Midterm for CSE 377 (Allen Tannenbaum)
Due in class on Thursday, March 23, 2017.

All parameter values in these problems are suggested. You can and should try your own.

1. (a) Take the image heart.jpg and find a threshold to pull out the two heart chambers. Please give me the threshold and results. See the power point medical.imaging.ppt.
   (b) Take the image brain.tech.jpg and find a threshold to pull out the tumor. Please give me the threshold and results. See the power point medical.imaging.ppt.

2. Look up the Hough transform for finding line segments in an image. Write a paragraph about the Hough transform, explaining how it works and its advantages and weaknesses.

3. Apply the Laplacian of Gaussian operator to find the edges in heart.jpg and brain.tech.jpg. Try several different values of the variance sigma. For example, sigma=1, 10, 100, 1000. Recall that the Gaussian filter is given by:

$$G_\sigma = \frac{1}{2\pi\sigma^2} e^{-\frac{(x^2+y^2)}{2\sigma^2}}$$

4. Apply histogram equalization to heart.jpg and brain.tech.jpg, and show results.

5. Let H be a Gaussian smoothing filter. Let F be the image heart.jpg. Consider the filter

$$F + \alpha\left(F - F * H\right) = \left(1 + \alpha\right) F - \alpha\left(F * H\right) = F * \left([1 + \alpha]e - H\right)$$

   What does this filter do? Take α=.5, and σ=10 (in the Gaussian), and apply to heart.jpg. Try a few other values of α and σ, and show the results. The symbol e in the above formula is the delta function.

Each problem is worth 20 points.