



S J P N Trust's

Hirasugar Institute of Technology, Nidasoshi.

Inculcating Values, Promoting Prosperity

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E&C Engg. Dept.
Exam.
Internal Assessment
Odd Sem(2017-18)

FIRST INTERNAL ASSESSMENT

Sem : V
Date: 15/09/2017

Sub: Information Theory and Coding
Time: 3:00pm-4:30pm

Sub. Code: 15EC54
Max. Marks: 25

Note: Answer two full questions, draw sketches wherever necessary.

Q. No	Discription of Question	Marks	CO
1	a Define and list the properties of entropy of long independent sequences	4	CO304. 1
	b The output of an information source consists of 128 symbols, 16 of which occur with a probability of 0.25 and remaining occur with 0.75. The source emits 1000 symbols/sec, assuming that symbols are chosen independently. Find the entropy and average information rate of the source.	8	CO304. 1
OR			
2	a Define Markov source with state transition diagram.	4	CO304. 1
	b For the Markov source shown in Figure: (i) Compute the state probabilities (ii) Compute the entropy of each state, and (iii) Compute the entropy of source.	8	CO304. 1
3	a The international Morse code uses dashes and dots for the transmission of English alphabets. The dash is represented by a current pulse with duration three times the dots. The probability of occurrence of dash is 1/3 of the probability of dot. (i) Calculate the information content of dash and dot (ii) Calculate the average information in the dot and dash (iii) Assume that dot lasts 1msec which is same interval as the pause between symbols. Find the average rate of information.	8	CO304. 1
	b A binary source is emitting an independent sequence of 0s and 1s with probabilities 'p' and '1-p'. Plot the entropy of the source vs. probability. Show that entropy reaches maximum when all symbols are equi-probable.	5	CO304. 1
OR			
4	a Show that $1 \text{Nat} = 1.443 \text{ bits}$	7	CO304. 1
	b State and prove the external property of entropy	6	CO304. 1

M.H. Godegr
HOD



- IA SCHEME OF EVALUATION

Sem :		Subject : ITC	Sub Code : ECE54	Date : 15/9/18	
Q. No.	Bit	Description	Marks	Mapped CO's	
1	(a)	$H(S) = \sum_{i=1}^q p_i \log \frac{1}{p_i} = \sum_{i=1}^q p_i \log \frac{1}{p_i}$ <p>i) The entropy function is symmetric & continuous ii) The entropy function is symmetrical function of its arguments iii) External property: Lower bound = 0, upper bound $H(S)_{max} = \log 2$ iv) Additivity property: $S_q = S_{q1}, S_{q2}, S_{q3} \dots S_{qn}$ $P_q = P_{q1} + P_{q2} + \dots + P_{qn}$ (last symbol) $H'(S) \geq H(S)$ v) source efficiency $\eta_s = \frac{H(S)}{H(S)_{max}}$</p>	04	CO304.1	
	(b)	$16 \times 0.25 \log \frac{1}{0.25} + 112 \times 0.75 \log \frac{1}{0.75}$ $= 42.822 \text{ bits/symbol}$ $\therefore R_s = r_s \cdot H = 1000 \times 42.822 = 42.832 \text{ kb/s}$	08	CO304.1	
2	(a)	Any state diagram with probabilities is expected.	04	CO304.1	
	(b)	$P(A) = P(C) = 5/18 = 0.277$ $P(B) = P(D) = 2/9 = 0.22$ $H(A) = 0.971 \text{ bits/state}$ $H(B) = 1 \text{ bit/state}$ $H(C) = 0.971 \text{ } \& \text{ } H(D) = 1 \text{ bit/state}$ $\therefore H = \sum_{i=1}^n p_i H_i = 0.9839 \text{ bits/binary digit}$	08	CO304.1	



- IA SCHEME OF EVALUATION

Sem :		Subject : ITC	Sub Code : 15EC54	Date : 15/9/12																							
Q. No.	Bit	Description	Marks	Mapped CO's																							
03	(a)	$t_{dash} = 3 t_{dot}$ $P_{dash} = \frac{1}{3} P_{dot}$ Wkt $P_{dash} + P_{dot} = 1$ $\frac{1}{3} P_{dot} + P_{dot} = 1$ $\Rightarrow P_{dot} = \frac{3}{4}; P_{dash} = \frac{1}{4}$ $\frac{4}{3} P_{dot} = 1$ $\therefore I_{dot} = 0 \log \frac{3}{4} = 0.4150$ $t = 1 \text{ msec}$ $I_{dash} = \log \frac{1}{4} = 2$ $\therefore r_s = 1000 \text{ b/s}$ $H = 0.8112$ $R_s = 812$	08	CO3a, 1																							
	(b)	$H(S) = \sum_{i=1}^n P_i \log \frac{1}{P_i} = P \log \frac{1}{P} + (1-P) \log \frac{1}{1-P}$	05	CO3b, 1																							
<table border="1" style="width: 100%; text-align: center;"> <tr> <td>P</td> <td>0.1</td> <td>0.2</td> <td>0.3</td> <td>0.4</td> <td>0.5</td> <td>0.6</td> <td>0.7</td> <td>0.8</td> <td>0.9</td> <td>1.0</td> </tr> <tr> <td>H(S)</td> <td>0.469</td> <td>0.722</td> <td>0.918</td> <td>1.0</td> <td>1.0</td> <td>0.918</td> <td>0.722</td> <td>0.469</td> <td>0</td> <td>0</td> </tr> </table>						P	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	H(S)	0.469	0.722	0.918	1.0	1.0	0.918	0.722	0.469	0	0
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H(S)	0.469	0.722	0.918	1.0	1.0	0.918	0.722	0.469	0	0																	



- IA SCHEME OF EVALUATION

Sem :		Subject : ITC	Sub Code : 15 ECE 54	Date : 15/9/17	
Q. No.	Bit	Description	Marks	Mapped CO's	
4	(a)	Expected the profit of 1 nat = 1.443 bits	02	CO304.1	
	(b)	Lower and upper bounds of Entropy $H(S)_{\min} = 0$ $H(S)_{\max} = \log_2 q$ When $q \rightarrow$ no. of symbols When all symbols are equi probable	06	CO304.1	