2.IDFT using inbuilt function and without using inbuilt function.

Theory:

Discrete Fourier Transform (DFT)

The **Discrete Fourier Transform (DFT)** is a mathematical transformation used to analyze the frequency content of discrete signals. For a sequence x[n] of length N, the DFT is defined as:

$$\quad 2\pi$$

$$X[k] = \sum^{N}{}_{n=0} x[n] \cdot e^{-j}{}_{N}{}^{nk}, k = 0,1, 2, .. . , N -1$$

- X[k] is the DFT of the sequence x[n].

2π

- The exponential factor represents $e_{-j}{}_{N}{}^{nk}$ the complex sinusoidal basis functions. •

The DFT maps the time-domain signal into the frequency domain.

Inverse Discrete Fourier Transform (IDFT)Method:

The **Inverse Discrete Fourier Transform (IDFT)** is used to convert a frequency-domain sequence X[k] back into its time-domain sequence x[n]. The IDFT is defined as:

$$x[n] = -\sum_{k=0}^{N} X[k] \cdot {}_{1}e_{j2\pi N}\, nk, n = 0, 1, 2,. . . ,N -1$$

$$N$$

- The IDFT takes the frequency components X[k] and reconstructs the original sequence x[n].

2π

- The exponential factor $e_{j}{}_{N}{}^{nk}$ is the inverse of the DFT's complex sinusoidal basis functions

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Application

- Spectrum (Analysis)
- Filtering
- Compression
- Modulation

- Convolution
- Demodulation
- Equalization
- Restoration

- Detection
- Estimation

Program:

1. Discrete Fourier Transform (DFT)

```
clc;  clear  all;  close  all;
x=input("enter    sequence:");
N=input("enter the N point:");
l=length(x);  x=[x  zeros(1,N-
l)]; X=zeros(1,N); for k=0:N-1
for n=0:N-1
        X(k+1)=X(k+1)+x(n+1)*exp(-1j*2*pi*n*k/N);
end end disp('X'); disp(X); disp('round(X)');
disp(round(X)); %verification disp('fft');
disp(fft(x));  %plotting k=0:N-1;
magX=abs(X);
phaseX=angle(X);
subplot(2,1,1);
stem(k,magX);
title("Magnitude
Plot"); hold on;
plot(k,magX);
subplot(2,1,2);
stem(k,phaseX); hold
on; title("Phase
Plot"); plot(k,phaseX);
```

2.IDFT

```
clc; clear
```

```
all; close
all;
X=input("enter sequence:");
N=input("enter the n point:");
l=length(X); X=[X zeros(1,N-
l)]; x=zeros(N,1); for k=0:N-1
for n=0:N-1
        x(n+1)=x(n+1)+X(k+1)*exp(1j*2*pi*n*k/N);
end end x=1/N.*x; disp('x'); disp(x);
disp('round(x)');
disp(round(x));
%verification disp('ifft');
disp(ifft(X));
```

Result:

Performed

1)DFT using inbuilt function and without using inbuilt function. Also plotted magnitude and phase plot of DFT.

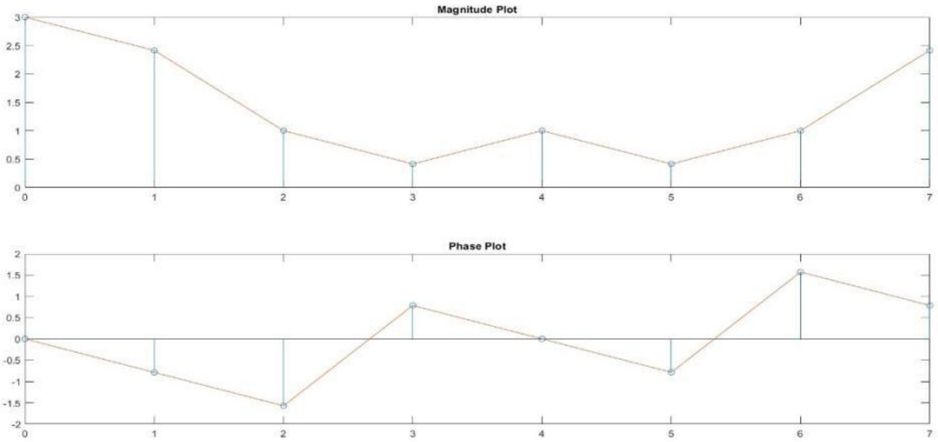
2)IDFT using inbuilt function and without using inbuilt function.

and verified the result.

Observation:

1.DFT

```
enter sequence:[1 1 1 0] enter

the N point:8

X

  Columns 1 through 7

   3.0000 + 0.0000i   1.7071 - 1.7071i   0.0000 - 1.0000i   0.2929 + 0.2929i   1.0000 + 0.0000i
0.2929 - 0.2929i  -0.0000 + 1.0000i

  Column 8

   1.7071 + 1.7071i round(X)

  Columns 1 through 7

   3.0000 + 0.0000i   2.0000 - 2.0000i   0.0000 - 1.0000i   0.0000 + 0.0000i   1.0000 + 0.0000i
0.0000 + 0.0000i   0.0000 + 1.0000i

  Column 8

   2.0000 + 2.0000i

fft

  Columns 1 through 7

   3.0000 + 0.0000i   1.7071 - 1.7071i   0.0000 - 1.0000i   0.2929 + 0.2929i   1.0000 + 0.0000i
0.2929 - 0.2929i   0.0000 + 1.0000i

  Column 8

   1.7071 + 1.7071i
```



2.IDFT

```
enter sequence: [3.0000 + 0.0000i   1.7071 - 1.7071i   0.0000 - 1.0000i   0.2929 + 0.2929i
1.0000 + 0.0000i   0.2929 - 0.2929i   0.0000 + 1.0000i]
enter the n point:8 x
   0.7866 - 0.2134i
   0.6982 - 0.0000i
   0.7866 + 0.2134i
  -0.0000 + 0.3018i
   0.2134 + 0.2134i
   0.3018 - 0.0000i
0.2134 - 0.2134i
   0.0000 - 0.3018i

round(x)
     1
     1
     1
     0
     0
     0
     0
0
ifft
  Columns 1 through 7

   0.7866 - 0.2134i   0.6982 + 0.0000i   0.7866 + 0.2134i   0.0000 + 0.3018i   0.2134 +
0.2134i   0.3018 + 0.0000i   0.2134 - 0.2134i

  Column 8

   0.0000 - 0.3018i
```