Problem Set I

1. Problem 2.4 Haykin

2. Problem 2.8 Haykin
   
   Use Matlab to plot the time, frequency, and phase response of the MA-generated LTI filter as well as your approximations.

3. Problem 2.1 a, c, d Diniz
   
   Supposing the input signal vector is composed by a delay line with a single input signal. Compute the correlation matrix for the following input signals:
   
   a. \( x[k] = \sin(\frac{\pi}{4} k) + \cos(\frac{\pi}{3} k) + n[k]. \)
   
   c. \( x[k] = a_n[k] \sin(\omega_0 k + n_2[k]). \)
   
   d. \( x[k] = -a_1 x[k - 1] - a_2 x[k - 2] + n[k]. \)
   
   In all cases, \( n[k], n_1[k], \) and \( n_2[k] \) are white noise with uniform distribution, with zero mean and with variances \( \sigma_n^2, \sigma_{n_1}^2, \) and \( \sigma_{n_2}^2, \) respectively. These random signals are considered independent.

4. Problem 4.5 Haykin

5. Problem 2.3 Diniz
   
   For the correlation matrix below, find its eigenvalues, eigenvectors, and the matrix \( Q. \)
   
   \[
   R_{xx} = \frac{1}{2} \begin{bmatrix} a_1 & a_2 \\ a_2 & a_1 \end{bmatrix}
   \]

Due date: **September 21** in class