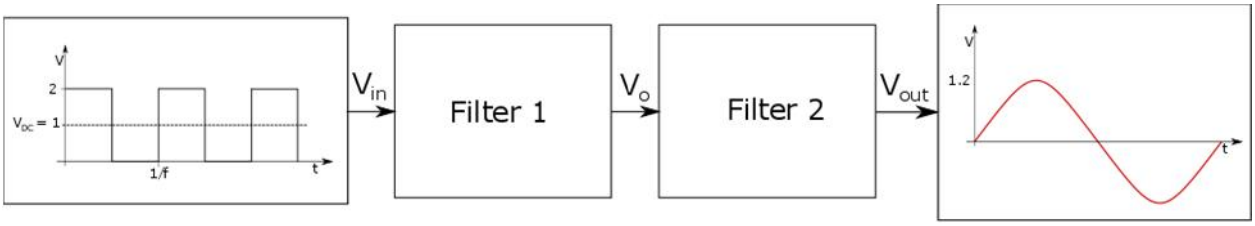
After successfully passing ECE3710, you created a brand new startup that builds inexpensive electronic gadgets out of old dismissed electronics.
Your new product is a signal generator that generates sine waves out of a square wave coming from an old microchip.

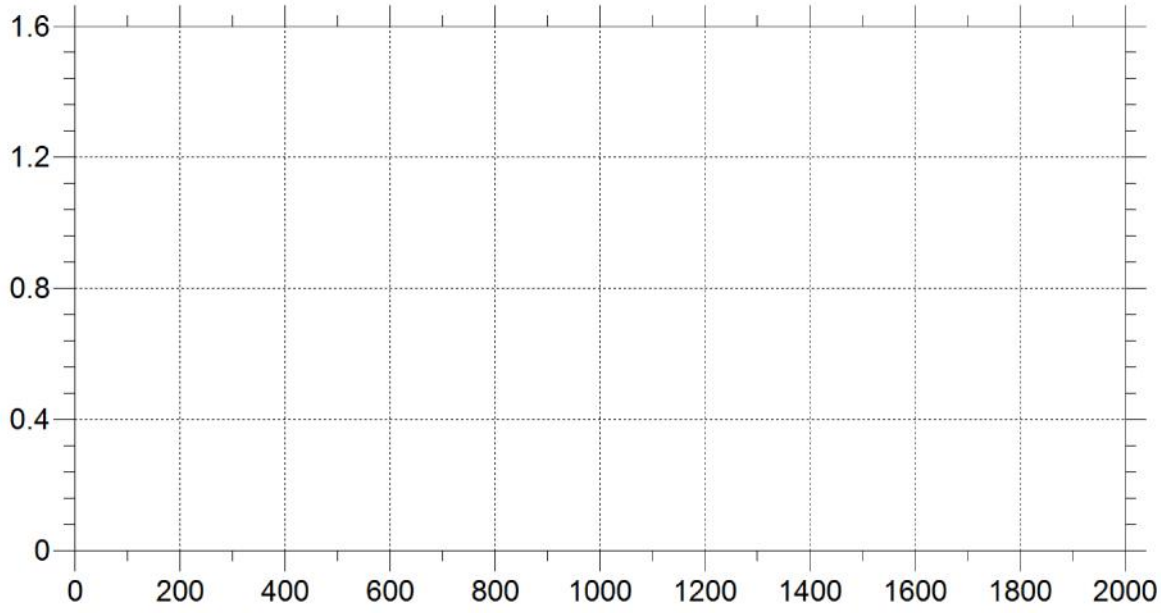
The square wave *x(t)*, shown in the block diagram below, has frequency f = 300 Hz and an amplitude of 2 V with 1 V DC offset. The square wave can be represented as:

$$x(t) = a_0 + a_1 cos(1 \cdot \omega_0 t - \frac{\pi}{2}) + a_3 cos(3 \cdot \omega_0 t - \frac{\pi}{2}) + a_5 cos(5 \cdot \omega_0 t - \frac{\pi}{2}) + a_7 cos(7 \cdot \omega_0 t - \frac{\pi}{2}) + \ldots$$

With: $a_0 = 1$ and $a_n = \frac{4}{\pi n}$ $n = 1, 3, \ldots$



A. Draw the frequency spectrum of the square wave *x(t):*



B. To obtain a sine wave of frequency f = 300 Hz and 0 V DC offset, you need to properly filter the square wave signal.

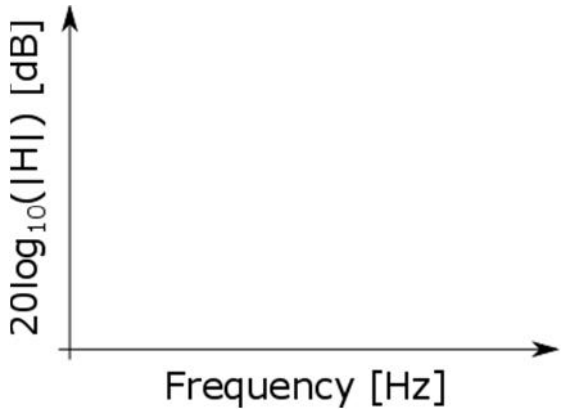
Name the two 1st-order filters that you would use to obtain the desired output

Filter 1: _____

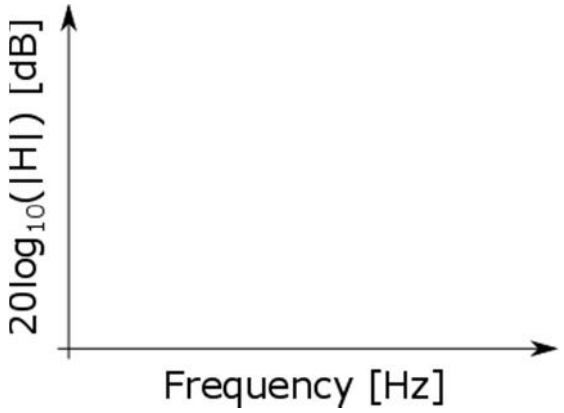
Filter 2: _____

For each filter, sketch the Bode plot (label the passband gains, the corner frequencies and the gains at the corner frequencies)

Filter 1:



Filter 2:



C. Draw the circuit schematic of the filters chosen in the previous section

Filter 1:

Filter 2:

D. Design the filters. For each filter, find the values of necessary R, C and/or L.
Show your work and don’t forget the units.

Filter 1:

R: _____

C: _____

L: _____

Filter 2:

R: _____

C: _____

L: _____