Solutions Homework #10
Introduction to Communication Systems – E3701

Problem 1

For an explanation of the derivation of matched filters see section 4.2 of the Haykin text.

For a linear, time invariant filter with stationary, white input noise of zero mean and power spectral density $N_0/2$ we may describe the matched filter as:

$$h_{match}(t) = kg(T - t)$$

where k is an arbitrary constant, g(t) is the input function and T is the time t = T at which the output of the filter is sampled. Thus, our matched filter is simply a time reversed, shifted, scaled version of the input signal.

It is easy to see convolving with a matched filter of a signal is equivalent to performing correction with the signal itself. Consequently, using two matched filters leads to same probability of detection error as the correlation detector.