

Digital Signal Processing

EE3900: Linear Systems and Signal Processing

Indian Institute of Technology Hyderabad

Assignment-1

Lokesh Badisa
AI21BTECH11005

22 Aug 2022

Abstract—This document contains solution to Assignment-1 [Question 3.1(f) from Discrete-Time Signal Processing by Alan V. Oppenheim and Ronald W. Schafer]

1. Z-TRANSFORM

1 [Question 3.1(f) from Discrete-Time Signal Processing by Alan V. Oppenheim] : Determine the z -transform and region of convergence for the following sequence:

$$\delta[n+1] \quad (1.1)$$

Solution: Given

$$x(n) = \delta[n+1] \quad (1.2)$$

$$\delta[n-a] = \begin{cases} 1 & n = a \\ 0 & \text{otherwise} \end{cases} \quad (1.3)$$

Given is Unit Sample Sequence shifted to -1.

Fig. 1. Region of Convergence

Fig. 1. $x(n)$

So,

$$\delta[n+1] = \begin{cases} 1 & n = -1 \\ 0 & \text{otherwise} \end{cases} \quad (1.4)$$

$$X(z) = \sum_{k=-\infty}^{\infty} x(k)z^{-k} \quad (1.5)$$

$$= -z \quad (1.6)$$

For $X(z)$ to converge, $|X(z)| < \infty$.

Region of convergence:

$$|z| < \infty \quad (1.7)$$