Assignment 2

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Q1

Done In Hard Copy

Q2

a. Done in Hard Copy
b. Mentioned the Expression in the Hard Copy and used that final obtained expression for finding the resulting matrix both full and same without using conv2.

   NOTE:-There are 2 file for this question one names Q2.m (it contain the script) and the other one is F.m (it contain the F function)

F.m:-

```
function  value= F( x,y )
if(x==0 && y==0)
   value=1;
elseif(x==1&&y==0)
   value=2;
elseif(x==2 && y==0)
   value=3;
elseif(x==0 && y==-1)
   value=4;
elseif(x==1 && y==-1)
   value=5;
elseif(x== 2&& y==-1)
   value=6;
elseif(x== 0&& y==-2)
   value=7;
elseif(x==1 && y==-2)
   value=8;
```

```
elseif(x== 2&& y==-2)
   value=9;
else
   value=0;
end
end
```

Q2.m

```
N1=zeros(5,5);
x=-1;
y=1;
for i=1:5
   for k=1:5
      N1(i,k)=5*F(x,y)+6*F(x-1,y)+4*F(x+1,y)+2*F(x,y-1)+F(x+1,y-1)+3*F(x-1,y-1)+7*F(x+1,y+1)+8*F(x,y+1)+9*F(x-1,y+1);
      x=x+1;
   end
   x=-1;
   y=y-1;
end

disp('Without using conv2: ')
disp('Full');
disp(N1);
disp('Same');
N2=N1(2:4,2:4);
disp(N2);
disp('Using conv2: ')
f=[1 2 3;4 5 6;7 8 9];
w=[1 2 3;4 5 6;7 8 9];
disp('full');
M1=conv2(f,w,'full');
disp(M1);
disp('Same');
M2=conv2(f,w,'same');
disp(M2);
```

c. Compared the result using conv2 command for both same and full and the resulting matrix is exactly same hence verified.
   NOTE:-The comparison is also done in Q2.m file

Q3

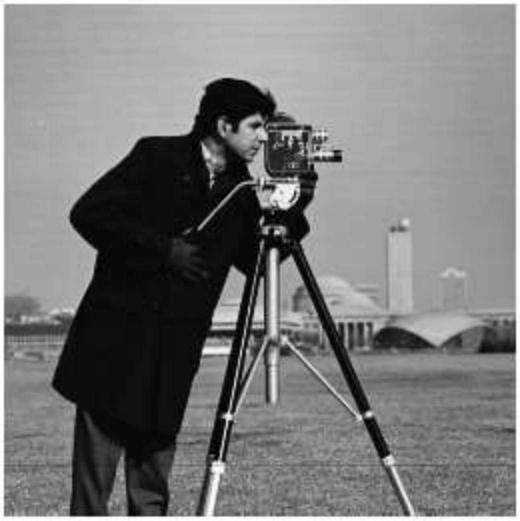
NOTE: The code is in Matching.m file

Matching.m:-

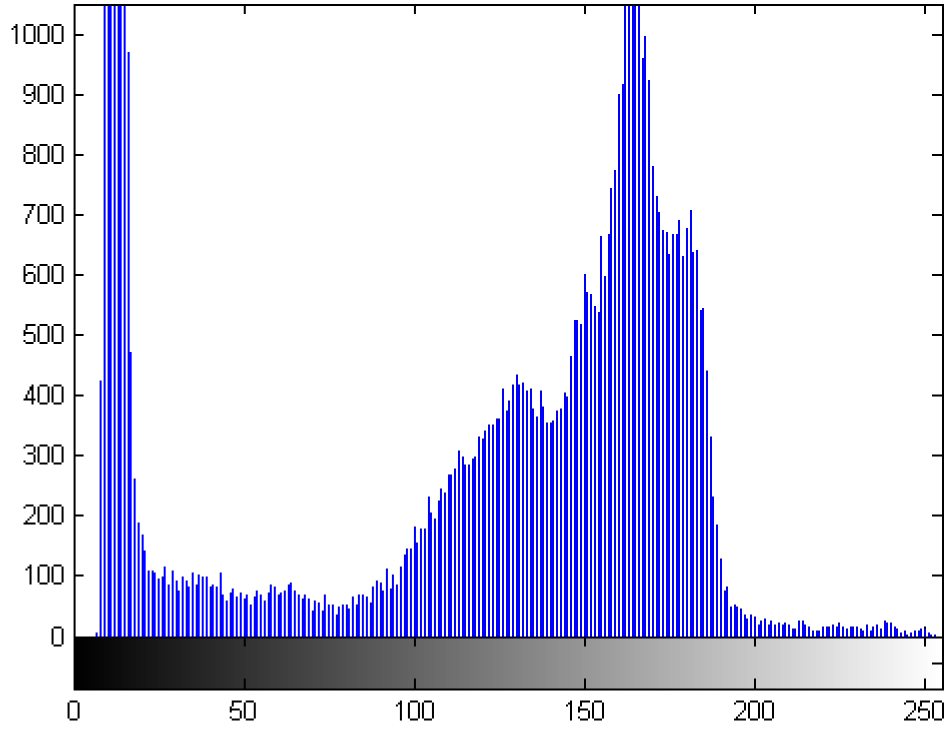
```
I=imread('cameraman.tif');
I=double(I);
pr=zeros(256,1);
for j=0:255
        pr(j+1)=nnz(I==j);
end
for j=1:256
        pr(j)=pr(j)/65536;
end
prk=zeros(256,1);
sum=0;
for i=1:256
        sum=0;
        for j=1:i
                sum=sum+pr(j);
        end
        prk(i)=sum*255;
end
prk=round(prk);
Z=imread('Fig0417(a)(barbara).tif');
Z=double(Z);
zs=zeros(256,1);
for j=0:255
        zs(j+1)=nnz(Z==j);
end
for j=1:256
        zs(j)=zs(j)/227532;
end
zsk=zeros(256,1);
sum=0;
for i=1:256
        sum=0;
```

```
    for j=1:i
        sum=sum+zs(j);
    end
    zsk(i)=sum*255;
end
zsk=round(zsk);
M=zeros(256,1);
min=9999;
index=-1;
for i=1:256
    min=9999;
    index=-1;
    for j=1:256
        if min > abs(prk(i)-zsk(j))
            min=prk(i)-zsk(j);
            index=j;
        end
    end
    M(i)=index;
end
for i=1:256
    for j=1:256
        I(i,j)=M(I(i,j)+1);
    end
end
I=uint8(I);
Preview=imread('cameraman.tif');
Reference=imread('Fig0417(a)(barbara).tif');
imshow(Preview),figure,imhist(Preview),figure,imshow(Reference),figure,imhist(Reference),figure,imshow(I),figure,imhist(I);
```

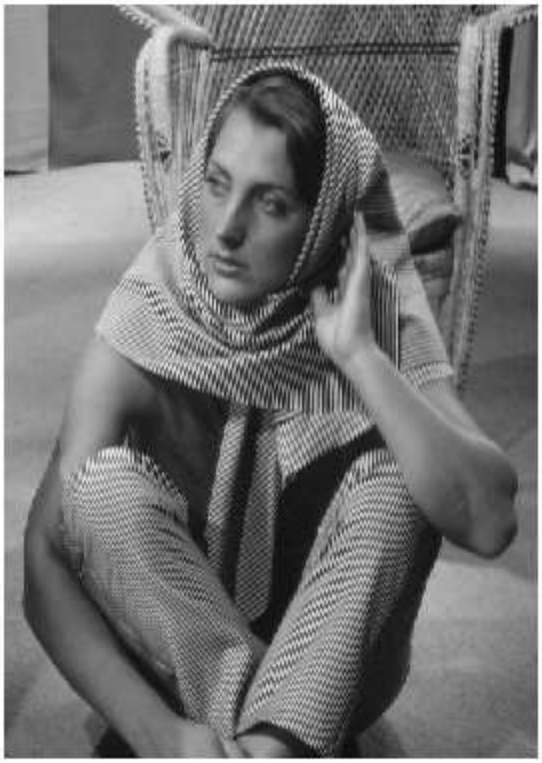
RESULT:



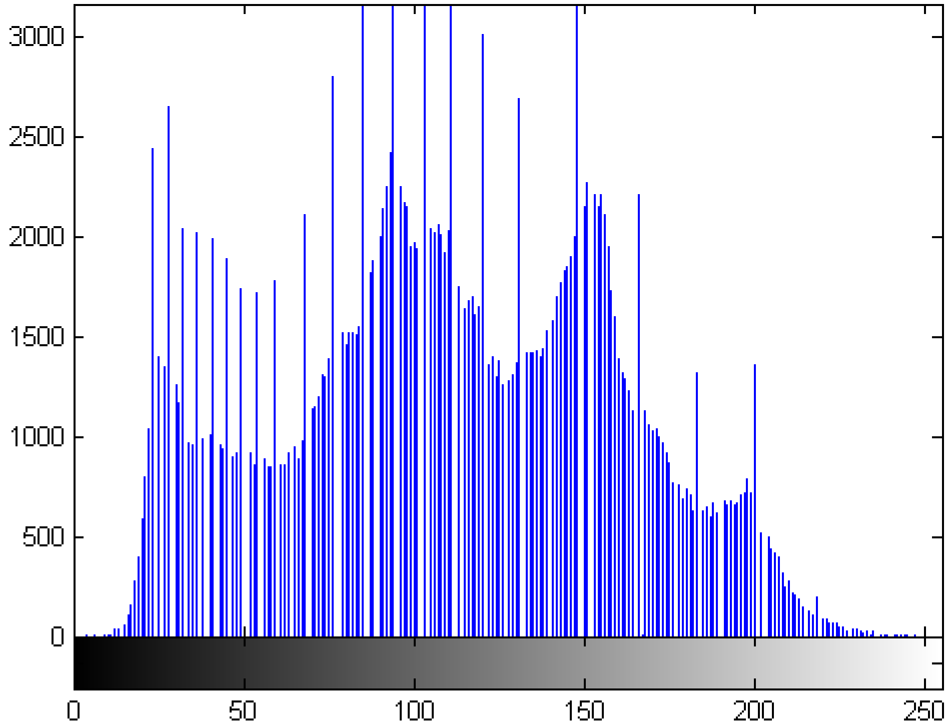
Original Image



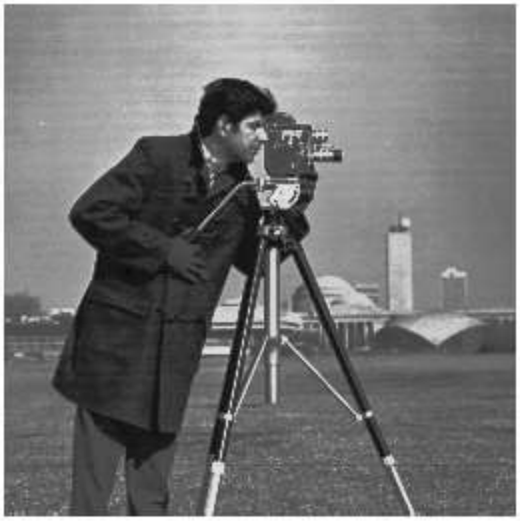
Histogram of Original Image



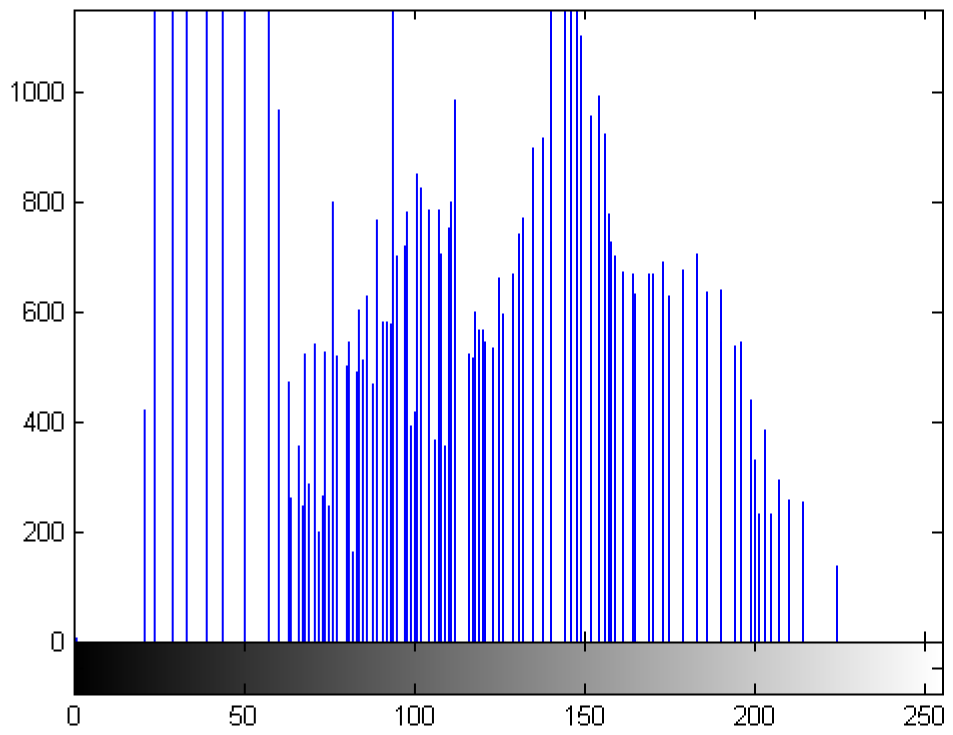
Reference Image



Histogram of Reference Image



Output Image



Output Histogram

OBSERVATION:

As we can see the difference in the histogram of the original image and the histogram after performing histogram matching (output histogram) with the reference image, in the original image the frequency of some so the pixel values were two high as seen from the peak in the histogram but after performing histogram matching, most of the pixel values are at the same height and the pixel values that have very low frequency there frequency is also raised. And we can also notice the difference between the histogram of the original image and the reference image, in the reference image most of the pixel values are at the same height as compared to original image where we can easily notice some peaks forming.

Q4

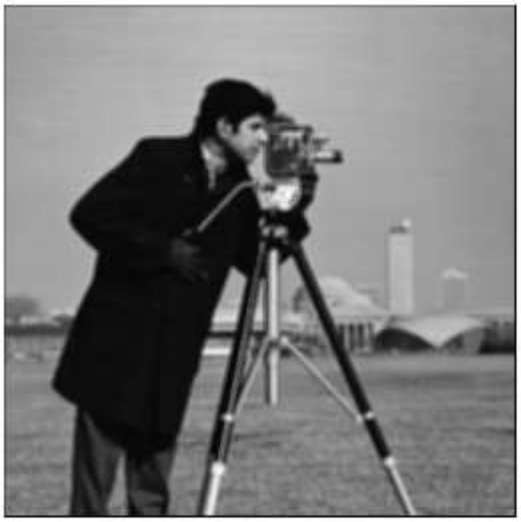
NOTE:-

a. **I have performed blurring using 3x3 box kernel, sharpening using Laplacian mask of 3x3 (only horizontal and vertical) and unsharp mask on cameraman.tif**
b. **Code for 3x3 box kernel is in Blurfilter.m file**
c. **Code for sharpening using Laplacian mask of 3x3 is in Sharpfilter.m file**
d. **Code for unsharp mask is in Unsharpmask.m file**
e. **Code for verifying the output of all three is in VerifyFilter.m file**

Blurfilter.m:

```
I=imread('cameraman.tif');
J=[I;zeros(1,256)];
J=[zeros(1,256);J];
Z=zeros(258,1);
J=[Z J Z];
J=double(J);
R=zeros(256,256);
for i=2:256
for j=2:256
R(i-1,j-1)=(J(i,j)+J(i-1,j)+J(i+1,j)+J(i,j+1)+J(i-1,j+1)+J(i+1,j+1)+J(i,j-1)+J(i+1,j-1)+J(i-1,j-1))/9;
end
end
R=uint8(R);
imshow(I),figure(),imshow(R);
```

Result:



Blur Image

OBSERVATION:

The 3X3 Box kernel is an average mask which when placed on an pixel, I assign the average value of its neighbor (3X3) including its value too, so all the pixel values in the image are affected, due to this averaging mask we lose the sharp edges in the image which make the image sharp, so the image seems to be blur.

Sharpfilter.m:

```
I=imread('cameraman.tif');
J=[I;zeros(1,256)];
J=[zeros(1,256);J];
Z=zeros(258,1);
J=[Z J Z];
J=double(J);
R=zeros(256,256);
for i=2:256
for j=2:256
R(i-1,j-1)=J(i+1,j)+J(i-1,j)+J(i,j+1)+J(i,j-1)-4*J(i,j);
end
end
R=uint8(R);
Out=I-R;
```

```
imshow(I),figure,imshow(R),figure,imshow(Out);
```

Result:

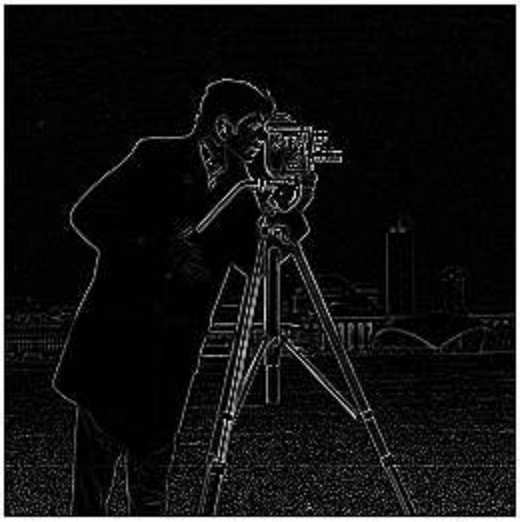


Figure-1

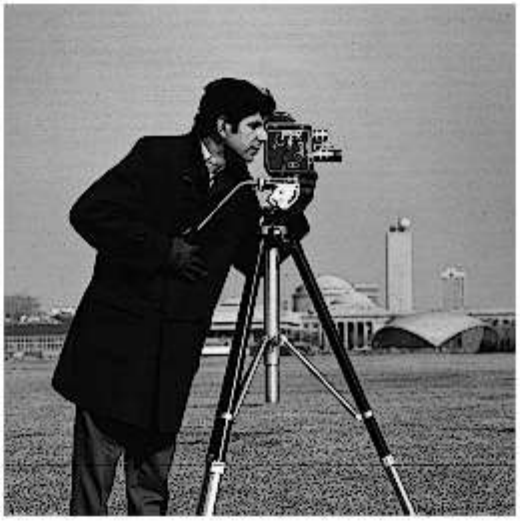


Figure-2

OBSERVATION:

Laplacian mask of 3x3 (only horizontal and vertical): [0 1 0; 1 -4 1; 0 1 0]
Figure-1 is the output we got by applying the Laplacian mask on the image (basically convolution of Laplacian mask and image) .Then we subtracted the original image from the Figure-1 as the center of our filter was negative to get the final sharp Figure-2, as we can see Figure-2 is much sharper than the original image; all the edges are highlighted or enhanced. Laplacian highlights the intensity discontinuity and deemphasizes region with slowly varying intensity levels, this tend to produce image having edge and discontinuity superimposed on a dark as you can see in Figure-1 and when we subtract it from original these edges become more sharp ,hence the image looks sharper.

Unsharpmask.m:

```
I=imread('cameraman.tif');
J=[I;zeros(1,256)];
J=[zeros(1,256);J];
Z=zeros(258,1);
J=[Z J Z];
J=double(J);
R=zeros(256,256);
for i=2:256
for j=2:256
R(i-1,j-1)=(J(i,j)+J(i-1,j)+J(i+1,j)+J(i,j+1)+J(i-1,j+1)+J(i+1,j+1)+J(i,j-1)+J(i+1,j-1)+J(i-1,j-1))/9;
end
end
I=double(I);
U=I-R;
G=I+U;
G=uint8(G);
I=uint8(I);
imshow(I),figure(),imshow(G);
```

Result:

Figure-1

OBSERVATION:

First we blur the image using an averaging mask (3X3 box kernel) the result of that we got a blur image same as above, then we subtract the blur image from the original image and get a mask as a result of that. At last we add this mask to the original image to get Figure-1.We have ramp in the original image going from dark to light or from light to dark pixel values, we may also call it edges now as a result of average mask these transition get smoothen up and when we subtract it from the original image we get the unsharp mask now when we add this mask to the original image it increases the range of the transactions in the original image for instance if there was a ramp from 100 to 200 ,by aging mask it changes to 90 to 210 thus the resulting image(Figure-1) is sharp that the original.

VerifyFilter.m

```
I=imread('cameraman.tif');

H = fspecial('laplacian');
```

```
MotionBlur = imfilter(I,H,'replicate');
Out1=I-MotionBlur;

H = fspecial('average');
MotionBlur = imfilter(I,H,'replicate');
Out2=MotionBlur;

H = fspecial('average');
MotionBlur = imfilter(I,H,'replicate');
G=I-MotionBlur;
Out3=I+G;

imshow(Out2),figure,imshow(Out1),figure,imshow(Out3);
```

Result:

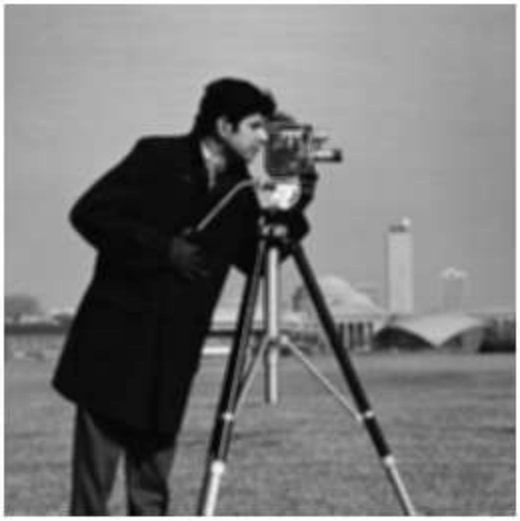


Figure-1

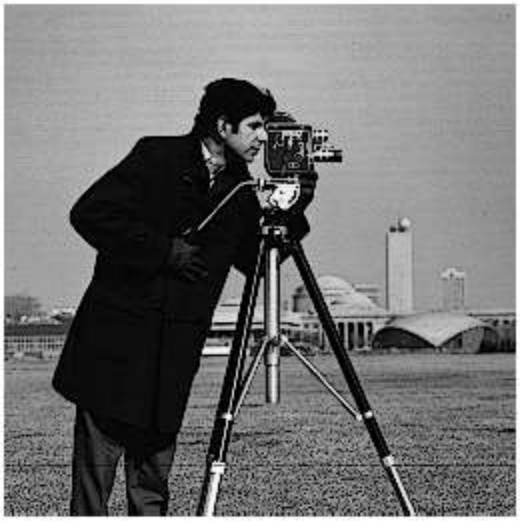


Figure-2

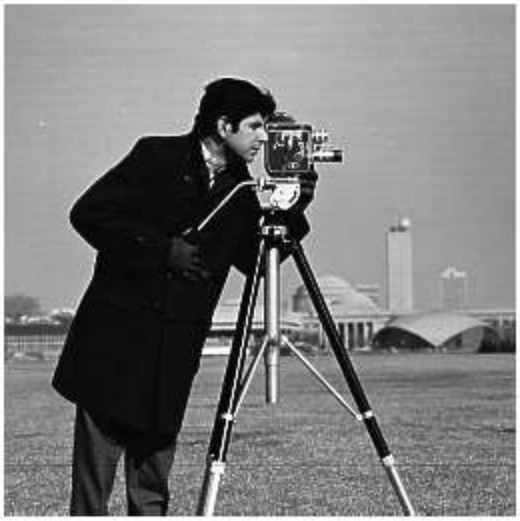


Figure-3

OBSERVATION:

Figure-1(blur) is the result of applying 3X3 box filter

Figure-2(sharp) is the result of applying laplacian mask on the image

Figure-3(sharp) is the result of applying unshap mask on the image

These results were obtained using inbuilt functions/commands fspecial and imfilter and as it is very clear that they are similar to the one we did without applying any inbuilt command/function or filter.

Q5

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