ECE 310 Midterm 1 Worksheet

By HKN Members

1 Ethan's Remix

Pramod has written a song, and wants Ethan to make a remix of it. To do this, Ethan creates a system described by the following LCCDE:

$\frac{1}{4}y[n-2] - \frac{4}{9}y[n] = \frac{4}{3}x[n-1] + \frac{8}{9}x[n]$

After running it on the song, is this system guaranteed to not cause Pramod's song to become unbounded?

2 V's MP

V has measured that his productivity on his ECE 411 MP is described by the system $\frac{1}{n}x[n]$, where n is the number of days until the MP is due, and $x[n]$ is how much work he accomplishes as a function of the number of days since the MP was assigned. Would delaying V's starting day have an effect on how much work he will accomplish in k days?

3 Proving LTIC (is fake)

Given the 5 systems below, prove or disprove that each one is LTIC.

1. $y[n] = \sin(2024n)$
2. $y[n] - y[n-2] = x[n-1] + x[n+2]$
3. $y[n] = \cos(x[n])$
4. $y[n] = n^2x[n] + x[n-2]$
5. $y[n] = \frac{1}{5}x[|n|]$

4 Insider Trading?

Shomik plays golf with Ethan after Ethan worked at a trading company. Ethan tells Shomik to construct a system over Ethan's company stock average every

day as a way of calculating how much to buy of it. This system is described by the impulse response:

$\{9, 4, \underset{\uparrow}{2}, 0, 2, 4, 6\}$

It is illegal to make trades based in not publicly known (future) information. After implementing this system successfully with Ethan's help, will the SEC arrest them?

5 Convoluted Convolving

Use your favorite method of convolution to convolve these two signals:

$$x[n] = \{\underset{\uparrow}{2}, 0, 2, 4\} \qquad h[n] = \{-1, \underset{\uparrow}{3}, 2, 0\}$$

6 Catching These Z-transforms

6.1 Inverse Z-Transforms

Take the Inverse Z-transform of these signals and state the ROC. Determine whether each system is BIBO stable or not as well.

$\frac{1}{1-z^{-1}}$, Right Sided

$\frac{1}{1-z^{-1}}$, Left Sided

$\frac{1+z^{-1}}{z^{-2}+z^{-1}+\frac{1}{4}}$, Right Sided

6.2 Z-Transform

Find the Z-Transform of the following systems in terms of $X(z)$:

$\frac{n}{4}x[n-4]$

$\frac{3}{4}x[n+5] + x[n]$

Find the Z-Transform of the following equations:

$n^2u[n-1] + (\frac{1}{2})^n u[n+1]$

$u[n+1] * u[n-1]$