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10CS/IS663

Sixth Semester B.E. Degree Examination, June/July 2013
Data Compression

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions, selecting at least TWO questions from each part.***

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.

PART – A

1 a. Write a note on compression techniques and how compression algorithm can be evaluated. **(04 Marks)**

b. Calculate the entropy for a binary image.
$P(S_w) = 15/31$, $P(S_b) = 16/31$, P(W/W) = 0.8, P(b/b) = 0.7. **(06 Marks)**

c. Determine whether the following codes are uniquely decodable:
i) {0, 01, 110, 111}; ii) {0, 01, 11, 111}. Give the procedure. **(04 Marks)**

d. A source emits letters from an alphabet A = $\{a_1, a_2, a_3, a_4\}$ with probabilities $P(a_1) = 0.13$, $P(a_2) = 0.07$, $P(a_3) = 0.5$ and $P(a_4) = 0.3$.
i) Calculate entropy of the source.
ii) Find the minimum variance Huffman code.
iii) Find the average length of Huffman code and its redundancy. **(06 Marks)**

2 a. A sequence is encoded using the LZ77 algorithm. Given that c(a) = 1, c(b) = 2, c(r) = 3 and c(t) = 4. Decode the following sequence of triples.
⟨0, 0, 3⟩ ⟨0, 0, 1⟩ ⟨0, 0, 4⟩ ⟨2, 8, 2⟩ ⟨3, 1, 2⟩ ⟨0, 0, 3⟩ ⟨6, 4, 4⟩ ⟨9, 5, 4⟩. Assume that the size of the window is 21 and the size of the look-ahead buffer is 10. **(08 Marks)**

b. Given the following primed dictionary and the received sequence below, build on LZW dictionary and decode the transmitted sequence. **(06 Marks)**

Received sequence : 1 2 3 4 2 5 6 2 1 7 9 11 7 10 12 14
Initial dictionary : Index – 1 2 3 4 5 6
Entry – T O B E R N

c. Give the algorithm used by CALIC to form the initial prediction and explain this algorithm. **(06 Marks)**

3 a. Explain the term distortion in Lossy coding. Discuss the different ways to measure distortion. **(08 Marks)**

b. What is quantization? Explain the quantization problem with an example. **(06 Marks)**

c. Explain the uniform quantization with fixed length code words and show that SNR of a uniform quantizer of a uniform distributed source is 6.02 ndB. **(06 Marks)**

4 a. With a neat block diagram, explain vector quantization procedure. **(06 Marks)**

b. Give Lloyd algorithm to generate the pdf – optimized scalar quantizer assuming that the distribution is known. Show how this algorithm can be generalized to the case where a training set is available. **(10 Marks)**

c. Explain the drawbacks of delta modulation with a sketch. **(04 Marks)**

PART – B

5 a. Explain the two properties of the linear system. **(04 Marks)**

b. Find the inverse Z-transform of $F(z) = \frac{2z^4 + 1}{2z^3 - 5z^2 + 4z - 1}$. **(08 Marks)**

c. Explain quantization and coding of transform coefficients. **(08 Marks)**

6 a. Explain basic subband coding algorithm with block diagram. **(10 Marks)**

b. Explain MPEG-2 AAC encoder with a neat block diagram. **(10 Marks)**

7 a. Explain multi resolution analysis and the scaling functions. **(10 Marks)**

b. For the seven-level decomposition shown below:

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

Find the bit stream generated by the EZW coder. **(10 Marks)**

8 a. Briefly explain ITU-T recommendation H.261 encoder with a block diagram. **(06 Marks)**

b. Briefly explain video signal representation. **(06 Marks)**

c. Briefly explain motion compensation. Consider the following 4 × 4 image

$$\begin{bmatrix} 110 & 218 & 116 & 112 \\ 108 & 210 & 110 & 114 \\ 110 & 218 & 210 & 112 \\ 112 & 108 & 110 & 116 \end{bmatrix}$$

Apply loop filter of H.261 coding algorithm. **(08 Marks)**

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