SynthSong

Create a C++ console program that plays a melody, using its own internal synthesizer.

Oscillators

The synth is based on waveform oscillators of various types. Their base class is Oscillator, which contains properties and functionality that all oscillators share.

Derived from Oscillator are special types of oscillators that produce sine waves, square waves, triangular shaped waves or arbitrary wave shapes. Choose three different types that you will implement.

A possible design strategy for the waveform oscillators:

1. decide which oscillators you want to study and implement (choose at least three)

2. write down which properties and functionality these have in common and assign these to the Oscillator class. Do not spend too much time on this: you will get back to it after the next steps
3. for every oscillator, write down the properties and functionality that are specific for this type
4. draw a class diagram showing Oscillator, the three oscillators, the relations between them and briefly the most important properties and methods. For every relation specify if this is a ‘has a’ or an ‘is a’ relation.
5. analyse the things you found in step 3 and see if there are common properties you didn't think of in step 2. If needed, go back to step 2 and adjust your design

Implement the base class and derived classes and let every oscillator produce 0.01 seconds of waveform samples in a buffer. Also write the samples to a text-file for analysis.

Tip: first develop and test one oscillator type and if this works, copy and modify it to other types.

The synths

Create a synthesizer that uses a mix of oscillators of different types and let it produce several seconds of sound via the sound hardware. In your design, create a Synthesizer class which make use of the oscillators.

Create another synthesizer that uses a different arrangement of oscillators than the first one, e.g. FM-synthesis, additive synthesis or other.

Playing music

You are now going to use the synthesizers from the previous steps for playing music. Add a `MelodyGenerator` class that generates a melody and use this class to play the melody with your Synthesizers. You are free to let both synthesizers play simultaneously or e.g. let the user decide which one to choose.

Human player

Add a command line user interface to your program that enables the user to use your application.

Extras

- Let the user indicate the relative amplitudes and/or de-tuning of the oscillators
- Handle real time MIDI or OSC commands to play notes on the synthesizer
- Let the program create variations of the melody: inversion, reverse etc.
- Add rhythm
- … *(share other ideas with the teachers before implementing)*