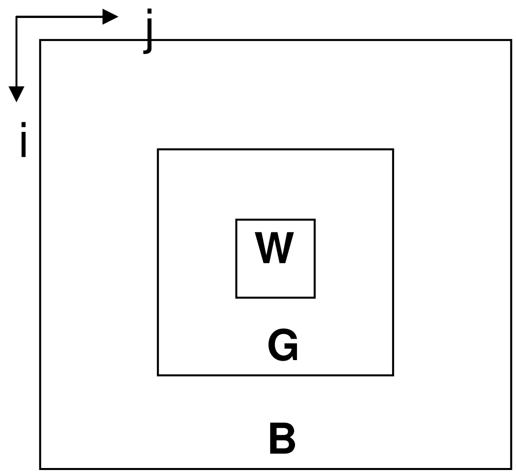
CSE 473/573 Fall 2006 Oct 20 2006

Midterm Exam

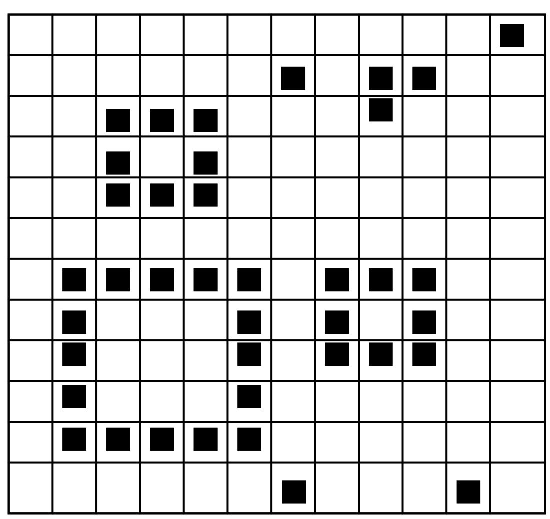
Instructions: anwer all 3 questions in the bluebook provided. 50 min, open book, notes.

1. A mask of size *NxM* with all positive weights which sum to one is used to linearly smooth an image. The image, an intensity image *X*, is pure black, *X(i,j)*=0.0, except for a 16x16 square in the middle of the image which is pure white, *X(i,j)*=1.0 for *i,j*=120,..,135. The smoothed image will have three regions: in **W** all pixels are pure white, **B** pure black, and those in **G** have gray levels in between.



(a) Suppose the region **W** has W_N rows and W_M columns. What does that tell you about *N* and *M*? What does it tell you about the location of the origin of the mask?
(b) Suppose the mask is of size *NxM* = 3x4 (3 rows, 4 columns) and that the upper left hand corner of the region **G** is at *(i,j)*=(120,117). Where on the 3x4 mask is its origin?

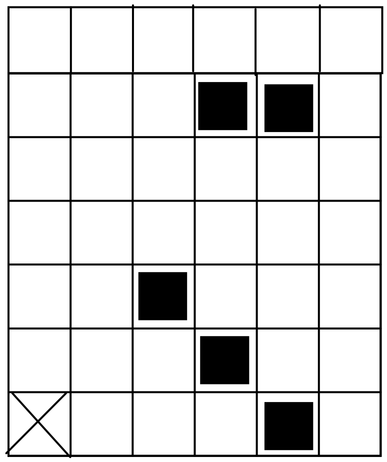
2.



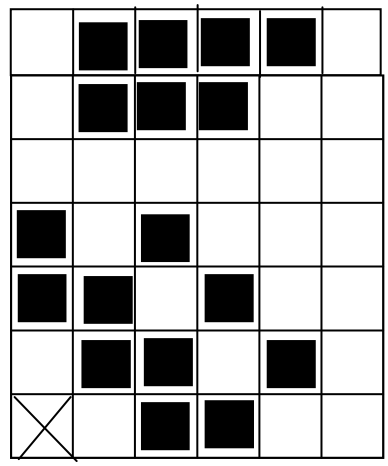
(a) If the Hough Transform were used to find straight lines in this image, what would the largest value in the accumulator array be? Explain your reasoning.

(b) If the generalized Hough Transform were used to find all squares of any size which were aligned with the vertical and horizontal axes, what variables would you use to set up the accumulator array? For this image, what would be largest value in the array? Explain.

3.



X



Y

(a) Find B such that Y is the binary dilation of X. Give your answer graphically, with foreground pixels in your B shown black and the origin marked with an "X".

(b) For some structuring elements which contain exactly two pixels, $X \bullet B = X$ for the image X above, where • is the <u>closing</u> operator. Give an example of such a B, label it B_T, and an example of a B with two pixels for which this equation is not true. Label that B as B_F. Give your answers algebraically, written as a set of pixels from ZxZ.