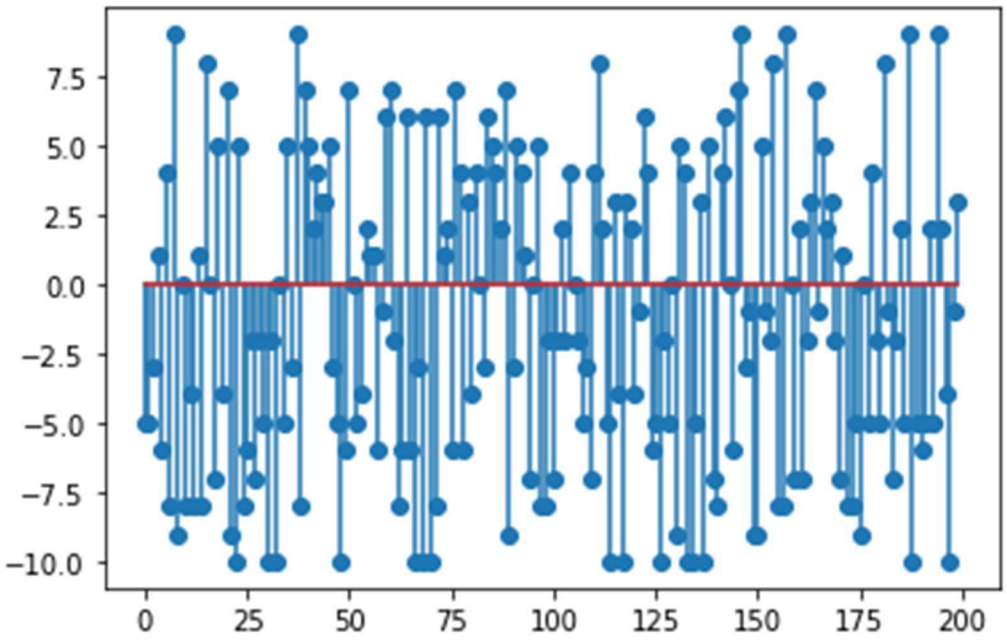
Digital Signal Processing Lab (EE 521)

Lab 3 Report

Task:

1. Implementation of DFT and FFT algorithms.

Input signal :

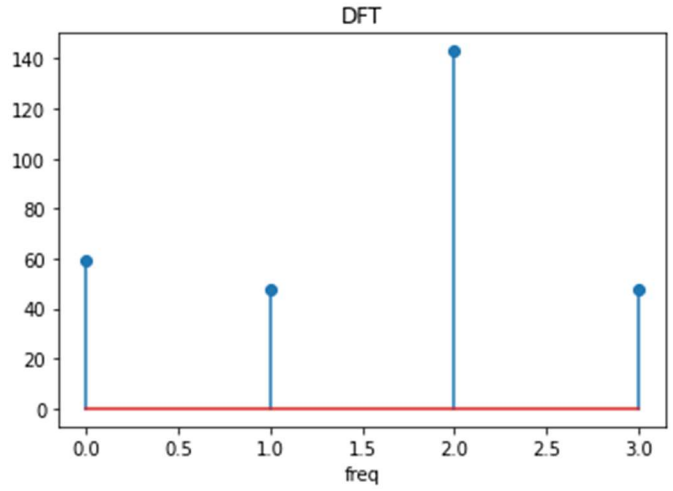


Discrete Fourier Transform (DFT) :

Discrete Fourier Transform (DFT) converts a finite sequence of equally spaced samples of a function into a same length sequence of equally spaced samples of the discrete time Fourier Transform (DTFT) which is a complex valued function of frequency. The interval at which the DTFT is sampled is the reciprocal of the duration of the input sequence.

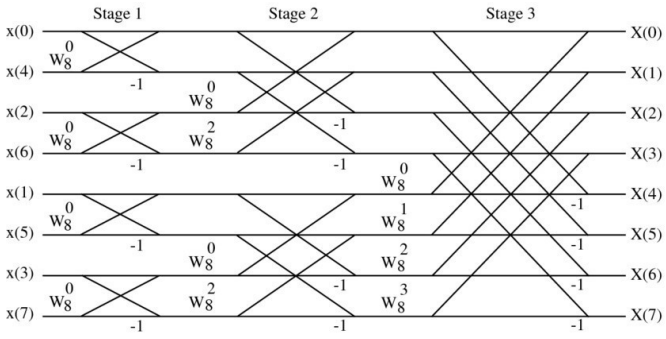
$$X_k = \sum_{n=0}^{N-1} x_n e^{-i 2\pi k n / N} \quad k = 0, \ldots, N-1$$

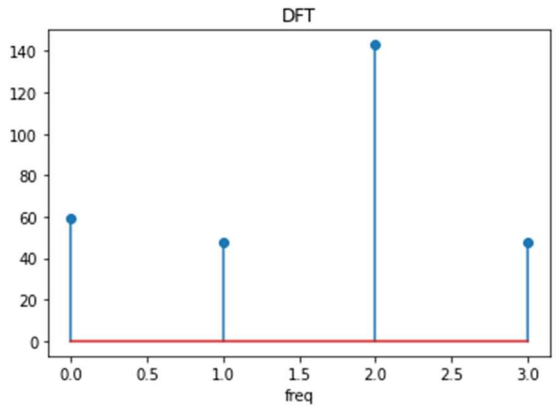
$$x_n = \frac{1}{N} \sum_{k=0}^{N-1} X_k e^{i 2\pi k n / N} \quad n = 0, \ldots, N-1$$



Fast Fourier Transform (FFT) :

Fast Fourier transform (FFT) is an algorithm that computes DFT of a sequence, or its inverse (IDFT) in O(NlogN) time complexity. A FFT rapidly computes such transformations by factorizing the DFT into a product of sparse (mostly zero) factors.





(magnitude plot)

Code : https://colab.research.google.com/drive/1u0ExKNciqh_c0CMyCjX0De-_EjtjVhCL#scrollTo=xr5_K_iKVebZ