ECE 431 HW #3

1. **MATLAB.** Write a MATLAB function `sqrwave(t,N)` that computes

$$\sum_{n=-N}^{N} x_n e^{j2\pi nt},$$

where the x_n are the Fourier coefficients of the square wave of period one whose values on $[-1/2, 1/2]$ are given by

$$x(t) = \begin{cases} 1, & |t| \le 1/4, \\ 0, & 1/4 < |t| \le 1/2. \end{cases}$$

   (a) Cite the authors, titles, and page numbers of any books you use for reference, tables, or formulas. Show all your calculations. Show the equations that you base your program on. Print out your program. Plot `sqwave(t,5)` for $|t| \le 1$.

   (b) If you were going to apply the sampling theorem to `sqwave(t,5)`, what is the smallest value of f_s that you would use?

2. **MATLAB.** Write a MATLAB script based on (1.14) to apply an ideal lowpass filter to `sqwave(t,N)`. Use the variable `lpfcf` to denote the lowpass filter cutoff frequency. You can approximate the sum in (1.14) by a sum from `-M` to `M`. Your program should print the input signal when `N=5` and the output signal for `lpfcf` equal to 6, 4, and 2. Plot signal values for $t \in [-1, 1]$. What can you plot to check that your output is correct in each case? Do it. Explain the value of f_s you use in (1.14). You will have to experiment to find a suitable value of `M`.