Discrete Assignment
EE1205 Signals and Systems

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Question 11.9.3.8: Find the sum to indicated number of term in each of the geometric progressions in $\sqrt{7}, \sqrt{21}, 3\sqrt{7}, ...n$ terms
Solution: Sum of the geometric progression of $\sqrt{7}, \sqrt{21}, 3\sqrt{7}, ...n$ terms is
Input Table:

variable	value	description
x(0)	$\sqrt{7}$	first term of the geometric progession
r	$\sqrt{3}$	common ratio of the geometeric progression
x(n)	$\sqrt{7 * 3^{(n)}}$	n^{th} term of the geometric progession
n		no of the term in the geometric progression
y(n+1)	$\frac{x(0)(r^{n+1}-1)}{r-1}$	Sum of the n+1 term of the geometric progression
U(z)	$\frac{1}{1-z^{-1}} \quad \lvert z^{-1}\rvert < 1$	z-transformation of u(n)

Z-Transformation:

$$\begin{aligned}
x(n) &= x(0)r^{(n)} && (1)\\
X(z) \xleftrightarrow{\mathcal{H}} Z\{x(n)\} &= \sum_{n=-\infty}^{\infty} x(n)z^{-n} && (2)\\
&= \sum_{n=0}^{\infty} x(n)z^{-n} && (3)\\
&= \sum_{n=0}^{\infty} x(0)r^n z^{-n} && (4)\\
&= x(0)\sum_{n=0}^{\infty} r^n z^{-n} && (5)\\
&= x(0)(z^0 r^0 U(z) + r^1 z^{-1}U(z) + r^2 z^{-2}U(z) + r^3 z^{-3}U(z) + r^4 z^{-4}U(z) + ...) && (6)\\
&= x(0)(1 + r^1 z^{-1} + r^2 z^{-2} + r^3 z^{-3} + r^4 z^{-4} + r^5 z^{-5} + r^6 z^{-6} + ...) && (7)\\
X(Z) &= x(0)\left(\frac{1}{1-rz^{-1}}\right), \quad |rz^{-1}| < 1 && (8)\\
y(n) &= x(n)u(n) && (9)\\
Y(z) &= X(z)U(z) && (10)\\
&= \text{x}(0)\left(\tfrac{1}{1-rz^{-1}}\right)\left(\tfrac{1}{1-z^{-1}}\right) && (11)\\
&= \sqrt{7}\left(\frac{1}{1-\sqrt{3}z^{-1}}\right)\left(\frac{1}{1-z^{-1}}\right) && (12)\\
&= \left(\frac{\sqrt{7}}{\sqrt{3}-1}\right)\left(\left(\frac{\sqrt{3}}{1-\sqrt{3}z^{-1}}\right)-\left(\frac{1}{1-z^{-1}}\right)\right) && (13)\\
y(n) &= \frac{\sqrt{7}}{\sqrt{3}-1}\left(\sqrt{3}^{n+1}-1\right)u(n) && (14)\\
y(n) &= \sqrt{7}\left(\frac{\left(\sqrt{3}^{n+1}-1\right)}{\sqrt{3}-1}\right)u(n) && (15)
\end{aligned}$$

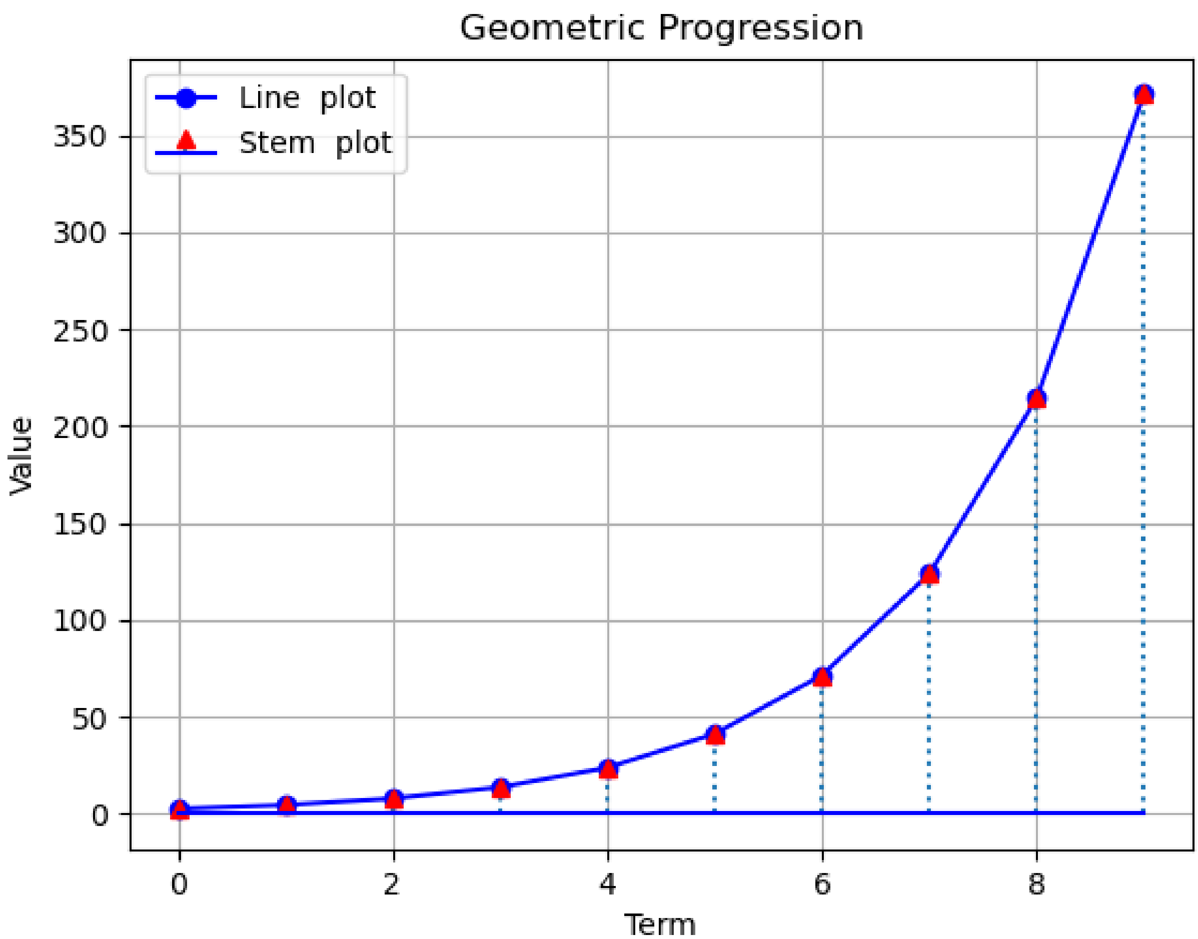
Geometric Progression
Line plot
Stem plot
Value
Term
0
50
100
150
200
250
300
350
0
2
4
6
8

Fig. 0.