5.7 Exercises

Solutions to these exercises are in `chap05soln.ipynb`.

Exercise 5.1 The Jupyter notebook for this chapter, `chap05.ipynb`, includes an interaction that lets you compute autocorrelations for different lags. Use this interaction to estimate the pitch of the vocal chirp for a few different start times.

Exercise 5.2 The example code in `chap05.ipynb` shows how to use autocorrelation to estimate the fundamental frequency of a periodic signal. Encapsulate this code in a function called `estimate_fundamental`, and use it to track the pitch of a recorded sound.

To see how well it works, try superimposing your pitch estimates on a spectrogram of the recording.

Exercise 5.3 If you did the exercises in the previous chapter, you downloaded the historical price of BitCoins and estimated the power spectrum of the price changes. Using the same data, compute the autocorrelation of BitCoin prices. Does the autocorrelation function drop off quickly? Is there evidence of periodic behavior?

Exercise 5.4 In the repository for this book you will find a Jupyter notebook called `saxophone.ipynb` that explores autocorrelation, pitch perception, and a phenomenon called the **missing fundamental**. Read through this notebook and run the examples. Try selecting a different segment of the recording and running the examples again.

Vi Hart has an excellent video called "What is up with Noises? (The Science and Mathematics of Sound, Frequency, and Pitch)"; it demonstrates the missing fundamental phenomenon and explains how pitch perception works (at least, to the degree that we know). Watch it at `https://www.youtube.com/watch?v=i_0DXxNeaQ0`.