Digital Signal Processing
EE3900: Linear Systems and Signal Processing
Indian Institute of Technology Hyderabad

Assignment-1

Lokesh Badisa
AI21BTECH11005

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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:

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

Solution: Given

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

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

Given is Unit Sample Sequence shifted to -1. So,

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

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

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

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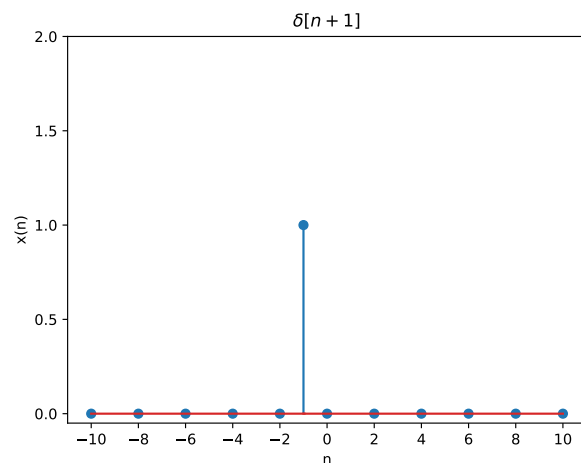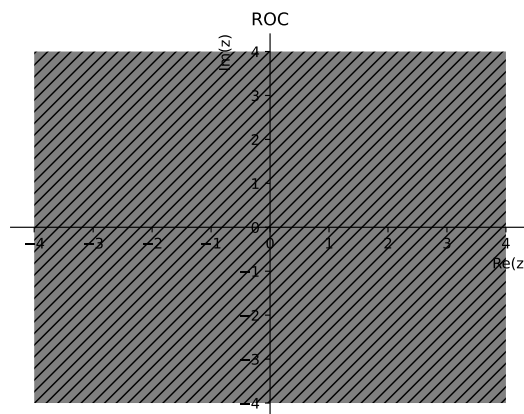Region of convergence:

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

Fig. 1. $x(n)$

Fig. 1. Region of Convergence