Assignment 1

Sachin Karumanchi - AI20BTECH11013

Download all python codes from

https://github.com/sachinkarumanchi/EE3900/blob/main/assignment_1.pdf

and latex codes from

https://github.com/sachinkarumanchi/EE3900/blob/main/assignment_1.tex

Problem

(3.8) The system function of a casual Linear time Invariant System is

$$H(z) = \frac{1 - z^{-1}}{1 + \frac{3}{4}z^{-1}} \tag{0.0.1}$$

The input of the system is

$$x[n] = \left(\frac{1}{3}\right)^n u[n] + u[-n-1] \tag{0.0.2}$$

(a) Find impulse response of the system,$h[n]$
(c) Is the system stable?,That is $h[n]$, is absolutely summable?

Solution

(a) To find the impulse response we need to find the inverse $\mathcal{Z}$ transform of $H(z)$

$$H(z) = \frac{1 - z^{-1}}{1 + \frac{3}{4}z^{-1}} \tag{0.0.3}$$

$$= \frac{1}{1 + \frac{3}{4}z^{-1}} - \frac{z^{-1}}{1 + \frac{3}{4}z^{-1}} \tag{0.0.4}$$

Now, apply Inverse $\mathcal{Z}$ transform on both sides
We know the Inverse $\mathcal{Z}$ transform of $\frac{1}{1-az^{-1}}$ is $a^n u[n]$
By using Time shifting property and Inverse $\mathcal{Z}$ transform we obtain the impulse response

$$h[n] = \left(\frac{-3}{4}\right)^n u[n] - \left(\frac{-3}{4}\right)^{n-1} u[n-1] \tag{0.0.5}$$

(b) For the system to be stable $h[n]$ must be absolutely summable
$h[n]$ is absolutely summable in ROC of $H(z)$ Therefore, $H(z)$ is stable for $|z|>3/4$