

AUSTRALIAN NATIONAL UNIVERSITY
Department of Engineering

ENGN6612/4612 Digital Signal Processing and Control
Problem Set #4 Difference Equations

Q1

Find the system transfer function $H(z) = Y(z)/X(z)$ when the LTI system is described by the following difference equation:

(a) $y[n] - \frac{1}{2}y[n-1] = x[n] + \frac{1}{3}x[n-1]$

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

(c) $y[n] + \frac{1}{4}y[n-1] - \frac{1}{8}y[n-2] = 3x[n-1] - x[n-2]$ (challenge problem)

Also draw the pole-zero plot for $H(z)$ and determine if the system is stable or unstable.

Q2

Consider a discrete time LTI system with following impulse response $h[n]$ and input function $x[n]$:

(a)

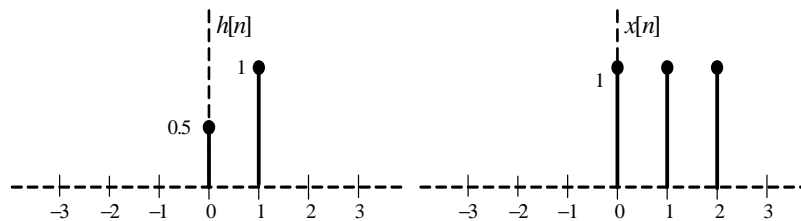


Figure 1: Figure Q2(a)

(b)

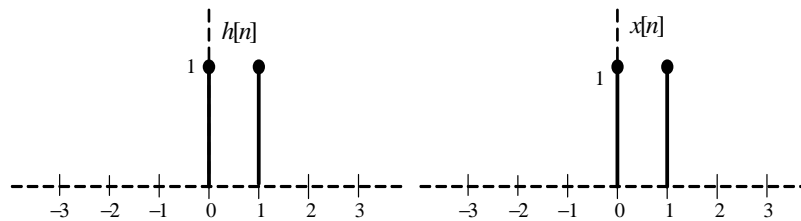


Figure 2: Figure Q2(b)

(c) $x[n] = \delta[n] - \delta[n-1]$ and

$h[n] = \delta[n] + \delta[n-1] + 0.5\delta[n-2] + 0.5\delta[n-3]$ (challenge problem).

Determine the output $y[n]$ using both (i) graphical discrete time convolution and (ii) z-transform method.