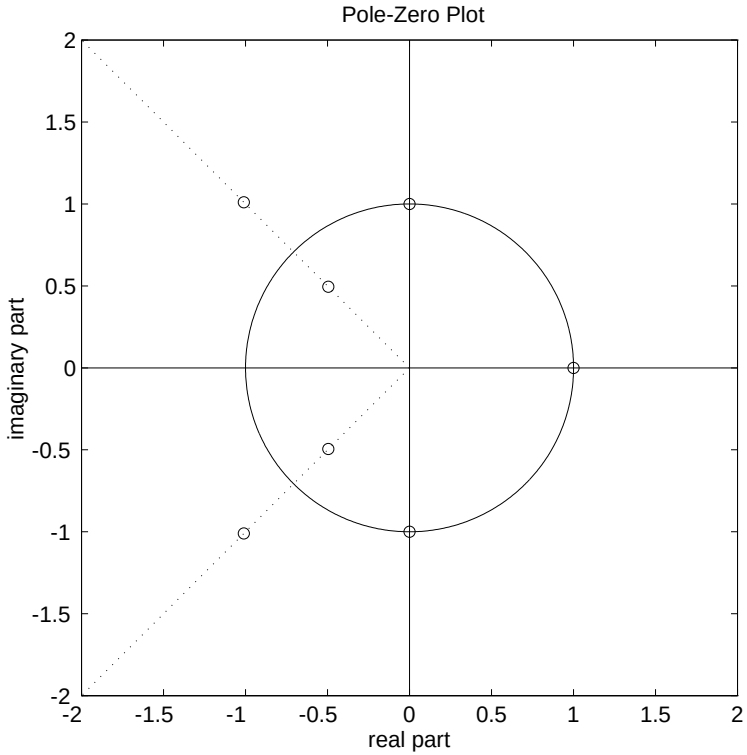
PROBLEM:



The above figure gives the z-plane plot of the zeros of the system function $H(z)$ of a LTI discrete-time system. The input of the system is the sequence $x[n]$ and the output is $y[n]$.

(a) If the input is of the form

$$x[n] = Ae^{j\phi}e^{j\hat{\omega}n}$$

for what values of $\hat{\omega}$ will the output be zero for all n? $\hat{\omega} =$ _____

(b) If it is known that the input $x[n]$ and output $y[n]$ are related by a difference equation of the form

$$y[n] = \sum_{k=0}^{M} b_k x[n-k]$$

How many poles does $H(z)$ have? _____ Mark their locations in the z-plane above.

(c) From just looking at the pole-zero plot above, sketch the magnitude of the frequency response $|H(e^{j\hat{\omega}})|$ for $-\pi < \hat{\omega} < \pi$. Be sure to label your plot with as much information as possible.

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

SOLUTION

(a) From the zero plot $y[n] = 0$ when $\hat{\omega} = 0, \pm \frac{\pi}{2}$.

(b) Since there are 7 zeros, $M = 7$ and we have $H(z) = \sum_{k=0}^{7} b_k z^{-k}$ with 7 poles at $z = 0$

(c)