

**Assignment # 2**

1. Find the values of  $J$  (the size of source alphabet) for which there will be a uniquely decodable source code with a fixed block size that attains the least code rate?
2. Plot the Entropy  $H(p)$  of a binary source as a function of  $P(1) = p$ . From the curve, comment on the effect of  $p$  on the minimum source code rate that can be achieved. Illustrate this by selecting two numerical examples.
3. For positive integers  $K$  and  $h$ ,  $1 \leq h \leq K$ . Let  $A_{K,d}$  denote the set of all binary sequences of length  $K$  with  $h$  or fewer ones. Derive expressions for the block error probability and rate of a fixed-block size source code having  $A_{K,d}$  as its set of correctly encoded sequence.
4. Consider a binary IID source with  $p_0 = 0.99$  and  $p_1 = 0.01$ . An almost lossless fixed block size code is to be designed with a source length  $K = 100$  such that the set of correctly encoded sequences which contains all sequences with 5 or fewer 1's.
  - (a) Find the minimum possible rate for such a code.
  - (b) Find the block error probability,  $P_E$ .
  - (c) Use Chebychev inequality to find an upper bound to  $P_{BE}$ . Compare the result to (b) and explain.
5. [Cover & Thomas], Problem 2.18.

**Note:** Please copy this and sign on each H.W. assignment:

*I testify that I will not refer to the solutions of the assignments of EE 575 by any means and in any form and from any source, before I submit the assignment to my instructor. For programming assignments, I testify that I will not use/refer to any ready code in any means or any form throughout and until the submission of the assignment.*