EE502 Pre-Test

The results of this test will NOT be used for your course grade. This is for my assessment of the class syllabus only.

Problem #1:

A discrete-time system is described by the difference equation:

$$y[n] = 5x[n] + 2x[n-2]$$

where $y[n]$ is the system output and $x[n]$ is the system input.

(1) Sketch the unit sample response of this system. Is it FIR or IIR?

(2) What is the z-transform of H(z) = Y(z)/X(z) ?

(3) What is the DC gain of this system?

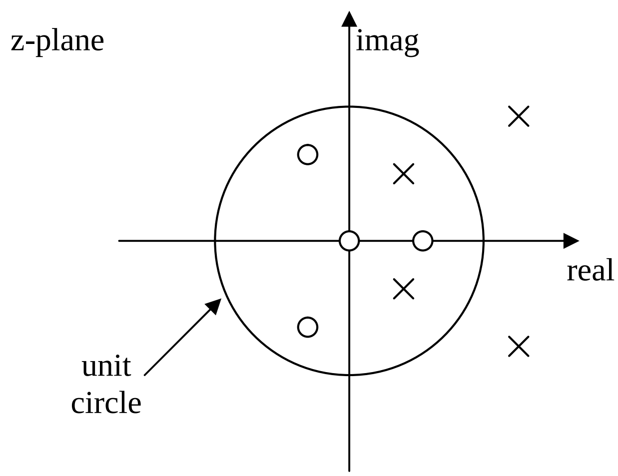
(4) Identify <u>all</u> poles and zeros of the system function H(z), then sketch the pole and zero locations on a z-plane diagram.

Problem #2:

A discrete-time signal is known to be a <u>real</u> sequence with <u>even</u> symmetry around time index zero. What, if anything, does this imply about the Fourier transform of this sequence?

Problem #3:

The poles and zeros of a discrete-time system are shown in the figure below.



(1) Is it possible to implement this system in a <u>stable</u> and <u>causal</u> form? Why or why not?

(2) Can this system have a stable and causal <u>inverse</u> system? Why or why not?

Problem #4:

(1) What is the z-transform expression for the sequence $x[n] = a^n u[n-5]$?

Recall that the z-transform of the sequence $a^n u[n]$ (with $\lvert a \rvert < 1$) is given by $\dfrac{1}{1 - az^{-1}}$.   Also, recall that the z-transform of $x[n - n_d]$ (with n_d an integer) is given by $z^{-n_d} X(z)$.

(2) What is the corresponding Fourier transform expression, based on the z-transform you found in part (1)?

Problem #5:

An analog sinusoid has a frequency of **5kHz**. This signal is sampled at an **8kHz** sample rate without an analog anti-aliasing filter, then the resulting digital signal is converted at an **8kHz** sample rate back to analog, but with an ideal analog lowpass reconstruction filter. Describe the characteristics of the resulting analog signal. Explain your reasoning.