Exercises Week 7

DSP

Left-over from last week:

1. A causal LTI system has the property that if the input signal is

$$x[n] = \left(\frac{1}{3}\right)^n u[n] - \frac{1}{4}\left(\frac{1}{3}\right)^n u[n-1],$$

then the output signal is

$$y[n] = \left(\frac{1}{4}\right)^n u[n]$$

   a. Find the system function H(z), draw the pole-zero diagram
   b. Compute the impulse response $h[n]$ of the system
   c. Find the difference equation of the system
   d. Characterize the system with respect to:
      - length of impulse response (FIR or IIR)
      - implementation (recursive or non-recursive)
      - stability

2. Find the DTFT of the signal $\{1, 1, 1, 0, 0, ...\}$, considering it is surrounded with infinitely-long zeros on both sides

   - write the expression of $|X(\omega)|$ and $\angle X(\omega)$
   - what is the signal's spectrum (modulus and phase) at frequency $f = \frac{1}{2}$?