Register Number

SATHYABAMA UNIVERSITY

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Course & Branch :M.E - W-AEL
Title of the Paper :Transforms and Probabilities   Max. Marks :80
Sub. Code :735101   Time : 3 Hours
Date :25/05/2011   Session :AN

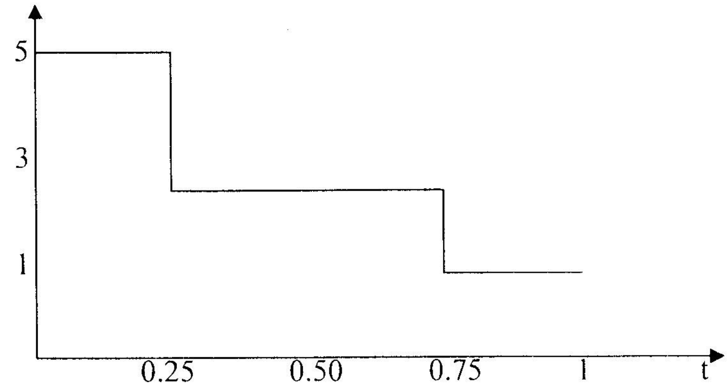
PART - A   (6 x 5 = 30)

Answer ALL the Questions

1. Consider the images shown. The image on the right was obtained by
(a) Multiplying the image on the left by $(-1)^{x+y}$;
(b) Computing the DFT.
(c) Taking the complex conjugate of the transform.
(d) Computing the inverse DFT; and
(e) Multiplying the real part of the result by $(-1)^{x+y}$;
Explain (mathematically) why the image on the right appears as it does.

2. Explain in detail about a Multiresolution formulation of a wavelet system.

3. What are the basis functions for Harr wavelet in V_0,W_0 and W1 function spaces? Split the function g(t) in Fig, into Vo, Wo and W1 into its pieces.



4. A lot of consists of 10 good articles, 4 with minor defects and 2 with major defects. Two articles are chosen from the lot at random (without replacement)
Find the probability that
   (a) Both are good
   (b) Both have major defects
   (c) At least 1 is good
   (d) At most 1 is good

5. If a random variable X has a MGF $M(t) = \dfrac{3}{3-t}$ obtain the standard deviation of X.

6. Buses arrive at a specified stop at 15 min intervals starting at 7AM that is they arrive at, 7:15, 7:30, 7:45 and so on. If the passenger arrives at the stop at a random time that is uniformly distributed between 7 and 7:30 AM, find the probability that he waits
   (a) Less than 5 min for a bus and
   (b) At least 12 min for a bus

PART – B (5 x 10 = 50)

Answer ALL the Questions

7. Compute 2D-DFT for the given 4 X 4 image matrix given as

$$f(x,y) = \begin{bmatrix} 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 \end{bmatrix}$$ using Orthogonality property.

F[k.1] = Kernel x f(x,y) x $(\text{kernel})^T$

(or)

8. Explain Discrete Cosine and Walsh transforms with a suitable algorithm.

9. Consider the following "image"

$$\begin{matrix} 4 & 3 & 2 & 1 \\ 3 & 2 & 1 & 1 \\ 2 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 \end{matrix}$$

Obtain the two-dimensional DWHT Transform by 1^{st} taking the one-dimensional transform of the rows, then taking the column by column transform of the resulting matrix.

Obtain the two dimensional DWHT transform by 1^{st} taking one dimensional transform of the Columns, then taking the row-by-row transform of the resulting matrix.

Compare and comment on the results of (a) and (b).

(or)

10. Describe Wavelet Packet Decomposition techniques.

11. A company produces machine components which pass through an automatic testing machine. 5% of the components entering the testing machine are defective. However, the machine is not entirely reliable. If a component is defective there is 4% probability that it will not be rejected. If a component is not defective there is 7% probability that it will be rejected.

(a) What fraction of all the components are rejected?

(b) What fraction of the components rejected are actually not defective?

(c) What fraction of those not rejected are defective?

(or)

12. The average number of collisions occurring in a week during the summer months at a particular intersection is 2.00. Assume that the requirements of the Poisson distribution are satisfied.
    (a) What is the probability of no collisions in any particular week?
    (b) What is the probability that there will be exactly one collision in a week?
    (c) What is the probability of exactly two collisions in a week?
    (d) What is the probability of finding not more than two collisions in a week?
    (e) What is the probability of finding more than two collisions in a week?
    (f) What is the probability of exactly two collisions in a particular two-week interval?
13. Given that the autocorrelation function for a stationary ergodic process with no periodic components is $R_{xx}(\tau) = 25 + \frac{4}{1+6\tau}$. Find the mean value and variance of the process [X(t)].

(or)

14. A WSS random process X(t) with autocorrelation function $R_x(\tau)=e^{-a|\tau|}$ where α is a real positive constant, is applied to the input of an LTI system with impulse response $h(t) = e^{-bt} u(t)$ where **b** is a real positive constant. Find the autocorrelation function of the output Y(t) of the system.

15. Describe Markov model of Multiclass Multiserver queuing system with priorities.

(or)

16. Compute the basis of the KL transform for the input data $x_1=(4,4,5)^T$ $x_2=(3,2,5)^T$, $x_3=(5,7,6)^T$ and $x_4 = (6,7,7)^T$.