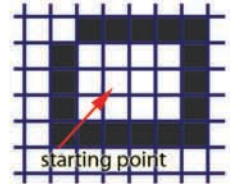


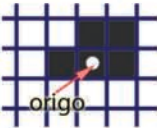
Video Processing

Date: 6/2/2013

Ex.1.[11 Pt] After a brief description of the Morphological filling [3 Pt], describe the steps done by morphological operators in order to fill the shape in the figure on the right.



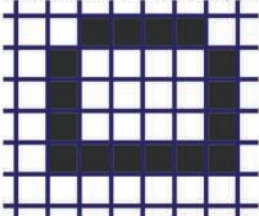
The starting point is the one indicated by the arrow and the structuring element is the following one:



The origo of the structuring element is the one depicted above.

Draw the value (black or white) of the internal pixels at each iteration [4Pt].

What problem would arise if the shape is the following? [3Pt]

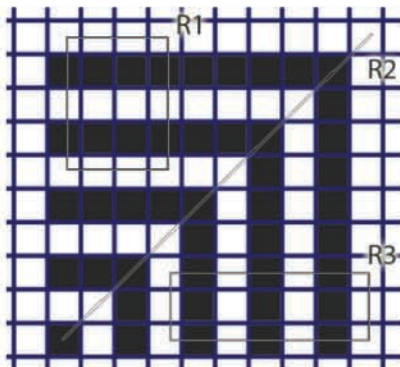


How can I avoid this problem?[1Pt]

Es.2. [11 pt] Consider the Gaussian Statistics assuming that the intensity value for white pixels is 1 and 0 for black ones.

Provide the 8 elements feature vectors for the 3 depicted regions, R1, R2 and R3.

In particular the region R2 is formed by pixel exactly on the corner straight line.



Es.3. [11 pt] Given a truecolor image in the file *image.bmp* with 8 bit per channel, implement in Matlab the following operations:

- Read the image, load it in the workspace and visualize it.[1Pt]
- Apply a Gaussian filter of size 9x9 and variance 1.2.[3Pt]
- Resize the image to an half of its original size. Use the nearest neighbor interpolation.[2Pt]
- Rescale the image to its original size using the bicubic filtering and compute the difference with respect to the original image.[3Pt]
- (Optional) repeat the previous 3 steps on the rescaled image obtained in step 3 in order to build the second layer of an image pyramid.[3Pt]

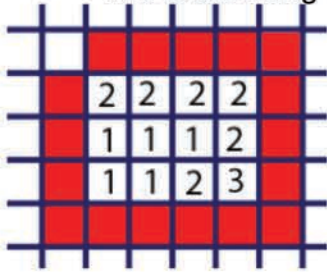
Matlab List of functions

```
figure  
fspecial  
getimage  
im2double  
imclose  
imfilter  
imopen  
imread  
imresize  
imrotate  
imshow  
size  
sqrt  
strel  
zeros
```

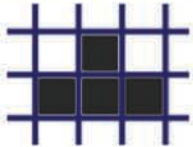
Solutions

Ex.1

- This is the filling sequence.



In the second case when we apply dilation for the third time the structuring element will also fill a pixel outside from the edge and then the filling algorithm will outflow from the border. In order to prevent this effect a different structuring element could be adopted, e.g.



Ex.2

Starting the first feature from North and moving clock-wise , summing over the internal regions points the values will be the following:

R1: [1, 1, 0, 1, 1, 1, 0, 1]*6

R2:[1, 1, 1, 1, 0, 1, 0, 1]*8

R3:[0, 1, 1, 1, 0, 1, 1, 1]*5

Ex.3

1.

```
img_rgb = imread('image.bmp');  
figure, imshow(img_rgb);
```

alternative:

```
imshow('image.bmp');  
img_rgb = getimage;
```

2.

```
gauss_kernel = fspecial('gaussian', 9, 1.2);  
img_gauss = imfilter(img_rgb, gauss_kernel);
```

3.

```
img_small = imresize(img_gauss, 0.5, 'nearest');
```

4.

```
img_big = imresize(img_small, 2, 'bicubic');  
img_diff = img_rgb - img_big;
```

5.

```
img_gauss_small = imfilter(img_small, gauss_kernel);  
img_resize = imresize(imresize(img_gauss_small, 0.5, 'nearest'), 2, 'bicubic');  
img_small_diff = img_small - img_resize;
```