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Second Semester M.Tech. Degree Examination, June/July 2016
Digital Signal Compression

Time: 3 hrs.

Max. Marks:100

Note: Answer any FIVE full questions.

- 1 a. Define data compression and compression ratio. (02 Marks)
 b. State and prove Kraft Mc. Millan inequality which provides necessary condition on the codeword length of uniquely decodable codes. (08 Marks)
 c. Loly modeling is required in data compression? How is data dependency is represented in Mackov Model and its use in binary image? (10 Marks)
- 2 a. For two random variables X and Y show that
 i) $H\left(\frac{X}{Y}\right) \leq H(X)$
 ii) $I(X; Y) = I(Y; X)$ (08 Marks)
 b. Derive rate distortion theory for Gaussian source. (08 Marks)
 c. List out the axioms satisfied by inner products in vector space. (04 Marks)
- 3 a. A source emits letters for an alphabet $A = \{a_1, a_2, a_3, a_4, a_5\}$ with probabilities $P(a_1) = 0.4, P(a_2) = 0.2, P(a_3) = 0.2, P(a_4) = 0.1, P(a_5) = 0.1$
 i) Compute the entropy of the source.
 ii) Find a Huffman code of the source.
 iii) Find its redundancy. (10 Marks)
 b. Given the probability model in Table 1. Find the real valued Tag for the sequence $a_1 a_1 a_3 a_2 a_3 a_1$ using arithmetic coding technique. (10 Marks)

Symbol	Probability
a_1	0.2
a_2	0.3
a_3	0.5

- 4 a. A sequence is encoded using LZ77 algorithm. Given that $C(a) = 1, C(b) = 2, C(r) = 3, C(t) = 4$ decode the following sequence of Triples.
 $\langle 0 \ 0 \ 3 \rangle \langle 0 \ 0 \ 1 \rangle \langle 0 \ 0 \ 4 \rangle \langle 2 \ 8 \ 2 \rangle \langle 3 \ 1 \ 2 \rangle \langle 0 \ 0 \ 3 \rangle \langle 6 \ 4 \ 4 \rangle \langle 9 \ 5 \ 4 \rangle$
 b. Assume that the size of the window is 20 and size of the look ahead buffer is 10. (08 Marks)
 Use Burrow wheeler decoding algorithm to recover the original sequence, which is encoded as $T = [7, 8, 3, 9, 10, 4, 0, 5, 6, 1, 2]$
 Given Lexicographic sequence order as,
 $L = [s \ h \ t \ t \ h \ b \ i \ i \ b \ e]$ (08 Marks)
 c. Mention list of 8 different predictive scheme in current standard JPEG – LS. (04 Marks)
- 5 a. Derive the expression for SNR of uniform quantizer of a uniformly distributed source. (08 Marks)
 b. Define and list down the steps involved in LBG algorithm. (06 Marks)
 c. Explain the process of building the binary codeword in Tree Structured Vector Quantization. (06 Marks)

- 6 a. Briefly explain Delta Modulation. (10 Marks)
b. Mention the advantages and disadvantages of KLT transform. (04 Marks)
c. Explain DCT transform and why it is most popular transform. (06 Marks)

- 7 a. Find the Bit stream generated for seven level decomposition shown below using SPIHT: (10 Marks)

26	6	13	10
-7	7	6	4
4	-4	4	-3
2	-2	-2	0

- b. Describe the basic steps involved in subband coding. (10 Marks)

- 8 a. Explain ITU-T recommendation H.261. (10 Marks)
b. Describe the principle of linear predictive coding. (10 Marks)

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