Elena Byun, Baltazar Ortiz, Angus MacMullen
6.111 Final Project Checklist
Nov. 16, 2016

Commitments
- Sequencer, Synth, Sampler all work in conjunction
- Sequencer
  - Multiple sampler and synth tracks, controlled in play/pause, write on/off modes
  - Commit/revert support
  - Use input/output hardware mostly on Nexys4
- Sampler
  - Storage controller
    - Load audio files off the SD card (formatted with python script to have exactly 15 files on it)
  - Sample controller
    - Take addresses from storage controller and assign to trigger inputs
    - Take trigger inputs from sequencer and send addresses to playback
  - Playback module
    - Play one audio file at a time
- Synth
  - Single synth channel
  - Single, tunable oscillator with multiple waveforms
  - Basic, "fixed" FIR filter (i.e. select from a few precomputed filter responses)
  - Parameters controllable via dedicated potentiometers, switches

Main Goals
- Commitments, plus:
- Sequencer
  - Use dedicated hardware interface created for our project, handle external inputs (switches, buttons, encoders) and create visual effects (LED arrays, 7 segment displays, etc.)
- Sampler
  - Improve playback module to allow multiple audio files to play back at once
- Synth
  - Multiple synth channels
  - 3 oscillators per channel with individual tuning, waveform, level control
  - Adjustable filter response, emulating typical analog lowpass filter
  - Amplitude, filter envelopes
  - Multi-function controls allow many parameters to be edited with same set of potentiometers, switches

Stretch Goals
- External DAC for better sound quality

- MIDI support (between Sequencer and Sampler/Synth; to/from external devices)
- VGA visualization - display graphical representation of sequence, oscilloscope-like display of sampler/synth/master output.
- Master output effects (filter/EQ, echo, overdrive, etc)
- Sequencer
    - Controllable BPM
    - Scene controller (user control)
        - Interact with Sampler to switch out active scene during use
- Sampler
    - Scene controller (user control)
        - Switch out active scene while device is being used
    - Recorder
        - Save overall output back to SD
        - (Much harder) replace samples in scene with live recorded audio clips
    - Basic FX
- Synth
    - Modulation between oscillators: hardsync, phase modulation, ring modulation
    - LFO modulation of filter, pitch, amplitude, etc
    - Additional filter types (highpass, bandpass, etc)
    - Polyphony
    - Save/recall synth patches (in BRAM, maybe on SD?)