

NOV—DEC 2023

(B. Tech) Program: (Artificial Intelligence and Data Science) AI-DS

Examination: TY Semester: V

Course Code: AIC504 and Course Name: Information Theory and Coding

Duration: 2.5 Hours

Max. Marks: 60

Instructions:

- (1) All questions are compulsory.
- (2) Draw neat diagrams wherever applicable.
- (3) Assume suitable data, if necessary.

Q 1	Solve any six questions out of eight:	Max. Marks	CO	BT level
		12		
i)	List properties of Information and Entropy	02	CO1	Remembering
ii)	Explain Extended Huffman code process	02	CO2	Understanding
iii)	Explain concept of dynamic dictionary	02	CO3	Understanding
iv)	Explain worst case situation of LZ77.	02	CO3	Understanding
v)	What are different steps involved in JPEG Compression process?	02	CO4	Understanding
vi)	Write short note on companding.	02	CO5	Understanding
vii)	Explain code tree representation of convolutional codes	02	CO6	Understanding
viii)	Explain properties of human auditory system	02	CO5	Understanding
<b>Q.2</b>	<b>Solve any four questions out of six.</b>	<b>16</b>		
i)	Calculate information rate if all 4 messages are equally likely. Nyquist Rate=2B Samples/message	04	CO1	Applying
ii)	For an alphabet $A=\{a_1, a_2, a_3, a_4\}$ with probabilities $P=\{0.5, 0.25, 0.125, 0.125\}$ . Find Shannon Fano Code, Determine average code word length, entropy, redundancy and efficiency of code.	04	CO2	Applying
iii)	Explain with example how RLE used for image compression.	04	CO3	Understanding
iv)	Explain different video compression methods.	04	CO4	Understanding
v)	Explain DPCM audio compression technique and What is the disadvantage of DPCM technique	04	CO5	Understanding
vi)	The generator polynomial of (7,4) cyclic code is $G(p)=p^3+p+1$ . Find all code vectors for the code in systematic and nonsystematic form	04	CO6	Applying
<b>Q.3</b>	<b>Solve any two questions out of three.</b>	<b>16</b>		
i)	For the convolution encoder with code rate 1/3 and $K=3$ generating vectors $g_1=(1\ 1\ 1)$ , $g_2=(1\ 0\ 1)$ , $g_3=(1\ 1\ 0)$ draw the encoder and find the code word for the input sequence 10101.	08	CO6	Applying

ii)	Consider the binary channel for which the input range and output range are in both cases equal to [0,1]. The corresponding transition probabilities matrix is in the case equal to  $P_{ch} = \begin{bmatrix} 3/4 & 1/4 \\ 1/8 & 7/8 \end{bmatrix}$ <p><math>P(x=0)=4/5</math> and <math>P(x=1)=1/5</math>. Calculate <math>P(y=0)</math> and <math>P(y=1)</math>, <math>P(x=0/y=0)</math>, <math>p(x=0/y=1)</math> and <math>p(x=1/y=1)</math></p>	08	CO1	Applying
iii)	Given as initial dictionary consisting letters {a,b,c,d,e,f} encode using LZW algorithm addaeabccdadeaeafccdeafccde. Also decode using the encoding sequence to get back the string.	08	CO3	Applying
<b>Q.4</b>	<b>Solve any two questions out of three.</b>	<b>16</b>		
i)	Explain different approaches to image compression. and Explain Discrete Cosign Transform used for image compression in details.	08	CO4	Understand
ii)	With $A=\{a,b,c,d\}$ and $P=\{0.35,0.25,0.3,0.1\}$ . Encode the message "dcbad" using arithmetic coding and also decipher the real value tag generated.	08	CO2	Applying
iii)	Explain ADPCM encoder and decoder in detail	08	CO5	Understand

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