NCERT 11.9.1.13Q

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Question: Write the first five terms of each of the sequences in Exercises 11 to 13 and obtain the corresponding series:
$a_1 = a_2 = 2, \quad a_n = a_{n-1} - 1, \quad n > 2$
Solution:

Parameter	Description	Value
$x(0)$	First term	2
$x(1)$	Second term	2
ROC	Region of convergence	$\left\{z : \left\vert\sum_{n=-\infty}^{\infty} x(n)z^{-n}\right\vert < \infty\right\}$
$x(n)$	General term	$x(n) = \begin{cases} ? & ; n \geq 0 \\ 0 & ; n < 0 \end{cases}$

TABLE 1
PARAMETER TABLE

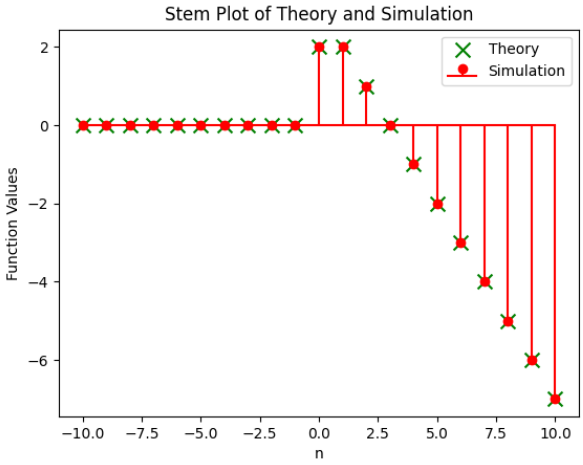

Fig. 1. Comparison of Theory and Simulated Values

From the figure1 we can see that the theoretical and simulated values overlap.

$$x(n) - x(n-1) = 2u(n) - 2u(n-1) - u(n-2) \tag{1}$$

$$X(z) - z^{-1}X(z) = \frac{2}{(1-z^{-1})} - \frac{z^{-2}}{(1-z^{-1})} - \frac{2z^{-1}}{(1-z^{-1})} \tag{2}$$

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

Using partial fractions

$$X(z) = \frac{2z^{-1}}{(1-z^{-1})} - \frac{z^{-2}}{(1-z^{-1})^2} + 2 \tag{4}$$

Taking inverse Z-transform by result of equation (**??**) in equation (4):

$$x(n) = 2u(n) + (1-n)\,u(n-1) \tag{5}$$

Substituting $n = 0, 1, 2, 3, 4$ in equation(5) :

$$x(0) = 2 \tag{6}$$
$$x(1) = 2 \tag{7}$$
$$x(2) = x(1) - 1 = 1 \tag{8}$$
$$x(3) = x(2) - 1 = 0 \tag{9}$$
$$x(4) = x(3) - 1 = -1 \tag{10}$$