Experiment – 7

Exercise – 1

```
clc;
clear variables;
close all;
A = zeros(10,10);
A(5,5) = 1;
display(A)
figure
imshow(A)
B=[1 1 1];
C=padarray(A,[1 1]);
D = false(size(A));
for i = 1:9
    for j = 1:9
        D(i,j)=sum(sum(B&C(i:i+2,j:j+2)));
    end
end
display(D)
figure
imshow(D)
```

A =

0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	1	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0

D =

0 0 0 0 0 0 0 0 0 0

0 0 0 0 0 0 0 0 0 0

0 0 0 0 0 0 0 0 0 0

0 0 0 0 0 0 0 0 0 0

0 0 0 1 1 1 0 0 0 0

0 0 0 0 0 0 0 0 0 0

0 0 0 0 0 0 0 0 0 0

0 0 0 0 0 0 0 0 0 0

0 0 0 0 0 0 0 0 0 0

0 0 0 0 0 0 0 0 0 0

Exercise – 2

```
clc;
clear variables;
close all;
A = zeros(11,11);
A(6,6) = 1;
display(A)
B = [1 1 1];
I = imdilate(A,B);
display(I)
```

A =

0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	1	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0

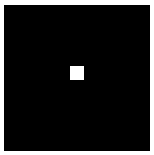
I =

0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	1	1	1	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0

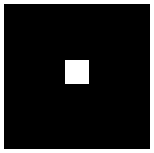
Exercise – 3

```
clc;
clear variables;
close all;
A = zeros(31,31);
A(14:16,15:17)=1;
figure
imshow(A)
B = ones(3,3);
C = ones(3,1);
D = zeros(3,3);
I = imdilate(A,B);
J = imdilate(A,C);
K = imdilate(A,D);
figure
imshow(I)
figure
imshow(J)
figure
imshow(K)
```

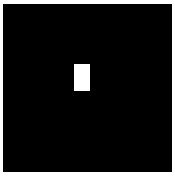
Original Image



First dilation



Second dilation



Third dilation

The results are as expected and they vary with the SE. In a), dilation is performed in all 3 directions. In b), dilation is performed along an axis and in c), the SE is composed of zeros and hence the result is obtained.

Exercise – 4

```
clc;
clear variables;
```

```
close all;
A = zeros(10,10);
A(5,5) = 1;
display(A)
B=[1 1 1];
C=padarray(A,[0 1],1);
D = false(size(A));
for i=1:size(C,1)
    for j=1:size(C,2)-2
        In=C(i,j:j+2);
        %Find the position of ones in the structuring element
        In1=find(B==1);
        %Check whether the elements in the window have the value one in the
        %same positions of the structuring element
        if(In(In1)==1)
        D(i,j)=1;
        end
    end
end
display(D)
figure
imshow(A)
figure
imshow(D)
```

A =

0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	1	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0

D =

0 0 0 0 0 0 0 0 0 0

0 0 0 0 0 0 0 0 0 0

0 0 0 0 0 0 0 0 0 0

0 0 0 0 0 0 0 0 0 0

0 0 0 0 0 0 0 0 0 0

0 0 0 0 0 0 0 0 0 0

0 0 0 0 0 0 0 0 0 0

0 0 0 0 0 0 0 0 0 0

0 0 0 0 0 0 0 0 0 0

0 0 0 0 0 0 0 0 0 0

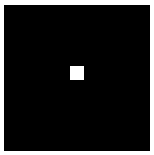
Exercise – 5

```
clc;
clear variables;
close all;
A = zeros(11,11);
A(6,6) = 1;
display(A)
figure
imshow(A)
B = [1 1 1];
I = imerode(A,B);
display(I)
figure
imshow(I)
```

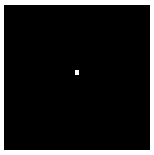
Exercise – 6

```
clc;
clear variables;
close all;
A = zeros(31,31);
A(14:16,15:17)=1;
figure
imshow(A)
B = ones(3,3);
C = ones(3,1);
D = zeros(3,3);
I = imerode(A,B);
J = imerode(A,C);
K = imerode(A,D);
figure
imshow(I)
figure
imshow(J)
figure
imshow(K)
```

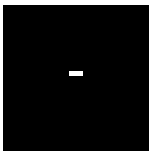
Original image



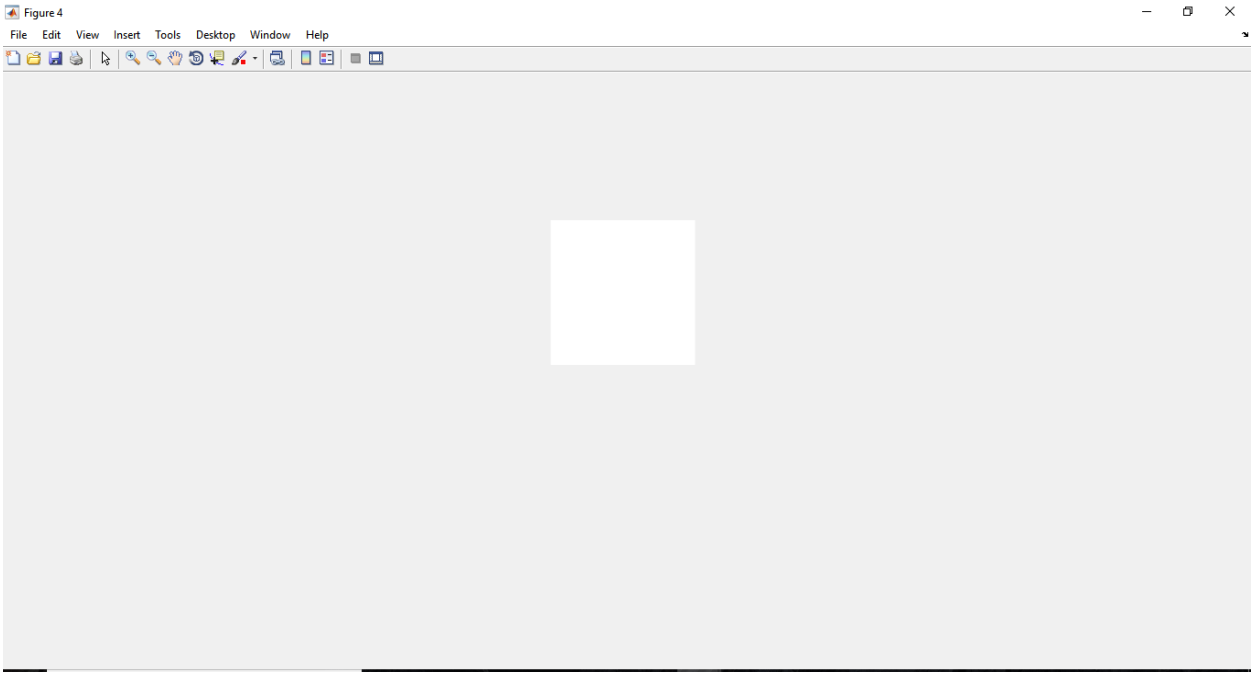
First erosion



Second Erosion



Third Erosion

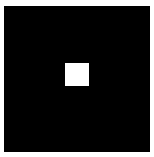


The results are as expected and they vary with the SE. In a), erosion is performed in all 3 directions. In b), erosion is performed along an axis and in c), the SE is composed of zeros and hence the result is obtained. If we did dilation on these images, similar results as Exercise 3 will be obtained.

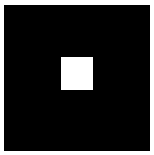
Exercise – 7

```
clc;
clear variables;
close all;
A = zeros(31,31);
A(13:17,14:18)=1;
B = ones(3,3);
figure
imshow(A)
I = imdilate(A,B);
J = imerode(I,B);
figure
imshow(I)
figure
imshow(J)
```

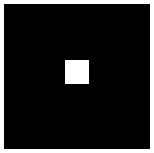
Original Image



After dilation



After erosion

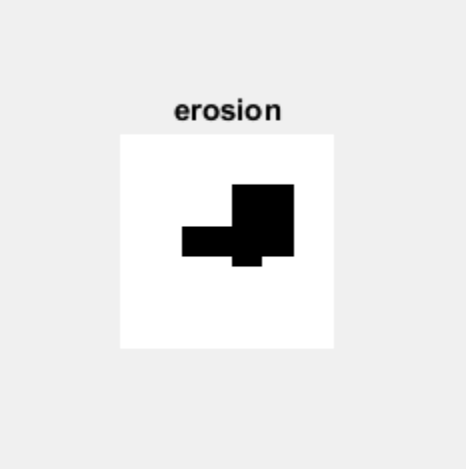


In this case, erosion is the opposite process of dilation and hence when the same SE is used, if we erode a dilated image we get back the original image because the boundary information is preserved and not lost.

Exercise – 8

```
clc;
clear variables;
close all;
A = ones(21,21);
A(6:7,5:17) = 0;
A(8:9,12:17) = 0;
A(10:12,7:17) = 0;
```

```
A(12:13,12:14) = 0;
B = ones(3,3);
figure
imshow(A)
title('original image');
I = imdilate(A,B);
J = imerode(I,B);
figure
imshow(I)
title('dilation');
figure
imshow(J)
title('erosion');
```



In an erosion, you lose information. There are multiple regions with different boundaries that result in the same thing when eroded.

In a binary image, there may be elements which are smaller than the structuring element. There are completely eroded away.