B. Tech

PECS 3408

Eighth Semester Examination – 2007

IMAGE PROCESSING

Full Marks – 70

Time : 3 Hours

*Answer Question No. **1** which is compulsory and any **five** from the rest.*

The figures in the right-hand margin indicate full marks for the questions

1. Answer **all** questions : 2×10

   (a) Give the mathematical model of a digital image.

(b) How much of memory space a typical 8-bit grayscale image of size 512 × 512 would consume ?

(c) How can you realize a spatial filter that would sharpen the image ?

(d) What are 4-connectivity and 8-connectivity ?

(e) Explain what you mean by gray level ?

(f) Explain what hue, saturation and intensity are ?

(g) Is it possible to display all kinds of colours in a colour monitor ? Justify.

(h) How generation of information is modeled as probabilistic process ?

(i) What are lossy and lossless compression ?

(j) What is quantization error in the context of image processing ?

2. Certain process yields binary images of rectangles as in Fig.-1. Develop a method for : 5×2

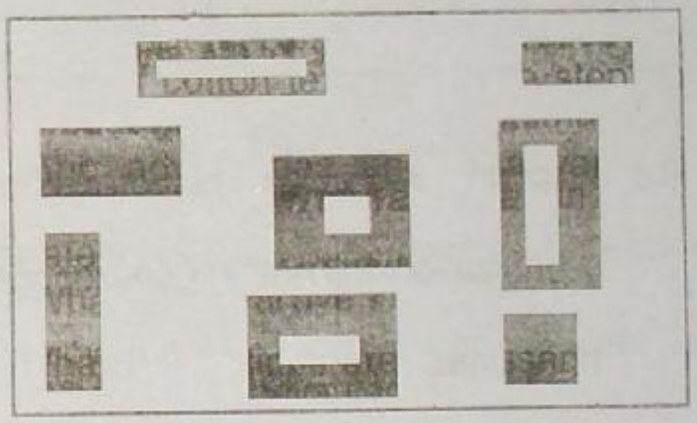

Fig.-1

(a) detecting whether any image contains any rectangle or not,

(b) classifying each rectangle as H rectangle if it has a hole and NH rectangle if it does not.

3. Show that : 5×2

(a) $f_{even}(x) = \frac{1}{2}(f(x) + f(-x))$ $f_{odd}(x) = \frac{1}{2}(f(x) - f(-x))$

(b) $F(f_{even}(x)) = Re(F[f(x)])$ $F(f_{odd}(x)) = jIm(F[f(x)])$

4. (a) Show that 1-D DCT can be computed using FFT. 5

(b) Explain why the discrete histogram equalization will not, in general, yield a flat histogram. 5

5. An image has the gray level PDF p(r) shown in Fig.-2. It is needed to transform the gray levels to another PDF p(z) as shown. Assuming

continuous quantities find the transformation that would accomplish this. 10

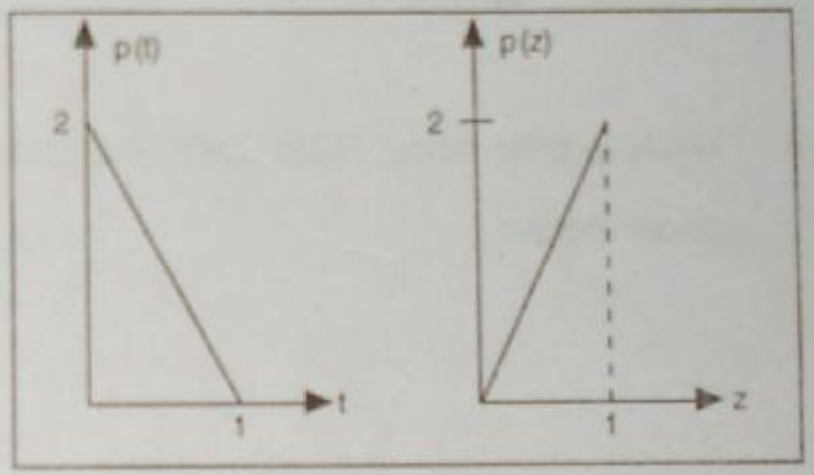

Fig.-2

6. (a) Discuss the limiting effect of repeatedly applying a 3 × 3 lowpass spatial filter to a digital image. 5

(b) Develop a procedure for computing the median of an n×n neighbourhood. 5

7. Discuss how first and second derivative may be used for detecting edges in an image. Also discuss the Sobel operator with an example. 10

8. Write, in brief, about RGB, CMY, YIQ and HSI colour models. 10