UNIVERSITY OF ILLINOIS
Department of Electrical and Computer Engineering
ECE 417 Multimedia Signal Processing

Lecture 7 Sample Problem Solutions

Problem 7.1

$$\frac{d\varepsilon}{da} = 2\sum_{k=0}^{N-1} x_k(ax_k - y_k)$$

which is zeroed by

$$\hat{a} = \frac{\sum_{k=0}^{N-1} y_k x_k}{\sum_{k=0}^{N-1} x_k^2}$$

Problem 7.2

$$\frac{\partial\varepsilon}{\partial a^*} = x^*(ax - y)$$

which is zeroed by

$$\hat{a} = \frac{x^* y}{|x|^2}$$

Problem 7.3

Plugging in the value of $\hat{a} = \frac{\sum_{k=0}^{N-1} y_k x_k}{\sum_{k=0}^{N-1} x_k^2}$ into the definition of $\varepsilon(P)$, we find that

$$\varepsilon(P) = \sum_{k=0}^{N-1} y_k^2 - \frac{\left(\sum_{k=0}^{N-1} y_k x_k(P)\right)^2}{\sum_{k=0}^{N-1} x_k^2(P)}$$