EXPERIMENT NO.4

AIM: To find Z transform and inverse Z transform of different sequences.

APPARATUS: MATLAB software

THEORY:

The Z-transform (ZT) is a mathematical tool which is used to convert the difference equations in time domain into the algebraic equations in z-domain.

The Z-transform is a very useful tool in the analysis of a linear shift invariant (LSI) system. An LSI discrete time system is represented by difference equations. To solve these difference equations which are in time domain, they are converted first into algebraic equations in z-domain using the Z-transform, then the algebraic equations are manipulated in z-domain and the result obtained is converted back into time domain using the inverse Z-transform.

The Z-transform may be of two types viz. unilateral (or one-sided) and bilateral (or two-sided).

Mathematically, if x(n) is a discrete-time signal or sequence, then its *bilateral or two-sided Z-transform* is defined as

$Z[x(n)]=X(z)=\sum n=-\infty to\infty\ x(n)z-n$

Where, z is a complex variable and it is given by,

$z=rej\omega$ Where, r is the radius of a circle.

Region of Convergence (ROC) of Z-Transform

The set of points in the z-plane, for which the Z-transform of a discrete-time sequence x(n) that is X(z) converges is called the region of convergence (ROC) of the Z-transform X(z) .

PROGRAM:

1. For x = 2^n - 3^n

```
syms n;
x = 2^n - 3^n;
y = ztrans(x);
disp(y);
m = iztrans(y)
```

OUTPUT:

y= z/(z - 2) - z/(z - 3)

m = 2^n - 3^n

2.For x = sin(n)

```
syms n;
x = sin(n);
y = ztrans(x);
disp(y);
```

```
m = iztrans(y)
```

OUTPUT:

```
y = (z*sin(1))/(z^2 - 2*cos(1)*z + 1)

m = sin(n)
```

3.For x = delta(n)

```
syms n;
x = kroneckerDelta(n, 0);
y = ztrans(x);
disp(y);
m = iztrans(y)
```

OUTPUT:

```
y = 1
```

4.For x = cos(n)

```
syms n;
x = cos(n);
y = ztrans(x);
disp(y);
m = iztrans(y)
```

OUTPUT:

```
y = (z*(z - cos(1)))/(z^2 - 2*cos(1)*z + 1)
m = cos(n)
```

5.For x = exp(5n)

```
syms n;
x = exp(5*n);
y = ztrans(x);
disp(y);
m = iztrans(y)
```

OUTPUT:

```
y = z/(z - exp(5))
m = exp(5*n)
```

6.For x = sinc(n)

```
syms n;
x = sinc(n);
y = ztrans(x);
disp(y);
m = iztrans(y)
```

OUTPUT:

```
y = sin(pi*n)/(n*pi)
m = sinc(n)
```

7.For x = heaviside(n)

```
syms n;
x = heaviside(n);
y = ztrans(x);
disp(y);
m = iztrans(y)
```

OUTPUT:

```
y = 1/(z - 1) + ½
```

8.For x = 5^n - cos(n) + exp(-7*n) - 8*n

```
syms n;
x = 5^n - cos(n) + exp(-7*n) - 8*n
y = ztrans(x);
disp(y);
pretty(y);
m = iztrans(y)
```

OUTPUT:

```
z       8 z         z          z (z - cos(1))
------ - ------- + ------- - ----------------
z - 5         2   z - exp(-7)    2
       (z - 1)                 z  - cos(1) z 2 + 1
```

POST LAB QUESTION:

Q1. Differentiate between Z Transform, Laplace Transform and Fourier Transform.