

بنام خدا

حل تکلیف شماره ۳ پردازش تصویر و بینایی ماشین

حل مسئله ۱ :

% problem-1

```
close all hidden;
clear all;
clc;

a=imread('egg1.gif');
figure(1);imshow(a);title('EGG');

s=strel('disk',1);
b=imopen(a,s);
b=imclose(b,s);

b=medfilt2(b,[5 5]);

figure(2);imshow(b);title('EGG after removing small freckles');
```

Problem 2:

```
close all hidden;
clear all;
clc;

%%%%%%%%%%%%% NOTICE %%%%%%%%%%%%%%
%in this question "barbara" picture has been replaced by
"barbara" picture%

a=imread('cameraman.tif');
figure(1);imshow(a);title('cameraman');
b=imread('barbara.gif');
figure(2);imshow(b);title('barbara');

a1 = imnoise(a,'salt & pepper');
figure(3);imshow(a1);title('salt & pepper noise');
b1 = imnoise(b,'salt & pepper');
figure(4);imshow(b1);title('salt & pepper noise');
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a2 = imnoise(a, 'gaussian');
figure(5);imshow(a2);title('gaussian noise');
b2 = imnoise(b, 'gaussian');
figure(6);imshow(b2);title('gaussian noise');

%%%%% cameraman with salt & pepper noise and average filter
%%%%%

h1=fspecial('average',[3 3]);
h2=fspecial('average',[5 5]);
h3=fspecial('average',[7 7]);

a3=imfilter(a1,h1,'replicate');
a4=imfilter(a1,h2,'replicate');
a5=imfilter(a1,h3,'replicate');

x=double(a);
x1=double(a1);
x3=double(a3);
x4=double(a4);
x5=double(a5);

[m,n]=size(x);

numerator1=0;
numerator3=0;
numerator4=0;
numerator5=0;

for i=1:m;
    for j=1:n;
        numerator1=numerator1+((abs(x(i,j))-x1(i,j)))^2);
        numerator3=numerator3+((abs(x(i,j))-x3(i,j)))^2);
        numerator4=numerator4+((abs(x(i,j))-x4(i,j)))^2);
        numerator5=numerator5+((abs(x(i,j))-x5(i,j)))^2);
    end
end

MSE1=round(numerator1/(m*n));
MSE3=round(numerator3/(m*n));
MSE4=round(numerator4/(m*n));
MSE5=round(numerator5/(m*n));

PSNR1=round(10*(log10((255^2)/MSE1)));
PSNR3=round(10*(log10((255^2)/MSE3)));
PSNR4=round(10*(log10((255^2)/MSE4)));

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```

PSNR5=round(10*(log10((255^2)/MSE5)));

x1=uint8(x1);
x3=uint8(x3);
x4=uint8(x4);
x5=uint8(x5);

z1=num2str(PSNR1);
z3=num2str(PSNR3);
z4=num2str(PSNR4);
z5=num2str(PSNR5);
y1=char('    PSNR=');

figure(7);
subplot(2,2,1);imshow(x1);title((strcat('cameraman with salt &
pepper noise',y1,z1)));
subplot(2,2,2);imshow(x3);title((strcat('3*3 average
filter',y1,z3)));
subplot(2,2,3);imshow(x4);title((strcat('5*5 average
filter',y1,z4)));
subplot(2,2,4);imshow(x5);title((strcat('7*7 average
filter',y1,z5)));

%%%% barbara with salt & pepper noise and average filter %%%%

b3=imfilter(b1,h1,'replicate');
b4=imfilter(b1,h2,'replicate');
b5=imfilter(b1,h3,'replicate');

x=double(b);
x1=double(b1);
x3=double(b3);
x4=double(b4);
x5=double(b5);

[m,n]=size(x);

numerator1=0;
numerator3=0;
numerator4=0;
numerator5=0;

for i=1:m;

```

```

    for j=1:n;
        numerator1=numerator1+((abs(x(i,j))-x1(i,j)))^2);
        numerator3=numerator3+((abs(x(i,j))-x3(i,j)))^2);
        numerator4=numerator4+((abs(x(i,j))-x4(i,j)))^2);
        numerator5=numerator5+((abs(x(i,j))-x5(i,j)))^2);
    end
end

MSE1=round(numerator1/(m*n));
MSE3=round(numerator3/(m*n));
MSE4=round(numerator4/(m*n));
MSE5=round(numerator5/(m*n));

PSNR1=round(10*(log10((255^2)/MSE1)));
PSNR3=round(10*(log10((255^2)/MSE3)));
PSNR4=round(10*(log10((255^2)/MSE4)));
PSNR5=round(10*(log10((255^2)/MSE5)));

x1=uint8(x1);
x3=uint8(x3);
x4=uint8(x4);
x5=uint8(x5);

z1=num2str(PSNR1);
z3=num2str(PSNR3);
z4=num2str(PSNR4);
z5=num2str(PSNR5);
y1=char('    PSNR=');

figure(8);
subplot(2,2,1);imshow(x1);title((strcat('barbara with salt &
pepper noise',y1,z1)));
subplot(2,2,2);imshow(x3);title((strcat('3*3 average
filter',y1,z3)));
subplot(2,2,3);imshow(x4);title((strcat('5*5 average
filter',y1,z4)));
subplot(2,2,4);imshow(x5);title((strcat('7*7 average
filter',y1,z5)));

%%%% cameraman with salt & pepper noise and median filter %%%%

a3=medfilt2(a1,[3 3]);
a4=medfilt2(a1,[5 5]);
a5=medfilt2(a1,[7 7]);

```

```

x=double(a);
x1=double(a1);
x3=double(a3);
x4=double(a4);
x5=double(a5);

[m,n]=size(x);

numerator1=0;
numerator3=0;
numerator4=0;
numerator5=0;

for i=1:m;
    for j=1:n;
        numerator1=numerator1+((abs(x(i,j))-x1(i,j)))^2);
        numerator3=numerator3+((abs(x(i,j))-x3(i,j)))^2);
        numerator4=numerator4+((abs(x(i,j))-x4(i,j)))^2);
        numerator5=numerator5+((abs(x(i,j))-x5(i,j)))^2);
    end
end

MSE1=round(numerator1/(m*n));
MSE3=round(numerator3/(m*n));
MSE4=round(numerator4/(m*n));
MSE5=round(numerator5/(m*n));

PSNR1=round(10*(log10((255^2)/MSE1)));
PSNR3=round(10*(log10((255^2)/MSE3)));
PSNR4=round(10*(log10((255^2)/MSE4)));
PSNR5=round(10*(log10((255^2)/MSE5)));

x1=uint8(x1);
x3=uint8(x3);
x4=uint8(x4);
x5=uint8(x5);

z1=num2str(PSNR1);
z3=num2str(PSNR3);
z4=num2str(PSNR4);
z5=num2str(PSNR5);
y1=char('    PSNR=');

figure(9);
subplot(2,2,1);imshow(x1);title((strcat('cameraman with salt &
pepper noise',y1,z1)));

```

```

subplot(2,2,2);imshow(x3);title((strcat('3*3 median
filter',y1,z3)));
subplot(2,2,3);imshow(x4);title((strcat('5*5 median
filter',y1,z4)));
subplot(2,2,4);imshow(x5);title((strcat('7*7 median
filter',y1,z5)));

%%%%% barbara with salt & pepper noise and median filter %%%%%

b3=medfilt2(b1,[3 3]);
b4=medfilt2(b1,[5 5]);
b5=medfilt2(b1,[7 7]);

x=double(b);
x1=double(b1);
x3=double(b3);
x4=double(b4);
x5=double(b5);

[m,n]=size(x);

numerator1=0;
numerator3=0;
numerator4=0;
numerator5=0;

for i=1:m;
    for j=1:n;
        numerator1=numerator1+((abs(x(i,j))-x1(i,j)))^2);
        numerator3=numerator3+((abs(x(i,j))-x3(i,j)))^2);
        numerator4=numerator4+((abs(x(i,j))-x4(i,j)))^2);
        numerator5=numerator5+((abs(x(i,j))-x5(i,j)))^2);
    end
end

MSE1=round(numerator1/(m*n));
MSE3=round(numerator3/(m*n));
MSE4=round(numerator4/(m*n));
MSE5=round(numerator5/(m*n));

PSNR1=round(10*(log10((255^2)/MSE1)));
PSNR3=round(10*(log10((255^2)/MSE3)));
PSNR4=round(10*(log10((255^2)/MSE4)));
PSNR5=round(10*(log10((255^2)/MSE5)));

```

```

x1=uint8(x1);
x3=uint8(x3);
x4=uint8(x4);
x5=uint8(x5);

z1=num2str(PSNR1);
z3=num2str(PSNR3);
z4=num2str(PSNR4);
z5=num2str(PSNR5);
y1=char('    PSNR=');

figure(10);
subplot(2,2,1);imshow(x1);title(strcat('barbara with salt &
pepper noise',y1,z1));
subplot(2,2,2);imshow(x3);title((strcat('3*3 median
filter',y1,z3)));
subplot(2,2,3);imshow(x4);title((strcat('5*5 median
filter',y1,z4)));
subplot(2,2,4);imshow(x5);title((strcat('7*7 median
filter',y1,z5)));

%%% cameraman with salt & pepper noise and gaussian filter
%%%

h1=fspecial('gaussian',5,.3);
h2=fspecial('gaussian',5,.6);
h3=fspecial('gaussian',5,.9);

a3=imfilter(a1,h1,'replicate');
a4=imfilter(a1,h2,'replicate');
a5=imfilter(a1,h3,'replicate');

x=double(a);
x1=double(a1);
x3=double(a3);
x4=double(a4);
x5=double(a5);

[m,n]=size(x);

numerator1=0;
numerator3=0;
numerator4=0;
numerator5=0;

for i=1:m;

```

```

    for j=1:n;
        numerator1=numerator1+((abs(x(i,j))-x1(i,j)))^2);
        numerator3=numerator3+((abs(x(i,j))-x3(i,j)))^2);
        numerator4=numerator4+((abs(x(i,j))-x4(i,j)))^2);
        numerator5=numerator5+((abs(x(i,j))-x5(i,j)))^2);
    end
end

MSE1=round(numerator1/(m*n));
MSE3=round(numerator3/(m*n));
MSE4=round(numerator4/(m*n));
MSE5=round(numerator5/(m*n));

PSNR1=round(10*(log10((255^2)/MSE1)));
PSNR3=round(10*(log10((255^2)/MSE3)));
PSNR4=round(10*(log10((255^2)/MSE4)));
PSNR5=round(10*(log10((255^2)/MSE5)));

x1=uint8(x1);
x3=uint8(x3);
x4=uint8(x4);
x5=uint8(x5);

z1=num2str(PSNR1);
z3=num2str(PSNR3);
z4=num2str(PSNR4);
z5=num2str(PSNR5);
y1=char('    PSNR=');

figure(11);
subplot(2,2,1);imshow(x1);title(strcat('cameraman with salt &
pepper noise ',y1,z1));
subplot(2,2,2);imshow(x3);title(strcat(' 5*5 gaussian filter
with sigma=.3',y1,z3));
subplot(2,2,3);imshow(x4);title(strcat(' 5*5 gaussian filter
with sigma=.6',y1,z4));
subplot(2,2,4);imshow(x5);title(strcat(' 5*5 gaussian filter
with sigma=.9',y1,z5));

%%%% barbara with salt & pepper noise and gaussian filter %%%%

b3=imfilter(b1,h1,'replicate');
b4=imfilter(b1,h2,'replicate');
b5=imfilter(b1,h3,'replicate');

```



```

x=double(b);
x1=double(b1);
x3=double(b3);
x4=double(b4);
x5=double(b5);

[m,n]=size(x);

numerator1=0;
numerator3=0;
numerator4=0;
numerator5=0;

for i=1:m;
    for j=1:n;
        numerator1=numerator1+((abs(x(i,j))-x1(i,j)))^2);
        numerator3=numerator3+((abs(x(i,j))-x3(i,j)))^2);
        numerator4=numerator4+((abs(x(i,j))-x4(i,j)))^2);
        numerator5=numerator5+((abs(x(i,j))-x5(i,j)))^2);
    end
end

MSE1=round(numerator1/(m*n));
MSE3=round(numerator3/(m*n));
MSE4=round(numerator4/(m*n));
MSE5=round(numerator5/(m*n));

PSNR1=round(10*(log10((255^2)/MSE1)));
PSNR3=round(10*(log10((255^2)/MSE3)));
PSNR4=round(10*(log10((255^2)/MSE4)));
PSNR5=round(10*(log10((255^2)/MSE5)));

x1=uint8(x1);
x3=uint8(x3);
x4=uint8(x4);
x5=uint8(x5);

z1=num2str(PSNR1);
z3=num2str(PSNR3);
z4=num2str(PSNR4);
z5=num2str(PSNR5);
y1=char('    PSNR=');

figure(12);
subplot(2,2,1);imshow(x1);title(strcat('barbara with salt &
pepper noise ',y1,z1));

```

```

subplot(2,2,2);imshow(x3);title(strcat(' 5*5 gaussian filter
with sigma=.3',y1,z3));
subplot(2,2,3);imshow(x4);title(strcat(' 5*5 gaussian filter
with sigma=.6',y1,z4));
subplot(2,2,4);imshow(x5);title(strcat(' 5*5 gaussian filter
with sigma=.9',y1,z5));

```

```

%%%%% cameraman with gaussian noise and average filter %%%%%

```

```

h1=fspecial('average',[3 3]);
h2=fspecial('average',[5 5]);
h3=fspecial('average',[7 7]);

```

```

a1=a2;
b1=b2;

```

```

a3=imfilter(a1,h1,'replicate');
a4=imfilter(a1,h2,'replicate');
a5=imfilter(a1,h3,'replicate');

```

```

x=double(a);
x1=double(a1);
x3=double(a3);
x4=double(a4);
x5=double(a5);

```

```

[m,n]=size(x);

```

```

numerator1=0;
numerator3=0;
numerator4=0;
numerator5=0;

```

```

for i=1:m;
    for j=1:n;
        numerator1=numerator1+((abs(x(i,j))-x1(i,j)))^2);
        numerator3=numerator3+((abs(x(i,j))-x3(i,j)))^2);
        numerator4=numerator4+((abs(x(i,j))-x4(i,j)))^2);
        numerator5=numerator5+((abs(x(i,j))-x5(i,j)))^2);
    end
end

```

```

MSE1=round(numerator1/(m*n));
MSE3=round(numerator3/(m*n));
MSE4=round(numerator4/(m*n));

```

```

MSE5=round(numerator5/(m*n));

PSNR1=round(10*(log10((255^2)/MSE1)));
PSNR3=round(10*(log10((255^2)/MSE3)));
PSNR4=round(10*(log10((255^2)/MSE4)));
PSNR5=round(10*(log10((255^2)/MSE5)));

x1=uint8(x1);
x3=uint8(x3);
x4=uint8(x4);
x5=uint8(x5);

z1=num2str(PSNR1);
z3=num2str(PSNR3);
z4=num2str(PSNR4);
z5=num2str(PSNR5);
y1=char('    PSNR=');

figure(11);
subplot(2,2,1);imshow(x1);title((strcat('cameraman with gaussian
noise',y1,z1)));
subplot(2,2,2);imshow(x3);title((strcat('3*3 average
filter',y1,z3)));
subplot(2,2,3);imshow(x4);title((strcat('5*5 average
filter',y1,z4)));
subplot(2,2,4);imshow(x5);title((strcat('7*7 average
filter',y1,z5)));

%%%% barbara with gaussian noise and average filter %%%%

b3=imfilter(b1,h1,'replicate');
b4=imfilter(b1,h2,'replicate');
b5=imfilter(b1,h3,'replicate');

x=double(b);
x1=double(b1);
x3=double(b3);
x4=double(b4);
x5=double(b5);

[m,n]=size(x);

numerator1=0;
numerator3=0;

```

```

numerator4=0;
numerator5=0;

for i=1:m;
    for j=1:n;
        numerator1=numerator1+((abs(x(i,j))-x1(i,j)))^2);
        numerator3=numerator3+((abs(x(i,j))-x3(i,j)))^2);
        numerator4=numerator4+((abs(x(i,j))-x4(i,j)))^2);
        numerator5=numerator5+((abs(x(i,j))-x5(i,j)))^2);
    end
end

MSE1=round(numerator1/(m*n));
MSE3=round(numerator3/(m*n));
MSE4=round(numerator4/(m*n));
MSE5=round(numerator5/(m*n));

PSNR1=round(10*(log10((255^2)/MSE1)));
PSNR3=round(10*(log10((255^2)/MSE3)));
PSNR4=round(10*(log10((255^2)/MSE4)));
PSNR5=round(10*(log10((255^2)/MSE5)));

x1=uint8(x1);
x3=uint8(x3);
x4=uint8(x4);
x5=uint8(x5);

z1=num2str(PSNR1);
z3=num2str(PSNR3);
z4=num2str(PSNR4);
z5=num2str(PSNR5);
y1=char('    PSNR=');

figure(13);
subplot(2,2,1);imshow(x1);title((strcat('barbara with with
gaussian noise',y1,z1)));
subplot(2,2,2);imshow(x3);title((strcat('3*3 average
filter',y1,z3)));
subplot(2,2,3);imshow(x4);title((strcat('5*5 average
filter',y1,z4)));
subplot(2,2,4);imshow(x5);title((strcat('7*7 average
filter',y1,z5)));

%%% cameraman with gaussian noise and median filter %%%

```

```

a3=medfilt2(a1,[3 3]);
a4=medfilt2(a1,[5 5]);
a5=medfilt2(a1,[7 7]);

x=double(a);
x1=double(a1);
x3=double(a3);
x4=double(a4);
x5=double(a5);

[m,n]=size(x);

numerator1=0;
numerator3=0;
numerator4=0;
numerator5=0;

for i=1:m;
    for j=1:n;
        numerator1=numerator1+((abs(x(i,j))-x1(i,j)))^2);
        numerator3=numerator3+((abs(x(i,j))-x3(i,j)))^2);
        numerator4=numerator4+((abs(x(i,j))-x4(i,j)))^2);
        numerator5=numerator5+((abs(x(i,j))-x5(i,j)))^2);
    end
end

MSE1=round(numerator1/(m*n));
MSE3=round(numerator3/(m*n));
MSE4=round(numerator4/(m*n));
MSE5=round(numerator5/(m*n));

PSNR1=round(10*(log10((255^2)/MSE1)));
PSNR3=round(10*(log10((255^2)/MSE3)));
PSNR4=round(10*(log10((255^2)/MSE4)));
PSNR5=round(10*(log10((255^2)/MSE5)));

x1=uint8(x1);
x3=uint8(x3);
x4=uint8(x4);
x5=uint8(x5);

z1=num2str(PSNR1);
z3=num2str(PSNR3);
z4=num2str(PSNR4);
z5=num2str(PSNR5);
y1=char('    PSNR=');

```

```

figure(14);
subplot(2,2,1);imshow(x1);title((strcat('cameraman with gaussian
noise',y1,z1)));
subplot(2,2,2);imshow(x3);title((strcat('3*3 median
filter',y1,z3)));
subplot(2,2,3);imshow(x4);title((strcat('5*5 median
filter',y1,z4)));
subplot(2,2,4);imshow(x5);title((strcat('7*7 median
filter',y1,z5)));

```

```

%% barbara with gaussian noise and median filter %%

```

```

b3=medfilt2(b1,[3 3]);
b4=medfilt2(b1,[5 5]);
b5=medfilt2(b1,[7 7]);

```

```

x=double(b);
x1=double(b1);
x3=double(b3);
x4=double(b4);
x5=double(b5);

```

```

[m,n]=size(x);

```

```

numerator1=0;
numerator3=0;
numerator4=0;
numerator5=0;

```

```

for i=1:m;
    for j=1:n;
        numerator1=numerator1+((abs(x(i,j))-x1(i,j)))^2);
        numerator3=numerator3+((abs(x(i,j))-x3(i,j)))^2);
        numerator4=numerator4+((abs(x(i,j))-x4(i,j)))^2);
        numerator5=numerator5+((abs(x(i,j))-x5(i,j)))^2);
    end
end

```

```

MSE1=round(numerator1/(m*n));
MSE3=round(numerator3/(m*n));
MSE4=round(numerator4/(m*n));
MSE5=round(numerator5/(m*n));

```

```

PSNR1=round(10*(log10((255^2)/MSE1)));
PSNR3=round(10*(log10((255^2)/MSE3)));

```

```

PSNR4=round(10*(log10((255^2)/MSE4)));
PSNR5=round(10*(log10((255^2)/MSE5)));

x1=uint8(x1);
x3=uint8(x3);
x4=uint8(x4);
x5=uint8(x5);

z1=num2str(PSNR1);
z3=num2str(PSNR3);
z4=num2str(PSNR4);
z5=num2str(PSNR5);
y1=char('    PSNR=');

figure(15);
subplot(2,2,1);imshow(x1);title((strcat('barbara with gaussian
noise',y1,z1)));
subplot(2,2,2);imshow(x3);title((strcat('3*3 median
filter',y1,z3)));
subplot(2,2,3);imshow(x4);title((strcat('5*5 median
filter',y1,z4)));
subplot(2,2,4);imshow(x5);title((strcat('7*7 median
filter',y1,z5)))

%%%% cameraman with gaussian noise and gaussian filter %%%%

h1=fspecial('gaussian',5,.3);
h2=fspecial('gaussian',5,.6);
h3=fspecial('gaussian',5,.9);

a3=imfilter(a1,h1,'replicate');
a4=imfilter(a1,h2,'replicate');
a5=imfilter(a1,h3,'replicate');

x=double(a);
x1=double(a1);
x3=double(a3);
x4=double(a4);
x5=double(a5);

[m,n]=size(x);

numerator1=0;
numerator3=0;
numerator4=0;

```

```

numerator5=0;

for i=1:m;
    for j=1:n;
        numerator1=numerator1+((abs(x(i,j)-x1(i,j)))^2);
        numerator3=numerator3+((abs(x(i,j)-x3(i,j)))^2);
        numerator4=numerator4+((abs(x(i,j)-x4(i,j)))^2);
        numerator5=numerator5+((abs(x(i,j)-x5(i,j)))^2);
    end
end

MSE1=round(numerator1/(m*n));
MSE3=round(numerator3/(m*n));
MSE4=round(numerator4/(m*n));
MSE5=round(numerator5/(m*n));

PSNR1=round(10*(log10((255^2)/MSE1)));
PSNR3=round(10*(log10((255^2)/MSE3)));
PSNR4=round(10*(log10((255^2)/MSE4)));
PSNR5=round(10*(log10((255^2)/MSE5)));

x1=uint8(x1);
x3=uint8(x3);
x4=uint8(x4);
x5=uint8(x5);

z1=num2str(PSNR1);
z3=num2str(PSNR3);
z4=num2str(PSNR4);
z5=num2str(PSNR5);
y1=char('    PSNR=');

figure(16);
subplot(2,2,1);imshow(x1);title(strcat('cameraman with gaussian
noise ',y1,z1));
subplot(2,2,2);imshow(x3);title(strcat(' 5*5 gaussian filter
with sigma=.3',y1,z3));
subplot(2,2,3);imshow(x4);title(strcat(' 5*5 gaussian filter
with sigma=.6',y1,z4));
subplot(2,2,4);imshow(x5);title(strcat(' 5*5 gaussian filter
with sigma=.9',y1,z5));

%%% barbara with gaussian noise and gaussian filter %%%%

b3=imfilter(b1,h1,'replicate');

```



```

b4=imfilter(b1,h2,'replicate');
b5=imfilter(b1,h3,'replicate');

x=double(b);
x1=double(b1);
x3=double(b3);
x4=double(b4);
x5=double(b5);

[m,n]=size(x);

numerator1=0;
numerator3=0;
numerator4=0;
numerator5=0;

for i=1:m;
    for j=1:n;
        numerator1=numerator1+((abs(x(i,j))-x1(i,j)))^2);
        numerator3=numerator3+((abs(x(i,j))-x3(i,j)))^2);
        numerator4=numerator4+((abs(x(i,j))-x4(i,j)))^2);
        numerator5=numerator5+((abs(x(i,j))-x5(i,j)))^2);
    end
end

MSE1=round(numerator1/(m*n));
MSE3=round(numerator3/(m*n));
MSE4=round(numerator4/(m*n));
MSE5=round(numerator5/(m*n));

PSNR1=round(10*(log10((255^2)/MSE1)));
PSNR3=round(10*(log10((255^2)/MSE3)));
PSNR4=round(10*(log10((255^2)/MSE4)));
PSNR5=round(10*(log10((255^2)/MSE5)));

x1=uint8(x1);
x3=uint8(x3);
x4=uint8(x4);
x5=uint8(x5);

z1=num2str(PSNR1);
z3=num2str(PSNR3);
z4=num2str(PSNR4);
z5=num2str(PSNR5);
y1=char('    PSNR=');

figure(17);

```

```
subplot(2,2,1);imshow(x1);title(strcat('barbara with gaussian  
noise ',y1,z1));  
subplot(2,2,2);imshow(x3);title(strcat(' 5*5 gaussian filter  
with sigma=.3',y1,z3));  
subplot(2,2,3);imshow(x4);title(strcat(' 5*5 gaussian filter  
with sigma=.6',y1,z4));  
subplot(2,2,4);imshow(x5);title(strcat(' 5*5 gaussian filter  
with sigma=.9',y1,z5));
```

% problem-2

```
close all hidden;  
clear all;  
clc;
```

```
a=imread('baboon.tif');  
figure(1);imshow(a);title('baboon');  
a=double(a);
```

```
w4=[0 1 0;1 -4 1;0 1 0];  
w8=[1 1 1;1 -8 1;1 1 1];
```

```
a1=imfilter(a,w4,'replicate');  
a2=a-a1;  
a2=uint8(a2);  
figure(2);imshow(a2);title('sharp baboon');
```

```
a1=imfilter(a,w8,'replicate');  
a2=a-a1;  
a2=uint8(a2);  
figure(3);imshow(a2);title('sharper baboon');
```

```
*****
```

% problem-3

```
close all hidden;
clear all;
clc;

a=imread('cameraman.tif');
figure(1);imshow(a);title('cameraman');
b=imread('barbara.gif');
figure(2);imshow(b);title('barbara');

a1 = imnoise(a,'salt & pepper');
figure(3);imshow(a1);title('salt & pepper noise');
b1 = imnoise(b,'salt & pepper');
figure(4);imshow(b1);title('salt & pepper noise');

a2 = imnoise(a,'gaussian');
figure(5);imshow(a2);title('gaussian noise');
b2 = imnoise(b,'gaussian');
figure(6);imshow(b2);title('gaussian noise');

%%%%% cameraman with salt & pepper noise and average filter
%%%%%

h1=fspecial('average',[3 3]);
h2=fspecial('average',[5 5]);
h3=fspecial('average',[7 7]);

a3=imfilter(a1,h1,'replicate');
a4=imfilter(a1,h2,'replicate');
a5=imfilter(a1,h3,'replicate');

x=double(a);
x1=double(a1);
x3=double(a3);
x4=double(a4);
x5=double(a5);

[m,n]=size(x);
```

```

numerator1=0;
numerator3=0;
numerator4=0;
numerator5=0;

for i=1:m;
    for j=1:n;
        numerator1=numerator1+((abs(x(i,j)-x1(i,j)))^2);
        numerator3=numerator3+((abs(x(i,j)-x3(i,j)))^2);
        numerator4=numerator4+((abs(x(i,j)-x4(i,j)))^2);
        numerator5=numerator5+((abs(x(i,j)-x5(i,j)))^2);
    end
end

MSE1=round(numerator1/(m*n));
MSE3=round(numerator3/(m*n));
MSE4=round(numerator4/(m*n));
MSE5=round(numerator5/(m*n));

PSNR1=round(10*(log10((255^2)/MSE1)));
PSNR3=round(10*(log10((255^2)/MSE3)));
PSNR4=round(10*(log10((255^2)/MSE4)));
PSNR5=round(10*(log10((255^2)/MSE5)));

x1=uint8(x1);
x3=uint8(x3);
x4=uint8(x4);
x5=uint8(x5);

z1=num2str(PSNR1);
z3=num2str(PSNR3);
z4=num2str(PSNR4);
z5=num2str(PSNR5);
y1=char('    PSNR=');

figure(7);
subplot(2,2,1);imshow(x1);title((strcat('cameraman with salt &
pepper noise',y1,z1)));
subplot(2,2,2);imshow(x3);title((strcat('3*3 average
filter',y1,z3)));
subplot(2,2,3);imshow(x4);title((strcat('5*5 average
filter',y1,z4)));
subplot(2,2,4);imshow(x5);title((strcat('7*7 average
filter',y1,z5)));

```

```
%%%%% barbara with salt & pepper noise and average filter %%%%%
```

```
b3=imfilter(b1,h1,'replicate');  
b4=imfilter(b1,h2,'replicate');  
b5=imfilter(b1,h3,'replicate');
```

```
x=double(b);  
x1=double(b1);  
x3=double(b3);  
x4=double(b4);  
x5=double(b5);
```

```
[m,n]=size(x);
```

```
numerator1=0;  
numerator3=0;  
numerator4=0;  
numerator5=0;
```

```
for i=1:m;  
    for j=1:n;  
        numerator1=numerator1+((abs(x(i,j))-x1(i,j)))^2);  
        numerator3=numerator3+((abs(x(i,j))-x3(i,j)))^2);  
        numerator4=numerator4+((abs(x(i,j))-x4(i,j)))^2);  
        numerator5=numerator5+((abs(x(i,j))-x5(i,j)))^2);  
    end  
end
```

```
MSE1=round(numerator1/(m*n));  
MSE3=round(numerator3/(m*n));  
MSE4=round(numerator4/(m*n));  
MSE5=round(numerator5/(m*n));
```

```
PSNR1=round(10*(log10((255^2)/MSE1)));  
PSNR3=round(10*(log10((255^2)/MSE3)));  
PSNR4=round(10*(log10((255^2)/MSE4)));  
PSNR5=round(10*(log10((255^2)/MSE5)));
```

```
x1=uint8(x1);  
x3=uint8(x3);  
x4=uint8(x4);  
x5=uint8(x5);
```

```
z1=num2str(PSNR1);
```

```

z3=num2str(PSNR3);
z4=num2str(PSNR4);
z5=num2str(PSNR5);
y1=char('    PSNR=');

figure(8);
subplot(2,2,1);imshow(x1);title((strcat('barbara with salt &
pepper noise',y1,z1)));
subplot(2,2,2);imshow(x3);title((strcat('3*3 average
filter',y1,z3)));
subplot(2,2,3);imshow(x4);title((strcat('5*5 average
filter',y1,z4)));
subplot(2,2,4);imshow(x5);title((strcat('7*7 average
filter',y1,z5)));

%%%% cameraman with salt & pepper noise and median filter %%%%

a3=medfilt2(a1,[3 3]);
a4=medfilt2(a1,[5 5]);
a5=medfilt2(a1,[7 7]);

x=double(a);
x1=double(a1);
x3=double(a3);
x4=double(a4);
x5=double(a5);

[m,n]=size(x);

numerator1=0;
numerator3=0;
numerator4=0;
numerator5=0;

for i=1:m;
    for j=1:n;
        numerator1=numerator1+((abs(x(i,j))-x1(i,j)))^2);
        numerator3=numerator3+((abs(x(i,j))-x3(i,j)))^2);
        numerator4=numerator4+((abs(x(i,j))-x4(i,j)))^2);
        numerator5=numerator5+((abs(x(i,j))-x5(i,j)))^2);
    end
end

MSE1=round(numerator1/(m*n));

```

```

MSE3=round(numerator3/(m*n));
MSE4=round(numerator4/(m*n));
MSE5=round(numerator5/(m*n));

PSNR1=round(10*(log10((255^2)/MSE1)));
PSNR3=round(10*(log10((255^2)/MSE3)));
PSNR4=round(10*(log10((255^2)/MSE4)));
PSNR5=round(10*(log10((255^2)/MSE5)));

x1=uint8(x1);
x3=uint8(x3);
x4=uint8(x4);
x5=uint8(x5);

z1=num2str(PSNR1);
z3=num2str(PSNR3);
z4=num2str(PSNR4);
z5=num2str(PSNR5);
y1=char('    PSNR=');

figure(9);
subplot(2,2,1);imshow(x1);title((strcat('cameraman with salt &
pepper noise',y1,z1)));
subplot(2,2,2);imshow(x3);title((strcat('3*3 median
filter',y1,z3)));
subplot(2,2,3);imshow(x4);title((strcat('5*5 median
filter',y1,z4)));
subplot(2,2,4);imshow(x5);title((strcat('7*7 median
filter',y1,z5)));

%%%% barbara with salt & pepper noise and median filter %%%%

b3=medfilt2(b1,[3 3]);
b4=medfilt2(b1,[5 5]);
b5=medfilt2(b1,[7 7]);

x=double(b);
x1=double(b1);
x3=double(b3);
x4=double(b4);
x5=double(b5);

[m,n]=size(x);

numerator1=0;

```



```

numerator3=0;
numerator4=0;
numerator5=0;

for i=1:m;
    for j=1:n;
        numerator1=numerator1+((abs(x(i,j))-x1(i,j)))^2);
        numerator3=numerator3+((abs(x(i,j))-x3(i,j)))^2);
        numerator4=numerator4+((abs(x(i,j))-x4(i,j)))^2);
        numerator5=numerator5+((abs(x(i,j))-x5(i,j)))^2);
    end
end

MSE1=round(numerator1/(m*n));
MSE3=round(numerator3/(m*n));
MSE4=round(numerator4/(m*n));
MSE5=round(numerator5/(m*n));

PSNR1=round(10*(log10((255^2)/MSE1)));
PSNR3=round(10*(log10((255^2)/MSE3)));
PSNR4=round(10*(log10((255^2)/MSE4)));
PSNR5=round(10*(log10((255^2)/MSE5)));

x1=uint8(x1);
x3=uint8(x3);
x4=uint8(x4);
x5=uint8(x5);

z1=num2str(PSNR1);
z3=num2str(PSNR3);
z4=num2str(PSNR4);
z5=num2str(PSNR5);
y1=char('    PSNR=');

figure(10);
subplot(2,2,1);imshow(x1);title(strcat('barbara with salt &
pepper noise',y1,z1));
subplot(2,2,2);imshow(x3);title((strcat('3*3 median
filter',y1,z3)));
subplot(2,2,3);imshow(x4);title((strcat('5*5 median
filter',y1,z4)));
subplot(2,2,4);imshow(x5);title((strcat('7*7 median
filter',y1,z5)));

%%%% cameraman with salt & pepper noise and gaussian filter
%%%%

```

```

h1=fspecial('gaussian',5,.3);
h2=fspecial('gaussian',5,.6);
h3=fspecial('gaussian',5,.9);

a3=imfilter(a1,h1,'replicate');
a4=imfilter(a1,h2,'replicate');
a5=imfilter(a1,h3,'replicate');

x=double(a);
x1=double(a1);
x3=double(a3);
x4=double(a4);
x5=double(a5);

[m,n]=size(x);

numerator1=0;
numerator3=0;
numerator4=0;
numerator5=0;

for i=1:m;
    for j=1:n;
        numerator1=numerator1+((abs(x(i,j))-x1(i,j)))^2);
        numerator3=numerator3+((abs(x(i,j))-x3(i,j)))^2);
        numerator4=numerator4+((abs(x(i,j))-x4(i,j)))^2);
        numerator5=numerator5+((abs(x(i,j))-x5(i,j)))^2);
    end
end

MSE1=round(numerator1/(m*n));
MSE3=round(numerator3/(m*n));
MSE4=round(numerator4/(m*n));
MSE5=round(numerator5/(m*n));

PSNR1=round(10*(log10((255^2)/MSE1)));
PSNR3=round(10*(log10((255^2)/MSE3)));
PSNR4=round(10*(log10((255^2)/MSE4)));
PSNR5=round(10*(log10((255^2)/MSE5)));

x1=uint8(x1);
x3=uint8(x3);
x4=uint8(x4);
x5=uint8(x5);

z1=num2str(PSNR1);

```

```

z3=num2str(PSNR3);
z4=num2str(PSNR4);
z5=num2str(PSNR5);
y1=char('    PSNR=');

figure(11);
subplot(2,2,1);imshow(x1);title(strcat('cameraman with salt &
pepper noise ',y1,z1));
subplot(2,2,2);imshow(x3);title(strcat(' 5*5 gaussian filter
with sigma=.3',y1,z3));
subplot(2,2,3);imshow(x4);title(strcat(' 5*5 gaussian filter
with sigma=.6',y1,z4));
subplot(2,2,4);imshow(x5);title(strcat(' 5*5 gaussian filter
with sigma=.9',y1,z5));

%%%%% barbara with salt & pepper noise and gaussian filter %%%%

b3=imfilter(b1,h1,'replicate');
b4=imfilter(b1,h2,'replicate');
b5=imfilter(b1,h3,'replicate');

x=double(b);
x1=double(b1);
x3=double(b3);
x4=double(b4);
x5=double(b5);

[m,n]=size(x);

numerator1=0;
numerator3=0;
numerator4=0;
numerator5=0;

for i=1:m;
    for j=1:n;
        numerator1=numerator1+((abs(x(i,j))-x1(i,j)))^2);
        numerator3=numerator3+((abs(x(i,j))-x3(i,j)))^2);
        numerator4=numerator4+((abs(x(i,j))-x4(i,j)))^2);
        numerator5=numerator5+((abs(x(i,j))-x5(i,j)))^2);
    end
end

MSE1=round(numerator1/(m*n));
MSE3=round(numerator3/(m*n));

```

```

MSE4=round(numerator4/(m*n));
MSE5=round(numerator5/(m*n));

PSNR1=round(10*(log10((255^2)/MSE1)));
PSNR3=round(10*(log10((255^2)/MSE3)));
PSNR4=round(10*(log10((255^2)/MSE4)));
PSNR5=round(10*(log10((255^2)/MSE5)));

x1=uint8(x1);
x3=uint8(x3);
x4=uint8(x4);
x5=uint8(x5);

z1=num2str(PSNR1);
z3=num2str(PSNR3);
z4=num2str(PSNR4);
z5=num2str(PSNR5);
y1=char('    PSNR=');

figure(12);
subplot(2,2,1);imshow(x1);title(strcat('barbara with salt &
pepper noise ',y1,z1));
subplot(2,2,2);imshow(x3);title(strcat(' 5*5 gaussian filter
with sigma=.3',y1,z3));
subplot(2,2,3);imshow(x4);title(strcat(' 5*5 gaussian filter
with sigma=.6',y1,z4));
subplot(2,2,4);imshow(x5);title(strcat(' 5*5 gaussian filter
with sigma=.9',y1,z5));

%%%% cameraman with gaussian noise and average filter %%%%

h1=fspecial('average',[3 3]);
h2=fspecial('average',[5 5]);
h3=fspecial('average',[7 7]);

a1=a2;
b1=b2;

a3=imfilter(a1,h1,'replicate');
a4=imfilter(a1,h2,'replicate');
a5=imfilter(a1,h3,'replicate');

x=double(a);
x1=double(a1);
x3=double(a3);

```

```

x4=double(a4);
x5=double(a5);

[m,n]=size(x);

numerator1=0;
numerator3=0;
numerator4=0;
numerator5=0;

for i=1:m;
    for j=1:n;
        numerator1=numerator1+((abs(x(i,j))-x1(i,j)))^2);
        numerator3=numerator3+((abs(x(i,j))-x3(i,j)))^2);
        numerator4=numerator4+((abs(x(i,j))-x4(i,j)))^2);
        numerator5=numerator5+((abs(x(i,j))-x5(i,j)))^2);
    end
end

MSE1=round(numerator1/(m*n));
MSE3=round(numerator3/(m*n));
MSE4=round(numerator4/(m*n));
MSE5=round(numerator5/(m*n));

PSNR1=round(10*(log10((255^2)/MSE1)));
PSNR3=round(10*(log10((255^2)/MSE3)));
PSNR4=round(10*(log10((255^2)/MSE4)));
PSNR5=round(10*(log10((255^2)/MSE5)));

x1=uint8(x1);
x3=uint8(x3);
x4=uint8(x4);
x5=uint8(x5);

z1=num2str(PSNR1);
z3=num2str(PSNR3);
z4=num2str(PSNR4);
z5=num2str(PSNR5);
y1=char('    PSNR=');

figure(11);
subplot(2,2,1);imshow(x1);title((strcat('cameraman with gaussian
noise',y1,z1)));
subplot(2,2,2);imshow(x3);title((strcat('3*3 average
filter',y1,z3)));
subplot(2,2,3);imshow(x4);title((strcat('5*5 average
filter',y1,z4)));

```

```
subplot(2,2,4);imshow(x5);title((strcat('7*7 average  
filter',y1,z5)));
```

```
%%% barbara with gaussian noise and average filter %%%
```

```
b3=imfilter(b1,h1,'replicate');  
b4=imfilter(b1,h2,'replicate');  
b5=imfilter(b1,h3,'replicate');
```

```
x=double(b);  
x1=double(b1);  
x3=double(b3);  
x4=double(b4);  
x5=double(b5);
```

```
[m,n]=size(x);
```

```
numerator1=0;  
numerator3=0;  
numerator4=0;  
numerator5=0;
```

```
for i=1:m;  
    for j=1:n;  
        numerator1=numerator1+((abs(x(i,j))-x1(i,j)))^2);  
        numerator3=numerator3+((abs(x(i,j))-x3(i,j)))^2);  
        numerator4=numerator4+((abs(x(i,j))-x4(i,j)))^2);  
        numerator5=numerator5+((abs(x(i,j))-x5(i,j)))^2);  
    end  
end
```

```
MSE1=round(numerator1/(m*n));  
MSE3=round(numerator3/(m*n));  
MSE4=round(numerator4/(m*n));  
MSE5=round(numerator5/(m*n));
```

```
PSNR1=round(10*(log10((255^2)/MSE1)));  
PSNR3=round(10*(log10((255^2)/MSE3)));  
PSNR4=round(10*(log10((255^2)/MSE4)));  
PSNR5=round(10*(log10((255^2)/MSE5)));
```

```
x1=uint8(x1);  
x3=uint8(x3);  
x4=uint8(x4);
```

```

x5=uint8(x5);

z1=num2str(PSNR1);
z3=num2str(PSNR3);
z4=num2str(PSNR4);
z5=num2str(PSNR5);
y1=char('    PSNR=');

figure(13);
subplot(2,2,1);imshow(x1);title((strcat('barbara with with
gaussian noise',y1,z1)));
subplot(2,2,2);imshow(x3);title((strcat('3*3 average
filter',y1,z3)));
subplot(2,2,3);imshow(x4);title((strcat('5*5 average
filter',y1,z4)));
subplot(2,2,4);imshow(x5);title((strcat('7*7 average
filter',y1,z5)));

%%% cameraman with gaussian noise and median filter %%%

a3=medfilt2(a1,[3 3]);
a4=medfilt2(a1,[5 5]);
a5=medfilt2(a1,[7 7]);

x=double(a);
x1=double(a1);
x3=double(a3);
x4=double(a4);
x5=double(a5);

[m,n]=size(x);

numerator1=0;
numerator3=0;
numerator4=0;
numerator5=0;

for i=1:m;
    for j=1:n;
        numerator1=numerator1+((abs(x(i,j))-x1(i,j)))^2);
        numerator3=numerator3+((abs(x(i,j))-x3(i,j)))^2);
        numerator4=numerator4+((abs(x(i,j))-x4(i,j)))^2);
        numerator5=numerator5+((abs(x(i,j))-x5(i,j)))^2);
    end
end
end

```

```

MSE1=round(numerator1/(m*n));
MSE3=round(numerator3/(m*n));
MSE4=round(numerator4/(m*n));
MSE5=round(numerator5/(m*n));

PSNR1=round(10*(log10((255^2)/MSE1)));
PSNR3=round(10*(log10((255^2)/MSE3)));
PSNR4=round(10*(log10((255^2)/MSE4)));
PSNR5=round(10*(log10((255^2)/MSE5)));

x1=uint8(x1);
x3=uint8(x3);
x4=uint8(x4);
x5=uint8(x5);

z1=num2str(PSNR1);
z3=num2str(PSNR3);
z4=num2str(PSNR4);
z5=num2str(PSNR5);
y1=char('    PSNR=');

figure(14);
subplot(2,2,1);imshow(x1);title((strcat('cameraman with gaussian
noise',y1,z1)));
subplot(2,2,2);imshow(x3);title((strcat('3*3 median
filter',y1,z3)));
subplot(2,2,3);imshow(x4);title((strcat('5*5 median
filter',y1,z4)));
subplot(2,2,4);imshow(x5);title((strcat('7*7 median
filter',y1,z5)));

%%%% barbara with gaussian noise and median filter %%%%

b3=medfilt2(b1,[3 3]);
b4=medfilt2(b1,[5 5]);
b5=medfilt2(b1,[7 7]);

x=double(b);
x1=double(b1);
x3=double(b3);
x4=double(b4);
x5=double(b5);

[m,n]=size(x);

```



```

numerator1=0;
numerator3=0;
numerator4=0;
numerator5=0;

for i=1:m;
    for j=1:n;
        numerator1=numerator1+((abs(x(i,j)-x1(i,j)))^2);
        numerator3=numerator3+((abs(x(i,j)-x3(i,j)))^2);
        numerator4=numerator4+((abs(x(i,j)-x4(i,j)))^2);
        numerator5=numerator5+((abs(x(i,j)-x5(i,j)))^2);
    end
end

MSE1=round(numerator1/(m*n));
MSE3=round(numerator3/(m*n));
MSE4=round(numerator4/(m*n));
MSE5=round(numerator5/(m*n));

PSNR1=round(10*(log10((255^2)/MSE1)));
PSNR3=round(10*(log10((255^2)/MSE3)));
PSNR4=round(10*(log10((255^2)/MSE4)));
PSNR5=round(10*(log10((255^2)/MSE5)));

x1=uint8(x1);
x3=uint8(x3);
x4=uint8(x4);
x5=uint8(x5);

z1=num2str(PSNR1);
z3=num2str(PSNR3);
z4=num2str(PSNR4);
z5=num2str(PSNR5);
y1=char('    PSNR=');

figure(15);
subplot(2,2,1);imshow(x1);title((strcat('barbara with gaussian
noise',y1,z1)));
subplot(2,2,2);imshow(x3);title((strcat('3*3 median
filter',y1,z3)));
subplot(2,2,3);imshow(x4);title((strcat('5*5 median
filter',y1,z4)));
subplot(2,2,4);imshow(x5);title((strcat('7*7 median
filter',y1,z5)))

```

```

%%%% cameraman with gaussian noise and gaussian filter %%%

h1=fspecial('gaussian',5,.3);
h2=fspecial('gaussian',5,.6);
h3=fspecial('gaussian',5,.9);

a3=imfilter(a1,h1,'replicate');
a4=imfilter(a1,h2,'replicate');
a5=imfilter(a1,h3,'replicate');

x=double(a);
x1=double(a1);
x3=double(a3);
x4=double(a4);
x5=double(a5);

[m,n]=size(x);

numerator1=0;
numerator3=0;
numerator4=0;
numerator5=0;

for i=1:m;
    for j=1:n;
        numerator1=numerator1+((abs(x(i,j))-x1(i,j)))^2);
        numerator3=numerator3+((abs(x(i,j))-x3(i,j)))^2);
        numerator4=numerator4+((abs(x(i,j))-x4(i,j)))^2);
        numerator5=numerator5+((abs(x(i,j))-x5(i,j)))^2);
    end
end

MSE1=round(numerator1/(m*n));
MSE3=round(numerator3/(m*n));
MSE4=round(numerator4/(m*n));
MSE5=round(numerator5/(m*n));

PSNR1=round(10*(log10((255^2)/MSE1)));
PSNR3=round(10*(log10((255^2)/MSE3)));
PSNR4=round(10*(log10((255^2)/MSE4)));
PSNR5=round(10*(log10((255^2)/MSE5)));

x1=uint8(x1);
x3=uint8(x3);
x4=uint8(x4);
x5=uint8(x5);

```

```

z1=num2str(PSNR1);
z3=num2str(PSNR3);
z4=num2str(PSNR4);
z5=num2str(PSNR5);
y1=char('    PSNR=');

figure(16);
subplot(2,2,1);imshow(x1);title(strcat('cameraman with gaussian
noise ',y1,z1));
subplot(2,2,2);imshow(x3);title(strcat(' 5*5 gaussian filter
with sigma=.3',y1,z3));
subplot(2,2,3);imshow(x4);title(strcat(' 5*5 gaussian filter
with sigma=.6',y1,z4));
subplot(2,2,4);imshow(x5);title(strcat(' 5*5 gaussian filter
with sigma=.9',y1,z5));

%%%% barbara with gaussian noise and gaussian filter %%%%

b3=imfilter(b1,h1,'replicate');
b4=imfilter(b1,h2,'replicate');
b5=imfilter(b1,h3,'replicate');

x=double(b);
x1=double(b1);
x3=double(b3);
x4=double(b4);
x5=double(b5);

[m,n]=size(x);

numerator1=0;
numerator3=0;
numerator4=0;
numerator5=0;

for i=1:m;
    for j=1:n;
        numerator1=numerator1+((abs(x(i,j))-x1(i,j)))^2);
        numerator3=numerator3+((abs(x(i,j))-x3(i,j)))^2);
        numerator4=numerator4+((abs(x(i,j))-x4(i,j)))^2);
        numerator5=numerator5+((abs(x(i,j))-x5(i,j)))^2);
    end
end
end

```

```
MSE1=round(numerator1/(m*n));
MSE3=round(numerator3/(m*n));
MSE4=round(numerator4/(m*n));
MSE5=round(numerator5/(m*n));

PSNR1=round(10*(log10((255^2)/MSE1)));
PSNR3=round(10*(log10((255^2)/MSE3)));
PSNR4=round(10*(log10((255^2)/MSE4)));
PSNR5=round(10*(log10((255^2)/MSE5)));

x1=uint8(x1);
x3=uint8(x3);
x4=uint8(x4);
x5=uint8(x5);

z1=num2str(PSNR1);
z3=num2str(PSNR3);
z4=num2str(PSNR4);
z5=num2str(PSNR5);
y1=char('    PSNR=');

figure(17);
subplot(2,2,1);imshow(x1);title(strcat('barbara with gaussian
noise ',y1,z1));
subplot(2,2,2);imshow(x3);title(strcat(' 5*5 gaussian filter
with sigma=.3',y1,z3));
subplot(2,2,3);imshow(x4);title(strcat(' 5*5 gaussian filter
with sigma=.6',y1,z4));
subplot(2,2,4);imshow(x5);title(strcat(' 5*5 gaussian filter
with sigma=.9',y1,z5));
```

% problem-4

```
close all hidden;
clear all;
clc;

a=imread('ART2.gif');
figure(1);imshow(a);

a=double(a);
[m,n]=size(a);

h1=[-1 -2 -1;0 0 0;1 2 1];
h2=[-1 0 1;-2 0 2;-1 0 1];
h3=[-2 -1 0;-1 0 1;0 1 2];
h4=[0 1 2;-1 0 1;-2 -1 0];

%%%%%%%% horizontal %%%%%%%%%

b1=imfilter(a,h1,'replicate');
b1=abs(b1);
ma=max(max(b1));
m1=.7*ma;
t=zeros(m,n);
t=logical(t);
for i=2:m-1;
    for j=2:n-1;
        if b1(i,j)>=m1
            t(i,j)=1;
        else
            t(i,j)=0;
        end
    end
end
end
t1=bwmorph(t,'skel',inf);

pq=paddedsz(size(a));
v=fft2(a,pq(1),pq(2));
h=freqz2(h1,pq(2),pq(1));
h=ifftshift(h);
```

```

ee=.5*log(abs(h));
figure(2);imshow(ee);
g=h.*v;
g=ifft2(g);
g=g(1:size(a,1),1:size(a,2));
b1=abs(g);
ma=max(max(b1));
m1=.7*ma;
t=zeros(m,n);
t=logical(t);
for i=2:m-1;
    for j=2:n-1;
        if b1(i,j)>=m1
            t(i,j)=1;
        else
            t(i,j)=0;
        end
    end
end
end
t2=bwmorph(t,'skel',inf);

figure(3);
subplot(1,2,1);imshow(t1);title('horizontal edges using
"spatial" domain ');
subplot(1,2,2);imshow(t2);title('horizontal edges using
"frequency" domain ');

%%%%%%%% vertical %%%%%%%%%

b1=imfilter(a,h2,'replicate');
b1=abs(b1);
ma=max(max(b1));
m1=.7*ma;
t=zeros(m,n);
t=logical(t);
for i=2:m-1;
    for j=2:n-1;
        if b1(i,j)>=m1
            t(i,j)=1;
        else
            t(i,j)=0;
        end
    end
end
end
end

```

```

t1=bwmorph(t, 'skel', inf);

pq=paddedsz(size(a));
v=fft2(a,pq(1),pq(2));
h=freqz2(h2,pq(2),pq(1));
h=ifftshift(h);
ee=.5*log(abs(h));
figure(4);imshow(ee);
g=h.*v;
g=ifft2(g);
g=g(1:size(a,1),1:size(a,2));
b1=abs(g);
ma=max(max(b1));
m1=.7*ma;
t=zeros(m,n);
t=logical(t);
for i=2:m-1;
    for j=2:n-1;
        if b1(i,j)>=m1
            t(i,j)=1;
        else
            t(i,j)=0;
        end
    end
end
t2=bwmorph(t, 'skel', inf);

figure(5);
subplot(1,2,1);imshow(t1);title('vertical edges using "spatial"
domain ');
subplot(1,2,2);imshow(t2);title('vertical edges using
"frequency" domain ');

%%%% positive slope diagonal %%%%

b1=imfilter(a,h3,'replicate');
b1=abs(b1);
ma=max(max(b1));
m1=.8*ma;
t=zeros(m,n);
t=logical(t);
for i=2:m-1;

```

```

        for j=2:n-1;
            if b1(i,j)>=m1
                t(i,j)=1;
            else
                t(i,j)=0;
            end
        end
    end
end
t1=bwmorph(t, 'skel', inf);

pq=paddedsz(size(a));
v=fft2(a,pq(1),pq(2));
h=freqz2(h3,pq(2),pq(1));
h=ifftshift(h);
ee=.5*log(abs(h));
figure(6);imshow(ee);
g=h.*v;
g=ifft2(g);
g=g(1:size(a,1),1:size(a,2));
b1=abs(g);
ma=max(max(b1));
m1=.8*ma;
t=zeros(m,n);
t=logical(t);
for i=2:m-1;
    for j=2:n-1;
        if b1(i,j)>=m1
            t(i,j)=1;
        else
            t(i,j)=0;
        end
    end
end
end
t2=bwmorph(t, 'skel', inf);

figure(7);
subplot(1,2,1);imshow(t1);title('positive slope diagonal edges
using "spatial" domain ');
subplot(1,2,2);imshow(t2);title('positive slope diagonal edges
using "frequency" domain ');

```

```

%%%%% negative slope diagonal %%%%

```



```

b1=imfilter(a,h4,'replicate');
b1=abs(b1);
ma=max(max(b1));
m1=.8*ma;
t=zeros(m,n);
t=logical(t);
for i=2:m-1;
    for j=2:n-1;
        if b1(i,j)>=m1
            t(i,j)=1;
        else
            t(i,j)=0;
        end
    end
end
t1=bwmorph(t,'skel',inf);

pq=paddedsz(size(a));
v=fft2(a,pq(1),pq(2));
h=freqz2(h4,pq(2),pq(1));
h=ifftshift(h);
ee=.5*log(abs(h));
figure(8);imshow(ee);
g=h.*v;
g=ifft2(g);
g=g(1:size(a,1),1:size(a,2));
b1=abs(g);
ma=max(max(b1));
m1=.8*ma;
t=zeros(m,n);
t=logical(t);
for i=2:m-1;
    for j=2:n-1;
        if b1(i,j)>=m1
            t(i,j)=1;
        else
            t(i,j)=0;
        end
    end
end
t2=bwmorph(t,'skel',inf);

figure(9);
subplot(1,2,1);imshow(t1);title('negative slope diagonal edges
using "spatial" domain ');

```

```
subplot(1,2,2);imshow(t2);title('negative slope diagonal edges  
using "frequency" domain');
```