EECS203A HW5 John Lin 25761868

Problems from the textbook: 5.1, 5.2, 5.3, 5.4, 5.5, 5.6, 5.7, 5.8, 5.9, 5.10
Note that these are the same problems in the second and third editions of the textbook. You may use a computer for problems 5.1, 5.2, ..., 5.9. For these nine problems, assume that the described input image is binary with gray levels 10 and 240. The problems are repeated below for convenience, but you will want to view the images in the book.

5.1 The white bars in the test pattern shown are 7 pixels wide and 210 pixels high. The separation between bars is 17 pixels. What would this image look like after application of

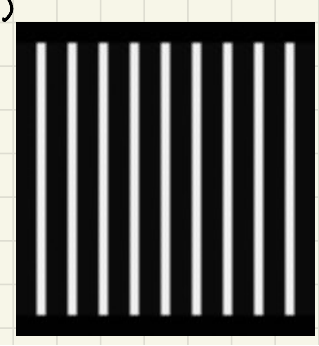
(a) A 3×3 arithmetic mean filter?

(b) A 7×7 arithmetic mean filter?

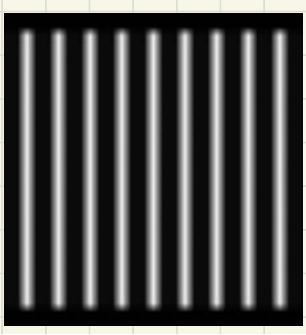
(c) A 9×9 arithmetic mean filter?

Note: This problem and the ones that follow it, related to filtering this image, may seem a bit tedious. However, they are worth the effort, as they help develop a real understanding of how these filters work. After you understand how a particular filter affects the image, your answer can be a brief verbal description of the result. For example, "the resulting image will consist of vertical bars 3 pixels wide and 206 pixels high." Be sure to describe any deformation of the bars, such as rounded corners. You may ignore image border effects, in which the masks only partially contain image pixels.

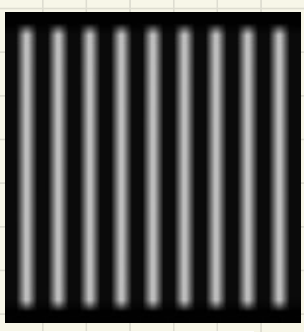
a)



b)

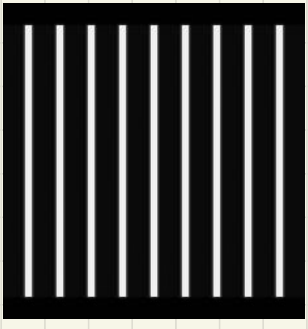


c)

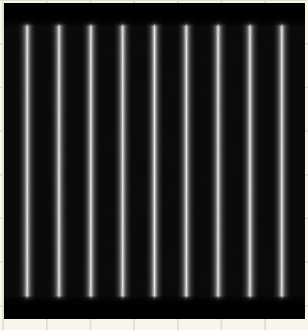


5.2 Repeat Problem 5.1 using a geometric mean filter.

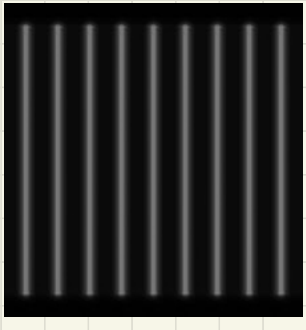
a)



b)

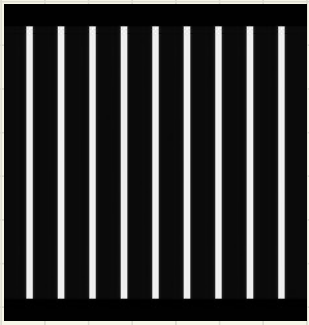
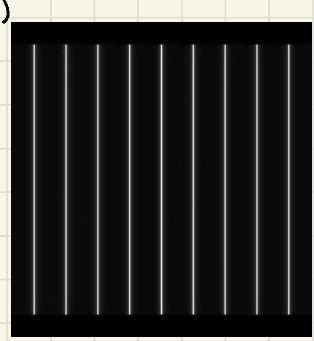


c)



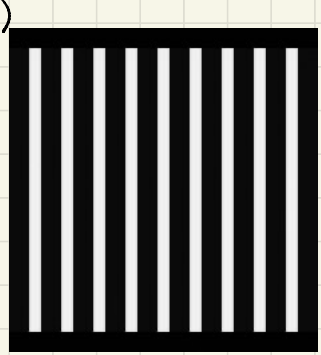
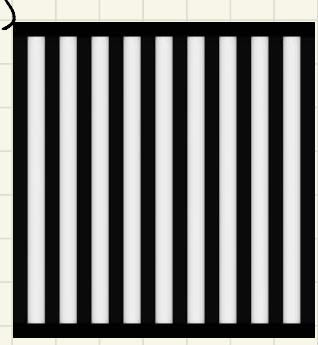
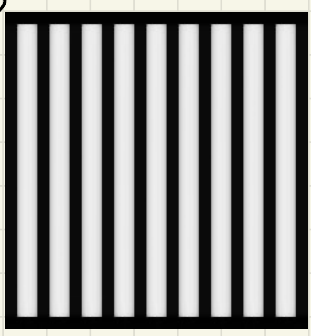
5.3 Repeat Problem 5.1 using a harmonic mean filter.

a) b) c)

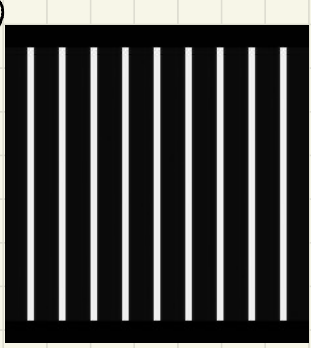
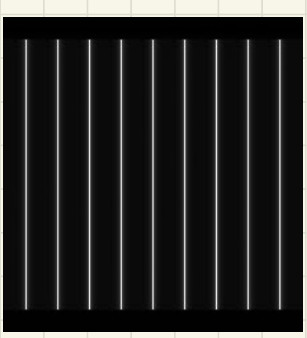
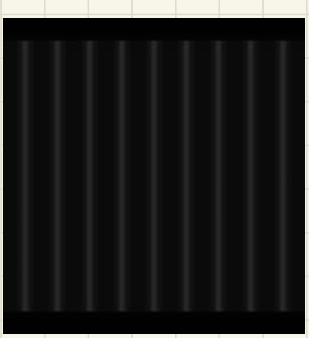

5.4 Repeat Problem 5.1 using a contraharmonic mean filter with $Q = 1$.

a) b) c)

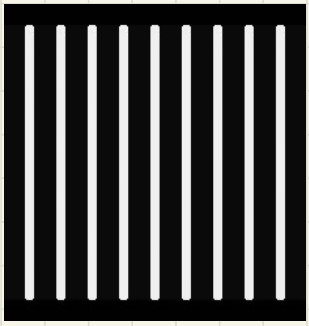
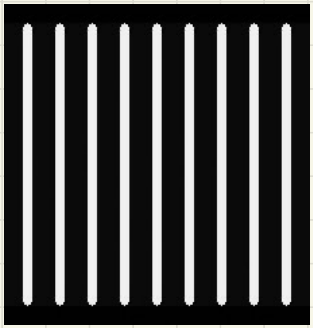
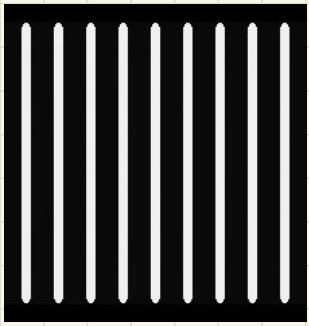
5.5 Repeat Problem 5.1 using a contraharmonic mean filter with $Q = -1$.

a) b) c)

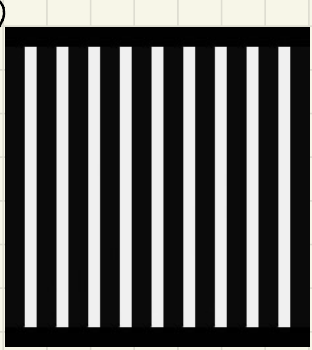
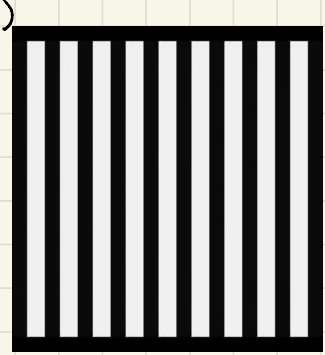
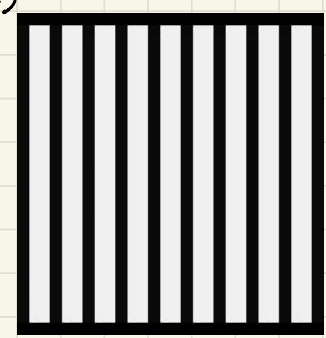
5.6 Repeat Problem 5.1 using a median filter.

a) b) c)

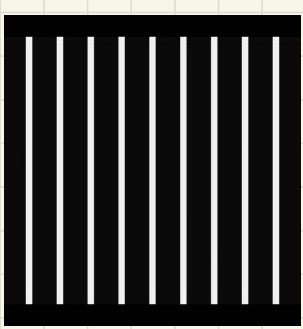
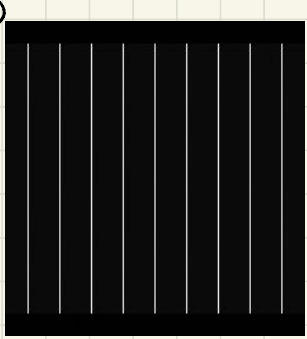
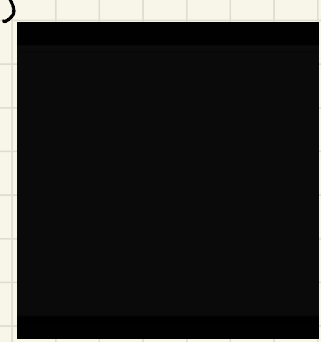
5.7 Repeat Problem 5.1 using a max filter.

a) b) c)

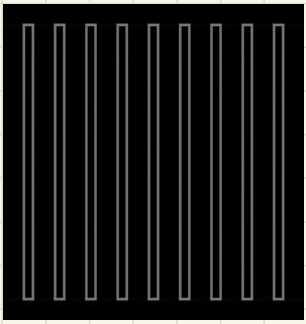




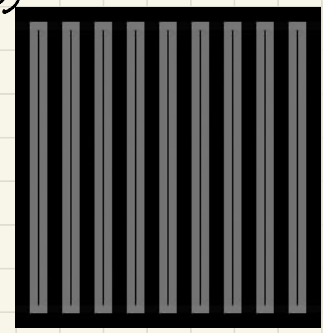
5.8 Repeat Problem 5.1 using a min filter.

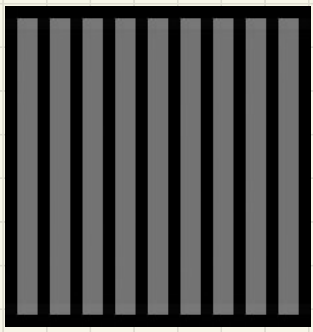
a) b) c)

5.9 Repeat Problem 5.1 using a midpoint filter.

a) 

b) 

c) 

5.10 The two subimages shown were extracted from the top, right corners of Figs. 5.7(c) and (d), respectively. Thus, the subimage on the left is the result of using an arithmetic mean filter of size 3×3; the other subimage is the result of using a geometric mean filter of the same size.

(a) Explain why the subimage obtained with geometric mean filtering is less blurred. Hint: Start your analysis by examining a 1-D step edge profile (see Fig. 3.38 for an example of a step edge).

(b) Explain why the black components in the right image are thicker.

a) Whenever at least one pixel in the mask is zero, the geometric mean is zero. But only if every pixel is zero, the arithmetic mean is zero. Intermediate values generated from arithmetic mean filter makes image more blurring than the one generated from geometric mean filter.

b) Because geometric mean is zero if any one pixel is zero, and the center of the mask can be outside of the original black area. So that the black components are thickened.