

1999 Paper 8 Question 11

Information Theory and Coding

What is the entropy H , in bits, of the following source alphabet whose letters have the probabilities shown?

A	B	C	D
1/4	1/8	1/2	1/8

[2 marks]

Why are fixed length codes inefficient for alphabets whose letters are not equiprobable? Discuss this in relation to Morse Code. [4 marks]

Offer an example of a uniquely decodable prefix code for the above alphabet which is optimally efficient. What features make it a uniquely decodable prefix code? [6 marks]

What is the coding rate R of your code? How do you know whether it is optimally efficient? [4 marks]

What is the maximum possible entropy H of an alphabet consisting of N different letters? In such a maximum entropy alphabet, what is the probability of its most likely letter? What is the probability of its least likely letter? [4 marks]