

General guidelines:

- Follow the function templates in the attached folder. Insert code only where you have been asked to.
- Ensure input and output dimensions of your functions are accurate.
- Toolbox methods are not allowed (e.g. xcorr)
- Core MATLAB functions are allowed (e.g. min, max, fft etc.)

### A. Pitch Chroma [40 points]

1. [30 points] Implement a function `[vpc] = FeatureSpectralPitchChroma(X, f_s)` which extracts the pitch chroma from a magnitude spectrum or spectrogram `X`. `f_s` is the sample rate. Use the following parametrization:
  - octave range 4 Octaves starting at C4
  - tuning frequency 440Hz
  - sum of each semitone band
  - normalize the pitch chroma to a sum of one
2. [10 points] Generate an input signal that allows you to verify the correct implementation of the pitch chroma and report the result.

### B. Key detection [60 points]

3. [30 points] Implement a simple template-based key detection algorithm using the average pitch chroma over the audio file. Use the function interface `[cKey] = ComputeKey(cAudioFilePath)`:
  - compute the average pitch chroma
  - compute distance with the (shifted, hint: `circshift()`) Krumhansl template key profiles as listed below. Don't forget to normalize.

`t_pc = [6.35 2.23 3.48 2.33 4.38 4.09 2.52 5.19 2.39 3.66 2.29 2.88 % major`

`6.33 68 3.52 5.38 2.60 3.53 2.54 4.75 3.98 2.69 3.34 3.17]; % minor`

4. [30 points] Evaluate your results with the GTZAN dataset<sup>1</sup> (Country only) using the key labels available online<sup>2</sup> and report the average accuracy and the confusion matrix.

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<sup>1</sup> <http://marsyas.info/downloads/datasets.html>

<sup>2</sup> [https://github.com/alexanderlerch/data\\_set](https://github.com/alexanderlerch/data_set)