DSP Practice Test #1.C

Name: _____ Start Time: _____

Problem 1:

For the system with the input-output relation: $y[n] = T\{x[n]\} = x[n]\sum_{k=0}^{\infty}\left(\delta[n-k]\right)$

determine the following properties of the system

A) The system is Linear/ Nonlinear / Not Enough Info

B) The system is Causal / Noncausal / Not Enough Info

C) The system is Time-variant / Time-Invariant / Not Enough Info

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D) The system is Stable / Unstable / Not Enough Info

Problem 2:

An LTI system has an impulse response defined by:

$$h[n] = \delta[n] + \delta[n-1] + \delta[n-2] + \delta[n-3] - 2\delta[n-4] - 2\delta[n-5].$$

Determine and sketch the output $y[n]$ when the input is $x[n] = u[n]$

Problem 3:

Consider an LTI system defined by the difference equation

$$y[n] = -2x[n] + 4x[n-1] - 2x[n-2]$$

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

B) Determine the frequency response of this system. Express your answer in the form $H\left(e^{j\omega}\right) = A\left(e^{j\omega}\right) e^{j\omega n_d}$,

where $A\left(e^{j\omega}\right)$ is a real function of ω, and n_d is the delay. Explicitly specify $A\left(e^{j\omega}\right)$ and the delay n_d of this system.

C) Suppose that the input to the system is $x[n] = 1 + e^{j0.5\pi n}$, $n \in \mathbb{Z}$.

Use the frequency response function to determine the corresponding output $y[n]$. Simplify your answer as much as possible.

Problem 4:

Consider a random signal $x[n] = s[n] + e[n]$, where $s[n]$ and $e[n]$are independent, zero-mean stationary random signals with autocorrelation functions $\phi_{ss}[m]$and $\phi_{ee}[m]$, respectively.

A) Determine the mean of $x[n]$, μ_x

B) Determine the autocorrelation function $\phi_{xx}[m]$, in terms of $\phi_{ss}[m]$ and $\phi_{ee}[m]$. Simplify your expression as much as possible.