Title: Project 1 Grading Document

Group Members:
Seongjin Park - Piano Synthesizer
Chad Burnham - Additive Synthesizer
Jay Ho - Effect Synthesizer

Piano Score Format:

```
<?xml version="1.0" encoding="utf-8"?>
<score bpm="120" beatspermeasure="4">
    <instrument instrument="Piano">
        <note measure="1" beat="1" duration="1" dynamic="2" note="CompletePiano/G1s.wav"/>
        <note measure="1" beat="1" duration="1"  dynamic="2" note="CompletePiano/G2s.wav"/>
        <note measure="1" beat="1" duration="1"  dynamic="2" note="CompletePiano/G3s.wav"/>
        <note measure="1" beat="1" duration="1"  dynamic="2" note="CompletePiano/pedald.wav"/>

        <note measure="1" beat="2" duration="1"  dynamic="1"  note="CompletePiano/D4s.wav"/>
        <note measure="1" beat="2" duration="1"  dynamic="1" note="CompletePiano/A3#s.wav"/>
        <note measure="1" beat="2" duration="1"  dynamic="1" note="CompletePiano/G3s.wav"/>
        <note measure="1" beat="2" duration="1"  dynamic="1" note="CompletePiano/D3s.wav"/>

        <note measure="1" beat="2.33" duration="1"  dynamic="1" note="CompletePiano/D4s.wav"/>
        <note measure="1" beat="2.33" duration="1"  dynamic="1" note="CompletePiano/A3#s.wav"/>
        <note measure="1" beat="2.33" duration="1"  dynamic="1" note="CompletePiano/G3s.wav"/>
        <note measure="1" beat="2.33" duration="1"  dynamic="1" note="CompletePiano/D3s.wav"/>
    </instrument>
</score>
```

Additive Score Format:

```
<score bpm="120" beatspermeasure="2">
     <instrument instrument="Additive">
                <!-- BASIC DEMONSTRATION -->
                <note measure="1" beat="1" duration="0.2" note="B3" a1="0.75" a2="0.5" a3="0.25"/>
                <note measure="1" beat="1.2" duration="0.2" note="B4" a1="0.75" a2="0.5" a3="0.25" />
                <note measure="1" beat="1.4" duration="0.2" note="Gb5" a1="0.75" a2="0.5" a3="0.25" />
                <note measure="1" beat="1.6" duration="0.2" note="C6" a1="0.75" a2="0.5" a3="0.25" />
                <note measure="1" beat="1.8" duration="0.2" note="Gb6" a1="0.5" a2="0.5" a3="0.25" />
                <note measure="1" beat="2" duration="0.5" note="A6" a1="0.5" a2="0.5" a3="0.25" />

                <!-- POLYPHONY -->
                <note measure="3" beat="1" duration="0.5" note="A6" a1="1" a2="1" a3="1" />
                <note measure="3" beat="1" duration="0.5" note="B3" a1="1" a2="1" a3="1" b1="0.25" b2="0.1" b3="0.25" b4="0.1" />

                <!-- CROSS FADING -->
                <note measure="6" beat="1" duration="1.5" note="G2" a1="0.5" a2="0.4" a3="0.3" a4="0.2" b1="0.9" b2="0.8" b3="0.7" b4="0.6"/>

                <!-- VIBRATO -->
                <note measure="8" beat="0.5" duration="2" a1="0.5" vFreq="5" vAmp="10" note="E3"/>
     </instrument>
</score>
```

Effects Score Format:

Noise Gate format:

```
<instrument instrument="Noise Gate">
        <note measure="1" delay=".0025" wet="1" dry="0" threshold="0.5" />
        <note measure="2" delay=".0025" wet=".75" dry=".25" threshold="0.5" />
        <note measure="2" delay=".0025" wet=".5" dry=".5" threshold="0.5" />
</instrument>
```

Compression format:

```
<instrument instrument="Compression">
        <note measure="7" delay=".0025" wet="2" dry="1" threshold=".9" />
</instrument>
```

Chorus format:

```
<instrument instrument="Chorus">
        <note measure="1" delay="2" wet="1" dry="0" range = "20" rate = "5" />

</instrument>
```

Flanger format:

```
<instrument instrument="Flanger">
        <note measure="1" delay="2" wet="1" dry="0" range = "40" rate = "20" />
</instrument>
```

Group Grading Component:

- “FinalScore (4).score” / “FinalScore.wav” (score file is in Scores folder, and wav file is in ScoresAudio folder)
    - Demonstrates all grading components listed above
- 10 - Suitable length audio files and web site turned in - Complete
- 20 - Audio file is recognizable as music in the opinion of the TA and Instructor
- 30 - Audio file utilizes all system components. - Complete
    - All components included in score file
- 40 - Audio file utilizes all capabilities of all system components - Complete.
    - All component capabilities included in score file

Piano Component

Owner: Seongjin Park

Function: The piano synthesizer generates a sound from 88 piano notes to implement various genres of piano music.

Grading elements supported:

10 - Plays piano notes - Complete

I searched for a file name in PianoSys class and used it to open the wav file that contains sample frames of the particular note I want to play. While the wav file is opened, I used a wavetable vector to store sample frames and then passed it to Piano class where I update new audio frames with every sample frame (from a wavetable) to generate sound of piano notes.

20 - Envelope generation - Complete

I set up attack and release variables in piano class to handle the duration of the piano.

30 - Pedal simulation - Incomplete

I attempted to change the duration of the piano when pedal is on but failed to keep the same duration in other notes.

35 - Basic dynamics - Complete

Depending on the value of the dynamic, the frequency of the piano note increases or decreases.

40 - Pedal noise - Complete

I implemented pedal noise by adding pedalu.wav and pedald.wav as notes in my score file.

50 - Advanced dynamics - Incomplete (due to time limit)

Score File attributes:

Measure: the measure of the note
Beat: the beat of the note
Duration: the duration of the note
Dynamic: the dynamic that determines loudness of the note
Note: file path of the piano note or pedal noises

Score/Wav files (In Score folder and ScoresAudio folder) for submission:

PianoTest.wav (Based on Rachmaninoff Prelude Op.3 No.2 in C# minor , 16 seconds)
PianoTest.score (Based on Rachmaninoff Prelude Op.3 No.2 in C# minor, 16 seconds)

Additive Component:

- Owner:
  - Chad Burnham
- Function:
  - The additive synthesizer generates sound by reading in a frequency and adding sinusoids together. This component ensures that harmonics beyond the nyquist frequency are not generated.
- Grading Elements Supported:
  - 10 - Sinusoid playback on demand from the sequencer - **Complete**
  - 20 - Definition of all harmonics - **Complete**
    - Harmonics 1-8 included
  - 30 - Envelope generation - **Complete**
    - Completed using AR class
  - 35 - Polyphony - Complete
  - 40 - Sound cross-fading - **Complete**
    - Completed using the [b1-b8] attributes
  - 50 - Vibrato - **Complete**
    - Completed using vFreq and vAmp attributes
- Score File Attributes:
  - **Measure**: The measure of the note
  - **Beat**: The beat of the note
  - **Note**: The note to play (frequency)
  - **Duration**: The duration of the note measured in beats
  - **a1-a2-a3-a4-a5-a6-a7-a8**: The amplitude of the harmonics being added, a1 = Fundamental, a2 = Harmonic 2, etc…
  - **b1-b2-b3-b4-b5-b6-b7-b8**: The amplitude of the harmonics of the note to be cross-faded into. If b1 doesn't exist the note won't have any cross-fade
  - **vFreq**: Frequency of the vibrato
  - **vAmp**: Amplitude/Magnitude of the vibrato
- Score Files For Additive Grading: (All score files located in "Scores" folder)
  - Take/Play these scores from backup submission if available
  - Demonstration:
    - "10SecAdddFeatures.score"
      - Demonstrates all grading components listed above
  - Full Score
    - "AdditiveFinal.score"
      - Demonstrates all grading components listed above
    - 10 - Suitable length audio files and web site turned in - Complete
    - 20 - Audio file is recognizable as music in the opinion of the TA and Instructor
    - 30 - Audio file utilizes all system components. - Complete
      - All components included in score file
    - 40 - Audio file utilizes all capabilities of all system components - Complete.
      - All component capabilities included in score file
    - 50 - The script has at least 240 notes in it. - Complete

Effects Component:

- Owner: Jay Ho
- Function: Effect is its own instrument, other synthesizer components such as piano and additive will pass their audio to the instrument. Then the effect will process the audio according to each “send” score attribute and modify the audio.
- Grading Elements Supported:
    - 10 - Component passes audio - Complete
    - 20 - 1 Effect - Complete
    - 30 - 3 Effects - Complete
    - 40 - Controllable effects send - Complete
    - 50 - 4 Effects - Maybe
- Score File Attributes
    - send0: dry
    - send1: Noise gate effect
    - send2: Compression effect
    - send3: Chorus effect
    - send4: Flanger effect
    - For each effect, it will have instrument tag
        - <instrument instrument="Noise Gate"></instrument>
    - For Chorus and Flanger
        - Delay: average delay
        - Range: amplitude of delay variation
        - Rate: speed of delay is varied
- Score Waves Files - Inside of ScoresAudio folder
    - AdditiveNoEffects - the wav file for original additive sound with no effects
    - AdditiveNoiseGate0.1 - the wav file for the original additive sound with noise gate effect with threshold 0.1
    - AdditiveNoiseGate0.5 - the wav file for the original additive sound with noise gate effect with threshold 0.5
    - AdditiveFlanger - the wav file for the original additive sound with flanger effect
    - AdditiveChorus - the wav file for the original additive sound with chorus effect