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Matplotlib: Visualization with Python

Matplotlib is a comprehensive library for creating ***static***, ***animated***, and ***interactive visualizations*** in Python.

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Installation

Anaconda

- conda install matplotlib

Conda-forge

- conda install -c conda-forge matplotlib

Pip

- python -m pip install -U matplotlib

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Basics of Matplotlib

- Matplotlib graphs your data on *Figures*.
- Each of which can contain one or more Axes.
- To create a figure with axes we use pyplot.subplots.
- Use Axes.plot to draw some data on the axes.

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Loading libraries

import matplotlib library

- **import** matplotlib.pyplot as **plt**
- %matplotlib inline

Alternatively

- **import** matplotlib
- matplotlib.use('qt5agg')

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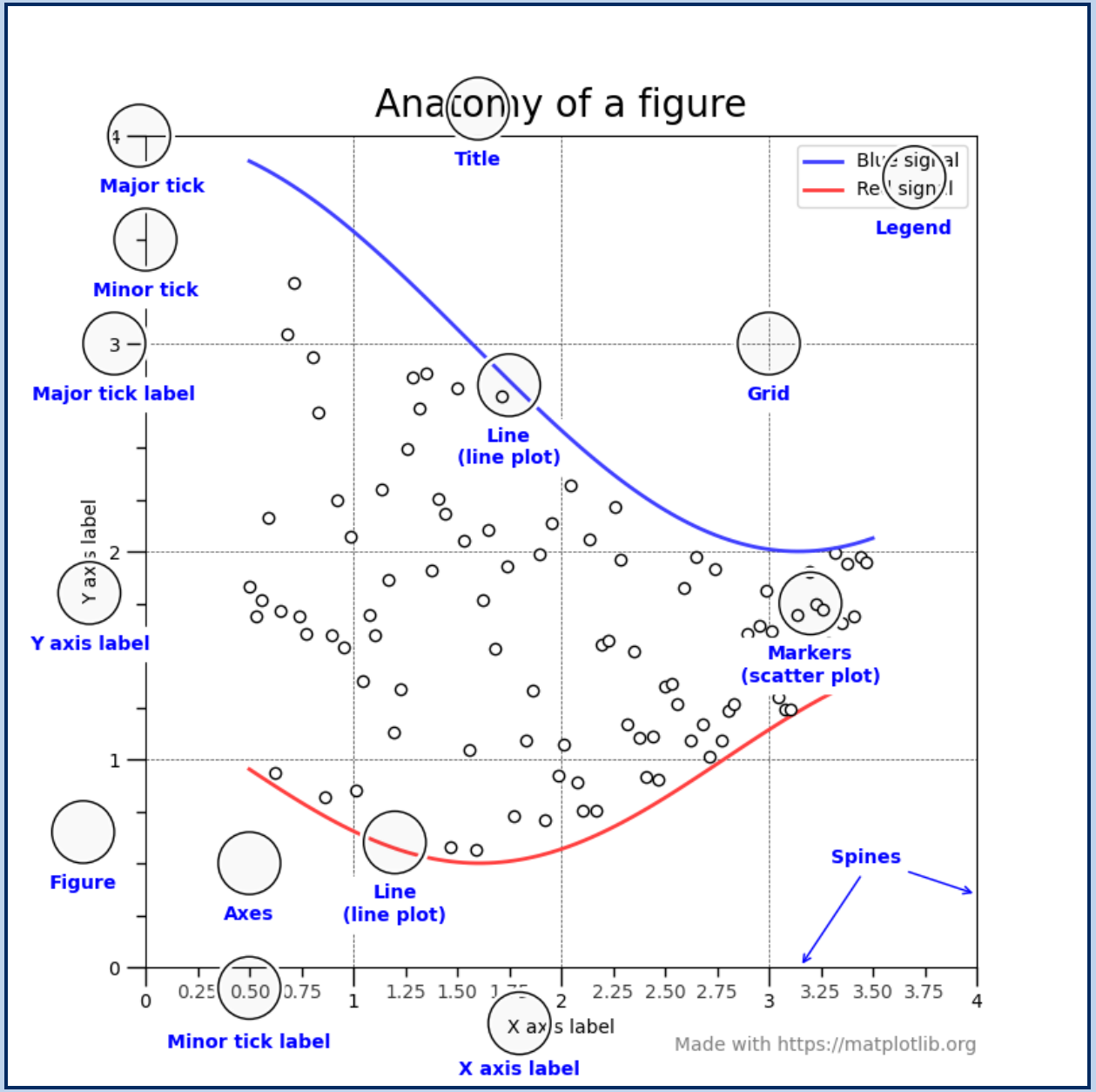
Anatomy of a figure.



Matplotlib figure

Figure

- A canvas which contains .
- Whole figure which may contain one or more than one axes (plots)

Axis

- Number line like objects that take care of generating the graph limits.

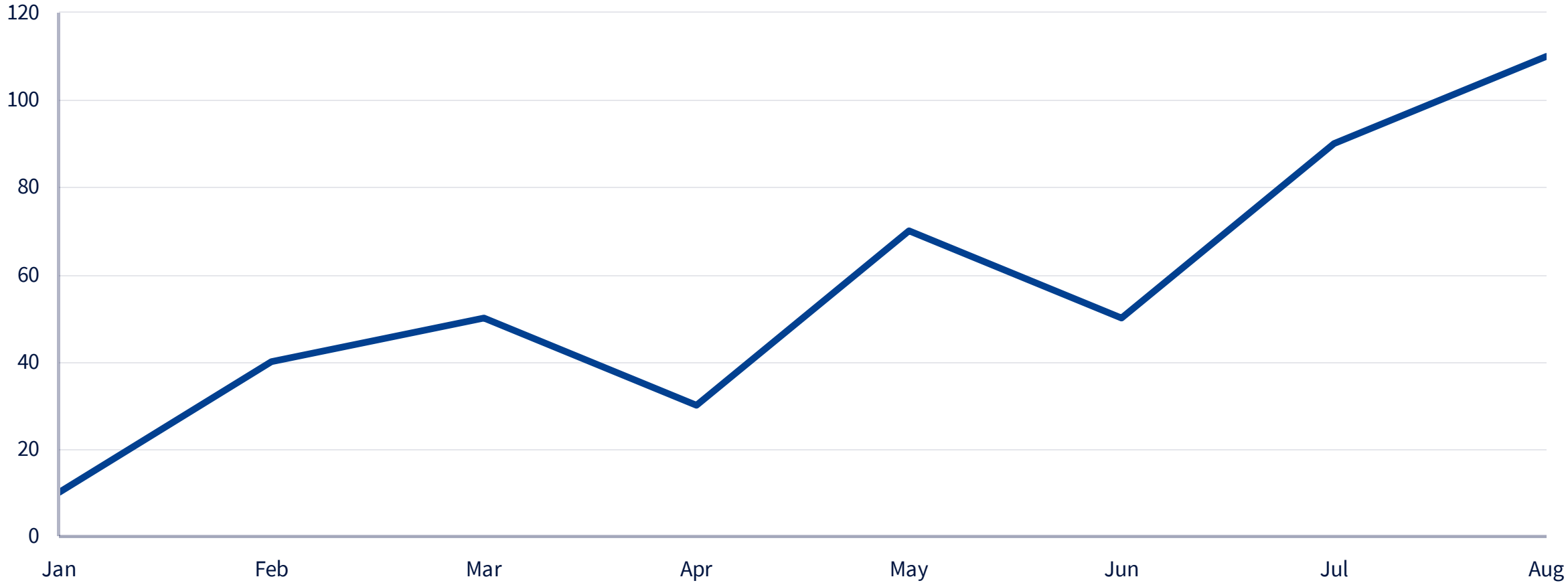
Axes

- What we generally think of as a plot.
- Each Axes has a title, an x-label and a y-label.

Artist

- Everything which one can see on the figure is an artist like Text objects, Line2D objects, collection objects.

Simple graph



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Note

- A given figure can contain many Axes, but a given Axes object can only be in one Figure.
- The Axes contains two (or three in the case of 3D) Axis objects
- Axes has a title (set via set_title()), an x-label (set via set_xlabel()), and a y-label set via set_ylabel()).

Object-oriented and pyplot interfaces

OO-style

- Explicitly create figures and axes, and call methods on them (the “object-oriented (OO) style”).
- Rely on pyplot to automatically create and manage the figures and axes, and use pyplot functions for plotting

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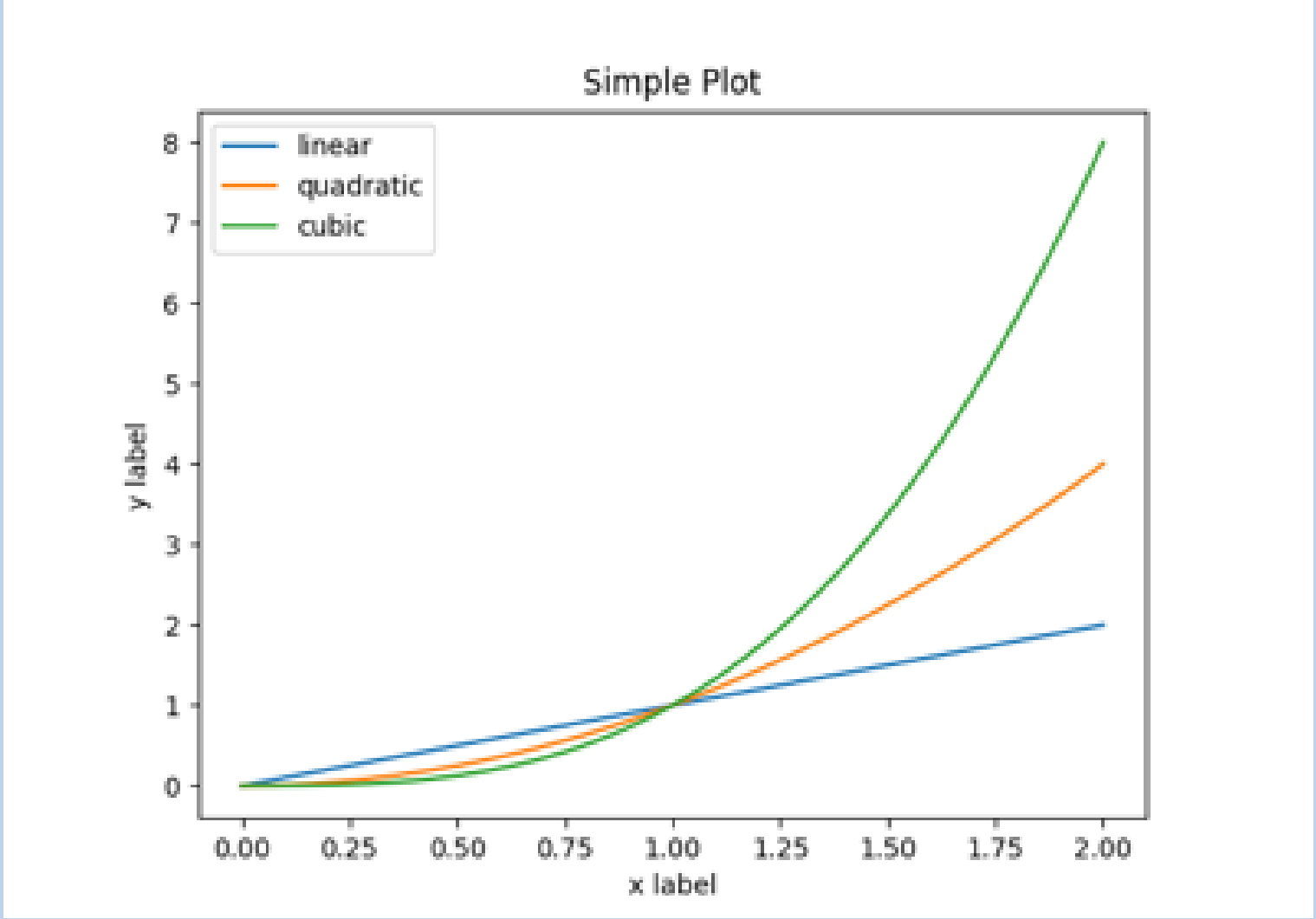
Simple plot



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MATPLOTLIB RECOMMENDATION

In general, we suggest to restrict pyplot to *interactive plotting* (Jupyter notebook), and to prefer the OO-style for *non-interactive plotting* (in functions and scripts that are intended to be reused as part of a larger project).

pyplot

Each pyplot function makes some change to a figure. e.g,

- Creates a figure.
- Creates a plotting area in a figure.
- Plots some lines in a plotting area.
- Decorates the plot with labels, etc

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pyplot properties

Property	Value Type
alpha	float
animated	[True | False]
antialiased or aa	[True | False]
clip_box	a matplotlib.transform.Bbox instance
clip_on	[True | False]
clip_path	a Path instance and a Transform instance, a Patch
color or c	any matplotlib color
contains	the hit testing function
dash_capstyle	['butt' | 'round' | 'projecting']
dash_joinstyle	['miter' | 'round' | 'bevel']
dashes	sequence of on/off ink in points
data	(np.array xdata, np.array ydata)
figure	a matplotlib.figure.Figure instance
label	any string
linestyle or ls	['-' | '--' | '-.' | ':' | 'steps' | ...]
linewidth or lw	float value in points
marker	['+' | ',' | '.' | '1' | '2' | '3' | '4']
markeredgecolor or mec	any matplotlib color
markeredgewidth or mew	float value in points
markerfacecolor or mfc	any matplotlib color
markersize or ms	float
markevery	[None | integer | (startind, stride)]
picker	used in interactive line selection
pickradius	the line pick selection radius

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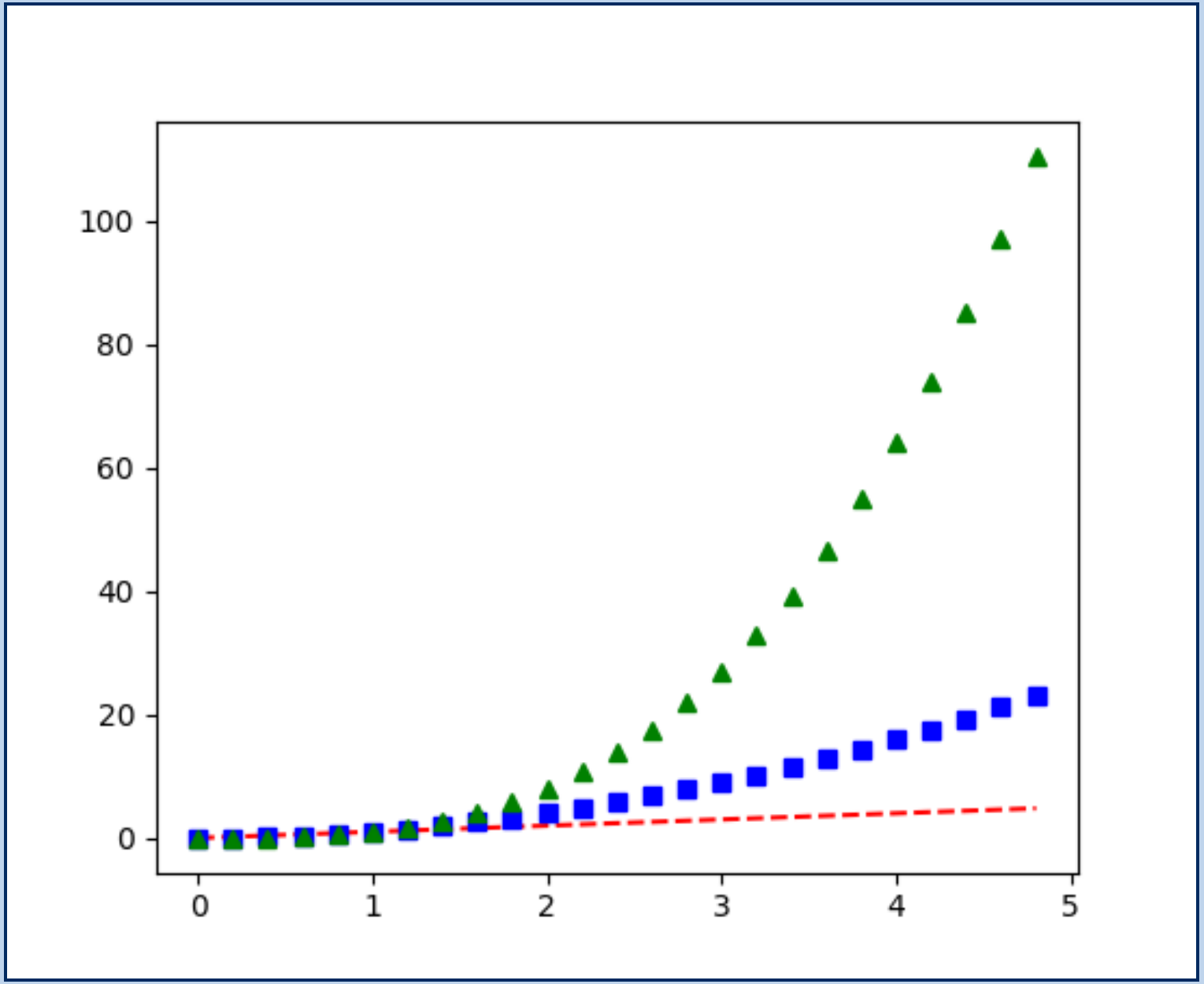
Formating style of plot



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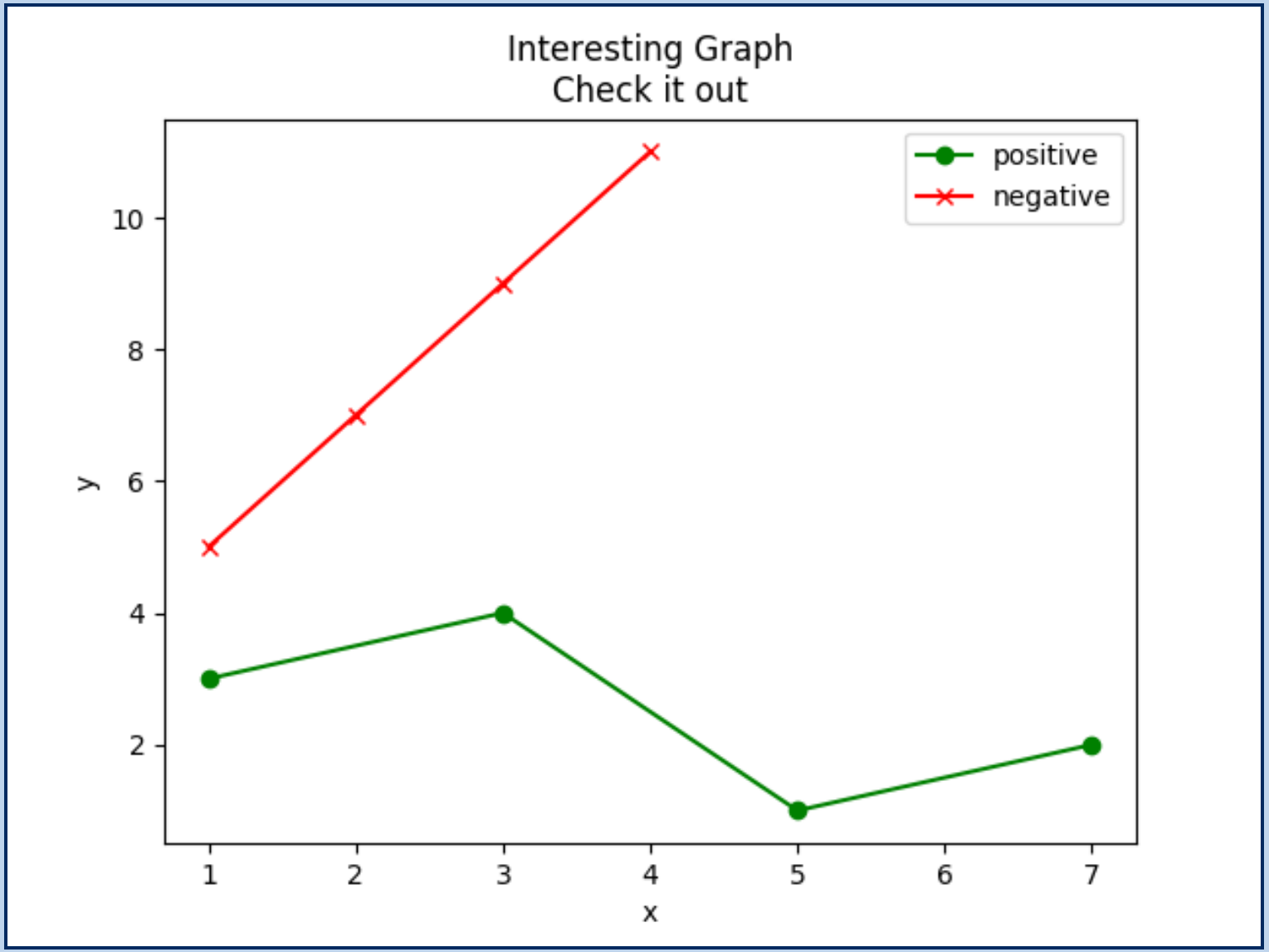
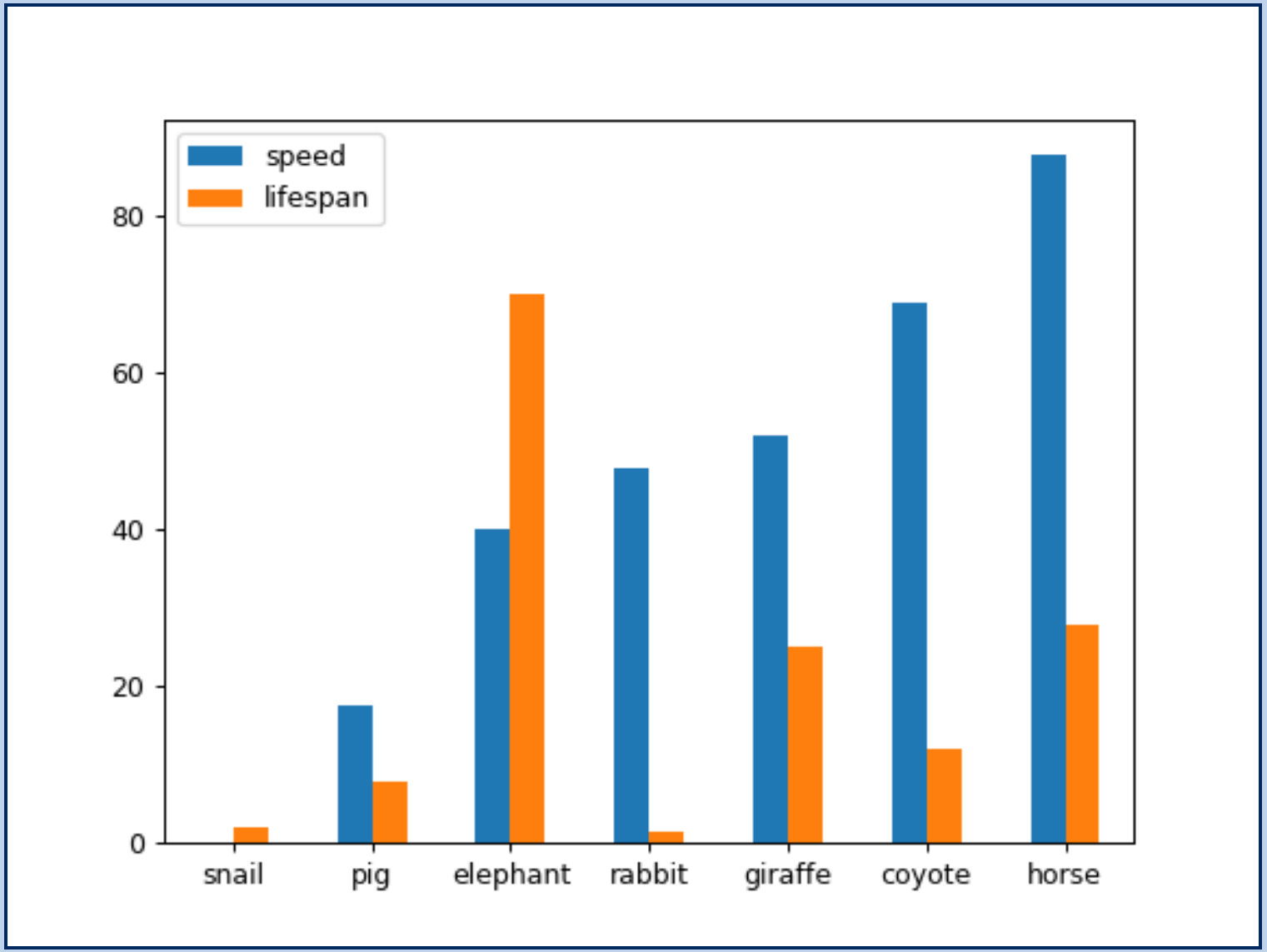
Legends, Titles, and Labels



Visualizations

Bar Charts

plt.bar()



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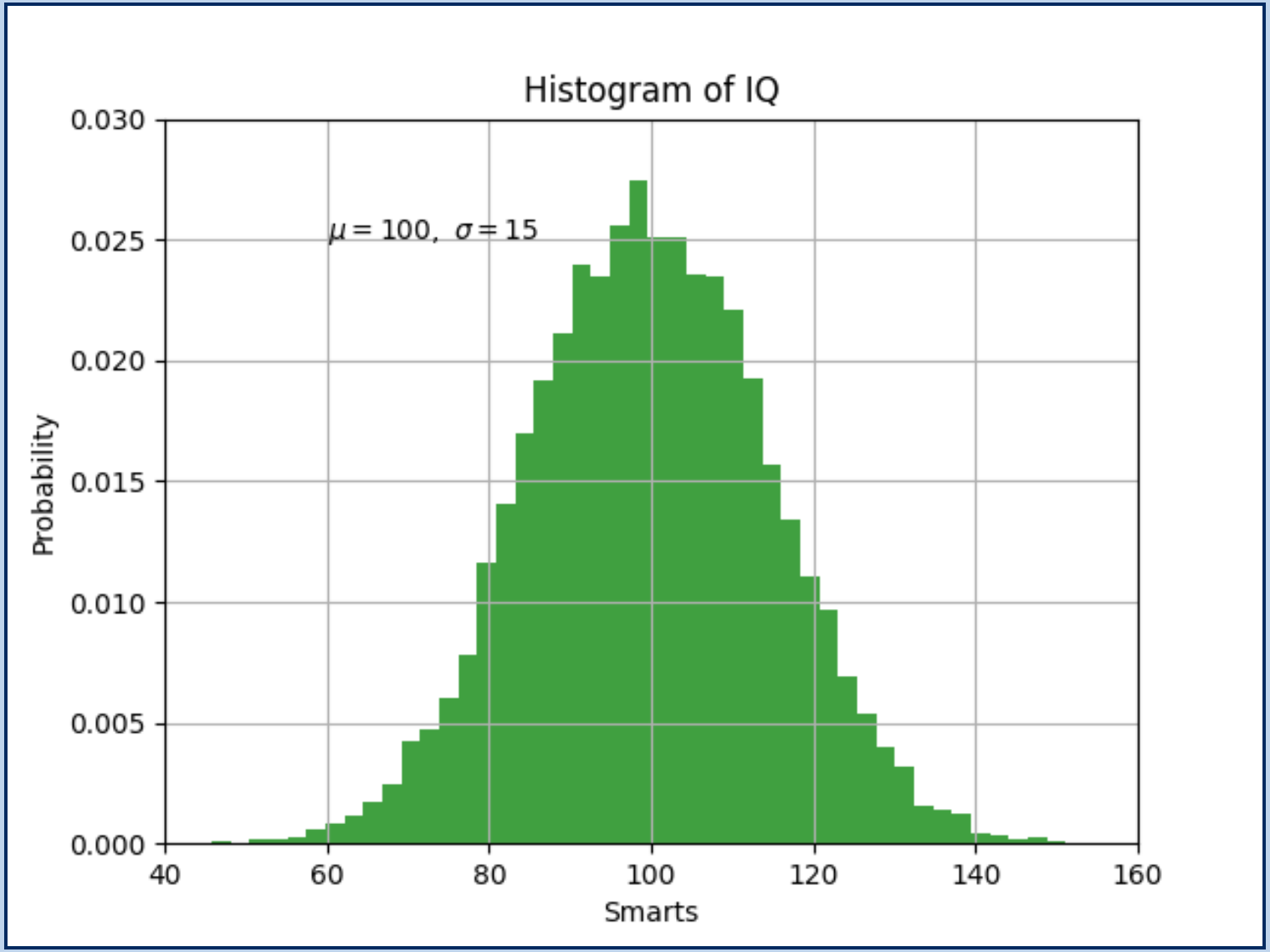
Histograms

plt.hist()



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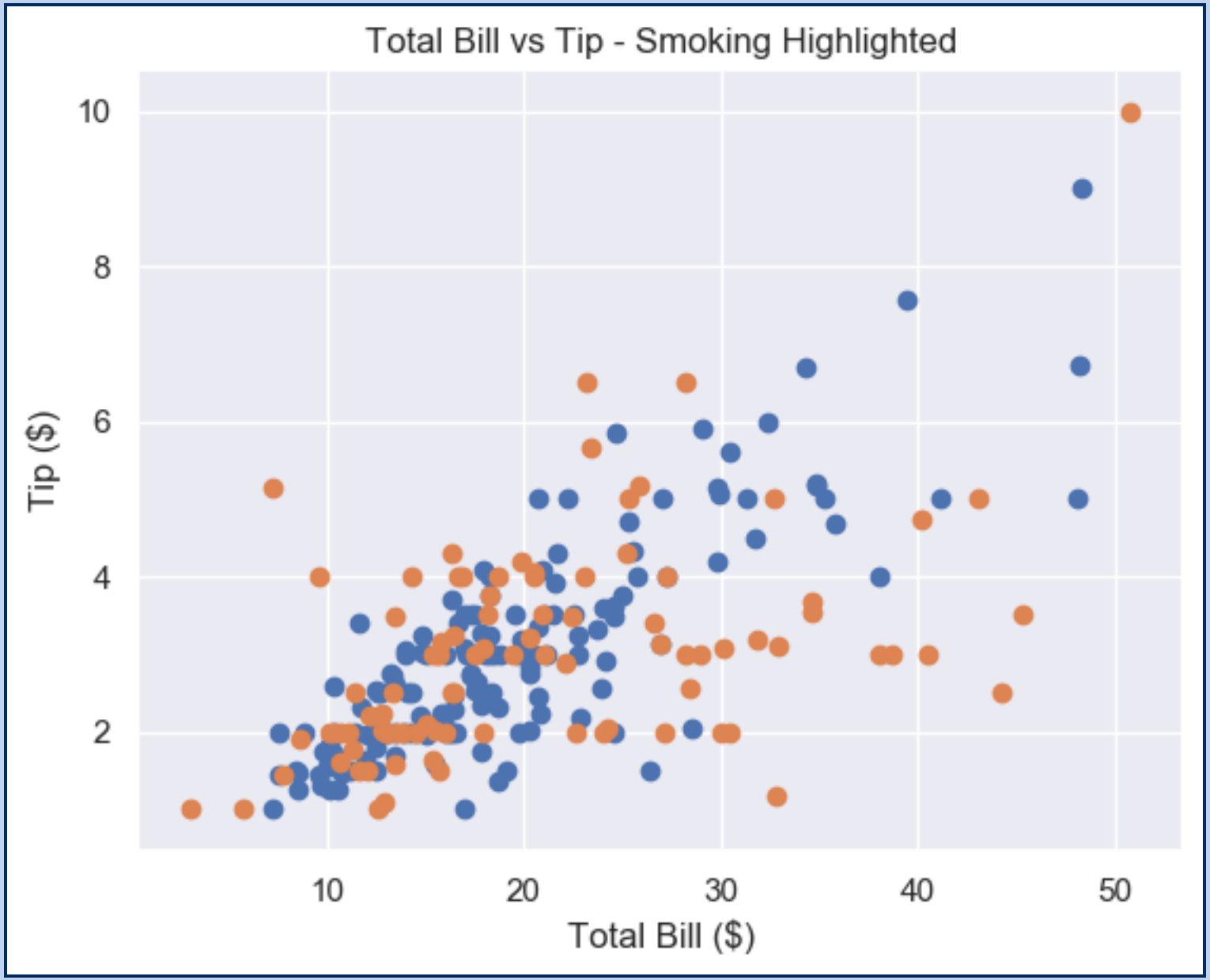
Scatter Plots

plt.scatter()



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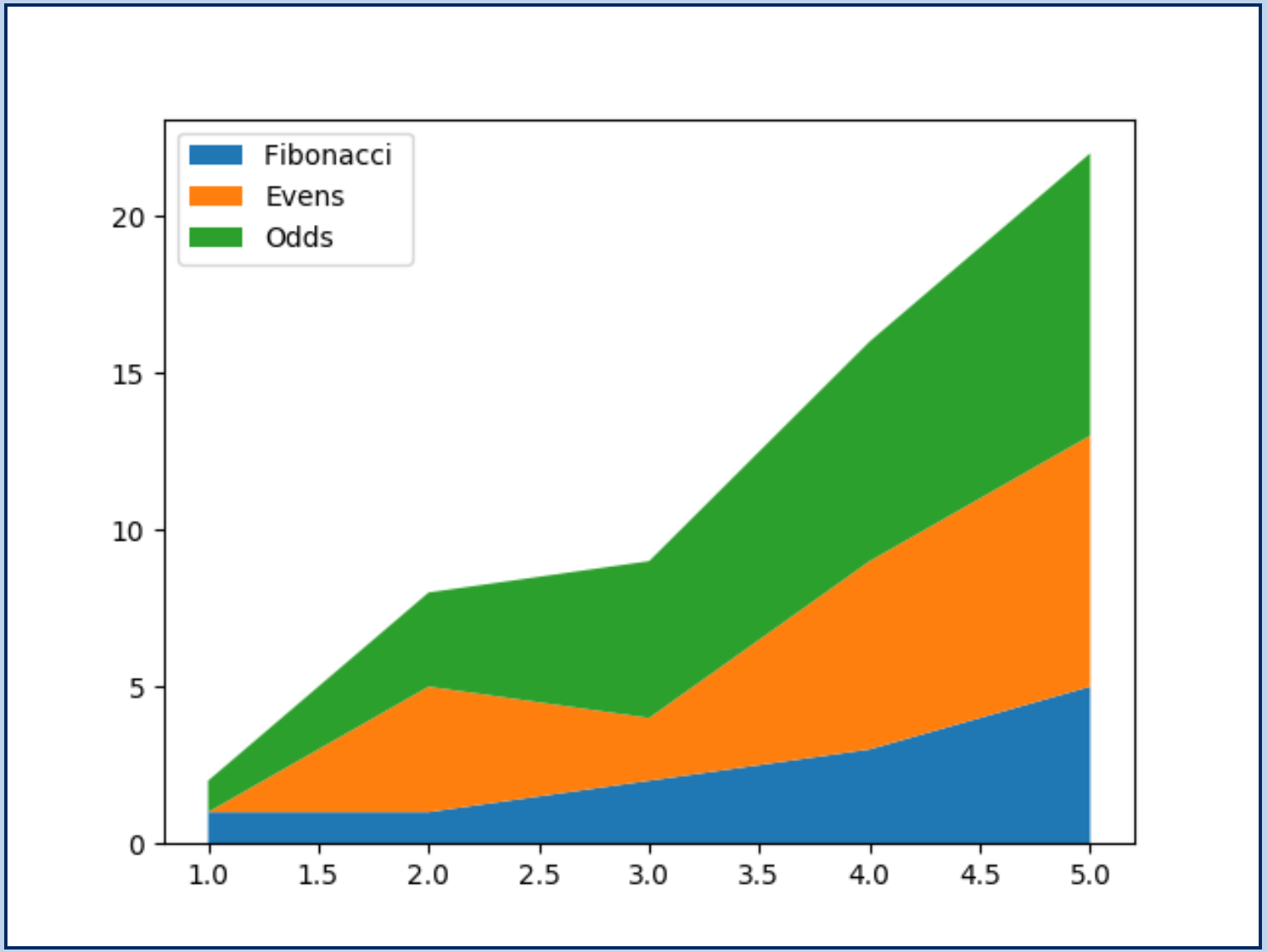
Stack Plots

plt.stackplot()



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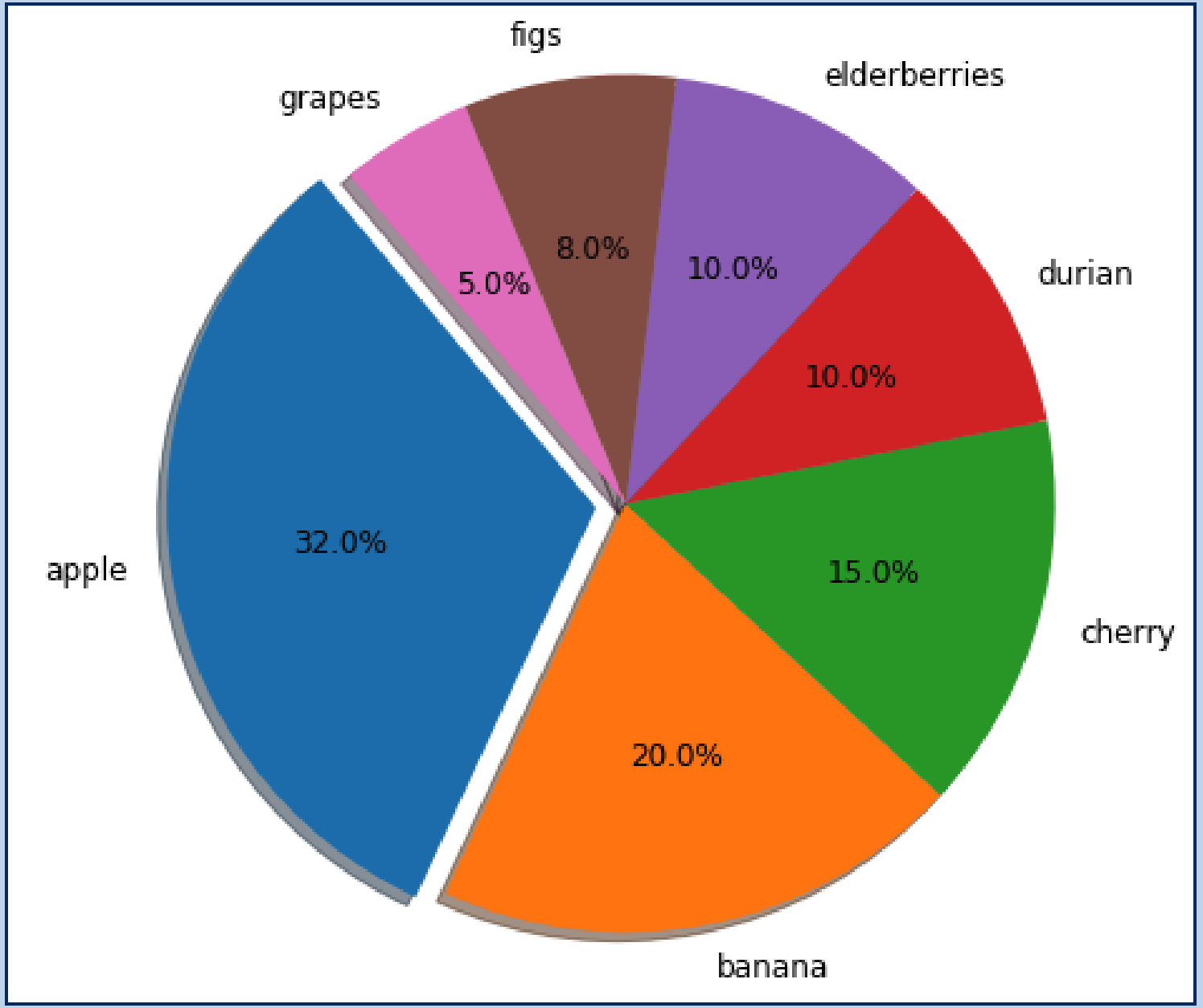
Pie Charts

plt.pie()



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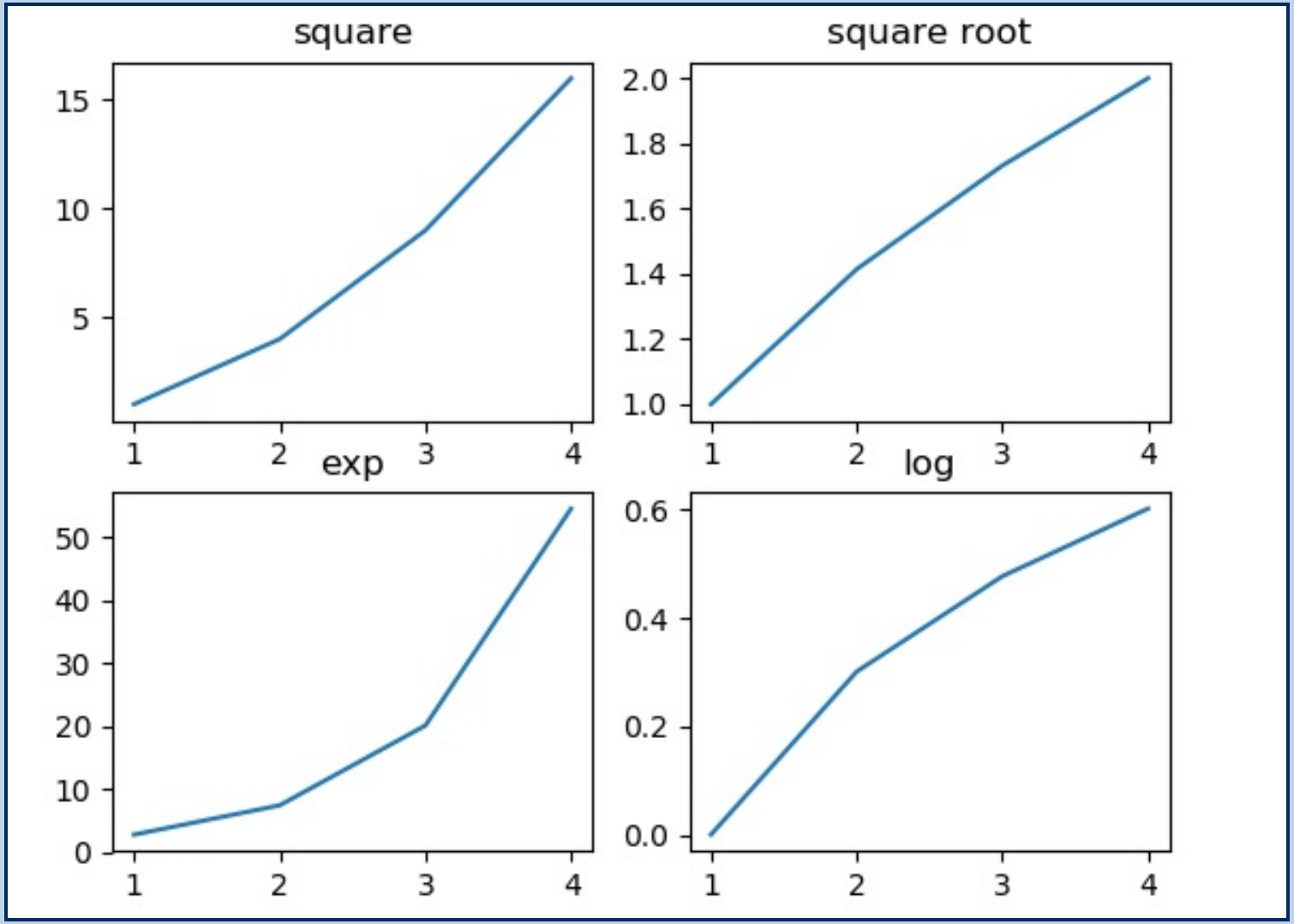
Matplotlib - Subplots() Function

plt.subplot()



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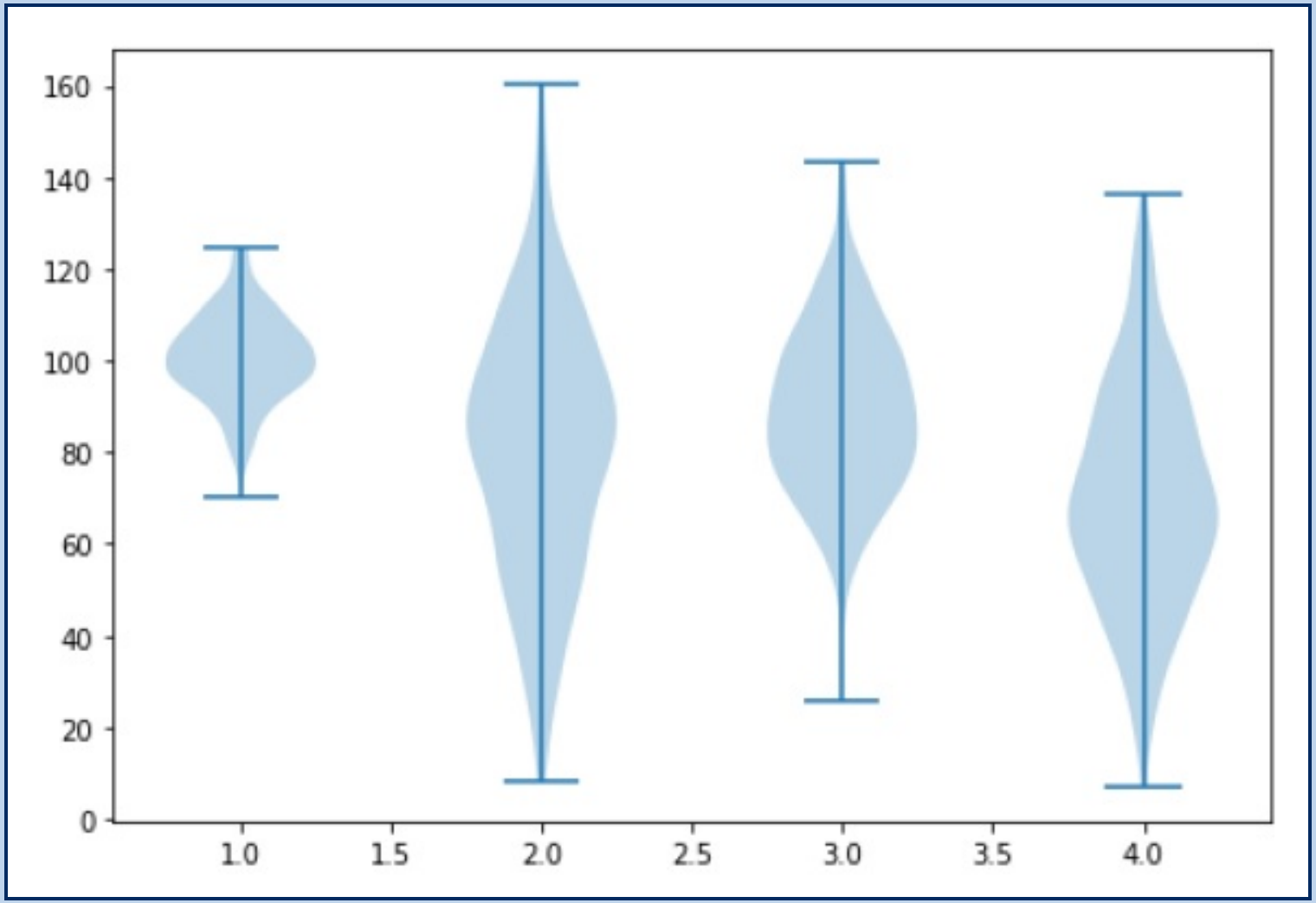
Violin Plot

ax.violionplot()



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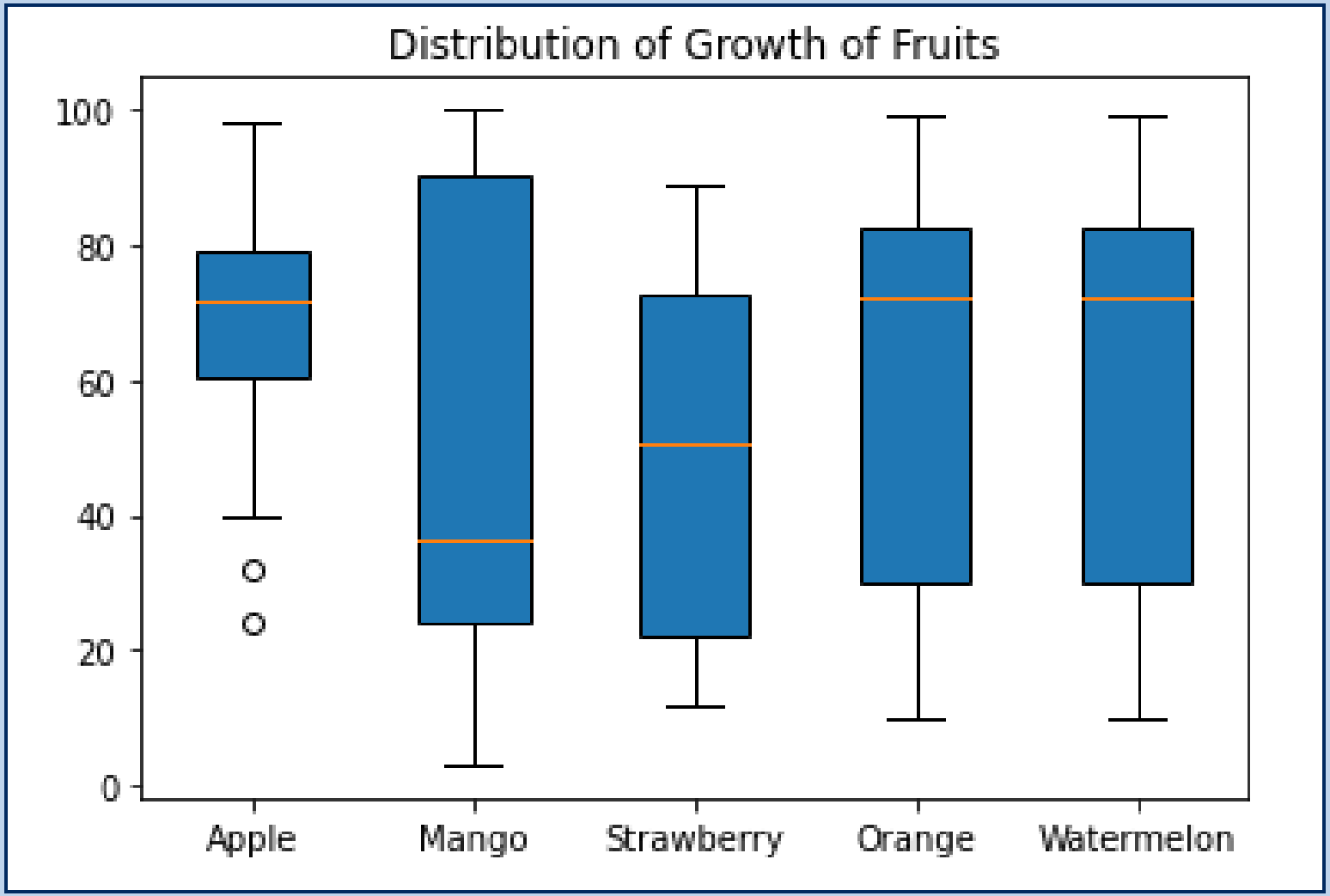
Box Plot

ax.boxplot()



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Backends.

What is a backend?

- To support variety of use cases, Matplotlib can target different outputs, and each of these capabilities is called a backend.
- The “frontend” is the user facing code, i.e., the plotting code, whereas the “backend” does all the hard work behind-the-scenes to make the figure.

Types of backends

User interface backends

- For use in PyQt/PySide, PyGObject, Tkinter, wxPython, or macOS/Cocoa.
- Also called, interactive backends.

Hardcopy backends

- To make image files such as PNG, SVG, PDF, PS.
- Also called, non-interactive backends.

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Selecting a backend

Setting rcParams[“backend”] in your matplotlibrc file

- backend : qt5agg

If your script depends on a specific backend

- import matplotlib
- matplotlib.use('qt5agg')

Setting the MPLBACKEND environment variable

> set MPLBACKEND=qt5agg

> python simple_plot.py

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Additional Resources

Class Notebooks

- https://github.com/Africa-Data-School/ADS_Course_Material

Matplotib Documentation

- https://matplotlib.org/stable/contents.html