General guidelines:

- These homeworks are tentatively due at the end of weeks 2, 4, 6, 8, 10. If the corresponding lecture material (module 1 for homework 1 etc.) has not been completed by the deadline, the deadline will be moved by one week. But the final deadlines are always **as posted on gradescope.**
- Welcome to start early, but homeworks should be considered in "draft form" until the submission page is active on gradescope
- **Each homework is worth 10% of the final grade, and one HW is dropped, so that all HWs are worth 40%**[1]
- Homeworks must be completed individually

Homework 1: Sine wave generation and binary classification

Homework 1 stubs and files:
https://drive.google.com/drive/folders/1CKMJ5mUGngTZ7eYrqDG9tpzt0r8sICkS?usp=sharing

Part A - Sine Wave Generation

1. Write a function that converts a musical note name to its corresponding frequency in Hertz (Hz) (1 mark)
2. Write a function that linearly decreases the amplitude of a given audio (1 mark)
3. Write a function that adds a delay effect to a given audio where the output is a combination of the original audio and a delayed audio (1 mark)
4. Write a function that generates a melody by concatenating sine waves for a sequence of notes and durations; write additional functions to concatenate a list of audio arrays sequentially, and to "mix" audio arrays by scaling and summing them (simulating simultaneous playback) (1 mark)
5. Modify your code so that your pipeline can generate sawtooth waves by adding 18 harmonics based on the equation in the stub (1 mark)

Part B - Binary Classification

6. Write functions (as per the stub) to compute simple statistics about the files (1 mark)
7. Implement a few simple feature functions, to compute the lowest and highest MIDI note numbers in a file, and the set of unique notes in a file (1 mark)
8. Implement an additional feature extraction function to compute the average MIDI note number in a file (1 mark)
9. The autograder will split your dataset into train and test sets using `scikit-learn`, and will train your model to classify whether a given file is intended for piano or drums; provide the feature function to do so (1 mark)[2]

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[1] This year, since there's no midterm, this will be rescaled to be out of 50

[2] I ended up discarding a more complex version of this question since I didn't want to get into ML details yet, so this one should be a freebie if you've gotten the questions above it right.

10. Creatively incorporate additional features into your classifier to make your classification more accurate (1 mark)

Submission: you should submit your homework to gradescope as **`homework1.py`**. Note that if using jupyter notebooks, you'll need to export your notebook as .py (rather than e.g. changing the extension). The autograder will import your submission (`#import homework1`) and compare your function outputs to a reference solution.