EE160 - Fall 2023 **San José State University**
Homework # 2 **Due: Thu. 9/14/23**

1. (Based on prelab work for lab experiment 1) The n-harmonic power of a waveform $x(t)$ is defined as $P_n = |x_n|^2$. On the other hand, the harmonic power ratio R_n, relative to the first harmonic, expressed in dB is given by

$$R_n = \frac{P_n}{P_1}\ (\text{dB}) = 10\ \log_{10}\left(\left|\frac{x_n}{x_1}\right|^2\right) = 20\ \log_{10}\left(\left|\frac{x_n}{x_1}\right|\right)\ \text{dB}.$$

   Evaluate R_n, $n = 2, 3, 4, 5$, for the following waveforms:

   (a) A periodic train of rectangular pulses of amplitudes $\{0, 1\}$ and duty cycle $d = 1/5$

   (b) A periodic train of rectangular pulses of amplitudes ± 1 and duty cycle $d = 1/2$. (That is, a square waveform.)

   (c) A triangular waveform of amplitudes ± 1

2. Plot or sketch carefully the discrete amplitude spectrum of each of the waveforms in problem 1, for $0 \leq n \leq 5$.

3. Let $x(t) = \cos(200\pi t) + 0.1\cos(600\pi t)$.

   (a) Determine the fundamental frequency f_0 and period T_0

   (b) Plot or sketch carefully $x(t)$ in the interval $-2T_0 \leq t \leq 2T_0$

   (c) Plot or sketch carefully the discrete amplitude spectrum