NCERT Discrete

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Question 11.9.3.18:
Find the sum to n terms of the sequence $8, 88, 888, 8888\ldots$
Solution :

x_1	x_2	x_3	x_4	X_n
8	88	888	8888	888...n

TABLE I
GIVEN INPUTS

General term

$$x_n = \sum_{k=0}^{n-1} 8(10)^k \tag{1}$$

$$S_n = \sum_{k=1}^{n} x_k \tag{2}$$

From (1) and (2)

$$S_n = \sum_{k=0}^{n-1} (n-k) \times 8(10)^k \tag{3}$$

On multiplying 10

$$10S_n = \sum_{k=0}^{n-1} (n-k) \times 8(10)^{k+1} \tag{4}$$

(4)−(3)

$$9S_n = \sum_{k=1}^{n} 8(10)^k - 8n \tag{5}$$

$$S_n = \left(\frac{8}{9}\right)\left(\left(\frac{10^n - 1}{10 - 1}\right)10 - n\right) \tag{6}$$

$$S_n = \left(\frac{8}{81}\right)(10^{n+1} - 9n - 10) \tag{7}$$