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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

SECOND SEMESTER M.TECH DEGREE EXAMINATION, MAY 2016

Electronics and Communication Engineering

01EC6302 Estimation and Detection Theory

Max. Marks : 60 Duration: 3 Hours

Part A

Answer any two questions.

1. a) State Neyman-Pearson theorem and explain how it is used for signal detection. (4 marks)

   b) Design a matched filter for the given signal x[n] = [1 3 2 1 2 4]. (5 marks)

2. a) For the dc level in the WGN detection problem assume that we wish to have $P_{FA} = 10^{-4}$ and $P_D = 0.99$. If the SNR is $10 \log_{10} A^2/\sigma^2 = -30$ dB, determine the necessary number of samples N. (5 marks)

   b) DefineChernoff bound. (4 marks)

3. a) Consider the detection problem

   $H_0 : x[0] = w[0]$

   $H_1 : x[0] = 1 + w[0]$

   where $w[0]$ is a uniformly distributed random variable on the interval $[-a, a]$ for $a > 0$. Discuss the performance of the detector that decides H_1 if $x[0] > ½$ as a increases. (5 marks)

   b)Define Baye's Risk function and explain. (4 marks)

Part B

Answer any two questions.

4. a) Consider the problem, x[n] = A +Bn + w[n], where w[n] ~ $N(0,\sigma^2)$; A and B are parameters to be estimated.Obtain the Fischer Information matrix. (5 marks)

   b) Discuss the concept of Bayesian estimation. (4marks)

5. a) We are given the following data

$$18.3 = 6t + w(0)$$
$$5.8 = 2t + w(1)$$
$$3.1 = t + w(2)$$

where w(n) is White Gaussian Noise. Find the LS estimate of t. (5marks)

b) Obtain the BLUE of t, if the noise samples have zero mean and unit variance. (4marks)

6. a) State CRLB theorem. (4 marks)

b) Explain MMSE and MAP estimators. (5 marks)

Part C

Answer any two questions.

7. a) Illustrate the discreteKalman filter algorithm and show how it is used in estimation. (7 marks)

b) Discuss the application of estimation theory in image processing. (5marks)

8.a) Derive the transfer function of the Weiner filter. (7marks)

b) Discusstheapplicationofdetectiontheoryinimageprocessing. (5marks)

9.a) List out the applications of estimation and detection. (7marks)

b) Discuss how an estimator can be chosen for a given application. (5marks)