EE634 Information Theory
Project – Due by November 10, 2006

For each question, submit a report of at most 2 pages length. Send any programs you write by email as a single file.

1. Consider the sequence of i.i.d. binary random variables X_1, X_2, X_3 , $\cdots$, with $Pr[X_1 = 1] = p$. Write programs (in MATLAB) to do the following:

   (a) Determine the elements of the typical set $A_\epsilon^{(n)}$ for given ϵ and n. Also determine the probability of the typical set.

   (b) For a given ϵ, determine the size and probability of the typical set as a function of n.

   (c) For a given n, determine the possible sizes of the typical set as a function of ϵ.

   Choose appropriate values for p, ϵ, and n to obtain illustrative plots of $|A_\epsilon^{(n)}|$ vs. n and $|A_\epsilon^{(n)}|$ vs. ϵ.

2. (a) Find or describe all binary-input, binary-output DMCs (2×2 probability transition matrices) that have capacity 0.5.

   (b) Find or describe binary-input, J-output DMCs ($2 \times J$ probability transition matrices for $J > 2$) that have capacity 0.5.

   I will strongly encourage you to think and solve the above problems independently. If you are unable to proceed, the following reference (available from IEEEXplore) is a good starting point.

   - R. A. Silverman, "On binary channels and their cascades," IEEE Transactions on Information Theory, vol. 1, no. 3, pp. 19-27, Dec. 1955.