BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(MID SEMESTER EXAMINATION MO/2023)

CLASS: BTECH **SEMESTER : VIIth**
BRANCH: CS **SESSION : MO/2023**

SUBJECT: CS429 INFORMATION & CODING THEORY

TIME: 02 Hours **FULL MARKS: 25**

INSTRUCTIONS:
1. The question paper contains 5 questions each of 5 marks and total 25 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
***4*. Tables/Data handbook/Graph paper etc., if applicable, will be supplied to the candidates**

			CO	BL
Q.1(a)	Given that a source generates three symbols S=<a, b, c> with probabilities P(a)=1/2, P(b)=1/4 and P(c)=1/4. Show that Entropy of the source is equivalent to the average number of questions with binary answers, required to know the outcome of the source.	[2]	1	2
Q.1(b)	Create the circuit diagram for a Linear Block code that uses the following Generator matrix. G= $\begin{matrix}1&0&0&1&1&0\\0&1&0&0&1&1\\0&0&1&1&0&1\end{matrix}$	[3]	2	3
Q.2(a)	Explain N^{th} extension of a source and how it is used to test for Unique Decodability of a code.	[2]	1	2
Q.2(b)	Perform decoding of Shannon Fano coded bit string 10000101011, given P(a)=0.3, P(b)= 0.1, P(c)=0.1, P(d)=0.1, P(e)=0.2 and P(f)=0.2 (use same ordering of symbols).	[3]	1	3
Q.3(a)	What do you infer from the inequality H(Y/X) ≤H(Y)? Explain.	[2]	1	1
Q.3(b)	Two events X = {Raining, Not raining} and, Y = {Cloudy, Not cloudy} occur with the following probabilities. Compute the entropy of cloudiness, given the knowledge of whether or not it is raining?	[3]	1	3
Q.4(a)	Determine the Hamming Bound for a (9,4) Linear Block Code that can correct 4 bits of error.	[2]	2	4
Q.4(b)	Let D(p||q) represent the Kullback Liebler distance between two distributions p and q. Prove that D(p||q)≠ D(q||p) with an example.	[3]	1	2
Q.5(a)	Create a Linear Block code in GF(2) from the subset: S= {000000, 010101, 110001}. Compute the Minimum Hamming weight and Minimum Hamming distance for the code.	[2]	2	4
Q.5(b)	Can the matrix G, given below be used as a generator matrix for (7,4) Linear Block code? If not, then make the necessary changes to it and then perform syndrome decoding to correct the received codeword r=1110011 $G=\begin{matrix}1&0&0&0&1&0&1\\0&1&0&0&1&1&1\\0&0&1&0&1&1&0\\0&0&0&1&0&1&1\end{matrix}$	[3]	2	3

	Cloudy	Not Cloudy
Raining	24/100	1/100
Not raining	25/100	50/100

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