Indian Institute of Technology Jodhpur
EEL2010: Signals and Systems
Programming Assignment
Due Date: April 12, 2023, Max Marks: 50

Instructions:

- Make a group of maximum 4 students and minimum 2 students to solve this problem. Clearly mention the contribution of each of the group members.
- Copying from internet and other groups is strictly prohibited. If found, you will earn -50 marks.
- You can use any one programming language of C/C++/MATLAB/Python.
- Codes should be properly commented.
- Prepare a report containing your results, analysis, and findings.
- Submit a single zip file containing all the recordings, your codes (.py/.cpp/.c/.m), and a report.
- Only one of the group member should submit the zip file named as "RollNo1_RollNo2_RollNo_3.zip"

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1. Consider below four sentences which are sequences of alphabets.

   Sentence 1: "D F G H K"

   Sentence 2: "A E I O U"

   Sentence 3: "B C D F G H K L M N"

   Sentence 4: "A B C D E F G H I K L M N O"

   Now, record the voice signal generated by each of the group member which speaking each of these sentences. Consider three sampling frequencies while you record: 500Hz, 2000Hz, 16000Hz. For example, if there are four members in your group, then you will have $4 \times 3 \times 4 = 48$ recorded signals. Now, find the frequencies present in each of the signal ($x[n]$) using the Discrete Fourier Transform (DFT). You can not use inbuilt function for finding the DFT. Implement the formula studied in the class. Let $X(f)$ denotes the DFT of $x[n]$. Plot $|X(f)|$ with respect to the frequency f for each of the recording. Clearly label the x-axis and the y-axis with proper range of magnitude and frequency. Analyse the frequencies preset in all the recordings as you vary across sentences, group members and sampling rates. Report your interesting findings. While, recording the signals, it is obvious that you will have some extras sound sources that will be captured in your signal (e.g. fan noise or the ambient noise). Propose and implement an algorithm to filter out these unwanted sources from the recorded signals. Your final submission file should also contain the filtered signals along with the raw recordings.