B. TECH.

EIGHTH SEMESTER EXAMINATION, 2003-2004

DATA COMPRESSION

Time : 3 Hours   _Total Marks : 100_

Note : (i) Attempt **ALL** questions.
(ii) All questions carry equal marks.

1.   Attempt any _FOUR_ of the following :—   **(5×4)**

(a)   What do you understand by Compression Ratio ? What is the need for it ?

(b)   Give two examples of different areas where lossless compression technique is necessary for data compression. Explain the reason, why.

(c)   Give two applications where lossy compression can be used for data compression. Comment upon the tolerance limit factor.

(d)   Explain the terms, Fidelity and Quality in reference to the difference between the Reconstruction and Original data.

(e)   Explain redundancy that exists in the data and state how it is related with the model.

(f)   Comment upon the statement —

"Compression is still largely an art and to gain proficiency in an art, you need to get it a feel for the process."

2. Attempt any FOUR of the following :— (5×4)

(a) Explain 'Self-information' defined by Shannon.

(b) How are probability models useful in data compression ?

(c) What is Zero-frequency model in Markov models in text compression ?

(d) Consider source alphabet $A = \{a_1, a_2, a_3, a_4\}$ with probabilities $P(a_1) = \dfrac{1}{2}$, $P(a_2) = \dfrac{1}{4}$, $P(a_3) = P(a_4) = \dfrac{1}{8}$.

The entropy for this source is 1·75 bits / symbol. Consider the codes for this source as follows :—

Letters	Probability	Code 1	Code 2	Code 3	Code 4
a_1	0·5	0	0	0	0
a_2	0·25	0	1	10	01
a_3	0·125	1	00	110	011
a_4	0·125	10	11	111	0111
Average length		1·125	1·25	1·75	1·875

Explain which code is the best and why.

(e) Explain minimum variance Huffman coding and encoding procedures with the help of examples.

(f) Explain in brief :
  (i) Optimality of Huffman code
  (ii) Length of Huffman code

3. Attempt any FOUR of the following :— (5×4)

(a) Explain Extended Huffman code with the help of example. Describe where it is useful.

(b) Explain the concept of Adaptive Huffman coding.

(c) Explain Golomb code with the help of example.

(d) Explain Tunstall code with the help of example.

(e) How is lossless Image Compression achieved ?

(f) How is Audio Compression done ?

4. Attempt any TWO of the following :— (10×2)

(a) How is Binary code generated ? What do you understand by uniqueness and efficiency of the Arithmetic code ? What are the steps for algorithm implementation of the arithmetic code ?

(b) Describe at least two applications, in detail of the arithmetic coding for each lossless and lossy compression.

(c) Discuss the role of Dictionary Techniques. Explain the concept of —

(i) Static Dictionary

(ii) Adaptive Dictionary and Building Approach of LZ 77 (or LZ 1) & LZ 78 (or LZ 2).

5. Attempt any *TWO* of the following :— (10×2)

   (a) What do you understand by Predictive coding ? Discuss multi-resolution approaches.

   (b) (i) What are the steps for Facsimile encoding ?

       (ii) Discuss the concept of Runlength coding.

   (c) (i) Explain Additive Noise model of a quantizer.

       (ii) Discuss the role of Quantization in image compression.

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