

- (e) Determine whether the code {0,01, 11} is uniquely decodable or not.
- (f) What is the difference between a fixed length code and a variable length code. In variable length code, define the term rate of the code.

2 Attempt any **four** parts of the following : **5×4=20**

- (a) A source emits letters from an alphabet $A = \{a_1, a_2, a_3, a_4, a_5\}$ with $P(a_1) = P(a_2) = 0.4$, $P(a_4) = P(a_5) = 0.1$. Find the Huffman code of the source.
- (b) How a minimum variance Huffman code is different from its corresponding Huffman code? Explain with the help of an example.
- (c) Prove that the average codeword length \bar{l} of an optimal code for a source S is greater than or equal to entropy $H(S)$.
- (d) Let Huffman code of a source S with three letters $\{a_1, a_2, a_3\}$ is $\{0,11,10\}$ respectively. Find the extended Huffman code of the same source taking two letters at a time. Compare the average code word length in both cases.
- (e) Explain the update procedure of adaptive Huffman coding algorithm with the help of a flow chart.
- (f) Write down the application of Huffman coding in text compression and audio compression.

3 Attempt any **four** parts of the following : **5×4=20**

- (a) Given a number a in the interval $[0,1]$ with an n -bit binary representation $(b_1 b_2 \dots b_n)$, show that for any other no. b to have a binary representation with $(b_1 b_2 \dots b_n)$ as the prefix b has to lie in the interval $(a, a + \frac{1}{2^n})$.

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- (b) Consider a three letter alphabet $A = \{a_1, a_2, a_3\}$ with $P(a_1) = 0.7$, $P(a_2) = 0.1$ and $P(a_3) = 0.2$. Using arithmetic coding, generate a code for the sequence $a_1 a_2 a_3$.
- (c) Explain the JBIG standard of Bi-level image compression. How arithmetic coding is applicable to it?
- (d) What do you mean by diagram coding? Given the following dictionary, encode the sequence abracadabra :

<i>Code</i>	<i>Entry</i>
000	a
001	b
010	c
011	d
100	r
101	ab
110	ac
111	ad

- (e) Give the LZ77 approach for adaptive dictionary based encoding.
- (f) What is Graphics Interchange Format (GIF) and where is it used?

4 Attempt any **two** parts of the following : **10×2=20**

- (a) What is lossy data encoding? Write down the distortion measure criterias to check the fidelity of a reconstructed source sequence to the original one in such type of encoding techniques.
- (b) What is QUANTIZATION? Describe the quantization problem with the help of an example in detail.

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- (c) How adaptive quantization is different from uniform quantization? Explain the two approaches forward adaptive approach and backward adaptive approach for adapting the quantizer parameters.

5 Attempt any **two** parts of the following : **10×2=20**

- (a) What is vector quantization? How is it different from scalar quantization? Write down some of the advantages of vector quantization over scalar quantization.
- (b) What do you mean by codebook of a quantizer? What problems can be there when designing a codebook for a higher dimensional quantizer? How Linde-Buzo-Gray algorithm is helpful here?
- (c) How the computational complexity of the code book design process in vector quantization is reduced by imposing a tree structure over it? What is the role of pruning in such type of vector quantization?
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