Maths Assignment

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Problem Statement

Write the first five terms of the sequence $x(n) = \frac{n(n^2+5)}{4}$.

Solution

Given $x(n) = \frac{n(n^2+5)}{4}$.

First term:

$$x(1) = \frac{1(1^2+5)}{4} = \frac{6}{4} = 1.5$$

Second term:

$$x(2) = \frac{2(2^2+5)}{4} = \frac{18}{4} = 4.5$$

Third term:

$$x(3) = \frac{3(3^2+5)}{4} = \frac{42}{4} = 10.5$$

Fourth term:

$$x(4) = \frac{4(4^2+5)}{4} = \frac{84}{4} = 21$$

Fifth term:

$$x(5) = \frac{5(5^2+5)}{4} = \frac{150}{4} = 37.5$$

Therefore, the first five terms of the sequence $x(n)$ are 1.5, 4.5, 10.5, 21, 37.5.

$$x(n) = \frac{n(n^2+5)}{4}$$

$$u(n) = n^2$$

To express $x(n)$ in terms of $u(n)$, let's consider the relation $x(n) = a \cdot u(n) + b$.

Substituting the sequences:

$$\frac{n(n^2+5)}{4} = a \cdot n^2 + b$$

Comparing coefficients: Coefficient of n^2: $a = \frac{1}{4}$ Constant term: $b = 5a = 5 \cdot \frac{1}{4} = \frac{5}{4}$

Therefore, relation between $x(n)$ and $u(n)$ is:

$$x(n) = \frac{1}{4} \cdot u(n) + \frac{5}{4}$$

If $u(z) = Z^2$, let's find $X(z)$ in terms of $U(z)$.

$$U(z) = Z^2$$

$$X(z) = \frac{1}{4} \cdot U(z) + \frac{5}{4} \cdot \mathcal{Z}\{1\}$$

Applying the Z-transform to 1 gives: $\mathcal{Z}\{1\} = \frac{z}{z-1}$

Therefore:

$$X(z) = \frac{1}{4} \cdot Z^2 + \frac{5}{4} \cdot \frac{z}{z-1}$$

This expression of $X(z)$ in terms of $U(z)$ represents the relation between sequences $x(n)$ and $u(n)$, transformed into the z-domain.