GEORGIA INSTITUTE OF TECHNOLOGY
School of Electrical and Computer Engineering

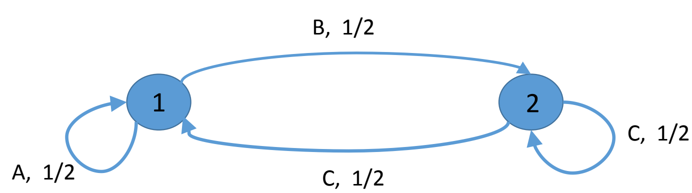
ECE 6605
Information Theory

Assigned: Tuesday, Sept. 25, 2018
Due: Thursday, Oct. 4, 2018
Due: Sections Q (Video Student): Thursday,, Oct 11, 2018

Problem Set #3

Problem 1-2: Solve the questions 4.12 and 4.13 from Chapter 4 of the textbook (the second edition).

Problem 3: For the source indicated below by the diagram, there is an underlying Markov process with states indicated by circles. Each time unit, the source in a given state emits an output symbol "A" or "B" or C and passes to a next state. The number on each transition branch is the probability of emitting that symbol and going to the indicated state in that transition. Assume that at the start (time=0), we are equally likely in either of the states. Note that the source output at each time is the symbols "A" or "B" or "C" in the transition of the Markov to the next state, (and not the state number).



(a) Compute the probability of each source output symbol, i.e., $Prob\{X_{n+1} = A\}$, $Prob\{X_{n+1} = B\}$, $Prob\{X_{n+1} = C\}$.

(c) Assume that both encoder and decoder knows that the source happens to be at state "1" at time zero. Then, the source produces the output symbols one at a time. Find the optimum pre-fix free compression scheme of this source, by designing the binary codewords. Explain clearly how your scheme works.

Problem 4: Solve the questions 4.28 from Chapter 4 of the textbook (the second edition).

Problem 5: For every stationary stochastic process $\{Y_i\}$; $i = 1, 2, \ldots$, prove that we have

$$\frac{1}{n}H(Y_1, Y_2, \ldots, Y_n) \leq \frac{1}{n-1}H(Y_1, Y_2, \ldots, Y_{n-1})$$

for any n.