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### %Problem 1

```
clc;
[cols,rows]=meshgrid(0:7,0:7);
t=sqrt(-1);
I1=0.5*exp(t*2*pi/8*(2.0*cols+2.0*rows));
fprintf(1,'%s\n','Re[I1]:');
disp(round(real(I1) * 10^4)*10^(-4));
subplot(2,2,1);
imshow(real(I1));
title('Real part of image I1');
```

```
fprintf(1,'%s\n','Im[I1]:');
disp(round(imag(I1) * 10^4)*10^(-4));
subplot(2,2,2);
imshow(imag(I1));
title('Imaginary part of image I1');
```

```
h=sum(hist(I1,0:8));
subplot(2,2,3);
bar(h);
title('Histogram for original image');
A=min(min(abs(I1)));
B=max(max(abs(I1)));
```

```
if A==B
    A=min(min(I1));
    b=min(min(I1));
end
k=8;
J=zeros(8,8);
for m=1:8
    for n=1:8
        J(m,n)=(((k-1)/(B-A))*(I1(m,n)-A));
    end
end
```

```
subplot(2,2,4);
imshow(J);
title('Full scale contrast image I1');
```

```
y=fftshift(fft2(I1));
fprintf(1,'%s\n','Re[DFT(I1)]');
disp(round(real(y) * 10^4)*10^(-4));
```

```
fprintf(1,'%s\n','Im[DFT(I1)]');
disp(round(imag(y) * 10^4)*10^(-4));
```

Output:

Re[I1]:

Columns 1 through 7

0.5000	0	-0.5000	0	0.5000	0	-0.5000
0	-0.5000	0	0.5000	0	-0.5000	0
-0.5000	0	0.5000	0	-0.5000	0	0.5000
0	0.5000	0	-0.5000	0	0.5000	0
0.5000	0	-0.5000	0	0.5000	0	-0.5000
0	-0.5000	0	0.5000	0	-0.5000	0
-0.5000	0	0.5000	0	-0.5000	0	0.5000
0	0.5000	0	-0.5000	0	0.5000	0

Column 8

0
0.5000
0
-0.5000
0
0.5000
0
-0.5000

Im[I1]:

Columns 1 through 7

0	0.5000	0	-0.5000	0	0.5000	0
0.5000	0	-0.5000	0	0.5000	0	-0.5000
0	-0.5000	0	0.5000	0	-0.5000	0
-0.5000	0	0.5000	0	-0.5000	0	0.5000
0	0.5000	0	-0.5000	0	0.5000	0
0.5000	0	-0.5000	0	0.5000	0	-0.5000
0	-0.5000	0	0.5000	0	-0.5000	0
-0.5000	0	0.5000	0	-0.5000	0	0.5000

Column 8

-0.5000
0
0.5000
0
-0.5000
0
0.5000
0

Re[DFT(I1)]:

0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	32	0
0	0	0	0	0	0	0	0

Im[DFT(I1)]:

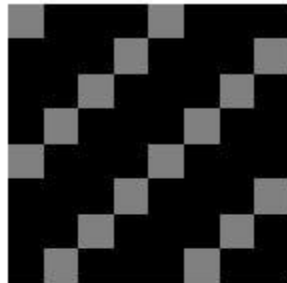
```

0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0

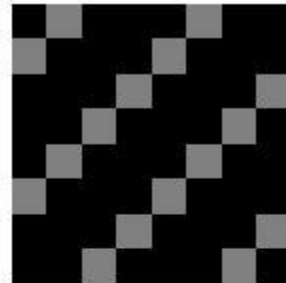
```

Output Images:

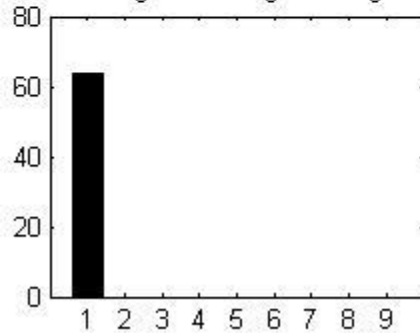
Real part of image I1



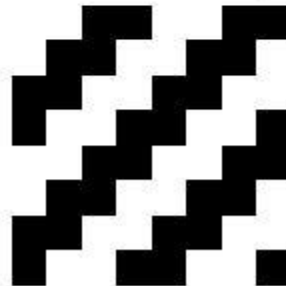
Imaginary part of image I1



Histogram for original image



Full scale contrast image I1



## %Problem 2

```

clc;
I1=zeros(8,8);
[cols,rows]=meshgrid(0:7,0:7);
t=sqrt(-1);
I1=0.5*exp(-t*2*pi/8*(2.0*cols+2.0*rows));
fprintf(1,'%s\n','Re[I2]:');
disp(round(real(I1) * 10^4)*10^(-4));
%figure(1);
subplot(2,2,1);
imshow(real(I1));
title('Real part of image I2');

```

```

fprintf(1,'%s\n','Im[I2]:');
disp(round(imag(I1) * 10^4)*10^(-4));
%figure(2);
subplot(2,2,2);
imshow(imag(I1));

```

```
title('Imaginary part of image I2');
```

```
h=sum(hist(I1,0:8));
```

```
%figure(3);
```

```
subplot(2,2,3);
```

```
bar(h);
```

```
title('Histogram for original image');
```

```
A=min(min(abs(I1)));
```

```
B=max(max(abs(I1)));
```

```
if A==B
```

```
    A=min(min(I1));
```

```
    b=min(min(I1));
```

```
end
```

```
%A=-0.5;
```

```
%B=5i;
```

```
k=8;
```

```
J=zeros(8,8);
```

```
for m=1:8
```

```
for n=1:8
```

```
J(m,n)=(((k-1)/(B-A))*(I1(m,n)-A));
```

```
end
```

```
end
```

```
%figure(4);
```

```
subplot(2,2,4);
```

```
imshow(J);
```

```
title('Full scale contrast image I2');
```

```
y=fftshift(fft2(I1));
```

```
fprintf(1,'%s\n','Re[DFT(I1)]:');
```

```
disp(round(real(y) * 10^4)*10^(-4));
```

```
fprintf(1,'%s\n','Im[DFT(I1)]:');
```

```
disp(round(imag(y) * 10^4)*10^(-4));
```

Output:

Re[I2]:

Columns 1 through 7

0.5000	0	-0.5000	0	0.5000	0	-0.5000
0	-0.5000	0	0.5000	0	-0.5000	0
-0.5000	0	0.5000	0	-0.5000	0	0.5000
0	0.5000	0	-0.5000	0	0.5000	0
0.5000	0	-0.5000	0	0.5000	0	-0.5000
0	-0.5000	0	0.5000	0	-0.5000	0
-0.5000	0	0.5000	0	-0.5000	0	0.5000
0	0.5000	0	-0.5000	0	0.5000	0

Column 8

0  
0.5000  
0  
-0.5000  
0  
0.5000  
0  
-0.5000

Im[I2]:

Columns 1 through 7

0	-0.5000	0	0.5000	0	-0.5000	0
-0.5000	0	0.5000	0	-0.5000	0	0.5000
0	0.5000	0	-0.5000	0	0.5000	0
0.5000	0	-0.5000	0	0.5000	0	-0.5000
0	-0.5000	0	0.5000	0	-0.5000	0
-0.5000	0	0.5000	0	-0.5000	0	0.5000
0	0.5000	0	-0.5000	0	0.5000	0
0.5000	0	-0.5000	0	0.5000	0	-0.5000

Column 8

0.5000	0
-0.5000	0
0.5000	0
-0.5000	0

Re[DFT(I2)]:

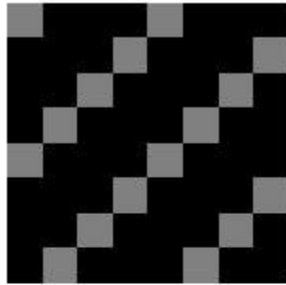
[illegible]

Im[DFT(I2)]:

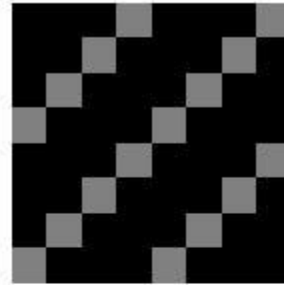
[illegible]

Output Images:

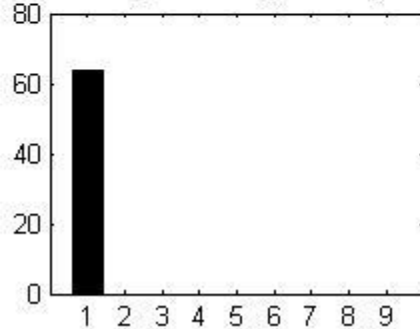
Real part of image I2



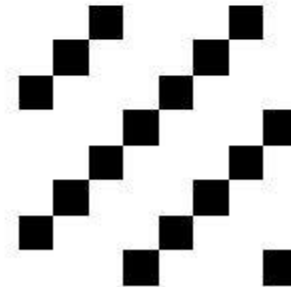
Imaginary part of image I2



Histogram for original image



Full scale contrast image I2



### %Problem 3

```
clc;
I1=zeros(8,8);
[cols,rows]=meshgrid(0:7,0:7);
I1=cos(2*pi/8*(2.0*cols+2.0*rows));
fprintf(1,'%s\n','Re[I3]:');
disp(round(real(I1) * 10^4)*10^(-4));
subplot(2,2,1);
imshow(real(I1));
title('Real part of image I3');

fprintf(1,'%s\n','Im[I3]:');
disp(round(imag(I1) * 10^4)*10^(-4));
subplot(2,2,2);
imshow(imag(I1));
title('Imaginary part of image I3');

h=sum(hist(I1,0:8));
subplot(2,2,3);
bar(h);
title('Histogram for original image');
A=min(min(abs(I1)));
B=max(max(abs(I1)));
```

```

k=8;
J=zeros(8,8);
for m=1:8
for n=1:8
J(m,n)=(((k-1)/(B-A))*(I1(m,n)-A));
end
end

%figure(4);
subplot(2,2,4);
imshow(J);
title('Full scale contrast stretch image I3');
%figure(1);colormap(gray(256));
%image('j');

y=fftshift(fft2(I1));
fprintf(1,'%s\n','Re[DFT(I3)]:');
disp(round(real(y) * 10^4)*10^(-4));

fprintf(1,'%s\n','Im[DFT(I3)]:');
disp(round(imag(y) * 10^4)*10^(-4));

%we can observe that full scale contrast image I3 is
%same as real part of I1

```

Output:

Re[I3]:

```

1  0 -1  0  1  0 -1  0
0 -1  0  1  0 -1  0  1
-1  0  1  0 -1  0  1  0
0  1  0 -1  0  1  0 -1
1  0 -1  0  1  0 -1  0
0 -1  0  1  0 -1  0  1
-1  0  1  0 -1  0  1  0
0  1  0 -1  0  1  0 -1

```

Im[I3]:

```

0  0  0  0  0  0  0  0
0  0  0  0  0  0  0  0
0  0  0  0  0  0  0  0
0  0  0  0  0  0  0  0
0  0  0  0  0  0  0  0
0  0  0  0  0  0  0  0
0  0  0  0  0  0  0  0
0  0  0  0  0  0  0  0

```

Re[DFT(I3)]:

```

0  0  0  0  0  0  0  0
0  0  0  0  0  0  0  0
0  0 32  0  0  0  0  0
0  0  0  0  0  0  0  0
0  0  0  0  0  0  0  0
0  0  0  0  0  0  0  0
0  0  0  0  0  0 32  0
0  0  0  0  0  0  0  0

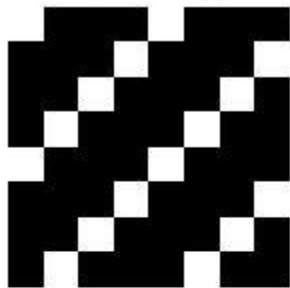
```

Im[DFT(I3)]:

```
0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0
```

Output Images:

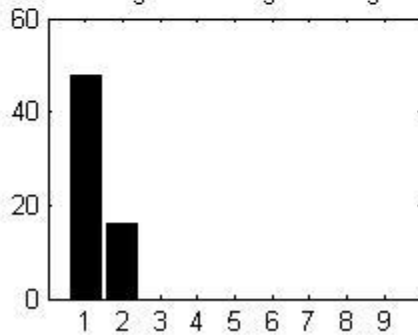
Real part of image I3



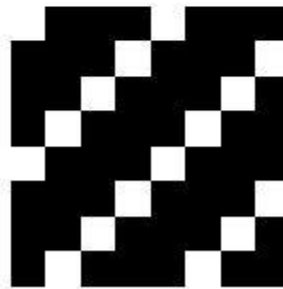
Imaginary part of image I3



Histogram for original image



Full scale contrast stretch image I3



#### %Problem 4

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

```
fprintf(1,'%s\n','Im[I4]:');
disp(round(imag(I1) * 10^4)*10^(-4));
%figure(2);
```



[illegible]

Re[DFT(I4)]:

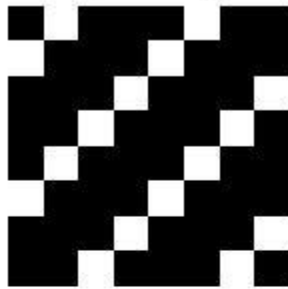
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0

Im[DFT(I4)]:

0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	32	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	-32	0
0	0	0	0	0	0	0	0

Output Images:

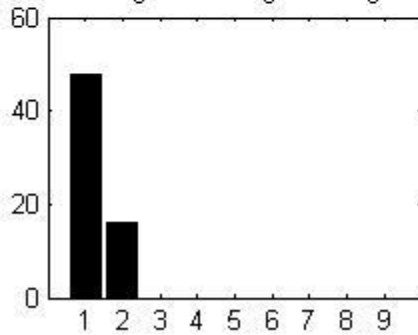
Real part of image I4



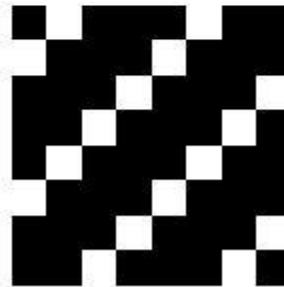
Imaginary part of image I4



Histogram for original image



Full scale contrast stretch image I4



%problem 5

```
clc;
[cols,rows]=meshgrid(0:7,0:7);
I1=cos(2*pi/8*(1.5*cols+1.5*rows));
fprintf(1,'%s\n','Re[I5]:');
disp(round((real(I1) * 10^4)*10^(-4)));
subplot(2,2,1);
imshow(real(I1));
title('Real part of image I5');

fprintf(1,'%s\n','Im[I5]:');
disp(round((imag(I1) * 10^4)*10^(-4)));
subplot(2,2,2);
imshow(imag(I1));
title('Imaginary part of image I5');

h=sum(hist(I1,0:8));
subplot(2,2,3);
bar(h);
title('Histogram for original image');
A=min(min(abs(I1)));
B=max(max(abs(I1)));

k=8;
J=zeros(8,8);
for m=1:8
for n=1:8
J(m,n)=(((k-1)/(B-A))*(I1(m,n)-A));
end
end

%figure(4);
subplot(2,2,4);
imshow(J);
title('Full scale contrast stretch image I5');
%figure(1);colormap(gray(256));
%image('j');

y=fftshift(fft2(I1));
fprintf(1,'%s\n','Re[DFT(I5)]');
disp(round((real(y) * 10^4)*10^(-4)));

fprintf(1,'%s\n','Im[DFT(I5)]');
disp(round((imag(y) * 10^4)*10^(-4)));
```

Output:

Re[I5]:

1	0	-1	-1	0	1	1	0
0	-1	-1	0	1	1	0	-1
-1	-1	0	1	1	0	-1	0
-1	0	1	1	0	-1	0	1
0	1	1	0	-1	0	1	1
1	1	0	-1	0	1	1	0
1	0	-1	0	1	1	0	-1
0	-1	0	1	1	0	-1	-1

Im[I5]:

0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0

Re[DFT(I5)]:

1	0	-1	3	2	3	-1	0
0	0	-3	5	2	2	1	1
-1	-3	-12	14	5	2	2	1
3	5	14	-12	-3	-2	2	2
2	2	5	-3	-1	-3	5	2
3	2	2	-2	-3	-12	14	5
-1	1	2	2	5	14	-12	-3
0	1	1	2	2	5	-3	0

Im[DFT(I5)]:

0	1	3	-2	0	2	-3	-1
1	1	3	-2	1	3	-2	0
3	3	5	0	3	5	0	2
-2	-2	0	-4	-2	0	-5	-3
0	1	3	-2	0	2	-3	-1
2	3	5	0	2	4	0	2
-3	-2	0	-5	-3	0	-5	-3
-1	0	2	-3	-1	2	-3	-1

%Problem 6 for camera.bin Image

```
clc;  
fidcamera = fopen('camera.bin','r');  
[camera,junk] = fread(fidcamera,[256,256],'uchar');
```

% to display camera image

```
camera = camera'; % for trasnpose of the image  
subplot(2,3,1);colormap(gray(256));  
image(camera);  
title('Original camera Image');  
I1=camera;
```

```
cdft=fftshift(fft2(I1));
```

%real part of centered dft

```
subplot(2,3,2);  
imshow(real(cdft));  
title('Real part centered DFT');
```

%imaginary part of centered dft

```
subplot(2,3,3);  
imshow(imag(cdft));  
title('Imaginary part centered DFT');
```

%full scale contrast stretch

```
h=sum(hist(cdft,0:255));  
A=min(min(abs(cdft)));  
B=max(max(abs(cdft)));
```

```
k=256;  
J=zeros(256,256);  
for m=1:256  
for n=1:256  
J(m,n)=(((k-1)/(B-A))*(cdft(m,n)-A));  
end  
end
```

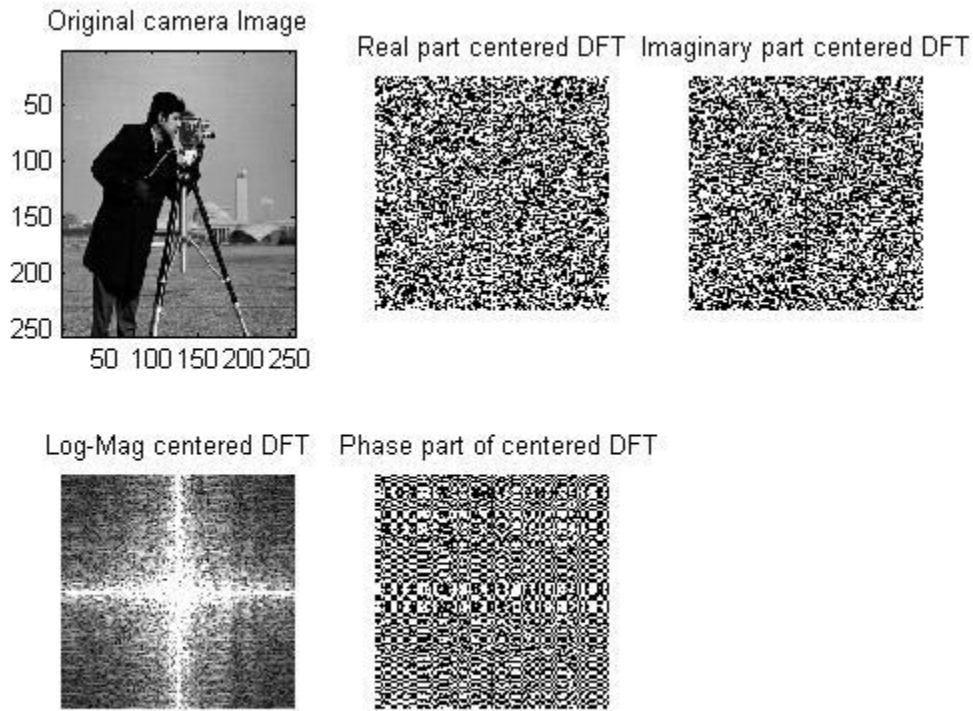
%log-magnitude of the centered dft

```
magn=sqrt(real(J)*real(J)+imag(J)*imag(J));  
lmagn=log(1+abs(magn));  
subplot(2,3,4);  
imshow(lmagn);  
title('Log-Mag centered DFT')
```

%phase of the centered dft

```
ph=atand(imag(J)/real(J));  
subplot(2,3,5);  
imshow(ph);  
title(' Phase part of centered DFT');
```

Output:



%Problem 6 for eyeR.bin Image

```
clc;
```

```
fideyeR = fopen('eyeR.bin','r');
```

```
[eyeR,junk] = fread(fideyeR,[256,256],'uchar');
```

% to display eyeR image

```
eyeR = eyeR'; % for trasnpose of the image
```

```
subplot(2,3,1);colormap(gray(256));
```

```
image(eyeR);
```

```
title('Original eyeR Image');
```

```
l1=eyeR;
```

```
cdft=fftshift(fft2(l1));
```

%real part of centered dft

```
subplot(2,3,2);
```

```
imshow(real(cdft));
```

```
title('Real part centered DFT');
```

%imaginary part of centered dft

```
subplot(2,3,3);
```

```
imshow(imag(cdft));
```

```
title('Imaginary part centered DFT');
```

%full scale contrast stretch

```
h=sum(hist(cdft,0:255));
```

```
A=min(min(abs(cdft)));
```

```
B=max(max(abs(cdft)));
```

```

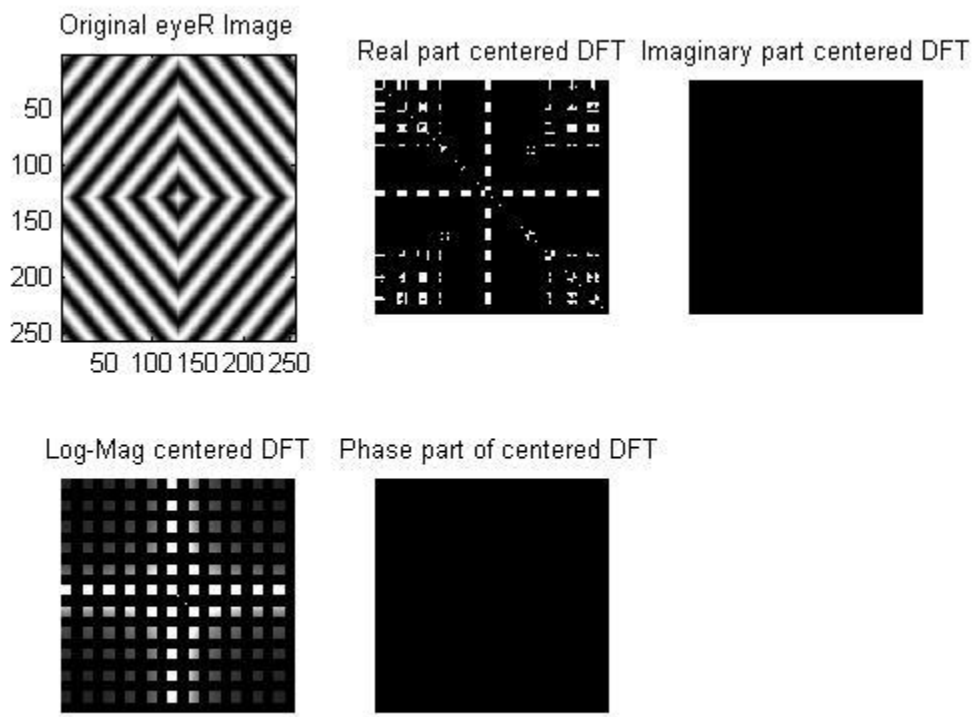
k=256;
J=zeros(256,256);
for m=1:256
for n=1:256
J(m,n)=(((k-1)/(B-A))*(cdft(m,n)-A));
end
end

%log-magnitude of the centered dft
magn=sqrt(real(J)*real(J)+imag(J)*imag(J));
lmagn=log(1+abs(magn));
subplot(2,3,4);
imshow(lmagn);
title('Log-Mag centered DFT')

%phase of the centered dft
ph=atand(imag(J)/real(J));
subplot(2,3,5);
imshow(ph);
title(' Phase part of centered DFT');

```

Output Images:



%Problem 6 for salesman.bin Image

```
clc;  
fidsalesman = fopen('salesman.bin','r');  
[salesman,junk] = fread(fidsalesman,[256,256],'uchar');
```

% to display salesman image

```
salesman = salesman' ; % for trasnpose of the image  
subplot(2,3,1);colormap(gray(256));  
image(salesman);  
title('Original salesman Image');  
I1=salesman;
```

```
cdft=fftshift(fft2(I1));
```

%real part of centered dft

```
subplot(2,3,2);  
imshow(real(cdft));  
title('Real part centered DFT');
```

%imaginary part of centered dft

```
subplot(2,3,3);  
imshow(imag(cdft));  
title('Imaginary part centered DFT');
```

%full scale contrast stretch

```
h=sum(hist(cdft,0:255)');  
A=min(min(abs(cdft)));  
B=max(max(abs(cdft)));
```

```
k=256;  
J=zeros(256,256);  
for m=1:256  
for n=1:256  
J(m,n)=(((k-1)/(B-A))*(cdft(m,n)-A));  
end  
end
```

%log-magnitude of the centered dft

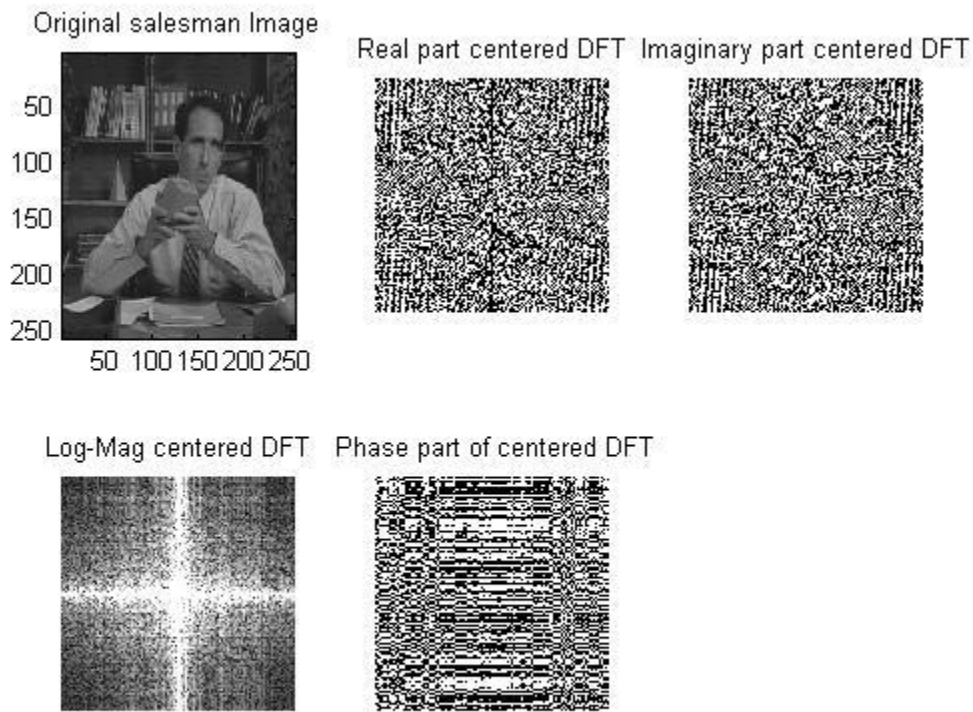
```
magn=sqrt(real(J)*real(J)+imag(J)*imag(J));  
Imagn=log(1+abs(magn));  
subplot(2,3,4);  
imshow(Imagn);  
title('Log-Mag centered DFT')
```

%phase of the centered dft

```
ph=atand(imag(J)/real(J));  
subplot(2,3,5);  
imshow(ph);  
title(' Phase part of centered DFT');
```



Output Images:



%problem 6 for head.bin Image

```
clc;  
fidhead = fopen('head.bin','r');  
[head,junk] = fread(fidhead,[256,256],'uchar');
```

% to display head image

```
head = head'; % for trasnpose of the image  
subplot(2,3,1);colormap(gray(256));  
image(head);  
title('Original head Image');  
I1=head;
```

```
cdft=fftshift(fft2(I1));
```

%real part of centered dft

```
subplot(2,3,2);  
imshow(real(cdft));  
title('Real part centered DFT');
```

%imaginary part of centered dft

```
subplot(2,3,3);  
imshow(imag(cdft));  
title('Imaginary part centered DFT');
```

%full scale contrast stretch

```
h=sum(hist(cdft,0:255));  
A=min(min(abs(cdft)));  
B=max(max(abs(cdft)));
```

```

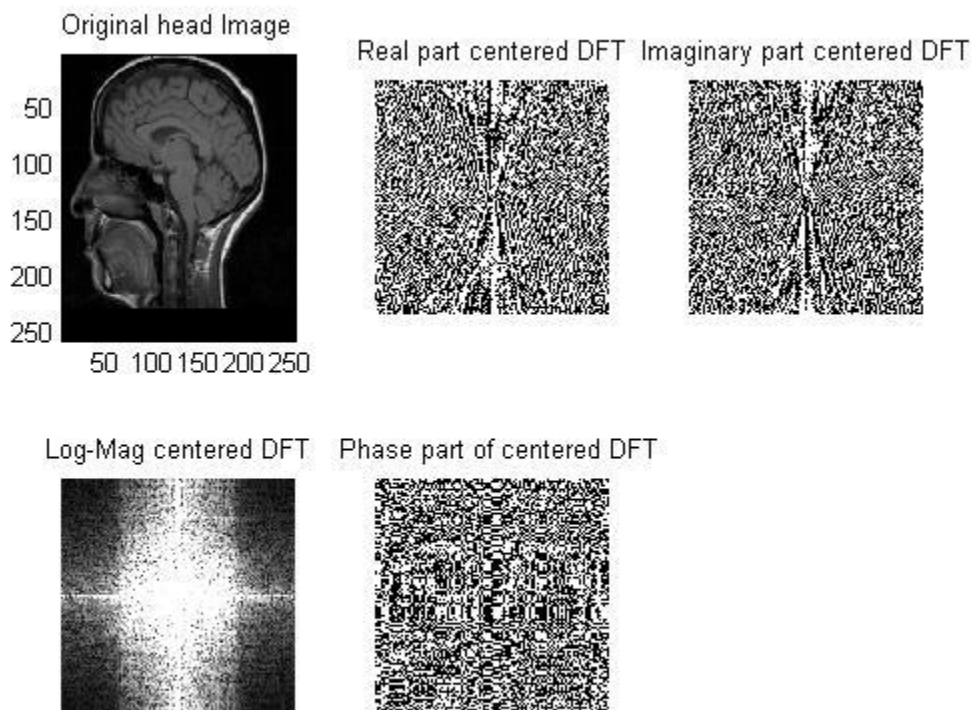
k=256;
J=zeros(256,256);
for m=1:256
for n=1:256
J(m,n)=(((k-1)/(B-A))*(cdft(m,n)-A));
end
end

%log-magnitude of the centered dft
magn=sqrt(real(J)*real(J)+imag(J)*imag(J));
lmagn=log(1+abs(magn));
subplot(2,3,4);
imshow(lmagn);
title('Log-Mag centered DFT')

%phase of the centered dft
ph=atand(imag(J)/real(J));
subplot(2,3,5);
imshow(ph);
title(' Phase part of centered DFT');

```

Output Images:



### %Problem7

```
clc;
fidcamera = fopen('camera.bin','r');
[camera,junk] = fread(fidcamera,[256,256],'uchar');
```

### % to display camera image

```
camera = camera' ; % for trasnpose of the image
subplot(2,2,1);colormap(gray(256));
image(camera);
title('Original camera Image');
I1=camera;
```

```
cdft=fftshift(fft2(I1));
```

### %new image J1

#### %magnitude of the centered dft

```
absJ1=abs(cdft);
argJ1=0;
k=round(absJ1*exp(1i*argJ1));
J1=ifft2(k);
subplot(2,2,2);
imshow(J1);
title('Image J1');
%full scale contrast stretch
h=sum(hist(J1,0:255));
A=min(min(abs(J1)));
B=max(max(abs(J1)));
```

```
k=256;
J=zeros(256,256);
for m=1:256
for n=1:256
J(m,n)=(((k-1)/(B-A))*(J1(m,n)-A));
end
end
```

### %log-magnitude of J1

```
Imagn=log(J);
subplot(2,2,2);
imshow(Imagn);
title('Image J1 after log')
```

### %new image J2

#### %phase of the centered dft

```
argJ2=atand(imag(cdft)/real(cdft));
absJ2=1;
J2=absJ2*(exp(1i*argJ2));
finJ2=ifft2(J2);
```

**%full scale contrast stretch**

```
h=sum(hist(finJ2,0:255)');
```

```
A=min(min(abs(finJ2)));
```

```
B=max(max(abs(finJ2)));
```

```
k=256;
```

```
J=zeros(256,256);
```

```
for m=1:256
```

```
for n=1:256
```

```
J(m,n)=(((k-1)/(B-A))*(finJ2(m,n)-A));
```

```
end
```

```
end
```

```
subplot(2,2,3);
```

```
imshow(J);
```

```
title('image J2');
```

Output Images:

