

Date: 14/11/2016

Seat No. \_\_\_\_\_

**GANPAT UNIVERSITY**  
**M. Tech Sem. III Computer Engineering/Information Technology**  
**Regular Examination Nov-Dec 2016**  
**3CE301/3IT301: Data Compression**

Max Time: 3 Hours]

[Max Marks: 60

- Instructions:** 1. Figures to the right indicate full marks of the question.  
2. All questions are compulsory.  
3. Each section should be written in a separate answer book.

**SECTION I**

- Q:1 (a)** Consider the experiment of tossing the coin two times.  $P(H)=0.6$  and  $P(T)=0.4$ . Tossing second time is independent of first time. Generated sample space is  $\{HH, HT, TH, TT\}$ . Find probabilities of each of these occurrences and also obtain Entropy for the given sample space. [5]
- (b)** Explain Uniquely decodable code. Determine whether the following codes are uniquely decodable or not: [5]
- a.  $\{aabb, aab, abb, aa\}$       b.  $\{abbb, ba, bb, abb, bbba\}$   
c.  $\{ba, bba, bbba, a\}$       d.  $\{aa, ab, ba, bb, aab\}$

**OR**

- Q:1 (a)** Consider the source has an alphabet  $a, b, c, d, e, \dots, z$  (26 characters). Encoding the sequence "ccabxcak" by using Adaptive Huffman method. [10]
- Q:2 (a)** A source emits letters from an alphabet having symbols  $a, b, c, d, e, f, g$  and  $h$  with probabilities  $p(a)=0.10, p(b)=0.04, p(c)=0.06, p(d)=0.05, p(e)=0.14, p(f)=0.16, p(g)=0.15$  and  $p(h)=0.30$ . [7]
- i. Calculate the entropy of this source.  
ii. Find Shannon-fano code for this source.  
iii. Find a Huffman code.  
iv. Find Minimum Variance Huffman Code.  
v. Find the average length of the code in (ii), (iii) and (iv).
- (b)** Briefly describe self information and entropy. [3]

**OR**

- Q:2 (a)** Apply integer implementation of arithmetic coding to encode a sequence 1 3 2 2 as per below frequency count table. (Assume  $m=8$ ) [10]

Symbol	Frequency Count
1	40
2	1
3	9

- Q:3 (a)** Consider 3 letter set  $S = \{1, 2, 3\}$  with given probability distribution.  $P(1)=0.6, P(2)=0.1$  and  $P(3)=0.3$ . Apply arithmetic coding to encode a sequence 3 3 2 1 1 and Generate a tag. [7]

- (b) Define following terms [3]  
 (i) Instantaneous Code (ii) Prefix Code (iii) Kraft-McMillan inequality

## SECTION II

- Q:4 (a) Obtain the Discrete Cosine transformation of the following matrix [6]  
 using  $V=AUU^T$ . Discuss on obtained results.

$$a = \begin{bmatrix} 2 & 2 \\ 3 & 5 \end{bmatrix}$$

- (b) Briefly explain GIF and PNG graphics format. [4]

**OR**

- Q:4 (a) Discuss the property of Discrete cosine transformation [4]

- (b) The output of the LZW encoder is the following sequence: [6]

3 1 4 6 8 4 2 1 2 5 10 6 11 13 6. Decode this sequence. Given Initial dictionary as follows.

Index	Entry
1	A
2	B
3	R
4	T

- Q:5 (a) Define Conditional Entropy. Also calculate conditional entropy i.e. [5]  
 $H(X|Y)$  for source alphabet  $x = \{0,1,\dots,15\}$  and reconstruction alphabet  $y = \text{floor}(x/2)*2$ .

- (b) Encode the message using LZ78 algorithm: "abracadabra" [5]

**OR**

- Q:5 (a) Discuss the encoder and decoder for Hierarchical mode of JPEG. [6]

- (b) Describe logarithmic search briefly for extracting of Motion vectors. [4]

- Q:6 (a) Explain Midtread and Midrise quantizer in brief with diagram. [5]

- (b) Briefly explain various distortion criteria. [5]

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