ECE 360 Practice Final Exam

1. Determine whether the following statements are true or false.

a) The system described by $y[n] = \cos(n\pi x[n])$ is time-invariant.

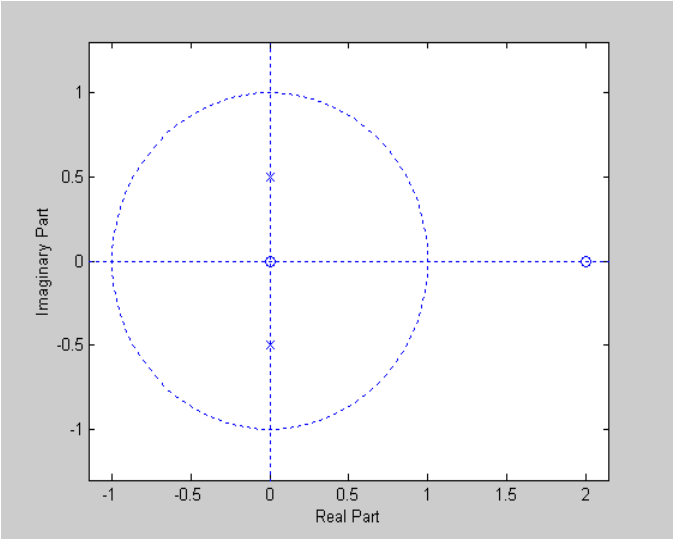
b) The period of $x[n] = \sin(\frac{4n\pi}{3})$ is $N = 6$.

c) Interpolation by a factor N implies increasing the sampling rate by N.

d) The impulse response of a LTI system is the zero-state response to unit step function.

e) Stability for any DT signal requires that the poles of the z-transform lie inside the unit circle.

2. Consider the causal DT-LTI system whose transfer function has the pole-zero plot shown below:



a) Determine the system transfer function and the impulse response given that $H(z)|_{z=1} = -2$.
b) Is the system stable? Justify your answer.
c) Write the difference equation corresponding to this system.
d) Find the output of the system if the input is $x[n] = (0.5)^n u[n]$

3. Consider the periodic signal $x(t) = \sum_{k=-\infty}^{\infty} tri(t-2k)$.

a) Find its Fourier transform $X(f)$.

b) Find the Fourier series coefficients $X[k]$.

c) Assume that this signal is passed through a filter with frequency response

$$H(f) = \begin{cases} 2, & -1 \le f \le 1 \\ 0, & otherwise \end{cases}$$

sketch the output $Y(f)$.

d) Find the output in the time-domain, $y(t)$.

4. Consider the continuous time signal, $x(t) = sinc^2(t) + \cos(4\pi t)$.

a) What is the Nyquist rate of sampling for this signal?

b) Write $x[n]$ if this signal is sampled at 8Hz.

c) Sketch the spectrum of the discrete-time signal.

d) Suggest a method for recovering the spectrum of the continuous time signal from the spectrum of the discrete-time signal.
Hint: This will require filtering of the spectrum in part c. Specify the type of the filter, the cutoff frequencies and the appropriate magnitude and phase responses.