## Experiment No.: 10

## Experiment Name: Z-Transform of a Discrete-Time Signal using MATLAB

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## Description of the Problem:

The objective of this experiment is to **compute the Z-transform** of a given discrete-time signal $x[n]$using MATLAB.

**Theory:**
The **Z-transform** of a discrete-time signal $x[n]$is defined as:

$$X(z) = \sum_{n=-\infty}^{\infty} x[n]z^{-n}$$

- $z$ is a complex variable.
- Z-transform is fundamental in **digital signal analysis**, **system stability**, and **filter design**.
- This experiment demonstrates **manual computation of Z-transform** using a MATLAB loop for any user-defined discrete signal.

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## Source Code Sample:

```
clc;
clear;
close all;

% Step 1: Take user input
x = input('Enter the discrete signal sequence (e.g., [1 2 3 4]): ');
n = input('Enter the corresponding indices (e.g., 0:3): ');

% Step 2: Define symbolic variable
syms z

% Step 3: Compute Z-transform manually
X = 0;
for k = 1:length(x)
    X = X + x(k)*z^(-n(k));
end

% Step 4: Display result
disp('Z-transform of x(n) is:');
pretty(X);

% Optional: Display it in readable format
```

```
fprintf('\nX(z) = ');
disp(X);
```

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## Sample Input:

### Example:

```
Enter the discrete signal sequence: [1 2 3 4]
Enter the corresponding indices: 0:3
```

- `x` → Signal sequence values
- `n` → Corresponding discrete-time indices

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## Sample Output:

After running the code:

1. MATLAB will display the **Z-transform** $X(z)$:

$$X(z) = 1 + 2z^{-1} + 3z^{-2} + 4z^{-3}$$

2. The `pretty()` function shows it in a readable, symbolic format.

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## Screenshot:

### Figure 10.1: Z-Transform Output in MATLAB