Name	Adwait Purao
UID no.	2021300101

Experiment 4	
AIM	The aim of this experiment is to implement computationally Fast Algorithms.
OBJECTIVE:	1. Develop a program to perform FFT of N point Signal. 2. Calculate FFT of a given DT signal and verify the results using a mathematical formula. 3. Computational efficiency of FFT.
INPUT SPECIFICATIONS:	1. Length of first Signal N 2. DT Signal values
PROBLEM DEFINITION:	(1) Take any four-point sequence x[n]. Find FFT of x[n] and IFFT of {X[k]}. (2) Calculate Real and Complex Additions & Multiplications involved to find X[k].
RESULT:	Case-1 : To find DFT of 4 point sequence Input x[n] = { 1,2,3,4 } Length N= 4 Output X[k] = Magnitude |X[k] | = { 10, 2.83, 2, 2.83 }

```
students@spit:~/Downloads$ cd Adwait_P/FOSIP/exp_4/
students@spit:~/Downloads/Adwait_P/FOSIP/exp_4$ gcc FFT.c -lm
students@spit:~/Downloads/Adwait_P/FOSIP/exp_4$ ./a.out


  Enter the length of x[n] ( 4 pt or 8 pt)  = : 4
  Enter the values of x[n]     : 1 2 3 4


  Input signal x[n] =   1.00    2.00    3.00    4.00

  FFT results X[k] =  :

   10.000  + j    0.000
   -2.000  + j    2.000
   -2.000  + j    0.000
   -2.000  + j   -2.000


  Inverse FFT results x[n] =  :

    1.000  + j    0.000
    2.000  + j   -0.000
    3.000  + j    0.000
    4.000  + j   -0.000

students@spit:~/Downloads/Adwait_P/FOSIP/exp_4$
```

Case-2 : To find DFT of zero padded signal
Input x[n] = { 1,2,3,4, 0, 0, 0, 0 } Length N=8
Output X[k] =
Magnitude |X[k] |=
= { 10, 7.25, 2.83, 2.72, 2, 2.72, 2.83,7.25 }

```
students@spit:~/Downloads/Adwait_P/FOSIP/exp_4$ ./a.out


 Enter the length of x[n] ( 4 pt or 8 pt)  = : 8
 Enter the values of x[n]     : 1 2 3 4 0 0 0 0


 Input signal x[n] =   1.00    2.00    3.00    4.00    0.00    0.00    0.00    0.00

 FFT results X[k] =  :

  10.000  + j    0.000
  -0.414  + j   -7.243
  -2.000  + j    2.000
   2.414  + j   -1.243
  -2.000  + j    0.000
   2.414  + j    1.243
  -2.000  + j   -2.000
  -0.414  + j    7.243


 Inverse FFT results x[n] =  :

    1.000  + j    0.000
    2.000  + j   -0.000
    3.000  + j    0.000
    4.000  + j   -0.000
   -0.000  + j    0.000
   -0.000  + j   -0.000
   -0.000  + j    0.000
    0.000  + j   -0.000

students@spit:~/Downloads/Adwait_P/FOSIP/exp_4$
```

CONCLUSION:

Conclusion

1. Computational Efficiency in DFT :

a) Total Real Multiplications = 4N2

b) Total Real Additions = 4N2-2N

2. Computational Efficiency in FFT :

a) Total Real Multiplications = 2N Log2N

b) Total Real Additions = 3N Log2N

3. FFT produces fast results due to ;

a) Less Computations

b) Parallel implementations