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23/516318/PA/22091

The 3rd Assignment

```
Original Segmentation (Threshold = 100):
0 0 0 1 1 1 0 1
0 0 0 1 1 1 1 1
0 0 0 1 1 1 1 1
0 0 0 1 1 1 1 1
0 0 0 0 0 0 0 0
0 0 0 0 0 1 0 0
0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0

After Opening (Removes 'salt' noise):
0 0 0 0 0 0 0 0
0 0 0 1 1 1 1 0
0 0 0 1 1 1 1 0
0 0 0 1 1 1 1 0
0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0

After Closing (Fills 'pepper' holes):
0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0
0 0 0 1 1 1 0 0
0 0 0 1 1 1 0 0
0 0 0 0 0 1 0 0
0 0 0 0 0 1 0 0
0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0

After Opening then Closing (Best result):
0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0
0 0 0 1 1 1 0 0
0 0 0 1 1 1 0 0
0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0
```

We can see that our Original Segmentation correctly identifies the main object but also includes "salt" noise (an isolated 1 in the background) and "pepper" noise (a 0 hole inside the object). When we apply the Opening operation, which is an erosion followed by a dilation, we observe that it successfully removes the "salt" noise. This happens because the erosion pass erases small speckles, and the subsequent dilation can't grow them back. Conversely, the Closing operation (dilation then erosion) is designed to fill the "pepper" hole by expanding the object to cover it and then shrinking the outer boundary. We get the best result by combining these: the "After Opening then Closing" matrix shows how we first use Opening to clean the "salt" noise from the background, and then use Closing to fill the "pepper" holes, leaving us with a single, clean object.