In this machine problem, we had to implement a few morphological algorithms including erosion, dilation, opening, closing, and a boundary identification algorithm as well. This assignment was again done in MATLAB, with the segmentation of the algorithms into their own .m files. In addition to those five algorithms and their files, two helper functions called overlap and superpose were created. The overall structure of the program involved using those two functions to implement erosion and dilation, which were then called in the opening, closing, and boundary algorithms.

The overlap helper function is fairly straightforward, it takes in two matrices of the same size, one of which is a potentially resized structuring element. It checks to see how much the two overlap, by counting the number of times the two matrices have the same value at the same indices. This number is then returned. In the erosion algorithm, if this number does not match the number of elements in the structuring element, then the pixel that the matrices passed into overlap is centered on is left as 0, if the number of overlapping elements matches the number of elements then the pixel becomes 1. In the dilation algorithm, even a single element overlapping causes the pixel to be set to 1.

The real centerpiece of the whole program is the superpose helper function. What it does is take in the matrix for the image, the structuring element, and a pixel that is being investigated. It then tests to see if overlaying the center of the structuring element on the image at the specified pixel location causes the structuring element to be out of bounds, in which case the structuring element is also adjusted. Otherwise, only a subset of the image is changed, in order to match the shape of the structuring element. What is returned is a subset of the image and a subset of the structuring element in the same shape to ensure valid comparison when these are fed into the overlap helper function as inputs.

As far as results are concerned, it seems that opening and closing as taught in class aren't quite sufficient to get rid of the noise. I attempted doing two dilations followed by a single erosion and got far better results, although the edges were far less distinct than they should've been. Overall closing seemed to work far better than opening as a method to filter out the noise and get expected images.