Assignment 1

EE3900: Linear Systems and Signal Processing

Indian Institute of Technology Hyderabad

Shreyas wankhede
AI21BTECH11028

23 Sept 2022

Discrete-time Signal Processing

Oppenheim and Schafer

Problem 3.10 (a): Find Z tranform of $\frac{1}{2}^{n} u[n]$, also find the region of convergence.

Solution: The Z -transform of x[n] is defined as ,

$$X[n] = \sum_{0}^{\infty} x[n] z^{-n} \tag{1}$$

$$= \sum_{0}^{\infty} \frac{1}{2}^{n} z^{-n} \tag{2}$$

$$= \sum_{0}^{\infty} \frac{1}{2z}^{n} \tag{3}$$

$$= \frac{1}{1 - \frac{1}{2z}} \tag{4}$$

$$= \frac{1}{1 - \frac{z^{-1}}{2}} \tag{5}$$

The region of convergence is $|z| > \frac{1}{2}$