

# 5 Problem Solutions

## Problem 5.1

The solutions to (a), (b), and (c) are shown in Fig. P5.1, from left to right:

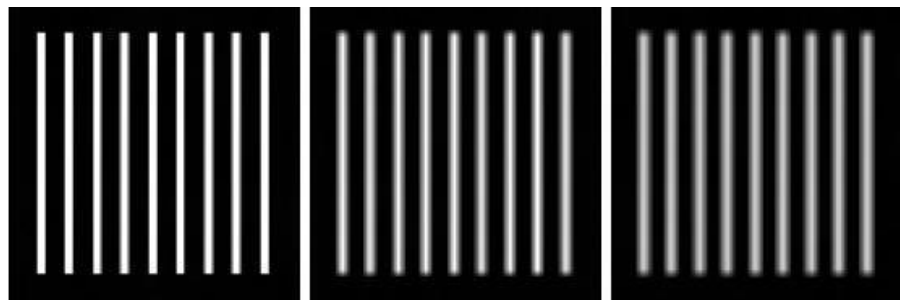


Figure P5.1

## Problem 5.2

The solutions to (a), (b), and (c) are shown in Fig. P5.2, from left to right:

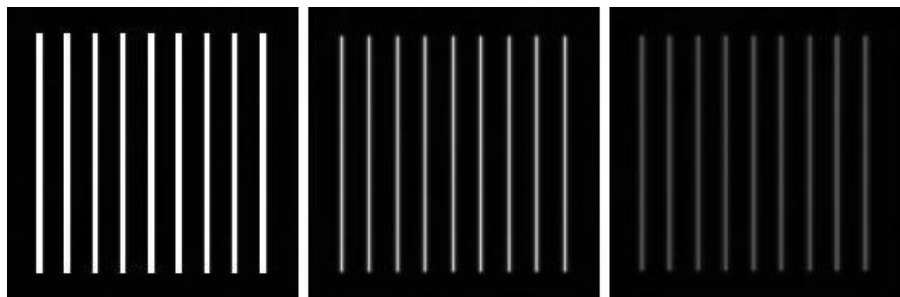


Figure P5.2

## 5.3

The solutions to (a), (b), and (c) are shown in Fig. P5.3, from left to right:

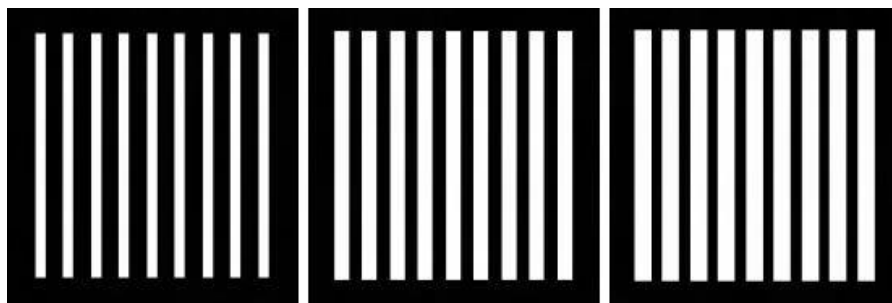


Figure P5.3

### Problem 5.4

The solutions to (a), (b), and (c) are shown in Fig. P5.4, from left to right:

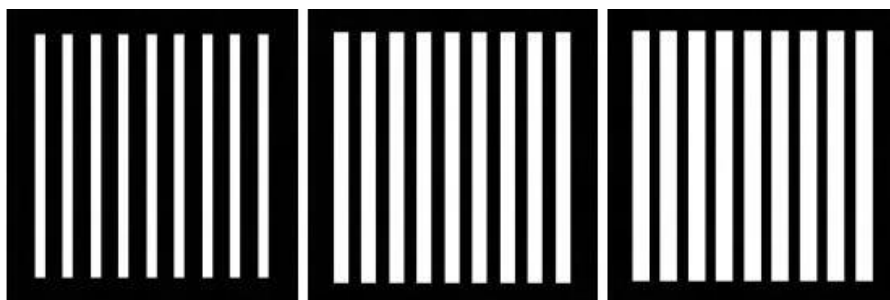


Figure P5.4

### Problem 5.5

The solutions to (a), (b), and (c) are shown in Fig. P5.5, from left to right:

Problem 5.6

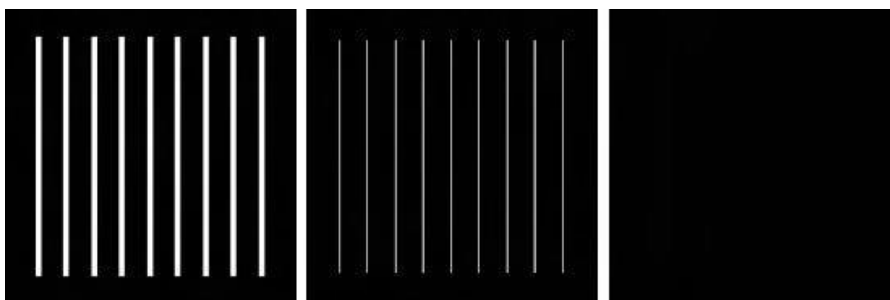


Figure P5.5

**Problem 5.6**

The solutions to (a), (b), and (c) are shown in Fig. P5.6, from left to right:

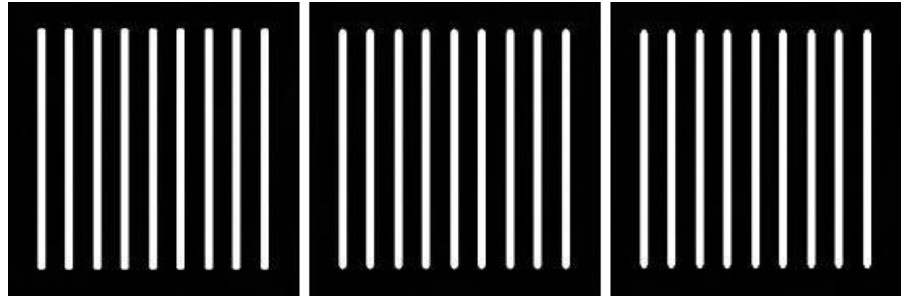


Figure P5.6

**Problem 5.7**

The solutions to (a), (b), and (c) are shown in Fig. P5.7, from left to right:

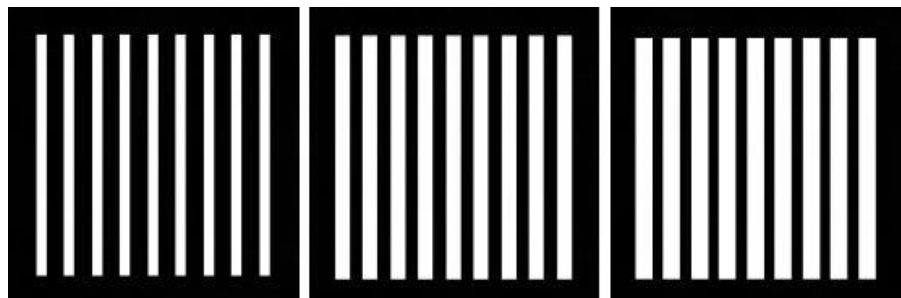


Figure P5.7

**5.8**

The solutions to (a), (b), and (c) are shown in Fig. P5.8, from left to right:

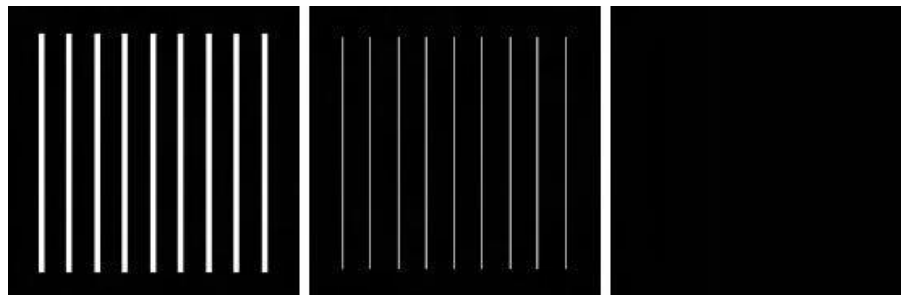
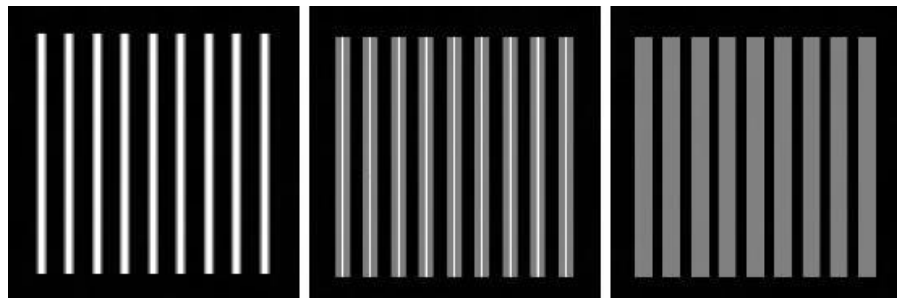


Figure P5.8

### Problem 5.9

The solutions to (a), (b), and (c) are shown in Fig. P5.9, from left to right:



**Figure P5.9**

### Problem 5.10

- (a) The key to this problem is that the geometric mean is zero whenever any pixel is zero. Draw a profile of an ideal edge with a few points valued 0 and a few points valued 1. The geometric mean will give only values of 0 and 1, whereas the arithmetic mean will give intermediate values (blur).
- (b) Black is 0, so the geometric mean will return values of 0 as long as at least one pixel in the window is black. Since the center of the mask can be outside the original black area when this happens, the figure will be thickened.