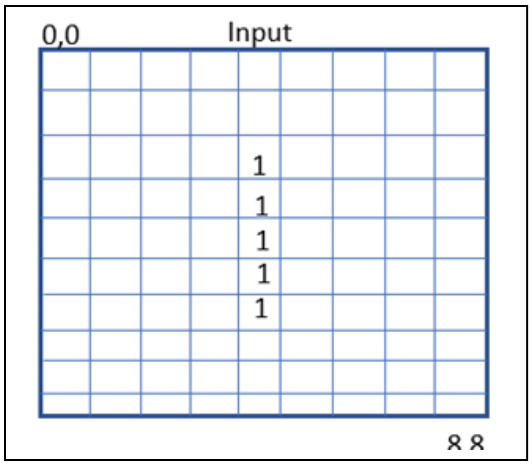
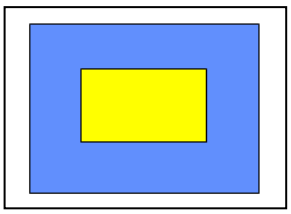
Homework 2: (100 points) In all cases, show all images with their corresponding intermediate results

1. (10 pt) Given an input image on the right, (a) compute output with the filter $\begin{pmatrix} 1 & -1 \\ 1 & -1 \end{pmatrix}$.



1. (10) Design a one dimensional filter of Gaussian, first derivative of Gaussian, and the second derivative of Gaussian with sigma = 2.4. Plot these filters with clear annotations along X and Y direction.

2. (30) Synthetic images are widely used in image analysis to assess performance of a method. Create a synthetic image as shown to the right where the background and foreground are 50 and 150, respectively. The large square should be 150-by-150 pixels, and the small square should be 75-by-75 pixels. Add Gaussian noise and increase the amount of noise to generate 2 additional corrupt images with variance of 0.005, 0.05. You will need to normalize these variances if you are using matlab imnoise command.



   b. Apply LoG Filter with sigma of 0.5, 2, 4 and compute zero crossing. Estimate the LoG filter with a DoG filter.
   c. Compute and show the edge magnitude and direction for synthetic and corrupted images. Study the edge direction along the square. Do you see the edge direction changing? Do you see that the edge directions are antiparallel at the opposite sides of the square?

3. (20) Use the stent image and apply the following operations
   a. Enhance image
   b. Add original image with a response of LoG filter and then enhance
   c. Create a blurred version of the image with a 3-by-3 filter. Subtract the original from the blurred version. Add the difference to the original image. Report the results

4. (30) Use Lenna Image
   a. Implement a derivative of Gaussian, with sigma of 1, 3, and 5, and convolve with the Lenna image. Show the derivatives in X and Y directions. Compute and show magnitude and edge direction.
   b. Show the zero-crossing image for sigma = 1, 2, 8.
   c. What is your insights based on a-b?