

## LAB - 8

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Subject	Image Processing

**Aim:** Introduction to Morphological Image Processing

**Q. 1: Create input image of size 9x9 as shown below. Perform 'Erosion', 'Dilation', 'Opening' and 'Closing' operations using 'Disk' structuring element of size '1'.**

❖ **Code:**

```

a_2.m x a_2_1.m x a_1.m x a_4.m x
1      clear all;
2
3      img = zeros(9, 9);
4
5      for i = 3 : 4
6          for j = 3 : 5
7              img(i, j) = 1;
8          end
9      end
10
11     for i = 5 : 7
12         for j = 3 : 7
13             img(i, j) = 1;
14         end
15     end
16
17     subplot(2, 3, 1);
18     imshow(img);
19     title("Original Image");
20
21     s = strel('Disk', 1);
22

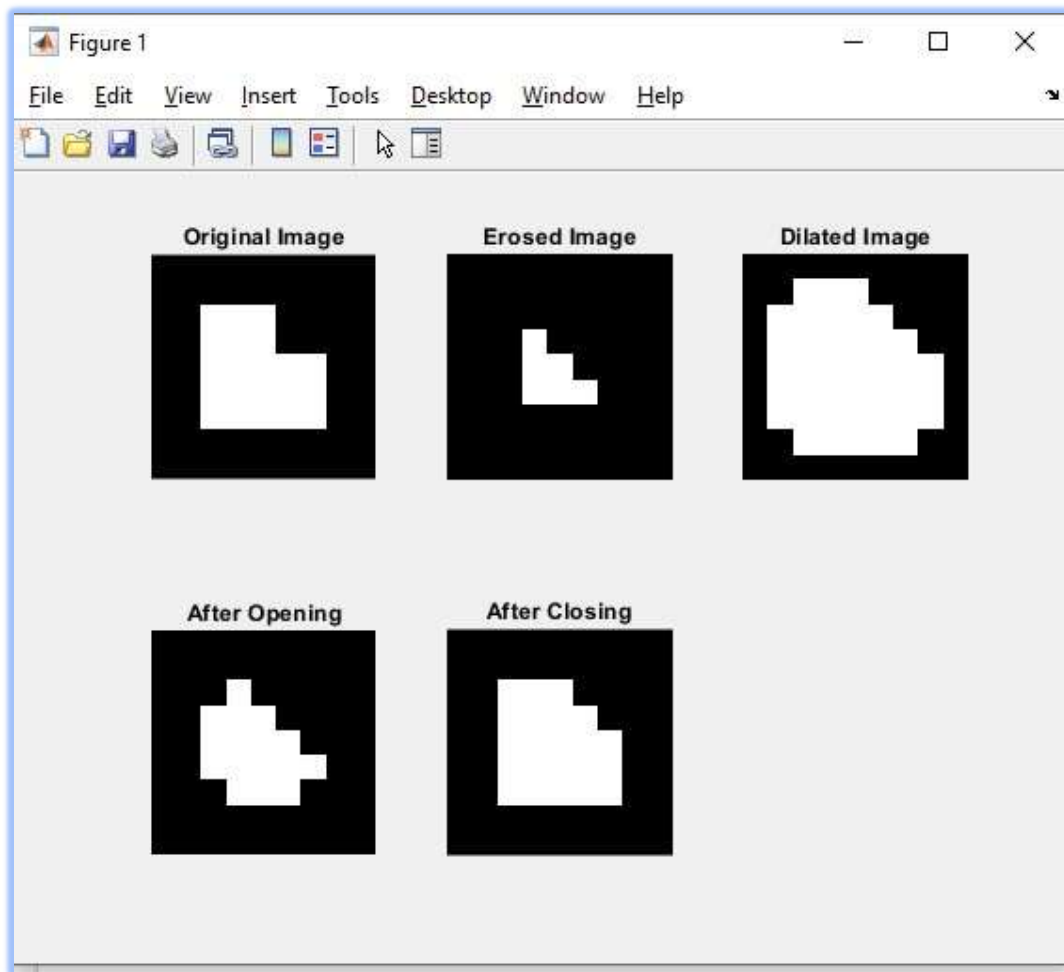
```

```

a_2.m x a_2_1.m x a_1.m x a_4.m x a_3.m x unt
23     % erosion
24     erosion = imerode(img, s);
25     subplot(2, 3, 2);
26     imshow(erosion);
27     title("Eroded Image");
28
29     % dilation
30     dilation = imdilate(img, s);
31     subplot(2, 3, 3);
32     imshow(dilation);
33     title("Dilated Image");
34
35     % opening
36     openingImage = imdilate(erosion, s);
37     subplot(2, 3, 4);
38     imshow(openingImage);
39     title("After Opening");
40
41     % closing
42     closingImage = imerode(dilation, s);
43     subplot(2, 3, 5);
44     imshow(closingImage);
45     title("After Closing");

```

❖ **Output:**



❖ **By using manual erosion and dilation function:**

- **Code of Erosion function: (Note: Remains same for all manual programs)**

```
a_1_1.m x convolutionErosion.m x convolutionDilation.m x a_1.m x +
1 function outputImg = convolutionErosion(img, s)
2     s = getnhood(s);
3     [m, n] = size(s);
4     radius = floor(m / 2);
5     [r, c] = size(img);
6
7     img = padarray(img, [radius, radius], 0, 'both');
8     new_img = zeros(r, c);
9     for i = radius + 1 : r
10         for j = radius + 1 : c
11             subimg = img((i - radius):(i + radius), (j - radius):(j + radius));
12
13             if bitand(subimg, s) == s
14                 new_img(i - radius, j - radius) = 1;
15             else
16                 new_img(i - radius, j - radius) = 0;
17             end
18         end
19     end
20     outputImg = (new_img);
21 end
```

➤ **Code of Dilation function: (Note: Remains same for all manual programs)**

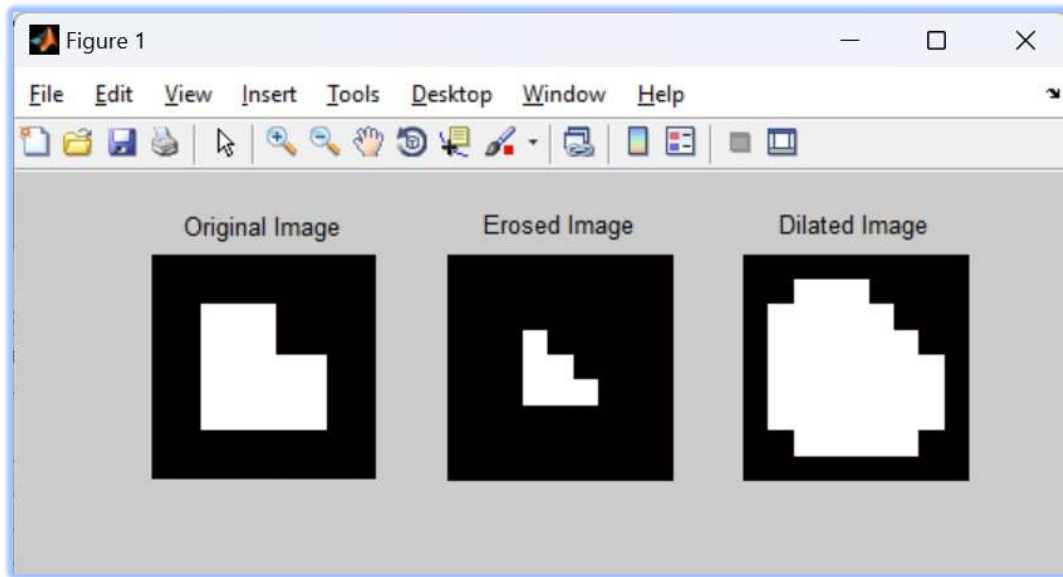
```
a_1_1.m x convolutionErosion.m x convolutionDilation.m x a_1.m x +
1 function outputImg = convolutionDilation(img, s)
2     s = getnhood(s);
3     [m, n] = size(s);
4     radius = floor(m / 2);
5     [r, c] = size(img);
6
7     img = padarray(img, [radius, radius], 0, 'both');
8     new_img = zeros(r, c);
9     for i = radius + 1 : r
10         for j = radius + 1 : c
11             subimg = img((i - radius):(i + radius), (j - radius):(j + radius));
12             if max(max(bitand(subimg, s))) == 1
13                 new_img(i - radius, j - radius) = 1;
14             else
15                 new_img(i - radius, j - radius) = 0;
16             end
17         end
18     end
19     outputImg = new_img;
20 end
```

➤ Code:

```
a_1_1.m x convolutionErosion.m x convol
1 - clear all;
2 - img = zeros(9, 9);
3
4 - for i = 3 : 4
5 -     for j = 3 : 5
6 -         img(i, j) = 1;
7 -     end
8 - end
9
10 - for i = 5 : 7
11 -     for j = 3 : 7
12 -         img(i, j) = 1;
13 -     end
14 - end
15
16 - subplot(2, 3, 1);
17 - imshow(img);
18 - title('Original Image');
19 - s = strel('Disk', 1);
20
```

```
20
21 - erosionImg = convolutionErosion(img, s);
22 - subplot(2, 3, 2);
23 - imshow(erosionImg);
24 - title('Eroded Image');
25
26 - dilationImg = convolutionDilation(img, s);
27 - subplot(2, 3, 3);
28 - imshow(dilationImg);
29 - title('Dilated Image');
30
31
```

➤ **Output:**



**Q. 2: Download 'banana' image. Convert it into black and white image as shown below. Perform 'Erosion' and 'Dilation' operation with 'Disk' and 'Square' structuring elements.**

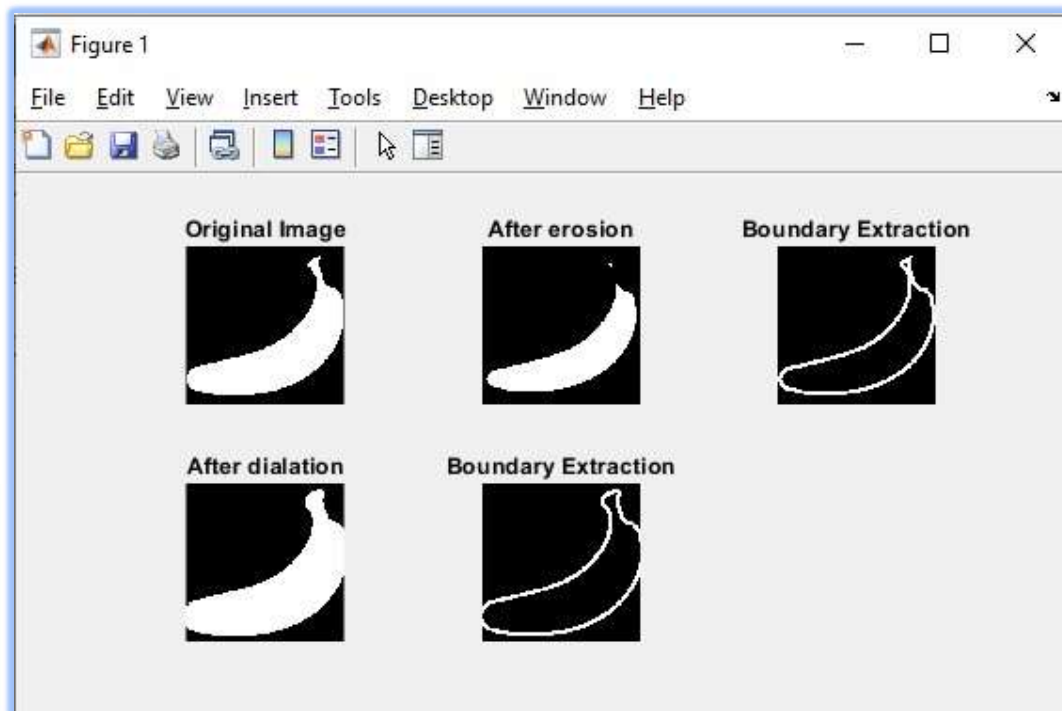
❖ **By using in-built function:**

➤ **Code with 'disk' as structuring element:**

```
a_2.m  x  a_2_1.m  x  +
1      img = imread('banana.bmp');
2      img = im2bw(img);
3      img = imcomplement(img);
4
5      subplot(3, 3, 1);
6      imshow(img);
7      title("Original Image");
8
9      % define structuring element.
10     s = strel('Disk', 6);
11
12     % erosion
13     erosion = imerode(img, s);
14
15     subplot(3, 3, 2);
16     imshow(erosion);
17     title("After erosion");
18
19     subplot(3, 3, 3);
20     imshow(img - erosion);
21     title("Boundary Extraction");
22
```

```
22
23     % dialation
24
25     dialation = imdilate(img, s);
26
27     subplot(3, 3, 4);
28     imshow(dialation);
29     title("After dialation");
30
31     subplot(3, 3, 5);
32     imshow(dialation - img);
33     title("Boundary Extraction");
34
35
```

➤ Output:



➤ Code with 'square' as a structuring element:

```
a_2.m x a_2_1.m x +
1      img = imread('banana.bmp');
2      img = im2bw(img);
3      img = imcomplement(img);
4
5      subplot(3, 3, 1);
6      imshow(img);
7      title("Original Image");
8
9      s = strel('square', 6);
10
11     % erosion
12     erosion = imerode(img, s);
13
14     subplot(3, 3, 2);
15     imshow(erosion);
16     title("After erosion");
17
18     subplot(3, 3, 3);
19     imshow(img - erosion);
20     title("Boundary Extraction");
21
```

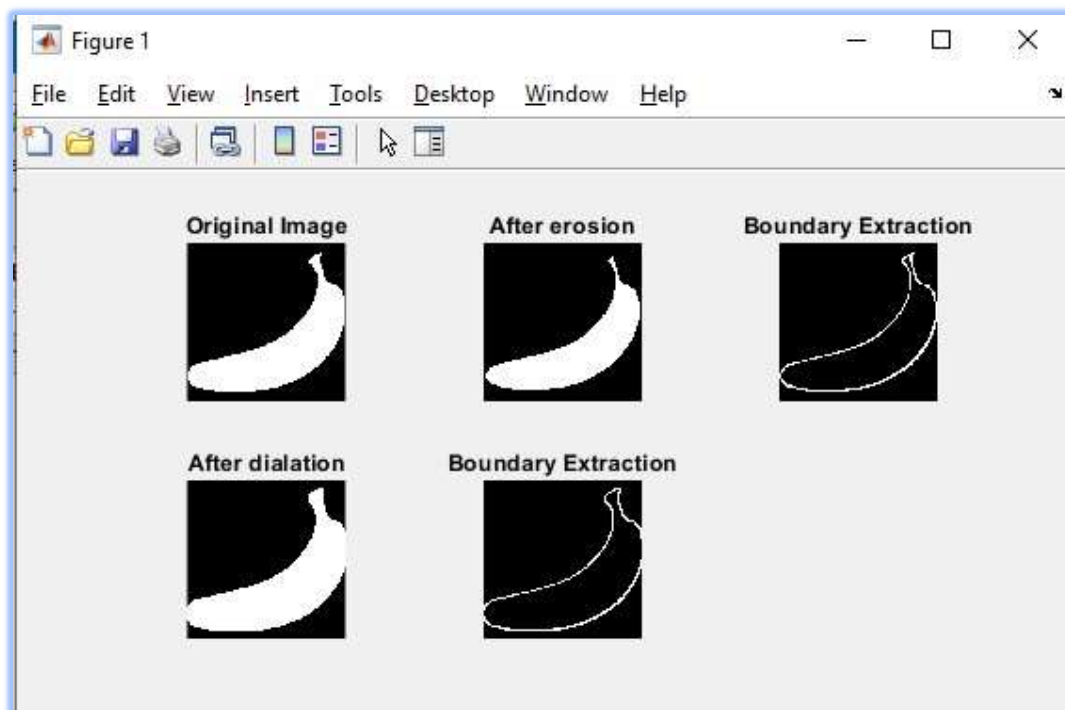


```

21
22     % dialation
23     dialation = imdilate(img, s);
24
25     subplot(3, 3, 4);
26     imshow(dialation);
27     title("After dialation");
28
29     subplot(3, 3, 5);
30     imshow(dialation - img);
31     title("Boundary Extraction");
32

```

➤ **Output:**



❖ **By using manual function:**

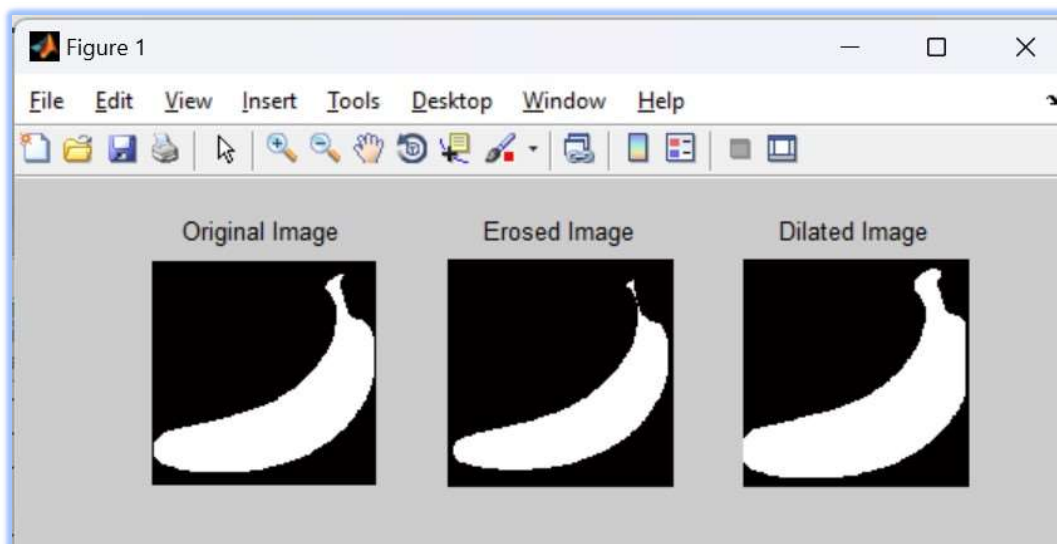
➤ **Code:**

```

1 - img = imread('banana.bmp');
2 - img = im2bw(img);
3 - img = imcomplement(img);
4
5 - subplot(2, 3, 1);
6 - imshow(img);
7 - title('Original Image');
8
9 - s = strel('Disk', 5);
10
11 - erosionImg = convolutionErosion(img, s);
12 - subplot(2, 3, 2);
13 - imshow(erosionImg);
14 - title('Eroded Image');
15
16 - dilationImg = convolutionDilation(img, s);
17 - subplot(2, 3, 3);
18 - imshow(dilationImg);
19 - title('Dilated Image');
20

```

➤ **Output:**



**Q. 3: Read in the image 'blobs.png'. This image should already be available with MATLAB as it comes with the Image Processing Toolbox. Perform 'Opening' and 'Closing' operations on the given image with 'Disk' structuring element of size '5'.**

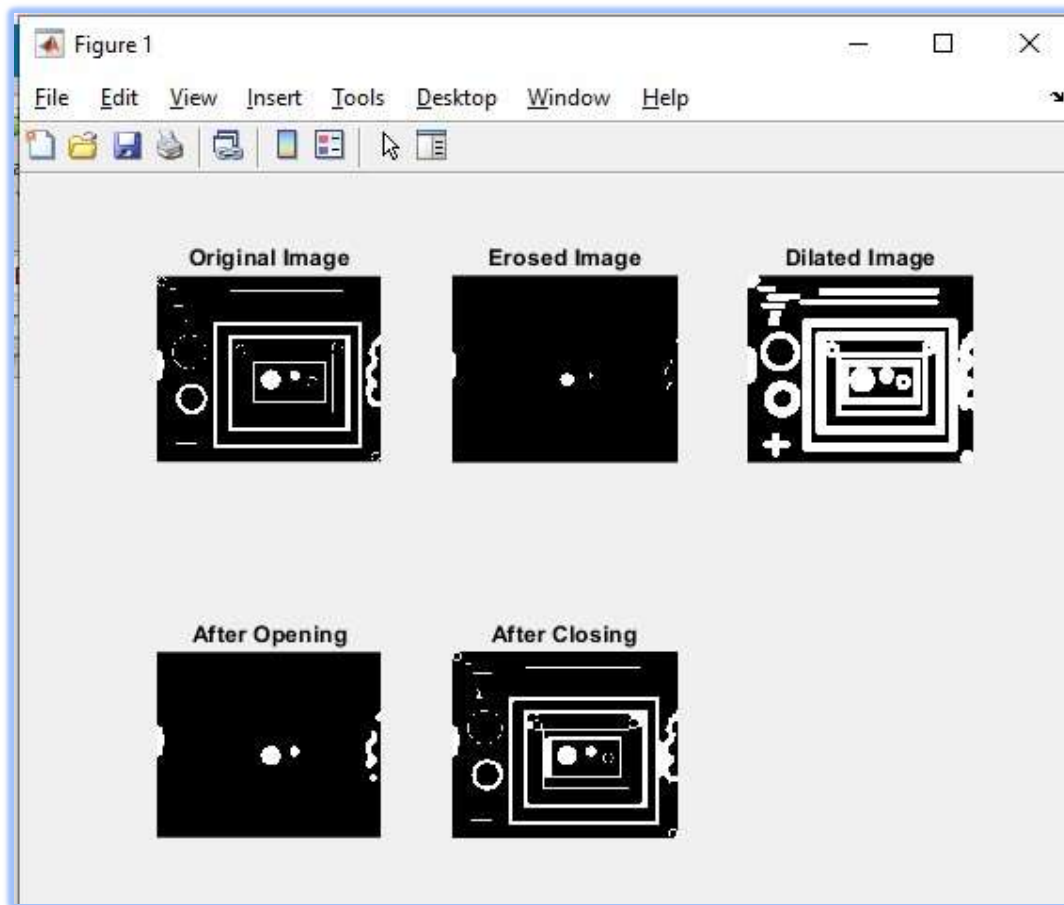
❖ **By using in-built function:**

➤ **Code:**

```
a_3.m x  untitled6 x  +
1      clear all;
2
3      img = imread('blobs.png');
4
5      subplot(2, 3, 1);
6      imshow(img);
7      title("Original Image");
8
9      s = strel('Disk', 5);
10
11     % erosion
12     erosion = imerode(img, s);
13     subplot(2, 3, 2);
14     imshow(erosion);
15     title("Eroded Image");
16
17     % dilation
18     dilation = imdilate(img, s);
19     subplot(2, 3, 3);
20     imshow(dilation);
21     title("Dilated Image");
22
```

```
22
23     % opening
24     openingImage = imdilate(erosion, s);
25     subplot(2, 3, 4);
26     imshow(openingImage);
27     title("After Opening");
28
29     % closing
30     closingImage = imerode(dilation, s);
31     subplot(2, 3, 5);
32     imshow(closingImage);
33     title("After Closing");
34
```

➤ **Output:**



❖ **By using manual function:**

➤ **Code:**

```

a_3.m x a_3_1.m x a_2_2.m x +
1 - clear all;
2 - img = imread('blobs.png');
3
4 - subplot(2, 3, 1);
5 - imshow(img);
6 - title('Original Image');
7
8 - subplot(2, 3, 1);
9 - imshow(img);
10 - title('Original Image');
11
12 - s = strel('Disk', 5);
13
14 - erosionImg = convolutionErosion(img, s);
15 - subplot(2, 3, 2);
16 - imshow(erosionImg);
17 - title('Eroded Image');
18
19 - dilationImg = convolutionDilation(img, s);
20 - subplot(2, 3, 3);
21 - imshow(dilationImg);
22 - title('Dilated Image');

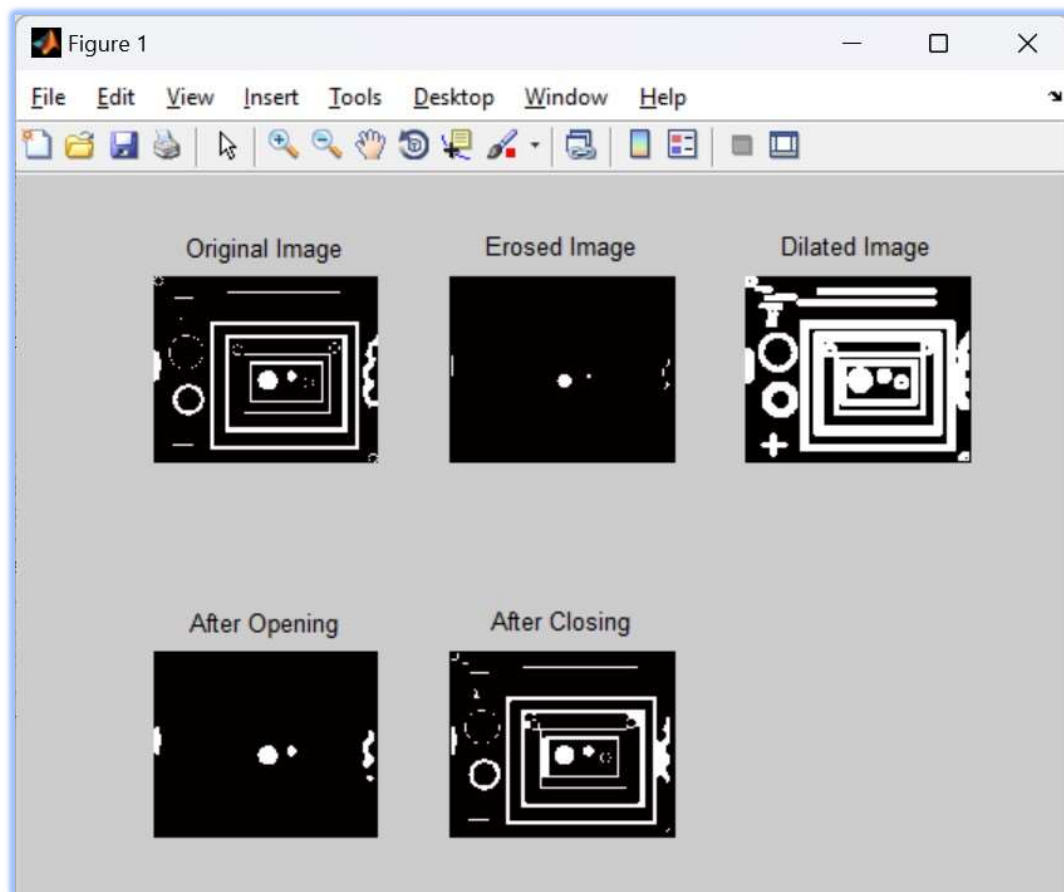
```

```

23
24 % opening
25 - openingImage = convolutionDilation(erosionImg, s);
26 - subplot(2, 3, 4);
27 - imshow(openingImage);
28 - title('After Opening');
29
30 % closing
31 - closingImage = convolutionErosion(dilationImg, s);
32 - subplot(2, 3, 5);
33 - imshow(closingImage);
34 - title('After Closing');
35

```

➤ **Output:**



**Q. 4: Perform 'Boundary Extraction' Operation on 'Banana' and 'Shapes' images.**

❖ **By using in-built function:**

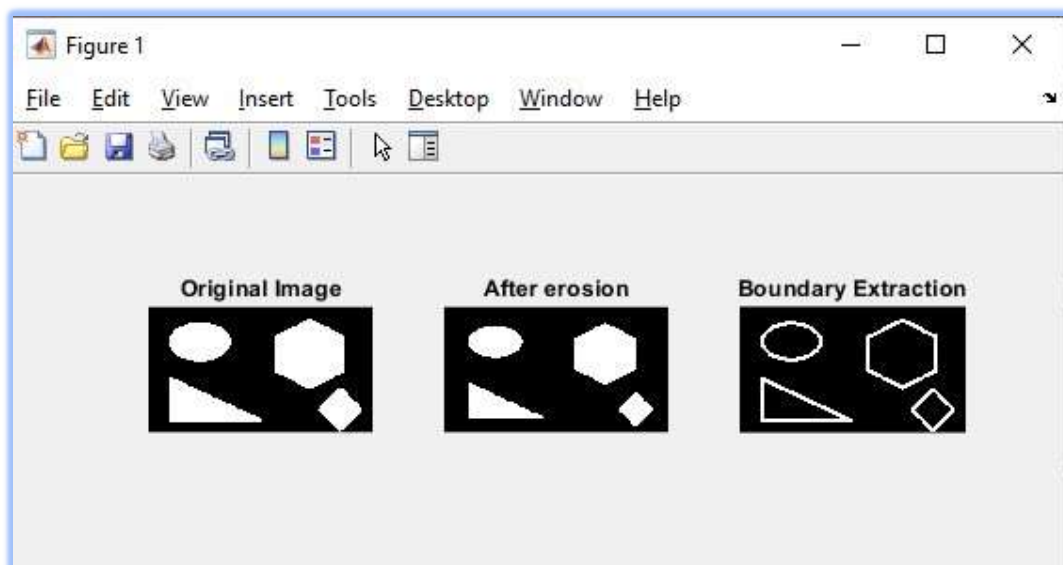
➤ **Code:**

```

a_4.m x +
1  img = imread('Geometrical.bmp');
2  img = im2bw(img);
3  img = imcomplement(img);
4
5  subplot(2, 3, 1);
6  imshow(img);
7  title("Original Image");
8  |
9  s = strel('Disk', 5);
10
11 % erosion
12 erosion = imerode(img, s);
13
14 subplot(2, 3, 2);
15 imshow(erosion);
16 title("After erosion");
17
18 subplot(2, 3, 3);
19 imshow(img - erosion);
20 title("Boundary Extraction");

```

➤ **Output:**



## ❖ By using manual function:

### ➤ Code:

```
a_2_2.m x a_4.m x a_4_1.m x +
1 - img = imread('Geometrical.bmp');
2 - img = im2bw(img);
3 - img = imcomplement(img);
4
5 - subplot(2, 3, 1);
6 - imshow(img);
7 - title('Original Image');
8
9 - s = strel('Disk', 5);
10
11 - erosionImg = convolutionErosion(img, s);
12 - subplot(2, 3, 2);
13 - imshow(erosionImg);
14 - title('Eroded Image');
15
16
17 - subplot(2, 3, 3);
18 - imshow(img - erosionImg);
19 - title('Boundary Extraction');
20
```

### ➤ Output:

