

Midterm Exam

1. In the 8x8 image X shown below, all pixels shown with an asterisk * have gray level 41, all the other pixels have gray level 14.

	*				*		
	*				*		
	*	*		*	*		
	*	*	*	*	*		
		*	*	*			
		*	*	*			
			*				
			*				

(a) Suppose we linearly smooth X using a 1-row by 3-column averaging mask whose origin is the center of the mask. How many of the 64 pixels in X will change value? What is the largest increase in brightness any pixel in the given image X will have?

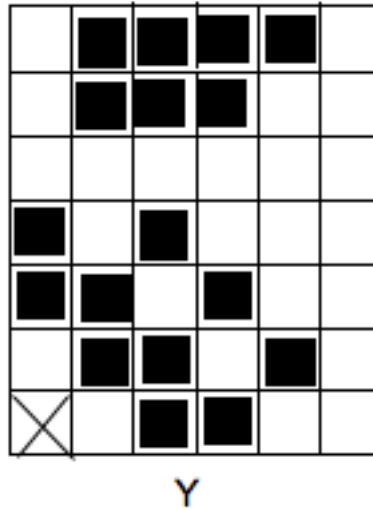
(b) Suppose instead we smooth X using a median filter with the same mask size and origin as in (a). How many of the 64 pixels in X will change value? What is the largest increase in brightness any pixel in the given image X will have due to this filtering?

2. Consider a binary 16x16 image Y which contains two foreground blobs, one is of size 2x2 pixels and the other of size 1 pixel. Assume that the pair of foreground blobs are not connected to each other (the blobs are neither 4-connected nor 8-connected to each other).

(a) How many nodes will there be in the T-pyramid for Y?

(b) What is the maximum, and the minimum, number of nodes in the quadtree for Y? For best part credit, show where you would place the blobs in Y and explain your reasoning.

3.



(a) Y above is a binary image with foreground pixels shown in black. Find $Z=Y(-)B_1$, the erosion of Y by the structuring element $B_1=\{(1,0),(0,1),(1,1)\}$. Give your answer graphically, with foreground pixels shown in black and the origin marked with an ex as above.

(b) Find B_2 so that Y shown above is the dilation of the binary image X shown below using structuring element B_2 . Give your answer graphically, with foreground pixels in B_2 shown in black and the origin marked with an ex.

