

MAT 120 — Homework 3 — Fall 2024

Due date: Monday, Oct 7

In the following exercises, work with the two octave Just Chromatic scale. The first octave is given below, as we did in class on Tuesday, September 19. The second octave is just a repetition of the same sequence of semitones, but the top frequency ratios (representing the degrees of the scale) are all multiplied by 2, going from 2 up to 4. Note: When looking for a particular pattern of semitones occurring in the two octave Just Chromatic Scale, you can take into account that the pattern repeats once the lower note (or degree of the scale) goes past the first octave (2).

The Just Chromatic Scale

$$\frac{1}{1} \rightarrow \frac{16}{15} \rightarrow \frac{9}{8} \rightarrow \frac{6}{5} \rightarrow \frac{5}{4} \rightarrow \frac{4}{3} \rightarrow \frac{64}{45} \rightarrow \frac{3}{2} \rightarrow \frac{8}{5} \rightarrow \frac{5}{3} \rightarrow \frac{16}{9} \rightarrow \frac{15}{8} \rightarrow \frac{2}{1}$$

$$\left(\frac{16}{15}\right) \left(\frac{135}{128}\right) \left(\frac{16}{15}\right) \left(\frac{25}{24}\right) \left(\frac{16}{15}\right) \left(\frac{16}{15}\right) \left(\frac{135}{128}\right) \left(\frac{16}{15}\right) \left(\frac{25}{24}\right) \left(\frac{16}{15}\right) \left(\frac{135}{128}\right) \left(\frac{16}{15}\right)$$

1. Find all types of *whole tone* occurring in the two octave Just Chromatic Scale. Give each type as a sequence of semitone types (you may choose your own labels for those if you want to avoid rewriting the fractions over and over), and also as a *reduced fraction* which gives the Just frequency ratio, and also as a cent value to one decimal place. Finally, also give the count of the number of times that each type occurs.
2. Same question for *minor third*.
3. Same question for *major third*.
4. Same question for *perfect fourth*.
5. Same question for *tritone*.
6. Same question for *perfect fifth*.
7. Same question for *minor sixth*.
8. Same question for *major sixth*.
9. Same question for *minor seventh*.
10. Same question for *major seventh*.