Transfer Functions and System Response:

1. Find the transfer functions of the following discrete-time systems:

a) $y[n] + 0.5y[n-1] = 2x[n]$

b) $y[n] + 2y[n-1] - y[n-2] = 2x[n] - x[n-1] + 2x[n-2]$

c) $y[n] + y[n-2] = 2x[n] - x[n-1]$

d) $y[n] = x[n] - 2x[n-1] + x[n-2]$

e) y[n] + y[n-1] + 0.25y[n-2] = x[n] - x[n-1]

2. Plot the poles and zeros of the following transfer functions. Determine the stability.

a) $H(z) = \frac{(z-0.5)}{z+0.75}$

b) $H(z) = \frac{(z-0.5)}{z-0.75}$

c) $H(z) = \frac{(z-0.5)}{z+2}$

d) $H(z) = \frac{z^2+1}{z^2-0.25}$

e) $H(z) = \frac{z(z-1)}{z^2-0.5z-0.5}$

f) $H(z) = \frac{z^2+1}{z^2-1.5z-1}$

g) $H(z) = \frac{(z-0.5)(z+0.5)}{z^2+z+0.74}$

h) $H(z) = \frac{(z-0.5)(z+0.5)}{z^2+z+4.25}$

3. Give the general form of the transient response for each of the transfer functions given in Problem 2.

4. Give the general form of the transient response for each of the transfer functions given below.

a) $H(z) = \frac{(z-0.5)(z-0.1)}{(z+0.75)^2}$

b) $H(z) = \frac{(z-0.5)(z+0.5)(z+1)}{(z^2+z+0.74)(z-0.75)}$

c) $H(z) = \frac{(z-0.5)^2(z+0.5)(z+1)^2}{(z^2+z+0.74)^2(z-0.75)}$

5. Determine the unit step response for each of the transfer functions given in Problem 2.

6. Given the following system:

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

a) Find the transfer function.
b) Give the impulse response.
c) Determine the stability.
d) Sketch the frequency response and determine the type of filter.