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No. of Printed Pages—5

CS-405

B. TECH.

**FOURTH SEMESTER EXAMINATION, 2003–2004
FUNDAMENTAL OF COMPUTER
COMMUNICATION SYSTEM**

Time : 2 Hours

Total Marks : 50

1. Attempt any FOUR parts of the following :— (3.5×4=14)

(a) A discrete source emits one of five symbols once every millisecond. The symbol

probabilities are $\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{8}$, $\frac{1}{16}$, $\frac{1}{16}$

respectively. Find the source entropy and information rate.

(b) Describe Shannon's Encoding Algorithm and its properties.

(c) A binary source is emitting symbols in independent sequences. Show that the source entropy is maximum when the symbols occur with equal probabilities.

(d) A binary source is emitting an independent sequence of 0's and 1's with probabilities p and $1-p$ respectively. Plot the entropy of this source versus p . ($0 < p < 1$)

(e) A non-symmetric binary channel is shown in fig-1 :—

Find $H(X)$, $H(Y)$, $H(X/Y)$ and $H(Y/X)$, when $P(X=0) = \frac{1}{4}$, $P(X=1) = \frac{3}{4}$,

$\alpha = 0.75$ and $\beta = 0.9$.

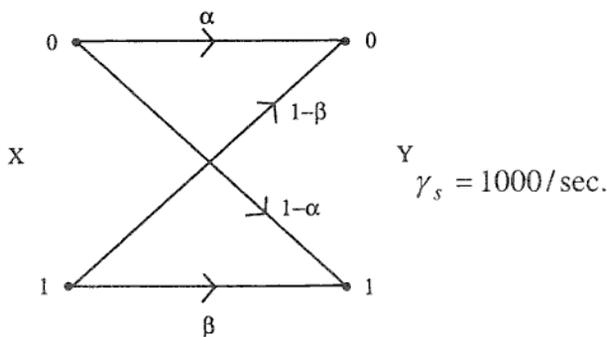


Fig. 1

(f) Show that

$$\begin{aligned} H(X, Y) &= H(X) + H(Y/X) \\ &= H(Y) + H(X/Y) \end{aligned}$$

2. Attempt any FOUR parts of the following :— (3×4=12)

(a) Calculate the capacity of the discrete channel shown in figure-2. Assume $\gamma_s = 1$ symbol/sec.

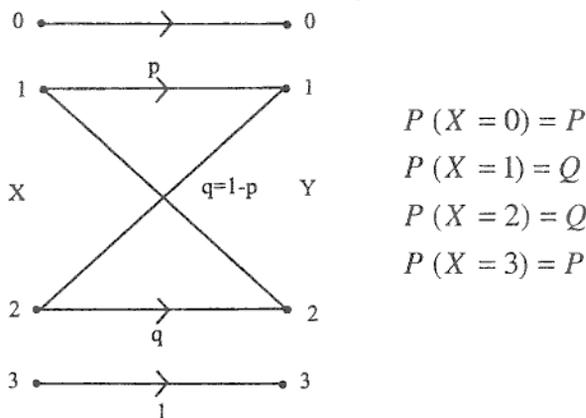


Fig. 2

(b) A Discrete channel accepts as its input a binary sequence with a bit rate of γ_b bits/sec. The channel signals are selected from a set of eight possible waveforms, each having a duration $3/\gamma_b$ sec. Thus, each waveform

may convey up to three bits of information. The channel noise is such that when the received waveform is decoded, each block of three input bits is received with no errors, or with exactly one error in the first, second or third bit position. Assuming that these four outcomes are equally likely to occur, find the capacity of the discrete channel.

- (c) Describe Shannon-Hartley Theorem and its implications.
 - (d) Calculate the capacity of Gaussian channel with B.W. 1 MHz and S/N of 30 dB. How long will it take to transmit one million ASCII characters over the channel ? (In ASCII code, each character is coded as an 8-bit binary word; ignore start and stop bits.)
 - (e) Describe the frequency spectrum of A.M. wave with the help of wave-diagram in frequency-domain and mathematical expression.
 - (f) Calculate the total power in A.M. wave and show that maximum power in A.M. signal at $m = 1$ is 1.5 times of P_c , where P_c is the power of carrier wave.
3. Attempt any TWO parts of the following :— (6×2=12)
- (a) (i) In a FM, the modulating frequency and voltage are 800 Hz and 3 volts respectively. The deviation is 6.3 KHz. If the modulating voltage is increased to 4.5 volts, calculate the new frequency deviation.

If now the modulating voltage is raised to 7 volts while the modulating

frequency is reduced to 500 Hz, what is the frequency deviation ? Also find the m_f in each of the three cases.

- (ii) Compare between FM and PM systems with the help of mathematical expression and wave-diagram in time-domain.
- (b) (i) Describe "Sampling Theorem" with the help of suitable example. Also describe Delta Modulation.
- (ii) Discuss the types of Analog Pulse Modulation and advantages of PCM.
- (c) (i) Explain how SNR in dB is related to M-level quantized signal in PCM and what is the function of "companding".
- (ii) What do you understand by Duobinary Baseband PAM system ?

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4. Attempt any TWO parts of the following :— (6×2=12)

- (a) (i) Describe the three general methods in which synchronization can be obtained.
- (ii) A statistically independent sequence of equiprobable binary digits is transmitted over a channel having infinite bandwidth using the rectangular signalling waveform shown as below in fig-3 :

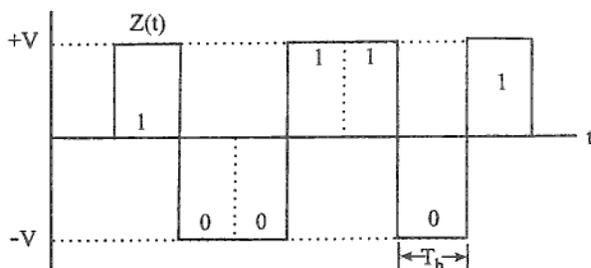


Fig. 3

The bit rate is γ_b and the channel noise is Gaussian with psd of $n/2$. Derive an expression for the probability of error.



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(b) (i) Prove, "The minimum distance of a Linear Block Code is equal to the minimum weight of any non-zero word in the code."

(ii) The Generator Polynomial of a (7, 4) cyclic code is $g(x) = 1 + x + x^3$. Find the 16 code words of this code by forming the code Polynomials using $V(x) = D(x)g(x)$, where $D(x)$ is Message Polynomial.

50

14)

(c) (i) What do you mean by Network Architecture ?

(ii) Why does ATM use small, fixed-length cells ?

(iii) Give an advantage and a disadvantage of frame relay over a leased telephone line.

(iv) Discuss :

(a) OSI Model

(b) Routers

