



**Image Processing  
Summer Semester Exam.**



Mansoura University  
Faculty of Engineering

**Biomedical Engineering Program - Level 300**  
**Exam Date: 27-8-2019**  
**Allowed Time: 2 Hours**

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**Attempt all questions. Assume any missed data. Full mark is 50**

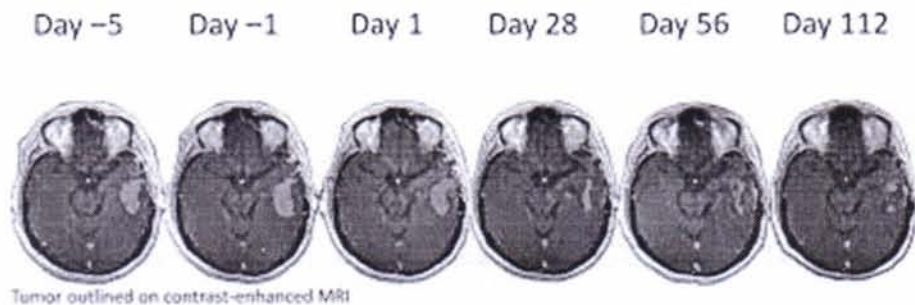
**Q.1) Use neat sketches to compare between each of the following [12 Marks]**

- CCD camera and flat-bed scanner
- The characteristics of a grey-scale image if we add 100 and the characteristics obtained if we multiply by 2.
- Block diagram of unsharp masking and block diagram of transform processing using discrete Fourier transform.
- Color image processing using RGB components and color image processing using intensity component.

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**Q.2) Give a short answer to each of the following questions: [15 Marks]**

- "New MRI techniques offer better images of brain tumors and quicker diagnoses. It can also help doctors decide more quickly to halt the use of ineffective medications."* How can image processing helps in this situation?



- "Applying the median filter can in general be a slow operation".* Suggest a faster operation to reduce the effect of salt and pepper noise. Comment on the suggested method.
  - "Adaptive thresholding can be useful in many situations".* Justify this statement. State the main applications of thresholding.
  - Define "edge" of an image. What is the main difference between "ramp edge" and "step edge"?* Give an example for a first-order and a second-order edge detectors.
  - "A color model is a method for specifying colors in some standard way".* Discuss the main three color models that are commonly used..
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**Q.3.a) Derive the parametric form of a straight line in an image.** Use the Hough transform to detect the two strongest lines in the binary image shown below. **[8 Marks]**

		X						
		0	1	2	3	4	5	6
y	0	1	0	0	0	0	0	1
	1	0	1	0	0	0	1	0
	2	0	0	0	0	0	0	0
	3	0	1	0	1	0	0	0
	4	0	0	1	0	0	0	0
	5	0	1	0	0	0	0	0
	6	0	1	0	0	0	0	0

**Q.3.b)** Consider the filtered image shown below:

0	15	15	15	15	15	15	0
15	-30	-15	-15	-15	-15	-30	1
10	-15	0	0	0	0	-15	10
10	-15	0	0	0	0	-15	10
10	-30	-15	0	0	0	-15	10
0	15	30	-15	0	0	-15	15
0	0	15	-30	-15	-15	-30	15
0	0	0	15	15	15	15	0

Apply "zero crossing" to obtain the edges of this image.

**[6 Marks]**

**Q.4.a) Given a 5x5 image, X, and a Roberts edge detector, H**

$$X = \begin{bmatrix} 115 & 110 & 105 & 105 & 350 \\ 105 & 100 & 100 & 100 & 355 \\ 100 & 140 & 120 & 100 & 350 \\ 110 & 130 & 145 & 115 & 345 \\ 120 & 130 & 130 & 125 & 345 \end{bmatrix} \quad \& \quad H = \begin{bmatrix} 1 & 0 & 0 \\ 0 & -1 & 0 \\ 0 & 0 & 0 \end{bmatrix}$$

Apply the given edge detector to the image? Modify values outside the range [0-255]. Then, apply a suitable threshold to transform the resulting image into a binary one. **[8 Marks]**

**Q.4.b) Suppose a 3 bit grey-scale image has the following grey values:**

**[6 Marks]**

i	0	1	2	3	4	5	6	7
$n_i$	5	10	20	25	30	40	30	40

- Sketch the histogram of this image. What do you expect about the appearance of it?
- Use histogram equalization to improve the appearance of the image. Sketch the result.

😊 Best wishes 😊

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