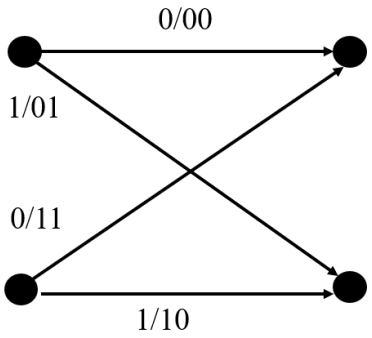
Exercise 1

Given the 2-state convolutional code with trellis:



Consider a 2-PSK constellation and an AWGN channel.

Write a Matlab program which plots the Bit Error Rate curve for E_b/N_0 ranging from 0 to 5 dB obtained by applying the Viterbi algorithm.

Optional: Plot in the same figure also the Bit Error Rate curves obtained by applying the early-decision Viterbi algorithm version, with delays equal to D = 2 and 5 bits.

Exercise 2

Given the block code with generator matrix

$$G = \begin{bmatrix} 1 & 0 & 1 & 1 \\ 0 & 1 & 0 & 1 \end{bmatrix}$$

the codewords $\underline{c} = (c_1\ c_2\ c_3\ c_4)$ are transmitted over a BSC with error probability p.

Write a Matlab program that:

1. Accepts as inputs:
    a. The error probability value p
    b. The received vector $\underline{c} = (y_1\ y_2\ y_3\ y_4)$

2. Computes the probabilities $p(c_i|\underline{y})$ i=1,2,3,4 by using:
    a. A brute-force approach working on the entire codebook.
    b. A factor graph approach.

Exercise 3

Given this training set

	x_1	x_2	x_3	c
v_1	30	0	10	0
v_2	30	0	70	0
v_3	30	1	20	0
v_4	30	1	80	1
v_5	60	0	40	0
v_6	60	0	60	1
v_7	60	1	50	0
v_8	60	1	60	1

Write a Matlab program that:

1. Builds a tree classifier based on the information gain ratio.
2. Given a vector $\underline{x} = \begin{pmatrix} x_1 & x_2 & x_3 \end{pmatrix}$, computes the corresponding class c.