

Homework 5

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1 First Answer or 1a

Matlab Code

```
1  clc;
2  clear all;
3  close all;
4
5  %Reading and displaying Salesman Image
6  salesman=fopen('salesman.bin','r');
7  s=fread(salesman,[256,256],'uchar');
8  s=s';
9  figure(1);
10 image(s);
11 title('Original Salesman');
12 axis off;
13 axis('image');
14 print (figure(1),'1aa','-dpng');%writing out image for LaTeX
    purpose
15
16 colormap(gray(256));
17 fss=contraststretch(s);
18 figure(2);
19 image(fss);
20 axis off;
21 axis('image');
22 title('Original salesman Image with full scale Stretch');
23
24 padsize=262;
25 ZPsalesman=zeros(padsize,padsize);
26 ZPsalesman(4:259,4:259)=s;
27 figure(3);
28 colormap(gray(256));
```

```

29 image(contraststretch(ZPsalesman));
30 title('Salesman man after Zeropadding and fullscale stretch');
31 axis off;
32 axis('image');
33 print (figure(3), 'lab', '-dpng'); %writing out image for LaTeX
    purpose
34
35 %Final salesman
36 Finsalesman=zeros(256,256);
37 for s=1:256
38     for j=1:256
39         sum=0;
40         for a=1:7
41             for b=1:7
42                 sum=sum+ZPsalesman(s+a-1,j+b-1);
43             end
44         end
45         Finsalesman(s,j)=sum/49;
46     end
47 end
48
49 figure(4);
50 colormap(gray(256));
51 image(contraststretch(Finsalesman));
52 title('Final salesman after filtering and fullscale contrast');
53 axis off;
54 axis('image');
55 print (figure(4), 'lac', '-dpng'); %writing out image for LaTeX
    purpose
56
57 function fin=contraststretch(orgn)
58     [m,n]=size(orgn);
59     A=min(min(abs(orgn)));
60     B=max(max(abs(orgn)));
61     if A==B
62         A=min(min((orgn)));
63         B=max(max((orgn)));
64     end
65     P=(m-1)/(B-A);
66     L=-1*A*((m-1)/(B-A));
67     fin=zeros(m,n);
68     for i=1:m
69         for j=1:n

```

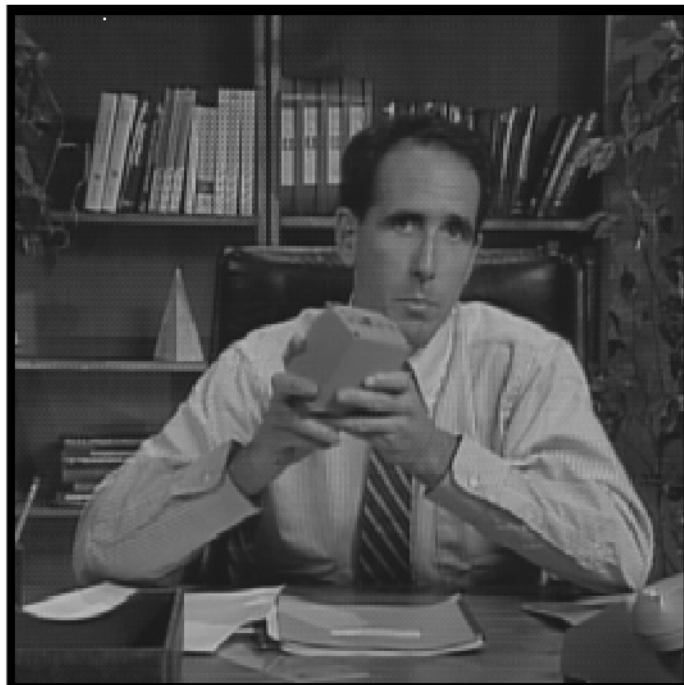
```
70         fin(i,j)=P*orgn(i,j)+L;  
71     end  
72 end  
73 end
```

Output Images:

Original Salesman



Salesman man after Zeropadding and fullscale stretch



Final salesman after filtering and fullscale contrast



2 Second Answer or 1b

Matlab Code

```
1  clc;
2  clear all;
3  close all;
4  %Display Salesman Image
5  salesman=fopen('salesman.bin','r');
6  s=fread(salesman,[256,256],'uchar');
7  s=s';
8  figure(1);
9  colormap(gray(256));
10 fsstretch=contraststretch(s);
11 image(fsstretch);
12 title('Original salesman Image with full scale Stretch');
13 axis off;
14 axis('image');
15 print (figure(1),'1ba','-dpng');%writing out image for LaTeX
    purpose
16
17
18 h=zeros(128,128);
19 h(62:68,62:68)=ones(7,7)/49;
20 figure(2);
21 Impresponse=contraststretch(h);
22 imshow(Impresponse);
23 title('Impulse response H');
24 axis off;
25 axis('image');
26 print (figure(2),'1bb','-dpng');%writing out image for LaTeX
    purpose
27
28
29 %Zeropadding and creating ZPsalesman and ZPh
30 Padsiz = 256+128-1;
31 ZPsalesman = zeros(Padsiz,Padsiz);
32 ZPsalesman(1:256,1:256) = s;
33 figure(3);
34 colormap(gray(256));
35 FZeroPaddedS=contraststretch(ZPsalesman);
36 image(FZeroPaddedS);
37 title('Zeropadded salesman Image');
38 axis off;
```

```

39 axis ('image');
40 print (figure(3), '1bc', '-dpng');%writing out image for LaTeX
    purpose
41
42
43 ZPh = zeros(Padsize, Padsize);
44 ZPh(1:128, 1:128) = h;
45 figure(4);
46 FZPh=contraststretch(ZPh);
47 colormap(gray(256));
48 image(FZPh);
49 title('Zeropadded H impulse reponse');
50 axis off;
51 axis ('image');
52 print (figure(4), '1bd', '-dpng');%writing out image for LaTeX
    purpose
53
54
55 %Centered DFT of salesman and Impulse responseH
56 fSCDFT=fftshift(fft2(ZPsalesman));
57 SCDFT=(fft2(ZPsalesman));
58 SSCDFT=contraststretch(fSCDFT);
59 LOZDS=log(1+abs(SSCDFT));
60 figure(5);
61 imshow(LOZDS);
62 title('Centered DFT log mag of Zeropadded Salesman Image');
63 axis off;
64 axis ('image');
65 print (figure(5), '1be', '-dpng');%writing out image for LaTeX
    purpose
66
67
68 %CODFT of H
69 fHCDFT= fftshift(fft2(ZPh));
70 HCDFT= (fft2(ZPh));
71 figure(6);
72 SHCDFT=contraststretch(fHCDFT);
73 LOZDH=log(1+abs(SHCDFT));
74 %imshow(HCDFT);
75 imshow(LOZDH);
76 title('Centered DFT log mag of Zeropadded H Image');
77 axis off;
78 axis ('image');

```

```

79 print (figure(6), '1bf', '-dpng');%writing out image for LaTeX
    purpose
80
81
82 %convolution or pointwise multiplication
83 Z1 = real( ifft2(SCDFT .* HCDFT));
84 FZ1=contraststretch(Z1);
85 figure(7);
86 colormap(gray(256));
87 image(FZ1);
88 title( ' Zeropadded Output Image');
89 axis off;
90 axis ( 'image');
91 print (figure(7), '1bg', '-dpng');%writing out image for LaTeX
    purpose
92
93
94 %Final Output Image
95 Finalsalesman=FZ1(65:320,65:320);
96 figure(8);
97 colormap(gray(256));
98 image(Finalsalesman);
99 title( 'Salesman Final Output image after filtering and cropping
    ');
100 axis off;
101 axis ( 'image');
102 print (figure(8), '1bh', '-dpng');%writing out image for LaTeX
    purpose
103
104
105 function fin=contraststretch(orgn)
106     [m,n]=size(orgn);
107     A=min(min(abs(orgn)));
108     B=max(max(abs(orgn)));
109     if A==B
110         A=min(min((orgn)));
111         B=max(max((orgn)));
112     end
113     P=(m-1)/(B-A);
114     L=-1*A*((m-1)/(B-A));
115     fin=zeros(m,n);
116     for i=1:m
117         for j=1:n

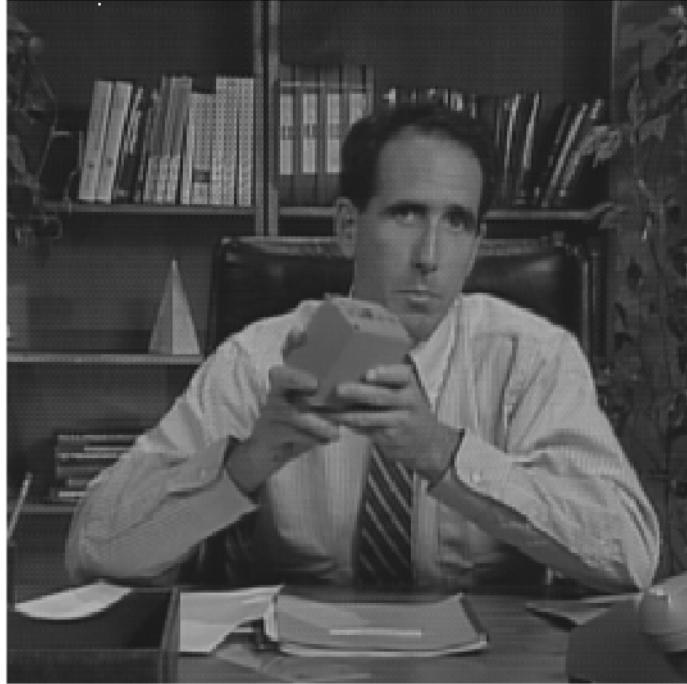
```



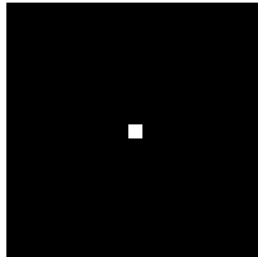
```
118         fin(i,j)=P*orgn(i,j)+L;  
119     end  
120 end  
121 end
```

Output Images:

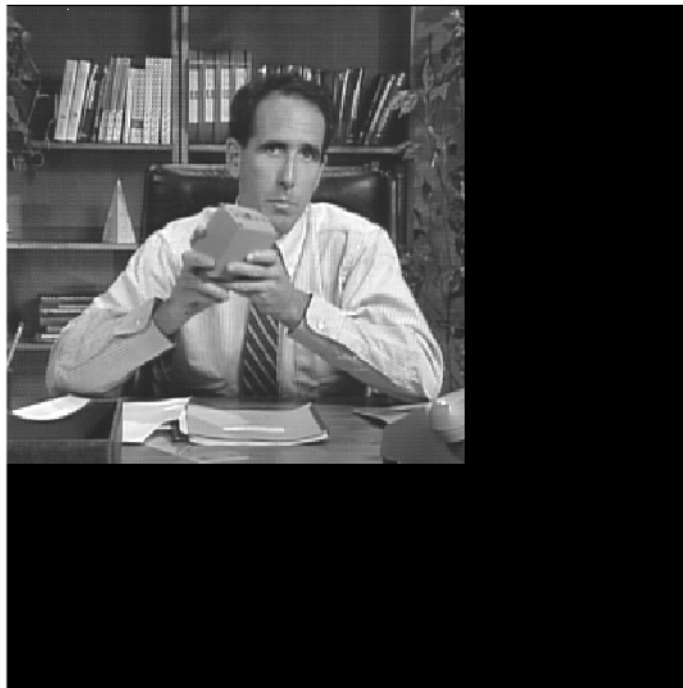
Original salesman Image with full scale Stretch



Impulse response H



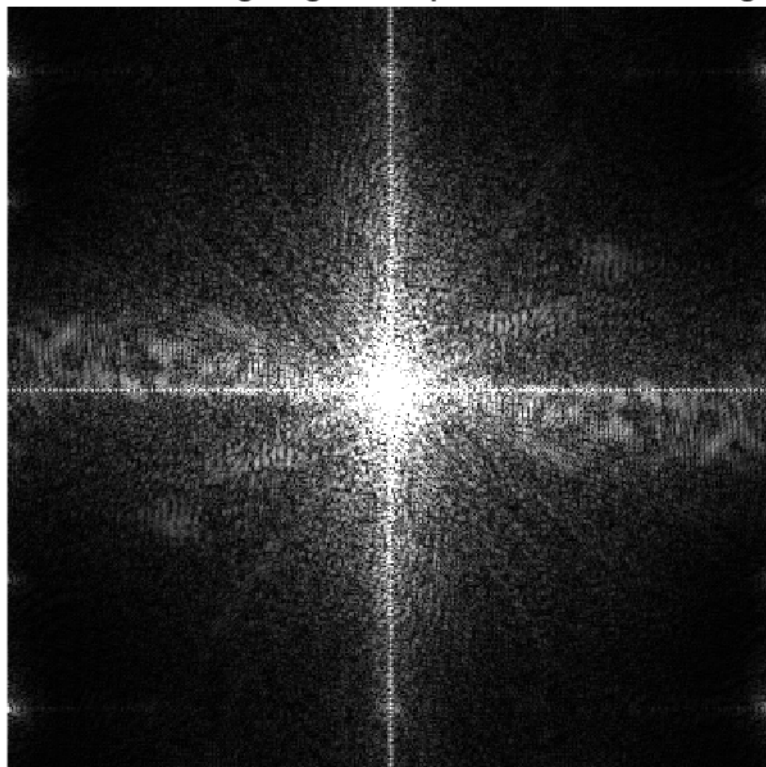
Zeropadded salesman Image



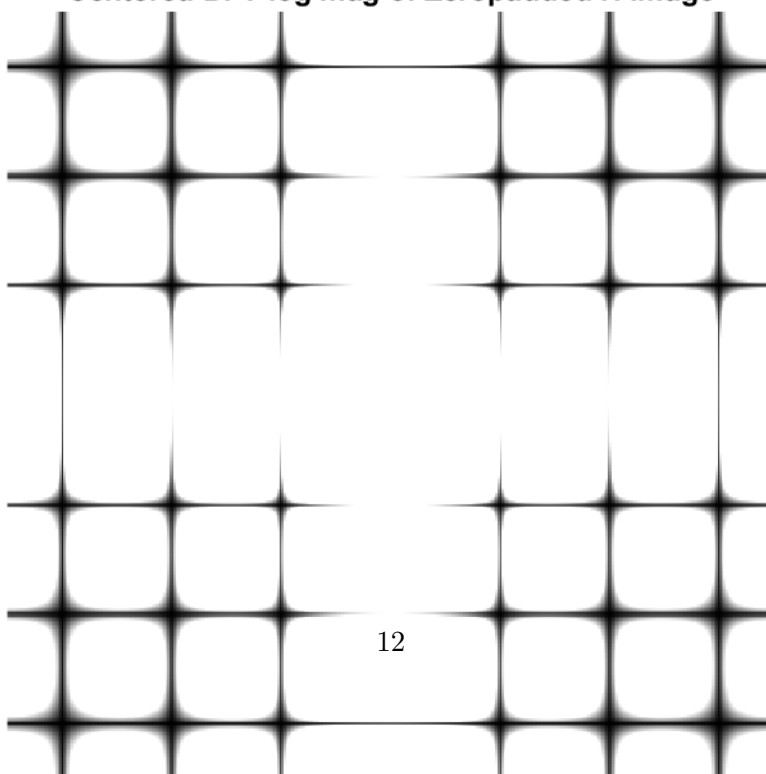
Zeropadded H impulse reponse



Centered DFT log mag of Zeropadded Salesman Image



Centered DFT log mag of Zeropadded H Image



Zeropadded Output Image



Salesman Final Output image after filtering and cropping



3 Third Answer or 1c

Matlab Code

```
1  clc;
2  clear all;
3  close all;
4
5  %Reading and displaying Salesman Image
6  salesman=fopen('salesman.bin','r');
7  s=fread(salesman,[256,256],'uchar');
8  s=s';
9  figure(1);
10 colormap(gray(256));
11 fin=contraststretch(s);
12 image(fin);
13 title('Original salesman Image with full scale Stretch');
14 axis off;
15 axis('image');
16 print (figure(1),'lca','-dpng');%writing out image for LaTeX
    purpose
17
18 ZPsalesman = zeros(512,512);
19 ZPsalesman(1:256,1:256) = s;
20 FZPsalesman=contraststretch(ZPsalesman);
21 figure(2);
22 colormap(gray(256));
23 image(FZPsalesman);
24 title('Zeropadded salesman image after fullscale contrast
    stretch');
25 axis off;
26 axis('image');
27 print (figure(2),'lcb','-dpng');%writing out image for LaTeX
    purpose
28
29 %impulse response
30 H= zeros(256,256);
31 H(126:132,126:132)=ones(7,7)/49;
32 figure(3);
33 colormap(gray(256));
34 image(contraststretch(H));
35 title('Filter H after Zeropadding and full scale stretch');
36 axis off;
37 axis('image');
```

```

38 print (figure(3), 'lcc', '-dpng');%writing out image for LaTeX
    purpose
39
40 H2=fftshift(H);
41 FH2=contraststretch(H2);
42 figure(4);
43 colormap(gray(256));
44 image(FH2);
45 title('H after fullscale stretch and shifting');
46 axis off;
47 axis('image');
48 print (figure(4), 'lcd', '-dpng');%writing out image for LaTeX
    purpose
49
50 ZPH2 = zeros(512,512);
51 ZPH2(1:128,1:128) = H2(1:128,1:128);
52 ZPH2(1:128,385:512) = H2(1:128,129:256);
53 ZPH2(385:512,1:128) = H2(129:256,1:128);
54 ZPH2(385:512,385:512) = H2(129:256,129:256);
55 FZPH2= contraststretch(ZPH2);
56 figure(5);
57 colormap(gray(256));
58 image(FZPH2);
59 title('Final H');
60 axis off;
61 axis('image');
62 print (figure(5), 'lce', '-dpng');%writing out image for LaTeX
    purpose
63
64 Z1 = ifft2(fft2(ZPsalesman).*fft2(ZPH2));
65 Z1 = Z1(1:256,1:256);
66 figure(6);
67 colormap(gray(256));
68 image(contraststretch(Z1));
69 title('Final 256*256 Output image ');
70 axis off;
71 axis('image');
72 print (figure(6), 'lcf', '-dpng');%writing out image for LaTeX
    purpose
73
74 function fin=contraststretch(orgn)
75     [m,n]=size(orgn);
76     A=min(min(abs(orgn)));

```

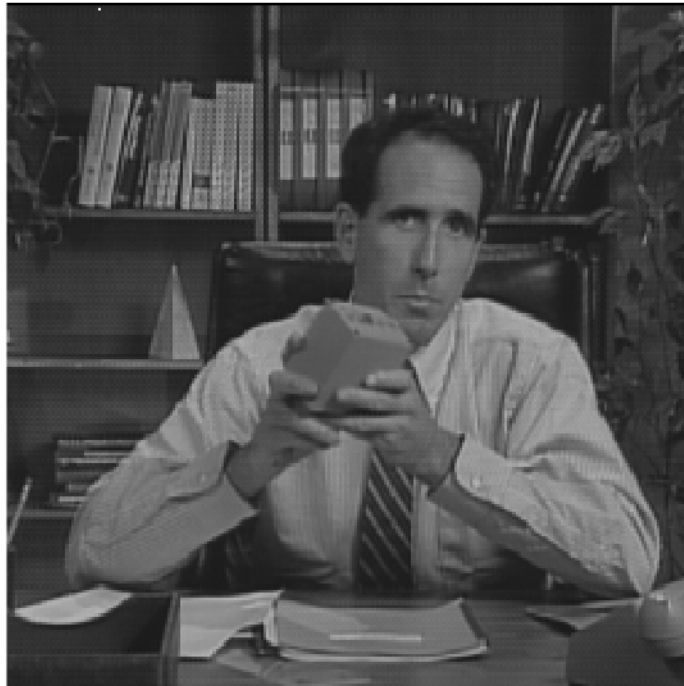
```

77     B=max(max(abs(orgn)));
78     if A==B
79         A=min(min(orgn));
80         B=max(max(orgn));
81     end
82     P=(m-1)/(B-A);
83     L=-1*A*((m-1)/(B-A));
84     fin=zeros(m,n);
85     for i=1:m
86         for j=1:n
87             fin(i,j)=P*orgn(i,j)+L;
88         end
89     end
90 end

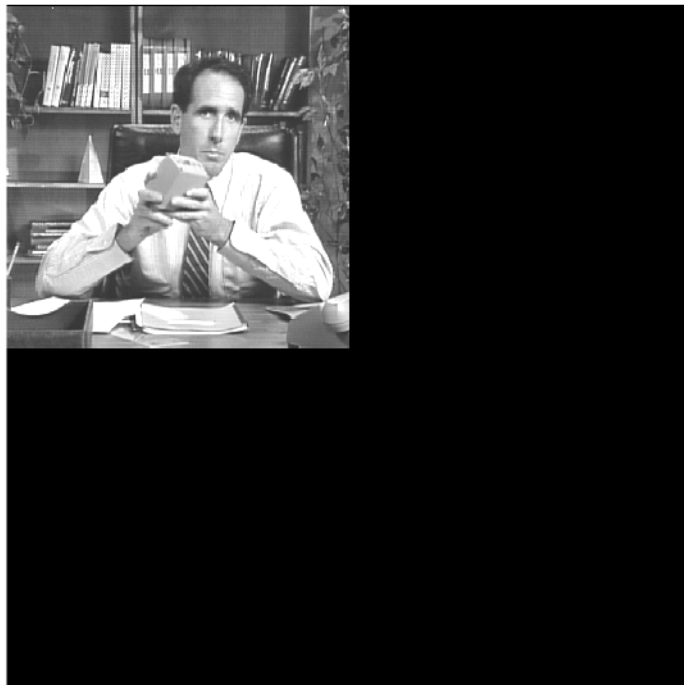
```

Output Images:

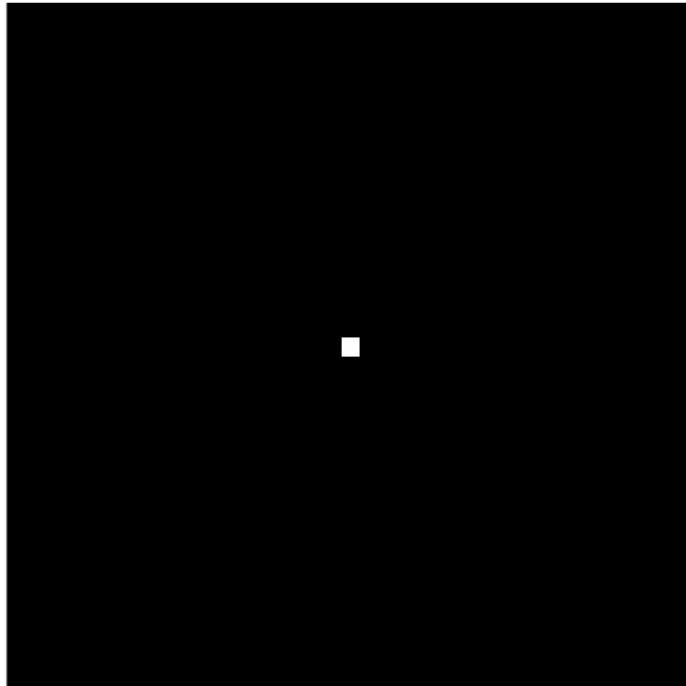
Original salesman Image with full scale Stretch



Zeropadded salesman image after fullscale contrast stretch



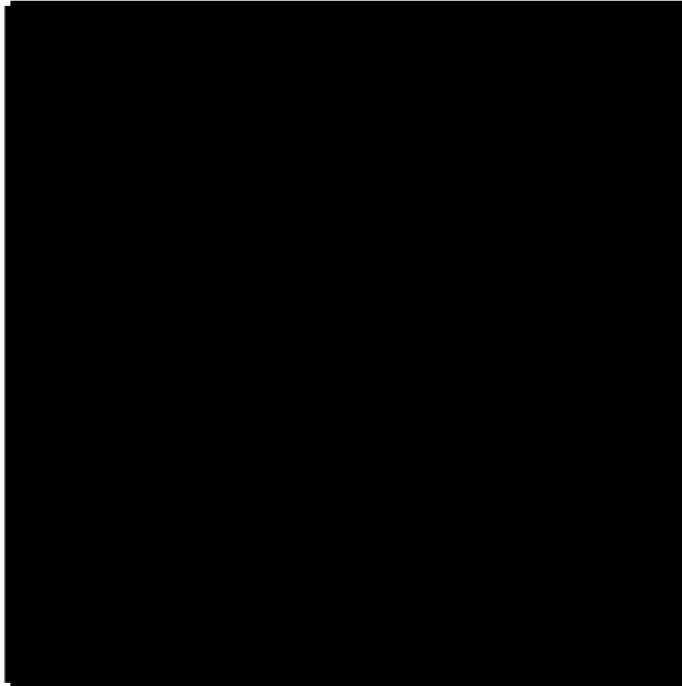
Filter H after Zeropadding and full scale stretch



H after fullscale stretch and shifting



Final H



Final 256*256 Output image



4 Fourth Answer or 2a

Matlab Code

```
1  clc;
2  clear all;
3  close all;
4
5  girl2=fopen('girl2.bin','r');
6  g=fread(girl2,[256,256],'uchar');
7  g=g';
8  figure(1);
9  colormap(gray(256));
10 image(g);
11 title('Original girl2 Image ');
12 axis off;
13 axis('image');
14 print (figure(1),'2aa','-dpng');%writing out image for LaTeX
    purpose
15
16 girl2Noise32Hi=fopen('girl2Noise32Hi.bin','r');
17 gnh=fread(girl2Noise32Hi,[256,256],'uchar');
18 gnh=gnh';
19 figure(2);
20 colormap(gray(256));
21 image(gnh);
22 title('Original girl2Noise32Hi Image ');
23 axis off;
24 axis('image');
25 print (figure(2),'2ab','-dpng');%writing out image for LaTeX
    purpose
26
27 girl2Noise32=fopen('girl2Noise32.bin','r');
28 gn=fread(girl2Noise32,[256,256],'uchar');
29 gn=gn';
30 figure(3);
31 colormap(gray(256));
32 image(gn);
33 title('Original girl2Noise32 Image ');
34 axis off;
35 axis('image');
36 print (figure(3),'2ac','-dpng');%writing out image for LaTeX
    purpose
37
```

```

38 M=256;
39 N=256;
40 sum2=0;
41
42 for m=1:256
43     sum1=0;
44     for n=1:256
45         NM=(g(m,n)-gnh(m,n))^2;
46         sum1=sum1+NM;
47     end
48     sum2=sum2+sum1;
49 end
50 MSE1=sum2/(M*N);
51 display(MSE1);
52
53 M=256;
54 N=256;
55 sum2=0;
56 for m=1:256
57     sum1=0;
58     for n=1:256
59         NM=(g(m,n)-gn(m,n))^2;
60         sum1=sum1+NM;
61     end
62     sum2=sum2+sum1;
63 end
64
65 MSE2=sum2/(M*N);
66 display(MSE2);

```

Output:

Results

MSE1 =

692.5050

MSE2 =

744.4679
c@FancyVer

Output Images:

Original girl2 Image



Original girl2Noise32Hi Image



Original girl2Noise32 Image



5 Fifth Answer or 2b

Matlab Code

```
1  clc;
2  close all;
3  clear all;
4
5  girl2=fopen('girl2.bin','r');
6  g=fread(girl2,[256,256],'uchar');
7  g=g';
8  figure(1);
9  colormap(gray(256));
10 image(g);
11 title('Original girl2 Image ');
12 axis off;
13 axis('image');
14 print (figure(1),'2ba','-dpng');%writing out image for LaTeX
    purpose
15
16 %
17 girl2Noise32Hi=fopen('girl2Noise32Hi.bin','r');
18 gnh=fread(girl2Noise32Hi,[256,256],'uchar');
19 gnh=gnh';
20 figure(2);
21 colormap(gray(256));
22 image(gnh);
23 title('Original girl2Noise32Hi Image ');
24 axis off;
25 axis('image');
26 print (figure(2),'2bb','-dpng');%writing out image for LaTeX
    purpose
27
28 %
29 girl2Noise32=fopen('girl2Noise32.bin','r');
30 gn=fread(girl2Noise32,[256,256],'uchar');
31 gn=gn';
32 figure(3);
33 colormap(gray(256));
34 image(gn);
35 title('Original girl2Noise32 Image ');
36 axis off;
37 axis('image');
38 print (figure(3),'2bc','-dpng');%writing out image for LaTeX
```



```

    purpose
39
40 %Computing the MSE
41 P=256;
42 Q=256;
43 sum2=0;
44 for m=1:256
45     sum1=0;
46     for n=1:256
47         QP=(g(m,n)-gnh(m,n))^2;
48         sum1=sum1+QP;
49     end
50     sum2=sum2+sum1;
51 end
52 MSE1=sum2/(P*Q);
53 disp('MSE between girl2 and girl2Noise32Hi ');
54 display(MSE1);
55
56 M=256;
57 N=256;
58 sum2=0;
59 for m=1:256
60     sum1=0;
61     for n=1:256
62         NM=(g(m,n)-gn(m,n))^2;
63         sum1=sum1+NM;
64     end
65     sum2=sum2+sum1;
66 end
67 MSE2=sum2/(M*N);
68 disp('MSE between girl2 image and girl2Noise32 image ');
69 display(MSE2);
70
71 %Filter
72 U_cutoff = 64;
73 [U,V] = meshgrid(-128:127,-128:127);
74 HLtildeCenter = double(sqrt(U.^2 + V.^2) <= U_cutoff);
75 HLtilde = fftshift(HLtildeCenter);
76 figure(4);
77 imshow(HLtilde);
78 title('HLtilde');
79 axis off;
80 axis('image');

```

```

81 print (figure(4), '2bd', '-dpng');%writing out image for LaTeX
    purpose
82
83 %Pointwise multiplication
84 %girl2
85 g1 = ifft2(HLtilde.*fft2(g));
86 figure(5);
87 colormap(gray(256));
88 image(contraststretch(g1));
89 title('girl2 image after pointwise multiplication');
90 axis off;
91 axis('image');
92 print (figure(5), '2be', '-dpng');%writing out image for LaTeX
    purpose
93
94 %girl2Noise32Hi
95 g2 = ifft2(HLtilde.*fft2(gnh));
96 figure(6);
97 colormap(gray(256));
98 image(contraststretch(g2));
99 title('girl2Noise32Hi image after pointwise multiplication');
100 axis off;
101 axis('image');
102 print (figure(6), '2bf', '-dpng');%writing out image for LaTeX
    purpose
103
104 %girl2Noise32
105 g3 = ifft2(HLtilde.*fft2(gn));
106 figure(7);
107 colormap(gray(256));
108 image(contraststretch(g3));
109 title('girl2Noise32 image after pointwise multiplication');
110 axis off;
111 axis('image');
112 print (figure(7), '2bg', '-dpng');%writing out image for LaTeX
    purpose
113
114 %computing MSE
115 P=256;
116 Q=256;
117 sum2=0;
118 for m=1:256
119     sum1=0;

```

```

120     for n=1:256
121         QP=(g(m,n)-g1(m,n))^2;
122         sum1=sum1+QP;
123     end
124     sum2=sum2+sum1;
125 end
126 FinalMSE=sum2/(P*Q);
127 disp('Final MSE after filtering between original girl2 image
128     and filtered girl2 image');
128 display(FinalMSE);
129
130 P=256;
131 Q=256;
132 sum2=0;
133 for m=1:256
134     sum1=0;
135     for n=1:256
136         QP=(g(m,n)-g2(m,n))^2;
137         sum1=sum1+QP;
138     end
139     sum2=sum2+sum1;
140 end
141 FMSE1=sum2/(P*Q);
142 disp('Final MSE after filtering between original girl2 and
143     girl2Noise32Hi ');
143 display(FMSE1);
144
145 M=256;
146 N=256;
147 sum2=0;
148 for m=1:256
149     sum1=0;
150     for n=1:256
151         NM=(g(m,n)-g3(m,n))^2;
152         sum1=sum1+NM;
153     end
154     sum2=sum2+sum1;
155 end
156 FMSE2=sum2/(M*N);
157 disp('Final MSE between original girl2 and girl2Noise32 ');
158 display(FMSE2);
159
160 %computing ISNR

```

```

161 ISNR1=10*log(MSE1/FMSE1);
162 disp('ISNR before and after filtering of girl2Noise32Hi ');
163 disp('ISNR1=');
164 disp(ISNR1);
165
166 ISNR2=10*log(MSE2/FMSE2);
167 disp('ISNR before and after filtering of girl2Noise32 ');
168 disp('ISNR2=');
169 disp(ISNR2);
170
171 function fin=contraststretch(orgn)
172     [m,n]=size(orgn);
173     A=min(min(abs(orgn)));
174     B=max(max(abs(orgn)));
175     if A==B
176         A=min(min(orgn));
177         B=max(max(orgn));
178     end
179     P=(m-1)/(B-A);
180     L=-1*A*((m-1)/(B-A));
181     fin=zeros(m,n);
182     for i=1:m
183         for j=1:n
184             fin(i,j)=P*orgn(i,j)+L;
185         end
186     end
187 end

```

Output:

Results

MSE between girl2 and girl2Noise32Hi

MSE1 =

692.5050

MSE between girl2 image and girl2Noise32 image

MSE2 =

744.4679

Final MSE after filtering between original girl2 image and filtered girl2 image

FinalMSE =

```
127.7481

Final MSE after filtering between original girl2 and girl2Noise32Hi
FMSE1 =

398.9978

Final MSE between original girl2 and girl2Noise32
FMSE2 =

550.8787

ISNR before and after filtering of girl2Noise32Hi
ISNR1=
5.5136

ISNR before and after filtering of girl2Noise32
ISNR2=
3.0116
c@FancyVer
```

Output Images:

Original girl2 Image



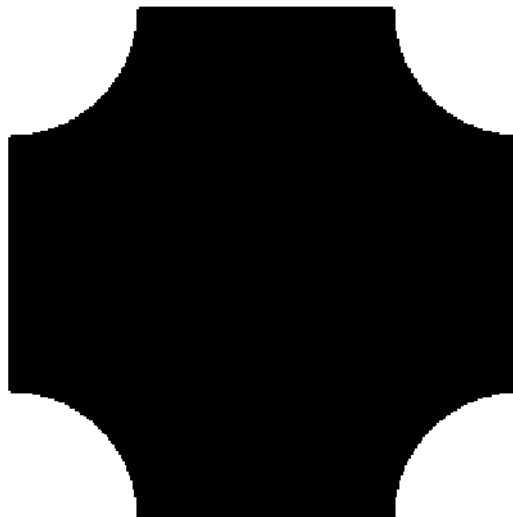
Original girl2Noise32Hi Image



Original girl2Noise32 Image



HLtilde



girl2 image after pointwise multiplication



girl2Noise32Hi image after pointwise multiplication



girl2Noise32 image after pointwise multiplication



6 Sixth Answer or 2c

Matlab Code

```
1  clc;
2  close all;
3  clear all;
4
5  girl2=fopen('girl2.bin','r');
6  g=fread(girl2,[256,256],'uchar');
7  g=g';
8  figure(1);
9  colormap(gray(256));
10 image(contraststretch(g));
11 title('Original girl2 Image ');
12 axis off;
13 axis('image');
14 print (figure(1),'2ca','-dpng');%writing out image for LaTeX
    purpose
15
16 %
17 girl2Noise32Hi=fopen('girl2Noise32Hi.bin','r');
18 gnh=fread(girl2Noise32Hi,[256,256],'uchar');
19 gnh=gnh';
20 figure(2);
21 colormap(gray(256));
22 image(contraststretch(gnh));
23 title('Original girl2Noise32Hi Image ');
24 axis off;
25 axis('image');
26 print (figure(2),'2cb','-dpng');%writing out image for LaTeX
    purpose
27
28 %
29 girl2Noise32=fopen('girl2Noise32.bin','r');
30 gn=fread(girl2Noise32,[256,256],'uchar');
31 gn=gn';
32 figure(3);
33 colormap(gray(256));
34 image(contraststretch(gn));
35 title('Original girl2Noise32 Image ');
36 axis off;
37 axis('image');
38 print (figure(3),'2cc','-dpng');%writing out image for LaTeX
```

```

    purpose
39
40 %Computing the MSE
41 M=256;
42 N=256;
43 sum2=0;
44 for m=1:256
45     sum1=0;
46     for n=1:256
47         NM=(g(m,n)-gnh(m,n))^2;
48         sum1=sum1+NM;
49     end
50     sum2=sum2+sum1;
51 end
52 MSE1=sum2/(M*N);
53 disp('MSE between girl2 and girl2Noise32Hi ');
54 display(MSE1);
55
56 M=256;
57 N=256;
58 sum2=0;
59 for m=1:256
60     sum1=0;
61     for n=1:256
62         NM=(g(m,n)-gn(m,n))^2;
63         sum1=sum1+NM;
64     end
65     sum2=sum2+sum1;
66 end
67 MSE2=sum2/(M*N);
68 disp('MSE between girl2 and girl2Noise32 ');
69 display(MSE2);
70
71 U_cutoff_H = 64;
72 SigmaH = 0.19 * 256 / U_cutoff_H;
73 [U,V] = meshgrid(-128:127,-128:127);
74 HtildeCenter = exp((-2*pi*SigmaH^2)/(256.^2)*(U.^2 + V.^2));
75 Htilde = fftshift(HtildeCenter);
76 H = ifft2(Htilde);
77 H2 = fftshift(H);
78 ZPH2 = zeros(512,512);
79 ZPH2(1:256,1:256) = H2;
80 ZPg1=zeros(512,512);

```

```

81 ZPg1(1:256,1:256)=g;
82 ZPgnh=zeros(512,512);
83 ZPgnh(1:256,1:256)=gnh;
84 ZPgn=zeros(512,512);
85 ZPgn(1:256,1:256)=gn;
86 g1 = real( ifft2( fft2(ZPH2).*fft2(ZPg1)) );
87 g2 = real( ifft2( fft2(ZPH2).*fft2(ZPgnh)) );
88 g3 = real( ifft2( fft2(ZPH2).*fft2(ZPgn)) );
89 cg1=g1(129:384,129:384);
90 figure(5);
91 colormap(gray(256));
92 image(contraststretch(cg1));
93 title('Original girl2 image after filtering and cropping ');
94 axis off;
95 axis('image');
96 print (figure(5),'2cd','-dpng');%writing out image for LaTeX
    purpose
97
98 cg2=g2(129:384,129:384);
99 figure(6);
100 colormap(gray(256));
101 image(contraststretch(cg2));
102 title('Original girl2Noise32Hi image after filtering and
    cropping ');
103 axis off;
104 axis('image');
105 print (figure(6),'2ce','-dpng');%writing out image for LaTeX
    purpose
106
107 cg3=g3(129:384,129:384);
108 figure(7);
109 colormap(gray(256));
110 image(contraststretch(cg3));
111 title('Original girl2Noise32 image after filtering and cropping
    ');
112 axis off;
113 axis('image');
114 print (figure(7),'2cf','-dpng');%writing out image for LaTeX
    purpose
115
116 M=256;
117 N=256;
118 sum2=0;

```

```

119 for m=1:256
120     sum1=0;
121     for n=1:256
122         NM=(g(m,n)-cg1(m,n))^2;
123         sum1=sum1+NM;
124     end
125     sum2=sum2+sum1;
126 end
127 FMSE=sum2/(M*N);
128 disp('Final MSE after filtering between original girl2 and
        filtered girl2 ');
129 display(FMSE);
130
131 M=256;
132 N=256;
133 sum2=0;
134 for m=1:256
135     sum1=0;
136     for n=1:256
137         NM=(g(m,n)-cg2(m,n))^2;
138         sum1=sum1+NM;
139     end
140     sum2=sum2+sum1;
141 end
142 FMSE1=sum2/(M*N);
143 disp('Final MSE after filtering between original girl2 and
        girl2Noise32Hi ');
144 display(FMSE1);
145
146 M=256;
147 N=256;
148 sum2=0;
149 for m=1:256
150     sum1=0;
151     for n=1:256
152         NM=(g(m,n)-cg3(m,n))^2;
153         sum1=sum1+NM;
154     end
155     sum2=sum2+sum1;
156 end
157 FMSE2=sum2/(M*N);
158 disp('final MSE between original girl2 and girl2Noise32 ');
159 display(FMSE2);

```

```

160 ISNR1=10*log(MSE1/FMSE1);
161 disp('ISNR before and after filtering of girl2Noise32Hi ');
162 disp('ISNR1='); disp(ISNR1);
163 ISNR2=10*log(MSE2/FMSE2);
164 disp('ISNR before and after filtering of girl2Noise32 ');
165 disp('ISNR2='); disp(ISNR2);
166
167 function fin=contraststretch(orgn)
168     [m,n]=size(orgn);
169     A=min(min(abs(orgn)));
170     B=max(max(abs(orgn)));
171     if A==B
172         A=min(min((orgn)));
173         B=max(max((orgn)));
174     end
175     P=(m-1)/(B-A);
176     L=-1*A*((m-1)/(B-A));
177     fin=zeros(m,n);
178     for i=1:m
179         for j=1:n
180             fin(i,j)=P*orgn(i,j)+L;
181         end
182     end
183 end

```

Output:

Results

MSE between girl2 and girl2Noise32Hi

MSE1 =

692.5050

MSE between girl2 and girl2Noise32

MSE2 =

744.4679

Final MSE after filtering between original girl2 and filtered girl2

FMSE =

102.3465

Final MSE after filtering between original girl2 and girl2Noise32Hi

FMSE1 =

422.1168

final MSE between original girl2 and girl2Noise32

FMSE2 =

539.7324

ISNR before and after filtering of girl2Noise32Hi

ISNR1=

4.9503

ISNR before and after filtering of girl2Noise32

ISNR2=

3.2160

c@FancyVer

Output Images:

Original girl2 Image



Original girl2Noise32Hi Image



Original girl2Noise32 Image



Original girl2 image after filtering and cropping



Original girl2Noise32Hi image after filtering and cropping



Original girl2Noise32 image after filtering and cropping



7 Seventh Answer or 2d

Matlab Code

```
1  clc;
2  close all;
3  clear all;
4
5  girl2=fopen('girl2.bin','r');
6  g=fread(girl2,[256,256],'uchar');
7  g=g';
8  figure(1);
9  colormap(gray(256));
10 image(contraststretch(g));
11 title('Original girl2 Image ');
12 axis off;
13 axis('image');
14 print (figure(1),'2da','-dpng');%writing out image for LaTeX
    purpose
15
16 %
17 girl2Noise32Hi=fopen('girl2Noise32Hi.bin','r');
18 gnh=fread(girl2Noise32Hi,[256,256],'uchar');
19 gnh=gnh';
20 figure(2);
21 colormap(gray(256));
22 image(contraststretch(gnh));
23 title('Original girl2Noise32Hi Image ');
24 axis off;
25 axis('image');
26 print (figure(2),'2db','-dpng');%writing out image for LaTeX
    purpose
27
28 %
29 girl2Noise32=fopen('girl2Noise32.bin','r');
30 gn=fread(girl2Noise32,[256,256],'uchar');
31 gn=gn';
32 figure(3);
33 colormap(gray(256));
34 image(contraststretch(gn));
35 title('Original girl2Noise32 Image ');
36 axis off;
37 axis('image');
38 print (figure(3),'2dc','-dpng');%writing out image for LaTeX
```

```

    purpose
39
40 %Computing the MSE
41 M=256;
42 N=256;
43 sum2=0;
44 for m=1:256
45     sum1=0;
46     for n=1:256
47         NM=(g(m,n)-gnh(m,n))^2;
48         sum1=sum1+NM;
49     end
50     sum2=sum2+sum1;
51 end
52 MSE1=sum2/(M*N);
53 disp('MSE between girl2 and girl2Noise32Hi ');
54 display(MSE1);
55
56 M=256;
57 N=256;
58 sum2=0;
59 for m=1:256
60     sum1=0;
61     for n=1:256
62         NM=(g(m,n)-gn(m,n))^2;
63         sum1=sum1+NM;
64     end
65     sum2=sum2+sum1;
66 end
67 MSE2=sum2/(M*N);
68 disp('MSE between girl2 and girl2Noise32 ');
69 display(MSE2);
70
71 U_cutoff_H = 64;
72 SigmaH = 0.19 * 256 / U_cutoff_H;
73 [U,V] = meshgrid(-128:127,-128:127);
74 HtildeCenter = exp((-2*pi*SigmaH^2)/(256.^2)*(U.^2 + V.^2));
75 Htilde = fftshift(HtildeCenter);
76 H = ifft2(Htilde);
77 H2 = fftshift(H);
78 ZPH2 = zeros(512,512);
79 ZPH2(1:256,1:256) = H2;
80 ZPg1=zeros(512,512);

```

```

81 ZPg1(1:256,1:256)=g;
82 ZPgnh=zeros(512,512);
83 ZPgnh(1:256,1:256)=gnh;
84 ZPgn=zeros(512,512);
85 ZPgn(1:256,1:256)=gn;
86 g1 = real( ifft2( fft2(ZPH2).*fft2(ZPg1)) );
87 g2 = real( ifft2( fft2(ZPH2).*fft2(ZPgnh)) );
88 g3 = real( ifft2( fft2(ZPH2).*fft2(ZPgn)) );
89 cg1=g1(129:384,129:384);
90 figure(5);
91 colormap(gray(256));
92 image(contraststretch(cg1));
93 title('Original girl2 image after filtering and cropping ');
94 axis off;
95 axis('image');
96 print (figure(5),'2dd','-dpng');%writing out image for LaTeX
    purpose
97
98 cg2=g2(129:384,129:384);
99 figure(6);
100 colormap(gray(256));
101 image(contraststretch(cg2));
102 title('Original girl2Noise32Hi image after filtering and
    cropping ');
103 axis off;
104 axis('image');
105 print (figure(6),'2de','-dpng');%writing out image for LaTeX
    purpose
106
107 cg3=g3(129:384,129:384);
108 figure(7);
109 colormap(gray(256));
110 image(contraststretch(cg3));
111 title('Original girl2Noise32 image after filtering and cropping
    ');
112 axis off;
113 axis('image');
114 print (figure(7),'2df','-dpng');%writing out image for LaTeX
    purpose
115
116 M=256;
117 N=256;
118 sum2=0;

```

```

119 for m=1:256
120     sum1=0;
121     for n=1:256
122         NM=(g(m,n)-cg1(m,n))^2;
123         sum1=sum1+NM;
124     end
125     sum2=sum2+sum1;
126 end
127 FMSE=sum2/(M*N);
128 disp('Final MSE after filtering between original girl2 and
        filtered girl2 ');
129 display(FMSE);
130
131 M=256;
132 N=256;
133 sum2=0;
134 for m=1:256
135     sum1=0;
136     for n=1:256
137         NM=(g(m,n)-cg2(m,n))^2;
138         sum1=sum1+NM;
139     end
140     sum2=sum2+sum1;
141 end
142 FMSE1=sum2/(M*N);
143 disp('Final MSE after filtering between original girl2 and
        girl2Noise32Hi ');
144 display(FMSE1);
145
146 M=256;
147 N=256;
148 sum2=0;
149 for m=1:256
150     sum1=0;
151     for n=1:256
152         NM=(g(m,n)-cg3(m,n))^2;
153         sum1=sum1+NM;
154     end
155     sum2=sum2+sum1;
156 end
157 FMSE2=sum2/(M*N);
158 disp('final MSE between original girl2 and girl2Noise32 ');
159 display(FMSE2);

```

```

160 ISNR1=10*log(MSE1/FMSE1);
161 disp('ISNR before and after filtering of girl2Noise32Hi ');
162 disp('ISNR1='); disp(ISNR1);
163 ISNR2=10*log(MSE2/FMSE2);
164 disp('ISNR before and after filtering of girl2Noise32 ');
165 disp('ISNR2='); disp(ISNR2);
166
167 function fin=contraststretch(orgn)
168     [m,n]=size(orgn);
169     A=min(min(abs(orgn)));
170     B=max(max(abs(orgn)));
171     if A==B
172         A=min(min((orgn)));
173         B=max(max((orgn)));
174     end
175     P=(m-1)/(B-A);
176     L=-1*A*((m-1)/(B-A));
177     fin=zeros(m,n);
178     for i=1:m
179         for j=1:n
180             fin(i,j)=P*orgn(i,j)+L;
181         end
182     end
183 end

```

Output:

Results

MSE between girl2 and girl2Noise32Hi

MSE1 =
692.5050

MSE between girl2 and girl2Noise32

MSE2 =
744.4679

Final MSE after filtering between original girl2 and filtered girl2

FMSE =
21.9643

Final MSE after filtering between original girl2 and girl2Noise32Hi

FMSE1 =

442.4524

final MSE between original girl2 and girl2Noise32

FMSE2 =

555.0764

ISNR before and after filtering of girl2Noise32Hi

ISNR1=

4.4798

ISNR before and after filtering of girl2Noise32

ISNR2=

2.9356

c@FancyVer

Output Images:

Original girl2 Image



Original girl2Noise32Hi Image



Original girl2Noise32 Image



Original girl2 image after filtering and cropping



Original girl2Noise32Hi image after filtering and cropping



Original girl2Noise32 image after filtering and cropping

