Homework #3, ENGR 100-430, W24. Due **Fri. Feb. 23, 5PM**

Notes

- This is an individual assignment, not a group project. Refer to the course syllabus for the collaboration policies.

1. [2] A periodic signal with period 1/2000 sec is known to be band-limited with maximum frequency 12000 Hz. How many samples must be taken of this signal to be able to determine its Fourier series coefficients?

2. [2] A sinusoidal signal has amplitude 7, frequency 440 Hz, and phase $\pi/3$. How fast must we sample this signal to avoid aliasing?

3. [2] Sketch the spectrum of the signal $x(t) = 5 + 3\cos(2\pi 200t) + 4\cos(2\pi 300t)$.

4. [2] Sketch the spectrum of the signal $x(t) = 6\cos(2\pi 200t)\cos(2\pi 300t)$. Be careful!

5. [2] How fast must we sample the signal $x(t) = 6\cos(2\pi 200t)\cos(2\pi 300t)$ to avoid aliasing?

6. [2] The *fundamental frequency* of a signal that has frequencies $f_1, f_2, \ldots$ is the greatest common divisor (GCD) of those frequency values.
For example, suppose a signal has frequencies 30 Hz, 1 kHz, and 2 kHz. The GCD of $f_1 = 30$ Hz, $f_2 = 1000$ Hz, and $f_3 = 2000$ Hz is 10 Hz, because $f_1/10\text{Hz} = 3$, $f_2/10\text{Hz} = 100$, $f_3/10\text{Hz} = 200$, and 3, 100, 200 have no common divisors. One can verify that in `Julia` using `gcd(30, 1000, 2000)`.

   Determine the *fundamental period* of the signal that has the following spectrum.