## Libraries (20 minutes)

Activity Introduction
Breakouts
Backup Google Doc

**Session 4**

## Purpose of Today's Session

This session is focused on basic applications of the matplotlib and Numpy libraries.

## HCs

# Readings

# Study Guide

**In this session, you will apply functions from two external libraries: matplotlib and Numpy**

**Read the following in the given order.**

📖 **https://www.learnpython.org/en/Modules_and_Packages - through "Exploring Built-In Modules"**

📖 **https://pythonprogramming.net/matplotlib-python-3-basics-tutorial/**

📖 **https://www.learnpython.org/en/Numpy_Arrays**

**The following links are optional, but highly recommended for a deeper dive into the material.**

📖 **https://campus.datacamp.com/courses/intro-to-python-for-data-science/chapter-4-numpy?ex=1 - do as many of the exercises as possible, starting with the one in the link.**

📖 **https://www.datacamp.com/community/tutorials/matplotlib-tutorial-python#gs.XX_rt=c**

**https://www.datacamp.com/community/tutorials/python-numpy-tutorial#gs.U6EJgLA**

**It is strongly recommended that you work on the exercises given last week if you did not finish them. Please see your tutors for a reminder of the problems.**

# Pre-Class Work

⊙ **Individual**

**Group**

## Background Readings for Faculty

## Classroom Activities

## Libraries                                                                    20m

**NOTES FOR FACULTY**

Today's exercises are about applying functions from various libraries, particularly matplotlib and Numpy. Should there be difficulties implementing the Cocalc notebooks, please use the document provided in the last step to share the problems with students.

### Activity Introduction    LAYOUT: 2-UP                                    5m

Remind students of the format of the structured study sessions: students work on Python exercises in small breakout groups with students of similar proficiency, calling on the peer tutors for help as needed. You should be prepared to move students around in the groups as appropriate. Students may work on problems appropriate to their level, but should continue working through the entire session. Students should also periodically check in with you to report on their progress.

#### Activity Learning Goal Slide

Slide

Activity Learning Goal

Apply functions from external libraries.

## ☐ Breakouts   LAYOUT: 1-UP                    10m

### Breakout

Cocalc breakouts

Groups

8 groups

40 minutes

## Breakout Notes

BREAKOUT NOTES CONTENT

**Session 4: Libraries / Matplotlib / Introduction to Numpy**

1. **(Beginner) Basic Matplotlib (Don't use Numpy yet) - a) Plot the line segments connecting the points in the plane (0,0), (2,1), (3,4), and (5,2). Now give your plot a title, and label the axes with whatever you want. Make two other changes of your choice, such as setting the style. b) Create a list called \*weights, \*that contains the weights of 10 people in ascending order. Next, create a list called** heights, **that contains the corresponding heights of the same 10 people in the same order as they are given in** weights. **Use either metric or English measurements. Now use matplotlib to make a scatterplot of weight vs. height. Add a title, label the axes, and make at least one cosmetic change to the plot.**

2. **(Beginner) Numpy and Matplotlib - a) Turn** weights **and** heights **into a single, 2-dimensional Numpy array. Check that the dimensions are correct by using the** .shape **method. b) Convert between**

English and metric units in your array, either making a new array, or modifying the old one. c) Make a scatter plot of the converted measurements directly from your Numpy array. Make at least one cosmetic change to the graph. d) Make a histogram or bar chart of only one column of your converted array.

3. **(Advanced beginner) - Random arrays  a) Write a function that takes an integer between 1 and 10 as input, then returns an m by n array, where m and n are random integers between 1 and 10. The entries of the array should be random integers between -m and n. b) Write a function that takes an m by n array and two integers between 1 and n as input, and outputs a scatterplot of the data from the inputted column numbers. Be mindful of how Python indexes columns. c) In the main part of your program, using your functions, make a scatterplot of two random columns of a randomly sized matrix of random entries (of the type your function creates) using a single line of code. You should call your functions from a) and b) as part of this line of code. Hint: Look up the appropriate library for generating random integers.**

4. **(Intermediate) - a) Create either a 10 by 3 array of first names, weights, heights, or a list of 10 tuples of the same three quantities. Ensure that there are some duplicates of names or quantities in order to make things interesting. Write a script that will sort your array, first by height, then by weight, then by name, and print the sorted array. Hint: look for a library that contains *itemgetter, *or use Numpy methods. b) Project Euler #166: https://projecteuler.net/problem=166**

◉ Same notes duplicated for all groups
Different notes for each group

ALL GROUPS

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Backup Google Doc   LAYOUT: 1-UP                          5m

### Resource

Document

Exercises Doc

DOC CONTENT

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## After teaching all sections of this class...

## please feel free to submit your feedback on this LP