Discrete Assignment

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1) **Question 11.9.4.9**: Find the sum to n terms of the series whose nth term is given by $n^2 + 2^n$?
Solution:

TABLE 1
INPUT PARAMETERS

Variable	Description	Value
$x(n)$	n-th term of sequence	$(n^2 + 2^n)u(n)$

$$y(n) = (x * u)(n) = \sum_{k=-\infty}^{\infty} x(k)u(n-k)$$

Given $(n^2 + 2^n)u(n)$, we have:

$$y(n) = \sum_{k=-\infty}^{\infty} (k^2 + 2^k)u(k)u(n-k)$$

Applying Z-transform of $y(n)$:

$$Y(z) = \sum_{n=0}^{\infty} y(n)z^{-n}$$

To find $Y(z)$, we need to use Z-transform pairs:

$$n^2 \cdot u(n) \overset{Z}{\longleftrightarrow} \frac{z(z+1)}{(z-1)^3}$$

$$2^n \cdot u(n) \overset{Z}{\longleftrightarrow} \frac{1}{1-2z^{-1}}$$

We need to express $y(n)$ in terms of known Z-transforms to find $Y(z)$.
Given:

$$Y(z) = \frac{z(z+1)}{(z-1)^3} + \frac{2}{1-2z^{-1}}$$

$$\frac{z(z+1)}{(z-1)^3} \xleftrightarrow{Z^{-1}} n^2u(n) + nu(n)$$

$$\frac{2}{1-2z^{-1}} \xleftrightarrow{Z^{-1}} 2 \cdot 2^n u(n)$$

Therefore, $y(n)$ is the sum of the above expressions:

$$y(n) = (n^2 + n)u(n) + 2 \cdot 2^n u(n)$$