Seminar 6 - Parameter estimation

DEDP

1. Fit a linear function $y = ax$ (i.e. estimate a) through the following data points $(x_i, y_i) = (1, 1.8), (2, 4.1), (2.5, 5.1), (4, 7.9), (4.3, 8.5)$, assuming the noise is $\mathcal{N}(0, \sigma^2 = 1)$
   a. use Maximum Likelihood (ML) estimation
   b. use Minimum Mean Squared Error (MMSE) estimation, with the prior distribution $w(a)$ being $\mathcal{N}(1, \sigma^2 = 0.64)$
   c. use Minimum Mean Squared Error (MMSE) estimation, with the prior distribution $w(a)$ being $U[1, 4]$
2. A received signal $r(t) = a \cdot t^2 + noise$ is sampled at time moments $t_i = [1, 2, 3, 4, 5]$, and the values are $r_i = [1.2, 3.7, 8.5, 18, 25.8]$. The noise distribution is $\mathcal{N}(0, \sigma^2 = 1)$. Estimate the parameter a.
   a. use Maximum Likelihood (ML) estimation
   b. use Minimum Mean Squared Error (MMSE) estimation, with the prior distribution $w(a)$ being $\mathcal{N}(1, \sigma^2 = 0.64)$
   c. use Minimum Mean Squared Error (MMSE) estimation, with the prior distribution $w(a)$ being $U[1, 4]$
3. A received constant signal $r(t) = \Theta + noise$ is sampled 3 times, and the values are $r_i = [1.2, 2.7, 2.2]$. The noise distribution is uniform $U(-1, 1)$. Estimate the parameter Θ using Maximum Likelihood estimation.