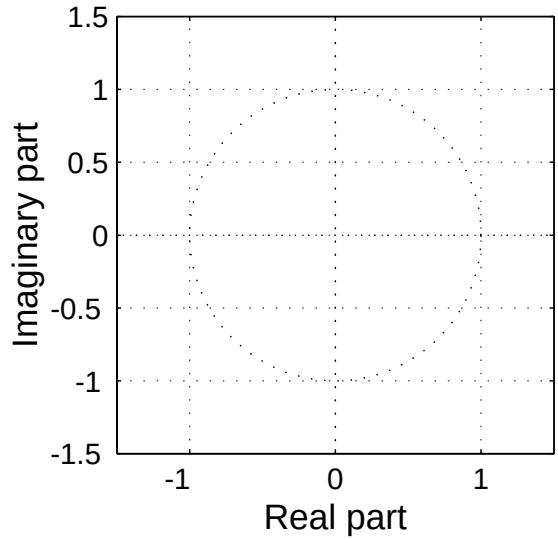
PROBLEM:

A discrete-time system is defined by the following system function:

$$H(z) = \frac{2 - 2z^{-1}}{1 + 0.64z^{-2}}$$

(a) Write down the difference equation that is satisfied by the input $x[n]$ and output $y[n]$ of the system.

(b) Determine *all* the poles and zeros of $H(z)$ and plot them in the z-plane.



(c) Fill in numbers for the vectors `bb` and `aa` in the following MATLAB computation of the frequency response of the system:

```
bb=[                    ];     aa=[                    ];

omegahat=-pi:pi/200:pi;
H=freqz(bb,aa,omegahat);
```

McClellan, Schafer and Yoder, *Signal Processing First*, ISBN 0-13-065562-7.
Prentice Hall, Upper Saddle River, NJ 07458.

SOLUTION

A discrete-time system is defined by the following system function:

$$H(z) = \frac{2 - 2z^{-1}}{1 + 0.64z^{-2}}$$

(a) Write down the difference equation that is satisfied by the input $x[n]$ and output $y[n]$ of the system.

"By inspection"

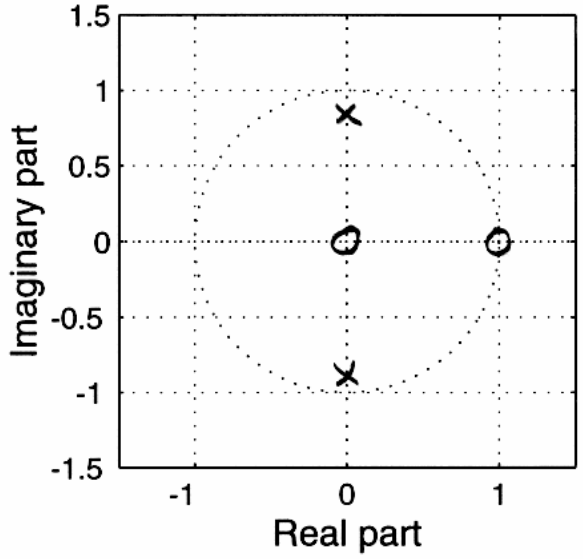
$$y[n] = -0.64\,y[n-2] + 2x[n] - 2x[n-1]$$

(b) Determine *all* the poles and zeros of $H(z)$ and plot them in the z-plane.

$$H(z) = \frac{2z(z-1)}{z^2 + 0.64} = \frac{2z(z-1)}{(z - j0.8)(z + j0.8)}$$

Poles: $z = \pm j0.8$

Zeros: $z = 0, 1$



(c) Fill in numbers for the vectors `bb` and `aa` in the following MATLAB computation of the frequency response of the system:

```
bb=[ 2, -2 ];    aa=[ 1, 0, 0.64];

omegahat=-pi:pi/200:pi;
H=freqz(bb,aa,omegahat);
```