UNIVERSITÀ DEGLI STUDI
DI MILANO

Master Degree in Computer Science

Methods for Image Processing

academic year 2017–2018 teacher: Stefano Ferrari

Questions for the written exam

January 7, 2019

The right answer is A, for all questions. However, in the exam answers can be motivated.
A good motivation can make a wrong question partially acceptable.

Q 01
If each intensity level is represented by a 4-bit binary number, the total number of gray shades is

A. 16

B. 4

C. 3

D. 15

E. 255

Q 02
If each intensity level is represented by a 3-bit binary number, the total number of gray shades is

A. 8

B. 4

C. 3

D. 7

E. 255

Q 03
How many bits are necessary to represent each pixel with a binary number, if the total number of gray levels in the image is 32?

A. 5

B. 2

C. 4

D. 31

E. 255

Q 04
How many bits are necessary to represent each pixel with a binary number, if the total number of gray levels in the image is 128?

A. 7

B. 5

C. 4

D. 64

E. 255

Q 05
If each intensity level is represented by a 4-bit binary number, the brightest shade (white) is:

A. 15

B. 4

C. 3

D. 16

E. 255

Q 06
If each intensity level is represented by a 3-bit binary number, the darkest shade (black) is:

A. 0

B. 1

C. 3

D. 7

E. 2

Q 07
If each intensity level is represented by a 2-bit binary number, the brightest shade (white) is:

A. 3

B. 1

C. 2

D. 0

E. 255

Q 08
If each intensity level is represented by a 2-bit binary number, the darkest shade (black) is:

A. 0

B. 1

C. 3

D. 4

E. 2

Q 09

With reference to the following figure, the 4-neighborhood of the pixel p, N_4, is

p_1	p_2	p_3
p_4	p	p_5
p_6	p_7	p_8

A. $N_4 = \{p_2, p_4, p_5, p_7\}$

B. $N_4 = \{p_1, p_2, p_3, p_4\}$

C. $N_4 = \{p_1, p_3, p_6, p_8\}$

D. $N_4 = \{p_1, p_3, p_5, p_7\}$

E. $N_4 = \{p_2, p_3, p_4, p_6\}$

Q 10

With reference to the following figure, the D-neighborhood of the pixel p, N_D, is

p_1	p_2	p_3
p_4	p	p_5
p_6	p_7	p_8

A. $N_D = \{p_1, p_3, p_6, p_8\}$

B. $N_D = \{p_1, p_2, p_3, p_4\}$

C. $N_D = \{p_2, p_4, p_5, p_7\}$

D. $N_D = \{p_1, p_3, p_5, p_7\}$

E. $N_D = \{p_2, p_3, p_4, p_6\}$

Q 11

With reference to the following figure, the 8-neighborhood of the pixel p, N_8, is

p_1	p_2	p_3
p_4	p	p_5
p_6	p_7	p_8

A. $N_8 = \{p_1, p_2, p_3, p_4, p_5, p_6, p_7, p_8\}$

B. $N_8 = \{p_8\}$

C. $N_8 = \{p_1, p_2, p_3, p_4, p_5, p_6, p_7\}$

D. $N_8 = \{p_1, p_3, p_5, p_8\}$

E. $N_8 = \{p_2, p_4, p_8\}$

Q 12

With reference to the following figure, the 8-adjacent pixels to the pixel p are

p_1	p_2	p_3
p_4	p	p_5
p_6	p_7	p_8

A. $\{p_2, p_3, p_5, p_6\}$

B. $\{p_2, p_5\}$

C. $\{p_3, p_6\}$

D. $\{p_1, p_4, p_7, p_8\}$

E. $\{p_1, p_3, p_6, p_8\}$

Q 13

With reference to the following figure, the 8-adjacent pixels to the pixel p are

p_1	p_2	p_3
p_4	p	p_5
p_6	p_7	p_8

A. $\{p_1, p_2, p_5, p_8\}$

B. $\{p_2, p_5\}$

C. $\{p_1, p_8\}$

D. $\{p_1, p_4, p_7, p_8\}$

E. $\{p_2, p_3, p_5, p_6\}$

Q 14

With reference to the following figure, the 8-adjacent pixels to the pixel p are

p_1	p_2	p_3
p_4	p	p_5
p_6	p_7	p_8

A. $\{p_1, p_4, p_7, p_8\}$

B. $\{p_2, p_3, p_5, p_6\}$

C. $\{p_2, p_7\}$

D. $\{p_1, p_3, p_6, p_8\}$

E. $\{p_1, p_3, p_6, p_8\}$

Q 15

With reference to the following figure, the 4-adjacent pixels to the pixel p are

p_1	p_2	p_3
p_4	p	p_5
p_6	p_7	p_8

A. $\{p_2, p_5\}$

B. $\{p_1, p_2, p_5, p_8\}$

C. $\{p_1, p_8\}$

D. $\{p_1, p_4, p_7, p_8\}$

E. $\{p_2, p_3, p_5, p_6\}$

Q 16

Given the following image (having L=8 intensity levels), which of the following array can be its histogram?

6	7	2	7
7	5	4	1
1	0	7	7

A. [1 2 1 0 1 1 1 5]

B. [−1 1 2 0 1 1 3 5]

C. [1 0 1 2 5 1 1 1]

D. [1 1 0 1 1 5 1 2]

E. [0 1 1 1 5 2 1 1]

Q 17

Given the following image (having L=8 intensity levels), which of the following array can be its histogram?

3	3	2	5
7	5	4	1
1	0	7	7

A. [1 2 1 2 1 2 0 3]

B. [1 1 1 2 1 2 1 3]

C. [0 3 1 2 1 2 5 3]

D. [2 1 2 1 5 0 1 2]

E. [1 2 3 4 4 3 2 1]

Q 18

Given the following image (having L=8 intensity levels), what is the probability of intensity 7?

6	7	2	1
7	5	4	1
1	0	7	7

A. 1/3

B. 3/4

C. 1/8

D. 2/3

E. 1

Q 19

Given the following image (having L=8 intensity levels), what is the probabiliy of intensity 6?

3	3	2	5
7	5	4	1
1	0	7	7

A. 0

B. 1/4

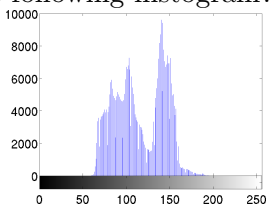
C. 1/8

D. 2/3

E. 6/7

Q 20

What can be inferred about the image that has the following histogram?



A. Probably, it has a poor contrast

B. Surely, it must be equalized

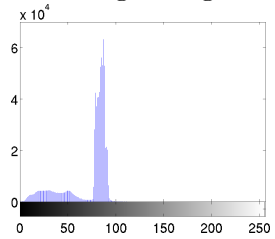
C. Probably, there is an excess of white pixels

D. It is the typical gamma function image

E. Probably, it cannot be equalized

Q 21

What can be inferred about the image that has the following histogram?



A. Probably, it is dark

B. Surely, it has a high contrast

C. It has too many white pixels

D. This histogram cannot belong to an image

E. It should be darkened

Q 22

Histogram equalization of digital images is a transformation

A. that aims to obtain a uniform histogram image

B. that can be applied only to dark images

C. that can be applied only to monotonic histogram images

D. that allows to obtain a light image

E. that preserves the details of all the shades

Q 23

A real digital image processed through histogram equalization usually

A. is more contrasted than the original

B. has the same number of pixels for each intensity level

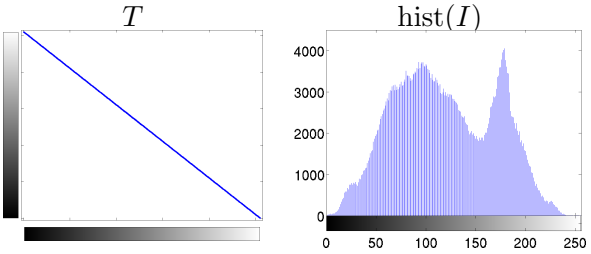
C. is lighter than its negative

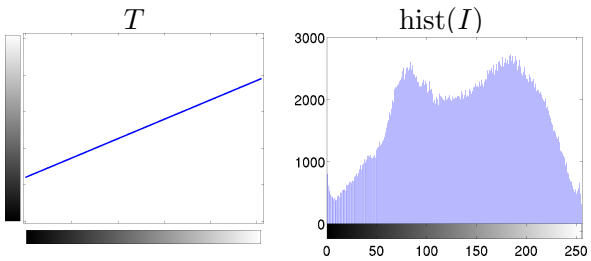
D. is darker than the original

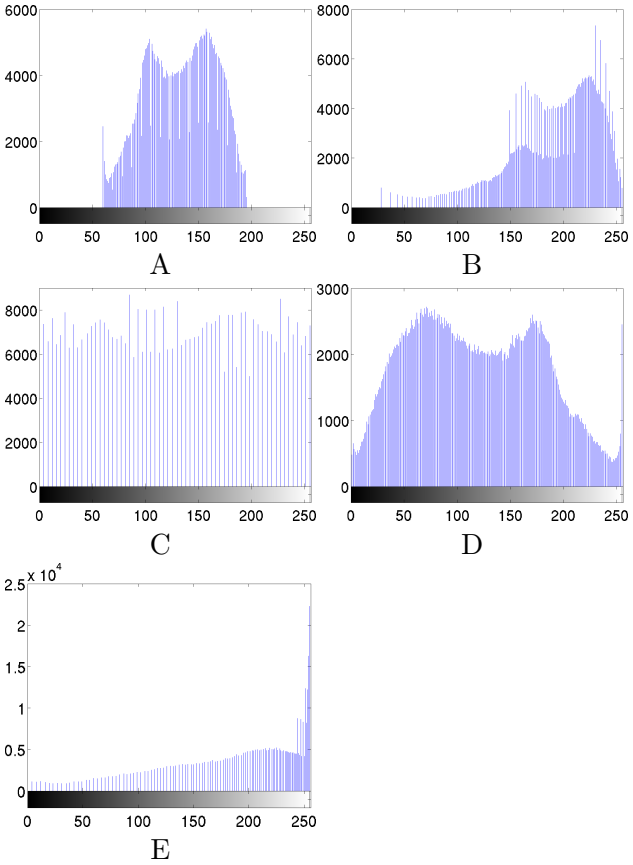
E. is lighter in the center than in the border regions

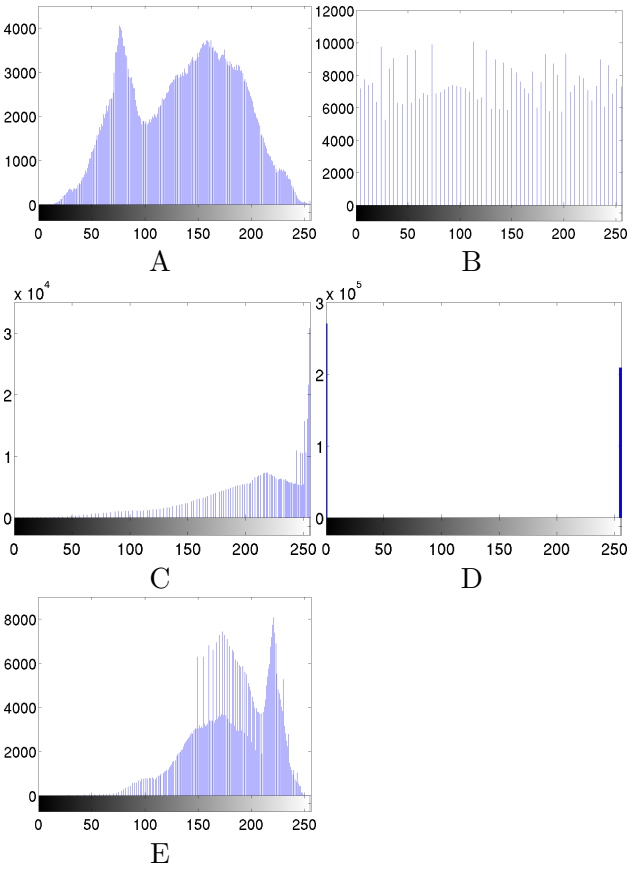
Q 24

Given the following intensity transformation T and the histogram of an image I, which of the following is the histogram of the image $T(I)$?









Q 25

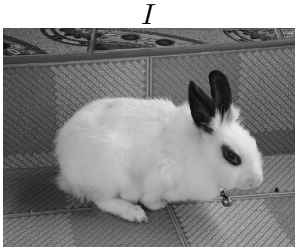
Given the following intensity transformation T and the histogram of an image I, which of the following is the histogram of the image $T(I)$?

Q 26

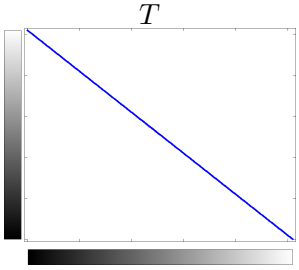
Given the following image I and the intensity transformation T, which of the following is the transformed image $T(I)$?

Given the following image I and the intensity transformation T, which of the following is the transformed image $T(I)$?

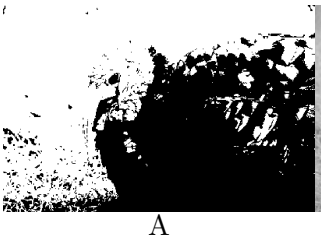
I



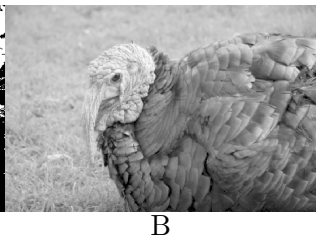
T



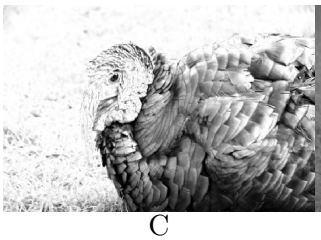
A



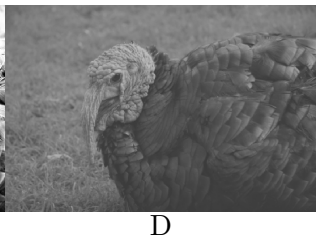
B



C



D



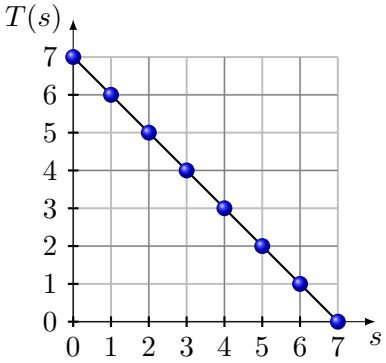
E

Q 28

Given the following image I and the intensity transformation T, which of the following images is $T(I)$?

I

3	2	1	4
5	1	2	3
0	0	3	5



A.

4	5	6	3
2	6	5	4
7	7	4	2

B.

7	0	0	7
7	0	0	7
0	0	7	7

C.

6	6	2	6
2	2	6	6
2	2	6	2

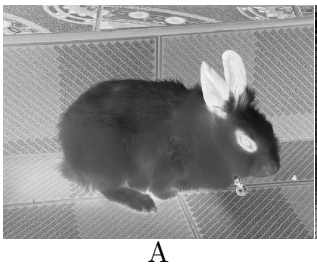
Q 27

Given the following image I and the intensity transformation T, which of the following is the transformed image $T(I)$?

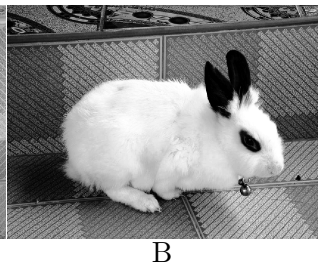
I

T

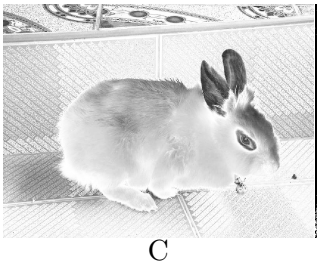
A



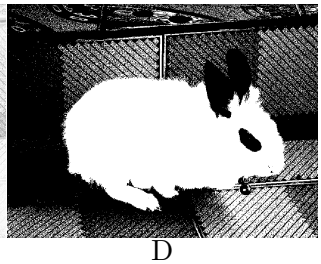
B



C



D



E

D.

7	2	1	7
5	1	2	7
0	0	7	5

E.

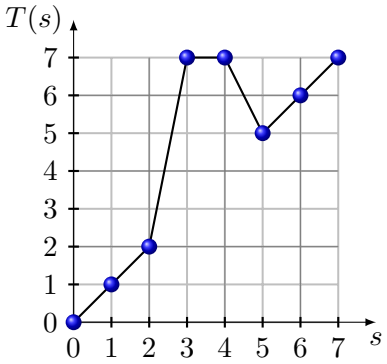
3	1	0	5
6	0	1	3
0	0	3	6

Q 29

Given the following image I and the intensity transformation T, which of the following images is $T(I)$?

I

7	5	7	3
4	5	0	6
7	1	2	1



A.

7	5	7	7
7	5	0	6
7	1	2	1

B.

0	2	0	4
3	2	7	1
0	6	5	6

C.

7	7	7	7
7	7	0	7
7	0	0	0

D.

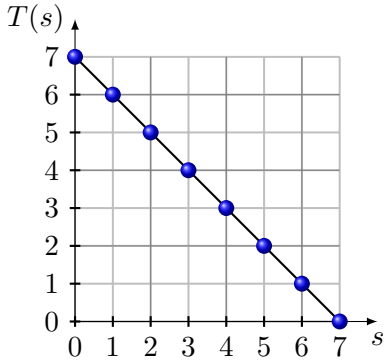
2	2	2	6
6	2	2	2
2	2	6	2

E.

7	6	7	3
5	6	0	6
7	0	1	0

Q 30

Which will be the effect of the following intensity transformation, T?



A. The transformed image $T(I)$ is the negative of the input image I

B. The transformed image $T(I)$ is darker than the input image I

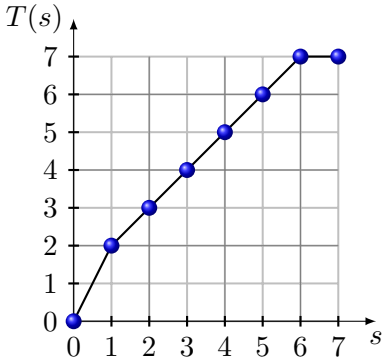
C. The transformed image $T(I)$ is brighter than the input image I

D. The transformed image $T(I)$ is less contrasted than the input image I

E. In the transformed image $T(I)$ the dark intensity levels of the input image I are more contrasted, while the bright ones are remapped to white

Q 31

Which will be the effect of the following intensity transformation, T?



A. The transformed image $T(I)$ is brighter than the input image I

B. In the transformed image $T(I)$ the dark intensity levels of the input image I are more contrasted, while the bright ones are remapped to white

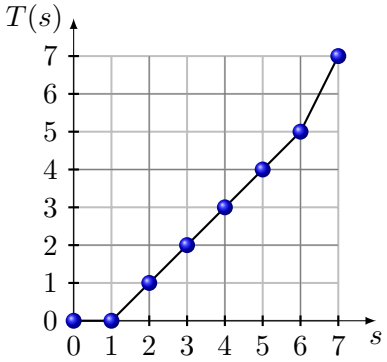
C. The transformed image $T(I)$ is less contrasted than the input image I

D. The transformed image $T(I)$ is darker than the input image I

E. The transformed image $T(I)$ is the negative of the input image I

Q 32

Which will be the effect of the following intensity transformation, T?



A. The transformed image $T(I)$ is darker than the input image I

B. The transformed image $T(I)$ is brighter than the input image I

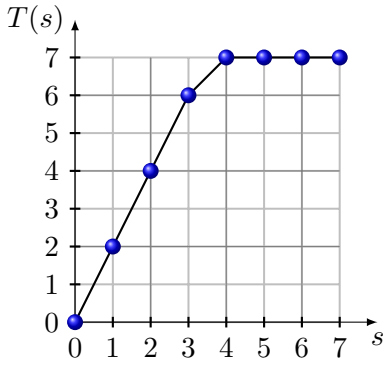
C. The transformed image $T(I)$ is the negative of the input image I

D. In the transformed image $T(I)$ the dark intensity levels of the input image I are more contrasted, while the bright ones are remapped to white

E. The transformed image $T(I)$ is less contrasted than the input image I

Q 33

Which will be the effect of the following intensity transformation, T?



A. In the transformed image $T(I)$ the dark intensity levels of the input image I are more contrasted, while the bright ones are remapped to white

B. The transformed image $T(I)$ is brighter than the input image I

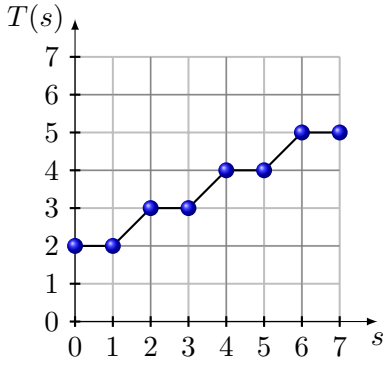
C. The transformed image $T(I)$ is the negative of the input image I

D. The transformed image $T(I)$ is less contrasted than the input image I

E. The transformed image $T(I)$ is darker than the input image I

Q 34

Which will be the effect of the following intensity transformation, T?



A. The transformed image $T(I)$ is less contrasted than the input image I

B. The transformed image $T(I)$ is darker than the input image I

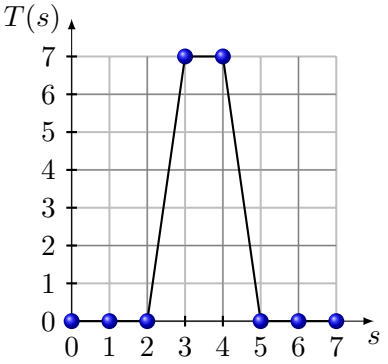
C. The transformed image $T(I)$ is brighter than the input image I

D. The transformed image $T(I)$ is the negative of the input image I

E. In the transformed image $T(I)$ the dark intensity levels of the input image I are more contrasted, while the bright ones are remapped to white

Q 35

Which will be the effect of the following intensity transformation, T?



A. The transformed image $T(I)$ is white where the input image I is middle gray, black elsewhere

B. The middle gray levels of the input image I are set to white in the transformed image $T(I)$, the other shades are the same

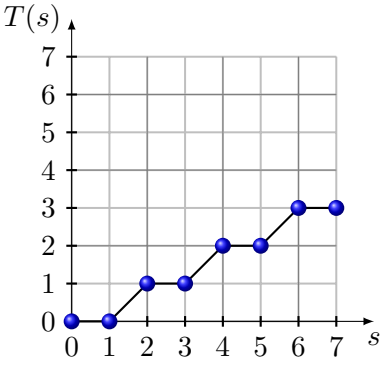
C. The transformed image $T(I)$ is the binarization of the input image I

D. In the transformed image $T(I)$ the middle gray levels of the input image I are more contrasted, while the other shades are saturated to black or white

E. The transformed image $T(I)$ is the 2-bit color resolution version of the input input image I

Q 36

Which will be the effect of the following intensity transformation, T?



A. The transformed image $T(I)$ is the 2-bit color resolution version of the input input image I

B. The transformed image $T(I)$ is the binarization of the input image I

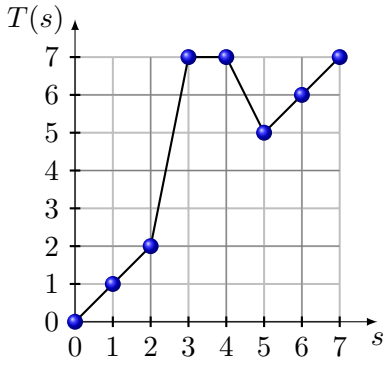
C. In the transformed image $T(I)$ the middle gray levels of the input image I are more contrasted, while the other shades are saturated to black or white

D. The middle gray levels of the input image I are set to white in the transformed image $T(I)$, the other shades are the same

E. The transformed image $T(I)$ is white where the input image I is middle gray, black elsewhere

Q 37

Which will be the effect of the following intensity transformation, T?



A. The middle gray levels of the input image I are set to white in the transformed image $T(I)$, the other shades are the same

B. The transformed image $T(I)$ is white where the input image I is middle gray, black elsewhere

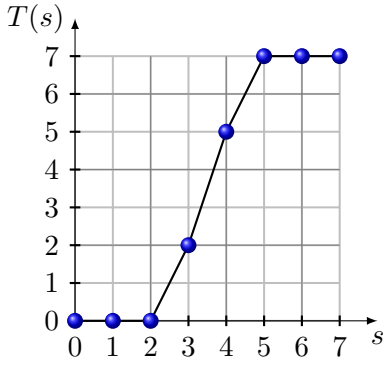
C. In the transformed image $T(I)$ the middle gray levels of the input image I are more contrasted, while the other shades are saturated to black or white

D. The transformed image $T(I)$ is the binarization of the input image I

E. The transformed image $T(I)$ is the 2-bit color resolution version of the input input image I

Q 38

Which will be the effect of the following intensity transformation, T?



A. In the transformed image $T(I)$ the middle gray levels of the input image I are more contrasted, while the other shades are saturated to black or white

B. The transformed image $T(I)$ is the 2-bit color resolution version of the input input image I

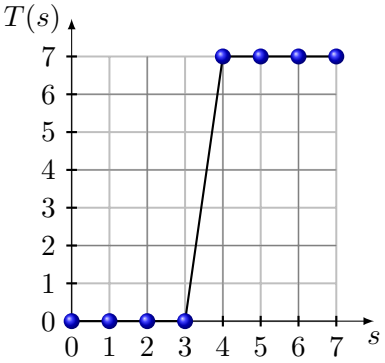
C. The transformed image $T(I)$ is white where the input image I is middle gray, black elsewhere

D. The transformed image $T(I)$ is the binarization of the input image I

E. The middle gray levels of the input image I are set to white in the transformed image $T(I)$, the other shades are the same

Q 39

Which will be the effect of the following intensity transformation, T?



A. The transformed image $T(I)$ is the binarization of the input image I

B. The transformed image $T(I)$ is white where the input image I is middle gray, black elsewhere

C. The middle gray levels of the input image I are set to white in the transformed image $T(I)$, the other shades are the same

D. The transformed image $T(I)$ is the 2-bit color resolution version of the input input image I

E. In the transformed image $T(I)$ the middle gray levels of the input image I are more contrasted, while the other shades are saturated to black or white

Q 40

Giving the following image, f, and filter, w, the value for the central pixel resulting from the filtering is

f:

2	3	0
1	4	3
0	2	3

w: $1/9\times$

1	1	1
1	1	1
1	1	1

A. 2

B. 3

C. 2.4

D. 0

E. 4

Q 41

Giving the following image, f, and filter, w, the value for the central pixel resulting from the filtering is

f:

2	4	0
1	4	3
0	2	3

w: $1/6\times$

0	1	0
1	2	1
0	1	0

A. 3

B. 2

C. 2.4

D. 0

E. 4

Q 42

Giving the following image, f, and filter, w, the value for the central pixel resulting from the filtering is

f:

2	3	0
1	4	3
0	2	3

w:

-1	-1	-1
0	0	0
1	1	1

A. 0

B. 2

C. 3

D. 2.4

E. 4

Q 43

Giving the following image, f, and filter, w, the value for the central pixel resulting from the filtering is

f:

2	3	0
1	4	3
0	2	3

w:

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

A. -1

B. 2.4

C. 3

D. -2

E. 0

Q 44

Giving the following image, f, and filter, w, the value for the central pixel resulting from the filtering is

f:

2	3	4
3	4	3
1	4	3

w: $1/9\times$

1	1	1
1	1	1
1	1	1

A. 3

B. 2

C. 2.4

D. 0

E. 4

Q 45

Giving the following image, f, and filter, w, the value for the central pixel resulting from the filtering is

f:

2	3	0
3	4	3
0	4	3

w: $1/9\times$

1	1	1
1	1	1
1	1	1

A. 2.4

B. 0

C. 2

D. 4

E. 3

Q 46

Giving the following image, f, and filter, w, the value for the central pixel resulting from the filtering is

f:

2	4	0
1	1	3
0	2	3

w: $1/6\times$

0	1	0
1	2	1
0	1	0

A. 2

B. 3

C. 2.4

D. 0

E. 4

Q 47

Giving the following image, f, and filter, w, the value for the central pixel resulting from the filtering is

f:

2	4	0
1	7	3
0	2	3

w: $1/6\times$

0	1	0
1	2	1
0	1	0

A. 4

B. 2

C. 0

D. 2.4

E. 3

Q 48

Giving the following image, f, and filter, w, the value for the central pixel resulting from the filtering is

f:

2	3	0
1	4	3
2	2	3

w:

-1	-1	-1
0	0	0
1	1	1

A. 2

B. 0

C. 3

D. 2.4

E. 4

Q 49

Giving the following image, f, and filter, w, the value for the central pixel resulting from the filtering is

f:

2	3	0
1	4	3
2	3	3

w:

-1	-1	-1
0	0	0
1	1	1

A. 3

B. 4

C. 2.4

D. 0

E. 2

Q 50

Giving the following image, f, and filter, w, the value for the central pixel resulting from the filtering is

f:

2	3	2
1	4	3
0	2	3

w:

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

A. -2

B. -1

C. 2.4

D. 3

E. 0

Q 51

Giving the following image, f, and filter, w, the value for the central pixel resulting from the filtering is

f:

2	3	2
1	4	3
3	2	3

w:

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

A. 0

B. -2

C. -1

D. 2.4

E. 3

Q 52

Which kind of filter is the following filter, w:

w: $1/5\times$

0	1	0
1	1	1
0	1	0

A. smoothing

B. derivative

C. Otsu

D. sharpening

E. Huffman

Q 53

Which kind of filter is the following filter, w:

w:

-1	-1	-1
0	0	0
1	1	1

A. derivative

B. smoothing

C. Gaussian

D. Huffman

E. averaging

Q 54

Which of the following statements about a sharpening filter are correct?

A. it enhances the noise

B. it operates on the border of the image

C. it is based on the integral of the image

D. it is a non-linear filter

E. all of the above

Q 55

How a Laplacian filter can be used to enhance an image?

A. Convolve the Laplacian filter with the image, multiply the resulting image by a negative constant and sum to the original image

B. Convolve the Laplacian filter with the image

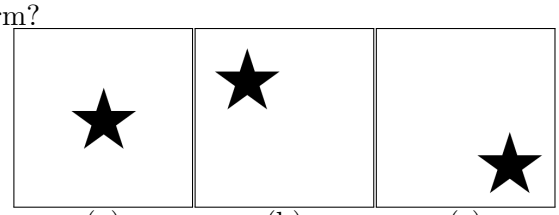
C. Convolve the Laplacian filter with the image, scale the resulting image in the range [0, 255] and pixel-wise multiply it to the original image

D. Pixel-wise sum the Laplacian filter to the original image

E. The Laplacian filter cannot be used for this task

Q 56

Given the three images reported in the following, what can be inferred about their Fourier transform?



(a) (b) (c)

A. All of them have the same spectrum

B. They have the same spectrum and the same phase angle

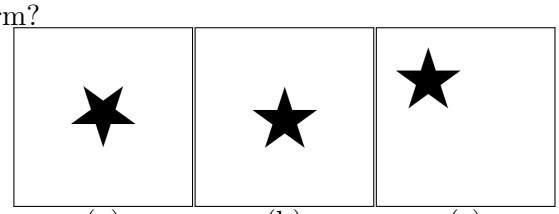
C. (b) and (c) have the same spectrum, but (a) has a different one

D. All of them have the same phase angle

E. Their spectrum is the same, but rotated

Q 57

Given the three images reported in the following, what can be inferred about their Fourier transform?



(a) (b) (c)

A. (b) and (c) have the same spectrum, but (a) has a different one

B. They have the same spectrum and the same phase angle

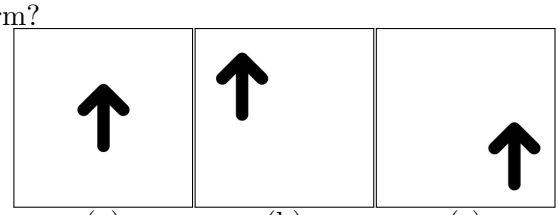
C. All of them have the same phase angle

D. Their phase angle is the same, but rotated

E. All of them have the same spectrum

Q 58

Given the three images reported in the following, what can be inferred about their Fourier transform?



(a) (b) (c)

A. All of them have the same spectrum

B. They have the same spectrum and the same phase angle

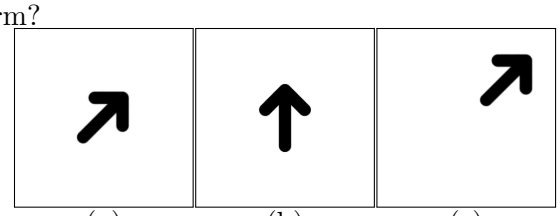
C. (b) and (c) have the same spectrum, but (a) has a different one

D. All of them have the same phase angle

E. Their spectrum is the same, but rotated

Q 59

Given the three images reported in the following, what can be inferred about their Fourier transform?



(a) (b) (c)

A. (a) and (c) have the same spectrum, but (b) has a different one

B. They have the same spectrum and the same phase angle

C. All of them have the same phase angle

D. Their phase angle is the same, but rotated

E. All of them have the same spectrum

Q 60

The spectrum of the Fourier transform is:

A. the absolute value (or modulus or magnitude) of the Fourier transform

B. the real part of the Fourier transform

C. the imaginary part of the Fourier transform

D. the local average of the Fourier transform

E. the peaks of the Fourier transform

Q 61

The phase angle of the Fourier transform is:

A. the angle of the Fourier transform with the positive real axis

B. the angle of the diagonal of the image with the last row

C. the main direction of the edges

D. the average direction of the edges

E. the rotation angle of the Fourier coefficients

Q 62

The coefficient of the Fourier transform in the origin $(0, 0)$ is:

A. proportional to the average intensity of the image

B. always the largest

C. always zero

D. proportional to the average value of the Fourier transform

E. equal to the size (#rows×#columns) of the image

Q 63
The convolution theorem states that:

A. the Fourier transform of the product of two images is equal to the convolution of the Fourier transforms of the two images

B. the Fourier transform of the convolution of an image with a filter is equal to the convolution of the Fourier transform of an image with a filter

C. the Fourier transform of the sum of two images is equal to the convolution of the Fourier transforms of the two images

D. the Fourier transform of the convolution of an images with itself is equal to the Fourier transform of the image

E. the Fourier transform of the convolution of an images with itself is equal to the Fourier transform of the complement image

Q 64
Which of the following statements is false?

A. two different functions can have the same Fourier transform

B. the Fourier transform of a real-valued function is generally a complex-valued function

C. given a Fourier transform pair, the composition of the Fourier transform with the inverse Fourier transform is equivalent to the composition of the inverse Fourier transform with the Fourier transform

D. the Fourier transform of the convolution of two functions is equal to the product of the Fourier transforms of the two functions

E. the Fourier transform of the sum of two functions is equal to the sum of the Fourier transforms of the two functions

Q 65
Which of the following statements is true?

A. the Fourier transform of a sampled function is a periodic function

B. the Fourier transform of a sampled function is step-wise constant

C. the Fourier transform of a real-valued function is also a real-valued function

D. the fase angle of the Fourier transform of a sampled function is a linear function

E. the power spectrum of the Fourier transform of a sampled function is constant

Q 66
Which of the following statements about the sampling theorem is false?

A. it states that the sampling of any continuous function involves an information loss

B. it relates the minimum sampling rate to avoid aliasing to the higher frequency component of the sampled function

C. it states that any function that is not band-limited can be sampled only with information loss

D. it states a necessary condition to enable the reconstruction of a continuous function from its samples

E. it states that sampling frequency must be larger than twice of the maximum frequency component of the sampled function to avoid aliasing

Q 67
Which of the following statements about the sampling theorem is true?

A. it relates the minimum sampling rate to avoid aliasing to the higher frequency component of the sampled function

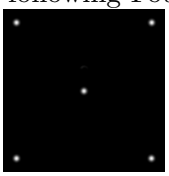
B. it states that any band-limited function can be sampled only with information loss

C. it states that sampling frequency must be larger than the maximum frequency component of the sampled function to avoid aliasing

D. it states that the sampling of any continuous function involves an information loss

E. it relates the peak value of the Fouried transform and the number of samples

Q 68
What can be inferred about the image having the following Fourier spectrum?



A. It must have some high frequency pattern

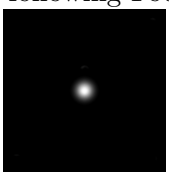
B. It has a dotted pattern

C. It has two diagonal lines

D. It is dark at the border and shading to white radially to the center

E. None of the above

Q 69
What can be inferred about the image having the following Fourier spectrum?



A. It must have some low frequency content

B. It is dark at the border and shading to white radially to the center

C. Nothing can be inferred from a Fourier spectrum

D. It has a dotted pattern

E. It has two diagonal lines

Q 70
Which of the following statements about the Canny edge detector is false?

A. it computes the zero crossing as final stage

B. it uses a Gaussian smoothing as preprocessing

C. it uses the gradient's direction to select robust edge points

D. it uses the weak edge points as candidates to increase the strong edge point set

E. it uses a double threshold to select those points that are likely to be edge points

Q 71
The thresholding of the gradient of an image aims to

A. select the points with higher discontinuity

B. approximate the histogram equalization

C. reduce the information to be processed

D. smooth the resulting image

E. improve the histogram

Q 72
The Hough transform can be used for

A. finding the most probable lines in the image

B. detecting those pixels that belong to an edge

C. improving the efficiency of the spatial filtering

D. smoothing the edges

E. reversing the Fourier transform

Q 73
The Hough transform

A. maps each point in the the set of lines it belongs to

B. shifts toward the center every pixel belonging to an edge

C. affects only the brighter pixels

D. makes more effective the Fourier transform

E. segments the image in uniform regions

Q 74
Otsu's method

A. aims to find the optimal value of the threshold

B. identifies the value of the threshold adaptively with respect to the position

C. is a smoothing procedure based on the histogram of the classes

D. is an iterative method based on the gradient information

E. makes use of filtering to improve its efficiency

Q 75
Growing based segmentation

A. starts from some points that belong to the objects and adds the neighbors until a stopping criterion is met

B. starts from the corners of the images and grows diagonally until a pixel that belong to an object is met

C. starts from the peaks of the histogram and adds the similar intensities to the classes

D. starts from the darkest pixels and add the pixels with an improving intensity

E. requires the user interaction to set the directions of the growing

Q 76
Which of the following statements about the segmentation through region splitting and merging are true?

A. It makes use of the similarity between adjacent regions as merging criterion

B. It can be applied only to square images

C. It uses iterative smoothing for blending the regions

D. It is an iterative procedure based on linear filtering

E. It makes use of the gradient information to decide the splitting direction

Q 77

The use of the histogram to choose the segmentation threshold

A. can be effective when there are only two well-separated peaks

B. is not affected by the uniformity of the illumination of the scene

C. cannot be applied if the image is a gray-level image

D. can make robust the choice in case of noise

E. allows the detection of small objects

Q 78

Given the following image, how many regions will result after applying the watershed technique using the 8-connectivity?

0	1	5	1	0
0	1	4	1	2
0	1	3	2	5
0	3	3	0	0
0	1	2	1	0
0	0	5	1	2
0	0	5	3	0

A. 4

B. 1

C. 3

D. 5

E. 2

Q 79

Given the following image, how many regions will result after applying the watershed technique using the 8-connectivity?

0	1	5	1	0	3
0	1	4	1	2	1
0	1	3	2	5	5
0	3	3	0	0	2
0	1	2	1	0	1
0	0	5	1	2	0

A. 3

B. 1

C. 2

D. 5

E. 4

Q 80

Given the following image, how many regions will result after applying the watershed technique using the 4-connectivity?

0	1	5	1	1
0	1	4	1	2
0	1	3	2	5
0	3	3	0	0
0	1	2	1	0
0	0	5	1	2
0	0	5	3	1

A. 4

B. 1

C. 3

D. 5

E. 2

Q 81

Given the following image, how many regions will result after applying the watershed technique using the 4-connectivity?

0	1	5	1	1	3
0	1	4	1	1	1
0	1	3	2	5	5
0	3	3	0	0	2
0	1	2	1	0	1
0	0	5	1	2	0

A. 4

B. 3

C. 1

D. 2

E. 5

Q 82

Which of the following sequences can be coded with the number 0.3 using the arithmethic coding, using the given symbol distribution:

Symbol	Probability	Initial Partition
a_1	0.2	[0.0, 0.2)
a_2	0.2	[0.2, 0.4)
a_3	0.4	[0.4, 0.8)
a_4	0.2	[0.8, 1.0)

A. $a_2\, a_3$

B. $a_1\, a_3$

C. $a_2\, a_1$

D. $a_3\, a_4$

E. $a_2\, a_4$

Q 83

Given the symbol probability distribution reported in the following table, which code can be a Huffman code?

symb.	prob.	code A	code B	code C	code D	code E
a_1	0.2	101	11	011	101	11
a_2	0.1	100	00	010	100	0
a_3	0.4	0	0	1	01	100
a_4	0.3	11	1	001	10	101

Q 84

Which of the following sequences can be coded with the number 0.1 using the arithmethic coding, using the given symbol distribution:

Symbol	Probability	Initial Partition
a_1	0.2	[0.0, 0.2)
a_2	0.2	[0.2, 0.4)
a_3	0.4	[0.4, 0.8)
a_4	0.2	[0.8, 1.0)

A. $a_1\, a_3$

B. $a_2\, a_3$

C. $a_1\, a_1$

D. $a_3\, a_4$

E. $a_1\, a_2$

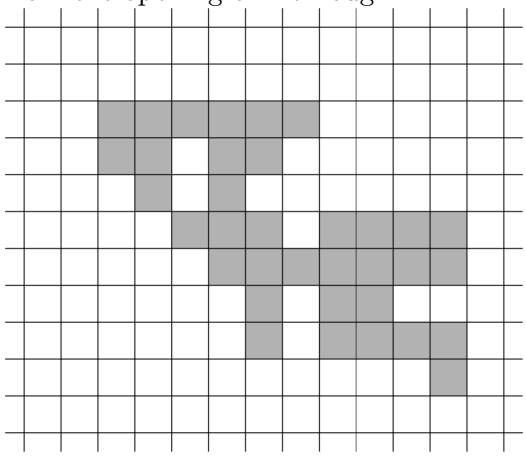
Q 85

Given the symbol probability distribution reported in the following table, which code can be a Huffman code?

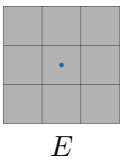
symb.	prob.	code A	code B	code C	code D	code E
a_1	0.1	111	11	011	101	11
a_2	0.1	110	00	010	100	0
a_3	0.3	10	0	1	01	100
a_4	0.5	0	1	01	10	101

Q 86

Given the following image I and the structuring element E, how many connected components result from the opening of I through E?



I



E

A. 0

B. 2

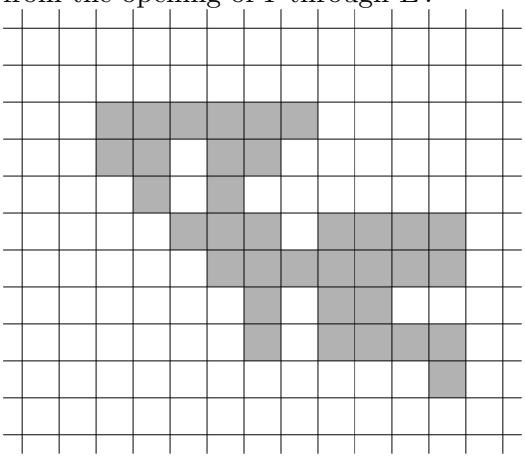
C. 1

D. 3

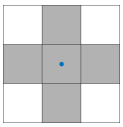
E. 4

Q 87

Given the following image I and the structuring element E, how many connected components result from the opening of I through E?



I



E

A. 1

B. 3

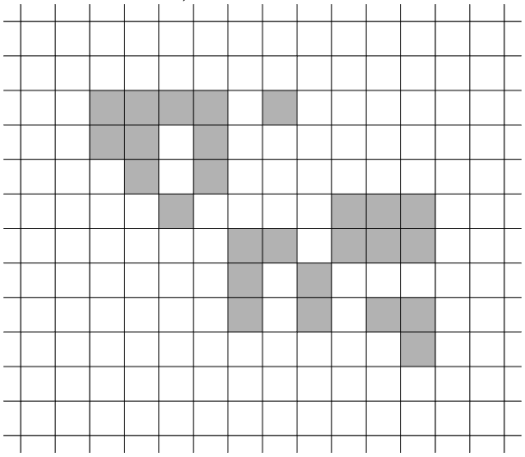
C. 0

D. 2

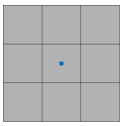
E. 4

Q 88

Given the following image I and the structuring element E, how many connected components result from the closing of I through E (considering the 8-connectivity)?



I



E

A. 1

B. 2

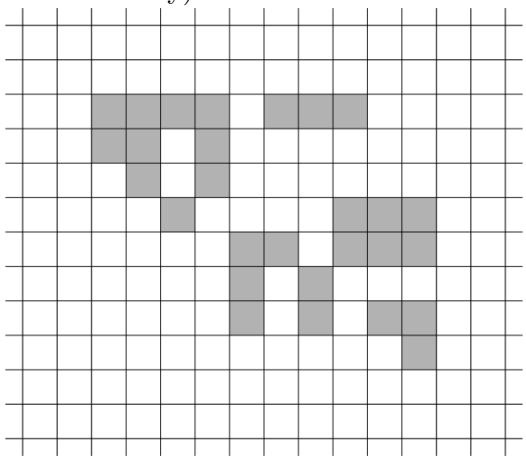
C. 0

D. 3

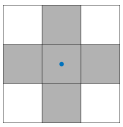
E. 4

Q 89

Given the following image I and the structuring element E, how many connected components result from the closing of I through E (considering the 4-connectivity)?



I



E

A. 2

B. 4

C. 3

D. 0

E. 1