Question 16.1

Not included

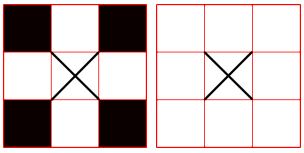
Question 16.2

A 12 x 12 image (0-based (x,y)-coordinate system with origin in upper left corner) is filled with the following *binary run-length code*:

[3; (4,5)], [4; (3,7)], [5; (4,7)], [6; (5,8)], [7; (6,7)]

Then a *morphological opening* is performed with SE1 from Figure 1. How many foreground pixels are there in the resulting image?

1. 7
2. 11
3. 19
4. 13
5. 16
6. Do not know



Figur 1: Left: SE1, Right: SE2. White pixels are foreground (1) and black pixels are background (0). The center is marked with a black cross.

Opgave 16.3

You have a camera with a *focal length* of 45 mm and a CCD chip of size 8 mm x 6 mm. It takes images with a size of 3200 x 2400 pixels. It can be assumed that $b = f$. From a distance of 1 meter, you have taken a sharp image of a completely circular mole, with a diameter of 1 cm. In the image a threshold is applied such that only the mole is visible and the area of the mole in pixels is calculated. What is the area?

1. 23040 pixels^2
2. 25447 pixels^2
3. 17900 pixels^2
4. 19124 pixels^2
5. 21987 pixels^2
6. Do not know

Opgave 16.4

Not included

Opgave 16.5

Not included

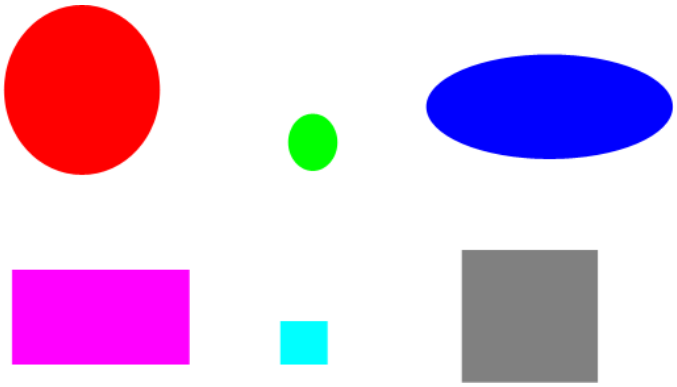
Question 16.6

A 5 x 5 image is filled with values, given by the *gray level run length* coding: 3, 120, 2, 110, 2, 120, 3, 110, 4, 95, 2, 110, 2, 100, 7, 80. The image has a 0-based (x,y)-coordinate system with origin in upper left corner. A median filtering is performed with a *3x3 filter kernel*. What is the result in the pixel with coordinates (2,2)?

1. 100
2. 120
3. 95
4. 80
5. 110
6. Do not know

Question 16.7

Which set of BLOB features can be used to seperate the 6 BLOBs in Figure 2.



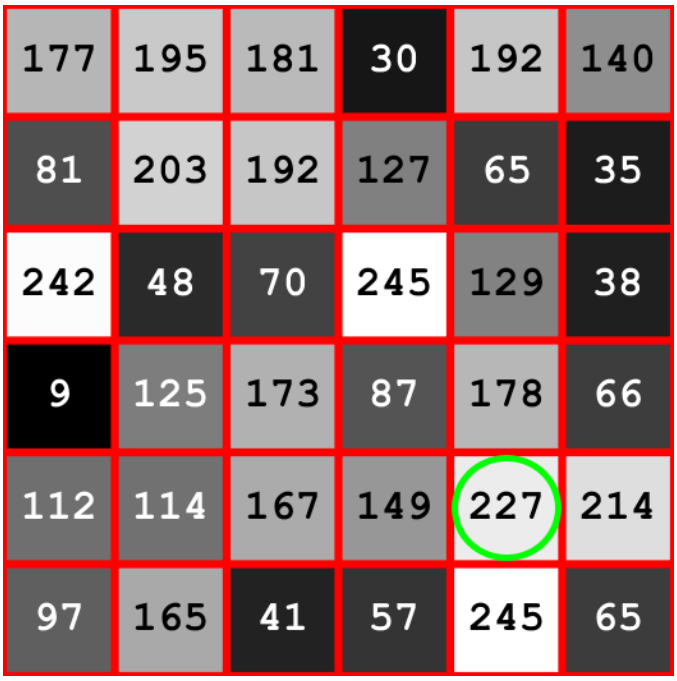
Figur 2: 6 BLOBs

1. Area and *bounding box ratio*
2. *compactness* and *circularity*
3. *bounding box ratio* and *circularity*
4. Area and *compactness*
5. *compactness* and *bounding box ratio*
6. Do not know

Question 16.8

The image as seen in Figure 3 is filtered with a *3x3 mean filter*. Afterwards a *gamma mapping* is conducted with $\gamma = 1.15$. What is the result in the marked pixel?

1. 129
2. 116
3. 144
4. 123
5. 131
6. Do not know

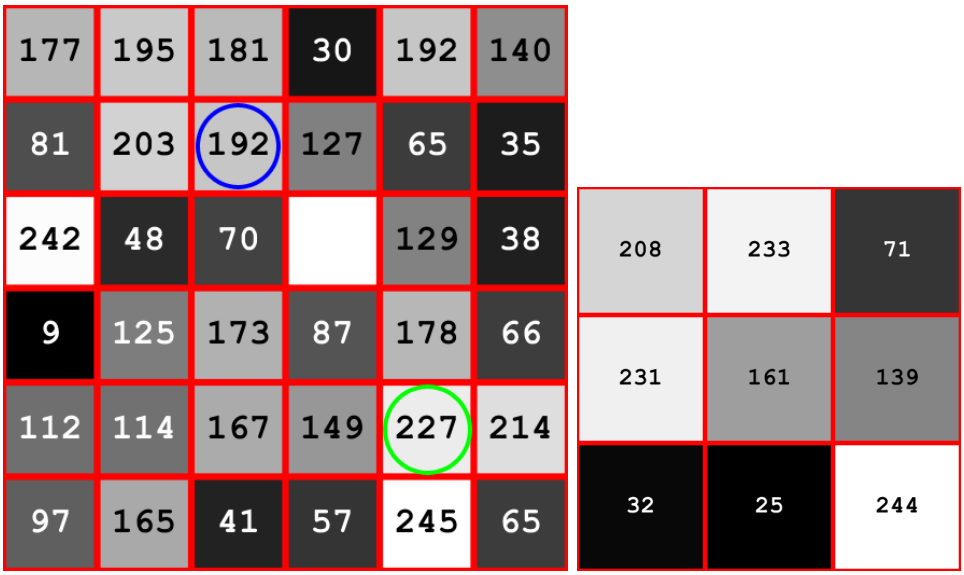


Figur 3: Grayscale image

Question 16.9

A *template matching* is performed on the image in Figure 4(left) with a template image as seen in Figure 4 (right). In the pixel marked with a blue circle the *correlation* is 243387. What is the original pixel value in the pixel with a missing value?

1. 10
2. 87
3. 245
4. 223
5. 198
6. Do not know



Figur 4: Left: Gray scale image. Right: Template

Question 16.10

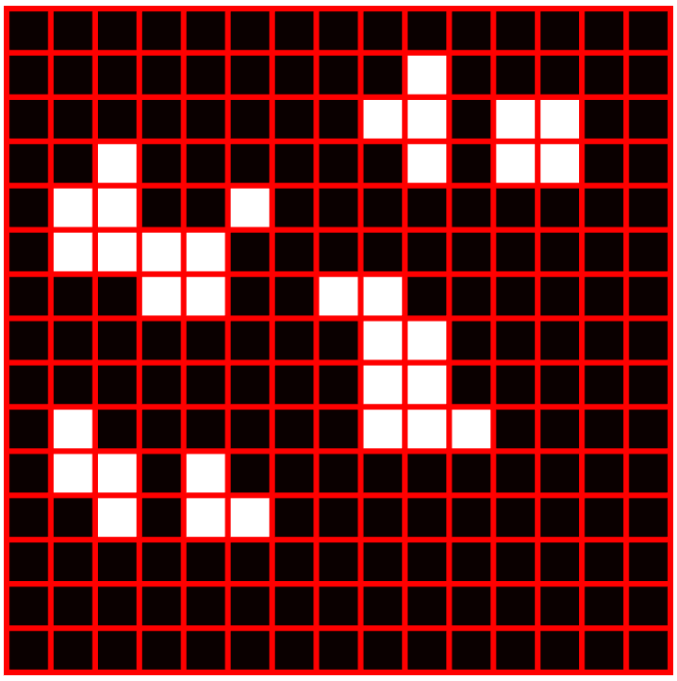
A *template matching* is performed on the image in Figure 4(right) with a template image as seen in Figure 4 (left). What is the *normalized cross correlation* in the pixel marked with a green circle?

1. 0.13
2. 0.86
3. 0.27
4. 0.77
5. 0.55
6. Do not know

Question 16.11

A BLOB analysis is conducted on the image in Figure 5. The largest and second largest BLOB is found with *4-connectivity* and their combined area is calculated. It is:

1. 14
2. 18
3. 5
4. 9
5. 23
6. Do not know



Figur 5: Binary Image. White pixels is foreground (1) and black pixels are background (0).

Question 16.12

A BLOB analysis is conducted on the image in Figure 5. The largest and the smallest BLOB is found with *8-connectivity* and both their *center of mass* is calculated. The euclidean distance between the two *center of mass* is calculated and is (in pixels):

1. 5.6
2. 7.8
3. 9.2
4. 4.3
5. 6.2
6. Do not know

Question 16.13

A grey scale profile is made by sampling in an image along a line from the point (36.6, 50.5) to the point (123.6, 70.9). What is the coordinates for the point lying in the center of the sampled profile?

1. (79.8, 60.5)
2. (80.1, 60.7)
3. (81.2, 60.3)
4. (80.2, 61.2)
5. (80.5, 61.5)
6. Do not know

Question 16.14

A grey scale profile is made by sampling in an image along a line from the point $(36.6, 50.5)$ to the point $(123.6, 70.9)$. Coordinates for the point in the center of the profile is calculated and the pixel value on the position is found using bilinear interpolation. The closest four pixels and their values are:

x	y	value
80	60	15
81	60	24
80	61	23
81	61	11

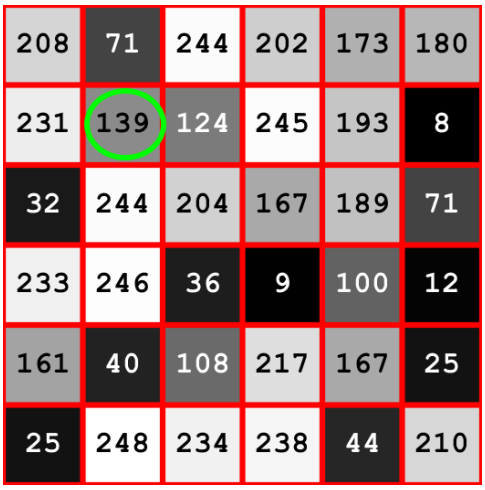
What is the interpolated value in the point?

1. 17
2. 20
3. 22
4. 18
5. 16
6. Do not know

Question 16.15

On the image in Figure 6 a *linear gray level mapping* is conducted in a way so that the new maximum value in the image is 160 and the new minimum value in the image is 50. Afterwards the image is filtered with a *3x3 maximum-rank filter*. What will the value of the marked pixel be?

1. 165
2. 158
3. 134
4. 187
5. 134
6. Do not know



Figur 6: Grayscale image

Question 16.16

In order to do *pixel classification* an expert has chosen areas in an image consisting of air, soft tissue, kidney, liver and bone. The original image pixel values is reported as Hounsfield Units. The chosen pixel values is seen in Table 1. A *minimum distance classification* is conducted. A pixel with the value 46 in the image will be classified as?

1. air
2. soft tissue
3. kidney
4. liver
5. bone
6. do not know

Tissue	pixel values
air	-945, -1032, -990
soft tissue	-50, -45, -67
kidney	30, 43, 37
liver	50, 54, 58
bone	210, 190, 230

Tabel 1: Pixel values in the areas the expert chose.

Question 16.17

In order to do *pixel classification* an expert has chosen areas in an image consisting of air, soft tissue, kidney, liver and bone. The original image pixel values is reported as Hounsfield Units. The chosen pixel values is seen in Table 1. A *minimum distance classification* is conducted. What is the *class range* for kidney?

1. $[-31.2, -12.2[$
2. $[4.2, 47.3[$
3. $[15.3, 48.2[$
4. $[-8.7, 45.3[$
5. $[8.7, 45.2[$
6. Do not know

Question 16.18

In order to do *pixel classification* an expert has chosen areas in an image consisting of air, soft tissue, kidney, liver and bone. The original image pixel values is reported as Hounsfield Units. The chosen pixel values is seen in Table 1. A *parametric classification* is conducted. A pixel with the value 120 in the image will be classified as?

1. air
2. soft tissue
3. kidney
4. liver
5. bone
6. do not know

Question 16.19

Not included

Question 16.20

Not included

Question 16.21

The points $(x, y) = (2, 3)$ and $(x, y) = (4, 2)$ is transformed first with the transformation matrix:

$$\begin{bmatrix} 3 & 2 \\ 4 & 1 \end{bmatrix} \tag{1}$$

and afterwards with the transformation matrix:

$$\begin{bmatrix} 2 & 1 \\ 1 & 3 \end{bmatrix} \tag{2}$$

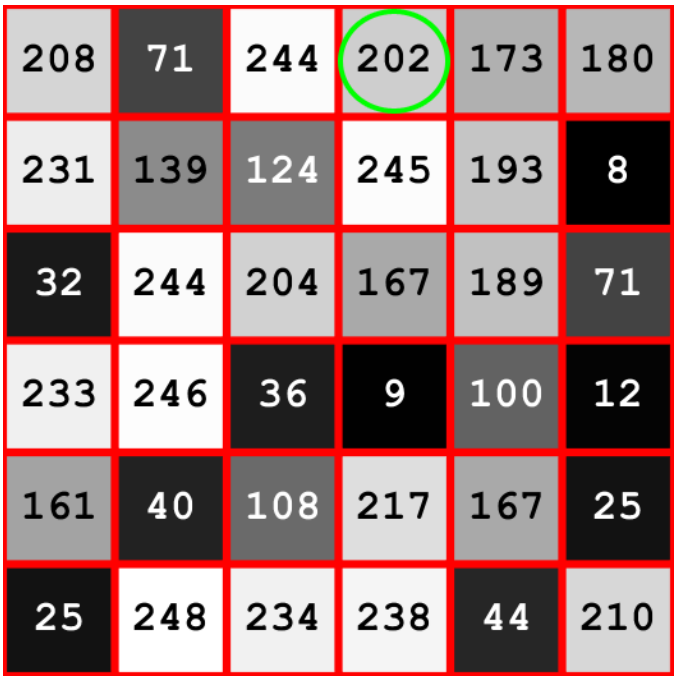
Afterwards the midpoint between the two points is found. It is:

1. $(32.0, 45.5)$
2. $(57.0, 25.5)$
3. $(42.5, 57.5)$
4. $(43.0, 34.5)$
5. $(23.5, 64.5)$
6. Do not know

Question 16.22

The image in Figure 7 is filtered with a *Vertical Prewitt filter*. To avoid *the border problem* the image is extended with the value 0 (zero padding). What is the value of the marked pixel after filtration?

1. -2
2. -15
3. 23
4. 6
5. 32
6. Do not know



Figur 7: Grayscale image

Question 16.23

A binary image is coded with a *binary chain coding*. A 0-based (x,y)-coordinate system with origo in the upper left corner is used:

(2,4)(00067651234)

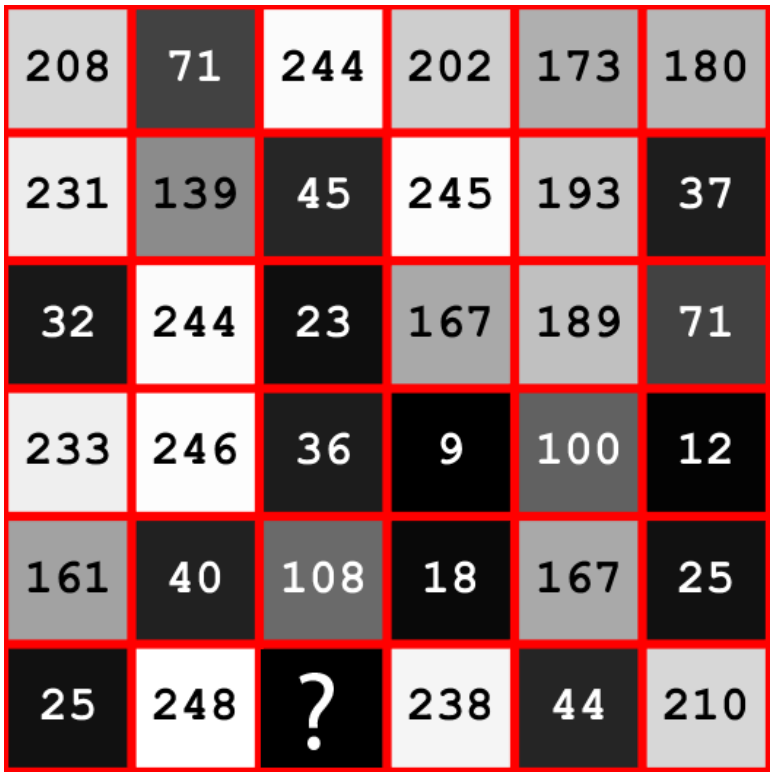
On this image a BLOB analysis is conducted with *4-connectivity*. How many BLOBS are found in the image?

1. 1
2. 2
3. 3
4. 4
5. 5
6. Do not know

Question 16.24

Using *dynamic programming* an *optimal path* from the top to the bottom of the image in Figur 8 is found. The combined *cost* for the found path is 188. What is the value of the pixel marked with a question mark?

1. 15
2. 22
3. 45
4. 19
5. 34
6. Do not know



Figur 8: Grayscale image.

Question 16.25

Using *dynamic programming* an *optimal path* from the top to the bottom of the image in Figur 8 is found. A Matlab matrix coordinate system is used. What is the value in the *accumulater* image on the coordinate $(3, 3)$:

1. 139
2. 110
3. 155
4. 144
5. 137
6. Do not know

Answers

Opgave	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Svar		5	2			1	4	5	3	4	2	5	2	2	2

Opgave	16	17	18	19	20	21	22	23	24	25
Svar	4	4	5			3	1	3	2	1