

6.263/16.36 Problem 8
MIT fall 2005

Issued: Nov 15
Due: Nov 29

Problem 1

A source with message probabilities $p_1; p_2; p_3; p_4$, where p_i is the probability of message i , is to be encoded into binary digits for transmission. The cost of sending a 1 is twice as much as the cost of sending a 0.

- a) Suppose $p_1 = 0.4; p_2 = 0.25; p_3 = 0.2; p_4 = 0.15$. Find an optimal prefix code minimizing the cost of transmission.
- b) Suppose all we know about the probabilities is that $p_1 > p_2 > p_3 > p_4$. Knowing that an optimal code assigns message 1 the codeword 0, can you give a lower bound on p_1 ?

2/ Network coding problem.

a/

Consider the following theorem (from the Ho et al paper in your reading)

For a feasible multicast connection problem with independent or linearly correlated sources and d receivers, in both the acyclic delay-free case and the general case with delays, there exists a solution in finite field F_q if $q > d$

Construct a network with as large a required finite field requirement as you can manage. Justify the requirement.

Note: there is no single right answer. The person with the smallest difference between q and d in his/her network gets a gift certificate.

b/

For the network and multicast connection you found in b/, find a finite field size to guarantee that the probability of failure using a distributed random code approach is below 0.00001 %.