NCERT Discrete - 11.9.1.2

EE23BTECH11049 - Praful Kesavadas*

Question : 11.9.1.2:
Write the first five terms of the sequence whose n^{th} terms $x(n) = \frac{n}{n+1}$
Solution:

Term	Value	Description
$x(n)$	$\frac{n+1}{n+2}u(n)$	General term

TABLE 0
Input Parameters

Here, Z-transform

$$X(z) = \sum_{n=-\infty}^{\infty} x(n).z^{-n} \tag{1}$$

$$= \sum_{n=-\infty}^{\infty} \frac{n+1}{n+2}.u(n).z^{-n} \tag{2}$$

$$= \sum_{n=-\infty}^{\infty} u(n).z^{-n} - \frac{1}{n+2}u(n).z^{-n} \tag{3}$$

Now,

$$u(n) \overset{Z}{\leftrightarrow} \frac{1}{1-z^{-1}}, \quad |z| > 1 \tag{4}$$

$$\sum_{n=-\infty}^{\infty} -\frac{1}{n+2}u(n).z^{-n} = -\frac{1}{2} - \frac{z^{-1}}{3} - \frac{z^{-2}}{4}...$$

$$= z^2[-z^{-1} - \frac{z^{-2}}{2} - \frac{z^{-3}}{3}...] + z$$

$$= z + z^2\log(1-z^{-1})$$

$$\frac{-1}{n+2}.u(n) \overset{Z}{\leftrightarrow} z + z^2\log(1-z^{-1}), \quad |z| > 1 \tag{5}$$

$$X(z) = \frac{1}{1-z^{-1}} + z + z^2\log(1-z^{-1}), \quad |z| > 1 \tag{6}$$

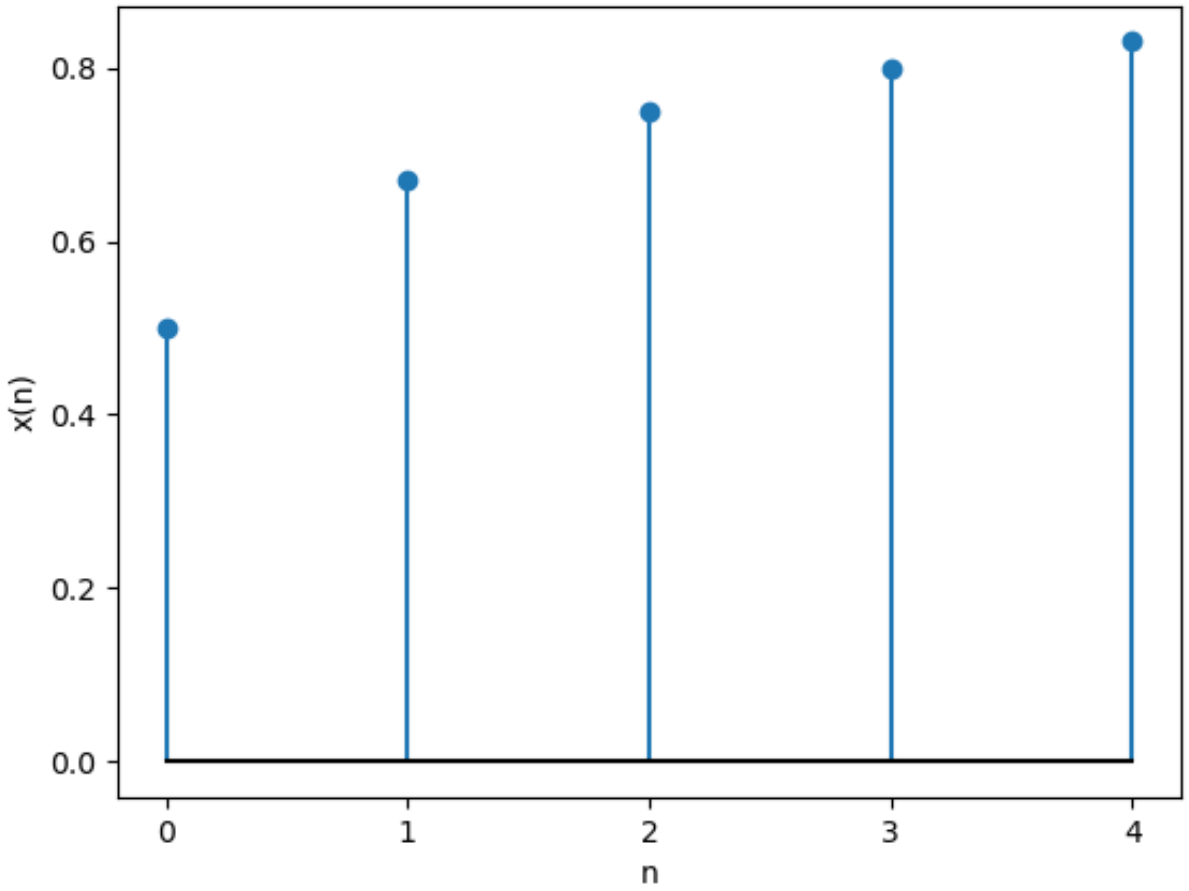

Fig. 0. Stem plot for x(n)