

# Homework 4

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## 1 First Answer

Matlab Code

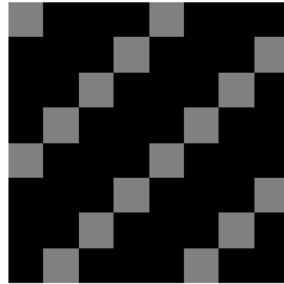
```
1  clc ;
2  [ cols ,rows]=meshgrid (0:7 ,0:7) ;
3  t=sqrt (-1) ;
4  I1=0.5*exp ( t*2*pi /8*(2.0*cols+2.0*rows) ) ;
5  fprintf (1 , '%s\n' , 'Re[ I1 ] : ' ) ;
6  disp (round (real (I1) * 10^4)*10^(-4)) ;
7
8  subplot (2 ,2 ,1) ;
9  imshow (real (I1)) ;
10 title ( 'Real part of image I1 ' ) ;
11 fprintf (1 , '%s\n' , 'Im[ I1 ] : ' ) ;
12 disp (round (imag (I1) * 10^4)*10^(-4)) ;
13
14 subplot (2 ,2 ,2) ;
15 imshow (imag (I1)) ;
16 title ( 'Imaginary part of image I1 ' ) ;
17 h=sum (hist (I1 ,0:8) ' ');
18
19 subplot (2 ,2 ,3) ;
20 bar (h) ;
21 title ( 'Histogram for original image' ) ;
22
23 A=min (min (abs (I1) ) ) ;
24 B=max (max (abs (I1) ) ) ;
25 if A==B
26     A=min (min (I1) ) ;
27     B=min (min (I1) ) ;
28 end
29
```

```

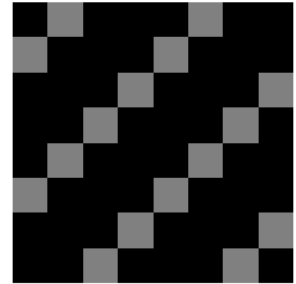
30 k=8;
31 J=zeros(8,8);
32 for m=1:8
33     for n=1:8
34         J(m,n)=(((k-1)/(B-A))*(I1(m,n)-A));
35     end
36 end
37
38 subplot(2,2,4);
39 imshow(J);
40 title('Full scale contrast image I1');
41 print (figure(1),'Q1','-dpng');%writing out image for LaTeX
    purpose
42
43 y=fftshift(fft2(I1));
44 fprintf(1,'%s\n','Re[DFT(I1)]:');
45 disp(round(real(y)*10^4)*10^(-4));
46
47
48 fprintf(1,'%s\n','Im[DFT(I1)]:');
49 disp(round(imag(y)*10^4)*10^(-4));

```

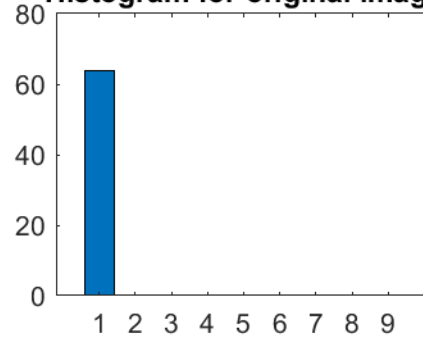
Real part of image I1



Imaginary part of image I1



Histogram for original image



Full scale contrast image I1



Output Images:

2 Second Answer

Matlab Code

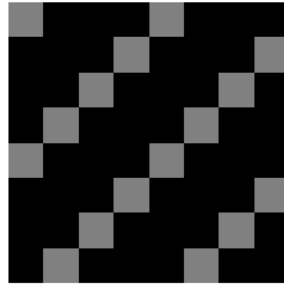
```
1  clc ;
2  I2=zeros(8,8);
3  [cols,rows]=meshgrid(0:7,0:7);
4  t=sqrt(-1);
5  I2=0.5*exp(-t*2*pi/8*(2.0*cols+2.0*rows));
6  fprintf(1,'%s\n','Re[I2]:');
7  disp(round(real(I2)*10^4)*10^(-4));
8
9  %figure(1);
10 subplot(2,2,1);
11 imshow(real(I2));
12 title('Real part of image I2');
13 fprintf(1,'%s\n','Im[I2]:');
14 disp(round(imag(I2)*10^4)*10^(-4));
15
16 %figure(2);
```

```

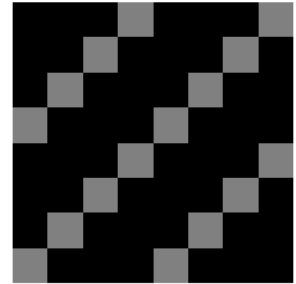
17 subplot(2,2,2);
18 imshow(imag(I2));
19 title('Imaginary part of image I2');
20 h=sum(hist(I2,0:8));
21
22 %figure(3);
23 subplot(2,2,3);
24 bar(h);
25 title('Histogram for original image');
26 A=min(min(abs(I2)));
27 B=max(max(abs(I2)));
28 if A==B
29     A=min(min(I2));
30     B=min(min(I2));
31 end
32
33 A=0.5;
34 B=5i;
35 k=8;
36 J=zeros(8,8);
37 for m=1:8
38     for n=1:8
39         J(m,n)=(((k-1)/(B-A))*(I2(m,n)-A));
40     end
41 end
42
43 %figure(4);
44 subplot(2,2,4);
45 imshow(J);
46 title('Full scale contrast image I2');
47 print (figure(1),'Q2','-dpng');%writing out image for LaTeX
    purpose
48
49 y=fftshift(fft2(I2));
50 fprintf(1,'%s\n','Re[DFT(I1)]:');
51 disp(round(real(y)*10^4)*10^(-4));
52
53 fprintf(1,'%s\n','Im[DFT(I1)]:');
54 disp(round(imag(y)*10^4)*10^(-4));

```

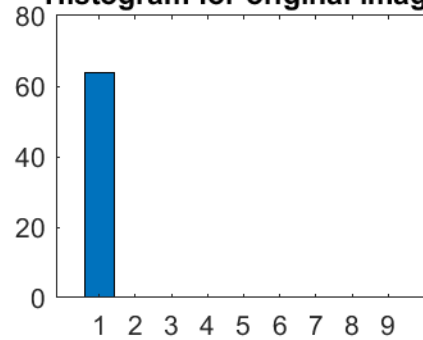
Real part of image I2



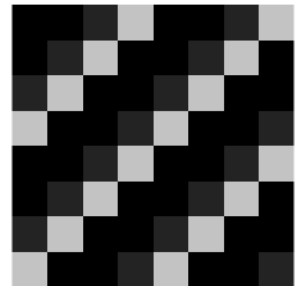
Imaginary part of image I2



Histogram for original image



Full scale contrast image I2



Output Images:

### 3 Third Answer

Matlab Code

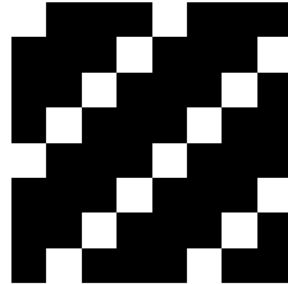
```
1  clc ;
2  I3=zeros(8,8);
3  [cols,rows]=meshgrid(0:7,0:7);
4  I3=cos(2*pi/8*(2.0*cols+2.0*rows));
5  fprintf(1,'%s\n','Re[I3]:');
6  disp(round(real(I3)*10^4)*10^(-4));
7
8  subplot(2,2,1);
9  imshow(real(I3));
10 title('Real part of image I3');
11 fprintf(1,'%s\n','Im[I3]:');
12 disp(round(imag(I3)*10^4)*10^(-4));
13
14 subplot(2,2,2);
15 imshow(imag(I3));
16 title('Imaginary part of image I3');
```

```

17 h=sum(hist(I3,0:8) ');
18
19 subplot(2,2,3);
20 bar(h);
21 title('Histogram for original image');
22
23 A=min(min(abs(I3)));
24 B=max(max(abs(I3)));
25
26 k=8;
27 J=zeros(8,8);
28 for m=1:8
29     for n=1:8
30         J(m,n)=((k-1)/(B-A))*(I3(m,n)-A);
31     end
32 end
33
34 %figure(4);
35 subplot(2,2,4);
36 imshow(J);
37 title('Full scale contrast stretch image I3');
38 print (figure(1), 'Q3', '-dpng');%writing out image for LaTeX
    purpose
39
40 y=fftshift(fft2(I3));
41 fprintf(1, '%s\n', 'Re[DFT(I3)]: ');
42 disp(round(real(y) * 10^4)*10^(-4));
43
44 fprintf(1, '%s\n', 'Im[DFT(I3)]: ');
45 disp(round(imag(y) * 10^4)*10^(-4));

```

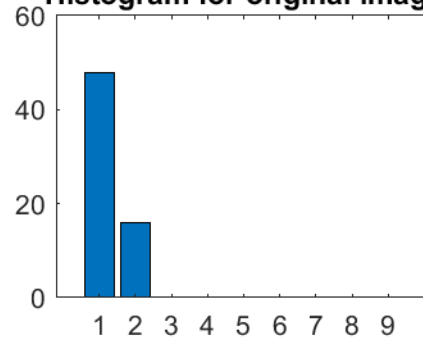
Real part of image I3



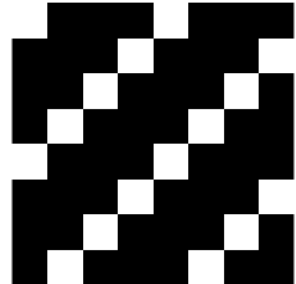
Imaginary part of image I3



Histogram for original image



Full scale contrast stretch image I3



Output Images:

#### 4 Fourth Answer

Matlab Code

```
1  clc ;
2  I4=zeros (8,8) ;
3  [ cols ,rows]=meshgrid (0:7,0:7) ;
4  %t=sqrt (-1);
5  I4=sin (2*pi/8*(2.0* cols +2.0*rows)) ;
6  %j=fft (I1) ;
7  fprintf (1, '%s\n', 'Re[ I4 ]: ');
8  disp (round (real (I4) * 10^4)*10^(-4)) ;
9
10 %figure (1) ;
11 subplot (2,2,1) ;
12 imshow (real (I4)) ;
13 title ('Real part of image I4') ;
14 fprintf (1, '%s\n', 'Im[ I4 ]: ');
15 disp (round (imag (I4) * 10^4)*10^(-4)) ;
16
```

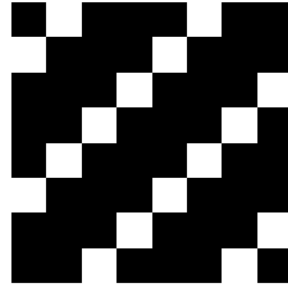
```

17 %figure(2);
18 subplot(2,2,2);
19 imshow(imag(I4));
20 title('Imaginary part of image I4');
21 h=sum(hist(I4,0:8)');
22
23 %figure(3);
24 subplot(2,2,3);
25 bar(h);
26 title('Histogram for original image');
27 A=min(min(abs(I4)));
28 B=max(max(abs(I4)));
29 k=8;
30 J=zeros(8,8);
31 for m=1:8
32     for n=1:8
33         J(m,n)=((k-1)/(B-A))*(I4(m,n)-A);
34     end
35 end
36
37 %figure(4);
38 subplot(2,2,4);
39 imshow(J);
40 title('Full scale contrast stretch image I4');
41 print (figure(1), 'Q4', '-dpng');%writing out image for LaTeX
    purpose
42
43
44 y=fftshift(fft2(I4));
45 fprintf(1, '%s\n', 'Re[DFT(I4)]: ');
46 disp(round(real(y) * 10^4)*10^(-4));
47
48 fprintf(1, '%s\n', 'Im[DFT(I4)]: ');
49 disp(round(imag(y) * 10^4)*10^(-4));

```



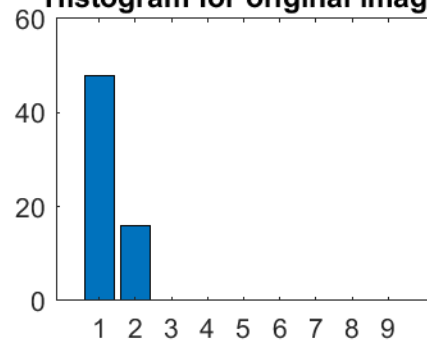
Real part of image I4



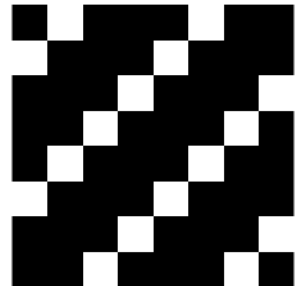
Imaginary part of image I4



Histogram for original image



Full scale contrast stretch image I4



Output Images:

## 5 Fifth Answer

Matlab Code

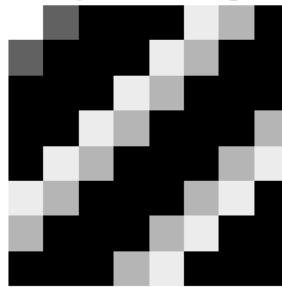
```
1  clc ;
2  [cols ,rows]=meshgrid (0:7 ,0:7) ;
3  I5=cos (2*pi /8*(1.5*cols+1.5*rows)) ;
4  fprintf (1 , '%s\n' , 'Re[I5]: ');
5  disp (round ((real (I5) * 10^4)*10^(-4))) ;
6
7  subplot (2,2,1) ;
8  imshow (real (I5)) ;
9  title ( 'Real part of image I5' ) ;
10 fprintf (1 , '%s\n' , 'Im[I5]: ');
11 disp (round ((imag (I5) * 10^4)*10^(-4))) ;
12
13 subplot (2,2,2) ;
14 imshow (imag (I5)) ;
15 title ( 'Imaginary part of image I5' ) ;
16 h=sum (hist (I5 ,0:8) ');
```

```

17
18 subplot(2,2,3);
19 bar(h);
20 title('Histogram for original image');
21
22 A=min(min(abs(I5)));
23 B=max(max(abs(I5)));
24
25 k=8;
26 J=zeros(8,8);
27 for m=1:8
28     for n=1:8
29         J(m,n)=((k-1)/(B-A))*(I5(m,n)-A);
30     end
31 end
32
33 %figure(4);
34 subplot(2,2,4);
35 imshow(J);
36 title('Full scale contrast stretch image I5');
37 print (figure(1),'Q5','-dpng');%writing out image for LaTeX
    purpose
38
39 %figure(1);colormap(gray(256));
40 %image('j');
41 y=fftshift(fft2(I5));
42 fprintf(1,'%s\n','Re[DFT(I5)]:');
43 disp(round((real(y) * 10^4)*10^(-4)));
44
45 fprintf(1,'%s\n','Im[DFT(I5)]:');
46 disp(round((imag(y) * 10^4)*10^(-4)));

```

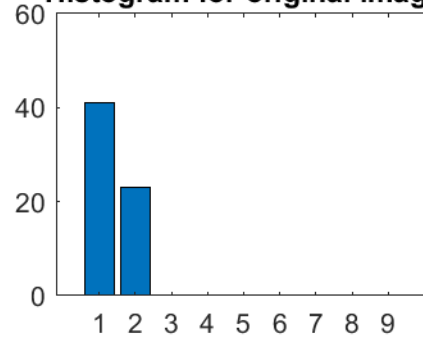
Real part of image I5



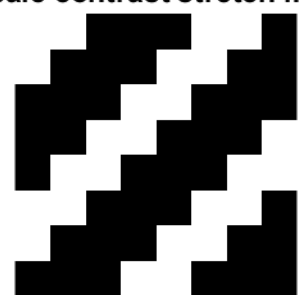
Imaginary part of image I5



Histogram for original image



Full scale contrast stretch image I5



Output Images:

## 6 Sixth Answer

Matlab Code

```

1 %%Camera. bin
2 clc;
3 fidcamera = fopen('camera.bin','r');
4 [camera,junk] = fread(fidcamera,[256,256],'uchar');
5
6 % to display camera image
7 camera = camera'; % for trasnpose of the image
8 subplot(2,3,1);colormap(gray(256));
9 image(camera);
10 title('Original camera Image');
11 I1=camera;
12 cdft=fftshift(fft2(I1));
13
14 %real part of centered dft
15 subplot(2,3,2);
16 imshow(real(cdft));

```

```

17 title('Real part centered DFT');
18
19 %imaginary part of centered dft
20 subplot(2,3,3);
21 imshow(imag(cdft));
22 title('Imaginary part centered DFT');
23 %full scale contrast stretch
24 h=sum(hist(cdft,0:255)');
25
26 A=min(min(abs(cdft)));
27 B=max(max(abs(cdft)));
28
29 k=256;
30 J=zeros(256,256);
31 for m=1:256
32     for n=1:256
33         J(m,n)=((k-1)/(B-A))*(cdft(m,n)-A);
34     end
35 end
36
37 %log-magnitude of the centered dft
38 magn=sqrt(real(J)*real(J)+imag(J)*imag(J));
39 lmagn=log(1+abs(magn));
40 subplot(2,3,4);
41 imshow(lmagn);
42 title('Log-Mag centered DFT')
43
44 %phase of the centered dft
45 ph=atand(imag(J)/real(J));
46 subplot(2,3,5);
47 imshow(ph);
48 title('Phase part of centered DFT');
49 print (figure(1),'Camera','-dpng');%writing out image for LaTeX
    purpose
50
51 %%eyeR.bin
52 clc;
53 fideyeR = fopen('eyeR.bin','r');
54 [eyeR,junk] = fread(fideyeR,[256,256],'uchar');
55
56 % to display eyeR image
57 eyeR = eyeR'; % for trasnpose of the image
58 subplot(2,3,1);colormap(gray(256));

```

```

59 image(eyeR);
60 title('Original eyeR Image');
61 I1=eyeR;
62 cdft=fftshift(fft2(I1));
63
64 %real part of centered dft
65 subplot(2,3,2);
66 imshow(real(cdft));
67 title('Real part centered DFT');
68
69 %imaginary part of centered dft
70 subplot(2,3,3);
71 imshow(imag(cdft));
72 title('Imaginary part centered DFT');
73
74 %full scale contrast stretch
75 h=sum(hist(cdft,0:255));
76 A=min(min(abs(cdft)));
77 B=max(max(abs(cdft)));
78 k=256;
79 J=zeros(256,256);
80 for m=1:256
81     for n=1:256
82         J(m,n)=(((k-1)/(B-A))*(cdft(m,n)-A));
83     end
84 end
85
86 %log-magnitude of the centered dft
87 magn=sqrt(real(J)*real(J)+imag(J)*imag(J));
88 lmagn=log(1+abs(magn));
89 subplot(2,3,4);
90 imshow(lmagn);
91 title('Log-Mag centered DFT');
92
93 %phase of the centered dft
94 ph=atan2(imag(J)/real(J));
95 subplot(2,3,5);
96 imshow(ph);
97 title('Phase part of centered DFT');
98 print('figure(1)', 'eyeR', '-dpng'); %writing out image for LaTeX
    purpose
99
100 %%salesman.bin

```

```

101  clc;
102  fidsalesman = fopen( 'salesman.bin' , 'r' );
103  [salesman ,junk] = fread( fidsalesman ,[256,256] , 'uchar' );
104
105  % to display salesman image
106  salesman = salesman' ; % for trasnpose of the image
107  subplot(2,3,1);colormap(gray(256));
108  image(salesman);
109  title( 'Original salesman Image' );
110  I1=salesman;
111  cdft=fftshift( fft2(I1) );
112
113  %real part of centered dft
114  subplot(2,3,2);
115  imshow(real( cdft ));
116  title( 'Real part centered DFT' );
117
118  %imaginary part of centered dft
119  subplot(2,3,3);
120  imshow(imag( cdft ));
121  title( 'Imaginary part centered DFT' );
122
123  %full scale contrast stretch
124  h=sum( hist( cdft ,0:255) ' ');
125
126  A=min(min( abs( cdft )));
127  B=max(max( abs( cdft )));
128
129  k=256;
130  J=zeros(256,256);
131  for m=1:256
132      for n=1:256
133          J(m,n)=((k-1)/(B-A))*(cdft(m,n)-A);
134      end
135  end
136
137  %log-magnitude of the centered dft
138  magn=sqrt( real( J)*real( J)+imag( J)*imag( J ));
139  lmagn=log(1+abs(magn));
140  subplot(2,3,4);
141  imshow(lmagn);
142  title( 'Log-Mag centered DFT' )
143

```

```

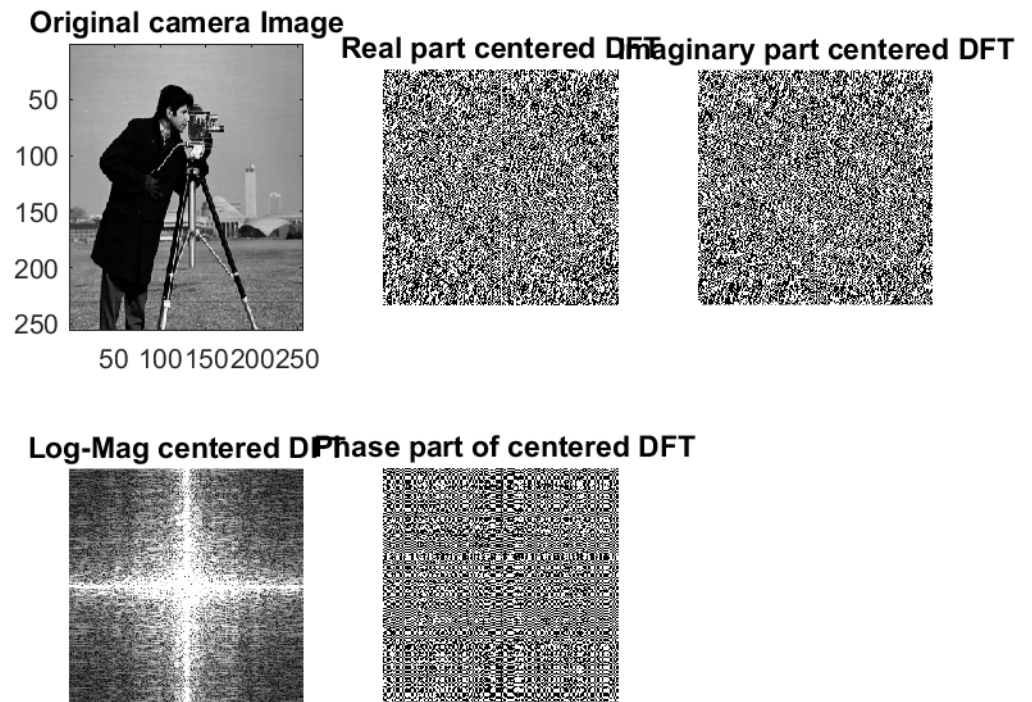
144 %phase of the centered dft
145 ph=atand(imag(J)/real(J));
146 subplot(2,3,5);
147 imshow(ph);
148 title('Phase part of centered DFT');
149 print (figure(1), 'salesman', '-dpng'); %writing out image for
    LaTeX purpose
150
151 %%head.bin
152 clc;
153 fidhead = fopen('head.bin', 'r');
154 [head, junk] = fread(fidhead, [256, 256], 'uchar');
155
156 % to display head image
157 head = head'; % for trasnpose of the image
158 subplot(2,3,1); colormap(gray(256));
159 image(head);
160 title('Original head Image');
161 I1=head;
162 cdft=fftshift(fft2(I1));
163
164 %real part of centered dft
165 subplot(2,3,2);
166 imshow(real(cdft));
167 title('Real part centered DFT');
168
169 %imaginary part of centered dft
170 subplot(2,3,3);
171 imshow(imag(cdft));
172 title('Imaginary part centered DFT');
173
174 %full scale contrast stretch
175 h=sum(hist(cdft, 0:255));
176 A=min(min(abs(cdft)));
177 B=max(max(abs(cdft)));
178 k=256;
179 J=zeros(256, 256);
180 for m=1:256
181     for n=1:256
182         J(m,n) = (((k-1)/(B-A)) * (cdft(m,n)-A));
183     end
184 end
185

```

```

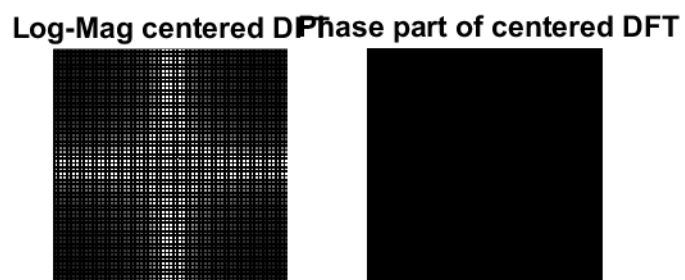
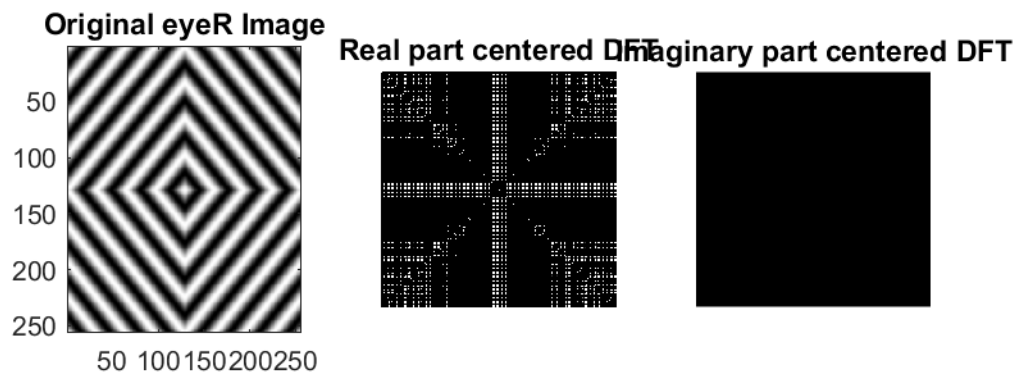
186 %log-magnitude of the centered dft
187 magn=sqrt(real(J)*real(J)+imag(J)*imag(J));
188 lmagn=log(1+abs(magn));
189 subplot(2,3,4);
190 imshow(lmagn);
191 title('Log-Mag centered DFT')
192
193 %phase of the centered dft
194 ph=atand(imag(J)/real(J));
195 subplot(2,3,5);
196 imshow(ph);
197 title('Phase part of centered DFT');
198 print (figure(1),'Head','-dpng');%writing out image for LaTeX
    purpose

```

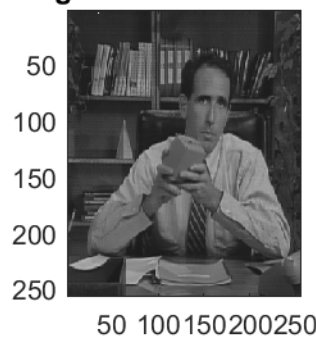


Output Images:

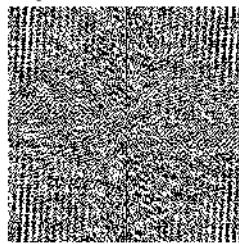




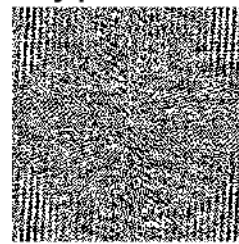
Original salesman Image



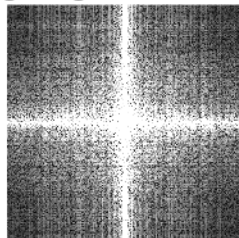
Real part centered DFT



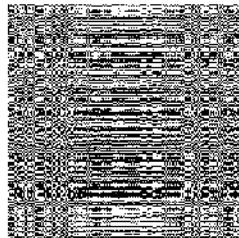
Imaginary part centered DFT

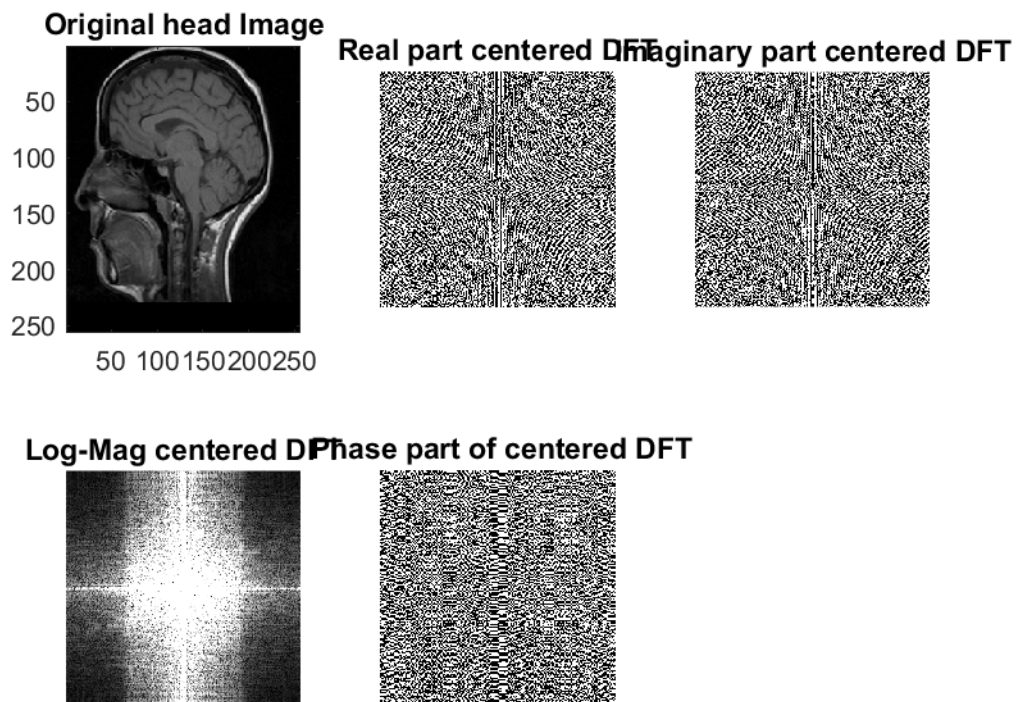


Log-Mag centered DFT



Phase part of centered DFT





## 7 Seventh Answer

Matlab Code

```

1  clc;
2  fidcamera = fopen('camera.bin','r');
3  [camera,junk] = fread(fidcamera,[256,256],'uchar');
4
5  % to display camera image
6  camera = camera' ; % for trasnpose of the image
7
8  subplot(2,2,1);colormap(gray(256));
9  image(camera);
10 title('Original camera Image');
11 I1=camera;
12 cdft=fftshift(fft2(I1));
13
14 %new image J1
15 %magnitude of the centered dft
16 absJ1=abs(cdft);

```

```

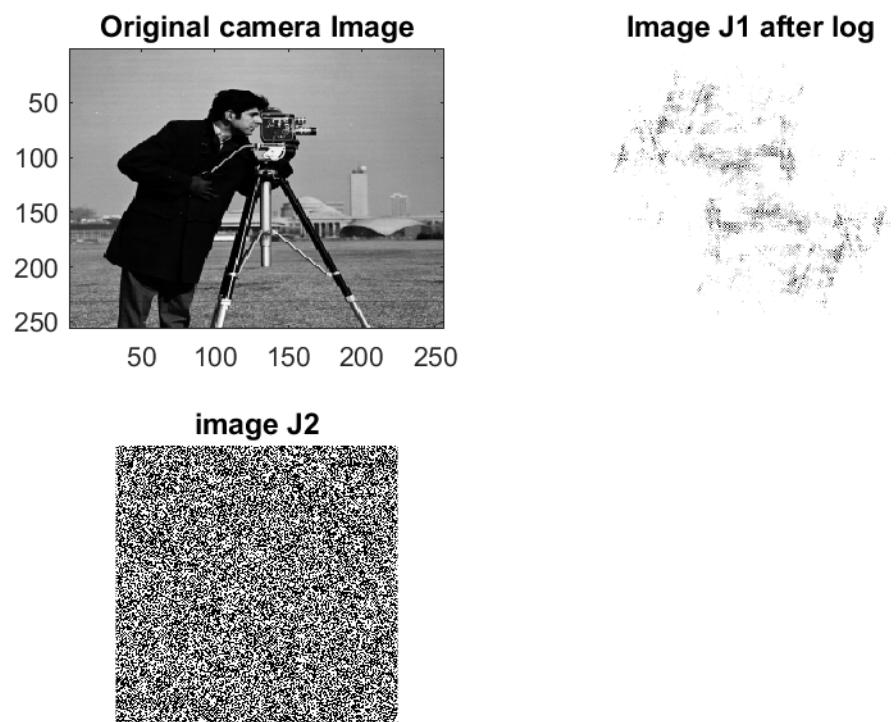
17  argJ1=0;
18  k=round( absJ1*exp(1 i*argJ1) );
19  J1=ifft2(k);
20
21  subplot(2,2,2);
22  imshow(J1);
23  title('Image J1');
24
25  %full scale contrast stretch
26  h=sum(hist(J1,0:255)');
27
28  A=min(min(abs(J1)));
29  B=max(max(abs(J1)));
30
31  k=256;
32  J=zeros(256,256);
33
34  for m=1:256
35      for n=1:256
36          J(m,n)=(((k-1)/(B-A))*(J1(m,n)-A));
37      end
38  end
39
40  %log-magnitude of J1
41  lmagn=log(J);
42  subplot(2,2,2);
43  imshow(real(lmagn));
44  title('Image J1 after log')
45
46  %new image J2
47  %phase of the centered dft
48  argJ2=atand(imag(cdft)/real(cdft));
49  absJ2=1;
50  J2=absJ2*(exp(1 i*argJ2));
51  finJ2=ifft2(J2);
52
53  %full scale contrast stretch
54  h=sum(hist(finJ2,0:255)');
55
56  A=min(min(abs(finJ2)));
57  B=max(max(abs(finJ2)));
58
59  k=256;

```

```

60 J=zeros(256,256);
61 for m=1:256
62     for n=1:256
63         J(m,n)=(((k-1)/(B-A))*(finJ2(m,n)-A));
64     end
65 end
66
67 subplot(2,2,3);
68 imshow(real(J));
69 title('image J2');
70 print (figure(1),'Q7','-dpng');%writing out image for LaTeX
    purpose

```



Output Images: