

5E1751

Roll No. _____

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B.Tech. V-Sem. (Main) Examination, January/February - 2024
Computer Sc. and Engg. (IOT)
5CIT3-01 Information Theory and Coding
CS, CCS, CIT

Time : 3 Hours**Maximum Marks : 70****Instructions to Candidates:**

Attempt all Ten questions from Part A, Five questions out of Seven questions from Part B and Three questions out of Five questions from Part C.

Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.

Use of following supporting material is permitted during examination. (Mentioned in form No.205)

PART-A

(Answer should be given up to 25 words only).

All questions are compulsory.

(10×2=20)

1. Prove the following statement "The sun rises in the east" contains zero amount of information.
2. Show that if there are 'n' number of equally likely message then entropy of the source is $\log_2 n$.
3. Define Kraft inequality.
4. Explain prefix code with example.
5. Differentiate between random error and burst error.
6. Classify the types of linear block code.
7. Explain 2 properties of Galois field.
8. Discuss cyclic codes and its generation.
9. Compare convolution code over other coding methods.
10. Describe the differences between state diagram and trellis diagram of convolution code.

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PART - B

(Analytical/Problem solving questions)

(5×4=20)

Attempt any Five questions.

1. The probabilities of five possible outcomes of an experiment are given as $P(x_1) = 1/2, P(x_2) = 1/4, P(x_3) = 1/8, P(x_4) = P(x_5) = 1/16$. Determine the entropy and information rate if there are 16 outcomes per second.
2. Show that for a discrete binding channel
 $H(X, Y) = H(X/Y) + H(Y)$
 $H(X, Y) = H(X) + H(Y)$
3. A discrete memoryless source emits four messages with probability set $[1/2, 1/4, 1/8, 1/8]$. Constructs a Shannon-fano code for this message and also find the efficiency.
4. A voice grade channel of telephone network has a bandwidth of 3.4 KHz. Calculate the information capacity of telephone channel for signal to noise ratio of 30 dB.
5. Illustrate the concept of systematic and non-systematic code.
6. The following polynomials $f(x)$ and $g(x)$ are defined over GF(3).
$$f(x) = 2 + x + x^2 + 2x^4$$
$$g(x) = 1 + 2x^2 + 2x^4 + x^5$$

Calculate addition and multiplication of above 2 polynomials.
7. Describe viterbi algorithm in detail.

PART - C

(Descriptive/Analytical/Problem Solving/Design question)

Attempt any Three questions.

(3×10=30)

1. a) Discuss the concept of joint entropy and mutual information. (5)
b) Explain different types of channels with their channel matrix (5)
2. Construct Huffman's code for following set of messages. Also find the efficiency
 $P(x_1) = 0.49, P(x_2) = 0.14, P(x_3) = 0.14, P(x_4) = 0.07, P(x_5) = 0.07,$
 $P(x_6) = 0.04, P(x_7) = 0.02, P(x_8) = 0.02, P(x_9) = 0.01$ (10)

3. Consider a (7,4) linear blockcode with the parity-check matrix H given by

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

a) Construct code words for this (7, 4) code (5)

b) Show that this code is a Hamming code (5)

4. The generator Polynomial of a (6, 3) cyclic code is $g(x) = 1 + x^2$.

a) Find all the code words for this code (6)

b) How many errors can this code correct (4)

5. Write a short note on

a) Sequential decoding (5)

b) Transfer function of convolutional code (5)
