DST Homework #1:

Please submit your assignment to Brightspace as a .zip file containing the following:

- a jupyter notebook containing your solution to the programming question
- the original “bad_audio.wav” file
- your solutions to the theory section as a photo, pdf or txt file

Programming:

It is your first day on the job at a recording studio and you spend all day recording some great songs but. . . OH NO! you realize that you forgot to turn off both the sine wave generator AND the high frequency noise generator in the recording room. You’ll need to quickly write a Python script to remove these problems from “bad_audio.wav” before your boss notices.

- Create a 2^{nd} order peaking filter and set its cutoff, bandwidth and gain to deal with the sine tone (573 Hz)

- Create a 2^{nd} order high shelf filter and set its cutoff and gain to deal with the high frequency noise band (>14kHz)

NOTES:

- You likely won’t be able to perfectly remove these tones but deal with them as much as you can without impacting the rest of the audio too much.
- Refer to the Equalizers section (starting p.61) of the attached “dafx)filters.pdf” for some filter structures.
  - Feel free to adapt their matlab implementation for your 2^{nd} order peaking filter
  - The PDF does not have a full implementation of the 2^{nd} order shelving filter so you’ll have to design it yourself. It would be easiest to use the coefficients in Table 2.3 to implement it as a canonical 2^{nd} order IIR filter

Theory:

Consider the difference equation for the recursive integrator:

$$y[n] = x[n] + y[n-1]$$

1. Find its transfer function $Y(z)/X(z)$

2. How might this filter develop trouble if you were to implement it?

3. Draw a signal flow graph of the filter.