Homework-5 Solutions

Question 1

You are given the following picture:

| | | 8 | | | 8 | 8 | |
|-----|--|---|---|---|---|---|--|
| | | | | | 8 | 8 | |
| P = | | | | | | | |
| 1 — | | | | | | | |
| | | | | | | | |
| | | | 8 | 8 | 8 | 8 | |
| | | | | | | | |
| | | | | | | | |

What picture is obtained if noise cleaning is applied to P, using the technique of smoothing with the following mask:

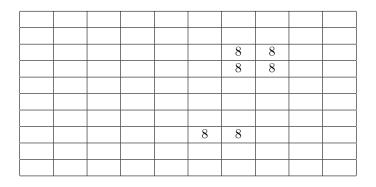
| 317. | |
|------|------|
| 0.25 | 0.25 |
| 0.25 | 0.25 |

This answer is for the mask center chosen at the upper left corner.

| 2 | 2 | | | 2 | 4 | 2 | |
|---|---|---|---|---|---|---|--|
| 2 | 2 | | | 4 | 8 | 4 | |
| | | | | 2 | 4 | 2 | |
| | | | | | | | |
| | | | | | | | |
| | | 2 | 4 | 4 | 4 | 2 | |
| | | 2 | 4 | 4 | 4 | 2 | |
| | | | | | | | |
| | | | | | | | |

What picture is obtained if noise cleaning is applied to P, performed by median filtering over a cross shaped neighborhood as shown below:

| | X | |
|---|---|---|
| X | X | X |
| | X | |



Question 2

The picture P is specified below:

| | | x = 0 | x = 1 | x = 2 | x = 3 | x = 4 | x = 5 | x = 6 | x = 7 |
|-----|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| P = | y = 0 | 0 | 0 | 0 | 9 | 9 | 9 | 9 | 9 |
| | y=1 | 0 | 0 | 0 | 9 | 9 | 9 | 9 | 9 |
| | y=2 | 0 | 0 | 0 | 9 | 9 | 9 | 9 | 9 |
| | y=3 | 0 | 0 | 0 | 9 | 9 | 9 | 9 | 9 |
| | y=4 | 0 | 0 | 0 | 9 | 9 | 9 | 9 | 9 |
| | y=5 | 0 | 0 | 0 | 9 | 9 | 9 | 9 | 9 |
| | y = 6 | 0 | 0 | 0 | 9 | 9 | 9 | 9 | 9 |

A.

What picture is obtained if noise cleaning is applied to P, using the technique of smoothing with the following mask:

| $\frac{1}{9}$ | 1 | 1 | 1 |
|---------------|---|---|---|
| | 1 | 1 | 1 |
| | 1 | 1 | 1 |

Compute the answer only for the window of 3 rows and 5 columns specified below.

| | x = 1 | x = 2 | x = 3 | x = 4 | x = 5 |
|-------|-------|-------|-------|-------|-------|
| y=2 | 0 | 3 | 6 | 9 | 9 |
| y = 3 | 0 | 3 | 6 | 9 | 9 |
| y=4 | 0 | 3 | 6 | 9 | 9 |

В.

What picture is obtained if noise cleaning is applied to P, performed by median filtering over a cross shaped neighborhood as shown below:

| | X | |
|---|---|---|
| X | X | X |
| | X | |

Compute the answer only for the window of 3 rows and 5 columns specified below.

| | x = 1 | x = 2 | x = 3 | x = 4 | x = 5 |
|-------|-------|-------|-------|-------|-------|
| y=2 | 0 | 0 | 9 | 9 | 9 |
| y = 3 | 0 | 0 | 9 | 9 | 9 |
| y=4 | 0 | 0 | 9 | 9 | 9 |

$\mathbf{C}.$

What picture is obtained if the Sobel edge detection technique is applied to P? Compute the answer only for the window of 3 rows and 5 columns specified below.

| | x = 1 | x = 2 | x = 3 | x = 4 | x = 5 |
|-------|-------|-------|-------|-------|-------|
| y=2 | 0 | 36 | 36 | 0 | 0 |
| y = 3 | 0 | 36 | 36 | 0 | 0 |
| y=4 | 0 | 36 | 36 | 0 | 0 |