DSP Practice Test #1.E

Name: _____ Start Time: _____

Problem 1:

For each fo the following systems below specify whether or not the system is (1) Linear, (20 time-invariant, (3) causal, (4) stable, or there is not enough information. The system input is $x[n]$ and the output is $y[n]$

A) $y[n] = T\{x[n]\} = x[2n]$

Linear? Y/N	Time-Invariant? Y/N	Causal? Y/N	Stable? Y/N

B) $y[n] = T\{x[n] + x[n-1]\}$

Time-Invariant? Y/N	Time-Invariant? Y/N	Causal? Y/N	Stable? Y/N

C) $y[n] = T\{x[n]\} = \left(x\left[-|n|\right]\right)^2$

Linear? Y/N	Time-Invariant? Y/N	Causal? Y/N	Stable? Y/N

Problem 2:

Let a causal LTI system be described by the following z-transform: $H(z) = \dfrac{1 + \frac{1}{2}z^{-1}}{1 - 2z^{-1}}$

A) Determine the frequency response of the system $H\left(e^{j\omega}\right)$

B) Determine the difference equation relating the input and the output of the system

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C) Plot the pole-zero plot of system $H(z)$

D) What is the ROC for this causal system?

E) Is the system stable?

F) Is the system causal?

Problem 3:

Given an input random signal, $x[n]$, that is white with zero mean and unit variance, that is put into a system that is described by the following difference equation:
$y[n] = x[n+1] + x[n-1]$

A) Determine the impulse response $h[n]$ of the system

B) Determine the transfer function $H\left(e^{j\omega}\right)$ of the system

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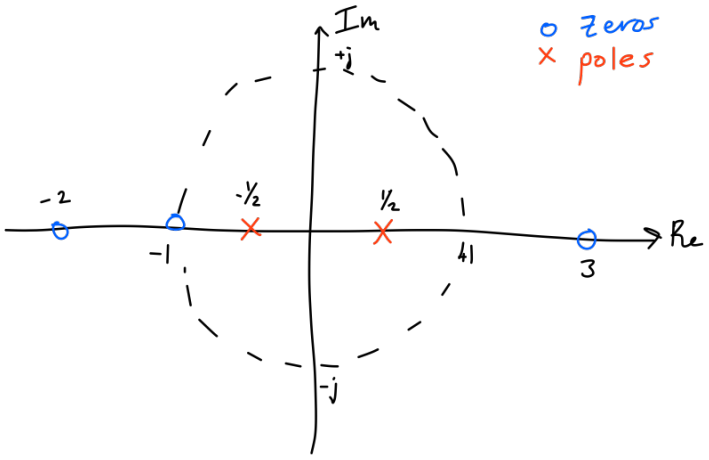
C) What is the autocorrelation of the input signal, $x[n]$, $\phi_{xx}[m]$?

D) What is the power spectral density of the input signal, $S_{xx}(\omega)$?

E) What is the power spectral density of the output signal, $S_{yy}(\omega)$?

Problem 4:

Given the following pole plot for the causal system $H(z)$



A) Determine an equation for $H(z)$ that corresponds to the pole-zero plot.

B) Is the system stable?

C) Given the input $x[n] = -30 + e^{j\pi/3n} + (-1)^n$, what is the output $y[n]$?