PROBLEM: 5.1
For each of the following systems (specified by either an $H(z)$ or a difference equation), determine all the poles and zeros and make a pole-zero plot.

(a) $S_a$: $y[n] = 5x[n] - 10x[n - 2] + 5x[n - 4]$

(b) $S_b$: $H(z) = \frac{3 + 3z^{-1} + 3^{-2}}{1 + 0.6z^{-1} + 0.81z^{-2}}$

(c) $S_c$: $y[n] = -0.81y[n - 2] + 4x[n - 1] - 5x[n - 2]$
For each of the pole-zero plots (#1, #2, #3 and #4), determine which one of the following systems (specified by either an $H(z)$ or a difference equation) matches the pole-zero plot.

$S_1:$ \[ y[n] = 0.77y[n - 1] + x[n] + x[n - 1] \]

$S_2:$ \[ y[n] = 0.77y[n - 1] + 0.77x[n] - x[n - 1] \]

$S_3:$ \[ H(z) = \frac{1 - z^{-1}}{1 + 0.77z^{-1}} \]

$S_4:$ \[ H(z) = 1 - z^{-1} + z^{-2} - z^{-3} + z^{-4} - z^{-5} \]

$S_5:$ \[ y[n] = \sum_{k=0}^{7} x[n - k] \]

$S_6:$ \[ H(z) = 3 - 3z^{-1} \]

PROBLEM: 5.3
Match the frequency responses (#A–#E) with the correct pole-zero plots (#1 – #6). Poles are denoted with an x and zeros with an o.
PROBLEM: 5.4
Match the impulses responses (#A–#E) with the correct pole-zero plots (#1 – #6). Poles are denoted with an \( x \) and zeros with an \( o \).
PROBLEM: 5.5

Use the most convenient form of these system functions to determine the corresponding impulse responses of the following:

(a) \( H_a(z) = \frac{1 + z^{-1}}{1 + 0.5z^{-1}} = \frac{1}{1 + 0.5z^{-1}} + \frac{z^{-1}}{1 + 0.5z^{-1}} = 2 - \frac{1}{1 + 0.5z^{-1}}. \)

(b) \( H_b(z) = \frac{2 - 0.9z^{-1}}{1 - 0.9z^{-1} + 0.81z^{-2}} = \frac{1}{1 - 0.9e^{j\pi/3}z^{-1}} + \frac{1}{1 - 0.9e^{-j\pi/3}z^{-1}}. \)

(c) \( H_c(z) = \frac{1 + z^{-2}}{1 + 0.25z^{-2}} = 4 - \frac{1.5}{1 - 0.5e^{j\pi/2}z^{-1}} - \frac{1.5}{1 - 0.5e^{-j\pi/2}z^{-1}}. \)

(d) \( H_d(z) = 1 + z^{-1} + z^{-2} + z^{-3} = \frac{1 - z^{-4}}{1 - z^{-1}}. \)