EL-GY 6123 Image and Video Processing
Matlab Assignment 3

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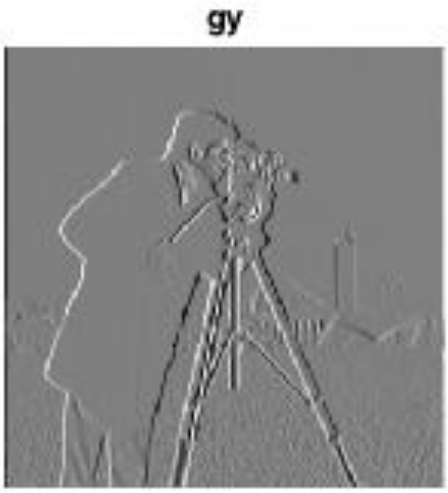
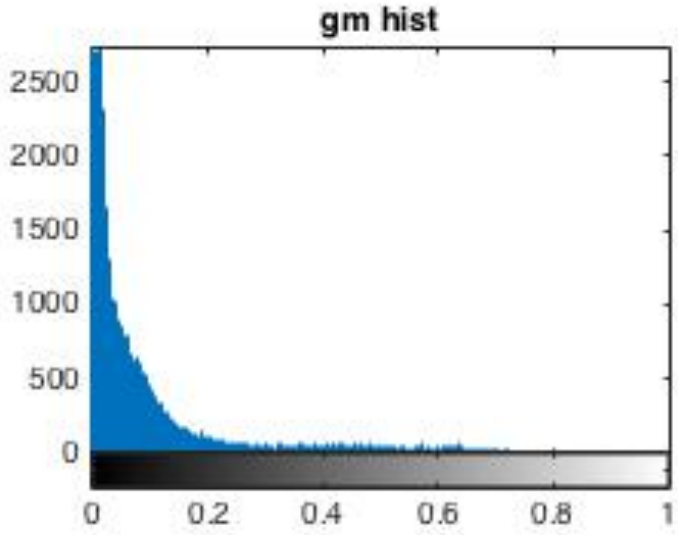
Question 1

```
close all;clc;clear all;

I=imread('cameraman.jpg');
I=rgb2gray(I);
I=im2double(I);
figure,
% subplot(2,2,1),imshow(I,[]);title('image');

% Sobel Operator
Hx=[-1 -2 -1;0 0 0;1 2 1]./4;
Hy=[-1 0 1;-2 0 2;-1 0 1]./4;

% Computing Horizontal and vertical gradient
gx=conv2(I,Hx,'same');
gy=conv2(I,Hy,'same');
subplot(2,2,1),imshow(gx,[]);title('gx');
subplot(2,2,2),imshow(gy,[]);title('gy');

%Magnitude
gm=sqrt((gx.^2)+(gy.^2));
subplot(2,2,3),imshow(gm,[]);title('gm');
subplot(2,2,4),imhist(gm);title('gm hist');

% Sorting and top 5%
[r,c]=size(gm);
len=r*c;
b=reshape(gm',1,len);
s=sort(b,'descend');

i=1;
thresh_avg=0;
while i<0.05*len
   thresh_avg=thresh_avg+s(i);
   i=i+1;
end
thresh_avg=thresh_avg/i;

% Thresholding by taking top 5%
for i=1:r
   for j=1:c
      if gm(i,j)<=thresh_avg
         G(i,j)=0;
      else
         G(i,j)=1;
      end
```

```
   end
end
% for a chosen Threshold

Bw1=im2bw(gm,0.2);
Bw2=im2bw(gm,0.4);
Bw3=im2bw(gm,0.1);
figure,
subplot(2,2,1),imshow(Bw3,[]);title('T=0.1');
subplot(2,2,2),imshow(Bw1,[]);title('T=0.2');
subplot(2,2,3),imshow(G,[]);title('gm thresh avg');
subplot(2,2,4),imshow(Bw2,[]);title('T=0.4');
```

Result:





Observation
If the threshold value is small 0.1, then we can see more edges i.e. image is brighter(more 255 value)
As we increase the threshold, edges become more finer and there are less number of 255 value pixel.
Good result is obtained at 0.2 threshold.

Question 2

```
clc;clear all; close all
I=imread('lenna.png');
I=rgb2gray(I);
Id=im2double(I);

% Add a salt and peeper noise
J1 = imnoise(Id,'salt & pepper',0.05);
J2 = imnoise(Id,'salt & pepper',0.2);



figure(1),subplot(2,2,1),imshow(J1,[]);title('noisy with d:0.05');
```

```
j=2;
for i=3:2:7
  f1=my_med_filt(J1);
  subplot(2,2,j),imshow(f1,[]);title(['filt with W :',num2str(i)]);
  j=j+1;
end

j=2;
figure(2),subplot(2,2,1),imshow(J2,[]);title('noisy with d:0.2');
for i=3:2:7
  f2=my_med_filt(J2);
  subplot(2,2,j),imshow(f2,[]);title(['filt with W :',num2str(i)]);
  j=j+1;
end


function m=my_med_filt(y)

[xh xw] = size(y);

in=input('Enter the order of filter');
h = ones(in,in)/(in^2);
[hh hw] = size(h);
hhh = (hh - 1) / 2;
hhw = (hw- 1) / 2;

z = y; %or z=zeros(xh,xw) if not low-pass filter
for m = hhh + 1:xh - hhh,
%skip first and last hhh rows to avoid boundary problems
 for n = hhw + 1:xw - hhw,
%skip first and last hhw columns to avoid boundary problems
 tmpy = 0;
 for k = -hhh:hhh,
 for l = -hhw:hhw,
 tmpv(k+hhh+1,l+hhw+1) = y(m - k,n - l);
 % substitute with median value
[r,c]=size(tmpv);
len=r*c;
b=reshape(tmpv,1,len);
me=median(b);
 end
 end
 z(m, n) = me;
 end
 m=z;
end
```

Result:

For noise density 0.05 and different window size

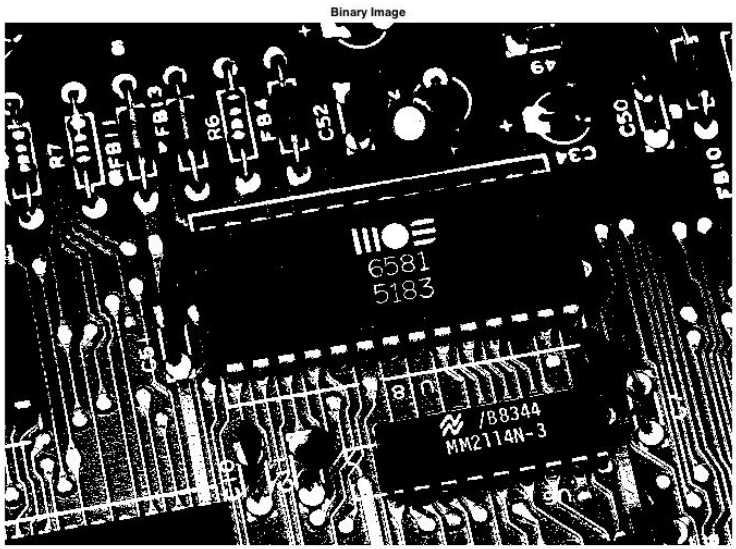
For noise density 0.05 and different window size

Observation:
When we have less noise density, it means less number of pixel in image has impulse value and when we have high noise density , more number of pixel will be affected by noise.
By using different window size, we can see that as the window size increases , image becomes more smooth and less noise can be seen as even the sparse noise pixel can come in large window and remove that noise.

Question 3:

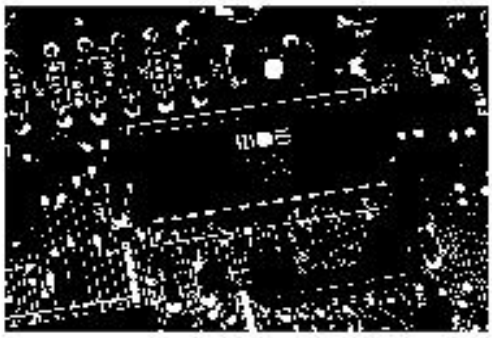
```
clc;clear all; close all
I=imread('circuit.jpg');
I=rgb2gray(I);
Ib=im2bw(I,0.65);
figure,imshow(Ib,[]);title('Binary Image');

SE=strel('square',3);
IE=imerode(Ib,SE);
ID=imdilate(Ib,SE);


figure,
subplot(2,2,1),imshow(IE,[]);title('Erosion with Square 7*7 SE');
subplot(2,2,2),imshow(ID,[]);title('Dilation');

% Open,  Eliminate false touching, thin ridges and branches
IEO=imerode(Ib,SE);
IDO=imdilate(IEO,SE);

% Close, Fill small gaps and holes
IDC=imdilate(Ib,SE);
IEC=imerode(IDC,SE);

subplot(2,2,3),imshow(IDO,[]);title('OPENING ');
subplot(2,2,4),imshow(IEC,[]);title('CLOSING');
```

Result

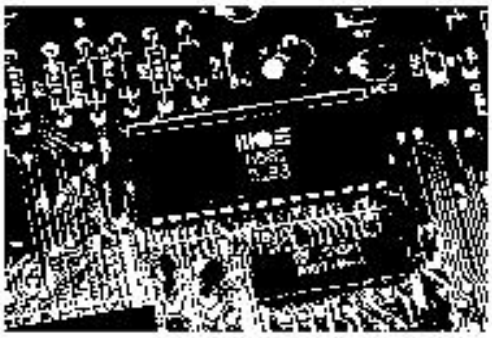


Morphological Operation using 3*3 square Structuring element

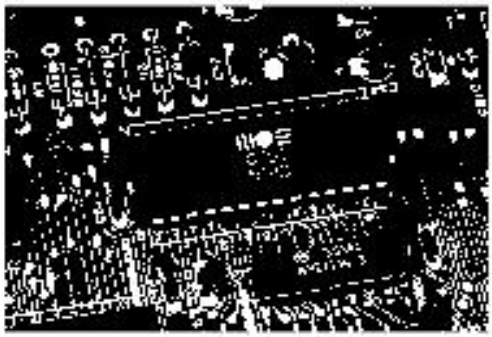
Erosion with Square 3*3 SE



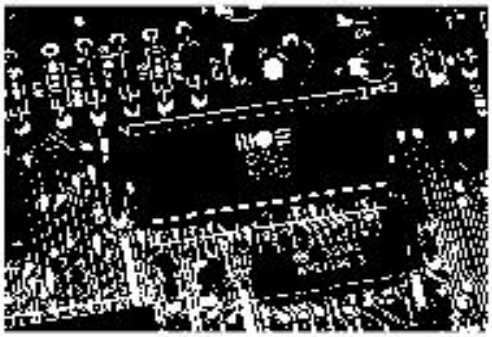
Dilation



OPENING

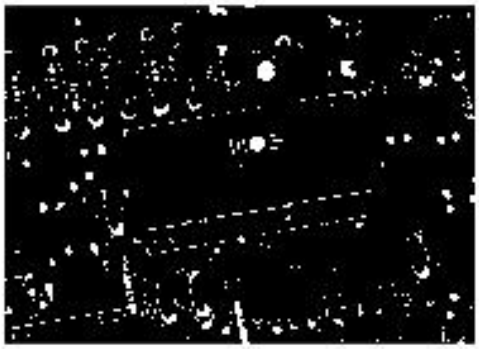


CLOSING

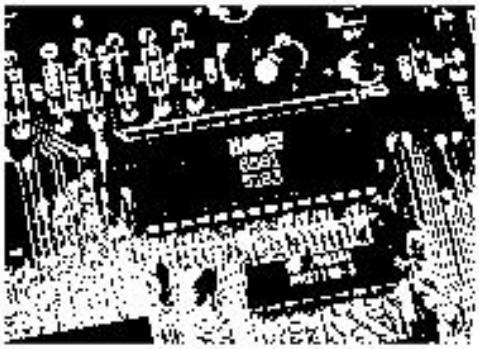


Morphological Operation using 7*7 square Structuring element

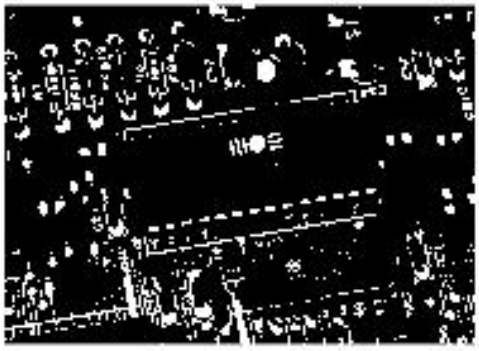
Erosion with Square 7*7 SE



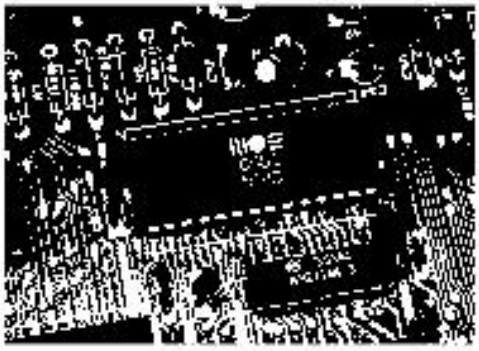
Dilation



OPENING



CLOSING



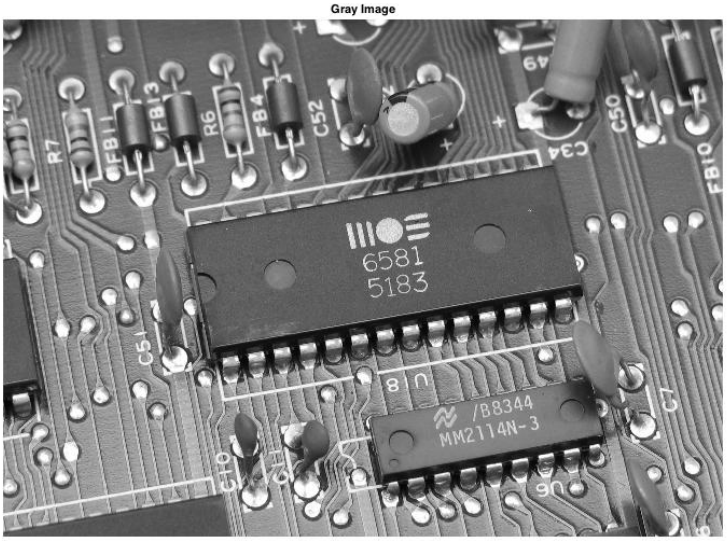
Observation:

Erosion- shrinks the edge
Dilation-Enlarges the edges
Opening- Eliminate false touching, thin ridges and branches
Closing- Fills small gaps and holes
By increasing the structuring element size, its neighborhood increases, hence , it shrinks or enlarge to great extent.

Question 4:

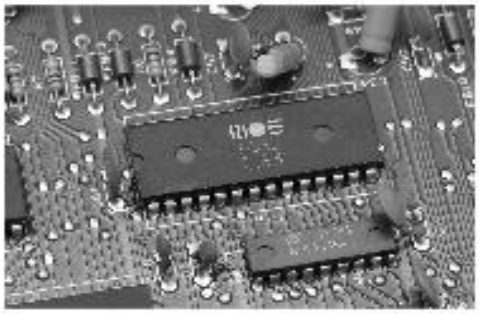
```
clc;clear all; close all
I=imread('circuit.jpg');
I=rgb2gray(I);

figure,imshow(I,[]);title('Gray Image');

SE=strel('square',3);
IE=imerode(I,SE);
ID=imdilate(I,SE);

figure,
subplot(2,2,1),imshow(IE,[]);title('Erosion with Square 3*3 SE');
subplot(2,2,2),imshow(ID,[]);title('Dilation');

% Open
IEO=imerode(I,SE);
IDO=imdilate(IEO,SE);

% Close
IDC=imdilate(I,SE);
IEC=imerode(IDC,SE);

subplot(2,2,3),imshow(IDO,[]);title('OPENING ');
subplot(2,2,4),imshow(IEC,[]);title('CLOSING');
```

Result:

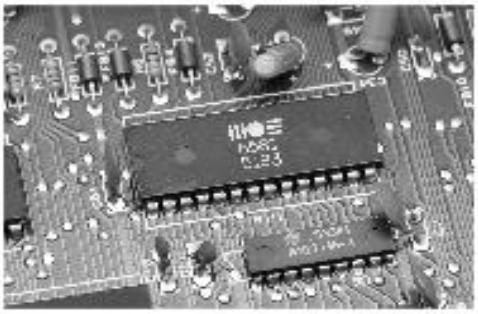


Morphological operation on grayscale image using square 3*3 SE

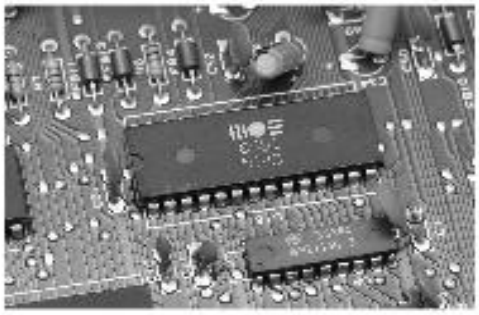
Erosion with Square 3*3 SE



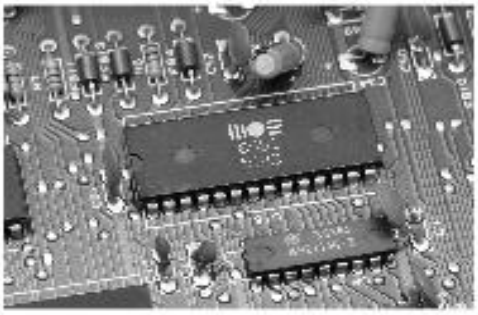
Dilation



OPENING

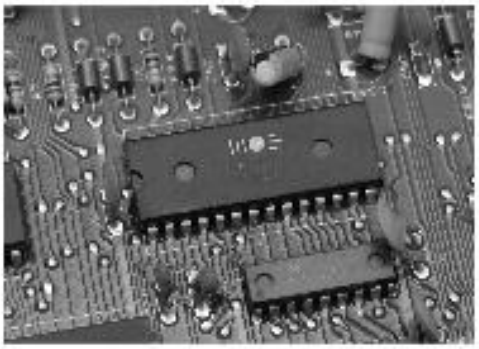


CLOSING

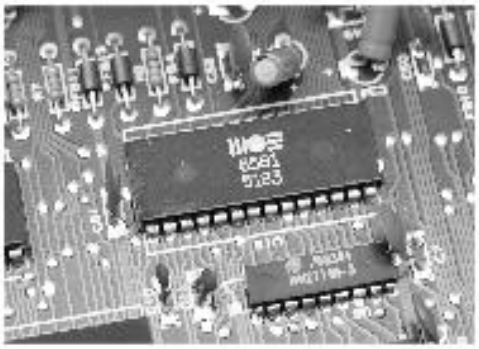


Morphological operation on grayscale image using square 7*7 SE

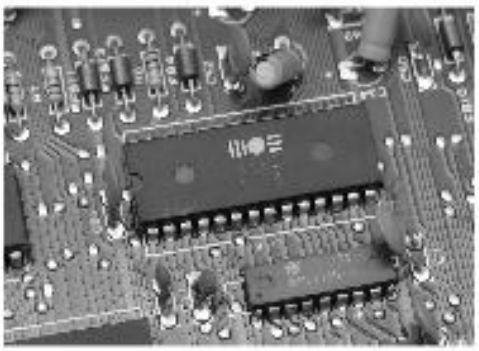
Erosion with Square 7*7 SE



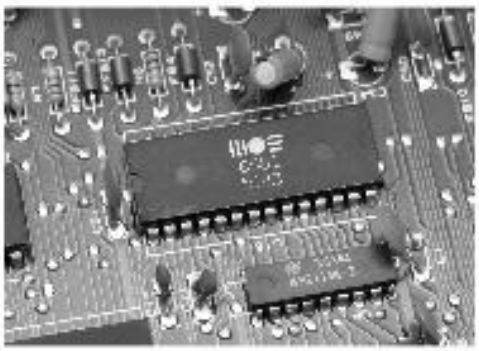
Dilation



OPENING



CLOSING



Observation:
Dilation- image appears brighter
Erosion- Image appears darker

If we increase the structuring element size, then image appears more brighter for dilation and less darker for erosion.