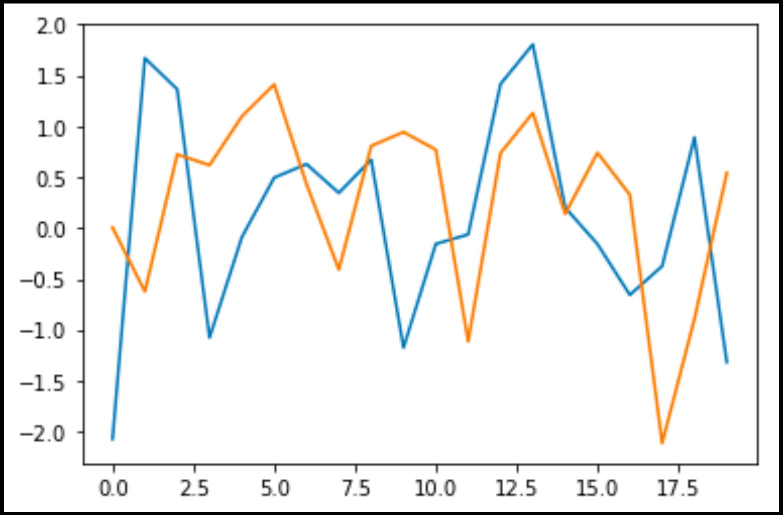
Intro to Computer Science CS-UH 1001, Spring 2022

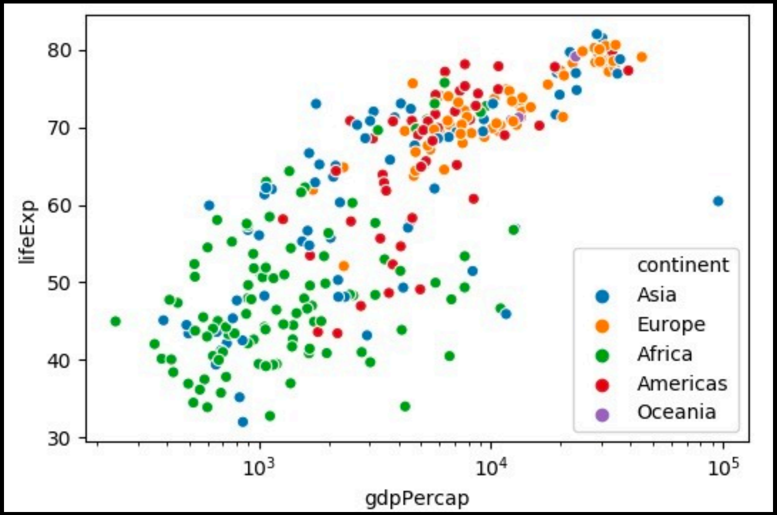
Lecture 22 – Plotting Figures in Python

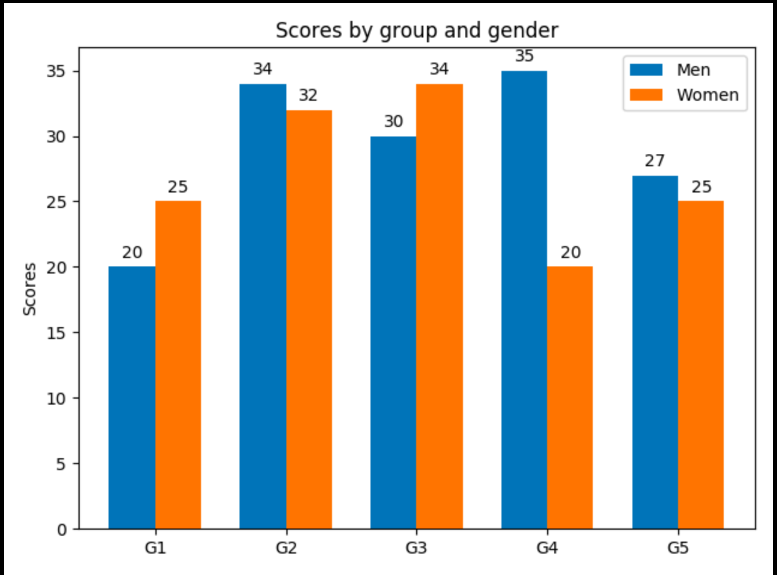
Matplotlib

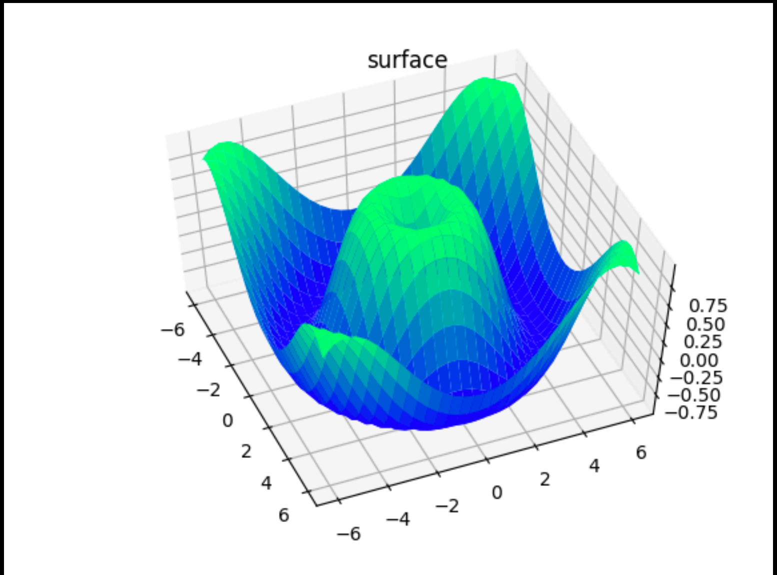
- Matplotlib is a 2D and 3D graphics module for generating scientific figures
- PyPlot is a collection of methods within Matplotlib which allow user to easily construct plots
  - It consists of several plots like line, bar, scatter, histogram, etc

Matplotlib Examples









Installing Matplotlib

Installing Matplotlib

- Open a command terminal and type:
  - Mac users:
    - pip3 install matplotlib
  - Windows (Linux subsystem) users:
    - sudo apt-get update
    - sudo apt-get install python3-pip
    - pip3 install matplotlib
  - Linux users (Virtual Machine):
    - matplotlib is already installed
    - if not, run: pip3 install matplotlib

Using Matplotlib

- Import the matplotlib.pyplot module:

```
import matplotlib.pyplot as plt
```

Basic Plots in Matplotlib

- plt.plot(x, y, color='value', lw=number)
  - Plots a curve with connecting the points in x,y
  - x and y have to be lists with the same length
  - Color value can be: 'r' (red), 'b' (blue), 'g' (green), 'm' (magenta), 'c' (cyan), etc
  - lw is the line width in pixels

- plt.bar(x, y, barwidth, color='value')
  - Plots a bar chart
  - barwidth is the width of each bar
  - Color values same as above

Saving the Figure

- plt.savefig(‘filename.extension’)
  - Saves the figure in the same folder
  - Filename can be any name
  - Extension can be .pdf, .png, .jpg etc.

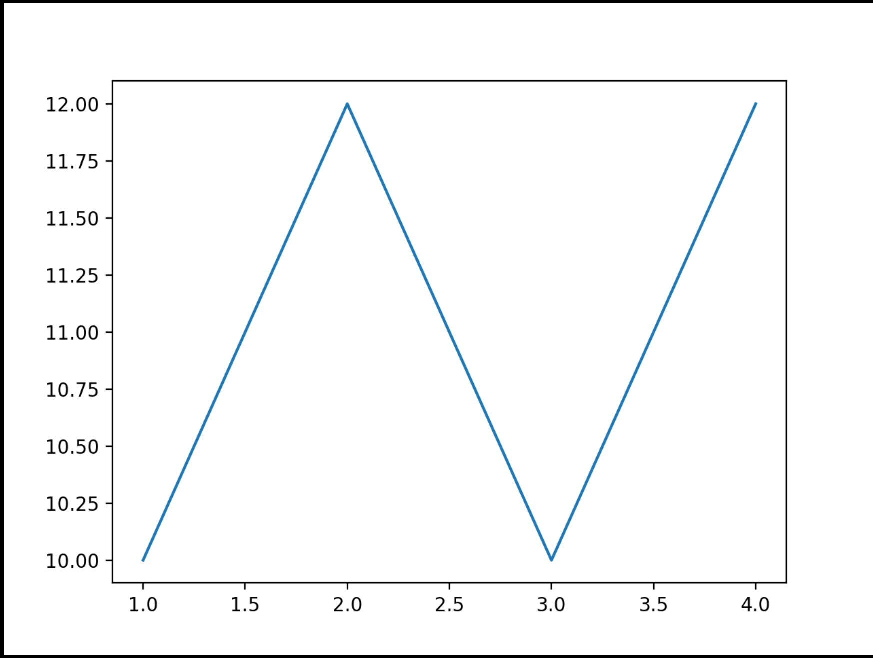
- The command must be called after plt.plot() or plt.bar()

Simple Example

```
import matplotlib.pyplot as plt

x = [1,2,3,4]
y = [10,12,10,12]
plt.plot(x, y)

plt.savefig(“fig.png”)
```



Useful Pyplot Functions

- plt.grid()
  - Add grid lines to the chart
- plt.ylabel(‘The label of the y-axis’)
  - Add a label for the y-axis
- plt.xlabel(‘The label of the x-axis’)
  - Add a label for the x-axis
- plt.ylim(min, max)
  - Set the figure range of the y-axis
- plt.xlim(min, max)
  - Set the figure range of the x-axis
- plt.title(“The title of the figure”)
  - Add a title on top of the figure

Adding a Legend

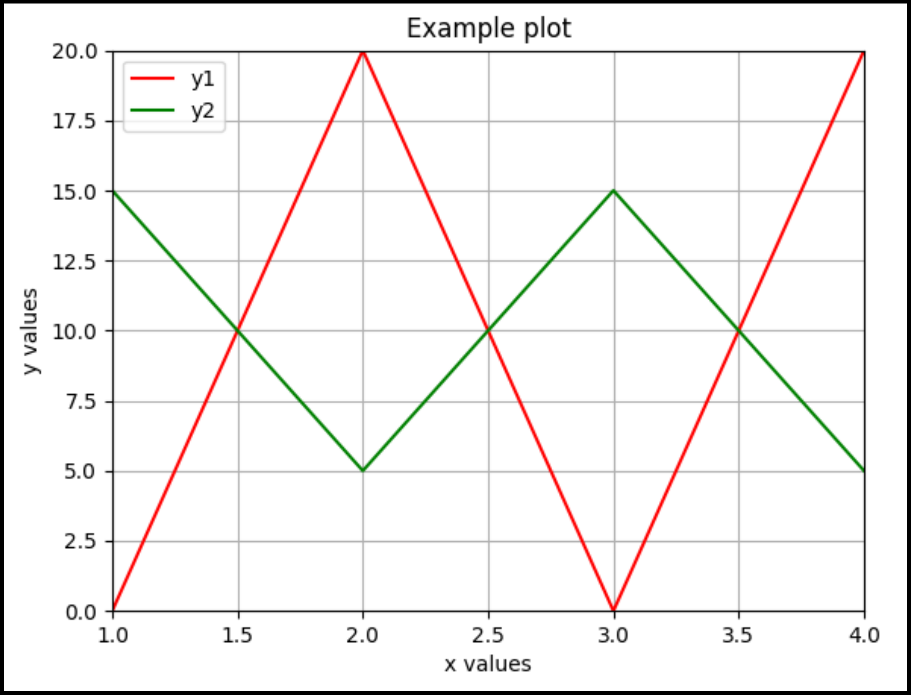
- To add a legend to the figure, add labels to the plots:
  - plt.plot(x1, y1, color=‘r’, label=“curve1”)
  - plt.plot(x1, y2, color=‘g’, label=“curve2”)
  - plt.legend()

Full Example

```
import matplotlib.pyplot as plt

x = [1, 2, 3, 4]
y1 = [0, 20, 0, 20]
y2 = [15, 5, 15, 5]

plt.plot(x, y1, color='r', label='y1')
plt.plot(x, y2, color='g', label='y2')
plt.title('Example plot')
plt.xlabel('x values')
plt.ylabel('y values')
plt.xlim(1, 4)
plt.ylim(0, 20)
plt.grid()
plt.legend()
plt.savefig('fig.png')
```



Breakout session I:
Plotting with Matplotlib

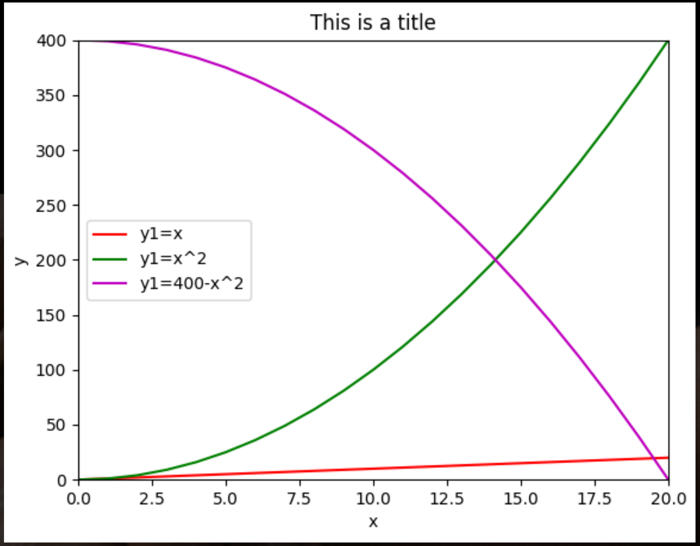
Plotting equations (ex_22.1.py)

Plot the following equations for 0 <= x <= 20:

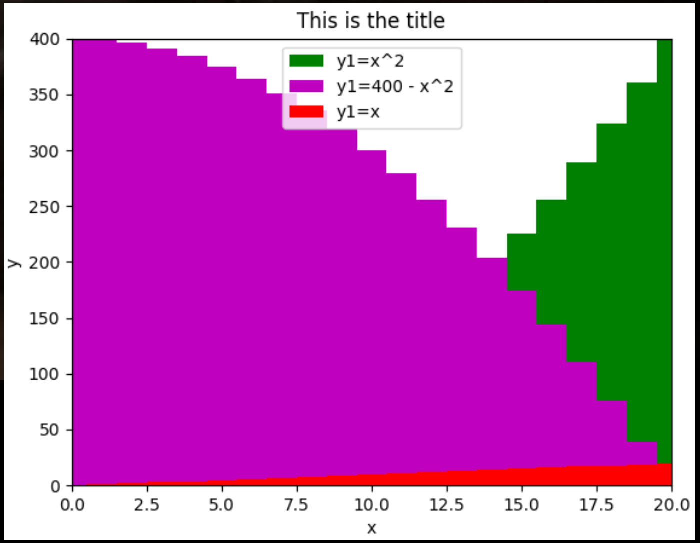
$y1 = x$

$y2 = x^2$

$y3 = 400 - x^2$



1. As a **line chart**
2. As a **bar chart**



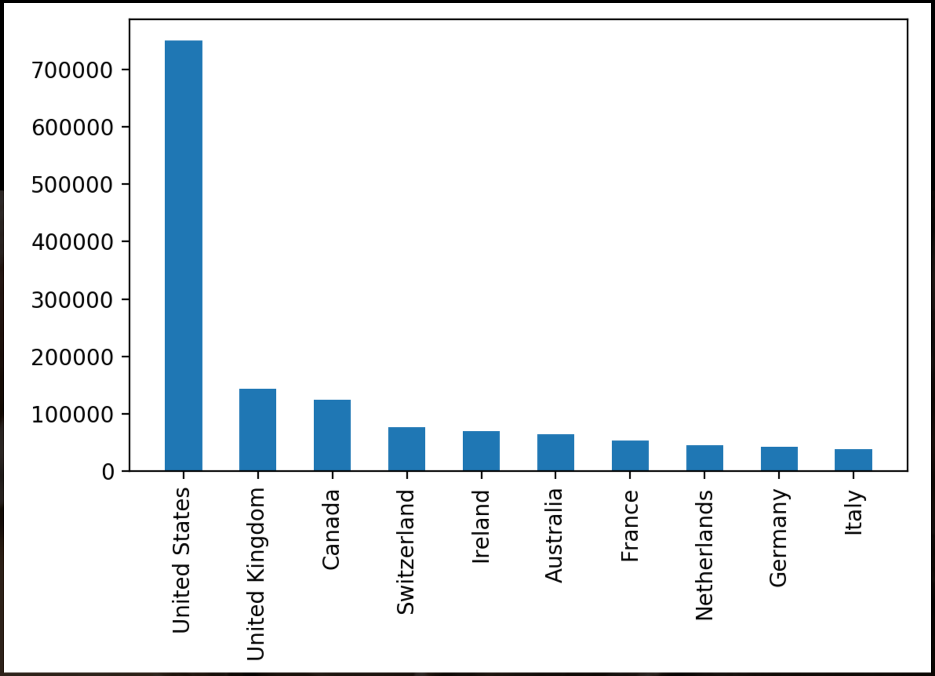
Breakout session II:
Sales CSV example

Plotting Sales (ex_22.2.py)

Download the CSV file “ex_22.2_SalesJan2009.csv” from Brightspace. It contains 1000 sales records with the following fields:

1. Transaction date
2. Product
3. Price
4. Payment type
5. Name
6. City
7. State
8. Country
9. Account created
10. Last login
11. Latitude
12. Longitude

Create a Python program that reads the CSV file and then calculates the total sales per Country. Plot the 10 countries with the highest sales as a bar chart.



Hints:

1. use the list.sort(reverse=True) method to sort a list in descending order
2. use the following lines to vertically align the x labels:
   plt.subplots_adjust(bottom=0.3, top=0.9)
   plt.xticks(rotation='vertical')