

## Assignment 7

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### Spectrogram

In the tutorial slide, the conditions of the showed spectrograms are different from the conditions in the assignment. To make it clear, an example spectrogram of notes [60, 62, 64, 65, 67, 69, 71, 72, 0] is shown in the Figure with the same conditions as the assignment ( $F_s = 8000\text{Hz}$ , window-size = 512 and 4 additive sine waves). The x-axis is the number of buffers (as you computed in the previous assignment and only keep complete buffer for every note; the number of buffers depends on the number of samples) and the y-axis is the size of the window (window size / 2 + 1) as computed in the `db_spectrum()` function.

You need to select your sine wave carefully to make the figure clear.

The change of the amplitude of Harmonic is optional. The tutorial slide (P6) is just for showing some examples to give a concept of the energy change of harmonics (eg:  $1 / 2^n$  or  $1 / (n + 1)$ ).

### ADSR amplitude envelop

To determine an ADSR envelop, you should determine ADR phase duration and use the ADR phase duration and total duration to determine S duration (eg:  $T - \text{ADR}$ ). You also need to determine the amplitude during S phase. After determine your ADSR envelop, you could use it on notes by multiplication.

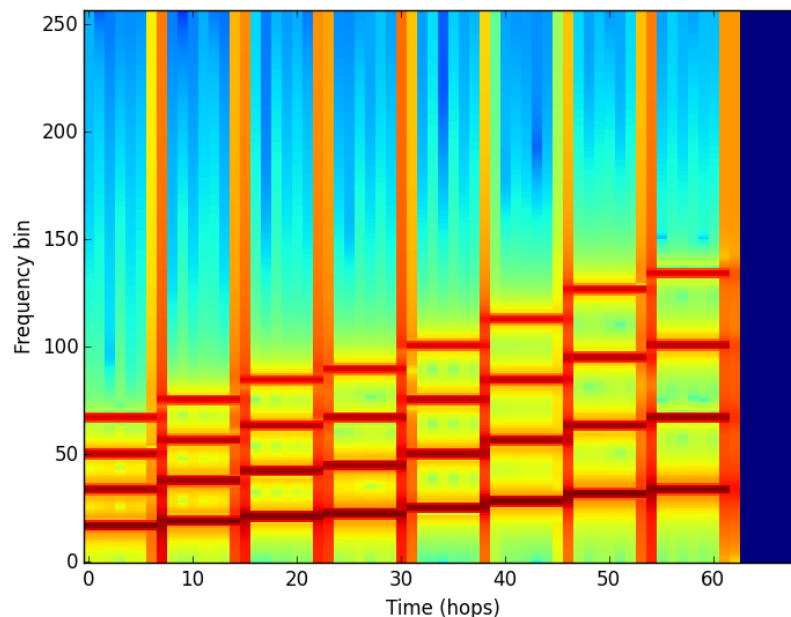


Figure. An example spectrogram