

**IV B.Tech. II Semester Supplementary Examinations, July -2005**  
**DIGITAL SPEECH & IMAGE PROCESSING**  
**(Information Technology)**

**Time: 3 hours****Max Marks: 80**

**Answer any FIVE Questions**  
**All Questions carry equal marks**

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1. Explain how a RGB colour image is converted into different colour models using different conversion formula.
2. (a) Justify that the transformation function derived from histogram equalization is a monotonically increasing function.  
 (b) What effect would setting to zero the lower-order bit planes have on the histogram of an image in general.
3. What is convolution function? How is the same implemented using a scan line Algorithm?
4. (a) What do you meant by multispectral thresholding? Explain how this method is useful for image segmentation?  
 (b) What do you meant by multilevel thresholding? Explain how this method is useful for image segmentation.
5. A sample image of size  $5 \times 5$  is shown below:

$$\begin{bmatrix} 3 & 2 & 3 & 4 & 1 \\ 0 & 2 & 4 & 3 & 7 \\ 3 & 4 & 2 & 1 & 0 \\ 4 & 1 & 3 & 3 & 7 \\ 5 & 4 & 5 & 4 & 6 \end{bmatrix}$$

Apply the mask corresponds to the Laplacean function of the form and show the truncated output image of size  $3 \times 3$ .

$$\nabla^2 f = 4Z_5 - (Z_2 + Z_4 + Z_6 + Z_8).$$

6. (a) With necessary diagrams explain the operation of opening.  
 (b) Let A and B are two sets in  $Z^2$ . Show that  $\bigcap_{b \in B} A \ominus B = \bigcap (A)_{-b}$
7. (a) What do you mean by compression? Briefly explain its requirement.  
 (b) Differentiate lossy compression and lossless compression. Mention their applications.  
 (c) What do you mean by improved Gray Scale Quantization?  
 (d) Explain the fidelity criteria in image compression.

8. What are the types of compression used in image application. Mention the requirements of compression. Briefly explain.

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1. (a) Explain Shannon's sampling theorem in respect of image sampling.  
 (b) Explain the effect of sampling over finite intervals with suitable graphical illustrations.
2. (a) Explain the following gray level transformations :
  - i. Image negatives
  - ii. Log transformations
  - iii. Power law transformations.
 (b) Explain the need for histogram equalization.
3. Describe the characteristics and applications of the following filter templates

(a) 
$$\begin{bmatrix} 0 & -1 & 0 \\ -1 & 4 & -1 \\ 0 & -1 & 0 \end{bmatrix}$$

(b) 
$$\begin{bmatrix} 1 & 1 & 1 \\ 1 & 1 & 1 \\ 1 & 1 & 1 \end{bmatrix}$$

(c) 
$$\begin{bmatrix} 1 & 3 & 1 \\ 3 & 16 & 3 \\ 1 & 3 & 1 \end{bmatrix}$$

(d) 
$$\begin{bmatrix} -1 & -1 \\ 1 & 1 \end{bmatrix}$$

4. Explain various detection of discontinuity methods in detail with suitable examples.
5. A sample image of size  $5 \times 5$  is shown below:

$$\begin{bmatrix} 3 & 2 & 3 & 4 & 1 \\ 0 & 2 & 4 & 3 & 7 \\ 3 & 4 & 2 & 1 & 0 \\ 4 & 1 & 3 & 3 & 7 \\ 5 & 4 & 5 & 4 & 6 \end{bmatrix}$$

Apply the mask corresponds to the Laplacean function of the form and show the truncated output image of size  $3 \times 3$ .

$$\nabla^2 f = 4Z_5 - (Z_2 + Z_4 + Z_6 + Z_8).$$

6. (a) Explain with an example the boundary extraction using morphology operations.  
(b) Write short notes on opening and closing
7. (a) What is false contouring?  
(b) Differentiate
  - i. compression and decompression
  - ii. coding and decoding and
  - iii. mapper and demapper
- (c) How the word distance is related with hamming code?
8. (a) Explain about
  - i. slope overload
  - ii. granular noise.
- (b) List out the advantages and drawbacks of different types of lossy compression techniques.

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1. Explain in detail about different active acquisition methods to acquire range images.
2. Give a detailed note about different point processing techniques.
3. (a) Find the averaging filter outputs for the given input image. Assume the size of averaging mask is 3x3 and assume two rows and columns of zeros are added on all sides of the images.

$$\begin{bmatrix} 2 & 4 & 6 & 3 \\ 0 & 1 & 3 & 3 \\ 2 & 2 & 4 & 1 \\ 1 & 1 & 3 & 0 \end{bmatrix}$$

- (b) Find the weighted averaging of the above image, if the weighted averaging mask is given as

$$\frac{1}{16} \begin{bmatrix} 1 & 2 & 1 \\ 2 & 4 & 2 \\ 1 & 2 & 1 \end{bmatrix}$$

4. Write short notes on the following:
  - (a) Global thresholding
  - (b) Adaptive thresholding
5. Write short notes on the following:
  - (a) Second order detection
  - (b) Compass operators
6. (a) Define thinning. Explain the thinning morphological operation with an example.  
(b) Define thickening operation. Explain with an example.
7. (a) What do you mean by relative address coding?  
(b) Differentiate one dimensional and two dimensional Run length coding.  
(c) What are the advantages of white block skipping?
8. (a) Explain about

- i. slope overload
  - ii. granular noise.
- (b) List out the advantages and drawbacks of different types of lossy compression techniques.

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1. Explain in detail about 2-D sampling theory with necessary derivations and graphical illustrations.
2. (a) What is the general form of gray-level transformation function. Explain the terms involved in it?  
(b) Explain how the
  - i. Contrast stretching and
  - ii. Thresholding functions are implemented.
3. (a) What procedure is followed to perform spatially dependent transforms.  
(b) Define the convolution operation performed in image processing.
4. Find the edge corresponding to the minimum-cost path in the subimage shown. The numbers in brackets are gray levels and the outer numbers are spatial coordinates. Assume that the edge starts in the first column and ends in the last column.

	1	2	3
1	•	•	•
	[2]	[1]	[0]
2	•	•	•
	[1]	[1]	[7]
3	•	•	•
	[6]	[8]	[2]

5. Explain how the enhancement is achieved using crack edge relaxation algorithm.
6. (a) Let A and B are two sets in  $Z^2$ , show that
 
$$A \oplus B = \bigcup_{b \in B} (A)_b$$
 (b) Sketch the dilation of a circle of radius r by a circular structuring element of radius r/4. Use this structuring element, to dilate a square of size r x r.
7. (a) With a neat block diagram, describe the image compression system model  
(b) What do you mean by mapper in source encoder?  
(c) Compare the statistical Compression and spatial Compression.
8. (a) What is meant by statistical coding? Classify.  
(b) Explain briefly about the types of statistical coding.

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