## CSE 4214 :: Problem Set 2

- 1. Let h[k] = [1, 2, 3, 2, 1] for k = [1, 2, 3, 4, 5], and h[k] = 0 elsewhere; also let g[k] = [1, 1, 1] for k = [1, 2, 3] and g[k] = 0 elsewhere. Find and sketch the discrete-time convolution  $h[k] \star g[k]$ .
- 2. Let x be a Gaussian random variable with mean  $\mu$  and variance  $\sigma^2$ . For some constant z, express the probability that x is greater than z in terms of the complementary error function (erfc).
- 3. Let s[k] represent a signal, zero everywhere except from k = 1 to  $n_b$  inclusive, and let h[k] represent the impulse response of the detection filter. If  $h[k] = s[n_b k]$ , show that

$$[s[k] \star h[k]]_{n_b} = \sum_{i=1}^{n_b} s[k]^2.$$

4. Let x(t) be a zero-mean random process with power spectral density

$$S_x(j\omega) = \begin{cases} 1+\omega, & -1 \le \omega < 0, \\ 1-\omega, & 0 \le \omega \le 1, \\ 0, & \text{elsewhere.} \end{cases}$$

Find the variance of the process x(t).

5. Let

$$s_0[k] = \begin{cases} 1, & 1 \le k \le 4, \\ -1, & 5 \le k \le 8, \\ 0 & \text{elsewhere,} \end{cases}$$

and let  $s_1[k] = -s_0[k]$ . Also let the decision threshold z = 0. Note that  $n_b = 8$ . If  $h[k] = s_0[n_b - k]$ , find an expression for the probability of error in terms of erfc.