

Exercises Week 11

DSP

1. Which of the following filters has a linear-phase?

- a. $H(z) = 7 + 3z^{-1} + z^{-2} + 7z^{-3} + 3z^{-4} + z^{-5}$
- b. $H(z) = \frac{1+2z^{-1}+z^{-2}}{1-2z^{-1}+z^{-2}}$
- c. $H(z) = 1 + 2z^{-1} + z^{-2}$
- d. $H(z) = 1 - 2z^{-1} + z^{-2}$
- e. $H(z) = 1 - 2z^{-1} - 2z^{-2} + z^{-3}$
- f. $H(z) = 1 + 2z^{-1} + 7z^{-2} - 2z^{-2} - z^{-3}$
- g. $H(z) = 1 - z^{-1}$
- h. $H(z) = 1 - z^{-2}$

2. Consider the causal system with the following equation:

$$y[n] - 0.7y[n-1] + 0.2y[n-2] = 2x[n] - x[n-2]$$

- a. Draw the pole-zero diagram and indicate the Region Of Convergence
- b. Find the system function $H(z)$ and characterize the system with respect to:
 - stability
 - length of impulse response
 - implementation (recursive or not)
- c. Find the impulse response
- d. Find the output signal $y[n]$ if the input signal is the unit step