EE 631: Detection and Estimation
Final Exam

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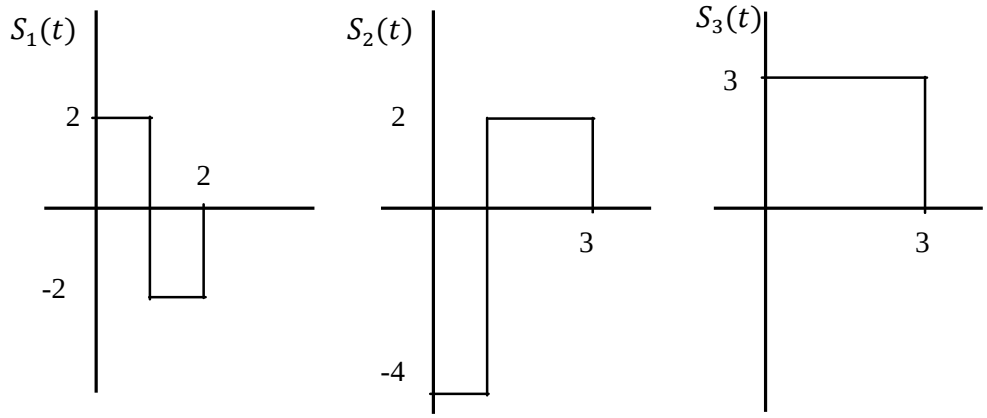
Date: Dec 3rd 2012 Time: 5:00-6:30pm Room: KNOX 104

Problem 1 (50%)

Figure 1 displays the waveform of three signals $S_1(t)$, $S_2(t)$, $S_3(t)$

a. Using the Gram-Schmidt orthogonalization procedure, find a set of orthonormal basis functions for this set of signals.

b. Express each of these signals in terms of the set of basis functions found in part (a).



Problem 2 (50%)

Given $X(t)$ and $Y(t)$ as zero mean, uncorrelated process and $Z(t)$ is defined as follows

$$Z(t) = X(t) + Y(t) + W(t)$$

Where $W(t)$ is white noise, independent of $X(t)$ and $Y(t)$. The autocorrelation of $X(t)$, $Y(t)$ and $W(t)$ are as follows:

$$K_x(t,u) = a_x \psi_1(t)\psi_1(u)$$

$$K_y(t,u) = a_y \psi_2(t)\psi_2(u)$$

$$K_\omega(t,u) = \sigma_\omega^2 \delta(t-u)$$

$\psi_1(t) = \cos(\frac{2\pi}{T}t)$, $\psi_2(t) = \sin(\frac{2\pi}{T}t)$ and a_x, a_y and a_ω are all deterministic constants.

Find the Eigen-functions and Eigen-values of $K_z(t,u)$.