1) Name the filters.

-1	0	+1
-2	0	+2
-1	0	+1

Gx

+1	+2	+1
0	0	0
-1	-2	-1

Gy

Shovel False

Sovel False

Sobel True

Prewit False

Prewitt False

Previt False

Roberts False

Robert False

Row-bert False

---

2) Name the filters.

+1	0	-1
+1	0	-1
+1	0	-1

Gx

-1	-1	-1
0	0	0
+1	+1	+1

Gy

Shovel False

Sovel False

Sobel False

Prewit False

Prewitt True

Previt False

Roberts False

Robert False

Row-bert False

---

3) Name the filters.

+1	0
0	-1

Gx

0	+1
-1	0

Gy

Shovel False

Sovel False

Sobel False

Prewit False

Prewitt False
Previt False

Roberts True

Robert False

Row-bert False

---

4) Which components of the gradient do these correlational filter masks compute?

-1	0	+1
-2	0	+2
-1	0	+1

+1	+2	+1
0	0	0
-1	-2	-1

magnitude and direction of the gradient False

gradient in 45 and 135 degrees False

vertical and horizontal gradient False

magnitude and orientation of the gradient False

horizontal and vertical gradient True

gradient in 45 and -45 degrees False

---

5) How many steps does the Canny edge detector have?

0 False

1 False

2 False

3 False

4 False

5 False

6 True

7 False

8 False

9 False

10 False

---

6) The last (6th) step in Canny edge detection is...

Gradient computation in perpendicular directions False

Gradient computation in terms of magnitude and orientation False

Double thresholding False

Noise removal False

Non-maxima suppression False

Hysteresits True

---

7) The second to last (5th) step in Canny edge detection is...

Gradient computation in perpendicular directions False

Gradient computation in terms of magnitude and orientation False

Double thresholding True

Noise removal False

Non-maxima suppression False

Hysteresits False

---

8) The fourth step in Canny edge detection is...

Gradient computation in perpendicular directions False

Gradient computation in terms of magnitude and orientation False

Double thresholding False

Noise removal False

Non-maxima suppression True

Hysteresits False

---

9) The third step in Canny edge detection is...

Gradient computation in perpendicular directions False

Gradient computation in terms of magnitude and orientation True

Double thresholding False

Noise removal False

Non-maxima suppression False

Hysteresits False

---

10) The second step in Canny edge detection is...

Gradient computation in perpendicular directions True

Gradient computation in terms of magnitude and orientation False

Double thresholding False

Noise removal False

Non-maxima suppression False

Hysteresits False

---

11) The first step in Canny edge detection is...

Gradient computation in perpendicular directions False

Gradient computation in terms of magnitude and orientation False

Double thresholding False

Noise removal True
Non-maxima suppression False

Hysteresits False

---

12) What noise removal technique should we use when applying Canny edge detection? (first step)

Median filter False

Mean filter False

Correlation using a box filter False

Gaussian filtering True

Non-maxima suppression False

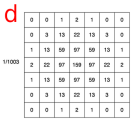
---

13) Based on the previous question, what filter or filters could we use in the first step?

a 

b 

c 

d 

e 

f 

a True

b True

c False

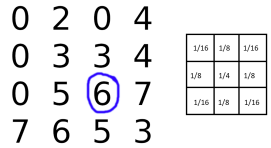
d True

e False

f False

---

14) Apply the Gaussian filter in the figure to the highlighted pixel. [RESULTS IN NEXT QUESTION]



0 False

1 False

2 False

3 False

4 False

5 True

6 False

7 False

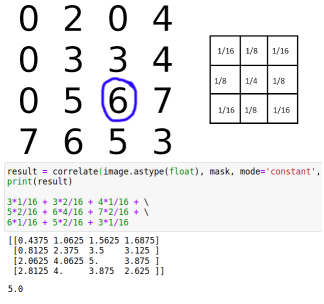
8 False

9 False

10 False

---

15) [RESULT]

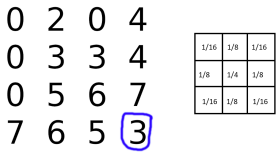


5 True

0 False

---

16) Apply the Gaussian filter in the figure to the highlighted pixel. [RESULTS IN NEXT QUESTION]



1.135 False

1.615 False

2.325 False

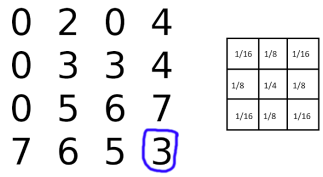
2.625 True

3.325 False

3.652 False

---

17) [RESULT]



2.625 True

0 False

---

18) Assume that you have computed the gradients of an image and used them to

calculate the gradient orientation and its magnitude. The results are shown in the image. Perform the non-maxima suppression of the Canny edge detector for the horizontal direction and select the elements that would be sent to zero in the image. [RESULTS IN NEXT QUESTION]

orientation

1	0	0	2
2	0	1	2
2	0	0	3
2	0	3	3

magnitude

10	34	12	10
12	21	9	12
1	26	19	36
5	32	28	29

0 horizontal
1 45 degrees
2 vertical
3 135 degrees

---

19) Assume that you have computed the gradients of an image and used them to calculate the gradient orientation and its magnitude. The results are shown in the image. Perform the non-maxima suppression of the Canny edge detector for the horizontal direction and select the elements that would be sent to zero in the image. [RESULTS IN NEXT QUESTION]

orientation

1	0	0	2
2	0	1	2
2	0	0	3
2	0	3	3

magnitude

10	34	12	10
12	21	9	12
1	26	19	36
5	32	33	29

0 horizontal
1 45 degrees
2 vertical
3 135 degrees

---

20) RESULTS

orientation

1	0	0	2
2	0	1	2
2	0	0	3
2	0	3	3

magnitude

~~10~~	34	~~12~~	~~10~~
12	21	9	12
~~1~~	26	~~19~~	36
~~5~~	32	33	29

0 horizontal
1 45 degrees
2 vertical
3 135 degrees

---

21) On paper, perform double thresholding with thresold values of 20 and 34. Provide your answers on Vevox for the high threshold only.

orientation

1	0	0	2
2	0	1	2
2	0	0	3
2	0	3	3

magnitude

0	34	0	10
0	21	0	12
0	26	0	36
0	32	33	29

---

22) RESULTS

low

0	255	0	0
0	255	0	0
0	255	0	255
0	255	255	255

high

0	255	0	0
0	0	0	0
0	0	0	255
0	0	0	0

---

23) Perform ONE hysteresis step.

low

0	255	0	0
0	255	0	0
0	255	0	255
0	255	255	255

high

0	255	0	0
0	0	0	0
0	0	0	255
0	0	0	0

---

24) RESULTS

low

0	255	0	0
0	255	0	0
0	255	0	255
0	255	255	255

high

0	255	0	0
0	0	0	0
0	0	0	255
0	0	0	0

X

0	255	0	0
0	255	0	0
0	0	0	255
0	0	255	255

---

25) Perform a SECOND hysteresis step.

low

0	255	0	0
0	255	0	0
0	255	0	255
0	255	255	255

high

0	255	0	0
0	0	0	0
0	0	0	255
0	0	0	0

X

0	255	0	0
0	255	0	0
0	0	0	255
0	0	255	255

---

26) RESULTS

low

0	255	0	0
0	255	0	0
0	255	0	255
0	255	255	255

high

0	255	0	0
0	0	0	0
0	0	0	255
0	0	0	0

X

0	255	0	0
0	255	0	0
0	255	0	255
0	255	255	255

---

27) Do we need to run a third hysteresis step?

low

0	255	0	0
0	255	0	0
0	255	0	255
0	255	255	255

high

0	255	0	0
0	0	0	0
0	0	0	255
0	0	0	0

X

0	255	0	0
0	255	0	0
0	255	0	255
0	255	255	255

no False

it depends True

yes True

---

28) RESULTS

0	255	0	0
0	255	0	0
0	255	0	255
0	255	255	255
