Department of Electrical & Computer Engineering
University of California, Santa Barbara

ECE 245
Spring 2011
Shynk
H.O. #10

HOMEWORK #4

Due Friday, April 29, 2011 (5:00 p.m.)

Reading: Chapters 5 (5.8, 5.9, and 5.16) and 6 (6.1, 6.2, and 6.6)

Problems:

1. Chapter 5: Problem 5
2. Chapter 5: Problem 8
3. Chapter 5: Problem 16
4. Show that the optimal perturbation relative to the total misadjustment is obtained when $P = M_{\text{tot}}/2$.
5. Derive a modified version of the LMS algorithm that minimizes the following cost function:

$$\xi_{\text{abs}} = E[|e(n)|].$$

6. Suppose that the LMS algorithm is used to identify a system with input $x(n)$ and output $d(n)$. Assume that $x(n)$ is a white-noise sequence with zero mean and variance σ_x^2. The unknown system has the following impulse response:

$$h(n) = \begin{cases} a, & n = 0 \\ b, & n = 1 \\ 0, & \text{else.} \end{cases}$$

Let the output of the adaptive estimator be

$$\hat{d}(n) = \sum_{k=0}^{N-1} w_k(n) x(n-k).$$

Find a functional form for $E[W(n)]$ in terms of a, b, and N (where $N > 2$). Assume that the initial weights $W(0) = [w_0(0), \ldots, w_{N-1}(0)]^T$ are not zero.