EE 5501 Prof. N. Jindal
Digital Communication Dec. 2, 2009

Homework 8
Due: Wednesday, Dec. 9, 1:00 PM

1. 5.9 (a) and (b)

2. In this problem we will implement different equalizers for the running example from pg. 201 (assuming BPSK modulation).

   (a) Implement MLSE using the Viterbi algorithm. In order to assist you with this, recall that MLSE is performed on the matched filter outputs, which are given by:

   $$z[n] = \sum_k b[k]h[n-k] + w[n]$$

   where

   $$w[n] = \int_{-\infty}^{\infty} n(t)p^*(t-nT)dt.$$

   The random process $w[n]$ is correlated Gaussian noise. If $u[n]$ represents uncorrelated Gaussian noise (with unit variance), verify that $w[k]$ can be generated by filtering $u[k]$ according to the following equation:

   $$\frac{\sigma}{\sqrt{3-\sqrt{5}}}u[k] - \frac{\sigma}{2}(\sqrt{3-\sqrt{5}})u[k-1].$$

   Using this equation you should be able to generate the matched filter outputs (based on $h[\cdot]$ and the random values of $b[k]$). Implement MLSE, and then produce a plot of the bit error rate versus σ^2 (the noise variance).

   (b) For the same matched filter outputs, implement the linear MMSE equalizers of length 5, 11, and 21, and for each plot bit error rate versus σ.