EC2032(Digital Signal Processing Lab)

LAB- 11

AIM: To find Discrete Fourier Transform and Inverse Discrete Fourier Transform of given digital signal using fft and ifft

Software: MATLAB/OCTAVE

Theory: Fourier Transform is a mathematical technique used to analyze functions in terms of sinusoidal basis functions. In the context of digital signals, the Discrete Fourier Transform (DFT) is employed. The DFT takes a sequence of complex numbers representing a digital signal and transforms it into a sequence of complex numbers that represent the signal in the frequency domain.

The IDFT is the reverse process of the DFT and is used to reconstruct the original signal from its frequency domain representation.

Basic equation to find the DFT of a sequence is given below:

$$X(k) = \sum_{n=0}^{N-1} x(n) W_N^{nk}$$

$$where \;\; W_N^{nk} = e^{-j\frac{2\pi nk}{N}} \; [\text{TWIDDLE FACTOR}]$$

Basic equation to find the IDFT of a sequence is given below:

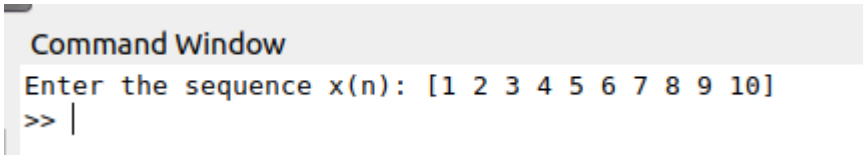
$$x_n = \frac{1}{N} \sum_{k=0}^{N-1} X_k e^{\frac{2\pi i}{N} kn} \qquad n = 0, \ldots, N-1.$$

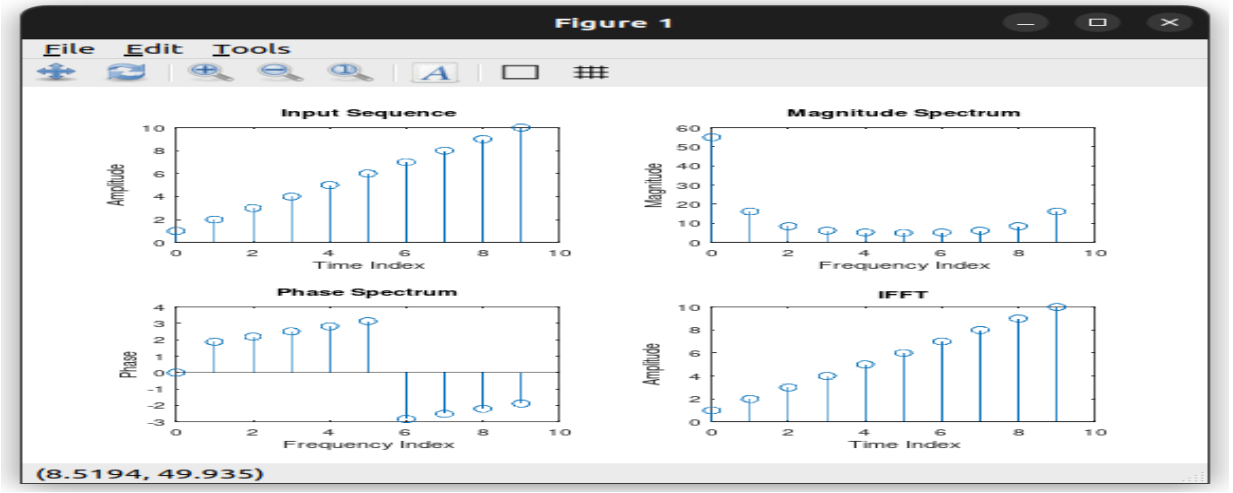
PROGRAM:

```
clc;
clear all;
close all;
xn = input('Enter the sequence x(n): ');
ln = length(xn);
xk = fft(xn);
t = 0:ln-1;
subplot(2,2,1);
stem(t, xn);
ylabel('Amplitude');
xlabel('Time Index');
title('Input Sequence');
subplot(2,2,2);
magnitude = abs(xk);
```

```
stem(t, magnitude);
ylabel('Magnitude');
xlabel('Frequency Index');
title('Magnitude Spectrum');
subplot(2,2,3);
phase = angle(xk);
stem(t, phase);
ylabel('Phase');
xlabel('Frequency Index');
title('Phase Spectrum');
ixk = ifft(xk);
subplot(2,2,4);
stem(t, real(ixk));
ylabel('Amplitude');
xlabel('Time Index');
title('IFFT');
```

INPUT:





OUTPUT:

Conclusion: In this lab, we explored the concepts of DFT and IDFT, which are fundamental tools for analyzing and processing digital signals in the frequency domain. By utilizing the efficient FFT and IFFT algorithms, we computed the DFT and IDFT of a given digital signal.