EE161 — Spring 2025 **San José State University**
Homework # 2 **Due: Thu. 2/13/25**

1. Consider a polar NRZ system communicating at a bit rate of 100 Mbps. The noise power spectral density at the receiver is $N_0 = 3 \times 10^{-21}$ W/Hz (see lecture note `PSD_AWGN_Shot.pdf`). You are asked to determine the received amplitude a such that the average bit error probability is $P_b = 10^{-2}$.

2. A wireless ASK (Amplitude-Shift Keying) system uses polar mapping. The received average bit energy-to-noise ratio E_b/N_0 is 7 dB.

   (a) Evaluate the resulting bit error probability P_b

   (b) Verify the result in part (a) by using a plot of E_b/N_0 (dB) versus P_b

3. A wireless OOK link (unipolar mapping) has as target an average bit error probability $P_b = 10^{-3}$. Evaluate the required bit energy-to-noise ratio E_b/N_0 in dB.

4. A binary communication system employs a polar NRZ pulse shaping scheme. Using a binary coded decimal (BCD) representation of the last two digits of your student ID, obtain a total of 8 bits. In the same graph, plot or sketch carefully the following signals, assuming that no noise is present: $R(t) = s(t)$.

   (a) The transmitted signal $s(t)$

   (b) The correlator output $y_{\text{corr}}(t)$

5. Download Matlab script `simbpsk.m`[1] and run it with your student ID. The resulting graph compares theoretical and simulated bit error rates of binary communication using BPSK (polar mapping). Include the graph in your answer along with a comment on the results.

[1] The file is located in Canvas under `Files` > `Matlab` > `_Scripts`