CT303 - Digital Communications
Autumn 2020

Lab 4: Binary PCM Processes — Submit by 4/10/2020, 12 noon

1. Let us analyze the NRZ-L scheme. Let $X(t)$ denote the stochastic process that generates random NRZ-L code signals, with pulse-width T sec.

   (a) Simulate the stochastic process $X(n) = X(nT_s)$ in Python, assuming independent bit stream.

   (b) Compute the mean m_X and Auto-correlation matrix R_X, and verify (approximately) whether $X(n)$ is wide-sense stationary or not.

   (c) Let $d \sim U[0, T]$ be a uniformly distributed RV that models a random starting point for the PCM scheme. Let $X_1(t) = X(t - d)$ denote the same NRZ-L signal with random initial delay d (begin with 0 for $t \in [0 \;\; d]$). Repeat the above step with $X_1(n) = X_1(nT_s)$.

   (d) Compute the PSD of $X(n)$ (or/and $X_1(n)$) for different pulse-widths T.