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BIEL-023

B.Tech. – VIEP – ELECTRONICS AND COMMUNICATION ENGINEERING (BTECVI)

00363

Term-End Examination

December, 2018

BIEL-023 : INFORMATION THEORY AND CODING

Time : 3 hours *Maximum Marks : 70*

Note : *Attempt any **seven** questions. All questions carry equal marks. Use of scientific calculator is permitted. Any missing data may be suitably assumed.*

1. State the Shannon Coding Theorem. Also derive the theorem. *3+7*

2. A source emits four possible symbols with probabilities of $\frac{1}{8}$, $\frac{1}{8}$, $\frac{1}{4}$ and $\frac{1}{2}$ respectively.

(a) Find H (Entropy). *5*

(b) Find information rate if the source emits one symbol/ms. *5*

3. Explain Kraft's inequality and McMillan's inequality. For 2-ary tree with $l_1 = 1$; $l_2 = 2$ and $l_3 = 2$, check whether Kraft's inequality is satisfied or not ? *5+5*

4. A source emits 6 possible symbols with probability of 0·3, 0·25, 0·2, 0·12, 0·08, 0·05. Construct the Shannon-Fano coding and also find the coding efficiency. *10*

5. A source emits 6 possible symbols with probabilities of 0·3, 0·25, 0·2, 0·12, 0·08, 0·05. Construct the Huffmann coding for the above transmitter. Also find the efficiency. *10*

6. Two binary systems are connected in cascade as shown in Figure 1 below : *4+4+2*

   (a) Find overall channel matrix and plot corresponding channel diagram.

   (b) Find $p(z_1)$ and $p(z_2)$, given that $p(x_1) = p(x_2) = 0{\cdot}5$.

   (c) Find H(Y) + H(Z).

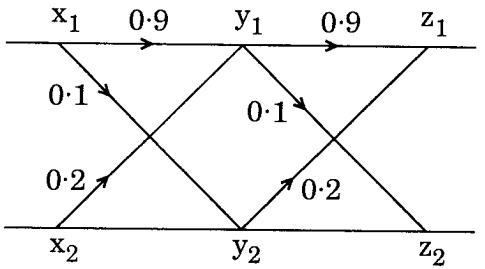

Figure 1

7. For a binary symmetric system as shown in Figure 2. *5+5*

(a) Show that $I(X; Y) = H(Y) + p \log_2 p + (1 - p) \log_2 (1 - p)$

(b) Find channel capacity

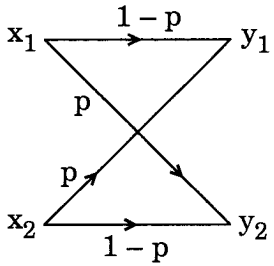

Figure 2

8. (a) For AWGN channel having bandwidth of 4 kHz corresponding S/N is given by 15 dB. Find channel capacity. *5*

(b) For AWGN channel having bandwidth of 4 kHz corresponding two-sided white noise PSD is 10^{-12} watts/Hz.

Find channel capacity required to get a signal power of 0·1 mwatts at channel output. *5*

9. For a (6, 3) Linear Block Codes (LBC), parity check bits are given as : *5+5*

$$c_4 = d_1 \oplus d_3$$

$$c_5 = d_1 \oplus d_2 \oplus d_3$$

$$c_6 = d_1 \oplus d_2$$

(i) Find Generator matrix.

(ii) Find all possible codewords.

10. For given generator matrix and parity bits matrix : *5+5*

$$G = \begin{bmatrix} 1 & 0 & 0 & 1 & 1 & 1 \\ 0 & 1 & 0 & 0 & 1 & 1 \\ 0 & 0 & 1 & 1 & 1 & 0 \end{bmatrix}_{k \times n} \qquad P = \begin{bmatrix} 1 & 0 & 1 \\ 1 & 1 & 1 \\ 1 & 1 & 0 \end{bmatrix}_{n-k \times k}$$

(a) Find parity check matrix (H).

(b) Decode the received codeword (010101) by Syndrome decoding.