

## E9-251: Signal Processing for Data Recording Channels

### Home Work #4 (Due 29<sup>th</sup> November 2012 in class)

Late Submission Policy: Points scored = Correct points scored \*  $e^{-\text{\#days late}}$

#### Problem 1:

Consider a memory less channel. Let the received signal be  $y = x + n$ , where  $n \sim N(0, \sigma^2)$  and  $x \in \{-1, 1\}$  with  $\Pr(x = -1) = 1 - p$ . Find the decision rule for optimal detection. Obtain the probability of error as a function of  $p, \sigma$ . What is the upper bound for the probability of error in the limit when the noise variance is very high? Prove your result. (50 pts)

#### Problem 2:

Consider a channel with memory. Let the ISI channel be  $H(z) = 1 + \alpha z^{-1}$ . Suppose the NRZ input is constrained such that a pattern '11' never occurs. Let the received sequence be  $\mathbf{r}$ .

- Sketch 2 stages of the trellis diagram for this channel. Indicate all the branch transitions showing only the relevant transitions.
- Show the computation of all the branch metrics for a single stage for this channel.

(50 pts)