

A Yoshimi Cookbook

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July 16, 2015

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1 Introduction

This document is a follow-on to the author's "A Yoshimi User Manual" [10]. The user manual attempts complete coverage of the user-interface and concepts behind *Yoshimi*. This cookbook attempts to provide recipes to solve some common problems in getting *Yoshimi* to perform at its best for the user.

1.1 Project Structure

The "Yoshimi Cookbook" project consists of two parts:

- The source material for this document.
- A self contained "yoshimi" configuration and data section to support the examples in this cookbook.

The documentation source-files are provided in the `tex` directory. They are used to create the cookbook via Makefiles and the external "latexmk" project. The result of a "make" is a new PDF of the cookbook in the `pdf` directory. The latest PDF is always provided there so that one does not have to install the external projects needed to create it.

The configuration, banks, presets, and instrument files can be used to supplement or replace the user's own configuration and data files.

1.2 What Game Shall We Play Today?

There are a number of recipes that are hinted at in the user manual, but that solve problems that the author has encountered while using *Yoshimi*.

- **Banks and MIDI.** *Yoshimi* has had recent modifications to support bank-switching and using program-change messages to make *Yoshimi* a more flexible MIDI playback tool.
- **General MIDI.** It should be possible to set up one or more banks that are General MIDI compliant.
- **Usage of Modulators.** *Yoshimi* provides a number of modulation setups, but it isn't clear how to use them, especially the ring modulator.
- **Creation of Special Instruments.** There are some instruments that don't seem to have decent *ZynAddSubFX/Yoshimi* instrument files. Some examples, based on our desires: sitar, koto, bagpipes, steel drums, telephone tones, middle-eastern pipes, Japanese instruments, that steel-whip percussion sound heard in many songs....
- **More!**

This document explains how to do some of the above tasks.

Oh, before you get started, go to *Menu / Instruments / Open Instruments...* and navigate to where you installed this project (for example, `/3rdparty/yoshimi-cookbook/yoshimi/banks` and click **Add to Favorites** in the **Favorites** dropdown. That's where we store our GM bank and the demonstration files.

2 Concepts

This section, like its counterpart in our *Yoshimi User Manual*, presents some useful concepts, while keeping them out of the way.

2.1 Concepts / Terms

This section doesn't provide comprehensive coverage of terms. It covers mainly terms that puzzled the author at first or that are necessary to understand the recipes.

2.1.1 Concepts / Terms / cent

The **cent** is a logarithmic unit of measure used for musical intervals. Twelve-tone equal temperament divides the octave into 12 semitones of 100 cents each. Typically, cents are used to measure extremely small finite intervals, or to compare the sizes of comparable intervals in different tuning systems. The interval of one cent is much too small to be heard between successive notes.

Since the detuning provided in *Yoshimi* is based primarily on cents (and octaves), it pays to understand cents. If a given frequency f' is offset from another frequency f , the relationships between them in semitones are:

$$f' = f * 2^s/12$$

$$s = 12\log(f'/f)/\log 2$$

In cents, these relationships become:

$$f' = f * 2^s/1200$$

$$s = 1200 \log(f'/f) / \log 2$$

These relationships hold whether f' is less than or greater than f . They provide an easy way to determine how much to detune a frequency in *Yoshimi*.

2.1.2 Concepts / Terms / ring modulation

Ring modulation is the multiplication (heterodyning) of two signals, and is named for the ring-like circuit that can produce it. When two tones, f_1 and f_2 , with $f_1 < f_2$, are multiplied, the spectrum changes from $\{f_1, f_2\}$ to $\{f_2-f_1, f_2+f_1\}$.

Depending on the ratio of f_1 and f_2 , the sounds can be bell-like or very discordant. *Yoshimi* provides ring modulation, as well as other forms of modulation.

3 Creating Instruments

One of our goals in using *Yoshimi* is to support *General MIDI (GM)* to the greatest extent possible.

However, no banks have been created with GM in mind. And many of the instruments, though given names that indicate what they are intended to be, fall well short of being recognizable per their name; they should be doable with a complex synthesizer like *Yoshimi*.

It is true that there are a vast number of patches out there. The author has attempted a survey of them, and the task is all but impossible. Still, many candidates have been identified. Other candidates might be suitable with a little tweaking.

Here are a number of categories of instruments for which we want to assemble an improved set of instruments.

1. **Bells**
2. **Ethnic**
3. **Drums**
4. **Effects**
5. **Piano**
6. **Leads**
7. **Guitar**
8. **Strings** (individual and ensemble)
9. **Bass**
10. **Saxophones**

For these recipes, the `banks` directories will be stored in the following directory of this project:

```
yoshimi/banks
yoshimi/banks/demo
```

3.1 Bells

The bells patches we've heard so far are nice, but a bit anemic.

Good bell patches are easier with ring modulation, done right. We're not sure if there are any such patches extant; please send us to them if there are some.

In the meantime, creating bells is a good excuse to master *Yoshimi*'s ring modulator. However, we will first learn how to create a reasonable, clangy bell using just a few voices in an ADDsynth part, and no need for modulation.

3.1.1 Bells by Voices

The following table comes from a tutorial ([2]). Along with a spectrum shown in reference [3], it allows us to recreate a simple, but realistic bell. In this table, F represents the fundamental frequency, i.e. the note being played.

Table 1: Simple Bell Tones

Wave Number	Frequency	Cents Offset	Relative Amplitude
1	0.56F	-1000	0.5
2	0.92F	-140	1.0
3	1.19F	+300	0.5
4	1.71F	+930	0.25
5	2.00F	+1200	0.125
6	2.74F	+1745	0.125
7	3.00F	+1901	0.125
8	3.76F	+2290	0.125
9	4.00F	+2400	

Note that the frequencies are relative to the fundamental frequency (F). Also note that wave 2 (close to F) can be missing, and the sound still is bell-like.

The file `yoshimi/banks/demo/Bells-simple-addsynth.xiz` is the result of following the steps below. We start, as usual, with a newly-started *Yoshimi* instance.

1. Open the ADDsynth editing window by clicking the **Edit** button in the bottom panel, and then clicking the ADDsynth **Edit** button in the edit window.
2. Click on the **Show Voice Parameters** button. Note that it is **Current Voice 1**, and it should be enabled.
3. For voice 1, make the following settings:
 1. **Octave**: Set to 0.
 2. **Detune Type**: Set to E1200cents.
 3. **FREQUENCY Detune**: Set to -1000 approximately.
4. Go to voice 2, and make the following settings:
 1. **Octave**: Set to 0.
 2. **Detune Type**: Set to E1200cents.
 3. **FREQUENCY Detune**: Set to -140 approximately.
5. Go to voice 3, and make the following settings:
 1. **Octave**: Set to 0.

2. **Detune Type:** Set to E1200cents.
3. **FREQUENCY Detune:** Set to 300 approximately.
6. Go to voice 4, and make the following settings:
 1. **Octave:** Set to 0.
 2. **Detune Type:** Set to E1200cents.
 3. **FREQUENCY Detune:** Set to 930 approximately.
7. Go to voice 5, and make the following settings:
 1. **Octave:** Set to 1.
 2. **Detune Type:** Set to Default.
 3. **FREQUENCY Detune:** Set to 0.
8. Go to voice 6, and make the following settings:
 1. **Octave:** Set to 1.
 2. **Detune Type:** Set to E1200cents.
 3. **FREQUENCY Detune:** Set to 545 approximately.
9. Go to voice 7, and make the following settings:
 1. **Octave:** Set to 1.
 2. **Detune Type:** Set to E1200cents.
 3. **FREQUENCY Detune:** Set to 700 approximately.
10. Go to voice 8, and make the following settings:
 1. **Octave:** Set to 1.
 2. **Detune Type:** Set to E1200cents.
 3. **FREQUENCY Detune:** Set to 1090 approximately.

These settings then end up roughly matching the settings of the first 8 waves in table 3.1.1 (“[Bells by Voices](#)”) on page 5. This instrument isn’t perfect. It’s not quite equally tempered, though close. The character of the tone changes a bit as the notes get higher. One can fiddle with the relative amplitudes of the various voices to change the character of this sound.

3.1.2 Ring Modulation with 440 Hz Tone

Now for an initial demonstration of ring modulation. This demonstration does not quite create a bell tone, but does show the sound of modulation.

Start with a fresh *Yoshimi* and a cleared instrument (“Simple Sound”). Open the virtual keyboard using the **virKbd** button. Click a key and verify that you can hear a tone. We’ll use the middle C key (the “comma” on the PC keyboard) as a reference. We will call it the “C” note.

The following steps will set up two tones, voice 1 and voice 2, and voice 2 will use voice 1 as an external modulator. Note that you can accomplish most of these steps by loading the project file *yoshimi/banks/demo/Bells-440-ring-modulation.xiz*, but use that only as a last resort.

1. Open the ADDsynth editing window by clicking the **Edit** button in the bottom panel, and then clicking the ADDsynth **Edit** button in the edit window.
2. In the **Amplitude Env** sub-panel, increase the **D.dt** and **R.dt** to give the current sound a nice slow decay.
3. Click on the **Show Voice Parameters** button. Note that it is **Current Voice 1**, and it should be enabled.
4. Switch to **Current Voice** number 2 and enable it. Play the “C” note, and observe that it is the same frequency, but louder.

5. Move the **FREQUENCY** Detune slider a bit, and play the "C" note. It should sound the same as before, but change slowly in amplitude, as heard and as seen on the **VU meter**. Try to set the detune back to 0; this is easier if you highlight the tuning knob and use the left or right arrow keys.
6. In the **MODULATOR** section of voice 2, for **Type**, select the **RING** value. (However, feel free to select one of the other modulators, to experiment, once you've mastered the ring modulator.) Press the "C" key again, and notice that the tone character changes a bit. This is due to the internal modulator.
7. For **External Mod.** for voice 2, select **Ext.M 1**, to use the voice 1 as the internal modulator. The "C" note may change in character, but only slightly. Apparently the default internal modulator is the same as the default external voice 1 waveform.
8. To actually hear some modulation, we have to separate the frequencies of voice 1 and voice 2. Click the **440Hz** check-box in the **FREQUENCY** section of voice 1. Press the "C" key and verify hearing a two-tone signal, somewhat like a phone tone.
9. Now go back to voice 2 and click the **Change** button to bring up the ADDsynth oscillator dialog.
10. Move the slider to maximum for harmonic 10. Press the "C" key and verify the new sound (a bit like a car horn). Set the sliders back to 0, and "C" will be a single tone again.
11. Change the **Octave** values of voice 2 in its **FREQUENCY** section and listen to the effects.

Now we need to see if we can apply modulation across instruments. Sadly, this does not seem to be possible.

Increase the **D.dt** and **R.dt** values of the main **Amplitude Env** to give this sound the onset and decay of a bell, and it then sounds less abstract, and more like a bell. Of course, this kind of bell is even less tunable than the simple bell of the previous section.

Another thing to try with this setup is to simply change voice 2 to use different types of modulators besides **RING**. **MORPH** sounds basically identical to **RING**. **PM** seems to expose higher harmonics, making the sound louder and brighter. **FM** sounds similar to PM, but softer and smoother. **PITCH** is disabled.

Another experiment is to disable the modulator (voice 1 here) and see how that changes the sound; all it should do is drop voice 1 from the spectrum – voice 1 will still be used as the modulator.

Finally, by adding a slow decay to this sound, it becomes amazingly more bell-like.

3.1.3 Complex Bells by Ring Modulation

The next step is to make the bells more complex, by combining the methods of the previous two sections. Recall table 3.1.1 ("Bells by Voices") on page 5. It shows the 9 frequencies in the simple bell spectrum, though we could define only 8 of them. How can we best add extra frequencies? We can ring-modulate the higher frequencies against one of the lower frequencies.

Table 2: Ring Modulation Bell Tones

Wave Number	Frequency	Mod Frequency	f2-f1	f2+f1
1	0.56F	—	—	—
2	0.92F	0.56F	0.36F	1.48F
3	1.19F	0.56F	0.63F*	1.75F*
4	1.71F	0.56F	1.15F*	2.27F
5	2.00F	0.56F	1.44F	2.56F
6	2.74F	0.56F	2.18F	3.30F

7	3.00F	0.56F	2.44F	3.56F
8	3.76F	0.56F	3.20F	4.32F

The asterisk marks frequencies that are close to existing frequencies. Luckily, there are only three of them, so our modulation should add a good number of frequencies.

1. Load the file `yoshimi/banks/demo/Bells-simple-addsynth.xiz` to save a lot of steps. The next steps add voice 1 as a ring modulator for voices 2 through 8.
2. Open the ADDsynth editing window by clicking the **Edit** button in the bottom panel, and then clicking the ADDsynth **Edit** button in the edit window.
3. Click on the **Show Voice Parameters** button. Note that it is **Current Voice 1**, and it should be enabled.
4. Go to voice 2 and do the following steps:
 1. In the **MODULATOR** section (greyed out), change the **Type** from **OFF** to **RING**.
 2. Changes the **External Mod.** dropdown from **Off** to **ExtMod. 1**.
5. Go to voice 3 and repeat those steps. Note how all the voices below the current voice become available as modulators.

We saved the result in the file `yoshimi/banks/demo/Bells-ringmod-addsynth.xiz` for safe-keeping.

QUESTION: If one loads and instrument and tinkers with it, but do not save it, does *Yoshimi* save it on exit anyway?

3.2 Ethnic

We've found a simple steel drum instruments, but think we might do better, creating one using ADDsynth and one using PADsynth.

Instruments we have not found, and would like to synthesize, are: bagpipes and arabic pipes.

3.2.1 Ethnic / Steel Drums

There is a steel-drum instrument that ships with *Yoshimi*: `/usr/share/yoshimi/banks/The_Mysterious_Bank/0122-`. It is an ADDsynth module comprised of three voices:

1. A **Unison**-enabled voice of **Size** = 10 and a **Frequency Spread** of 44.6 cents.
2. Another voice that is exactly the same as the first, except that it has its **Amplitude Env** sub-panel enabled, to add more volume and character to the instrument, it is stronger on the right, and, most importantly, an octave higher.
3. Another voice that is exactly the same as the second, except it is an octave lower than voice 0.

If voice 2 and 3 are disabled, the instrument still sounds reminiscent of steel drums, so obviously the overall amplitude envelope is important.

Can we do better? Well, the instrument above sounds too pristine. We should be able to add some "dirt" to the instrument to make it sound more lively.

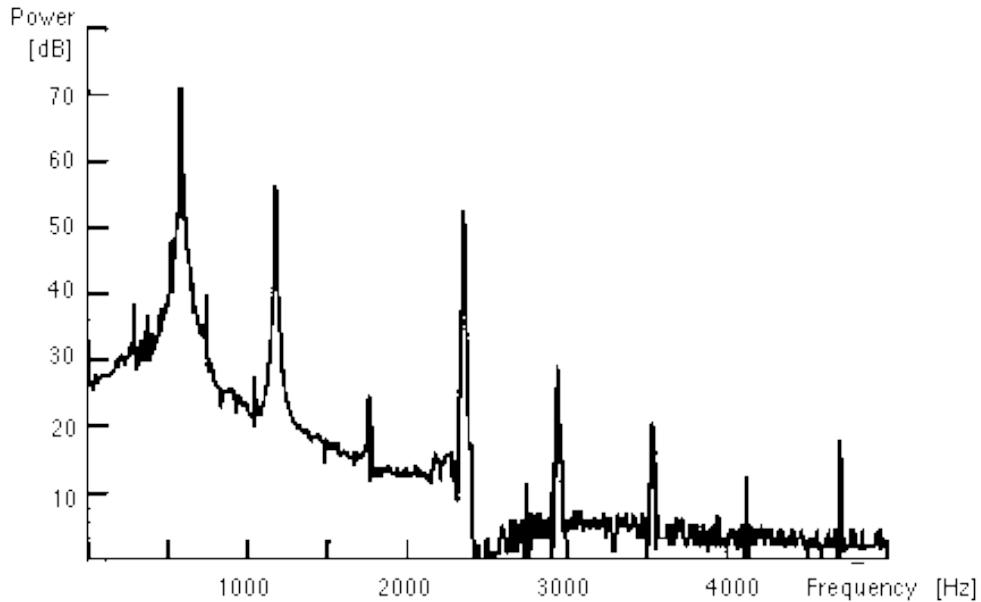


Figure 1: Typical Steel Drum Spectrum

Taking a cue from this figure, our steel drums extend the original by adding a couple more tones at octave intervals. Also, some slight detuning was introduced to add to the flavor. We could probably add a couple more, and carefully contour their amplitude levels to match the spectrum levels shown above.

To hear the ADDsynth steel drum sound, load the file `yoshimi/banks/demo/Add_Pseudo_Steel_Drums.xiz`.

Not content with that, with our hands behind our back, we pull SUBsynth from a hat. The SUBsynth settings for a steel drum are shown in the following figure:

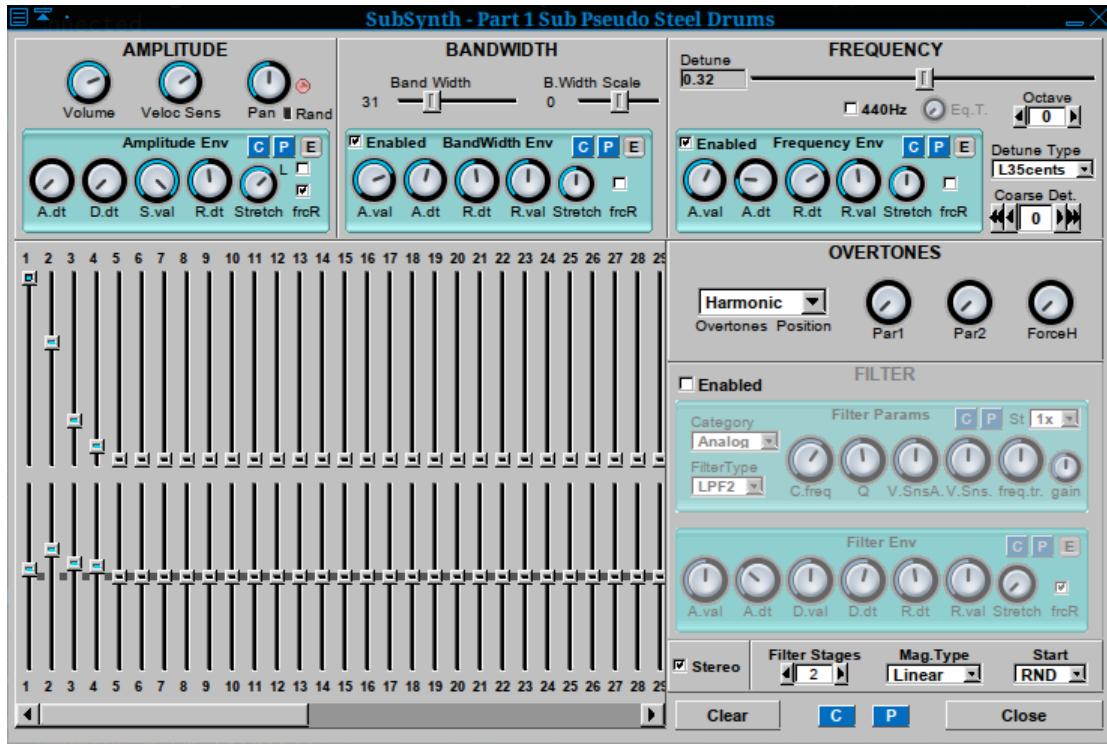


Figure 2: Steel Drum SUBsynth Configuration

Note the top box of slider controls. It sets the amplitudes of the harmonics, and should vaguely resemble the spectrum diagram. The lower box of slider controls sets the bandwidth of each harmonic, with the fundamental frequency being very narrow.

To hear the SUBsynth steel drum sound, load the file `yoshimi/banks/demo/Sub_Pseudo_Steel_Drums.xiz`.

3.3 Drums

We want a decent drum kit that attempts to fill in the gaps for a GM-compliant drum kit with solid sounds, with the help of an existing kit.

It turns out that a "Natural Drum Kit", which we'd found separately on the Internet a long time ago, is now part of the instruments installed with *Yoshimi*. But long ago we used some of the sounds from various kits to create our own "natural drum kit", and extended some of the sounds across more (pitched) keys so that any MIDI drum note would produce some sound. We also made sure the sounds were laid out in GM format as much as possible.

Fire up *Yoshimi* and load the instrument stored in `yoshimi/banks/demo/Natural_Drum_Kit_Basic.xiz`, and we'll walk through it.

No.	M.		Min.k	Max.k	ADsynth	SUBsynth	PADsynth	FX.r.
1	<input checked="" type="checkbox"/>		0	127				OFF
2	<input checked="" type="checkbox"/>	Snare - Stick + Snares	38	40	<input checked="" type="checkbox"/> edit	<input checked="" type="checkbox"/> edit	<input type="checkbox"/> edit	OFF
3	<input checked="" type="checkbox"/>	Snare-Head+Resonance	38	40	<input checked="" type="checkbox"/> edit	<input checked="" type="checkbox"/> edit	<input type="checkbox"/> edit	OFF
4	<input checked="" type="checkbox"/>	HiHat closed 2	42	42	<input type="checkbox"/> edit	<input checked="" type="checkbox"/> edit	<input type="checkbox"/> edit	OFF
5	<input checked="" type="checkbox"/>	HiHat closed long 1	44	44	<input type="checkbox"/> edit	<input checked="" type="checkbox"/> edit	<input type="checkbox"/> edit	OFF
6	<input checked="" type="checkbox"/>	HiHat open 1	46	46	<input type="checkbox"/> edit	<input checked="" type="checkbox"/> edit	<input type="checkbox"/> edit	OFF
7	<input checked="" type="checkbox"/>	Crash Cymbal 3	49	49	<input checked="" type="checkbox"/> edit	<input checked="" type="checkbox"/> edit	<input type="checkbox"/> edit	OFF
8	<input checked="" type="checkbox"/>	Side Stick	37	37	<input checked="" type="checkbox"/> edit	<input type="checkbox"/> edit	<input type="checkbox"/> edit	OFF
9	<input checked="" type="checkbox"/>	Tom	50	81	<input checked="" type="checkbox"/> edit	<input type="checkbox"/> edit	<input type="checkbox"/> edit	OFF
10	<input checked="" type="checkbox"/>	Bass Drum 2	36	36	<input type="checkbox"/> edit	<input checked="" type="checkbox"/> edit	<input type="checkbox"/> edit	OFF
11	<input checked="" type="checkbox"/>	Acoustic Bass Drum	35	35	<input type="checkbox"/> edit	<input checked="" type="checkbox"/> edit	<input type="checkbox"/> edit	OFF
12	<input checked="" type="checkbox"/>	Low Floor Tom	41	41	<input checked="" type="checkbox"/> edit	<input type="checkbox"/> edit	<input type="checkbox"/> edit	OFF
13	<input checked="" type="checkbox"/>	High Floor Tom	43	43	<input checked="" type="checkbox"/> edit	<input type="checkbox"/> edit	<input type="checkbox"/> edit	OFF
14	<input checked="" type="checkbox"/>	Low Tom	45	45	<input checked="" type="checkbox"/> edit	<input type="checkbox"/> edit	<input type="checkbox"/> edit	OFF
15	<input checked="" type="checkbox"/>	Low-Mid Tom	47	47	<input checked="" type="checkbox"/> edit	<input type="checkbox"/> edit	<input type="checkbox"/> edit	OFF
16	<input checked="" type="checkbox"/>	Hi-Mid Tom	48	48	<input checked="" type="checkbox"/> edit	<input type="checkbox"/> edit	<input type="checkbox"/> edit	OFF

Figure 3: Natural Drum Kit from DS 2

Item 1 is the master control for the whole kit, determining the range of keys that it covers and the effect (if any) it goes through.

Item 2 and **Item 3** provide the two parts of the "natural" snare drum. Both parts are composed of an ADDsynth and a SUBsynth section, and they provide 3 pitches of snare.

The "Snare - Stick + Snares" sections....

MORE DESCRIPTIONS MORE DESCRIPTIONS MORE DESCRIPTIONS MORE DESCRIPTIONS
MORE DESCRIPTIONS

Now, without defining more than one drum kit, we have only about 15 "drums" available to us in *Yoshimi*. So we filled in the missing drums with more "toms", just so some sound will be made. The frequencies of the upper toms get pretty crazy! Here's a diagram of the keyboard layout. Correlate it with figure 3 ("Natural Drum Kit from DS 2") on page 11, to understand the abbreviations.

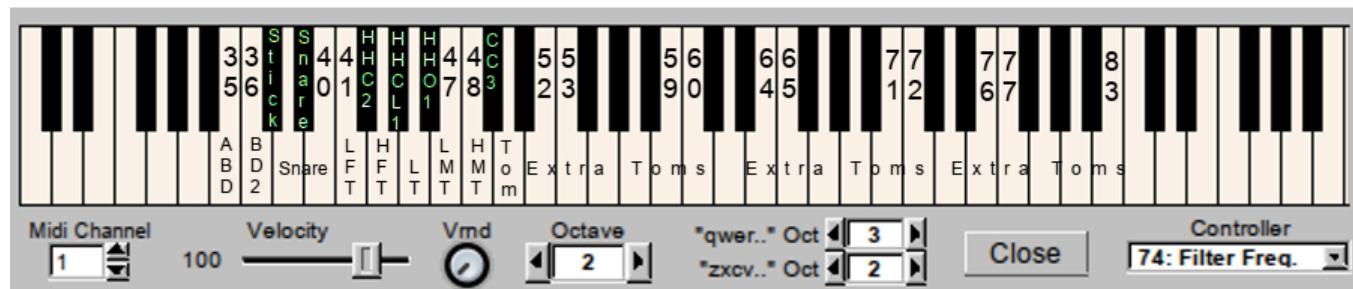


Figure 4: Natural Drum Kit Keyboard Layout

For your reference, here is the full GM drum layout. The diagram is taken from [WikiMedia.org](#).

GM Standard Drum Map

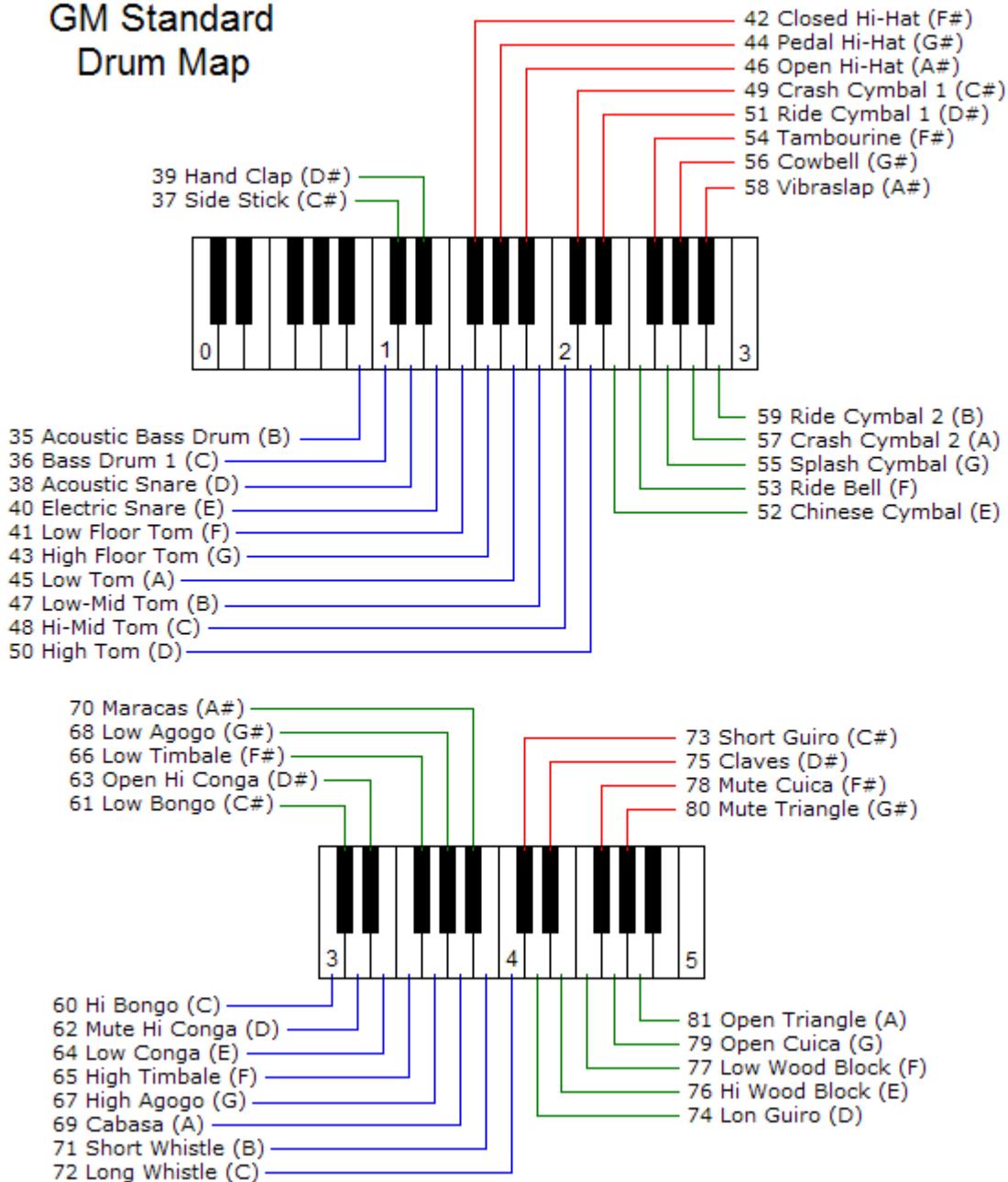


Figure 5: General MIDI Drum Kit Keyboard Layout

3.4 Effects

This section documents the various "effects" instruments we've created.

3.4.1 Effects / Dial Tones

We've created a nice dial-tone effect that we'll describe here. Dial tones consist of two notes, as shown by the **Low F** and **High F** columns in the following table.

Table 3: DTMF Frequencies Table

Tag	DTMF	Kit#	MIDI#	Low	Low F	Actual F	High	High F	Actual F
1	1	5	53	F3	697	705	F5	1209	1245
2	2	6	77	F5	697	705	F5	1336	1337
3	3	7	89	F6	697	698	F5	1477	1468
4	4	8	55	G3	770	770	G5 -	1209	1236
5	5	9	79	G5	770	776	G5 -	1336	1334
6	6	10	91	G6	770	773	G5 -	1477	1462
7	7	11	57	A3	852	855	G#5 +	1209	1245
8	8	12	81	A5	852	868	G#5 +	1336	1327
9	9	13	93	A6	852	866	G#5 +	1477	1480
*		14	59	B3	941	948	A#5 +	1209	1257
0	0	15	83	B5	941	968	A#5 +	1336	1281
#	#	16	95	B6	941	950	A#5 +	1477	1480
A	A	—	—	A2	697	—	F5	1633	—
B	B	—	—	B2	770	—	G5 -	1633	—
C	C	—	—	C2	852	—	G#5 +	1633	—
D	D	—	—	D2	941	—	A#5 +	1633	—
b	busy	2	71	B4	480	472	B4 -	620	622
r	ringback	3	69	A4	440	440	A4	480	480
d	dialtone	4	65	F4	350	350	F4	440	440

This table is implemented in a *Yoshimi kit*. Each note in the kit is created by making an ADDsynth instrument with two voices. The lower voice generally corresponds to the note being play, with an offset, if needed, to achieve close to the proper frequency for the lower note of the DTMF tone. The second voice corresponds to the other note, and it is detune appropriately to achieve close to the proper frequency for the upper note of the DTMF tone.

The following figure shows the kit dialog:

Kit List - Part 1 DTMF Kit										
No.	M.		Min.k	Max.k	ADsynth	SUBsynth	PADsynth	FX.r.		
1	<input checked="" type="checkbox"/>	<input type="checkbox"/>	0	127	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	OFF
2	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Busy	71	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	OFF
3	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Ringback	69	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	OFF
4	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Dial tone	65	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	OFF
5	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Key 1	53	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	OFF
6	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Key 2	77	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	OFF
7	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Key 3	89	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	OFF
8	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Key 4	55	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	OFF
9	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Key 5	79	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	OFF
10	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Key 6	91	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	OFF
11	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Key 7	57	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	OFF
12	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Key 8	81	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	OFF
13	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Key 9	93	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	OFF
14	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Key *	59	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	OFF
15	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Key 0	83	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	OFF
16	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Key #	95	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	OFF

Mode: Single Drum mode: Close

Figure 6: Kit Edit Dialog for DTMF Kit

To edit the kit, follow the steps below. If desired, open the instrument file `yoshimi/banks/demo/DTMF_Kit.xiz` to save some work.

1. Open the kit editing window by clicking the **Edit** button in the bottom panel, and then clicking the **Kit Edit** button in the edit window.
2. Make sure that the **Mode** is set to **Single**.
3. Make sure that the **Drum mode** is enabled.
4. For all 16 kit items, make sure that the **FX.r** selections are set to **OFF**.
5. For kit items 2 to 16, enable the the **ADsynth** check-box.
6. For kit items 2 to 16, perform the following procedure to set up the two frequencies correctly as per the table above:
 1. In the kit editor, click the **Name** field and enter the name of the DTMF tone item being edited.
 2. In the kit editor, set **Min.k** and **Max.k** to the value of the note that is less than or equal to the lower note of the item listed in the table.
 3. Click the ADDsynth **edit** button.
 4. Click on the **Show Voice Parameters** button. Note that it is **Current Voice 1**, and it should be enabled.
 5. Given the frequency for the note being edited, detune voice 1 to achieve the desired lower frequency.
 6. Change to voice 2, and enable it.
 7. Given the frequency for the note being edited, detune voice 1 to achieve the desired higher frequency.

The "Actual F" values were verified using 24-Hz resolution (at 1200 Hz) in the spectrum analyzer built

into Audacity. Sometimes it took a few tries to get the best possible frequency. We could list the detuning values in a table; for now, you can see the values we ended up using.

The following figure shows the layout on the *Yoshimi* virtual keyboard:

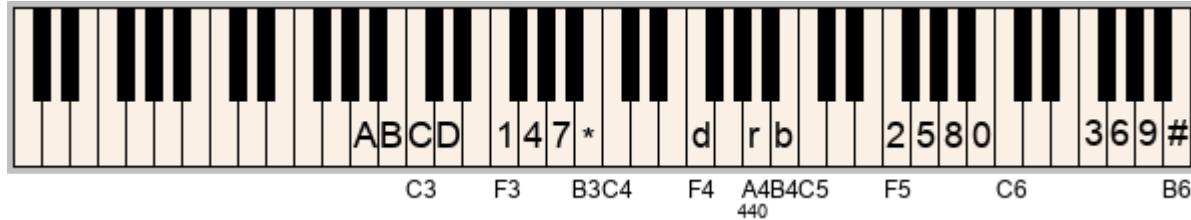


Figure 7: DTMF Layout on the Keyboard

3.5 Piano

TODO.

3.6 Leads

TODO.

3.7 Guitar

TODO.

3.8 Strings

(individual and ensemble)

TODO.

3.9 Bass

TODO.

3.10 Saxophones

TODO.

4 Banks and General MIDI

Banks are discussed quite heavily in the user manual [10]. Banks have evolved quite a bit in *Yoshimi*, and are a powerful way to manage instruments, and more amenable to automation than ever.

In this section, we will attempt to set up a basic bank that is compliant with the General MIDI specification. In order to do so, we will cherry pick instruments from the package that is provided when *Yoshimi* is installed, renaming them as needed to fit into the appropriate General MIDI slot.

One problem is the selection of the *best* instrument for a given General MIDI program number. There are simply too many to be able to evaluate them all.

For this recipe, the `banks` and `presets` will be stored in the following directories of this project:

```
yoshimi/banks
yoshimi/banks/demo
yoshimi/banks/gm-basic
yoshimi/presets
```

4.1 Creating a Basic GM Bank

Creating even a basic General MIDI bank is beset with issues, even if one has at hand a large number of pre-built instruments.

First, what is the purpose of the General MIDI specific? To provide a dependable set of instruments so that tunes will sound basically similar on different GM-compliant synthesizers. That's about it. It doesn't guarantee that the sounds are consistent, nor does it guarantee that they are all of high quality. The "FX", "Lead", and "Pad" instruments provide ambiguous descriptions that a wide range of sounds might fit. Getting a complete and high-quality set of sounds is extremely difficult.

Second, evaluating a large number of pre-built instruments takes a lot of work. We'd done some of this work for another project, and never finished. Nor is the naming of such instruments all that helpful; many of the file-names are misleading. Finding decent matches for a GM instrument takes time.

Third, there are many GM instruments for which we've been able to find no good *ZynAddSubFX/Yoshimi* counterpart. The only options are to pick a tolerable match, build a tolerable match oneself, or just plug in any old sound and wait for others to step up.

Nonetheless, let's forge ahead. The project file `contrib/instrument.ods` is a *LibreOffice* spreadsheet that represents some research in finding GM-compatible instruments. It's pretty bad; maybe 50% useful.

We converted it to `contrib/gmcopy` to copy the files into the project directory `yoshimi/banks/gm/basic`. We show the banks in table 4.1 for convenience.

Table 4: GM Basic Files

General MIDI Instrument	Yoshimi Instrument Used
0001-Acoustic Grand Piano	SynthPiano/0033-Analog Piano 1
0002-Bright Acoustic Piano	SynthPiano/0034-Analog Piano 2
0003-Electric Grand Piano	SynthPiano/0143-Space Piano
0004-Honky-tonk Piano	SynthPiano/0068-Synth Piano 3 fat
0005-Electric Piano 1	Rhodes/0002-DX Rhodes 2
0006-Electric Piano 2	Rhodes/0007-Dig Rhodes
0007-Harpsichord	Piano/0139-Home Piano
0008-Clavinet	Misc Keys/0060-Clavinet 1
0009-Celesta	Bells/0002-Music_Box
Continued next page	

General MIDI Instrument	Yoshimi Instrument Used
0010-Glockenspiel	Bells/0011-Glass bells
0011-Music Box	Bells/0013-Tiny bells
0012-Vibraphone	Chromatic Percussion/0045-Vibes no_trem
0013-Marimba	Chromatic Percussion/0056-FM marimba
0014-Xylophone	Will_Godfrey_Collection/0001-Xylophone
0015-Tubular Bells	Chromatic Percussion/0097-Marimba 3
0016-Dulcimer	Plucked/0004-Plucked 4
0017-Drawbar Organ	Organ/0001-Organ 1
0018-Percussive Organ	Organ/0012-Organ 12
0019-Rock Organ	Organ/0068-Square Organ
0020-Church Organ	Organ/0061-Great Organ
0021-Reed Organ	Reed_and_Wind/0039-Reed 7
0022-Accordion	Organ/0097-Accordion Pad 1
0023-Harmonica	Reed_and_Wind/0099-Sharp Reed
0024-Tango Accordion	Organ/0101-Accordion 1
0025-Acoustic Guitar nylon	Piano/0144-Soft Piano1
0026-Acoustic Guitar steel	Guitar/0065-Clean Guitar1
0027-Electric Guitar jazz	Guitar/0066-Electric Guitar
0028-Electric Guitar clean	Guitar/0133-Smooth Guitar
0029-Electric Guitar muted	Guitar/0035-Short
0030-Overdriven Guitar	Guitar/0042-Trash Guitar 3
0031-Distortion Guitar	Guitar/0005-Dist Guitar 5
0032-Guitar harmonics	Laba170bank/0028-PianoBell
0033-Acoustic Bass	Will_Godfrey_Collection/0045-Steel Bass
0034-Electric Bass finger	Bass/0009-Electric bass 1
0035-Electric Bass pick	Bass/0041-Electric_Bass
0036-Fretless Bass	Bass/0050-Fretless Bass
0037-Slap Bass 1	Rhodes/0042-Hard Rhodes1
0038-Slap Bass 2	Rhodes/0042-Hard Rhodes1
0039-Synth Bass 1	Bass/0013-FM rubber bass
0040-Synth Bass 2	Bass/0024-Moog bass
0041-Violin	Strings/0051-Synth Violin 2 Fat
0042-Viola	Strings/0051-Synth Violin 2 Fat
0043-Cello	Strings/0051-Synth Violin 2 Fat
0044-Contrabass	Bass/0005-Bass 5
0045-Tremolo Strings	Strings/0001-Saw Strings 1
0046-Pizzicato Strings	Strings/0003-Saw Strings 3
0047-Orchestral Harp	Pads/0065-Soft Pad
0048-Timpani	Noises/0018-Gun
0049-String Ensemble 1	VDX/0065-Strings
0050-String Ensemble 2	folderol collection/0029-Full Strings
0051-Synth Strings 1	Strings/0010-Strings Pad1
0052-Synth Strings 2	Strings/0014-Strings Pad5
0053-Choir Aahs	Choir_and_Voice/0001-AHH Choir 1
0054-Voice Oohs	Choir_and_Voice/0004-Voice OOH
0055-Synth Voice	Choir_and_Voice/0005-Choir Pad1

Continued next page

General MIDI Instrument	Yoshimi Instrument Used
0056-Orchestra Hit	Misc/0010-Industrial orchestra
0057-Trumpet	Leads/0027-Prophet horn 2
0058-Trombone	Brass/0033-Analog Brass 1
0059-Tuba	Brass/0001-FM Thrumpet
0060-Muted Trumpet	Synth/0001-Soft Synth 1
0061-French Horn	Brass/0034-Analog Brass 2
0062-Brass Section	Brass/0007-Synth Brass 5
0063-Synth Brass 1	Brass/0003-Synth Brazz 1
0064-Synth Brass 2	Brass/0004-Synth Brazz 2
0065-Soprano Sax	Reed.and.Wind/0066-Fat Reed2
0066-Alto Sax	Reed.and.Wind/0065-Fat Reed1
0067-Tenor Sax	Reed.and.Wind/0037-Reed 5
0068-Baritone Sax	Reed.and.Wind/0099-Sharp Reed
0069-Oboe	Reed.and.Wind/0040-Reed 8
0070-English Horn	Brass/0034-Analog Brass 2
0071-Bassoon	Will_Godfrey_Collection/0102-Bassoon
0072-Clarinet	Reed.and.Wind/0006-Clarinet
0073-Piccolo	Will_Godfrey_Collection/0071-Ocarina
0074-Flute	Will_Godfrey_Collection/0057-Soft Flute
0075-Recorder	Will_Godfrey_Collection/0059-Ocarina
0076-Pan Flute	Will_Godfrey_Collection/0127-Pan Pipe
0077-Blown Bottle	Will_Godfrey_Collection/0125-Bottle
0078-Shakuhachi	Will_Godfrey_Collection/0125-Pan Pipe 32
0079-Whistle	Will_Godfrey_Collection/0027-Ghost Whistle
0080-Ocarina	Flute/0071-Ocarina
0081-Lead 1 square	Leads/0022-Square lead
0082-Lead 2 sawtooth	Louigi_Verona_Workshop/0008-saw-lead
0083-Lead 3 calliope	Leads/0018-Sine lead
0084-Lead 4 chiff	chip/0018-Chiffer_Chip
0085-Lead 5 charang	Louigi_Verona_Workshop/0001-progressive-lead-1
0086-Lead 6 voice	Choir_and_Voice/0067-Vocal Morph 3
0087-Lead 7 fifths	chip/0017-SuperSquare1
0088-Lead 8 bass lead	Strings/0157-Dual Strings Oct2
0089-Pad 1 new age	Pads/0028-Ethereal
0090-Pad 2 warm	Will_Godfrey_Companion/0019-Warm Square Swell
0091-Pad 3 polysynth	Dual/0065-Dream of the Saw
0092-Pad 4 choir	Alex_J/0100-Choir Pad
0093-Pad 5 bowed	The_Mysterious_Bank/0004-trance_strings_pad
0094-Pad 6 metallic	The_Mysterious_Bank/0011-dreaming_bells
0095-Pad 7 halo	Alex_J/RadioPulsePad
0096-Pad 8 sweep	Pads/0011-lightbeam
0097-FX 1 rain	The_Mysterious_Bank/0037-the_rain
0098-FX 2 soundtrack	The_Mysterious_Bank/0038-falling_stars
0099-FX 3 crystal	Will_Godfrey_Companion/0006-Tinkle Bell
0100-FX 4 atmosphere	The_Mysterious_Bank/0038-the_starting_machine
0101-FX 5 brightness	Noises/0014-droplets for chords

Continued next page

General MIDI Instrument	Yoshimi Instrument Used
0102-FX 6 goblins	Noises/0002-Ioioioioioi
0103-FX 7 echoes	Noises/0072-Cave Gates
0104-FX 8 sci-fi	The_Mysterious_Bank/0031-etrangle_sound
0105-Sitar	Guitar/0097-Space Guitar
0106-Banjo	Guitar/0065-Clean Guitar1
0107-Shamisen	Plucked/0034-Plucked String2
0108-Koto	Plucked/0003-Plucked 3
0109-Kalimba	Plucked/0001-Plucked 1
0110-Bagpipe	Reed_and_Wind/0033-Reed 1
0111-Fiddle	Laba170bank/0055-DevilsFiddle2
0112-Shanai	Reed_and_Wind/0035-Reed 3
0113-Tinkle Bell	Bells/0011-Glass bells
0114-Agogo	The_Mysterious_Bank/0028-snare
0115-Steel Drums	C_Ahlstrom/Add_Pseudo_Steel_Drums_2
0116-Woodblock	The_Mysterious_Bank/0028-snare
0117-Taiko Drum	The_Mysterious_Bank/0028-snare
0118-Melodic Tom	The_Mysterious_Bank/0028-snare
0119-Synth Drum	The_Mysterious_Bank/0028-snare
0120-Reverse Cymbal	The_Mysterious_Bank/0028-snare
0121-Guitar Fret Noise	The_Mysterious_Bank/0028-snare
0122-Breath Noise	The_Mysterious_Bank/0028-snare
0123-Seashore	Noises/0008-Wind and Surf
0124-Bird Tweet	The_Mysterious_Bank/0028-snare
0125-Telephone Ring	The_Mysterious_Bank/0028-snare
0126-Helicopter	The_Mysterious_Bank/0028-snare
0127-Applause	The_Mysterious_Bank/0028-snare
0128-Gunshot	Noises/0018-Gun
0129-Drum Kit	C_Ahlstrom/Natural_Drum_Kit_Basic
End of table	

Presumably, this basic bank could be improved enough to be useful for most music. Alternative (and better) banks could be created, as well.

4.2 Root Paths

The first thing to do is to add the yoshimi-cookbook `banks` directory to your setup.

Run *Yoshimi*, and navigate the following user-interface path: *Menu / Instrument / Show Root Paths ...*

Then click **Add root directory....** Navigate to where the yoshimi-cookbook project is stored and add the `yoshimi/banks` directory. The result should be something like the following:

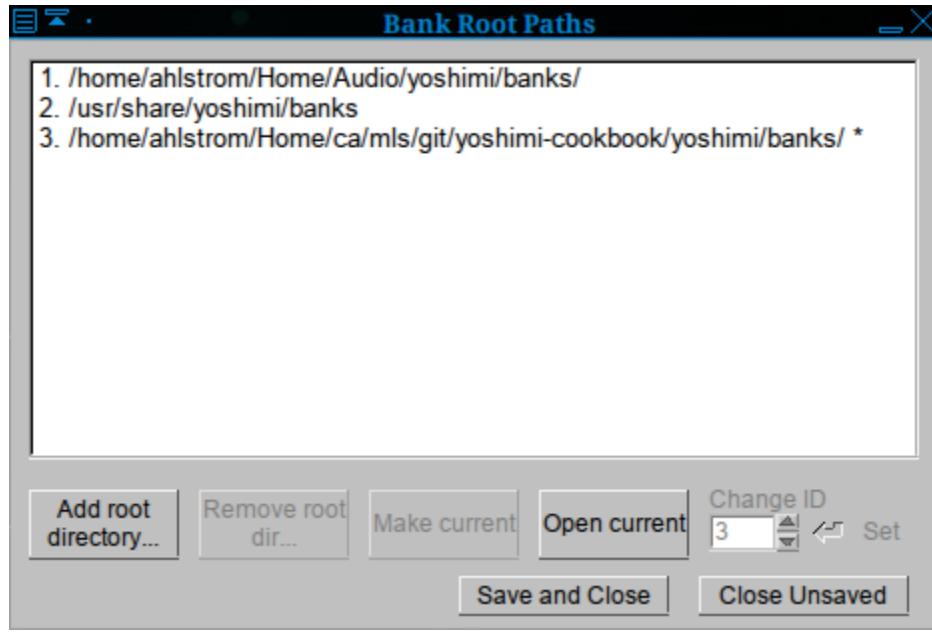


Figure 8: Bank Root Paths

Click on the new directory. It has ID = 3 in that diagram. We will refer to this value as the "banks path". Now click the **Make current** button. Verify that it now has the asterisk. Click the **Save and Close** button.

Now let's open the "gm-basic" bank. Run *Yoshimi*, and navigate the following user-interface path: *Menu / Instrument / Show Banks ...*

In the matrix of banks, you should see "gm-basic" somewhere. (We also have a "demo" bank in place.)

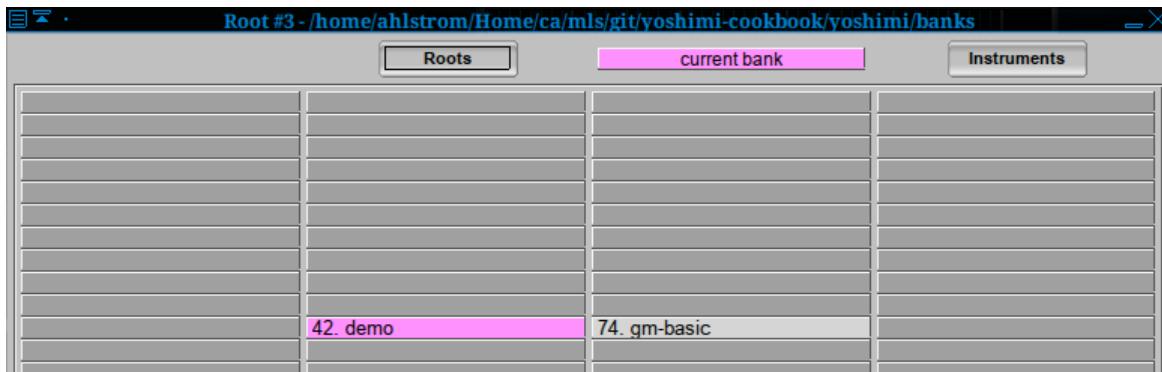


Figure 9: Two Banks, Demo and Basic GM

Click on the "gm-basic" bank. The larger dialog below will be shown.

Root #3, Bank #42 - /home/ahlstrom/Home/ca/mls/git/yoshimi-cookbook/yoshimi/banks/gm/basic

42. basic	Roots	Banks	This column uses MIDI Extended Program Change
1. Acoustic Grand Piano	33. Acoustic Bass	65. Soprano Sax	97. FX 1 rain
2. Bright Acoustic Piano	34. Electric Bass finger	66. Alto Sax	98. FX 2 soundtrack
3. Electric Grand Piano	35. Electric Bass pick	67. Tenor Sax	99. FX 3 crystal
4. Honky-tonk Piano	36. Fretless Bass	68. Baritone Sax	100. FX 4 atmosphere
5. Electric Piano 1	37. Slap Bass 1	69. Oboe	101. FX 5 brightness
6. Electric Piano 2	38. Slap Bass 2	70. English Horn	102. FX 6 goblins
7. Harpsichord	39. Synth Bass 1	71. Bassoon	103. FX 7 echoes
8. Clavinet	40. Synth Bass 2	72. Clarinet	104. FX 8 sci-fi
9. Celesta	41. Violin	73. Piccolo	105. Sitar
10. Glockenspiel	42. Viola	74. Flute	106. Banjo
11. Music Box	43. Cello	75. Recorder	107. Shamisen
12. Vibraphone	44. Contrabass	76. Pan Flute	108. Koto
13. Marimba	45. Tremolo Strings	77. Blown Bottle	109. Kalimba
14. Xylophone	46. Pizzicato Strings	78. Shakuhachi	110. Bagpipe
15. Tubular Bells	47. Orchestral Harp	79. Whistle	111. Fiddle
16. Dulcimer	48. Timpani	80. Ocarina	112. Shanai
17. Drawbar Organ	49. String Ensemble 1	81. Lead 1 square	113. Tinkle Bell
18. Percussive Organ	50. String Ensemble 2	82. Lead 2 sawtooth	114. Agogo
19. Rock Organ	51. Synth Strings 1	83. Lead 3 calliope	115. Steel Drums
20. Church Organ	52. Synth Strings 2	84. Lead 4 chiff	116. Woodblock
21. Reed Organ	53. Choir Aahs	85. Lead 5 charang	117. Taiko Drum
22. Accordion	54. Voice Oohs	86. Lead 6 voice	118. Melodic Tom
23. Harmonica	55. Synth Voice	87. Lead 7 fifths	119. Synth Drum
24. Tango Accordion	56. Orchestra Hit	88. Lead 8 bass lead	120. Reverse Cymbal
25. Acoustic Guitar nylor	57. Trumpet	89. Pad 1 new age	121. Guitar Fret Noise
26. Acoustic Guitar stee	58. Trombone	90. Pad 2 warm	122. Breath Noise
27. Electric Guitar jazz	59. Tuba	91. Pad 3 polysynth	123. Seashore
28. Electric Guitar clean	60. Muted Trumpet	92. Pad 4 choir	124. Bird Tweet
29. Electric Guitar mutec	61. French Horn	93. Pad 5 bowed	125. Telephone Ring
30. Overdriven Guitar	62. Brass Section	94. Pad 6 metallic	126. Helicopter
31. Distortion Guitar	63. Synth Brass 1	95. Pad 7 halo	127. Applause
32. Guitar harmonics	64. Synth Brass 2	96. Pad 8 sweep	128. Gunshot

SELECT
 RENAME
 SAVE
 DELETE
 SWAP
 Show synth engines
 Add Sub Pad

Close

Figure 10: A General MIDI Basic Bank

Remember that these banks have GM names; the original files used to create each one are listed in the spreadsheet mentioned in the previous section.

Also note the drum kit, with an ID of 129. Normally, drum kits might be stored in a bank of drum kits, but here we have a GM-compliant drum kit, compliant in the sense that most of the keys are mapped correctly, and all keys will play *something*.

5 Summary

In summary, we can say that you will absolutely love cooking with *Yoshimi*.

6 References

The *Yoshimi* cookbook reference list.

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