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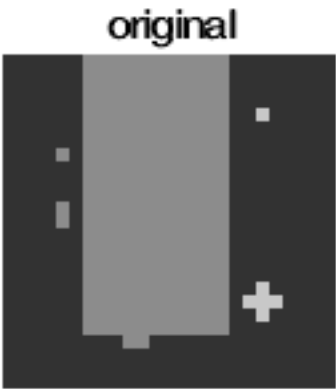
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ELEN 640 HW 4

Problem 1

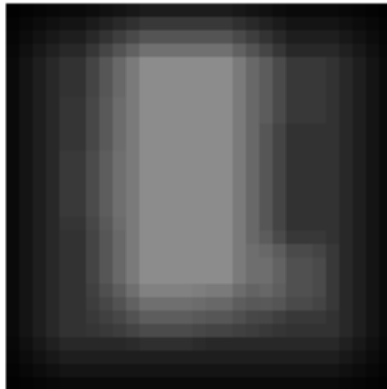
The more things are averaged the blurrier they become. Lines are distorted, isolated points get lost to noise, and finite shapes become unrecognizable.



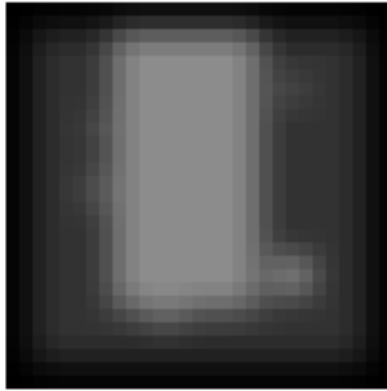
Problem 1 Part a



Problem 1 Part b



Problem 1 Part c



Problem 2

Median filtering cuts the corners on all the squares. It also removes distinct points or misattributes them to weird places. Ultimately it leaves less noise, but at the cost of some of the main shape. Compared to Averaging, it is less blurry, but distorted in a different way. Which is better would depend on the desired result

Problem 2 Part a



Problem 2 Part b



Problem 2 Part c



Problem 3

If a median filter is applied to a line that is one pixel wide, it will remove the line entirely. This is due to how many spaces the line takes up in the filter. Only taking up 3 means it will never be the median. Conversely, a 2 pixel width line will not be removed because the pixels will take up 6 of the 9 spaces of the filter. Median filters are non-linear. They do not take into account value of the pixels only the position, which will be changing constantly.

Problem 4

*The gradient components will show 0 in areas where there are no changes and something when there is a change occurring in the image value.
A detected edge is 20 pixels wide vertical or horizontal. A detected diagonal is twice that at 50 pixels, which scales to 2 and 5 pixels*

The angles are related to the direction of the change happening in the tangent. White is 90 degrees, or a vertical change, and black is 0 degrees or horizontal change. Gray is somewhere in between.

Test 1



Sobel Magnitude, Test 1



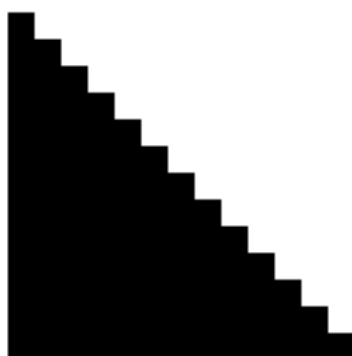
Test 2



Sobel Magnitude, Test 2



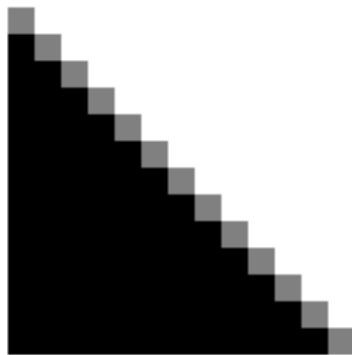
Test 3



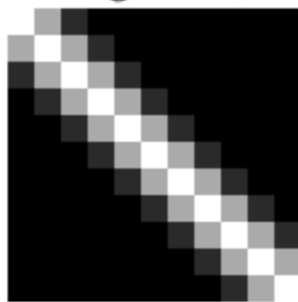
Sobel Magnitude, Test 3



Test 4



Sobel Magnitude, Test 4

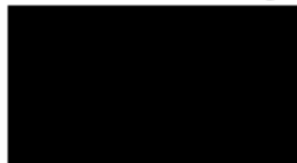


Test 5



Sobel Magnitude, Test 5

Sobel Test 1 angles



Sobel Test 2 angles



Sobel Test 3 angles



Sobel Test 4 angles



Sobel Test 5 angles

Problem 5

Roberts vertical and horizontal lines are 10 pixels in width, where diagonal are 20 wide.

Roberts angles are related in the same way that Sobels angles are.

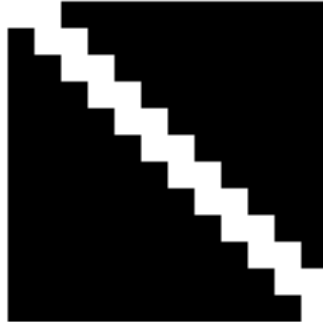
Roberts Magnitude, Test 1



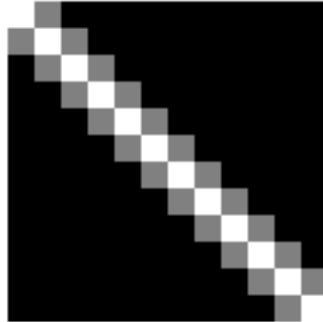
Roberts Magnitude, Test 2



Roberts Magnitude, Test 3



Roberts Magnitude, Test 4



Roberts Magnitude, Test 5

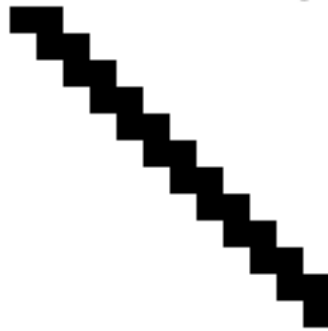
Roberts Test 1 angles



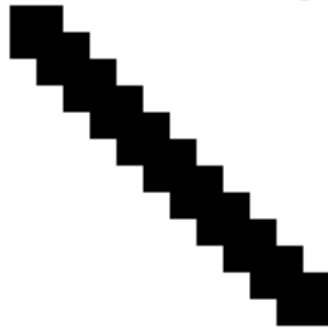
Roberts Test 2 angles



Roberts Test 3 angles



Roberts Test 4 angles

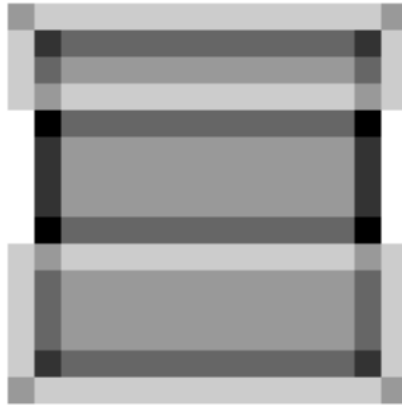


Roberts Test 5 angles

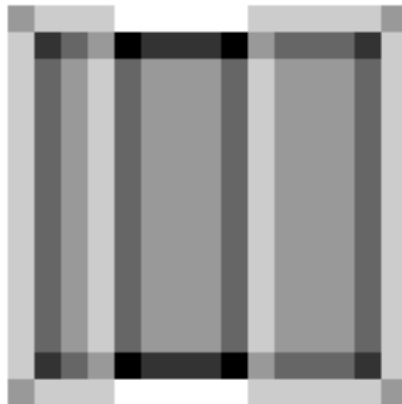


Problem 6

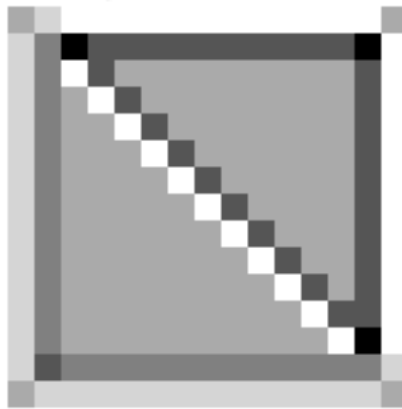
Laplacian Test 1



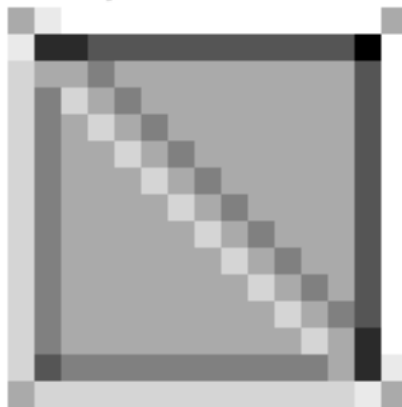
Laplacian Test 2



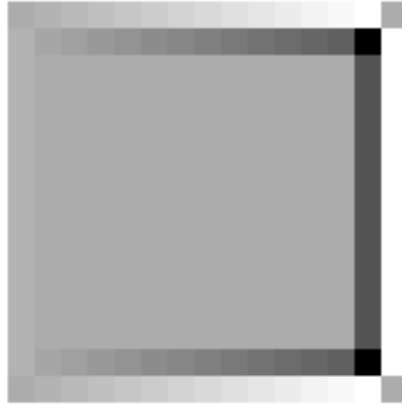
Laplacian Test 3



Laplacian Test 4



Laplacian Test 5



Problem 7

maxzero6 =

433.6534

maxzero7 =

619.3570

minnonzero6 =

372.9877

minnonzero7 =

227.1062

maxangle16 =

447.5357

minangle16 =

-1.6063

maxangle26 =

1.6310

minangle26 =

1.4839

maxangle17 =

526.7033

minangle17 =

-1.8262

maxangle27 =

2.1494

minangle27 =

0.8690

Test 6



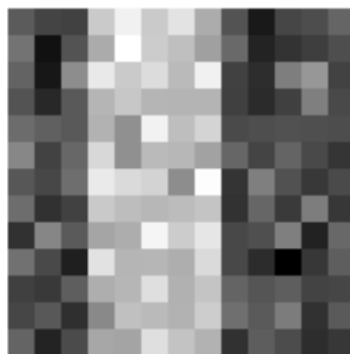
Sobel Magnitude, Test 6



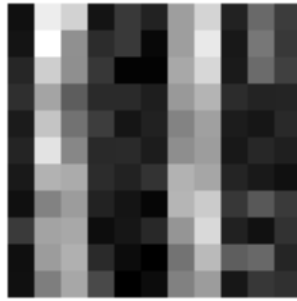
Test 6 angles



Test 7



Sobel Magnitude, Test 7



Test 7 angles



Problem 8

Ratio of h1 is < 0.01
Ratio of h2 is > 0.01
Ratio of h3 is > 0.01
The size needed is 15

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