

Running the program

To run the program, install libraries **music21** and **mido** on **Python 3.9**, and to change the input/output files, edit the “input_file” and “output_file” variables in the main() function, which has the main code.

Key detection algorithm

To detect the key of the music, I used music21's music analyzation algorithms - `midi_score.analyze("key")`

Detected keys

The detected keys were D minor for Input 1, F Major for Input 2, E minor for Input 3.

Algorithm flow

First, the program reads in the midi files using mido. Then, it uses music21 to analyze the key, and calculates the necessary scale, chord length, the tempo of the music, the average velocity and displacement, alongside calculating the consonant chords through the Circle of the Fifths. Afterwards, we generate a population of 128 chromosomes, with each chromosome being the accompaniment of the song. We set a number of 5000 max iterations, and each iteration we calculate the ratings for each chromosome by first setting the rating to the size of the chromosome and then lowering it by 0.5 if the consonant chords contain a chord in the gene pool of the chromosome, then further lowering it by 0.5 if there is a pause in the song at the moment or if the note isn't in any of the consonant chords or the current gene has the current note. Afterwards, we sort the population by rating and select the top 25% chromosomes as survivors. Then, we repopulate by selecting random chromosomes and crossing them over at one point, and afterwards we mutate one gene in half of the chromosomes. If the rating of the first chromosome is 0, which means we found the perfect accompaniment, we stop the program and write the accompaniment to the midi file, and we also do the same if the iteration count has reached the limit (which is 5000.)