

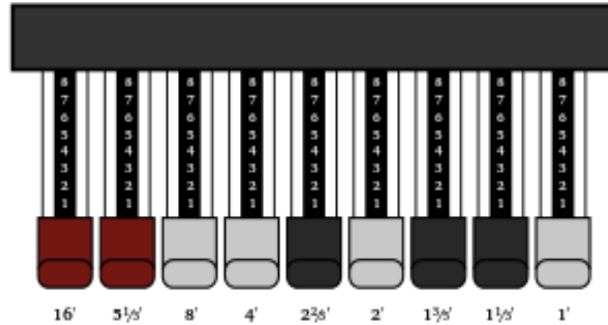
Assignment 04 - Making your additive synth into a Hammond Organ.

The hammond organ is a sort of additive synthesizer using tonewheels as oscillators. Read more about it in wikipedia:

https://en.wikipedia.org/wiki/Hammond_organ

As you can see in the drawbar section, the hammond adds nine signals. “The labeling of the drawbar derives from the [stop](#) system in pipe organs, in which the physical length of the pipe corresponds to the pitch produced. [...] The drawbar marked “8” generates the [fundamental](#) of the note being played, the drawbar marked “16” is an octave below, and the drawbars marked “4”, “2” and “1” are one, two and three octaves above, respectively.” Some drawbars have pipe

lengths that are not exact doublings of the fundamental, so we need to do a bit more work to figure out what to do. A more precise definition of what harmonic each drawbar is supposed to produce is given in this chart below.



Drawbar No.	Harmonic	Pipe Foot length	Factor for fundamental multiplication	Drawbar Color
1	Sub Fundamental ¹	16'	$\frac{1}{2}$	Brown
2	Sub Third ²	5 $\frac{1}{3}$ '	$\frac{2}{3}$	Brown
3	Fundamental	8'	1	White
4	2nd Harmonic	4'	2	White
5	3rd Harmonic	2 $\frac{2}{3}$ '	3	Black
6	4th Harmonic	2'	4	White
7	5th Harmonic	1 $\frac{3}{5}$ '	5	Black
8	6th Harmonic	1 $\frac{1}{3}$ '	6	Black
9	8th Harmonic	1	8	White

¹ An octave below the Fundamental frequency

² An octave below the 3rd Harmonic

A central aspect of this class is for you to understand how to modify existing patches to do what you want them to do. In this case, we will modify the additive organ patch we made in class by changing a few things.

Your assignment consists of the following tasks:

1. Our additive organ patch currently has 8 oscillators with harmonic frequencies that are 1 through 8 times the fundamental frequency ($[* 1]$, $[* 2]$, ... $[* 8]$), modify your patch so that it has nine oscillators matching the hammond drawbars in the chart above .
2. Change your organ so it has 8 voices instead of 4 (you'll need to change stuff in poly, route and a couple more things...).
3. Check out this video: <https://www.youtube.com/watch?v=r5KaQ5OB0kE>
 - a. Make presets for Jimmy Smith, Groove Holmes, Erroll Garner, Charles Earland, Full Organ.³
 - b. For now use ADSR to try to mimic the percussion on/off setting by setting a sharp attack followed by a sharp decay. The ADSR is not exactly how it worked on the Hammond, but we will address that later.
 - c. Also, ignore "vibrato", "chorusing" and "leslie" settings for now, we'll add those later in the semester.
4. Make your patch pretty! Try to hide stuff you don't need to see while you play, by using abstractions and subpatches. Also, check out the properties (right click) for Bangs, Toggles, and V Sliders to work with changing size and color.

³ While you're at it, listen to these artists, after all, presets are named after them. Here is a playlist I'm working on: <https://open.spotify.com/playlist/7rfkeVPW1S3xsLdtLR5aJx?si=839cf3209a914601>
I also put some Medeski, Martin and Wood to hear some more recent organ stuff.