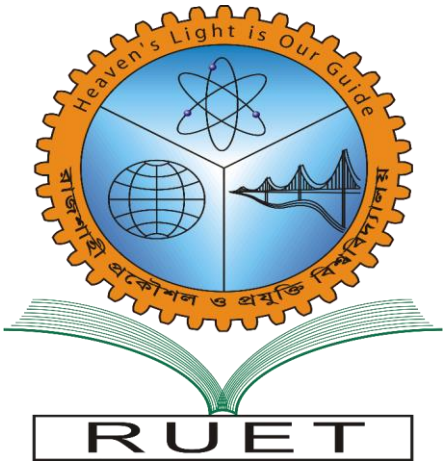
Heaven's Light is Our Guide

Rajshahi University of Engineering & Technology



Department of Electrical & Computer Engineering

Course No : ECE 4124
Course Title : Digital Signal Processing Sessional

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Experiment No: 05

Experiment Name: Experiment on finding the Z-transform and inverse Z-transform of a function.

Theory:
A mathematical technique called the Z-transform is used to translate differential equations in the time domain into algebraic equations in the z-domain.
The Z-transform formula-

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

The method of determining the time domain signal x(n) from its Z-transform X(z) is known as the inverse Z-transform. The symbol for the inverse Z-transform is-

$$x(n) = Z^{-1}[X(z)]$$

$$x_n = \frac{1}{2\pi j} \int_c X(z) z^{n-1} dz$$

Code:
Z-transform and inverse Z-transform of right-side signal:

```
clc;
close all;
clear all;

syms n;
x = [1 2 3 4 5];
l = length(x);

trans = 0;
z = sym('z');
for i=0:l-1
trans=trans+x(i+1).*z^(-i);
end

disp('Z-transform: ');
disp(trans);

f=iztrans(trans);
disp('Inverse Z-transform:');
disp(f);
```

Z-transform and inverse Z-transform of left-side signal:

```
clc;
close all;
clear all;

syms n;
x = [1 2 3 4 5];
y = fliplr(x);
l = length(y);

trans = 0;
z = sym('z');
for i=0:l-1
trans=trans+y(i+1).*z^(i);
end

disp('Z-transform:');
disp(trans);

f=iztrans(trans);
disp('Inverse Z-transform:');
disp(f);
```

Z-transform and inverse Z-transform of non-causal signal:

```
clc;
close all;
clear all;

syms n;
x = [1 2 3 4 5 6 7];
n = length(x);

k=input('Enter zero index:');
p=[];
for i=0:k
p(i+1)=x(i+1);
end

h=fliplr(p);
u=length(h);

trans = 0;
z = sym('z');
for i=0:u-1
trans=trans+h(i+1).*z^(i);
end

q=[];
for i=0:(n-k-2)
q(i+1)= x(i+k+2);
end
```

```
28.
29. v=length(q);
30. for i=0:v-1
31. trans=trans+q(i+1).*z^(-(i+1));
32. end
33.
34. disp('Z-transform:');
35. disp(trans);
36. f=iztrans(trans);
37. disp('Inverse Z-transform:');
38. disp(f);
```

Output:

Z-transform and inverse Z-transform of right-side signal:

```
Z-transform:
2/z + 3/z^2 + 4/z^3 + 5/z^4 + 1


Inverse Z-transform:
2*kroneckerDelta(n - 1, 0) + 3*kroneckerDelta(n - 2, 0) + 4*kroneckerDelta(n - 3, 0) + 5*kroneckerDelta(n - 4, 0) + kroneckerDelta(n, 0)
```

Z-transform and inverse Z-transform of right-side signal:

```
Z-transform:
z^4 + 2*z^3 + 3*z^2 + 4*z + 5


Inverse Z-transform:
5*kroneckerDelta(n, 0) + 3*iztrans(z^2, z, n) + 2*iztrans(z^3, z, n) + iztrans(z^4, z, n) + 4*iztrans(z, z, n)
```

Z-transform and inverse Z-transform of non-causal signal:

```
Enter zero index:4
Z-transform:
4*z + 6/z + 7/z^2 + 3*z^2 + 2*z^3 + z^4 + 5

Inverse Z-transform:
6*kroneckerDelta(n - 1, 0) + 7*kroneckerDelta(n - 2, 0) + 5*kroneckerDelta(n, 0) + 3*iztrans(z^2, z, n) + 2*iztrans(z^3, z, n) + iztrans(z^4, z, n) + 4*iztrans(z, z, n)
```

Discussion:

In this experiment, we have worked with Z-transform and inverse Z-transform of three types of signals – right side signal, left side signal and both sided that is non-causal signal. In right side signal we found the power of z as negative and in case of left side signal those power of z was positive which was matched with our theoretical explanations also.

For inverse z-transform, we used a function ‘iztrans’ which worked correctly to find out the inverse of the Z-transform of the functions.

Conclusion: The code was executed successfully and no errors were found.