Calculating rhythmic pattern outcomes through matrix manipulation

Linear Algebra 2270-004 Semester Project

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Outline:

- Basics of musical composition:
    - We want to be able to create all possible rhythmic outcomes using matrices. Depending on the time signature for the piece desired (¾, 4/4, etc.), there will be be a certain amount of outcomes for the rhythm desired.
    - In this program, we will be using eighth notes and eighth rests in order to replicate the 8 bit binary sequence.
    - How is this interesting for us from a linear algebra perspective?
    - This software will allow a user to enter in a certain pattern to start off the rhythm with (or not, if you would like it to be completely random), and then have the computer generate measures of rhythmic patterns based on the user input.
    - We can represent this with a markov chain. Since Markov chains are mathematical systems that track the probabilities of state transitions, they can be used to model and predict behavior. They're used in a lot commercial applications, like text autocomplete and Google's PageRank algorithm.
- For our software:
    - In the final project, we will further detail how to we represented the combinations of notes.
    - We will also show source code of how we used python to generate every possible rhythmic combo
    - There will also be explanations on how the matrices made from our python code were in maple.
    - As well as explain the lilypond plugin and describe how it works
    - And finally, we'll disclose many examples of the sheet music pdf generated with lilypond