EE23BTECH11024 - G.Karthik Yadav*

11.9.5.14

1. Let S be the sum, P the product and R the sum of reciprocals of n terms in a G.P. Prove that $P^2R^n = S^n$.

Solution:
from table I

Symbol	Parameters	Value
$u(n)$	Unit step function	1, if n≥ 0; 0 otherwise
r	Common ratio of GP	
$x(n)$	General term in a GP	$x(0)\, r^n$
$y(n)$	General term of reciprocal terms in a GP	$\frac{r^{-n}}{x(0)}$
S(z)	Z-transform of S	?
R(z)	Z-transform of R	?

TABLE I
INPUT PARAMETERS

$$x(n) = x(0)\, r^n u(n) \tag{1}$$

Using (**??**),

$$S = x(0) \left(\frac{r^{n+1} - 1}{r - 1} \right) u(n) \tag{2}$$

$$S(z) = \frac{x(0)}{(1 - rz^{-1})(1 - z^{-1})} \tag{3}$$

$$y(n) = \frac{1}{x(0)} r^{-n} u(n) \tag{4}$$

Using (**??**) and setting the first term as $\frac{1}{x(0)}$ and common ratio as r^{-1},

$$R = \frac{1}{x(0)} \left(\frac{1 - r^{-(n+1)}}{1 - r^{-1}} \right) u(n) \tag{5}$$

$$R(z) = \frac{(x(0))^{-1}}{\left(1 - (rz)^{-1}\right)(1 - z^{-1})} \tag{6}$$

$$P = (x(0))^{n+1}\, r^{\frac{n(n+1)}{2}} u(n) \tag{7}$$

by using eq (2), eq (5) and eq (7)
$P^2R^n = S^n$.

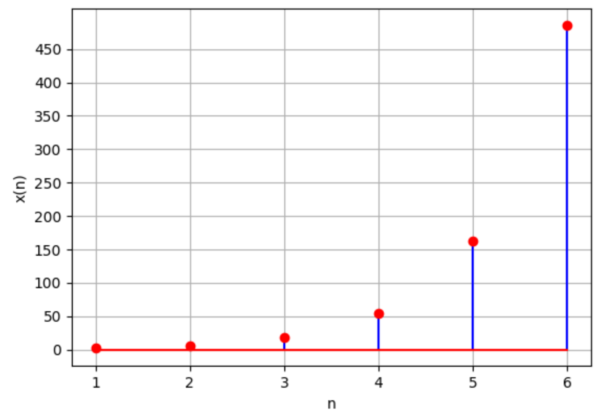

Fig. 1. Stem Plot of $x(n) = (2)\, 3^n u(n)\,, x(0) = 2$ and $r = 3$

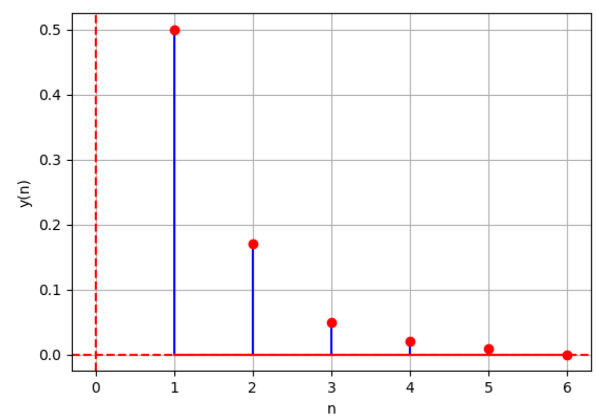

Fig. 2. Stem Plot of $y(n) = (0.5)\, 3^{-n} u(n)\,, x(0) = 2$ and $r = 3$