ECEN 760: Probabilistic Graphical Models - Homework 3

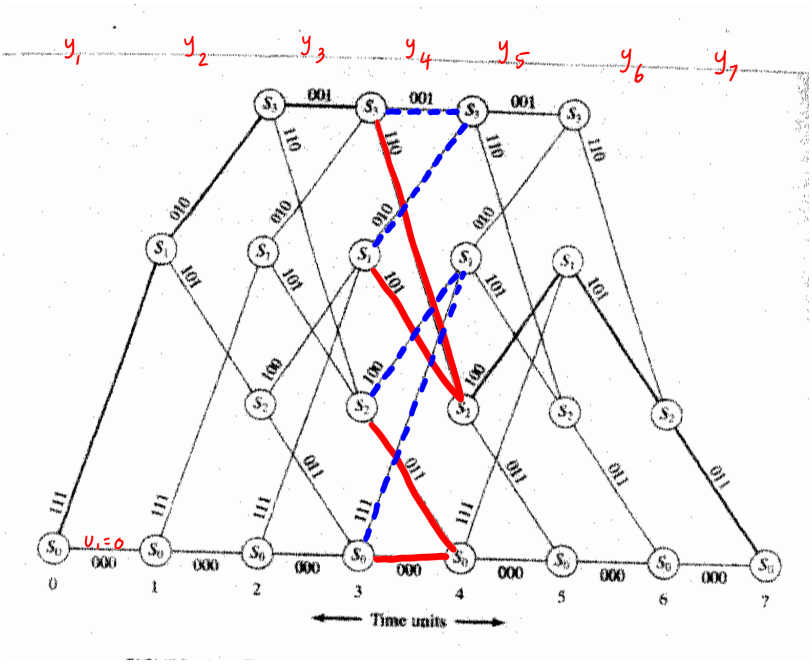
- Date Assigned: Friday, Oct 6, 2017
- Date Due: Monday, Oct 16, 2017

I Reading Exercise

Paper "Factor Graphs and the Sum-Product Algorithm", F.R. Kschischang, B.J. Frey and H.-A. Loeliger

II Problems

1. Consider the Trellis diagram corresponding to a state transition machine as shown in the figure below.



Write a program that will perform the following operations

- Encode the information vector $\underline{u} = [1\ 1\ 0\ 1\ 0\ 0\ 1\ 1\ 0\ 0]$ and find the codeword $\underline{x}$ corresponding to the information vector. $\underline{x}$ should be a vector of 30 bits, 10 groups of 3 bits each.
- Simulation of the channel : Suppose we transmit these bits through a BSC(p) channel for $p = 0.2$. Let us simulate this channel in the following way. Let $\underline{y}$ be the received vector, i.e., a noisy version of $\underline{x}$ where $\underline{y}$ differs from $\underline{x}$ in the bit positions $i_1, i_2, \ldots, i_6$. Randomly choose 6 positions to flip the bits. Once you have randomly chosen the 6 bits to flip, it may seem that the p of the channel is irrelevant. However, you will need this information for performing inference. Think about it.

- Write a program to implement the forward-backward algorithm to compute the *a posteriori* probabilities for each of the information bits u_i's.
- Add a functionality to your program that can compute the optimal *a posteriori* probabilities for the x_i's.

Turn in the source code, the 6 bit positions that are flipped and a posteriori probabilities for u_i's and x_i's.