Bharati Vidyapeeth's College of Engineering for Women, Pune-43

Department of Electronics and Telecommunication Engineering

Subject: Information Theory and Coding Techniques

Unit Test I -- T.E(E &TC) Div II (Acad-Year : 2010-2011 Sem II)

Date: 12/03/2010

Duration: 1 hour **Max Marks: 25**

Instructions:

1. Assume Suitable data, wherever necessary.
2. All Questions are Compulsory.
3. Bold numbers to the right indicate maximum marks.

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Q.1

a) Define Self-Information of the event $X = x_i$.

b) Consider a source flipping a coin. How much information is contained in the message "the coin landed heads up"?

c) Consider a fast-food restaurant in which a customer is nine times as likely to order a hamburger than a fish sandwich. How much information is contained in the message "the customer wants a hamburger"? How much information is contained in the message "the customer wants a fish sandwich"?

d) Justify the statement "Lower probability implies higher degree of uncertainty and contains more information and vice versa"

(15)

Q.2

a) A weather information source transmits visibility information with the probabilities given as below:

Visibility	Probability
Very poor	1/4
Poor	1/8
Moderate	1/8
Good	1/2

Evaluate the entropy of a source. **(05)**

Q.3

Consider a fast food restaurant in which a customer is nine times as likely to order a hamburger than a fish sandwich. How much information is contained in the message, "the customer wants a hamburger"? How much information is contained in the message, "the customer wants a fish sandwich"? **(05)**

*******************Best of Luck*****************

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Subject: Information Theory and Coding Techniques

Unit Test II -- T.E(E &TC) Div II (Acad-Year : 2010-2011 Sem II)

Date: 01/04/2010

Duration: 1 hour **Max Marks: 25**

Instructions:

1. Assume Suitable data, wherever necessary.
2. All Questions are Compulsory.
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Q.1) Evaluate the efficiency, length and entropy of the source code containing the following symbols:

x_1 is encoded as 1
x_2 is encoded as 10
x_3 is encoded as 100
x_4 is encoded as 1000

Their probabilities of occurrence are given by:

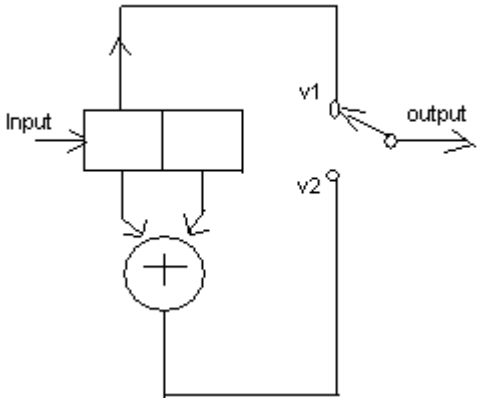
$P(x_1) = ¼$, $P(x_2) = 1/8$, $P(x_3) = 1/8$, $P(x_4) = ½$.

(10)

Q.2) State Kraft Inequality Theorem**.** ***(02)***

Q.3) Define Hamming Weight and Hamming Distance of a Linear Block Code**.** ***(03)***

Q.4) Consider the Convolutional Encoder shown below



a) Determine the output code word for input data d = (1 0 1)
b) Sketch state diagram
c) Sketch trellis diagram
d) Find the free distance of this convolutional code

(10)

**********BEST OF LUCK**********

BHARATI VIDYAPEETH'S COLLEGE OF ENGINEERING FOR WOMEN, PUNE-43
Department of Electronics and Telecommunication Engineering
UNIT TEST I – Information Theory and Coding Techniques
Time: 1 Hour **Class: T.E. I** **Max. Marks: 30**

Q.1 **[A]** State and prove Shannon's Information capacity theorem. Compare it with Shannon-Heartly Theorem. (8)

[B] Prove that the maximum channel capacity $C_\infty = 1.44\ P/N_0$ (7)

Q.2 **[A]** A analog signal having 4 MHZ band width is sampled at 1.25 times the Nyquist rate and each sample is quantized into 1 of 1024 equally likely levels . Assume that the successive sample are statically independent (8)

i) What is information rate of source

ii) Can the output of this source be transmitted without error over an AWGN channel with a bandwidth of 10 KHZ and S/N ratio of 20 dB

iii) Find the S/N ratio required for error free transmission for part (ii)

iv) Find the bandwidth required for an AWGN channel for error free transmission of output of this source if S/N ratio is 20 dB.

[B] Write short Note on : (7)

i) Entropy and its Properties

ii) Channel encoder

iii) BSC

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Department of Electronics and Telecommunication Engineering
UNIT TEST I – Information Theory and Coding Techniques
Time: 1 Hour **Class: T.E. I** **Max. Marks: 30**

Q.1 **[A]** Explain the sphere packing problem. (8)
[B] Explain Shannon Fano and Huffman Algorithm with suitable example. (7)

Q.2 **[A]** What is entropy? Show that the entropy is maximum , when all the messaging are equiprobable. Assume m=3. (6)
[B] Define the following with their significance and application in Digital Communication System. (5)
1) Noisefree channel
2) Kraft inequality
[C] Write a short note on : (4)
1) Data Compaction
2) Shannon Source Coding Theorem

BHARATI VIDYAPEETH'S COLLEGE OF ENGINEERING FOR WOMEN, PUNE-43
Department of Electronics and Telecommunication Engineering
UNIT TEST I – Information Theory and Coding Techniques
Time: 1 Hour 30 Min. **Class: T.E. I** **Max. Marks: 50**

Q.1 **[a]** Suggest a suitable polynomial for a (7, 4) systematic cyclic code and find code words for the following data words **(10)**

i) 1010
ii) 1111
iii) 0001
iv) 1000

[b] Explain FEC and ARQ in detail. **(8)**

Q.2 **[a]** Design a Linear Block Code with a minimum distance of three of a message block of size of 8 bits. **(10)**

[b] Write short notes on: **(8)**

i) Fire Codes
ii) GOLAY Codes

Q.3 **[a]** What are Unger Bock's TCM design rules? Explain Asymptotic coding gain? **(7)**

[b] Explain generator matrix and parity check matrix for (7,4) systematic code **(7)**

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UNIT TEST I – Information Theory and Coding Techniques
Time: 1 Hour 30 Min. **Class: T.E. I** **Max. Marks: 50**

Q.1 **[a]** For the rate ½ convolution encoder with constraint length 3 and algebraic function generators $g_1=111, g_2=101$. **(10)**

i) Decode the received sequence 10101101010111 using Viterbi Algorithm

ii) Find d_{free}

[b] Explain turbo code with the help of encoder and decoder .Explain the role of interleaver in the encoder. **(8)**

Q.2 **[a]** Construct a systematic (7,4) cyclic code using generator polynomial $g(x) = X^3 + X^2 + 1$ for the message 1010 **(10)**

[b] Explain with suitable example concept of "Burst error" and comment detection capabilities of CRC codes. **(8)**

Q.3 **[a]** Draw and explain block diagram of FEC and ARQ . Also state four comparisons between them. **(7)**

[b] Explain : **(7)**
(i)Distance bound
(ii)Performance bound
(iii) Code gain