


<div>Cairo University Faculty of Engineering Semester Programs</div> <div></div>	Computer Engineering Department (CMP)					
	3 <sup>rd</sup> Grade					
	Course Title:	Elective 1 Image Processing and Computer Vision			Course Code:	CMP362
	Course Instructor:	Elsayed Hemayed				
Exam Date:	13/11/2016	Allowed Time:	90Min	Total Marks:	20	

Question 1: [5 points] (T/F)

1. Motion blurring effect can be reduced by convolving the blurred image with a 1D high pass filter along the moving direction. **F**
2. The retina in the human eye has higher density of photo receptors than the Fovea. **F**
3. The Co-occurrence matrix has the same size as its image. **T**
4. The final result of K-mean segmentation depends on its initialization. **F**
5. Image resolution and image size are equivalent. **F**
6. Convolution in the spatial domain is equivalent to Fourier transform in the frequency domain. **F**
7. Pixels with high gradient values may affect the selection of the segmentation threshold from the image histogram. **T**
8. Image interpolation technique should be used whenever the image size is increased but no need to use it when the image size is decreased. **F**
9. Median cut algorithm can be used to represent the image using only two grey levels (image halftoning). **F**
10. To preserve horizontal and vertical lines while eliminating salt and pepper noise, we should use a 3x3 median filter. **F**



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**Question 2: [5 points]**


2.a) [2 pt] For the shown image, decide the range (min and max) of the window size to use in the mean shift algorithm to obtain 3 segments; segment 1 has color (0, 5, 7), segment 2 has color (17, 20) and segment 3 has color (32, 36, 40). Justify your decision.

0	7	17	20	32	40
0	7	17	20	32	40
0	7	17	20	32	40
0	7	17	20	32	40
5	20	20	32	36	40
5	20	20	32	36	40
5	20	20	32	36	40
5	20	20	32	36	40

0   5   7   17   20   32   36   40  
 4   4   4   4   12   8   4   8  
 segment 1   segment 2   segment 3

min 4x1  
max 4x2



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2.b) [3 pt] Shown below are the results of image segmentation techniques A and B. Decide visually which technique has a better segmentation. Then suggest two different objective functions to measure the quality of the segmentation. Use these functions to compare between the two segmented images. Hint: It is expected that your objective functions leads to the same decision as your visual decision.

*B is better*

Segmented Image using A: (1,1,1,1,1,2,2,2,2,2,5,5,5,5,5) and (6,6,6,6,6,7,7,7,7,7)

Segmented Image using B: (1,1,1,1,1,2,2,2,2,2) and (5,5,5,5,5,6,6,6,6,6,7,7,7,7,7)

Functions to measure the quality:-

① distance between the Pixels in segment

② adjacent Pixels in the segment

B has better Segmentation as distance between Pixels in Segment 1 is 1 and so in Segment 2

but A has bigger and unequal difference of distance between Pixels in segment 1

So in B the difference between the foreground & the background is clearly shown and you can see different objects better



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**4.5**  
**5**  
**Question 3: [5 points]**

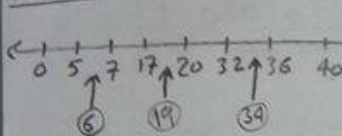
3.a) [1 pt] What is the maximum shutter time of your camera to be able to capture a sharp image for a ball moving at speed of 100 pixel/sec. If needed, make assumptions for missing data.

assume Camera FOV 60 Pixel

$$t = \frac{60}{100} = 0.6 \text{ sec}$$

3.b) [2 pt] Use the median cut algorithm and the popularity algorithm to represent the following image using only 3 colors. Compare between the obtained results.

median



6	6	19	19	34	34
6	6	19	19	34	34
6	6	19	19	34	34
6	6	19	19	34	34
6	19	19	34	34	34
6	19	19	34	34	34
6	19	19	34	34	34
6	19	19	34	34	34



0	7	17	20	32	40
0	7	17	20	32	40
0	7	17	20	32	40
0	7	17	20	32	40
5	20	20	32	36	40
5	20	20	32	36	40
5	20	20	32	36	40
5	20	20	32	36	40

Popularity

intensity	0	5	7	20	32	36	40
Count	4	4	4	12	8	4	8

→ most Popular 3 Colors: 20, 32, 40

20	20	20	20	32	40
20	20	20	20	32	40
20	20	20	20	32	40
20	20	20	20	32	40
20	20	20	32	32	40
20	20	20	32	32	40
20	20	20	32	32	40
20	20	20	32	32	40



using median result gives more color distribution than Popularity algorithm because Popularity algorithm depends on specific colors but median compute colors close to the real one





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3.c) [2 pt] Propose a halftone image with two levels only (0 and 1) for the shown image. The image has 10 grey levels. Justify your answer and show your dither matrix.

2	2	2	5	5	5	8	8
2	2	2	5	5	5	8	8
2	2	2	5	5	5	8	8
1	1	1	4	4	4	7	7
1	1	1	4	4	4	7	7
1	1	1	4	4	4	7	7
0	0	0	3	3	3	6	6
0	0	0	3	3	3	6	6
0	0	0	3	3	3	6	6

9x8 Original Image

1	0	0	0	1	1	0	0
0	1	0	0	1	1	0	0
0	0	0	1	1	0	1	0
0	0	0	0	1	1	1	0
0	1	0	0	1	1	0	0
0	0	0	1	0	0	0	1
0	0	0	0	1	1	0	0
0	0	0	0	0	1	0	0
0	0	0	1	0	0	0	1

Halftone image

1	2	6	7
3	0	8	10
4	5	9	2

my matrix

3x3 would be better



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**Question 4: [5 points]**

4.a) [2 pt] Propose a modification to simplify the original line detector by Hough transform to detect only diagonal lines (angle = 45 degrees).

4.b) [3 pt] Apply your modified Hough transform to the following edge image. Use appropriate range and step. Show the Hough space and the detected line(s) equation.

