Digital Signal Processing - Assignment 6

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Exercise 1

1.1

This is the Method of Least Squares, which can be solved as follows. First, find the partial derivatives by a and b, and set them to 0:

$$\frac{\partial \epsilon}{\partial a} = \sum_{i=1}^{N} 2x_i(ax_i + b - y_i) = 0$$

$$\frac{\partial \epsilon}{\partial b} = \sum_{i=1}^{N} 2(ax_i + b - y_i) = 0$$

Next, rewrite them as a series of linear equations:

$$\left[\sum_{i=1}^{N} x_i^2\right] a + \left[\sum_{i=1}^{N} x_i\right] b = \sum_{i=1}^{N} x_i y_i$$

$$\left[\sum_{i=1}^{N} x_i\right] a + \left[\sum_{i=1}^{N} 1\right] b = \sum_{i=1}^{N} y_i$$

Then solve the equations for a and b:

$$a = \frac{N \sum_{i=1}^{N} (x_i y_i) - \sum_{i=1}^{N} x_i \sum_{i=1}^{N} y_i}{N \sum_{i=1}^{N} x_i^2 - \left(\sum_{i=1}^{N} x_i \right)^2}$$

$$b = \frac{\sum_{i=1}^{N} y_i - \left(\sum_{i=1}^{N} x_i \right) a}{N}$$

1.2

The results from the attached Matlab script hw12.m are $a = -0.3613$ and $b = 1.1576$.

Exercise 2

TODO