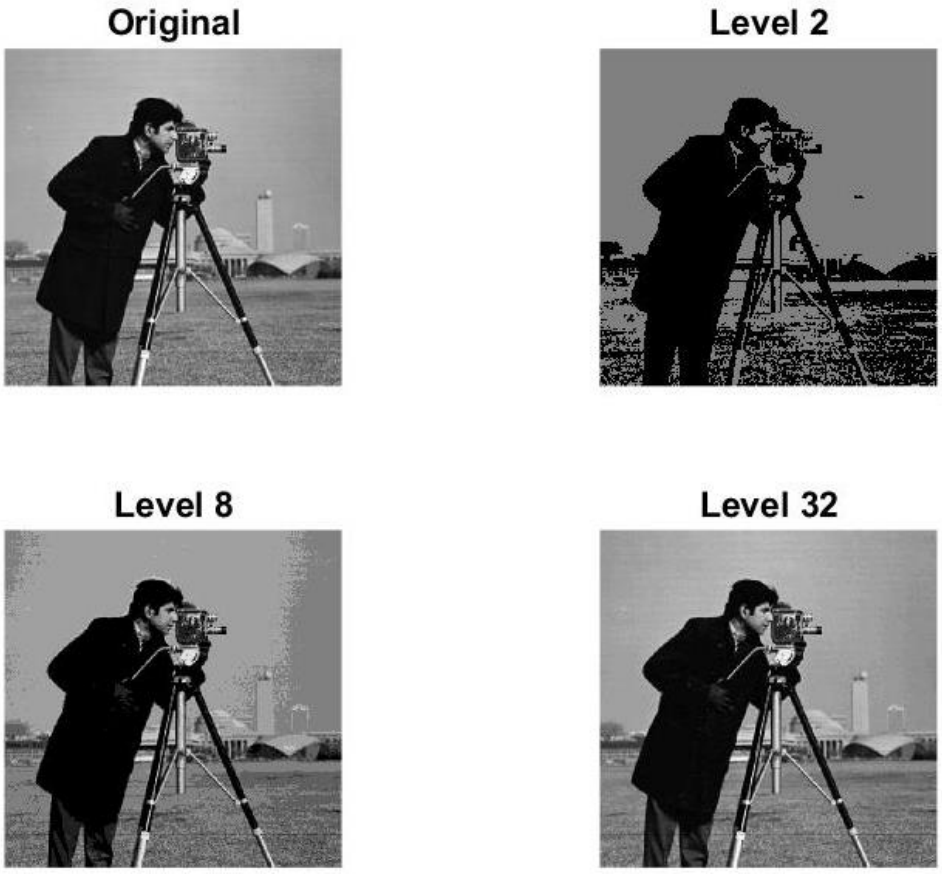
a. Negative Images

```
im = imread('Cameraman Image.jpg');
im = double(im);
figure(1);
subplot(1,2,1);
imshow(uint8(im));
title('Original');

%Image negatives

[sz1,sz2] = size(im);
res = 255 - im;
subplot(1,2,2);
imshow(uint8(res));
title('Image Negatives');
```



b. Intensity Transformation

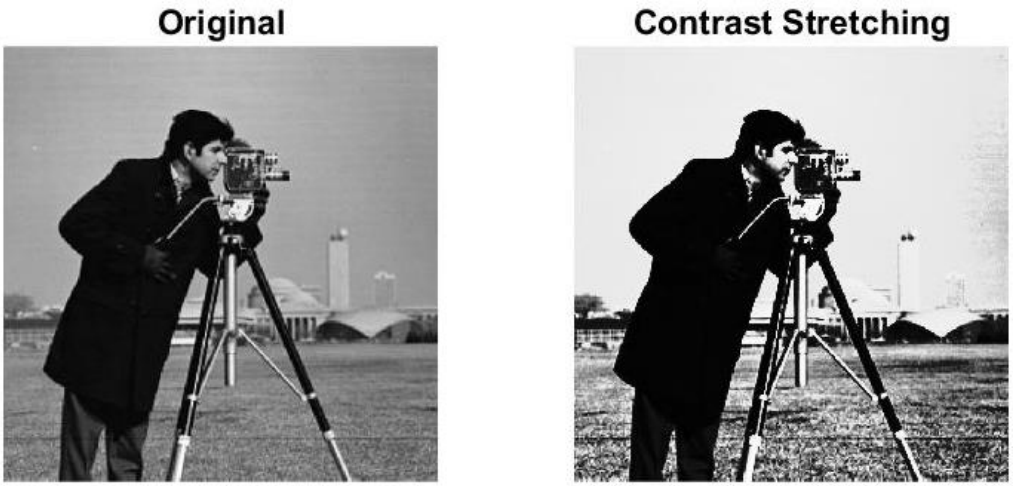
```
for i = 1:3
    subplot(2,2,i+1);
    form = 2*i - 1;
    pow = 2^form;
    res = floor((im.*pow)./256).*256/(pow);
    imshow(uint8(res));
    title(['Level ', num2str(pow)]);
end
```

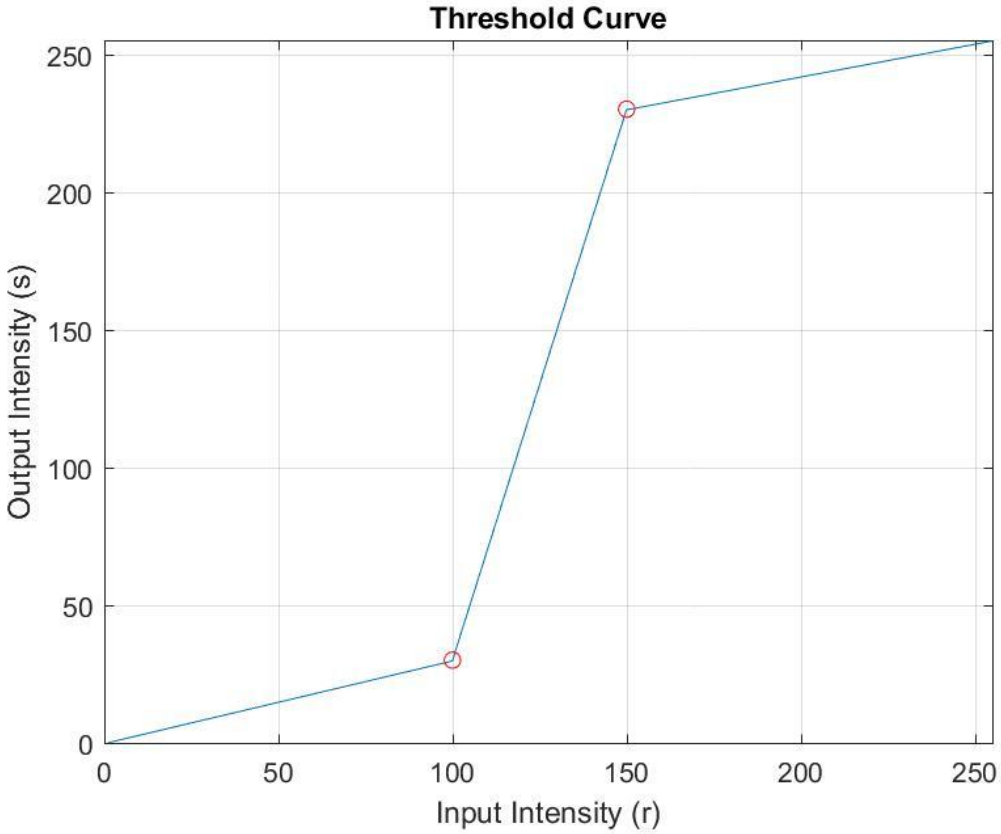


c. Contrast Stretching

```
l = 100;
h = 150;
a = 0.3;
b = 4;
ya = a*l;
yb = b*(h - l) + ya;
ratio = (255-yb)/(255-h);
for i=1:sz1
    for j=1:sz2
        if(im(i,j)<l)
            res(i,j) = im(i,j)*a;
        elseif(im(i,j)<h)
            res(i,j) = ((im(i,j)-l)*b + ya);
        else
            res(i,j) = (im(i,j)-h)*ratio + yb;
        end
    end
end
subplot(1,2,2);
imshow(uint8(res));
title('Contrast Stretching');

figure(2);
y1 = a*(0:l-1);
y2 = b*(1:h-l) + ya;
y3 = ratio*((h:255)-h) + yb;
```

```
plot(1:256,[y1 y2 y3]);
hold on;
plot(100,30,'ro');
hold on;
plot(150,230,'ro');
xlabel('Input Intensity (r)');
ylabel('Output Intensity (s)');
title('Threshold Curve');
xlim([0,255]);ylim([0,255]);
```





d. Logarithmic transformation

```
% Logarithmic transformation

c = (255/log(256));
res = c*log(1 + im);
subplot(1,3,2);
```

```
imshow(uint8(res));
title('Log');

%Inverse Logarithmic Transformation

c = 255/log(256);
res = (exp(res) .^ (1/c));
subplot(1,3,3);
imshow(uint8(res));
title('Log Inverse');
saveas(gcf,strcat('l3ans5d.jpg'))
```

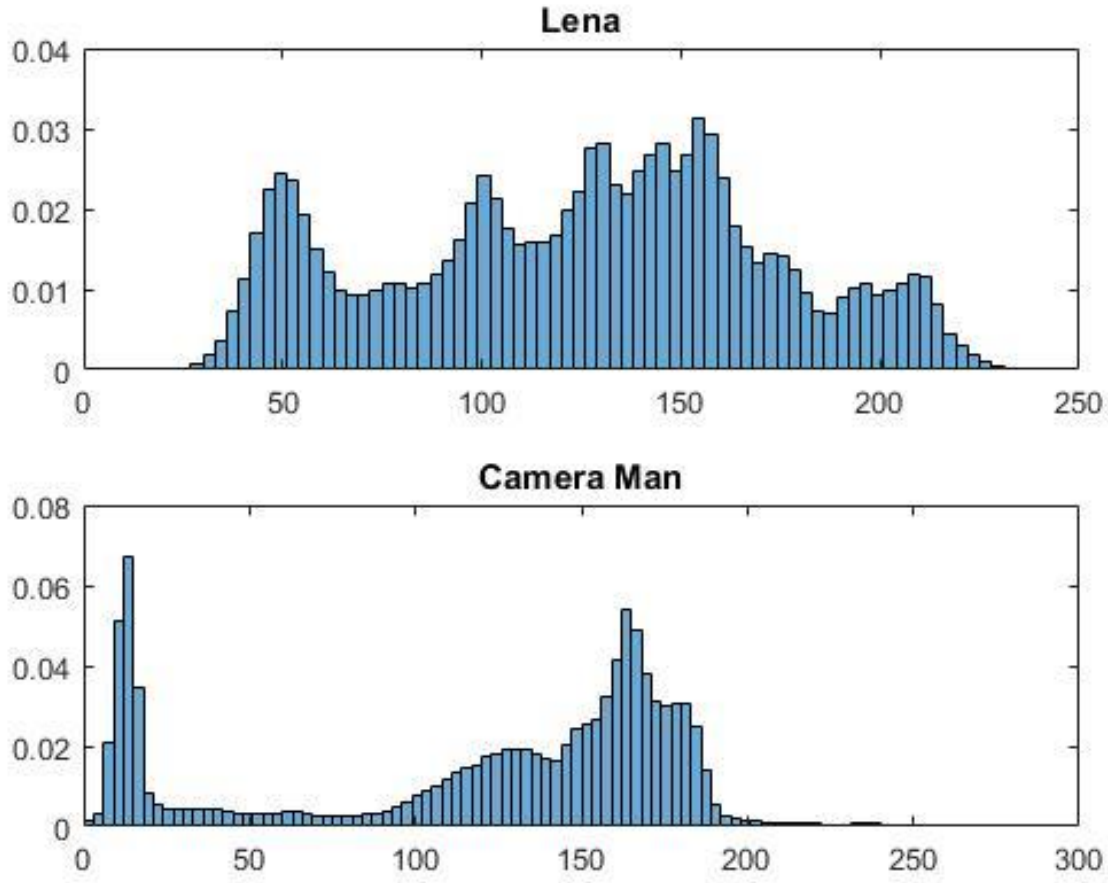
e. Power Law transformation

```
vals = [0.2,1,2.2];

for i = 1:length(vals)
    g = vals(i);
    res = (255^(1-g))*im.^g;
    subplot(1,3,i);
    imshow(uint8(res));
    title(['\gamma = ',num2str(g)]);
end
```

Que 6. Histogram Processing, Equalization, Specification

a. Histogram

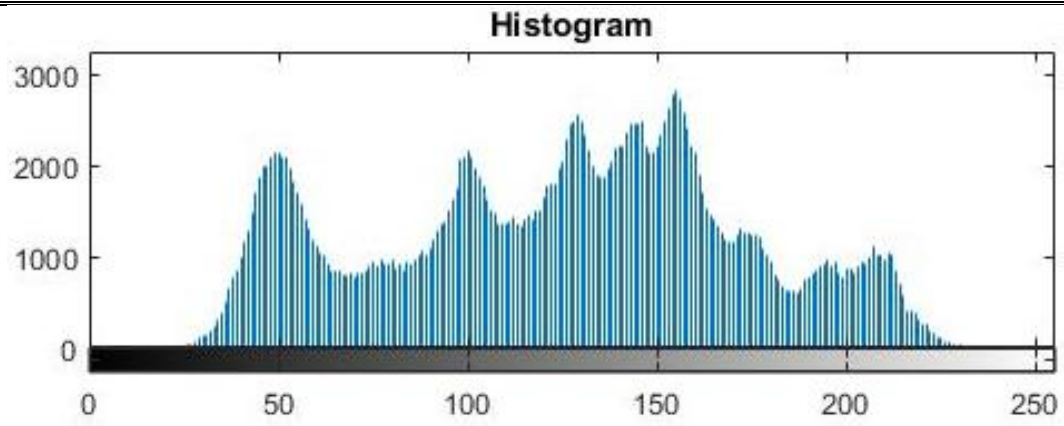
```
x = imread('lenaTest1.jpg');
y = imread('Cameraman Image.jpg');

subplot(2,1,1);
histogram(x,'Normalization','probability');
title('Lena');

subplot(2,1,2);
histogram(y,'Normalization','probability');
title('Camera Man');
```

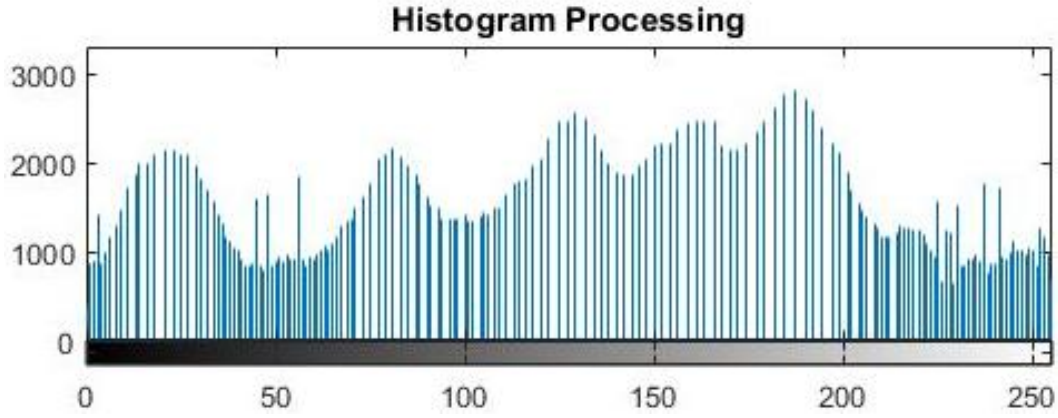


b. Histogram Processing and Equalization

```
x = imread('lenaTest1.jpg');
[sz1, sz2] = size(x);

frequency = sum(histc(x,0:255),2);
cumulative = double(cumsum(frequency));
normalized = round(255*cumulative/(m1*m2));
Equalized = uint8(normalized(x+1));

figure(1);
xlim([0,255]);
```

```
ylim([0,3000]);
subplot(2,1,1);
imhist(x);
title('Histogram');
subplot(2,1,2);
imhist(Equalized);
title('Histogram Processing');

figure(2);
subplot(1,2,1);
imshow(x);
title('Original');
subplot(1,2,2);
imshow(Equalized);
title('After Equalization');
```





c. Histogram Specification / Matching

```
X1 = imread('lenaTest1.jpg');
X2 = imread('Camera Man Image.jpg');
% Note swap X1 and X2 for second Plot

frequency1 = sum(histc(X1,0:255),2);
cumulative1 = double(cumsum(frequency1));

frequency2 = sum(histc(X2,0:255),2);
cumulative2 = double(cumsum(frequency2));

match_mask = zeros(256,1,'uint8');

for i=1:256
    [~,id]  = min(abs(cumulative1(i)- cumulative2));
    match_mask(i) = id - 1;
end

Y = match_mask(double(X1)+1);

figure();

subplot(2,3,1);
imshow(X1);
title('Original');

subplot(2,3,2);
imshow(X2);
title('Matching Image');

subplot(2,3,3);
imshow(Y);
title('After');

subplot(2,3,4);
imhist(X1);
title('Histogram');

subplot(2,3,5);
imhist(X2);
title('Histogram Matching');

subplot(2,3,6);
imhist(Y);
title('After Matching');

suptitle('Specialisation')
```

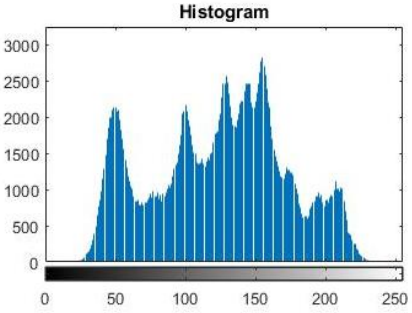
Specialisation

Original

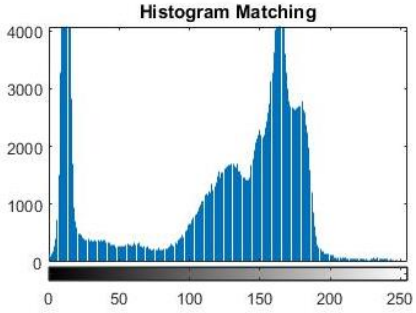
Matching Image

After

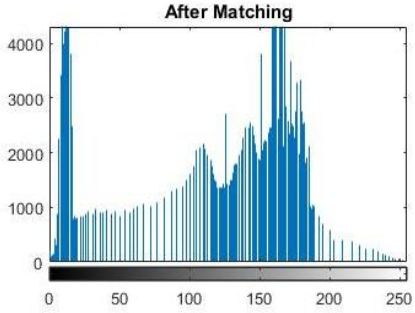
Histogram



Histogram Matching



After Matching



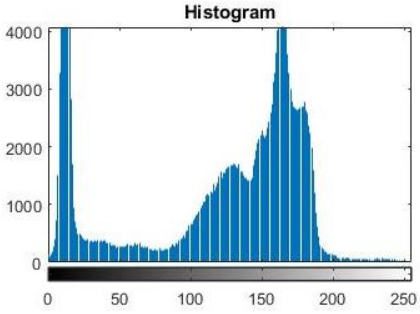
Specialisation

Original

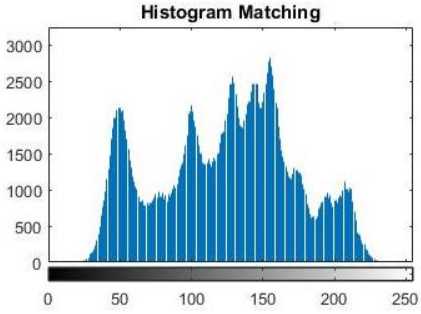
Matching Image

After

Histogram



Histogram Matching



After Matching