EE23BTECH11047 - Deepakreddy P

Exercise 9.1

4 Write the first five terms of the sequence whose nth term is $\frac{2n-3}{6}$ and obtain the Z transform of the series
Solution:

$$x\left(0\right)=\frac{2\times0-3}{6}=\frac{-1}{2} \tag{1}$$
$$x\left(1\right)=\frac{2\times1-3}{6}=\frac{-1}{6} \tag{2}$$
$$x\left(2\right)=\frac{2\times2-3}{6}=\frac{1}{6} \tag{3}$$
$$x\left(3\right)=\frac{2\times3-3}{6}=\frac{1}{2} \tag{4}$$
$$x\left(4\right)=\frac{2\times4-3}{6}=\frac{5}{6} \tag{5}$$
$$x\left(n\right)=\frac{2n-3}{6}\left(u\left(n\right)\right) \tag{6}$$

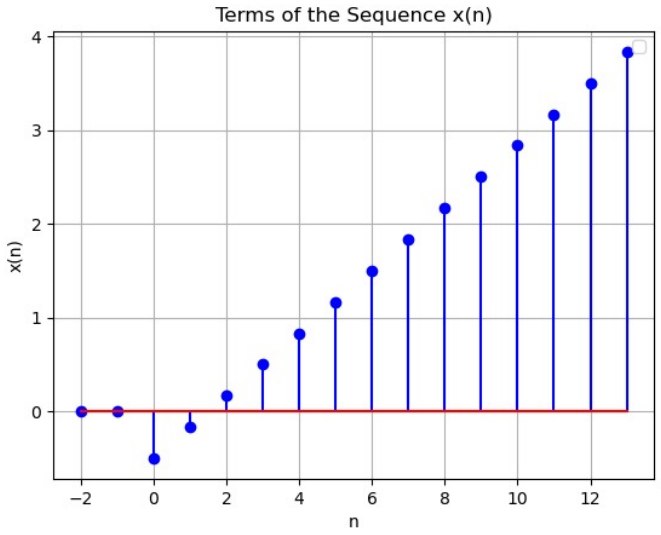

Fig. 1. Plot of x(n) vs n

$$x\left(n\right)\overset{\mathcal{Z}}{\longleftrightarrow}X\left(z\right) \tag{7}$$

$$X(Z)=\sum_{n=-\infty}^{\infty}x(n)Z^{-n} \tag{8}$$
$$=\sum_{n=-\infty}^{\infty}(\frac{n}{3}-\frac{1}{2})u(n)z^{-n} \tag{9}$$
$$=\sum_{n=0}^{\infty}\frac{n}{3}z^{-n}-\sum_{n=0}^{\infty}\frac{1}{2}z^{-n} \tag{10}$$

$$\sum_{n=0}^{\infty}\frac{n}{3}z^{-n}=\frac{1}{3}\left(\frac{Z}{(z-1)^2}\right) \tag{11}$$
$$\sum_{n=0}^{\infty}\frac{1}{2}z^{-n}=\frac{1}{2}\left(\frac{1}{1-z^{-1}}\right) \tag{12}$$

$$X(z)=\frac{1}{3}\frac{z}{(z-1)^2}-\frac{1}{2}\frac{1}{1-z^{-1}} \tag{13}$$
$$X(z)=\frac{5z-3z^2}{6(z-1)^2}\qquad\{z\in\mathbb{C}:z\neq1\} \tag{14}$$

Symbol	Parameters
x(n)	general term of the series
X(z)	Z-transform of x(n)
u(n)	unit step function

TABLE I
Parameters