ÉCOLE POLYTECHNIQUE FÉDÉRALE DE LAUSANNE
School of Computer and Communication Sciences

Principles of Digital Communications: Assignment date: June 07, 2007
Summer Semester 2007 Due date: June 14, 2007

Homework 10

Problem 1. Lecture notes Problem 1 *(PSD of the Convolutional Code Considered in Class)* of Section 6.6
Typo: Just after equation (6.8), it should read $R_\psi(\tau) = \int_{-\infty}^{\infty} \psi(t+\tau)\psi(t)dt$.

Problem 2. Consider the transmitter shown in Figure 1, when $\ldots D_{-i}, D_i, D_{i+1}, \ldots$ is a sequence of independent and uniformly distributed random variables taking value in $\{\pm 1\}$.

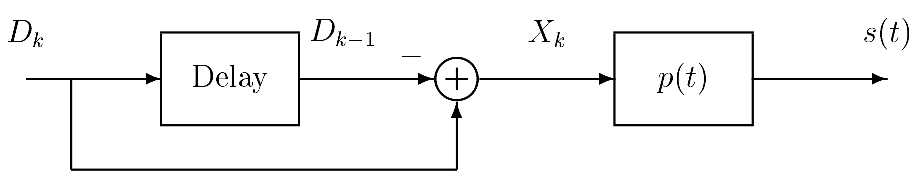

Figure 1: Encoder

The transmitted signal is

$$s(t) = \sum_{i=-\infty}^{\infty} X_i p(t - iT - \Theta),$$

where Θ is a random variable, uniformly distributed in $[0, T]$.

$$X_i = D_i - D_{i-1}$$

$$p(t) = 1_{[-\frac{T}{2}, \frac{T}{2}]}(t).$$

(a) Determine $R_X[k] = E[X_{i+k}X_i]$.

(b) Determine $R_p(\tau) = \int_{-\infty}^{\infty} p(t+\tau)p(t)dt$.

(c) Determine the autocorrelation function $R_s(\tau)$ of the signal $s(t)$.

(d) Determine the power spectral density $S_s(f)$.

Problem 3. Lecture notes Problem 3 *(Trellis Section)* of Section 6.6

Problem 4. Lecture notes Problem 4 *(Maximum Likelihood Path)* of Section 6.6