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# Problem 1

Discuss how you determined the reference frequency and all scale / chord frequencies for this project.

Because starting not with C, I thought it would be more visible to see how my calculation went through by re organizing my table from C to Cb. Also I merged just temperament because iteration of same numbers is not necessary. My table is constructed using Excel for understanding how my calculation goes through. I realized that my result frequency is somewhat different from what was given in the notes, but I think there are multiple ways to construct just temperament frequency table. How minor tone and major tone applied is not specified, so that I chose a method for my homework referenced to online resources.

My method of determining reference frequency starts from A = 440Hz, as shown in the given notes. For any given keys, I wrote down scales starting with specified keys, and made tone and semitone so that I can clearly understand how much difference they have. For example, spacing between each note is same as value of ‘pattern’ in my matlab codes. After filling out main 7 notes, I filled out rest of the frequency relative to written values. Major, Minor and semitone value is given in the note, so I just multiplied/divided those values to the frequency (A=440Hz). For example, I multiplied semitone(16/15) if my note increases by 1 step. Determining major and minor tone is by creating scale starting from the key. If key start with C, then scale goes ‘C-D-E-F-G-A-B-C’. Then I looked for spacing between two notes and found all major scales have ‘T(tone)-T-S(semitone)-T-T-T-S’ relationships. First two ‘T-T’ relationship is always ‘Major-Minor’, and last three tones are always ‘Major-Minor-Major’ sequences. Using that information, I could determine reference frequency using this method.

In order to use my value from Excel to Matlab, I used xlsread and save function in my Matlab to create .mat data file and used that for my project. For just temperament, value has 15 columns and 12 rows.

# Problem 4

Insert plots and describe.

My plots are inserted in the published matlab code, and my references are based on how my plots are labeled.

(b)

When I plotted over one wavelength, I couldn’t recognize any differences between major and minor chords of just temperament and equal temperament. They all look the same. My figure 1,2,5,6 shows how my chords’ wavelength looks like.

Unlike plot over one wavelength, plot over tens of wavelength shows some visible difference between just temperament and equal temperament. For major chord, plot for just temperament seems to have equal amplitude along the time and same shape shows up. However, for equal temperament major chord, amplitude changes and also shape of the wave seems to change over time period. Similar to this, equal tempered minor chord plot also has change in the wave shape over time.

However, from figure 7 and 8, I can know that this problem is not just being equal temperament because I can observe distortion in both equal and just temperament

# Problem 5

1. Can you hear the difference between the just tempered Major scale and the equal tempered Major scale?

**It seems to sound equal for both just and equal tempered Major scale.**

1. Which one sounds better? - Why (explain)

**For me, just tempered sounds little bit better because sound comes out more clearly.**

1. Can you hear the difference between the just tempered Minor scale and the equal tempered Minor scale?

**Both just tempered minor scale and equal tempered minor scale sound the same.**

1. Which one sounds better? - Why (explain)

**Similar to b), just tempered minor scale has clearer sound.**

1. Can you hear the difference between the just tempered Major chord and the equal tempered Major chord?

**Yes, sound from equal tempered major chord has some vibration which makes sound different from just tempered major chord.**

1. Which one sounds better? - Why (explain)

**For me, just tempered major chord sounds better because it has clearer sound.**

1. Can you hear the difference between the just tempered Minor chord and the equal tempered Minor chord?

**Yes, equal tempered minor chord sound smoother and just tempered minor chord has some disturbance.**

1. Which one sounds better? - Why (explain)

**Equal tempered minor chord sound better because it has smoother sound which allows better listening.**

# Other Comments