NCERT Discrete - 11.9.1.8

EE23BTECH11045 - Palavelli Srija*

Question 11.9.1.8:

1) Find the seventh term of the sequence where the nth term is given by $a_n = \frac{n^2}{2^n}$

Solution:

$$x(n) = \frac{(n+1)^2}{2^{(n+1)}}u(n) \tag{1}$$

Parameter	Value
$x(n)$	$\frac{(n+1)^2}{2^{(n+1)}}u(n)$
$x(6)$	?

TABLE 1
INPUT PARAMETERS

$$x(6) = \frac{(6+1)^2}{2^{(6+1)}} \tag{2}$$

$$x(6) = \frac{49}{128} \tag{3}$$

1) By the differentiation property:

$$ny[n] \overset{\mathcal{Z}}{\leftrightarrow} [-z]\frac{dY[z]}{dz} \tag{4}$$

$$\implies nu[n] \overset{\mathcal{Z}}{\leftrightarrow} \frac{z^{-1}}{(1-z^{-1})^2}, \quad |z| > 1 \tag{5}$$

$$\implies n^2u[n] \overset{\mathcal{Z}}{\leftrightarrow} \frac{z^{-1}(z^{-1}+1)}{(1-z^{-1})^3}, \quad |z| > 1 \tag{6}$$

2) Time shifting property:

$$y[n-k] \overset{\mathcal{Z}}{\leftrightarrow} z^{-k}Y[z] \tag{7}$$

3) Scaling property:

$$a^nu[n] \overset{\mathcal{Z}}{\leftrightarrow} \frac{1}{(1-az^{-1})}, \quad |z| > |a| \tag{8}$$

The Z transform of x(n) is given by from (6),(7) and (8)

$$X(z) = \frac{1+(2z)^{-1}}{2(1-(2z)^{-1})^3}, \quad |z| > \frac{1}{2} \tag{9}$$

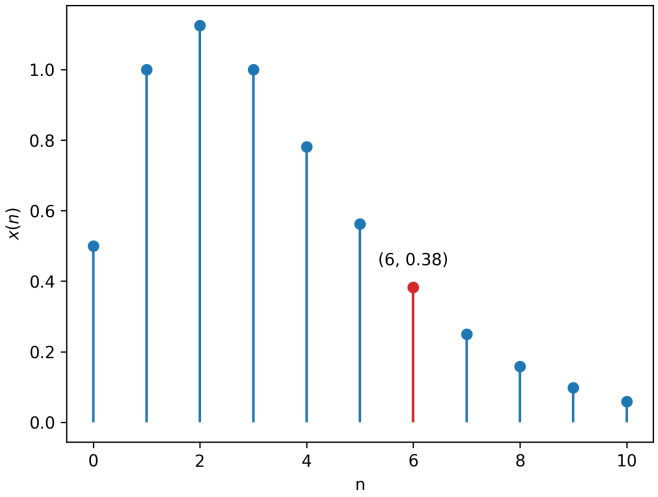

Fig. 3. stem plot of $x(n)$