Digital Signal Processing

EE3900: Linear Systems and Signal Processing

Indian Institute of Technology Hyderabad

Assignment-1

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***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:

$$\delta\left[n+1\right] \tag{1.1}$$

Solution: Given

$$x(n) = \delta\left[n+1\right] \tag{1.2}$$

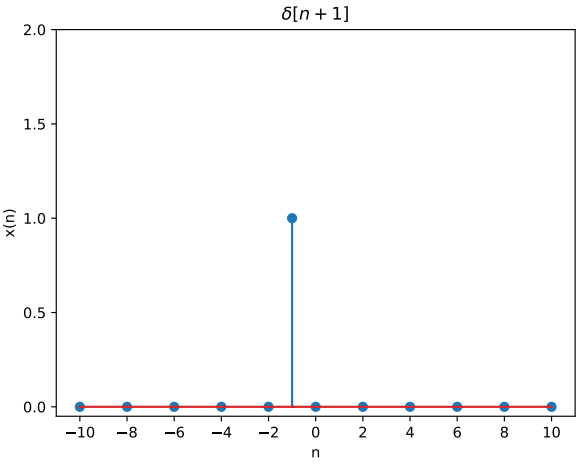

Fig. 1. $x(n)$

$$\delta\left[n-a\right] = \begin{cases} 1 & n = a \\ 0 & otherwise \end{cases} \tag{1.3}$$

So,

$$\delta\left[n+1\right] = \begin{cases} 1 & n = -1 \\ 0 & otherwise \end{cases} \tag{1.4}$$

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

$$= -z \tag{1.6}$$

For $X(z)$ to converge, $|X(z)| < \infty$.
Region of convergence:

$$|z| < \infty \tag{1.7}$$

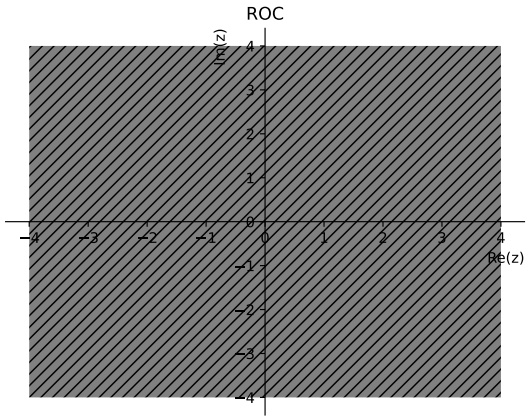

Fig. 1. Region of Convergence