Principles of Computer Science II

Python Data Visualization Library

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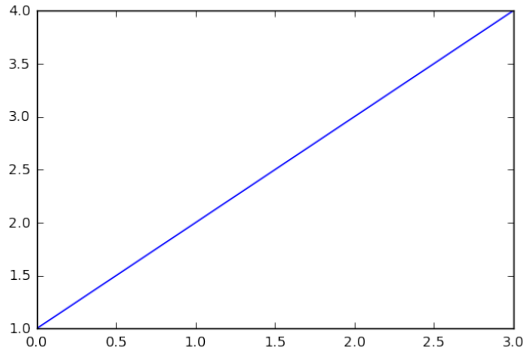
Lecture 14

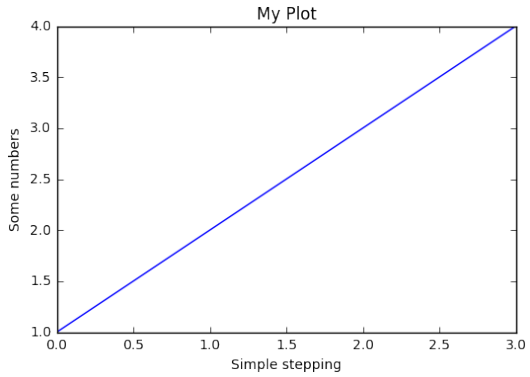
Simple Plotting

```
1 import matplotlib.pyplot as plt
2
3 plt.plot([1,2,3,4])
4
5 plt.show()
```

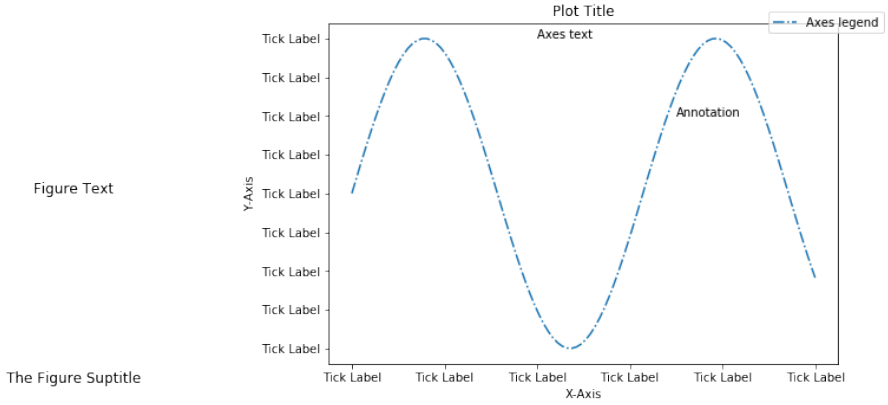


Axis Labels & Title

```
1 plt.plot([1,2,3,4])
2 plt.ylabel('Some numbers')
3 plt.xlabel('Simple stepping')
4 plt.title('My Plot')
5 plt.show()
```



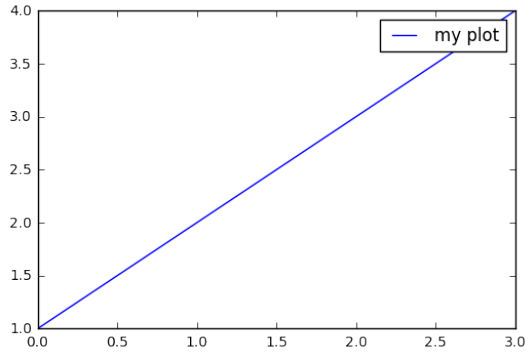
Plotting Areas



- A range of options are provided to parameterize the look&feel of the figure.
- `savefig("filename")` – plotting + store to file.

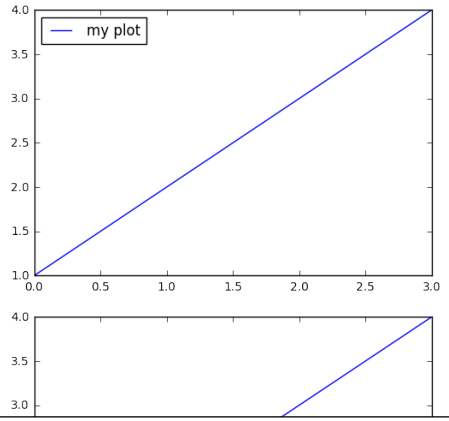
Plot Labels & Legend

```
plt.plot([1,2,3,4], label='my plot')
plt.legend()
plt.show()
```



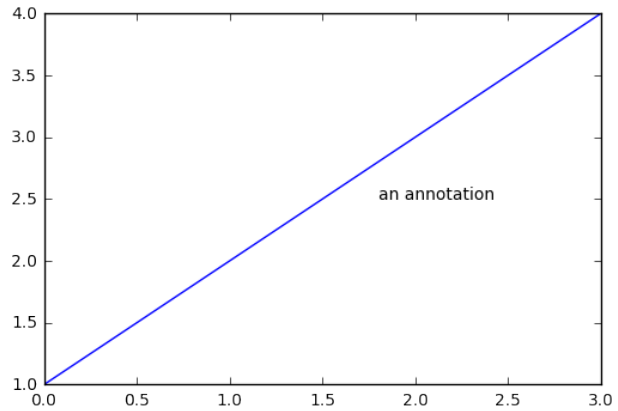
Legend Location

```
plt.plot([1,2,3,4], label='my plot')
plt.legend(bbox_to_anchor=(0.3, 1))
plt.show()

plt.plot([1,2,3,4], label='my plot')
plt.legend(bbox_to_anchor=(1, 0.2))
plt.show()
```



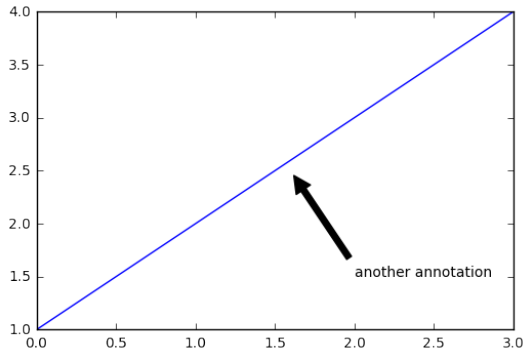
Simple Text

```
plt.plot([1,2,3,4], label='my plot')
plt.text(1.8, 2.5, 'an annotation')
plt.show()
```



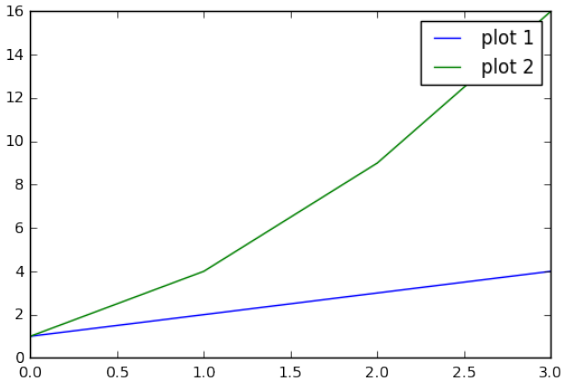
Text Annotations

```
plt.plot([1,2,3,4], label='my plot')
plt.annotate('another annotation', xy=(1.6, 2.5),
             xytext=(2, 1.5),
             arrowprops=dict(facecolor='black',shrink=0.05))
plt.show()
```



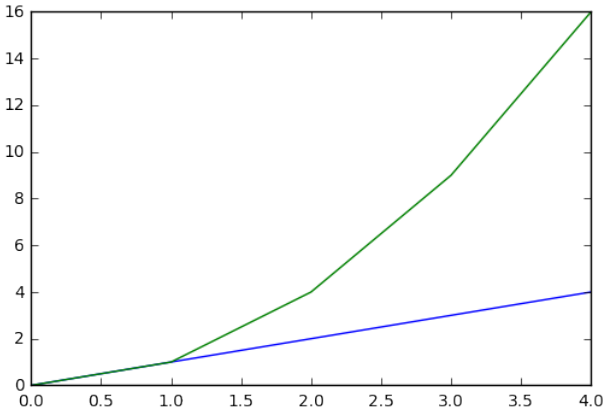
Multiple Plots

```
plt.plot([1,2,3,4], label='plot 1')
plt.plot([1,4,9,16], label='plot 2')
plt.legend()
plt.show()
```



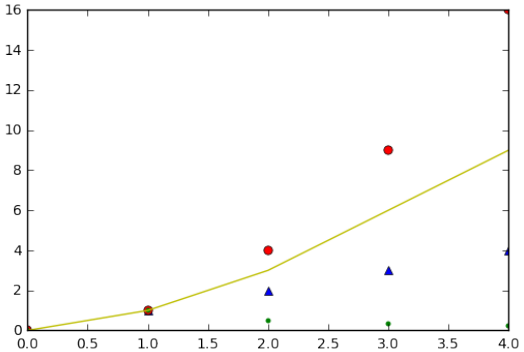
Plot X-axis Values

```
plt.plot([0,1,2,3,4], [0,1,2,3,4])
plt.plot([0,1,2,3,4], [0,1,4,9,16])
plt.show()
```



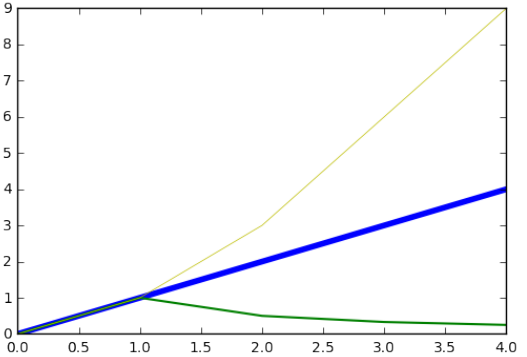
Marker Style

```
plt.plot([0,1,2,3,4], [0,1,2,3,4], 'b^')
plt.plot([0,1,2,3,4], [0,1,4,9,16], 'ro')
plt.plot([0,1,2,3,4], [0,1,.5,.33,.25], 'g.')
plt.plot([0,1,2,3,4], [0,1,3,6,9], 'y-')
plt.show()
```



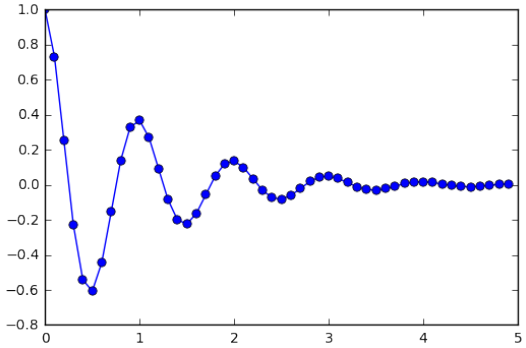
Line Style

```
plt.plot([0,1,2,3,4], [0,1,2,3,4], 'b', linewidth=4.0)
plt.plot([0,1,2,3,4], [0,1,.5,.33,.25], 'g', linewidth=1.5)
plt.plot([0,1,2,3,4], [0,1,3,6,9], 'y', linewidth=0.5)
plt.show()
```



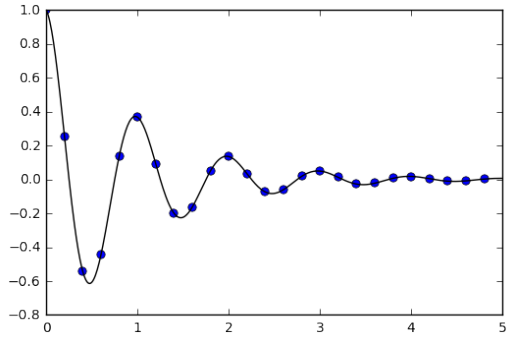
Line Style & Markers Style

```
import math
x = [i * 0.1 for i in range(0, 50)]
y = [math.exp(-i) * math.cos(2*math.pi*i) for i in x]
plt.plot(x, y, 'bo-', linewidth=1.0)
plt.show()
```



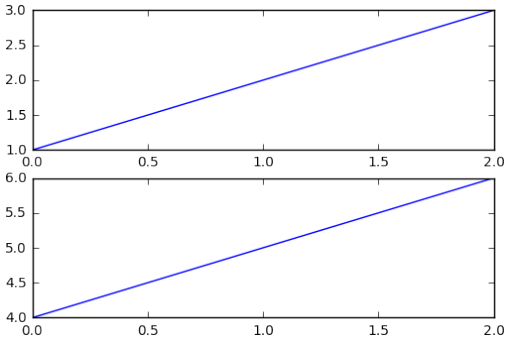
Separate Line Style, Marker Style + Marker positioning

```
x1 = [i * 0.2 for i in range(0, 25)]
y1 = [math.exp(-i) * math.cos(2*math.pi*i) for i in x1]
x2 = [i * 0.01 for i in range(0, 500)]
y2 = [math.exp(-i) * math.cos(2*math.pi*i) for i in x2]
plt.plot(x1, y1, 'bo', x2, y2, 'k')
plt.show()
```



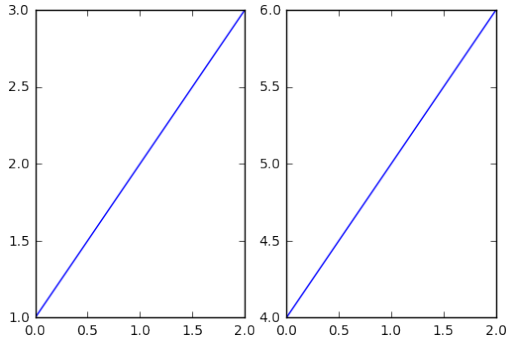
Multiple Subplots – Vertical

```
plt.figure()
plt.subplot(211)
plt.plot([1, 2, 3])
plt.subplot(212)
plt.plot([4, 5, 6])
plt.show()
```



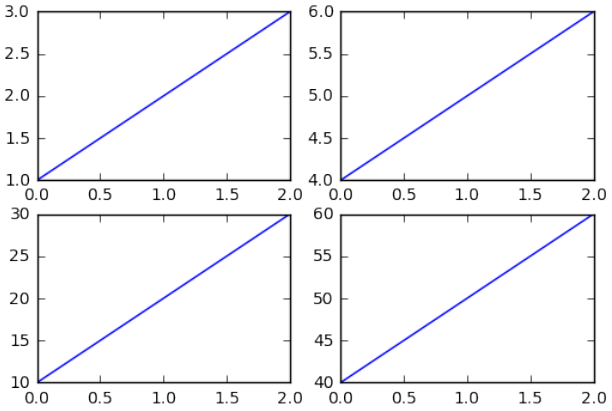
Multiple Subplots – Horizontal

```
plt.figure()
plt.subplot(121)
plt.plot([1, 2, 3])
plt.subplot(122)
plt.plot([4, 5, 6])
plt.show()
```



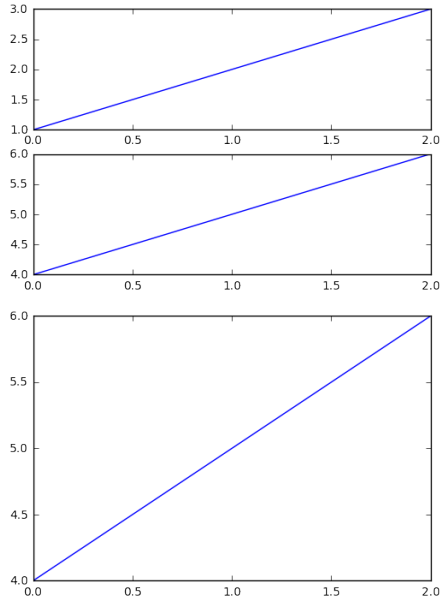
Multiple Subplots – Grid

```
plt.figure()
plt.subplot(221)
plt.plot([1, 2, 3])
plt.subplot(222)
plt.plot([4, 5, 6])
plt.subplot(223)
plt.plot([10, 20, 30])
plt.subplot(224)
plt.plot([40, 50, 60])
plt.show()
```



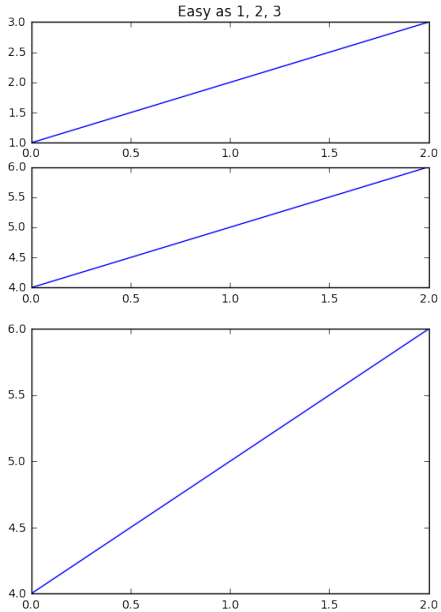
Multiple Figures

```
plt.figure(1)
plt.subplot(211)
plt.plot([1, 2, 3])
plt.subplot(212)
plt.plot([4, 5, 6])

plt.figure(2)
plt.plot([4, 5, 6])
plt.show()
```



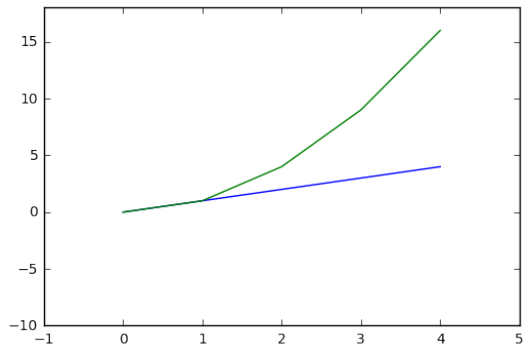
Multiple Figures – Concurrent Access

```
plt.figure(1)
plt.subplot(211)
plt.plot([1, 2, 3])
plt.subplot(212)
plt.plot([4, 5, 6])


plt.figure(2)
plt.plot([4, 5, 6])

plt.figure(1)
plt.subplot(211)
plt.title('Easy as 1,
    2, 3')
plt.show()
```



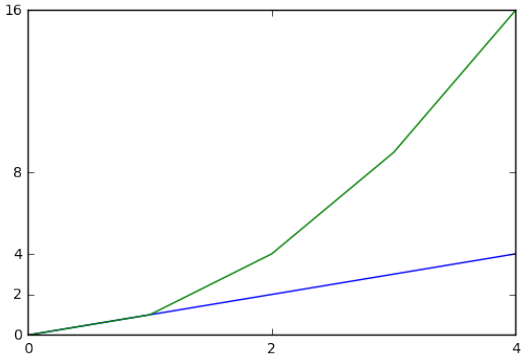
Controlling Axis Values

```
plt.plot([0,1,2,3,4], [0,1,2,3,4])
plt.plot([0,1,2,3,4], [0,1,4,9,16])
plt.xlim(-1,5)
plt.ylim(-10,18)
plt.show()
```



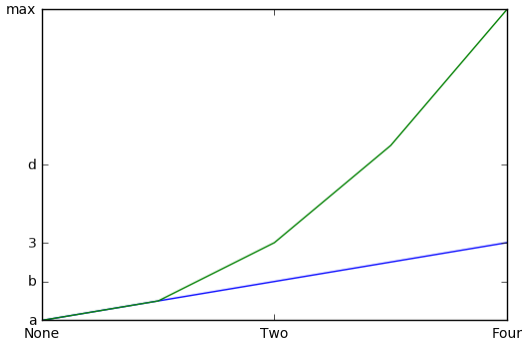
Axis Tick Positioning

```
plt.plot([0,1,2,3,4], [0,1,2,3,4])
plt.plot([0,1,2,3,4], [0,1,4,9,16])
plt.xticks([0,2,4])
plt.yticks([0,2,4,8,16])
plt.show()
```



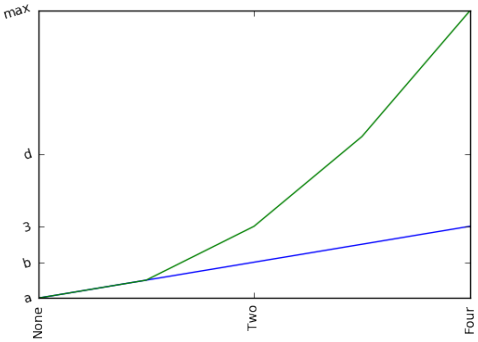
Axis Tick Positioning & Labels

```
plt.plot([0,1,2,3,4], [0,1,2,3,4])
plt.plot([0,1,2,3,4], [0,1,4,9,16])
plt.xticks([0,2,4],['None','Two','Four'])
plt.yticks([0,2,4,8,16],['a','b',3,'d','max'])
plt.show()
```



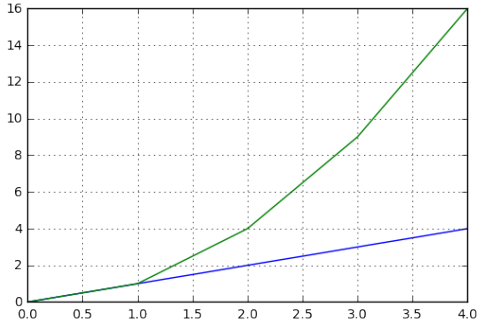
Axis Tick Positioning, Labels & Orientation

```
plt.plot([0,1,2,3,4], [0,1,2,3,4])
plt.plot([0,1,2,3,4], [0,1,4,9,16])
plt.xticks([0,2,4],['None','Two','Four'],rotation='vertical
    ')
plt.yticks([0,2,4,8,16],['a','b',3,'d','max'], rotation=70)
plt.show()
```



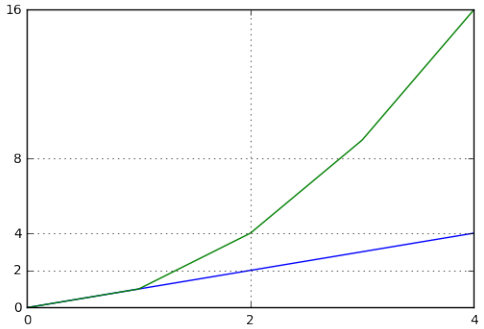
Simple Grid

```
plt.plot([0,1,2,3,4], [0,1,2,3,4])
plt.plot([0,1,2,3,4], [0,1,4,9,16])
plt.grid()
plt.show()
```



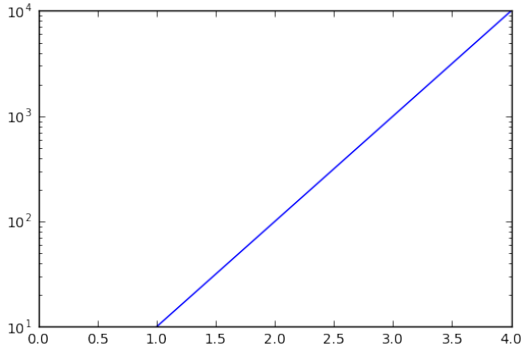
Ticks & Grid

```
plt.plot([0,1,2,3,4], [0,1,2,3,4])
plt.plot([0,1,2,3,4], [0,1,4,9,16])
plt.xticks([0,2,4])
plt.yticks([0,2,4,8,16])
plt.grid()
plt.show()
```



Logarithmic Scale

```
plt.plot([0,10,100,1000,10000])
plt.yscale('log')
plt.show()
```



Logarithmic Scale & Grid

```
plt.plot([0,10,100,1000,10000])
plt.yscale('log')
plt.grid()
plt.show()
```