

(Following Paper ID and Roll No. to be filled in your
Answer Books)

Paper ID : 131408

Roll No.

B.TECH.

Theory Examination (Semester-IV) 2015-16

INFORMATION THEORY AND CODING

Time : 3 Hours

Max. Mar : 100

Note: Attempt questions from all Sections as per directions.

Section-A

Q1. Attempt all parts of this section. Answer in brief.
(2×10=20)

- (a) Derive the relation between conditional and joint entropies.
- (b) What is DMC? Explain its significance.
- (c) Give difference between digital audio and audio compression.
- (d) Briefly explain Run Length Encoding (RLE). State its examples.
- (e) Compare and contrast Huffman coding and arithmetic coding.

- (f) If C is a valid code vector, then prove that $CH^T = 0$ where H^T is transpose of parity check matrix H .
- (g) Explain in brief the Golay code.
- (h) State the limitations of sequential decoding.
- (i) What is ARQ? State its types.
- (j) Differentiate among Code rate, Constraint length and Code dimension.

Section-B

Attempt any five questions from this section. (10×5=50)

- Q2. Prove that the upper bound on the value of entropy H of a source is $\log_2 M$, where M is the number of symbols.
- Q3. For a discrete memory less source there are three symbols with probabilities $p_1 = \alpha$ and $p_2 = p_3$. Determine the entropy of the source and sketch its variation for different values of α .
- Q4. Define and explain the term information rate. State the relation between information rate and entropy.
- Q5. Design a syndrome calculator for a (7, 4) cyclic Hamming code generated by the polynomial $G(p) = p^3 + p + 1$. Calculate the syndrome for $Y = (1\ 0\ 0\ 1\ 1\ 0\ 1)$.
- Q6. State and explain source coding theorem. What is coding efficiency?

Q7. A channel has the following channel matrix.?

$$[P (Y/X)] = \begin{pmatrix} 1-p & p & 0 \\ 0 & p & 1-p \end{pmatrix}$$

- (i) Draw the channel diagram.
- (ii) If the source has equally like outputs. Compute the probabilities associated with the channel output for $p=0.2$.

Q8. Determine For the given code shown in figure 1 obtain the convolution code for the bit sequence 1 1 0 1 1 0 1 1 and decode it by constructing the corresponding code tree.

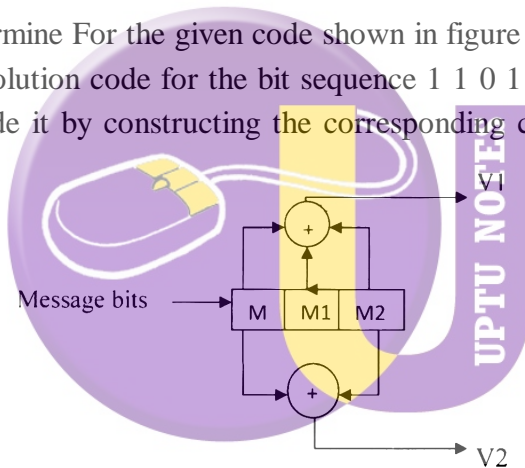


Fig.1

Q9. Explain VRC and LRC techniques. Define minimum distance dmm and explain its role in detecting and correcting errors.

Section-C

Attempt any two questions from this section. (15×2=30)

Q10. With the following symbol and their probability of occurrence, encode the message "wentff" using arithmetic coding algorithms.

Symbol	e	n	w	t	'#'
Probability	0.3	0.3	0.1	0.1	0.1

Fig-3

Q11. For the joint probability matrix (JPM) shown below, $H(X,Y)$, $H(X)$, $H(Y)$, $H(X/Y)$ and $H(Y/X)$

$$\begin{pmatrix} 0.2 & 0 & 0.2 & 0 \\ 0.1 & 0.01 & 0.01 & 0.01 \\ 0 & 0.02 & 0.02 & 0 \\ 0.04 & 0.04 & 0.01 & 0.06 \\ 0 & 0.06 & 0.02 & 0.2 \end{pmatrix}$$

Q12. How do you obtain the generator polynomial for the cyclic code? Check if the following codes are cyclic or not

$$\text{Code X,} = \{0000, 0101, 1010, 1111\}$$

$$\text{Code X:=} \{0000, 0110, 1001, 1111\}$$