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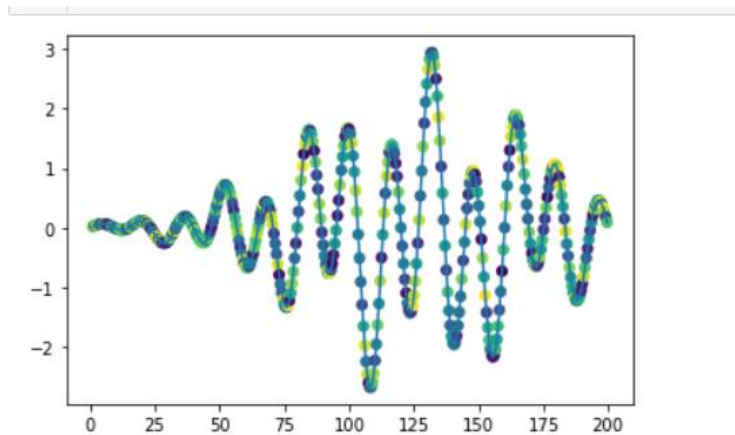
A2

Note: I used 12 hours of the free late submission credit.

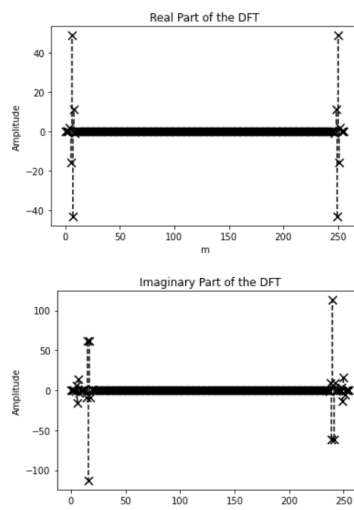
DFT and IDFT Implementation along with the code for other questions can be found in the attached notebook.

DFT and IDFT implementation is done using the matrix method described in the slides and getting $X = F_N \cdot x_N$. and $x = \text{inv}(F_N)X_N$.

Q1] the signal generated: x-axis-> samples, y axis- values. Both continuous and scatter points drawn.

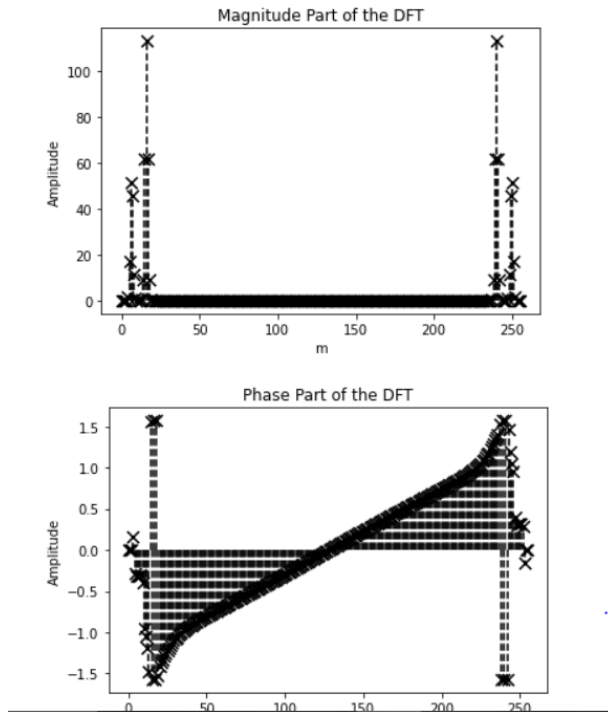


Q2]more on the plots can be found in the notebook.

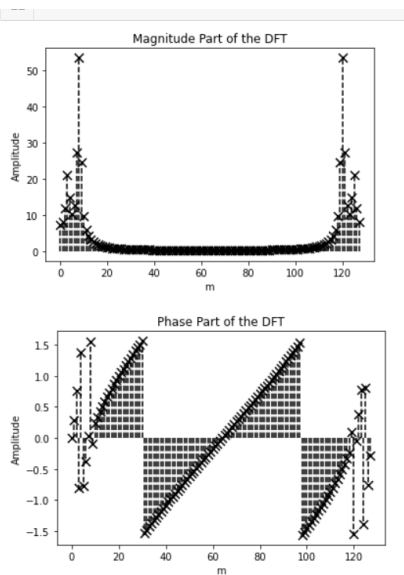


Q3] more on the plots can be found in the notebook. **Note:** angles are in radian; the phase values can be alittle weird because of the approximation of python float point operation.

```
4 plot_FT(n,X_magnitude,X_phase,polar=True)
5
```



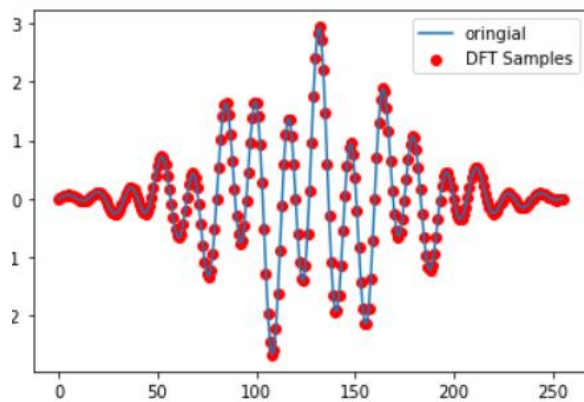
Q4] more on the plots in the notebook. **Note:** angles are in radian; the phase values can be alittle weird because of the approximation of python float point operation.



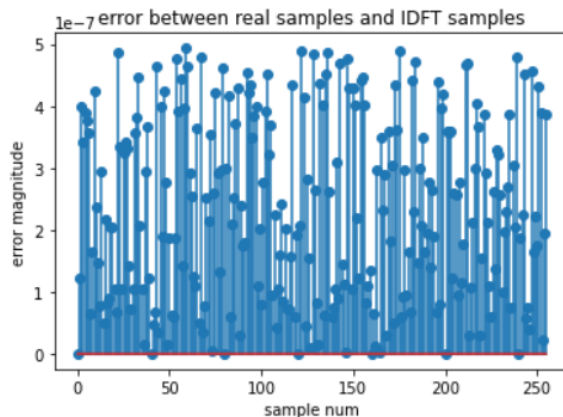
Q5] Yes.

- 1- The amplitude of the frequency components is higher in the case of the 256 DFT. This is because the amplitude is proportional to N (number of points taken).
- 2- We can note that almost the same order of frequency components happen in the 256 DFT later than the 128 DFT. i.e. (frequencies have higher m index). This is because the frequency components are related to m by $f = m/N * f_s$.
- 3- Also, the 256 DFT can represent more frequency components due to having higher N (from the equation above.)

Q6] more on plots in the notebook. The original signal and the IDFT samples are shown.



Also, the plot of the errors between the original sample values and the IDFT samples is shown. The error is in the order of 10^{-7} which means that they are extremely close to each other.



Q7] records using audacity and read using scipy.io.wavfile. The sampling rate for recording was 8k which is suitable to record human voices only as per what is taken in the lecture.

Q8] Original and generated audios are attached. The plot of the original signal is shown (right and the generated from IDFT is shown on the left.) they are identical.

