

USN

--	--	--	--	--	--	--	--	--	--

12EC030

M.Tech. Degree Examination, June/July 2014

Digital Signal Compression

Time: 3 hrs.

Max. Marks:100

Note: Answer any FIVE full questions.

- 1
 - a. Distinguish between lossy and lossless compression give example for each compression scheme. (08 Marks)
 - b. Explain the measures of performance of compression techniques. (06 Marks)
 - c. Define entropy of a source of information. Calculate the entropy for an alphabet $A[a_1, a_2, a_3, a_4]$ with probability of occurrence $p(a_1) = 0.5$, $p(a_2) = 0.25$ and $p(a_3) = p(a_4) = 0.125$. (06 Marks)

- 2
 - a. State the Kraft-McMillian equality theorem and show that $K(e) = \sum_{i=1}^n 2^{-l_i} \leq 1$ when e be a code with N codewords of length l_1, l_2, \dots, l_n and e is uniquely decodable. (08 Marks)
 - b. Define prefix codes and show that the code [0, 01, 11] is an uniquely decodable code and the code [0, 01, 10] is not uniquely decodable. (06 Marks)
 - c. Explain the minimum description length principle based as Kolmogorov complexity with an example. (06 Marks)

- 3
 - a. Design minimum variance Huffman code for an alphabet $A[a_1, a_2, a_3, a_4, a_5]$ with $p(a_1) = p(a_3) = 0.2$, $p(a_2) = 0.4$ and $p(a_4) = p(a_5) = 0.1$. Draw the encoding procedure and binary tree for the same and calculate the average length. (08 Marks)
 - b. Explain the procedure for adaptive Huffman coding. Encode the message [a, a, r, d, v] for an English alphabet. (07 Marks)
 - c. Define the procedure for Golomb codes and design the Golomb codes for $m = 5$. (05 Marks)

- 4
 - a. Show that for every additional bit in an uniform quantizer there will be an increase of 6 dB in SNR. (06 Marks)
 - b. List the steps of LBG algorithm when a training set is available. (06 Marks)
 - c. Draw the State and Trellies diagram for the selection process with binary tables for the state transitions. Derive the distance achieved for a sequence of values 0.2, 1.6 and 2.3 using trellies TCQ algorithm. (08 Marks)

- 5
 - a. Explain the procedures for KLT and DCT transforms and discuss their advantages and disadvantages. (08 Marks)
 - b. Explain the concept of differential encoding algorithm with an example. (06 Marks)
 - c. Explain the procedure of quantization and coding of transform coefficients. (06 Marks)

- 6
 - a. Briefly explain the procedure for JPEG image compression and reconstruction with an example. (07 Marks)
 - b. Describe the basic subband coding algorithm with a neat diagram and design of filter bank for a sequence (x_0, x_1, x_2, \dots) (07 Marks)
 - c. Explain the polyphase decomposition techniques. (06 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

- 7 a. Explain the concepts of predictive coding in DPCM and derive an expression for calculating predictive coefficients and autocorrelation value. (08 Marks)
- b. Explain the difference between forward and backward adaptive quantization in DPCM. (08 Marks)
- c. Describe the motion compression technique in the context of video compression. (04 Marks)

- 8 a. For a seven level decomposition shown below, obtain a bit stream for E2W encoder.

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

- (08 Marks)
- b. Explain the significance of wavelet coding techniques. Briefly explain how the wavelets are generated. (06 Marks)
- c. Write notes on (any one) of the following:
- MPEG – 4
 - CELP
 - G.722 standard
 - CALIC
 - Fractals compression
- (06 Marks)

* * * * *