

# ECE 351 DSP: Practice Problems 1

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- 1) Find  $x[n]$  when  $X(z) = \frac{z^{-1}-3z^{-2}+3z^{-3}}{(1-z^{-1})(1-5z^{-1})^2}$ .
- 2) Find the  $\alpha$  required for a low pass filter with cutoff frequency  $\frac{\pi}{6}$ . Draw the implementation of this filter using only simple elements like delay, additions, and scaling.

[**Hint:** The filter is an IIR, so it needs to be implemented using its difference equation.]

- 3) Consider the bandpass filter given by  $H(z) = \frac{0.2(1-z^{-2})}{2-1.8\sqrt{3}z^{-1}+1.6z^{-2}}$ .
  - a) What is its 3-dB bandwidth?
  - b) Suppose we design a comb filter  $G(z) = H(z^4)$ . How many peaks does  $|G(\omega)|$  have in the fundamental period, i.e., between  $-\pi$  and  $\pi$ ? Also, compute the  $\omega$ s where these peaks are located.