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Question Paper Code: 45406

B.E. / B.Tech. DEGREE EXAMINATION, MAY 2022

Fifth Semester

Electronics and Communication Engineering

14UEC506 - INFORMATION THEORY AND CODING

(Regulation 2014)

Duration: Three hours

Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. What is the maximum bit rate for a channel having bandwidth 4100Hz and SNR 10 dB using Shannon's theorem?
 - (a) 10000 bits/sec
 - (b) 41000 bits/sec
 - (c) 14183.67 bits/sec
 - (d) 1418.367 bits/sec
2. In a discrete memory less channel the output of channel decoder depends on
 - (a) Present signal
 - (b) future input signal
 - (c) past signal
 - (d) present and past signal
3. Lempel Ziv algorithm belongs to which type of compression algorithm?
 - (a) Arithmetic coding
 - (b) Dictionary based
 - (c) static coding
 - (d) Huffman coding
4. The bit allocation information mode that is used by the decoder to dequantize the set of sub band samples in a Dolby AC-1 is known as
 - (a) Forward adaptive bit allocation
 - (b) Backward adaptive bit allocation
 - (c) hybrid adaptive bit allocation
 - (d) none of the above

5. The compression ratio achieved by JPEG2000 without loss of quality is
 (a) 2000:1 (b) 200:1 (c) 20:1 (d) 2:1
6. The compression ratio achieved by MPEG-1 standard is
 (a) 4000:1 (b) 400:1 (c) 40:1 (d) 4:1
7. If the degree of the generator polynomial is 3 and the length of the message is 4 then the total number of bits in the cyclic coded sequence is
 (a) 4 (b) 3 (c) 7 (d) 11
8. If the parity check matrix is H and the error vector is E then syndrome vector S can be calculated by
 (a) $S=HE^H$ (b) EH^T (c) $E^T H^T$ (d) $(EH)^T$
9. While representing the convolutional code by (n, k, m), what does 'm' signify or represent in it?
 (a) memory order (b) message bits (c) coded bits (d) all the above
10. In Viterbi's algorithm, the selected paths are regarded as
 (a) survivors (b) defenders (c) destroyers (d) carriers

PART - B (5 x 2 = 10 Marks)

11. What is meant by discrete memoryless channel?
12. Define on perceptual coding.
13. Draw the block diagram of MPEG DASH standard.
14. Write about cyclic codes for error correction.
15. What is sequential decoding algorithm?

PART - C (5 x 16 = 80 Marks)

16. (a) Show that the Huffman coding is not unique by considering 7 possible symbols with corresponding probabilities $P(x_1)=0.46$, $P(x_2)=0.3$, $p(x_3)=0.12$, $P(x_4)=0.06$, $P(x_5)= 0.03$, $P(x_6)= 0.02$, $P(x_7)=0.01$. Use an alternate way of Huffman coding and discuss about the entropy and average number of binary digits per symbol. (16)

Or

- (b) Consider a source with source symbol set $S = \{S_1, S_2, S_3, S_4\}$ with probabilities $P = \{0.2, 0.3, 0.4, 0.1\}$. Obtain the entropy of the source. Prove that $H(S^2) = 2XH(S)$. (16)

17. (a) Explain with a block diagram model of speech synthesis. (16)

Or

- (b) Discuss on linear predictive coding with an example. (16)

18. (a) With neat sketches and necessary mathematical expressions, explain the JPEG encoder. (16)

Or

- (b) What is TIFF? Draw and explain the TIFF audio encoder and decoder. (16)

19. (a) The generator matrix for a (6, 3) block code is given below. Find all code vectors of this code.

(i) Find the parity matrix

(ii) Find equation for check bits

(iii) Determine check bits and code vectors for every message vector.

$$G = \left[\begin{array}{ccc|ccc} 1 & 0 & 0 & 0 & 1 & 1 \\ 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & 1 & 1 & 0 \end{array} \right]. \quad (16)$$

Or

- (b) Construct a systematic (7, 4) cyclic code using the generator polynomial $g(x) = x^3 + x + 1$. What are the error correcting capabilities of this code? Construct the decoding table and determine the transmitted data word for the received code word 1101100. (16)

20. (a) With an example draw the state diagram of trellis in convolutional code. (16)

Or

- (b) Draw the diagram of the $\frac{1}{2}$ rate convolutional encoder with generator polynomials $g^{(1)}(D) = 1+D$ and $g^{(2)}(D) = 1+D+D^2$. Also compute the encoder output for input sequence 101101. Obtain the code tree, code trellis and state diagram. (16)

