National Institute of Technology Calicut

Winter Semester 2019-'20

CS4043D IMAGE PROCESSING

*Total time **90 minutes**.* ***Maximum mark 20**.*

Question 1: [4 marks] Consider the following set of symbols and their associated probabilities. Assume that Huffman coding is used to encode the given symbols, where encoding of each symbol is performed using 2 bits - 0 and 1.

Symbol	**Probability**
$a1$	0.40
$a2$	0.10
$a3$	0.06
$a4$	0.10
$a5$	0.04
$a6$	0.30

1. [3 marks] What is the average number of bits required to encode a symbol according to this coding scheme?

Question 2: [4 marks] Hamming code is capable of detecting 1 bit error(TRUE/FALSE). It is also capable of detecting 2 bit errors (TRUE/FALSE). Hamming code is capable of correcting 1 bit error(TRUE/FALSE). It is also capable of correcting 2 bit errors (TRUE/FALSE).

Question 3: [1 mark] Which statement(s) is(are) true?
1. Each possible sequence gets mapped to a unique number in [0,1) in Arithmetic coding.
2. Huffman coding generates codes for all possible sequences.

- Only statement (1) is true.
- Only statement (2) is true.
- Both statements (1) and (2) are false.
- Both statements (1) and (2) are true.

Question 4: [3 marks] Compute the entropy of the given image I.

$$I = \begin{bmatrix} 21 & 21 & 21 & 95 & 169 & 243 & 243 & 243 \\ 21 & 21 & 21 & 95 & 169 & 243 & 243 & 243 \\ 21 & 21 & 21 & 95 & 169 & 243 & 243 & 243 \\ 21 & 21 & 21 & 95 & 169 & 243 & 243 & 243 \end{bmatrix}$$

Question 5: [5 marks] Use Arithmetic Coding to generate a unique tag for the string AAAABCCCDD.