ECGR 6118
Computer Project: Edge Detection
Student Name:_____

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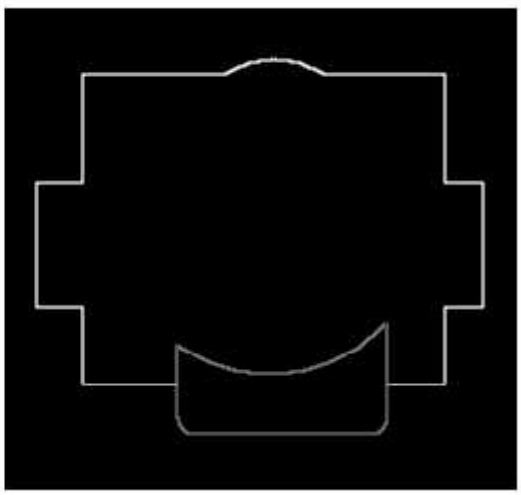
For this project, you may use mathcad or NetBeans

Project tasks:
Complete the tasks below and turn in a project report.

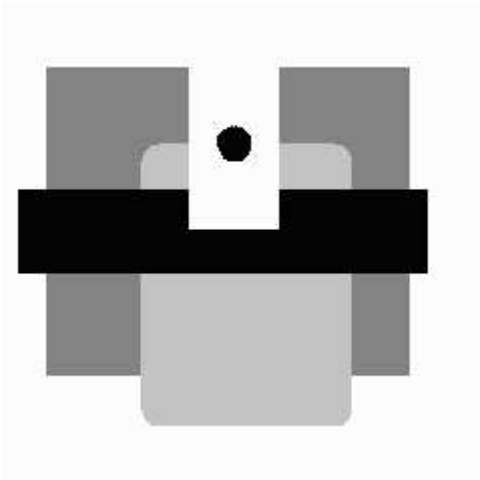
Turn in a 8-page report,
with page-1 cover sheet,
page 2 explaining the methods you used,
pages 3 - 7 being 6x6 inch printouts of your images for each of the tasks below.
Make sure that you caption each image, clearly stating what the image is.
Include your Mathcad or Java as an appendix.

1. For the image testpat2.gif, write a program to compute a magnitude Sobel gradient G(x,y) = |Sx(x,y)| + |Sy(x,y)|, where Sx(x,y) and Sy(x,y) are the Sobel operator outputs for the x and y diresctions. Note that the gradient may need to be rescaled to between 0 and 255 gray-levels. Plot the gradient image.

Below, the input image testpat2.gif is illustrated on the left, and a magnitude Sobel is illustrated on the right. Do not use the image below, download the original image from the website.

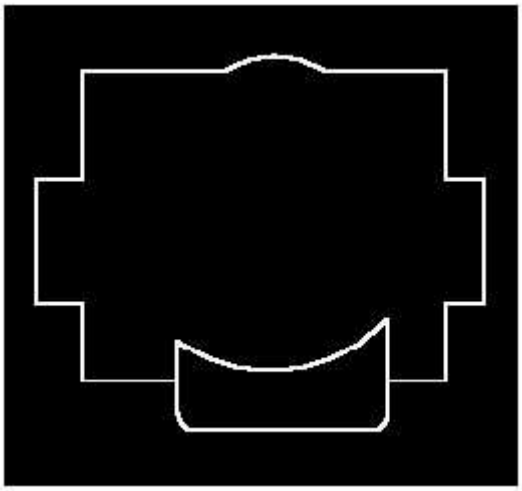


2. For the image testpat1.gif, shown below, write a program to compute a magnitude Sobel gradient, and plot the gradient image. Note that the gradient may need to be rescaled to between 0 and 255 gray-levels.



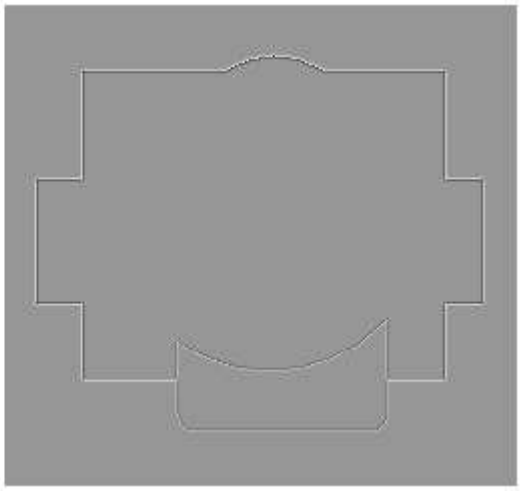
3. For the image testpat1.gif, write a program to threshold the magnitude Sobel gradient image to show the edges in black and white as illustrated below. Plot the edge image.

Note that the edge image example below IS NOT for testpat1.gif



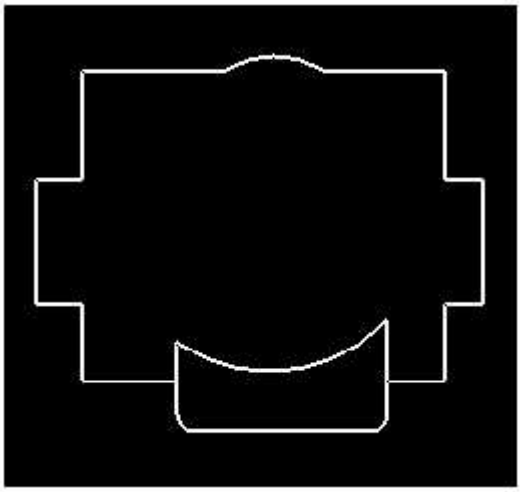
4. For the image testpat1.gif, shown below, write a program to compute the Laplacian image (Eq. 15.3-4b) and plot the Laplacian image.

Use a background of 128, as illustrated below.
The example below IS NOT for testpat1.gif



5. For the image testpat1.gif, write a program to find zero-crossings of the Laplacian image to show the edges in black and white as illustrated below. Plot the edge image.

Note that the edge image example below IS NOT for testpat1.gif



Q6. Run the Hough transform on the edge image result from **Q5** above.
You may use the Hough() function below as a starting point.
Note that you must add the histogram equalization function.

$$
\begin{aligned}
&\text{hough}(f) := \\
&\quad nc \leftarrow \text{cols}(f) \\
&\quad nr \leftarrow \text{rows}(f) \\
&\quad y \leftarrow f \\
&\quad \text{for } rr \in 0..\text{rows}(f) - 1 \\
&\qquad \text{for } cc \in 0..\text{cols}(f) - 1 \\
&\qquad\quad y_{rr,cc} \leftarrow 0 \\
&\quad \text{for } rr \in 0..\text{rows}(f) - 1 \\
&\qquad \text{for } cc \in 0..\text{cols}(f) - 1 \\
&\qquad\quad \text{for } th \in 0..255 \qquad\qquad \text{if } f_{rr,cc} > 120 \\
&\qquad\qquad ang \leftarrow 0 + \frac{\pi \cdot th}{255} \\
&\qquad\qquad pp \leftarrow \frac{(cc \cdot \cos(ang) + rr \cdot \sin(ang))}{1.415} \\
&\qquad\qquad pp \leftarrow \text{floor}\left(\left(\frac{pp + 255}{2}\right)\right) \\
&\qquad\qquad pp \leftarrow 0 \quad \text{if } pp < 0 \\
&\qquad\qquad y_{pp,th} \leftarrow y_{pp,th} + 1 \\
&\quad ymax \leftarrow \max(y) \\
&\quad ymin \leftarrow \min(y) \\
&\quad \text{for } rr \in 0..\text{rows}(f) - 1 \\
&\qquad \text{for } cc \in 0..\text{cols}(f) - 1 \\
&\qquad\quad z_{rr,cc} \leftarrow \text{floor}\left(250 \cdot \frac{y_{rr,cc} - ymin}{ymax - ymin}\right) \\
&\quad zz \leftarrow \text{histeq}(z) \\
&\quad \text{return } zz
\end{aligned}
$$

add your own histogram equalization function here