# Demo 15: Keyboard
# Exercises

DSP Lab (EE 4163 / EL 6183)

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## 1 Demo files

To detect when a key on the keyboard is pressed, we can use either pygame or open-cv (called cv2). Pygame is a Python library for creating games. Open-cv (cv2) is a Python library for computer vision.

Pygame:

`pygame_demo_01.py`
`play_keys.py`

Open-CV:

`cv2_key_demo_01.py`
`cv2_key_demo_02.py`
`cv2_key_demo_03.py`
`play_keys_cv2.py`

## 2 Exercises

1. Make a version of `play_keys.py` or `play_keys_cv2.py` where different keys produce different notes (different frequencies). The notes should play overlappingly (if a note is played before the previous notes has become silent, then both notes should be heard at the same time). There should be a separate difference equation (filter) to implement each note. Each difference equation should have its own input and output signals. The output signals of the separate filters should be added together to give the total output signal which should be played on the speaker/headphones. You can use either pygame or cv2. SUBMIT

   Adjacent notes on a piano keyboard are related via

   $$f_k = \alpha^k f_0, \quad k = 0, \pm 1, \pm 2, \ldots \tag{1}$$

   where $\alpha = 2^{1/12}$. You can set $f_0 = 440$ Hz which is 'middle A'.