

Exercises Week 8

DSP

1. Consider the system with the following difference equation:

$$y[n] = -0.1y[n-1] + 0.2y[n-2] + x[n] + x[n-1]$$

- a. Find the system function $H(z)$, draw the pole-zero diagram, and specify if the system is stable
 - b. Compute the impulse response $h[n]$ of the system
 - c. Compute the response of the system to the unit step $x[n] = u[n]$
 - d. Compute the response of the system to the input signal $x[n] = \left(\frac{1}{3}\right)^n u[n]$
2. 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