EJTC

END SEM EXAMINATION (SPRING 2013)

Information Theory and Statistics (RSSP)

Marks: 50 Max. time: 3 hrs.

General instructions:

1.Please attempt questions in the same order as they appear in the paper

2.Explain answers with clarity using Logic and Maths, credit is for method and not final answer

Q1.

a) A spy-system(CDMA) is to be designed for information communication. Develop & justify the conditions applying on p and $H(p)$? {Max Entropy/Cover} 5

b)Observers A and B conclude with statistical surveys giving p and q as distributions of data. Justify that the decision error is upper bounded by

$P(\ error\ ) \leq \exp[-D(p||q) * n * H(p)]$ {Universal Source coding/Chernoff} 5

Q2.

a) Depicting a Universal Trellis by Binary Tree, prove the Kraft-McMillan Inequality. What is achieved by this rule? {Prefix free coding/Karush} 5

b)What are main constraints in design of: Sampling , Quantization ;for a noiseless source? {Representation/Shannon} 5

c)Develop the major blocks (architecture) and steps(algorithm) in a Vector Quantizer for Image Compression. {Maths of Quantization/Gray} 5

Q3.

a) Given letters 1,2,3,4,5,6 are outcomes of a sample space(assume equi-probable or, non- uniform distribution). Design Dictionary/Codebook for the following cases:

i)not uniquely decode-able

ii)prefix free

iii)uniquely decodable {Codebook generation/Cover} 5

b) Reason why a Uniform Length Source Coding is not an optimal choice for representation. {Equiprobable randomness/Ziv-Briemann} 5

c)Use Linear Programming or otherwise prove that $H_2(p)$ indeed is minimum length description of a universal program with Binary states. Can this be generalized for $H_a(p)$. {Complexity theory/Kolmogorov-Chaitin} 5

Q4.

a) Depict with 2-state Markov process a model for information processing. {Information coding and transmission/Verdu} 5

b) Errors occur in typing from a keypad with alphanumeric letters. Errors arise due to the four neighbourhood keys around any given key. Assume a keypad and formuate the maximum rate of typing for reliablility (error free typing)? {Information capacity/Shannon} 5

OR

c) Develop Shannon's Information model and measure for Reliable communication {Digital Information/Shannon} 5