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Question Paper Code : 31511

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2013.

Fifth Semester

Information Technology

IT 2302/IT 52 — INFORMATION THEORY AND CODING

(Regulation 2008)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What is Shannon limit?

2. State the channel coding theorem.

3. Compare LZ and LZW coding.

4. What is meant by frequency and temporal masking?

5. State the main difference between MPEG video compression algorithms and H.261.

6. What is TIFF?

7. Give example for repetition code.

8. Enumerate the properties of a syndrome.

9. Define constraint length of a convolutional code.

10. What is the significance of Turbo coding?

PART B — (5 × 16 = 80 marks)

11. (a) (i) State and brief channel capacity theorem. (4)

(ii) In the message, each letter occurs the following percentage of times : (12)

Letter :	A	B	C	D	E	F
% of occurrence :	23	20	11	9	15	22

(1) Calculate the entropy of this alphabet of symbols.

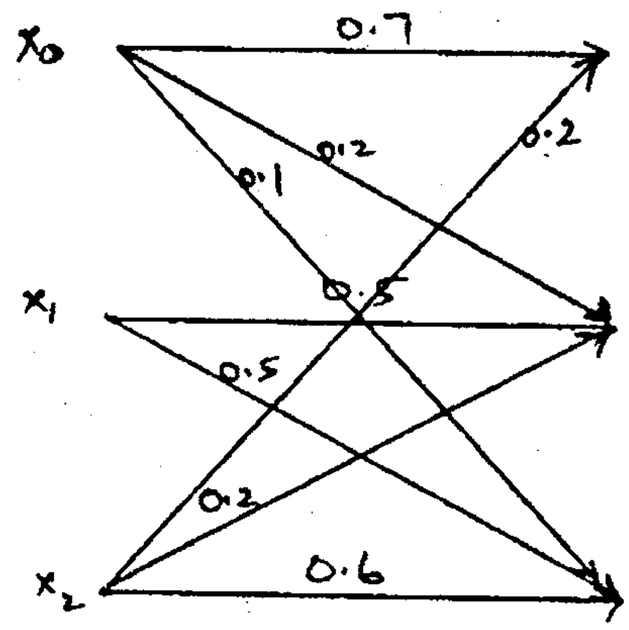
(2) Devise a codebook using Huffman technique and find the average codeword length.

(3) Devise a codebook using Shannon-Fano technique and find the average codeword length.

(4) Compare and comment on the results of both techniques.

Or

(b) A discrete source emits messages x_0, x_1, x_2 with probabilities 0.6, 0.2 and 0.2. The source is connected to the receiver as shown below : (16)



Determine the different entropies, mutual information and channel capacity.

12. (a) (i) Explain adaptive Huffman coding for the message "Malayalam". (8)

(ii) Encode the message "NEWS" using arithmetic coding algorithm with the following probabilities of occurrences of each symbol. (8)

Symbol :	E	W	S	N
Probability of occurrence :	0.3	0.3	0.2	0.2

Or

(b) (i) With neat illustrations, explain the various versions of Dolby ACs stating its merits and demerits. (8)

(ii) With neat illustrations, explain Linear Predictive Coding. (8)

13. (a) (i) How do you encode and decode a P-frame and B-frame? (10)

(ii) Explain the entropy encoding block of JPEG standard. (6)

Or

(b) (i) Write short notes on H.261 video compression standard. (8)

(ii) With neat illustrations, explain graphical interchange format. (8)

14. (a) (i) Consider a (7, 4) cyclic code whose generator polynomial is $g(x)=1+x^2+x^3$. (12)

(1) Encode the message (1001) using encoder and algorithm.

(2) Decode the received word if error has occurred at middle bit using both syndrome calculator circuit and algorithm.

(ii) Let $c_1=\{1101001\}$ and $c_2=\{1100100\}$. Calculate $w(c_1), w(c_2)$ and $w(c_1+c_2)$ for two arbitrary binary vectors c_1 and c_2 of same length. $w(c_1+c_2)=w(c_1)+w(c_2)-?$ (4)

Or

(b) (i) Consider a (7, 4) linear block code with parity check matrix given by, (12)

$$H=\begin{bmatrix}1&0&1&1&1&0&0\\1&1&0&1&0&1&0\\0&1&1&1&0&0&1\end{bmatrix}.$$

(1) Generate the codebook.

(2) Show that this code is a Hamming code.

(3) Illustrate the relation between the minimum distance and structure of the parity check matrix by considering the codeword 0101100.

(ii) Show that the minimum hamming distance d_{min} between two code words of a binary linear block code is equal to the hamming weight of the codeword with the smallest number of 1s. excluding all-0 codeword for the codebook C = {0000, 1010, 0101,1111). (4)

15. (a) (i) Consider the rate $r = 1/2$, constraint length K = 4 convolutional encoder. The encoder outputs are represented as v_1 = XOR (s_1, s_3) and v_2 = XOR (s_1, s_2, s_3). Determine the encoder output produced by the message sequence 10100 using state diagram, tree diagram and trellis diagram. (12)

(ii) Explain how do you determine d_{free} using Trellis diagram. (4)

Or

(b) (i) Explain the Viterbi decoding algorithm. (6 + 10)

(ii) Determine the decoded data bits by applying Viterbi decoding algorithm, if r = 1100000111 rest all 0.

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