



UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**FINAL EXAMINATION
SEMESTER II
SESSION 2017/2018**

COURSE NAME : IMAGE PROCESSING
COURSE CODE : BEC 42203
PROGRAMME CODE : BEJ
EXAMINATION DATE : JUNE/JULY 2018
DURATION : 3 HOURS
INSTRUCTION : **ANSWERS ALL QUESTIONS IN
THIS BOOKLET.**

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THIS QUESTION PAPER CONSISTS OF **THIRTEEN (13)** PAGES

PART 1: Objective Questions (Instruction: Circle the right answer.)

Q1 Which of the following type of noise is not suggested to be removed by using spatial domain filter?

- (a) Salt and Pepper noise
- (b) Gaussian noise
- (c) Periodic noise
- (d) All of above

(2 marks)

Q2 Based on **Equation Q2**, given R and a structuring element Q. The equation is used to calculate

$$R \circ Q = (R \oplus Q) \ominus Q$$

Equation Q2

- (a) opening
- (b) closing
- (c) dilation
- (d) erosion

(2 marks)

Q3 Opening technique is performed by applying

- (a) erosion followed by a dilation
- (b) dilation followed by an erosion
- (c) erosion followed by a closing
- (d) dilation followed by a closing

(2 marks)

Q4 **Q4** is based on **Figure Q4**. Which compression scheme is the most suitable for compressing image in **Figure Q4**?

**Figure Q4**

- (a) Lossless compression
- (b) Lossyless compression
- (c) Losy compression
- (d) Lossy compression

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(2 marks)

Q5 Based on Figure Q5, shows a model of the image degradation process. $f(x,y)$ represents

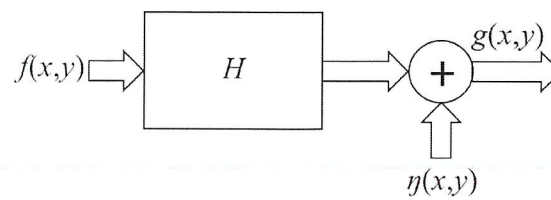


Figure Q5

- (a) degradation function
- (b) additive noise
- (c) degraded image
- (d) input image

(2 marks)

Q6 Which is the principle source of noise causing image degradation?

- (a) sensor temperature
- (b) light condition
- (c) atmospheric disturbance
- (d) all of above

(2 marks)

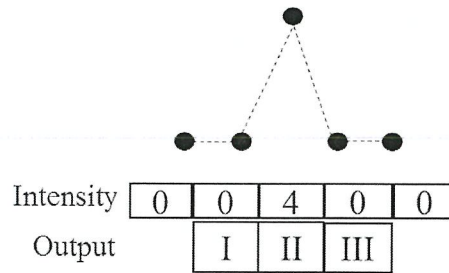
Q7 Which of these statements describing a line?

- (a) an edge segment where the intensity of the background on either side of the line is either much higher/lower than the intensity of the line pixels
- (b) viewed as a line whose length and width are equal to one pixel.
- (c) sets of connected edge pixels
- (d) local image processing methods designed to detect edge pixels

(2 marks)

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Q8 Figure Q8 shows the derivative condition between first-order and second order derivatives. Evaluate which output will provide the similar pixel intensity value for this isolate point?



$$f'(x) = f(x + 1) - f(x)$$

$$f''(x) = f(x + 1) + f(x - 1) - 2f(x)$$

Figure Q8

- (a) I
- (b) II
- (c) III
- (d) I and II

(2 marks)

Q9 Based on Equation Q9, the following threshold technique is referred to as

$$g(x, y) = \begin{cases} 1 & \text{if } f(x, y) > 127 \\ 0 & \text{if } f(x, y) \leq 127 \end{cases}$$

Equation Q9

- (a) multiple threshold
- (b) global threshold
- (c) double threshold
- (d) adapt threshold

(2 marks)

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Q10 Figure Q10 (b) is the result of performing dilation to Figure Q10 (a). If we repeatedly perform dilation the resulting image, what will happened to the output image?

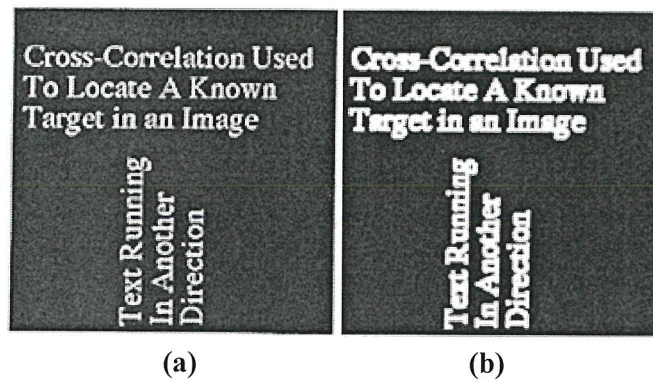


Figure Q10

- (a) we would end up with a thinner words
- (b) we would end up with a thicker words
- (c) we would end up with a completely black image
- (d) we would end up with a completely white image

(2 marks)

Q11 IDWT stands for

- (a) Inverse Depth Wavelet Transform
- (b) Inverse Discrete Wave Transform
- (c) Inverse Discrete Wavelet Transform
- (d) Invert Discrete Wavelet Transform

(2 marks)

Q12 Based on Figure Q12. Figure Q12 shows the result of decomposition level =1 of the wavelet transform. Subimage A shows the result of _____ filter?

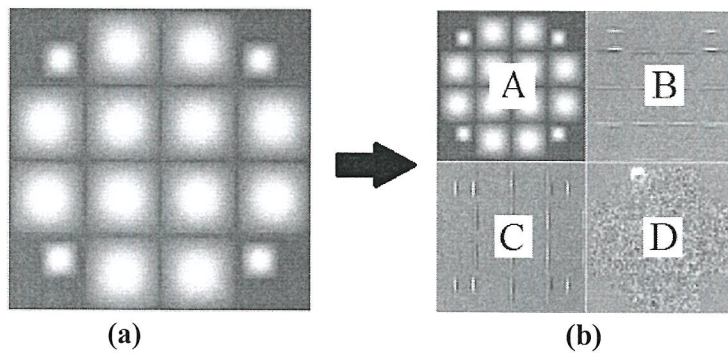


Figure Q12

- (a) HH
- (b) HL
- (c) LH
- (d) LL

TERBUKA (2 marks)

PART 2: Subjective Questions

Q13 Figure Q13 (b) and Figure Q13 (c) show the results of applying edge detector in two preferred directions. Propose TWO (2) 3x3 masks to detect edges in the preferred direction for each image, respectively. Use coefficients values -2 and 4 for the masks.

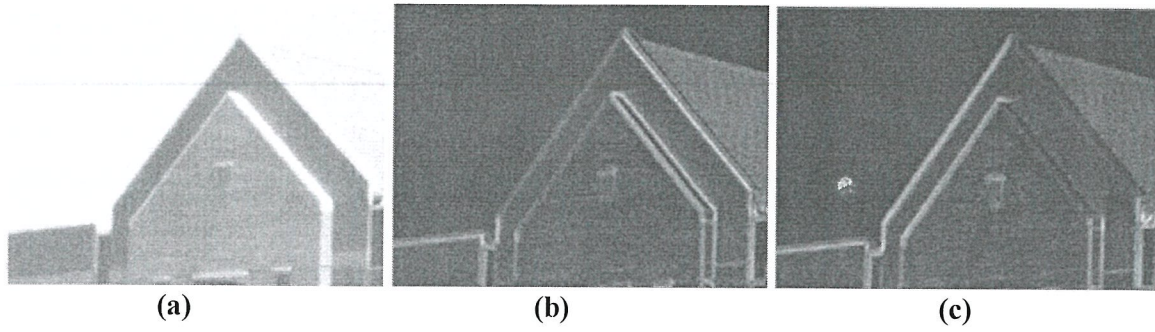
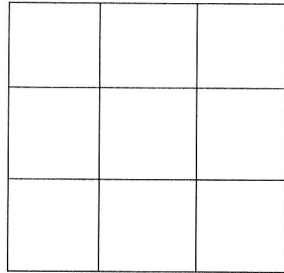


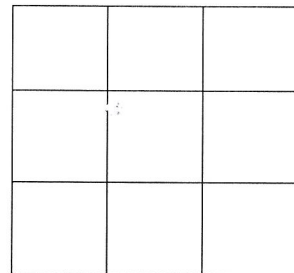
Figure Q13

(9 marks)

Answer:



(A1) Figure Q13 (b)



(A2) Figure Q13 (c)

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Q14 Based on **Figure Q14**, which pixel values on locations (x,y) represent the grayscale intensity values. Compute the output of the 3×3 Prewitt edge detector as shown in **Figure Q14 (b)** at pixel location $(2,2)$.

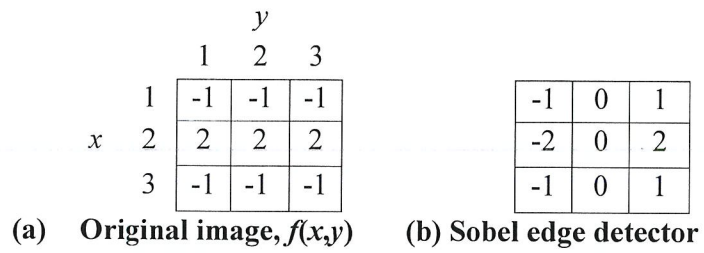


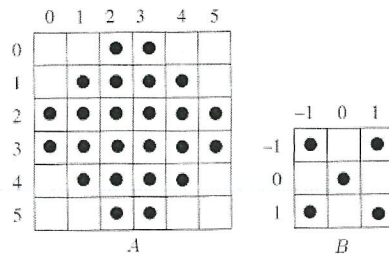
Figure Q14

(10 marks)

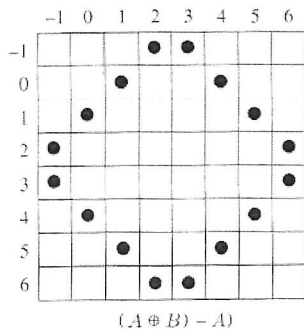
Answer:



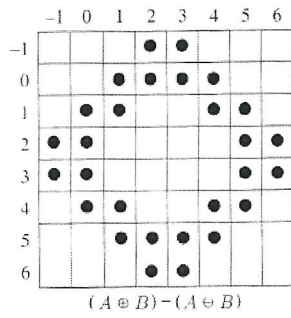
Q15 Based on **Figure Q15**, which of the following image is the result of applying morphological gradient to **Figure Q15 (a)**? Explain why you choose that image.



(a)

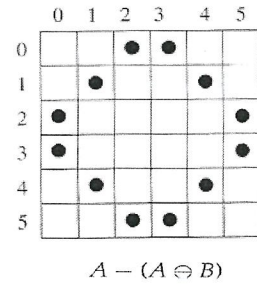


(b)



(c)

Figure Q15



(d)

(6 marks)

Answer:

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Q16 Table Q16 shows the details of steps involved in JPEG baseline compression scheme, which are not in the correct order. Match the steps to the correct processes in the compression scheme as shown in **Figure Q16**. Provide your answers in pair of process name and step details (eg. I: [A], II: [B], .).

Table Q16

[A]	The image is divided into 8 x 8 blocks, with each block transformed and compressed separately.
[B]	The DCT is applied to each shifted block.
[C]	For each 8 x 8 block, the values are shifted by subtracting 128 from each value.
[D]	The DCT values are normalized by dividing by a normalization matrix Q. This matrix is formed into a vector by reading off all nonzero values from the top left in a zigzag fashion.
[E]	The DC coefficients of each vector are encoded by listing the difference between each value and the values from the previous block.
[F]	AC coefficients are compressed using a Huffman encoding.
[G]	RLE compression is performed for DC coefficients' block differences.

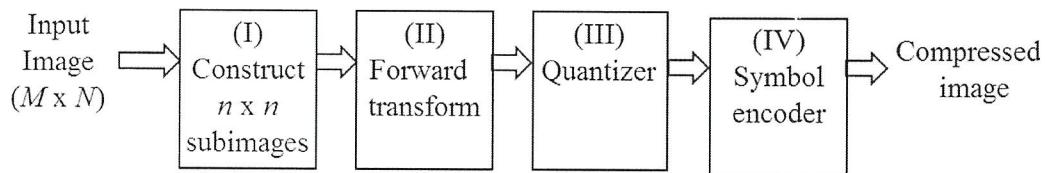


Figure Q16

(7 marks)

Answer:

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Q17 Based on **Figure Q17**, which pixel values on locations (x,y) represent the grayscale intensity values,

- (i) compute the output of a 3×3 median at $(2,2)$.
- (ii) compute the output of a 3×3 median at $(2,3)$ using zero padding technique.

		y		
		1	2	3
	1	4	6	255
x	2	7	5	5
	3	0	6	2

Figure Q17

Answer:

(9 marks)

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- Q18** Based on **Figure Q18**, which pixel values on locations (x,y) represent the grayscale intensity values,
- compute the output of a 3×3 average filter at $(3,3)$.
 - compute the output of a 5×5 average filter at $(3,3)$.

(10 marks)

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

Figure Q18**Answer:**

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Q19 Based on **Figure Q19**, which pixel values on locations (x,y) represent the grayscale intensity values for sets of pixels A and Image B ,

- (i) find the output pixel value for the dilation of A and B for pixel location at $(2,2)$.
- (ii) find the output pixel value for the dilation of A and B for pixel location at $(1,1)$ without using padding technique.

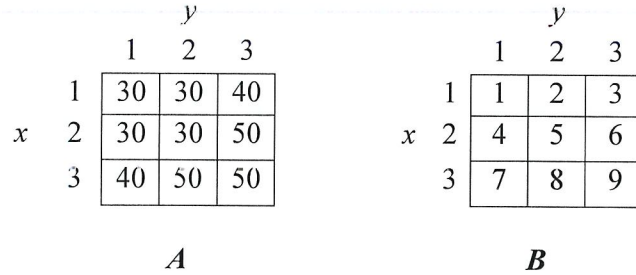


Figure Q19

(13 marks)

Answer:

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Q20 A simple 1D wavelet transform works by performing just two operations: taking averages of two values and differencing. Given a vector:

$$V = [70, 60, 20, 20, 30, 30, 10, 10]$$

Create a new vector dI , which is the discrete wavelet transform at decomposition level 1 of the original vector V . Show all your calculation.

(12 marks)

Answer:

-END OF QUESTIONS -

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