**General Instructions:** For each problem below, turn a PDF with embedded images in addition to written answers to the questions posed.

**Problem 1:** The white bars in the text pattern shown below are 7 pixels wide and 210 pixels high. The separation between the bars is 17 pixels. What would this image look like after application of the following:

1. 3 3 arithmetic mean filter?

The image will be identical to the original.

1. 7 7 arithmetic mean filter?

The bars would become larger.

1. 9 9 arithmetic mean filter?

The bars would become much larger.



**Problem 2:** Repeat Problem 1 using a 2D geometric mean filter.

1. The 3x3 will cause no change in the image.
2. The 7x7 will cause the bars to be narrower.
3. The 9x9 will make the image all zeros, because the product at any point in the bar will be 0.

**Problem 3:** Repeat Problem 1 using a 2D harmonic mean filter.

1. The results are the same as the geometric mean, because the values utilizes a product within the kernel, which yields smaller bars due to the product of 0 being 0.

**Problem 4:** Repeat Problem 1 using a 2D median filter.

1. The width of the bar for all kernels will be the same as the original image. However, the top and the bottom sides of the bars will be rounder as the kernel size increases, because the number of 0s within the kernel around the corners increases as the kernel size increases.