

# **Plotting and Visualization**

**Using data visualization libraries**

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## matplotlib API primer

- Figures and subplots
- adjusting the spacing around subplots
- colors, markers and line styles
- ticks, labels, and legends
- adding legends
- annotation and drawing on a subplot
- saving plots to file
- matplotlib configuration

## plotting with pandas and seaborn

- line plots

- Bar plots
- Histogram and density plots
- Scatter or Point plots
- Facet Grids and Categorical Data

## Into matplotlib

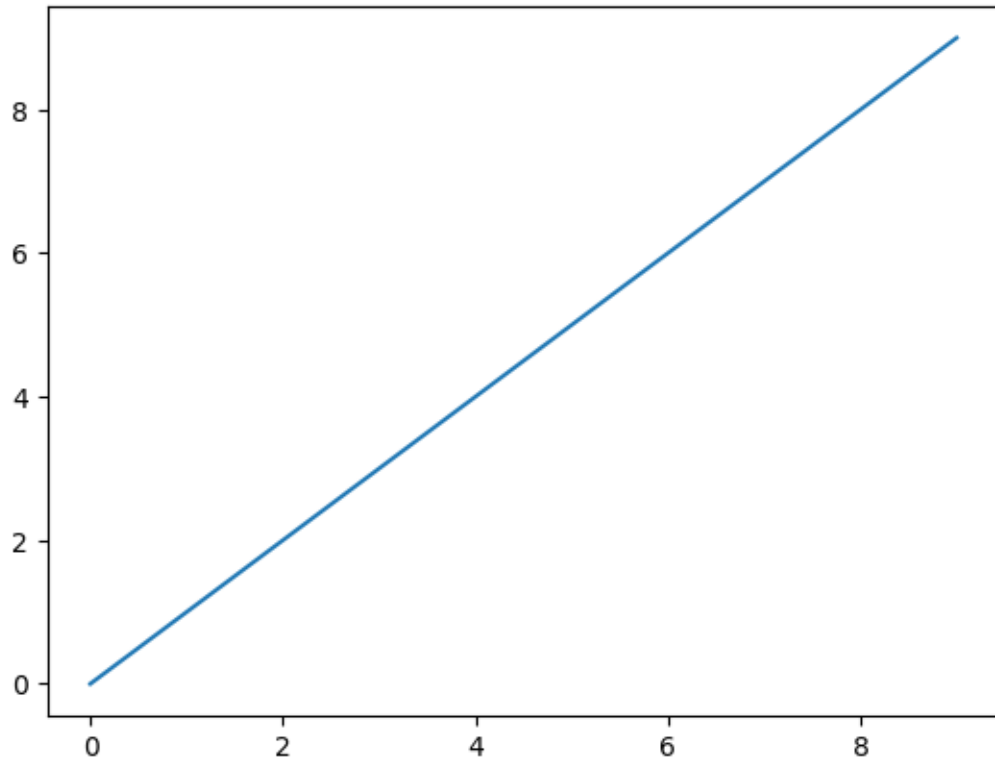
```
import matplotlib.pyplot as plt
import numpy as np
import pandas as pd
%matplotlib inline
```

```
data = np.arange(10)
```

```
data
```

```
array([0, 1, 2, 3, 4, 5, 6, 7, 8, 9])
```

```
plt.plot(data)
```



## Figures and subplots

```
fig = plt.figure()
plt.show()
```

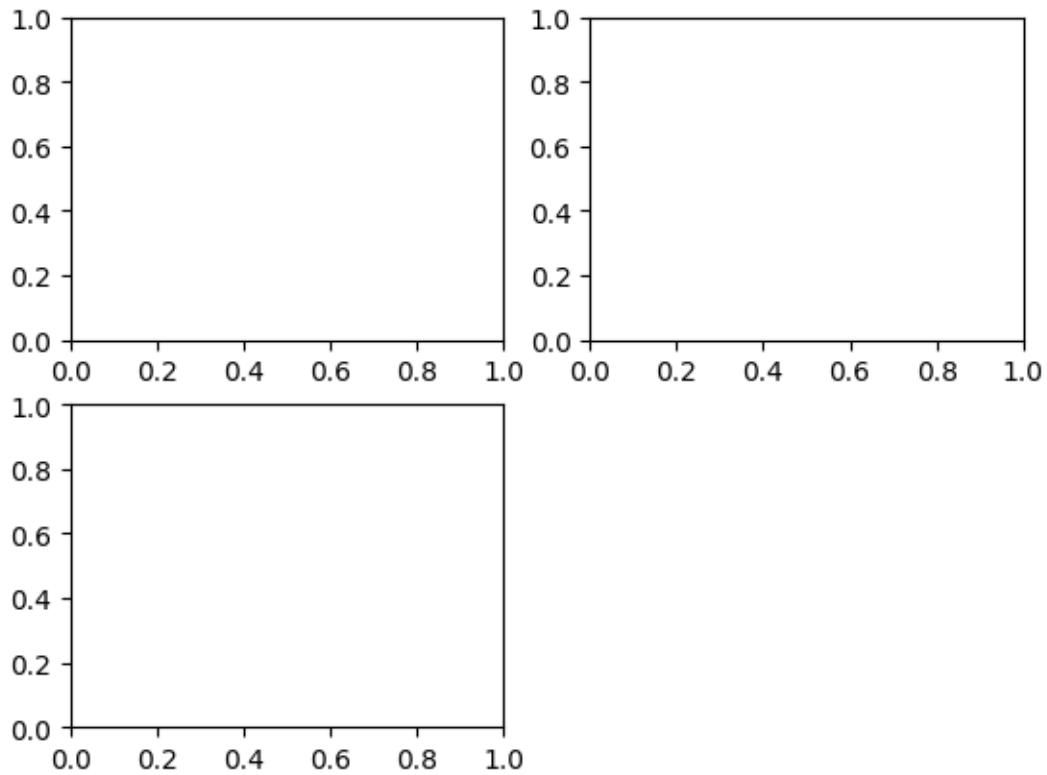
```
# 2, 2 means 4 sub-plots will be created
```

```
# % matplotlib
ax1 = fig.add_subplot(2, 2, 1)
```

```
ax2 = fig.add_subplot(2, 2, 2)
ax3 = fig.add_subplot(2, 2, 3)
```

```
fig = plt.figure()
ax1 = fig.add_subplot(2, 2, 1)
```

```
ax2 = fig.add_subplot(2, 2, 2)
ax3 = fig.add_subplot(2, 2, 3)
```



```
%matplotlib notebook
ax3.plot(np.random.standard_normal(50).cumsum(),
        color = 'black', linestyle= 'dashed')
```

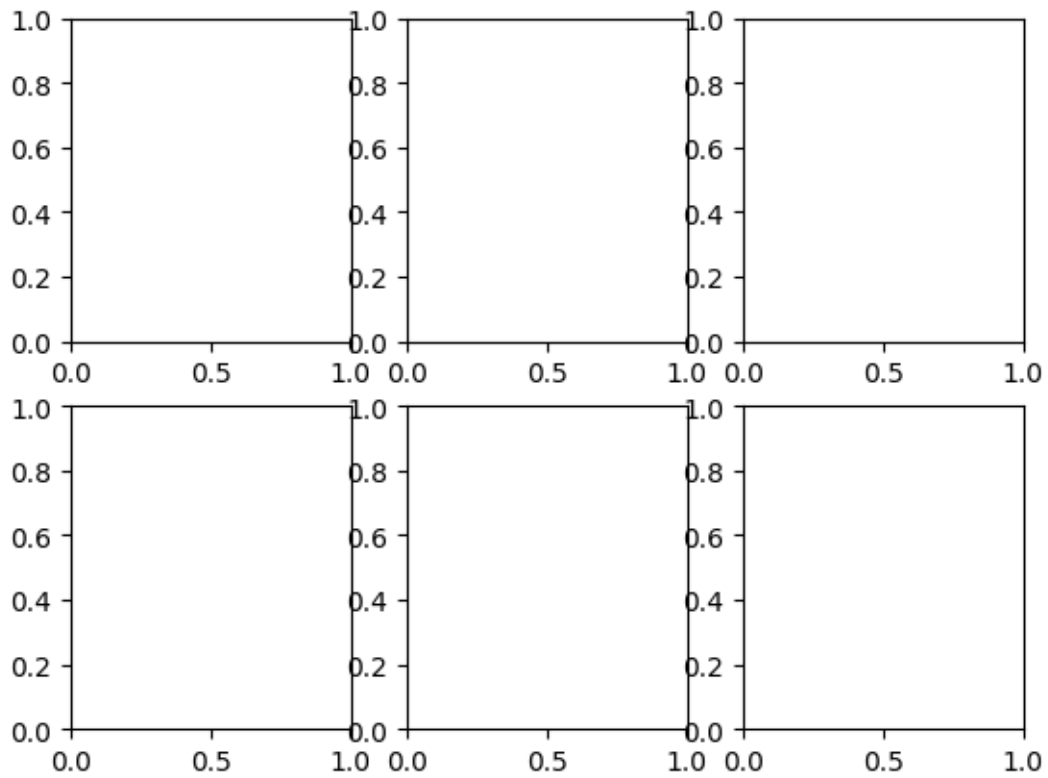
```
ax3.plot(np.random.standard_normal(50).cumsum(),
        color = 'black', linestyle = 'dashed');
```

```
help(plt)
```

```
ax1.hist(np.random.standard_normal(100), bins = 20,
        color = 'black', alpha = 0)
ax2.scatter(np.arange(30), np.arange(30) + 3 * np.random.standard_normal(30));
```

```
! pip install ipympl
```

```
fig, axes = plt.subplots(2,3)
```



```
axes
```

```
array([[<Axes: >, <Axes: >, <Axes: >],  
       [<Axes: >, <Axes: >, <Axes: >]], dtype=object)
```

### Adjusting spacing around subplots

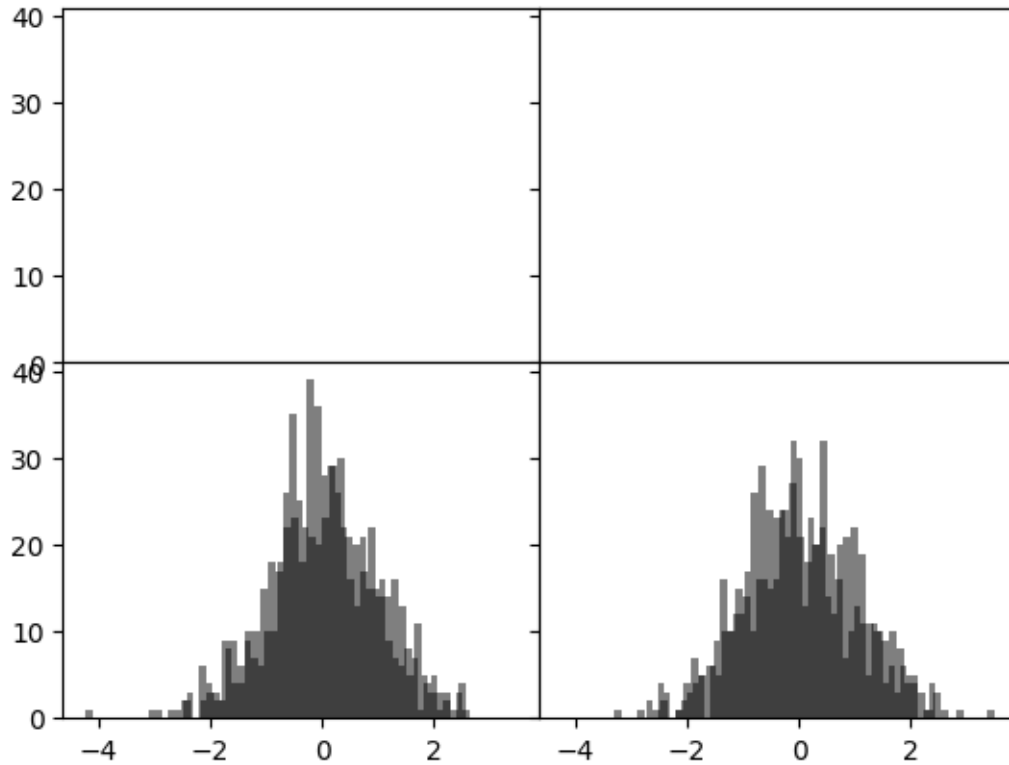
```
subplots_adjust(left= None, bottom= None,  
                right= None, top= None,  
                wspace = None, hspace= None);
```

```

fig, axes = plt.subplots(2, 2, sharex = True, sharey = True)
for i in range(2):
    for j in range(2):
        axes[1, j].hist(np.random.standard_normal(500),
                        bins = 50, color = 'black', alpha = 0.5)

fig.subplots_adjust(wspace= 0, hspace= 0)

```



```

ax.plot(x, y, linestyle = '--', color = 'green')

ax = fig.add_subplot()

ax.plot(np.random.standard_normal(30).cumsum(),
        color = 'black', linestyle = 'dashed', marker= 'o' )

```

```

fig = plt.figure()
ax = fig.add_subplot()

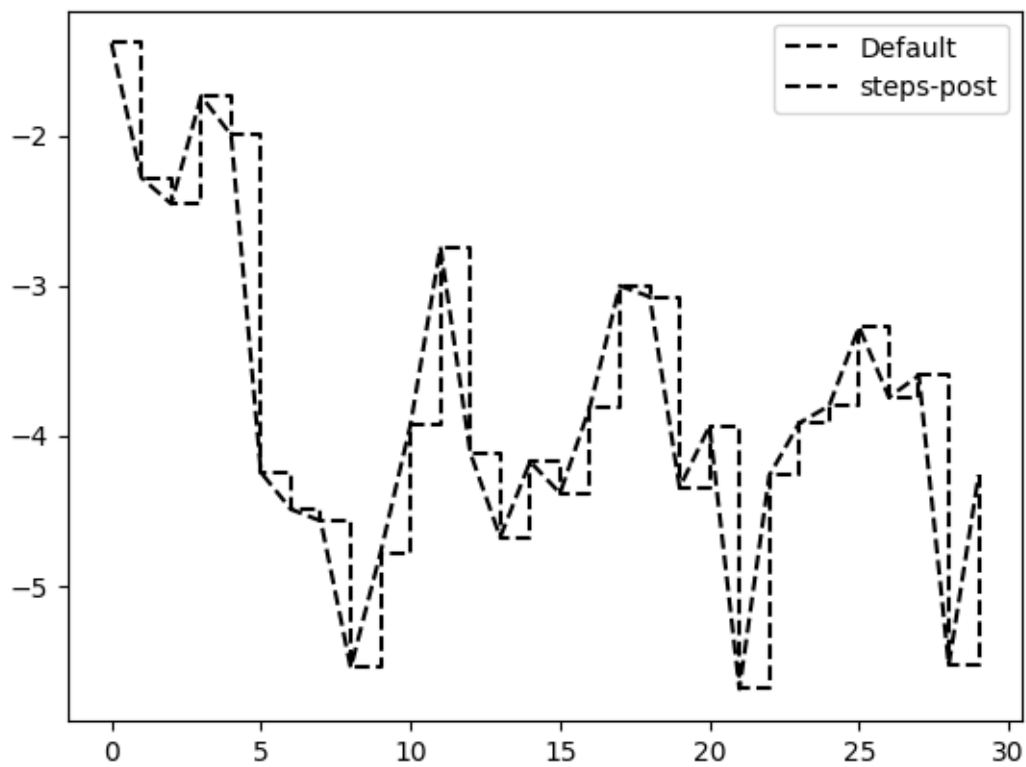
data = np.random.standard_normal(30).cumsum()

ax.plot(data, color = 'black', linestyle = 'dashed',
        label = 'Default')
ax.plot(data, color = 'black', linestyle = 'dashed',
        drawstyle= 'steps-post', label= 'steps-post')

ax.legend()

```

<matplotlib.legend.Legend at 0x205861b2460>





## Ticks, Labels, and Legends

```
ax.get_xlim([0, 10])
```

```
help(plt.xlim)
```

Help on function xlim in module matplotlib.pyplot:

```
xlim(*args, **kwargs)
```

Get or set the x limits of the current axes.

Call signatures::

```
left, right = xlim() # return the current xlim
xlim((left, right)) # set the xlim to left, right
xlim(left, right)   # set the xlim to left, right
```

If you do not specify args, you can pass *\*left\** or *\*right\** as kwargs, i.e.::

```
xlim(right=3) # adjust the right leaving left unchanged
xlim(left=1)  # adjust the left leaving right unchanged
```

Setting limits turns autoscaling off for the x-axis.

Returns

-----

left, right

A tuple of the new x-axis limits.

Notes

-----

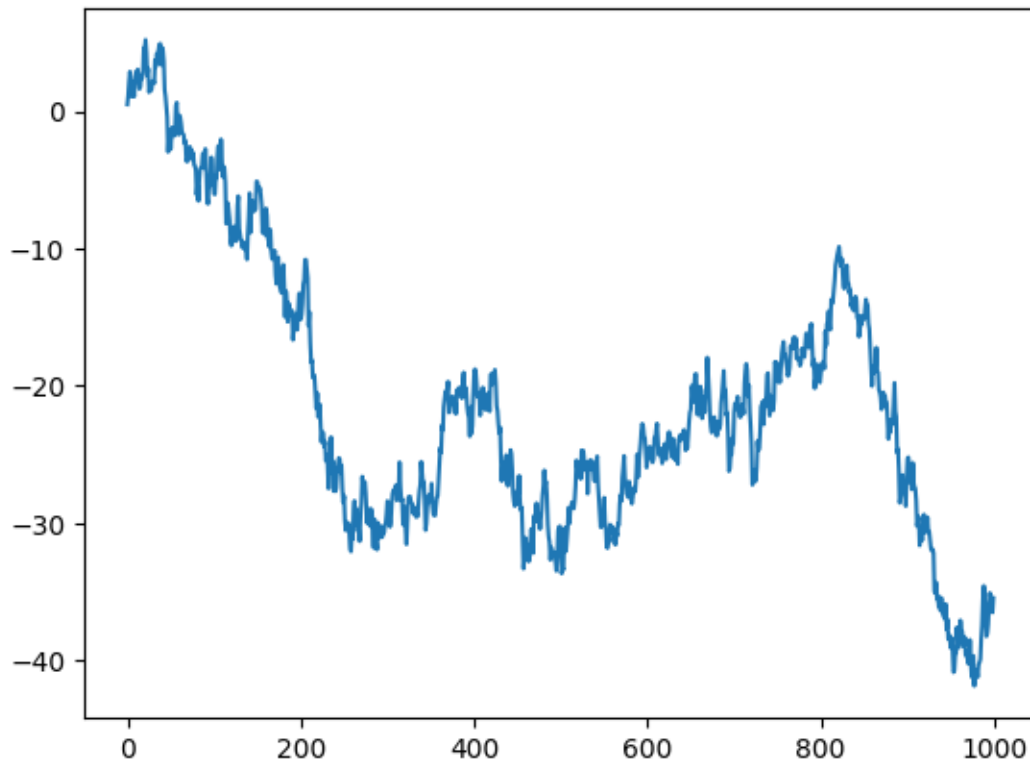
Calling this function with no arguments (e.g. ```xlim()```) is the pyplot equivalent of calling `~.Axes.get_xlim`` on the current axes.

Calling this function with arguments is the pyplot equivalent of calling `~.Axes.set_xlim`` on the current axes. All arguments are passed though.

## Setting the title, axis labels, ticks, and tick labels

```
fig, ax = plt.subplots()

ax.plot(np.random.standard_normal(1000).cumsum());
```



```
ticks= ax.set_xticks([0, 250, 500, 750, 1000])

labels = ax.set_xticklabels(['one', 'two', 'three',
                             'four', 'five'],
                             rotation = 30, fontsize=8)

ax.set_xlabel('Stages')
```

```
Text(0.5, 1.0, 'My matplotlib plot')
```

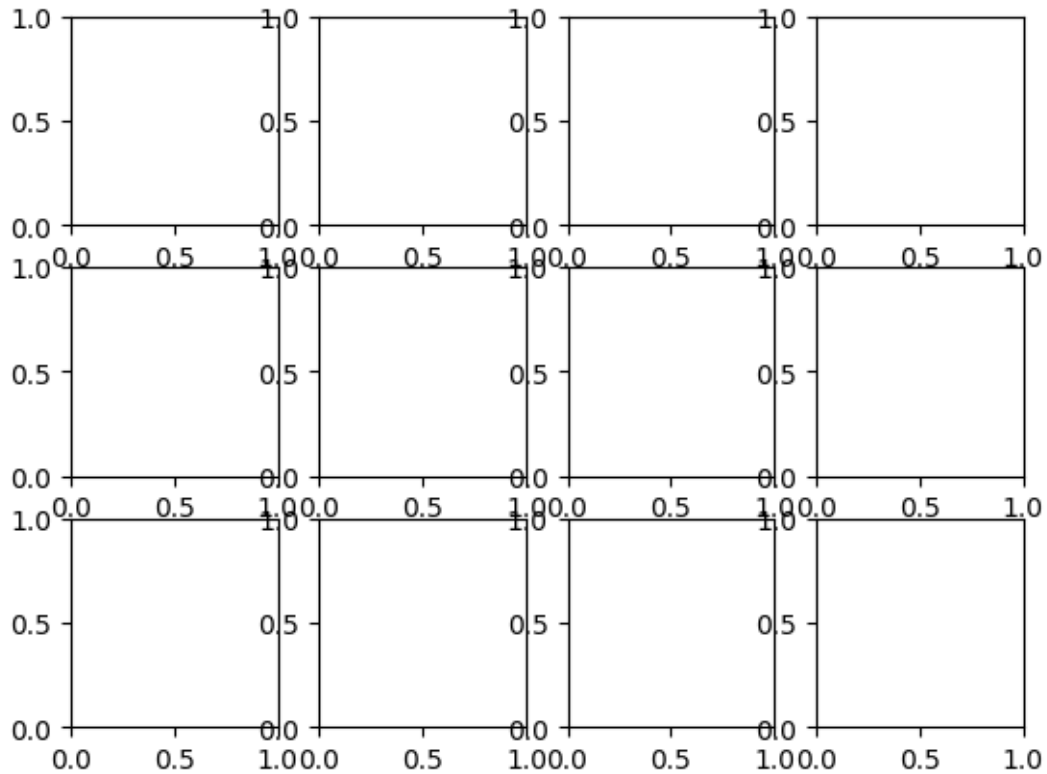
```
ax.set_title('My matplotlib plot')
```

```
Text(0.5, 1.0, 'My matplotlib plot')
```

```
plt.show()
```

## Adding legends

```
fig, ax = plt.subplots(3, 4)
```

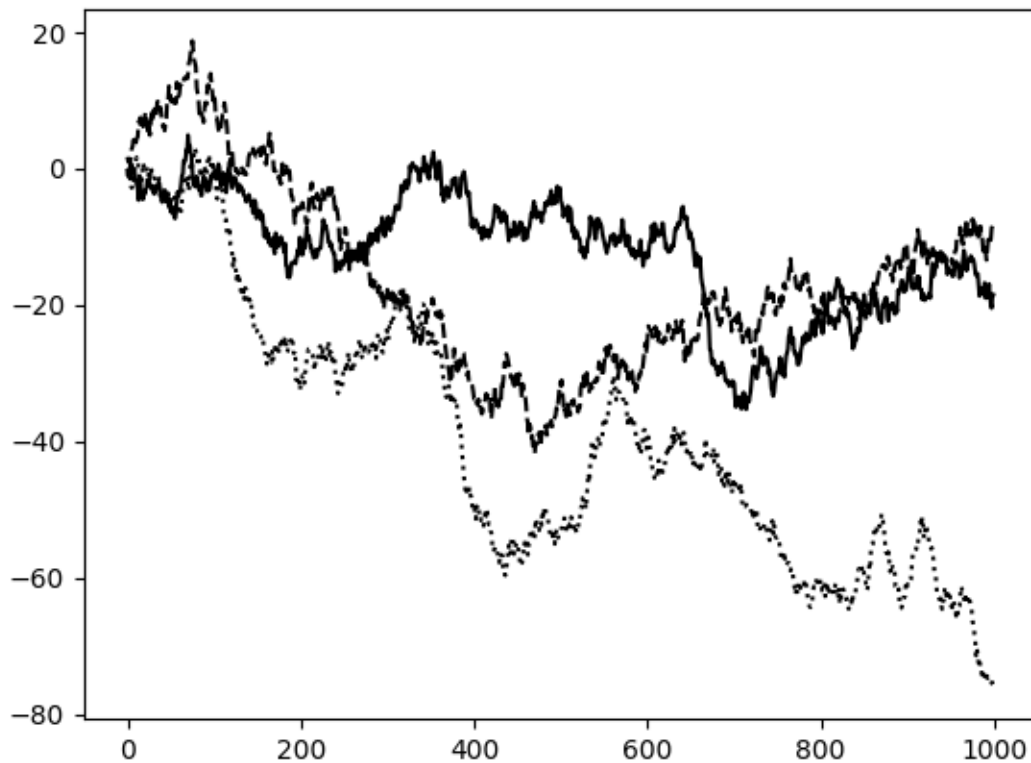


```
fig, ax = plt.subplots()
ax.plot(np.random.randn(1000).cumsum(), color = 'black',
```

```

    label = 'one')
ax.plot(np.random.randn(1000).cumsum(), color = 'black',
        linestyle = 'dashed')
ax.plot(np.random.randn(1000).cumsum(), color= 'black',
        linestyle = 'dotted', )

```



```
ax.legend()
```

<matplotlib.legend.Legend at 0x20588a6e700>

## Annotations and Drawing on a Subplot

```

ax.text(x, y, 'Hello world!',
        family = 'monospace', fontsize= 10)

```

```

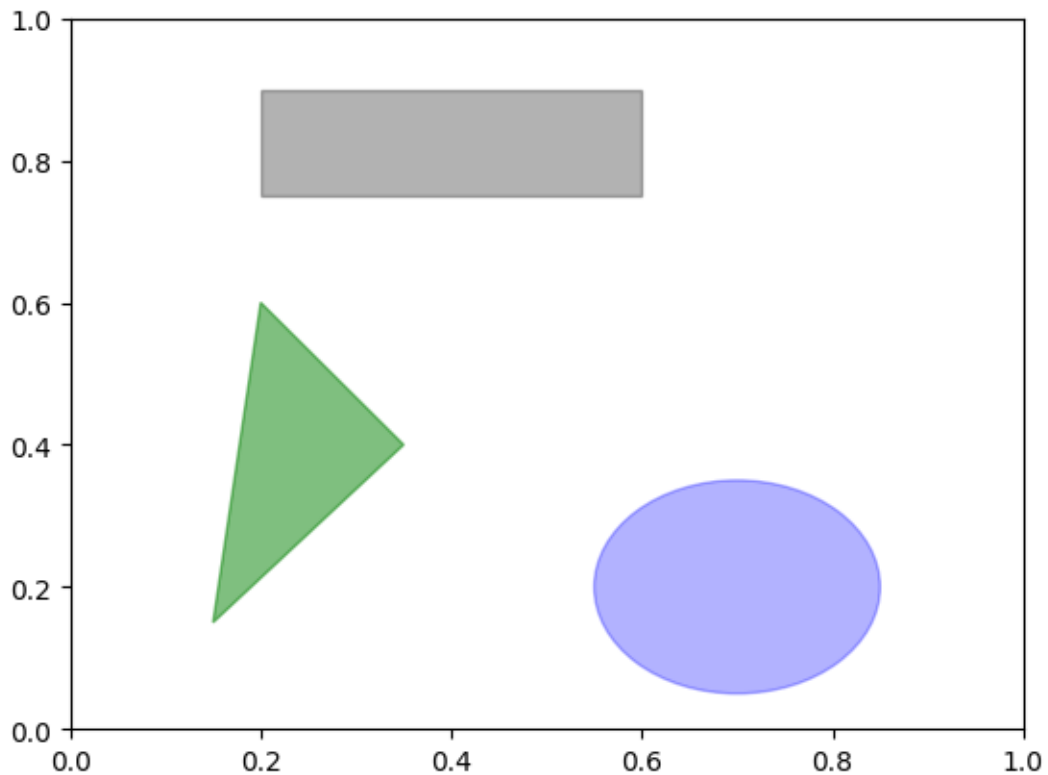
from datetime import datetime
fig, ax = plt.subplots()

rect = plt.Rectangle((0.2, 0.75), 0.4, 0.15, color = 'black', alpha=0.3)
circ = plt.Circle((0.7, 0.2), 0.15, color = 'blue', alpha= 0.3)
pgon = plt.Polygon([[0.15, 0.15], [0.35, 0.4], [0.2, 0.6]],
                    color = 'green', alpha =0.5)

ax.add_patch(rect)
ax.add_patch(circ)
ax.add_patch(pgon)

```

<matplotlib.patches.Polygon at 0x20588b71a60>



## Saving photos to file

```
fig.savefig('figpath.svg')
```

```
fig.savefig('figpath.png', dpi=400)
```

## Matplotlib configuration

```
plt.rc('figure', figsize = (10, 10))
```

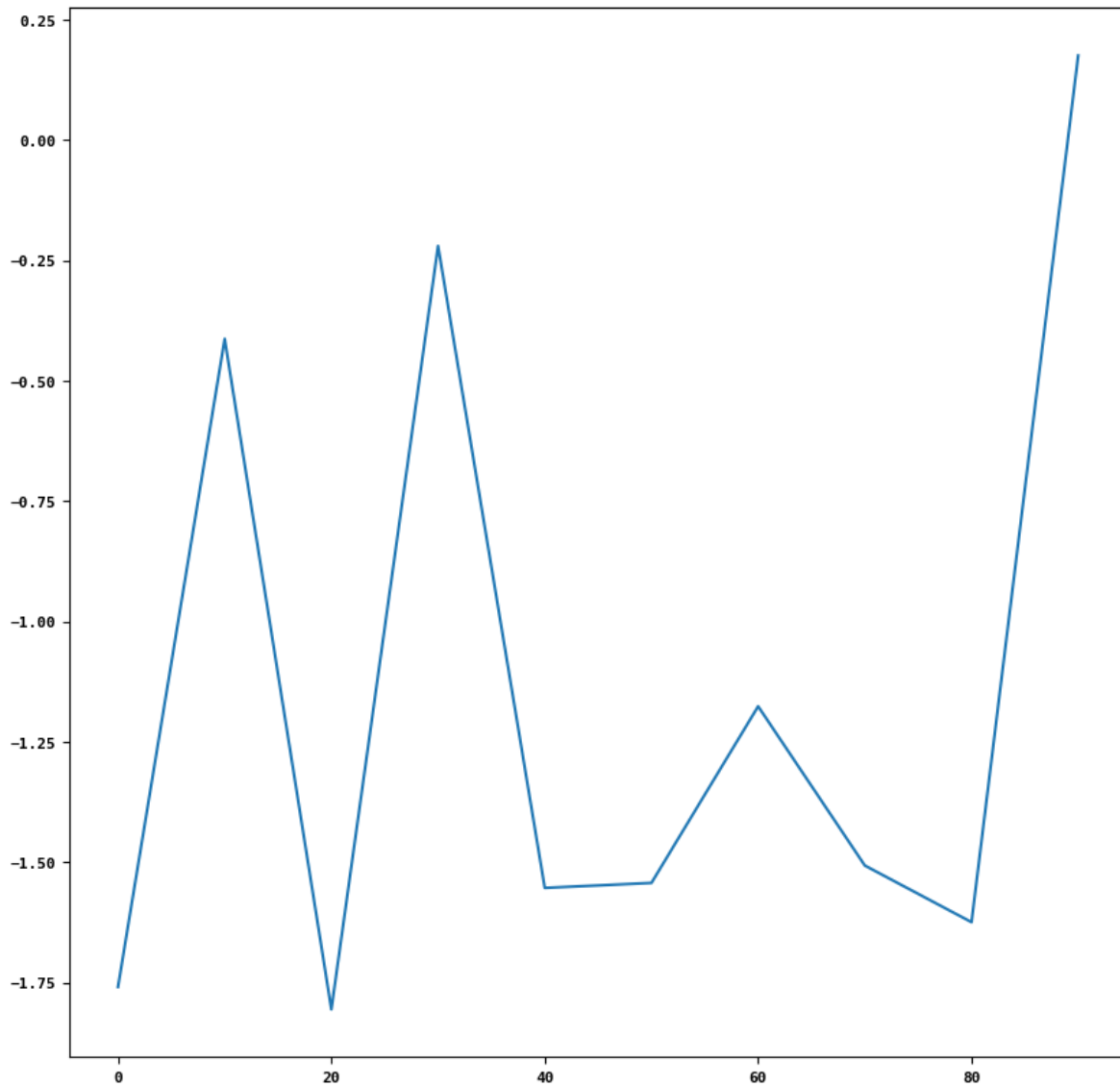
```
plt.rc('font', family= 'monospace', weight = 'bold', size= 8)
```

## Plotting with pandas and seaborn

### Line plots

```
s = pd.Series(np.random.standard_normal(10).cumsum(),  
              index = np.arange(0, 100, 10))  
s.plot()
```

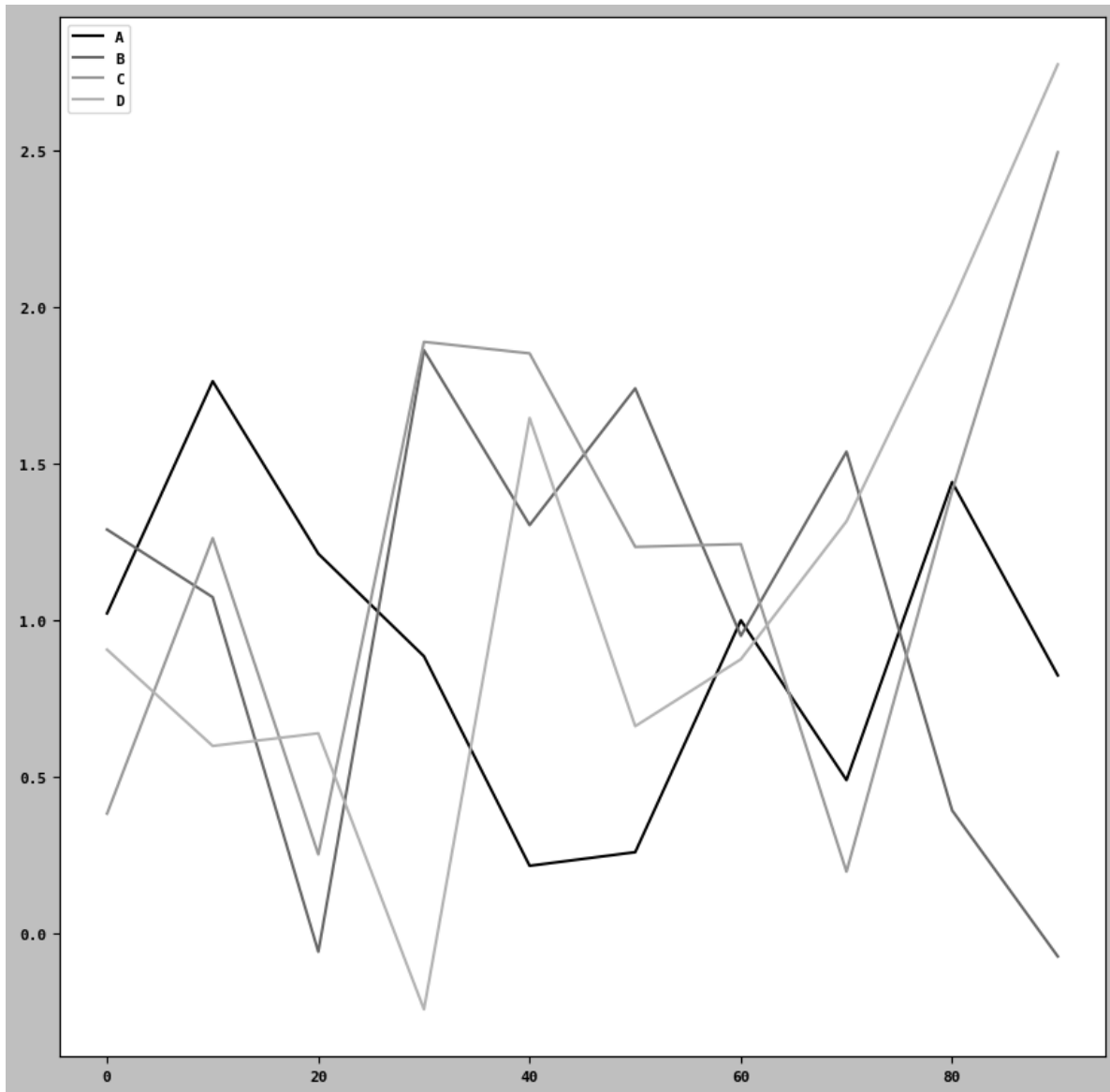
<Axes: >



```
# to know more about plot method types  
help(pd.Series.plot)
```

```
df = pd.DataFrame(np.random.standard_normal((10,4)).cumsum(0),  
                  columns = ['A', 'B', 'C', 'D'],  
                  index = np.arange(0, 100, 10))  
plt.style.use('grayscale')  
df.plot()
```

<Axes: >



## Bar Plots

```
fig, axes = plt.subplots(2, 1)

data = pd.Series(np.random.uniform(size=11),
```



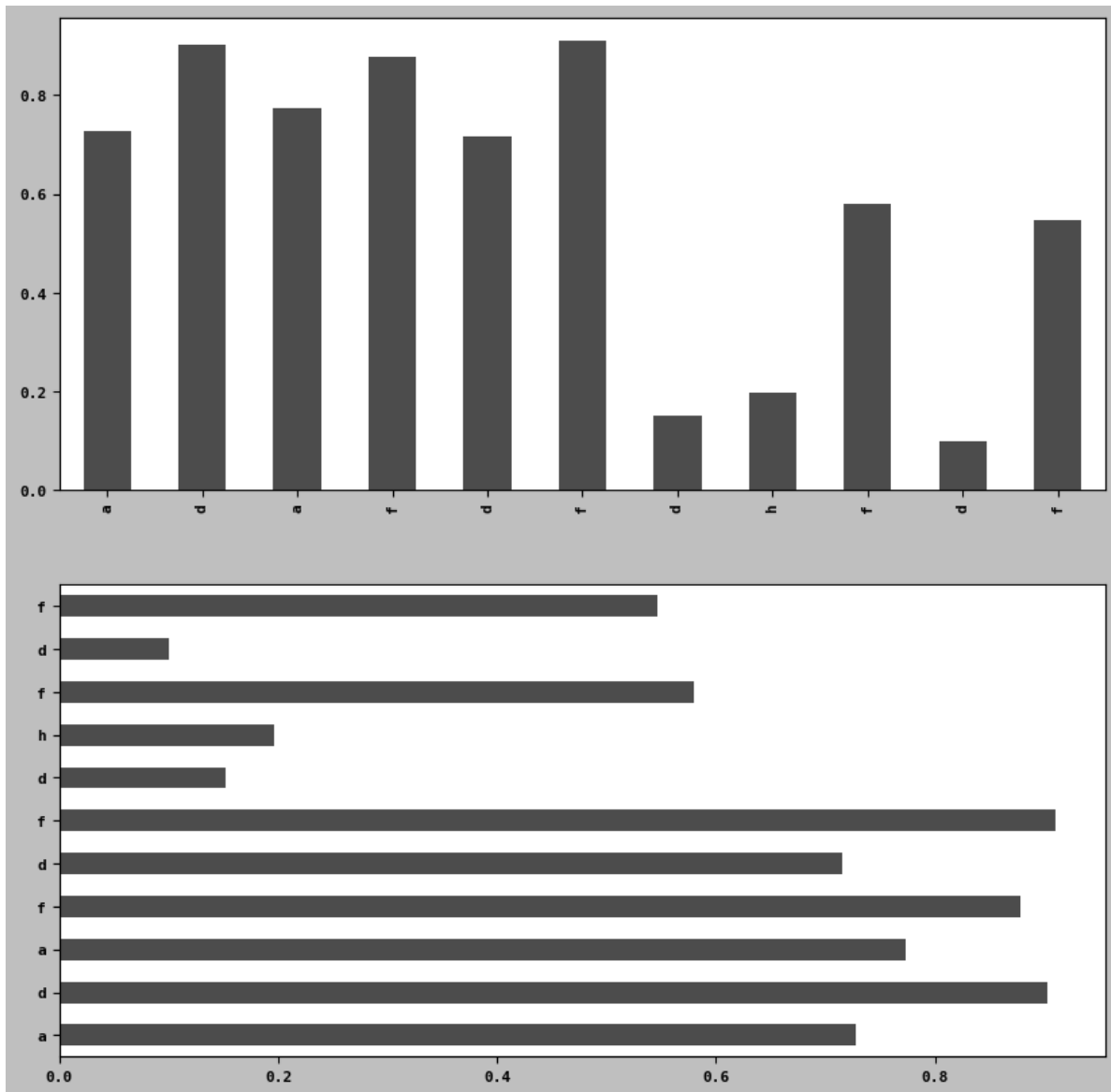
```

        index=list('adafdfdhdhfd')
data.plot.bar(ax = axes[0], color= 'black', alpha=0.7)

data.plot.barh(ax= axes[1], color= 'black', alpha= 0.7)

```

<Axes: >



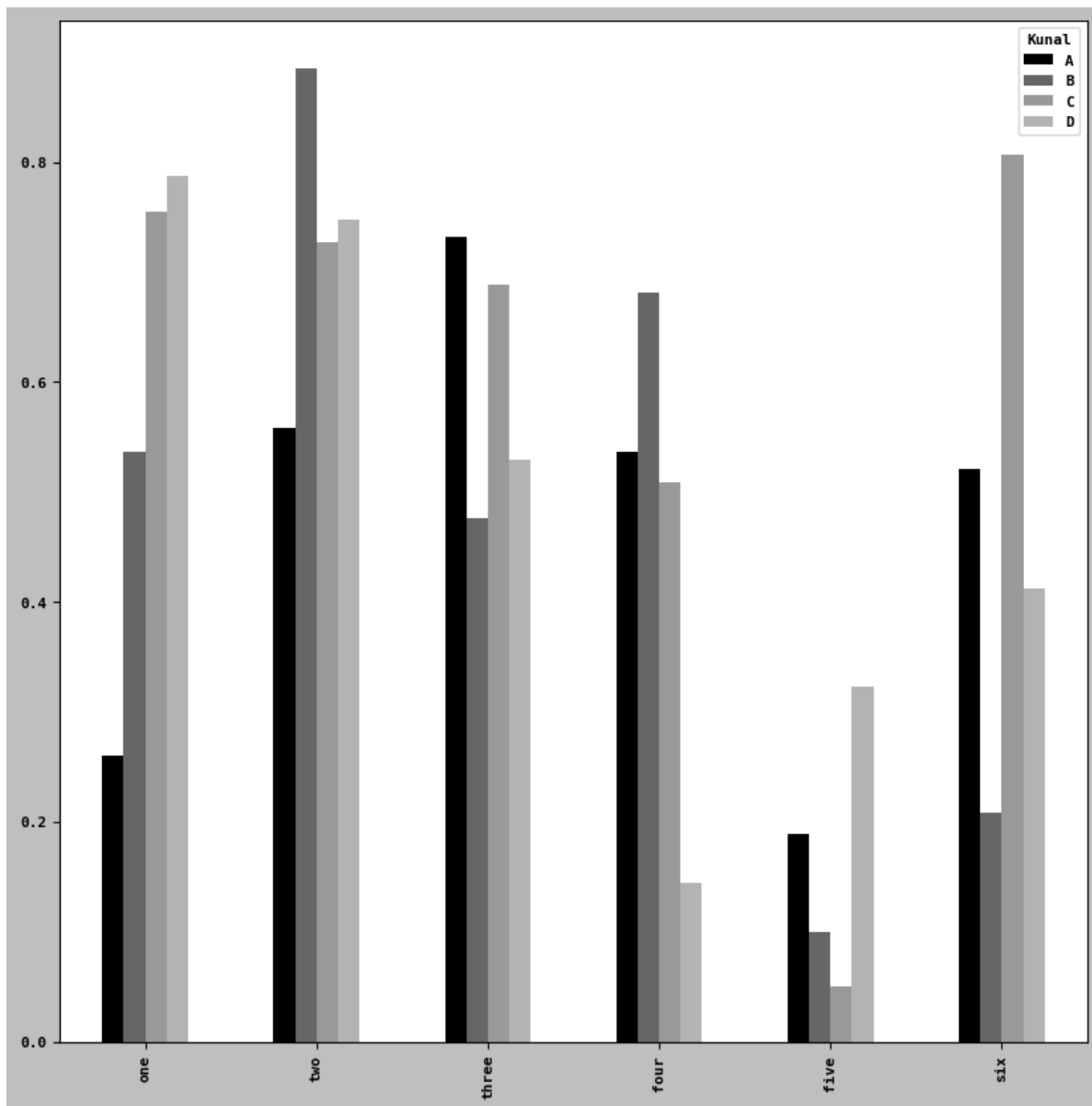
```
df2 = pd.DataFrame(np.random.uniform(size=(6,4)),
                    index = ['one', 'two', 'three', 'four', 'five', 'six'],
                    columns =pd.Index(['A', 'B', 'C', 'D'], name= 'Kunal'))
```

```
df2
```

Kunal	A	B	C	D
one	0.260658	0.536198	0.754708	0.788162
two	0.558069	0.885258	0.726874	0.747412
three	0.731644	0.476325	0.688620	0.529862
four	0.536672	0.681522	0.509112	0.143861
five	0.188829	0.099173	0.050697	0.323006
six	0.521520	0.208836	0.807558	0.411876

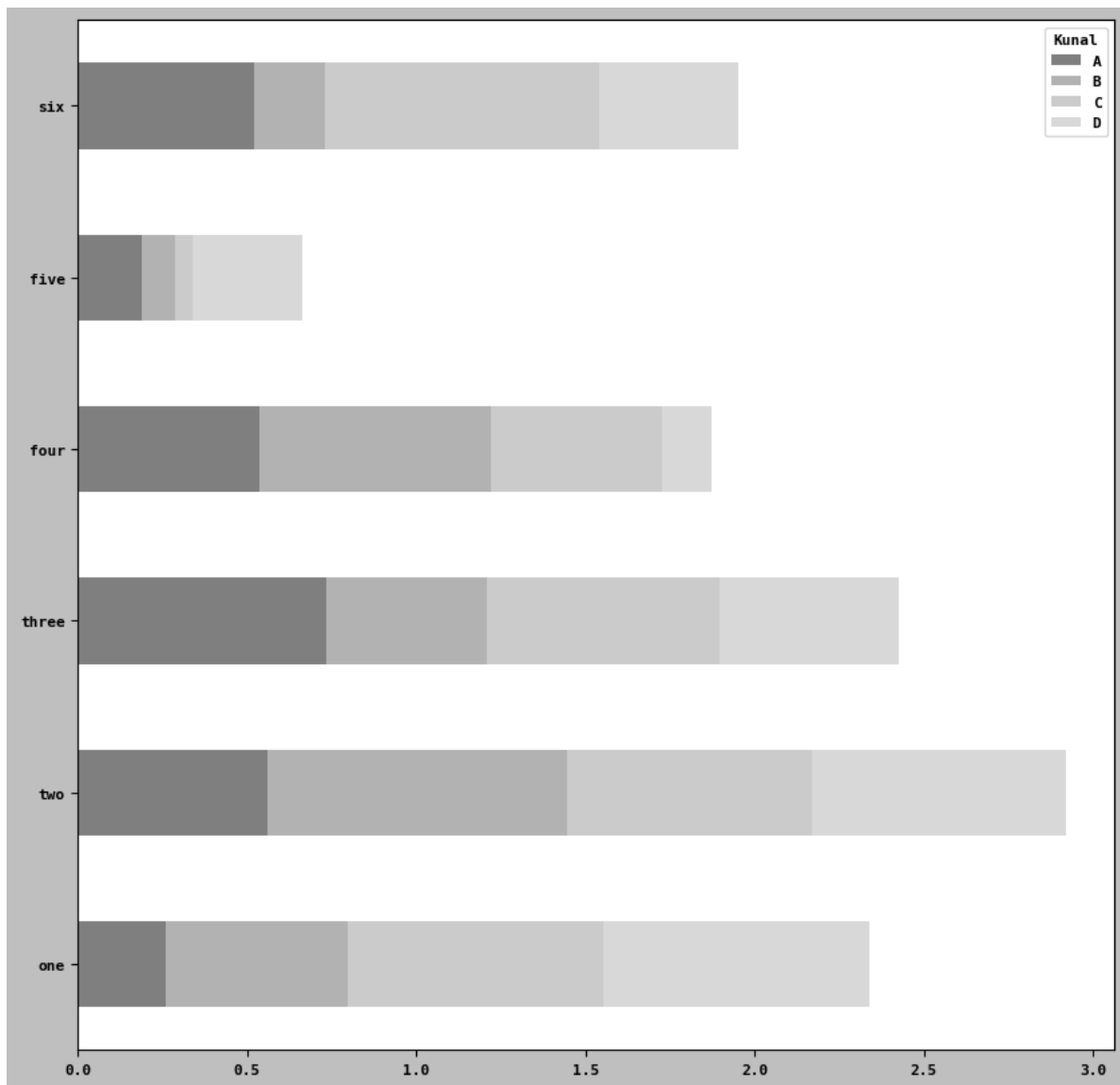
```
df2.plot.bar()
```

```
<Axes: >
```



```
df2.plot.barh(stacked=True, alpha=0.5)
```

<Axes: >



```
iris = pd.read_csv(r"E:/pythonfordatanalysis/semainedu26fevrier/iris.csv")
iris.head()
```

	Id	Sepal Length (cm)	Sepal Width (cm)	Petal Length (cm)	Petal Width (cm)	Species
0	1	5.1	3.5	1.4	0.2	Iris-setosa
1	2	4.9	3.0	1.4	0.2	Iris-setosa
2	3	4.7	3.2	1.3	0.2	Iris-setosa
3	4	4.6	3.1	1.5	0.2	Iris-setosa

	Id	Sepal Length (cm)	Sepal Width (cm)	Petal Length (cm)	Petal Width (cm)	Species
4	5	5.0	3.6	1.4	0.2	Iris-setosa

```
iris.tail()
#len_wd = pd.
```

	Id	Sepal Length (cm)	Sepal Width (cm)	Petal Length (cm)	Petal Width (cm)	Species
145	146	6.7	3.0	5.2	2.3	Iris-virginica
146	147	6.3	2.5	5.0	1.9	Iris-virginica
147	148	6.5	3.0	5.2	2.0	Iris-virginica
148	149	6.2	3.4	5.4	2.3	Iris-virginica
149	150	5.9	3.0	5.1	1.8	Iris-virginica

```
print(iris.columns)
```

```
Index(['Id', 'Sepal Length (cm)', 'Sepal Width (cm)', 'Petal Length (cm)',
      'Petal Width (cm)', 'Species'],
      dtype='object')
```

```
count = pd.crosstab(iris['Sepal Length (cm)'], iris['Sepal Width (cm)'])
```

```
count2 = count.reindex(index=['length', 'width', ])
```

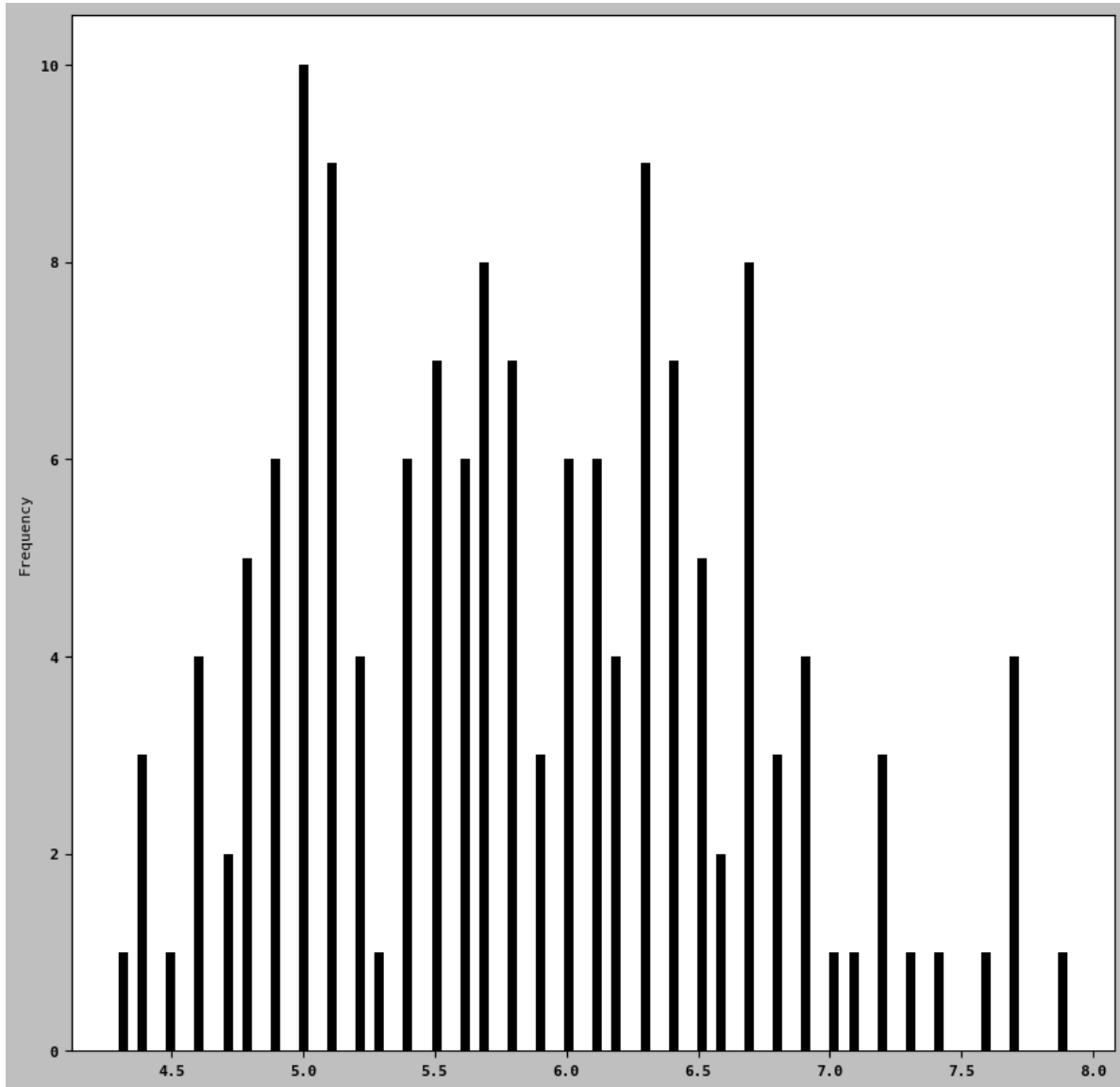
```
count2
```

Sepal Width (cm)	2.0	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0	...	3.4	3.5	...
Sepal Length (cm)														
length	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	...	NaN	NaN	...
width	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	...	NaN	NaN	...

## Histogram and Density plots

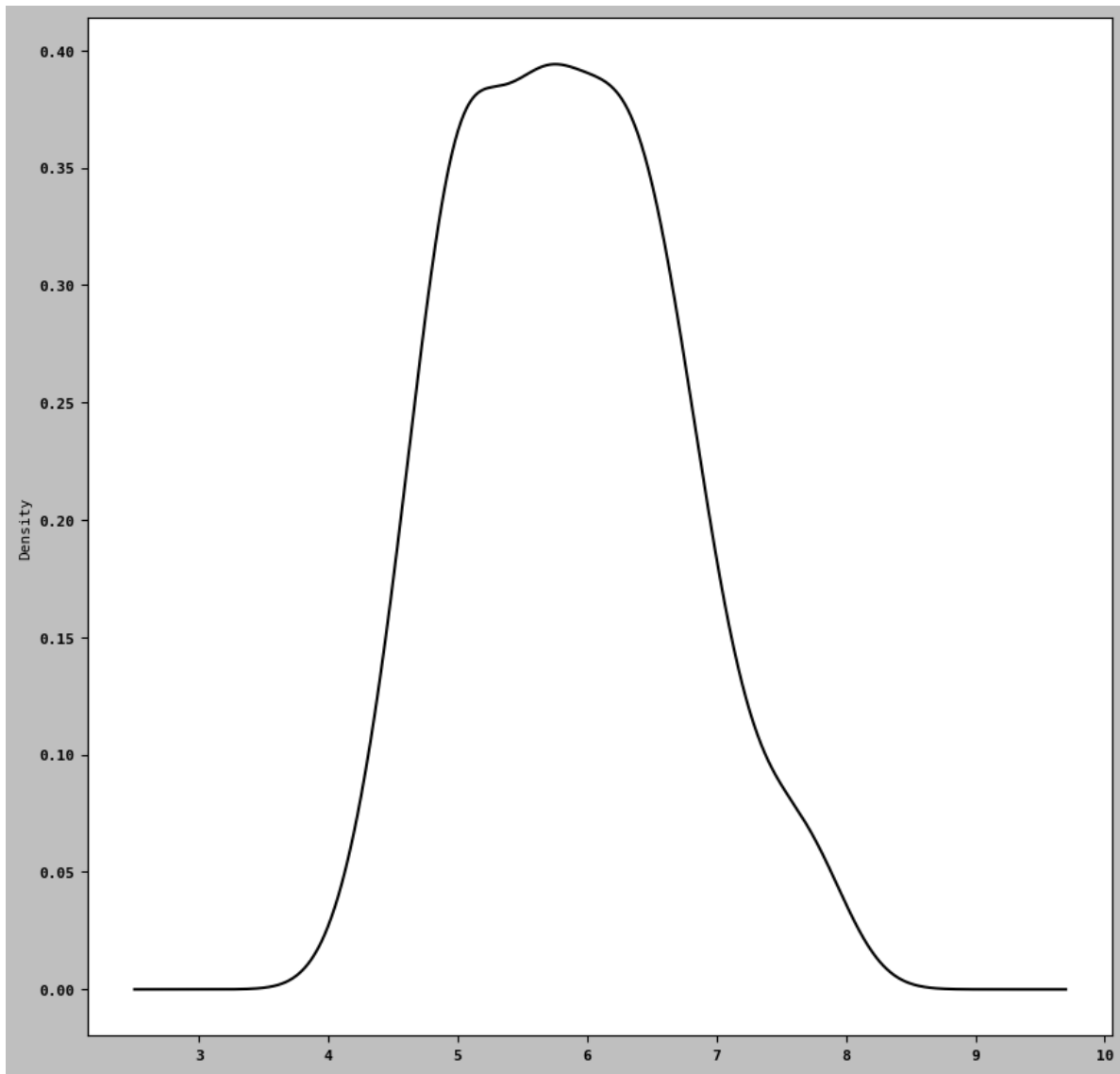
```
iris['Sepal Length (cm)'].plot.hist(bins= 100)
```

<Axes: ylabel='Frequency'>



```
iris['Sepal Length (cm)'].plot.density()
```

```
<Axes: ylabel='Density'>
```



```
! pip install seaborn
```

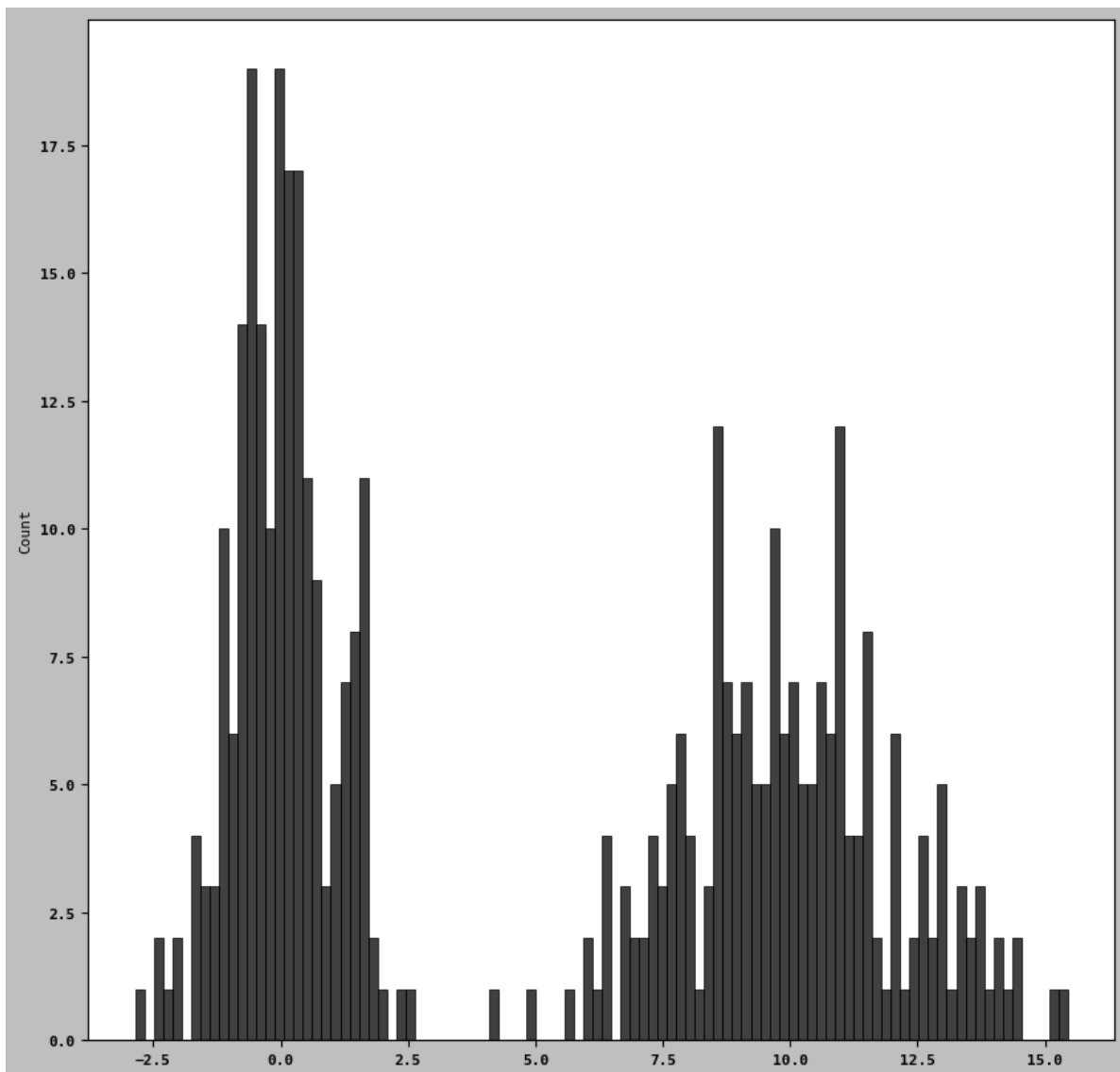
```
import seaborn as sns
```

```
comp1 = np.random.standard_normal(200)
comp2 = 10 + 2 * np.random.standard_normal(200)

values = pd.Series(np.concatenate([comp1, comp2]))

sns.histplot(values, bins= 100, color = 'black')
```

<Axes: ylabel='Count'>





## Scatter or point plots

```
iris.head()
```

	Id	Sepal Length (cm)	Sepal Width (cm)	Petal Length (cm)	Petal Width (cm)	Species
0	1	5.1	3.5	1.4	0.2	Iris-setosa
1	2	4.9	3.0	1.4	0.2	Iris-setosa
2	3	4.7	3.2	1.3	0.2	Iris-setosa
3	4	4.6	3.1	1.5	0.2	Iris-setosa
4	5	5.0	3.6	1.4	0.2	Iris-setosa

```
iris2 = iris[['Sepal Length (cm)', 'Sepal Width (cm)', 'Petal Length (cm)',  
            'Petal Width (cm)']]
```

```
trans_iris2 = np.log(iris2).diff().dropna()
```

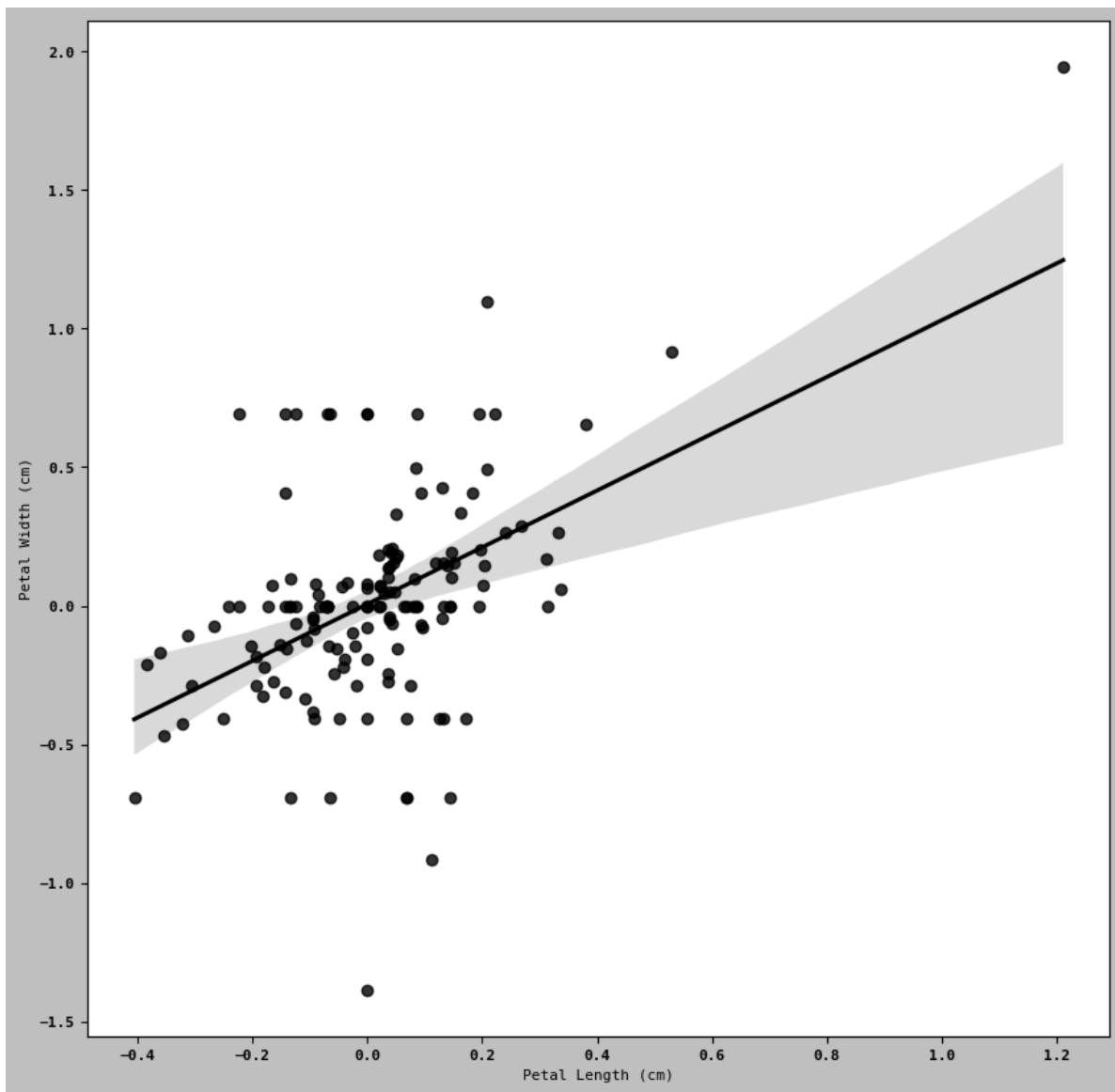
```
trans_iris2.tail()
```

	Sepal Length (cm)	Sepal Width (cm)	Petal Length (cm)	Petal Width (cm)
145	0.000000	-0.095310	-0.091808	-0.083382
146	-0.061558	-0.182322	-0.039221	-0.191055
147	0.031253	0.182322	0.039221	0.051293
148	-0.047253	0.125163	0.037740	0.139762
149	-0.049597	-0.125163	-0.057158	-0.245122

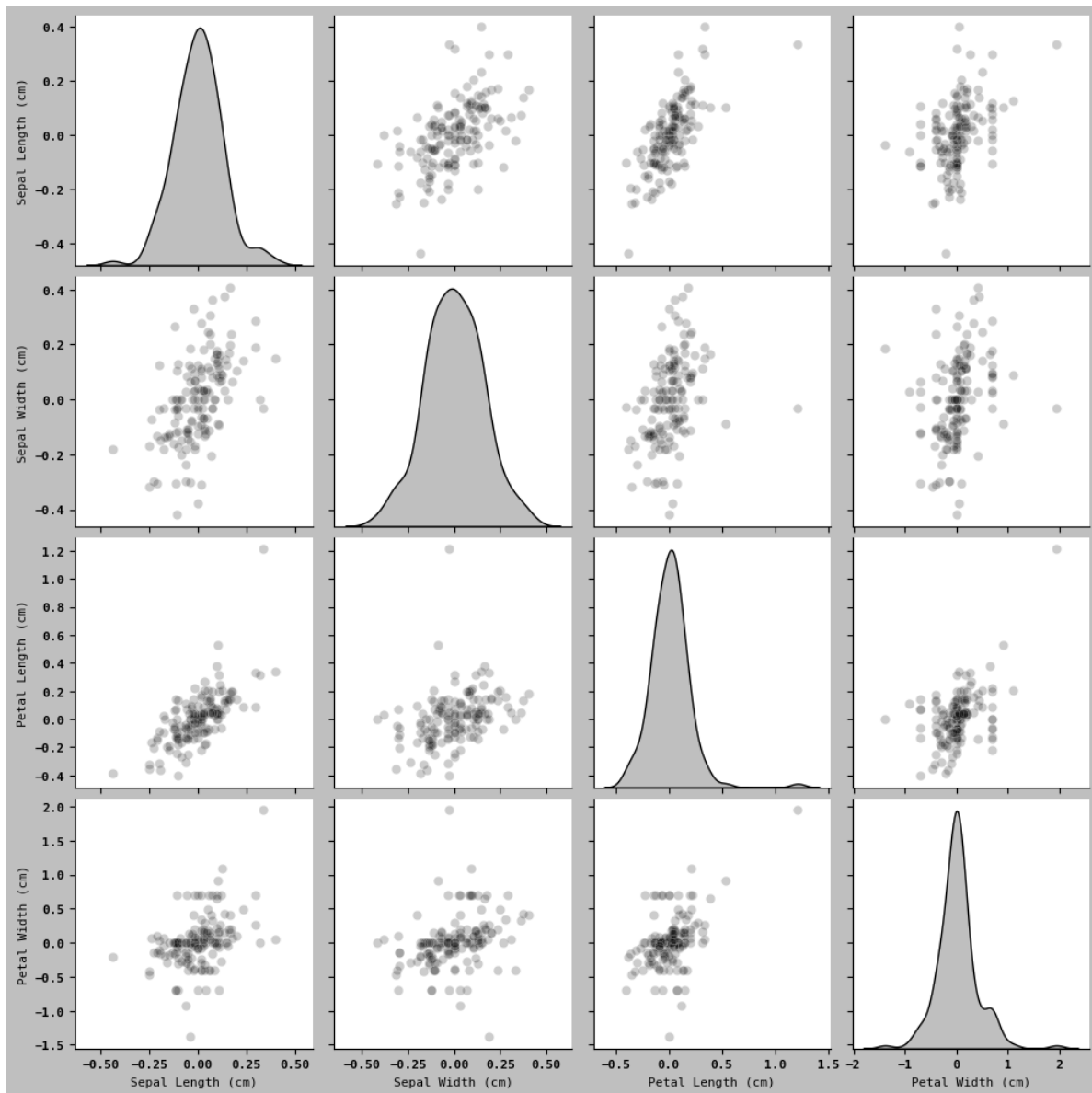
## using regplot method to make scatter plots

```
ax = sns.regplot(x= "Petal Length (cm)", y = "Petal Width (cm)", data= trans_iris2)
```

```
#ax.title("Change in log (Petal Length (cm)) length versus log (Petal Width (cm)) width ")
```



```
sns.pairplot(trans_iris2, diag_kind= 'kde', plot_kws={'alpha': 0.2} )
```



## Facet Grids and Categorical Data

- catplots

```
sns.catplot(x = 'Petal Length (cm)', y= 'Petal Width (cm)',
            data = iris2[iris2.Petal Length (cm) < 0.5])
```

SyntaxError: invalid syntax (3918704872.py, line 2)

```
# renaming columns

df3 = df.rename(columns={
    'Sepal Length (cm)' : 'sepal_lengh',
    'Sepal Width (cm)': 'sepal_width_1',
    'Petal Length (cm)': 'petal_length',
    'Petal Width (cm)' : 'petal_width_2',
})
```

df3

	A	B	C	D
0	1.023099	1.290412	0.383457	0.906869
10	1.764172	1.074479	1.263072	0.599487
20	1.213259	-0.057754	0.253086	0.639868
30	0.885836	1.862965	1.889980	-0.241599
40	0.216726	1.304783	1.853073	1.646926
50	0.260248	1.741218	1.235233	0.662542
60	1.000675	0.951141	1.243977	0.876234
70	0.490475	1.539086	0.198194	1.316823
80	1.442176	0.393618	1.413128	2.013297
90	0.825008	-0.072619	2.495192	2.775830

```
sns.catplot(x = 'Sepal Length (cm)', y= 'Sepal Width (cm)',
            kind = 'box',
            data = iris2)
```

