Modules:

FFT:
Takes audio input, and outputs a set of real and imaginary coefficients on every clock cycle.

Will be used in conjunction with the Pitch Finder module to demonstrate full functionality.

Pitch Finder:
Takes in a pair of coefficients from the FFT, and performs a linear search over the set to find the largest.

Should detect frequency of a sung note to within about 6Hz of tolerance.

Counterpoint FSM:
Takes in the pitch value from the Pitch Finder and calculates the appropriate musical interval that composes the appropriate counterpoint melody.

Should demonstrate adherence to a modified set of counterpoint rules, with more counterpoint lines being output if time permits.

Pitch Shifter:
Takes in audio input from the AC97 ADC and an interval value from the Counterpoint FSM to produce a pitch-shifted signal.

Should demonstrate ability to properly pitch-shift a given signal, achieving better clarity if time permits.

Effects:
Distortion: Applies gain to each signal and clips it, making the analog signal resemble more of a square wave.

Reverb: Adds an attenuated, delayed copy of the signal to the output signal.

Equalizer (time permitting): Applies a variable gain to different frequency bands in the signal.

The effects of these modules should be audible, but can also be demonstrated in ModelSim with appropriate dummy inputs.