Information Sheet: ECE 545- Communication Theory

Course	or equivalent course	Grade	School
Stochastic Signals & Sys.			
System Analysis			

$$g(t) = p(t) - p(t-T) - p(t-2T).$$

Let $h(t)$ be an impulse response of a filter matched to $p(t)$, that is $h(t) = p(t)$.

(a) Plot $g(t)$

(b) Let $y_0(t) = g(t) * h(t)$. Find $b_k = \text{sign}\{y_0(kT)\}$, for $k = 1, \ldots, 3$. and $c_k = \text{sign}\{y_0((k - .5)T)\}$, for $k = 1, \ldots, 3$.

(c) Let $w(t)$ be a white (zero mean) Gaussian noise process with power spectral density $N_0/2.$, and $n(t) = h(t) * w(t)$. Compute the variance $Var\{n(t)\}$. Hint: use the Parseval equality:

$$\int_{-\infty}^{+\infty} \|H(f)\|^2 df = \int_{-\infty}^{+\infty} h^2(t) dt.$$

Let

$$\hat{b}_k = sign\{b_k + n_k\},$$

for $k = 1, \ldots, 3$.

(d) What is the probability that $\hat{b}_1 = b_1$.

(e) What is the probability that there exists $k \in \{1, 2, 3\}$ such that $\hat{b}_k \neq b_k$? That is, what is the probability that at least one estimate of b_k, $\hat{b}_k$ is in error?