

NCERT Discrete 10.5.2 -15

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Question: For what value of n , are the n th terms of two A.Ps: 63, 65, 67,... and 3, 10, 17,... equal?

Solution:

Parameter	Sub-question	Description	Value
$x_i(0)$	$x_1(0)$	1 st term of 1 st A.P.	63
	$x_2(0)$	1 st term of 2 nd A.P.	3
d_i	d_1	Common difference of 1 st A.P.	2
	d_2	Common difference of 2 nd A.P.	7

TABLE I
PARAMETERS USED

$$X(z) = x(0)z(z-1)^{-1} + dz(z-1)^{-2} \forall |z| > 1 \quad (1)$$

- 1) For the 1st A.P. let $x_1(n)$ be n th term: Finding $x_1(n)$ for the 1st A.P:

$$x_1(0) + d_1 = 65 \quad (2)$$

$$\Rightarrow x_1(n) = 63u(n) + 2n \cdot u(n) \quad (3)$$

To find $X_1(z)$:

$$\therefore X_1(z) = 63z(z-1)^{-1} + 2z(z-1)^{-2} \forall |z| > 1 \quad (4)$$

- 2) For the 2nd A.P. let $x_2(n)$ be n th term: Finding $x_2(n)$ for the 1st A.P:

$$x_2(0) + d_2 = 10 \quad (5)$$

$$\Rightarrow x_2(n) = 3u(n) + 7n \cdot u(n) \quad (6)$$

To find $X_2(z)$:

$$\therefore X_2(z) = 3z(z-1)^{-1} + 7z(z-1)^{-2} \forall |z| > 1 \quad (7)$$

- 3) given, $x_1(n) = x_2(n)$

$$\therefore 63 + 2n = 7n + 3 \quad (8)$$

$$5n = 60 \quad (9)$$

$$\Rightarrow n = 12 \quad (10)$$

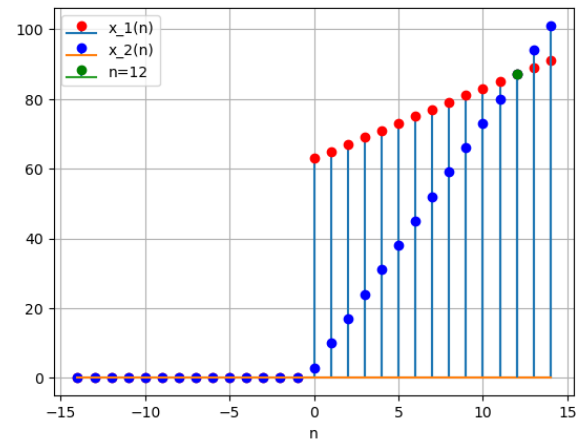


Fig. 1. Graphs of $x_1(n)$ and $x_2(n)$ and both are equal at $n = 12$