

# Homework # 3

( Due May 12, 2016 )

1. Consider a (2,1,3) convolutional code with

$$g^{(1)} = 1 + D^2, \quad g^{(2)} = 1 + D + D^2 + D^3$$

a. Draw the block diagram of the encoder

b. Draw the state diagram

c. Draw the trellis diagram for information length  $L=4$

d. For a BSC,  $p < 0.5$ , using Viterbi algorithm to decode the received sequence  $r = 10, 01, 00, 00, 11, 11, 00$

Find the codeword transmitted and the corresponding message bits.

2. The generator matrix of a (2,1,2) systematic recursive convolutional code encoder is given by

$$G(D) = [ 1 \quad (1+D+D^2) / (1+D^2) ]$$

Suppose that a sequence  $x$  consisting of 6 coded symbols is transmitted over a binary symmetric channel with  $p < 0.5$ . The following sequence of 12 numbers is received at the decoder input.

- $$y = \{ y_1 \ y_2 \ y_3 \ y_4 \ y_5 \ y_6 \}$$
$$= \{ -1 \ 1 \ 11 \ 11 \ -1 \ 1 \ 1 \ -1 \ 1 \ -1 \ }$$

The encoder input bits  $u_k = +1$  or  $-1$  are equally likely and the trellis path associated sequence  $x$  begins and ends in all-zero state.

Decode the received sequence to find the original information sequence at the transmitter side.