EE160 - Fall 2023 **San José State University**
Homework # 8 **Due: WED. 12/6/23 11:59 PM**

1. Baseline wander

   Download MATLAB script `baseline_wander2.m` from Canvas. The script computes and plots the running average (in blue), or *baseline wander*, and the waveform (in black) of several pulse shaping techniques for a random sequence of bits.

   (a) For each of the following values of probability that a bit equals zero, run the script and attach the resulting figure

      i. 0.03

      ii. 0.97

   (b) Verify that Manchester signaling has the lowest variation in its baseline wander.

2. FSK

   Download MATLAB Simulink model `FSK_2023b.slx` from Canvas. You can modify the value of the frequency deviation Δf by typing `df = VALUE` in the command window. Run the model for each of the following frequency deviation values. In each case, sketch or capture the resulting time waveform and spectrum and attach them to your solution.

   (a) $\Delta f = 9600$ Hz (default)

   (b) $\Delta f = 19200$ Hz

3. Bloch sphere representation of quantum states

   Read the documentation in MATLAB. You can do this by searching the string "Introduction to Quantum Computing" from the upper right side of the command window.

   (a) Run MATLAB script `bloch_sphere_states.m` from Canvas. The script generates six states of a qubit on a Bloch sphere. Attach the six figures to your solution.

   (b) Obtain the Bloch sphere representation of the quantum state

   $$|\psi\rangle = \frac{1}{\sqrt{10}}|0\rangle + \frac{3}{\sqrt{10}}i|1\rangle.$$

   Attach the resulting figure to your solution

4. Local Quantum State Simulation

   For more information read the documentation in MATLAB by searching for "Local Quantum State Simulation".

   (a) Run MATLAB script `quantum_state_sim.m` from Canvas. The script simulates a quantum circuit and analyzes the simulation results. The circuit is composed of a Hadamard gate and two CNOT gates. Verify that the only two possible states are $|011>$ and $|100>$ and that they have the same probability of occurrence.

(b) Simulate a CNOT gate as illustrated below with initial state `11`.