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UNIVERSIDAD COMPLUTENSE DE MADRID

Programación. Python

Librería matplotlib

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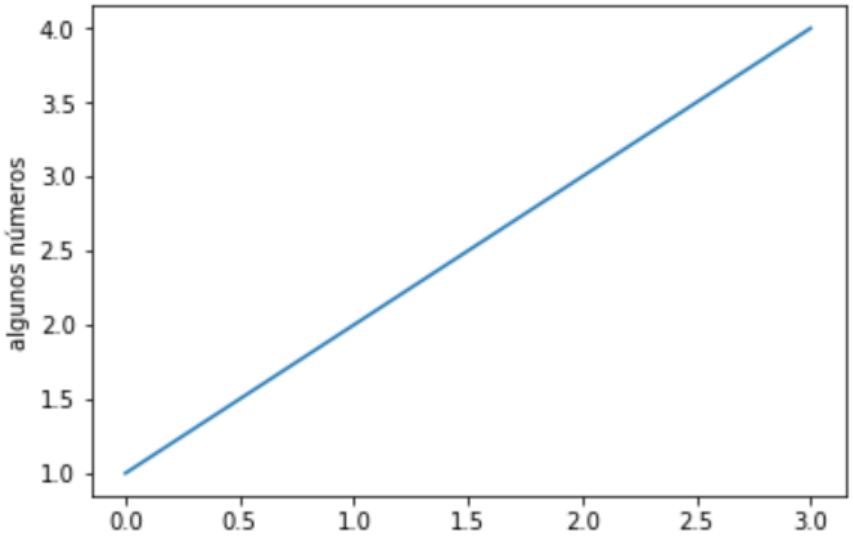
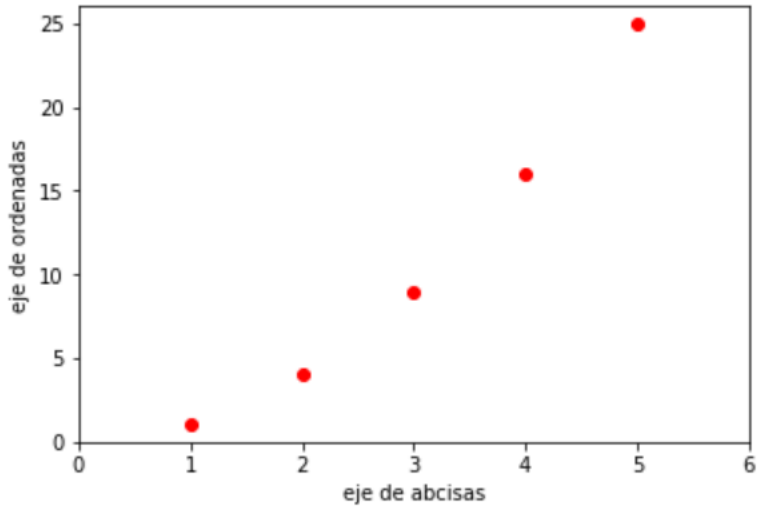
matplotlib. Introducción

```
import matplotlib.pyplot as plt
plt.plot([1, 2, 3, 4])
plt.ylabel('algunos números')
plt.show()
```



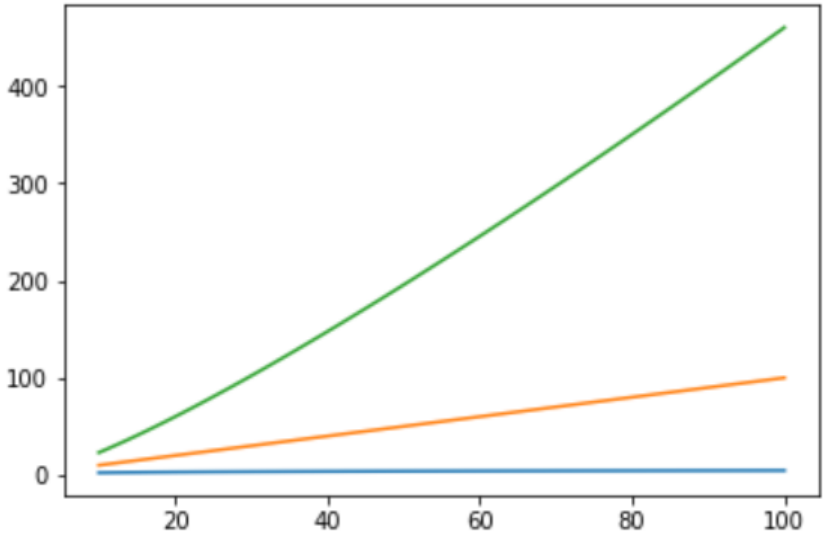

```
import matplotlib.pyplot as plt
plt.plot([1, 2, 3, 4, 5], [1, 4, 9, 16, 25], 'ro')
plt.axis([0, 6, 0, 26])      # x <- [0. 6], y <- [0, 26]
plt.xlabel('eje de abcisas')
plt.ylabel('eje de ordenadas')
plt.show()
```



https://matplotlib.org/users/pyplot_tutorial.html

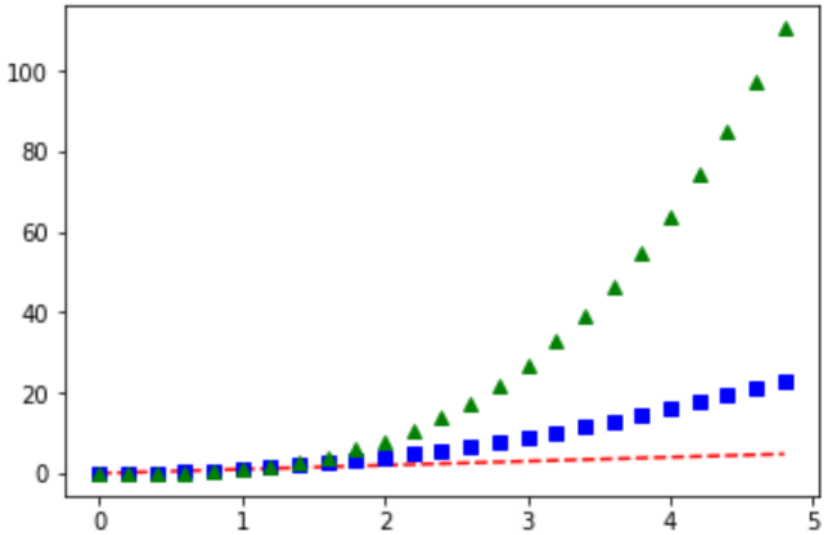
Varias gráficas juntas

```
import numpy as np  # para usar arrays.

def nlogn(x):
    return np.log(x) * x
points = np.linspace(10,100,100)
plt.plot(points, np.log(points), points, points, points, nlogn(points))
plt.savefig('./figuras/plot.png', dpi=600) # hacer antes que show
plt.show()
```



Con formatos específicos

```
# Tres gráficas juntas a pasos discretos: [0.0, 5.0] a pasos de 0.2
t = np.arange(0., 5., 0.2)

# red dashes, blue squares and green triangles
plt.plot(t, t, 'r--', t, t**2, 'bs', t, t**3, 'g^')  # x1, y1, (color1, forma1), ...
plt.show()
```



Encapsulado en una función

```python
# https://stackoverflow.com/questions/14000595/graphing-an-equation-with-matplotlib

import numpy as np
import matplotlib.pyplot as plt

def graph(formula, x_range):
    x = np.array(x_range)
    y = formula(x)
    plt.plot(x, y)
    plt.show()

def my_formula(x):
    return x**3 - 50*x

def my_graph():
    graph(my_formula, range(-7, 8))

my_graph()
```

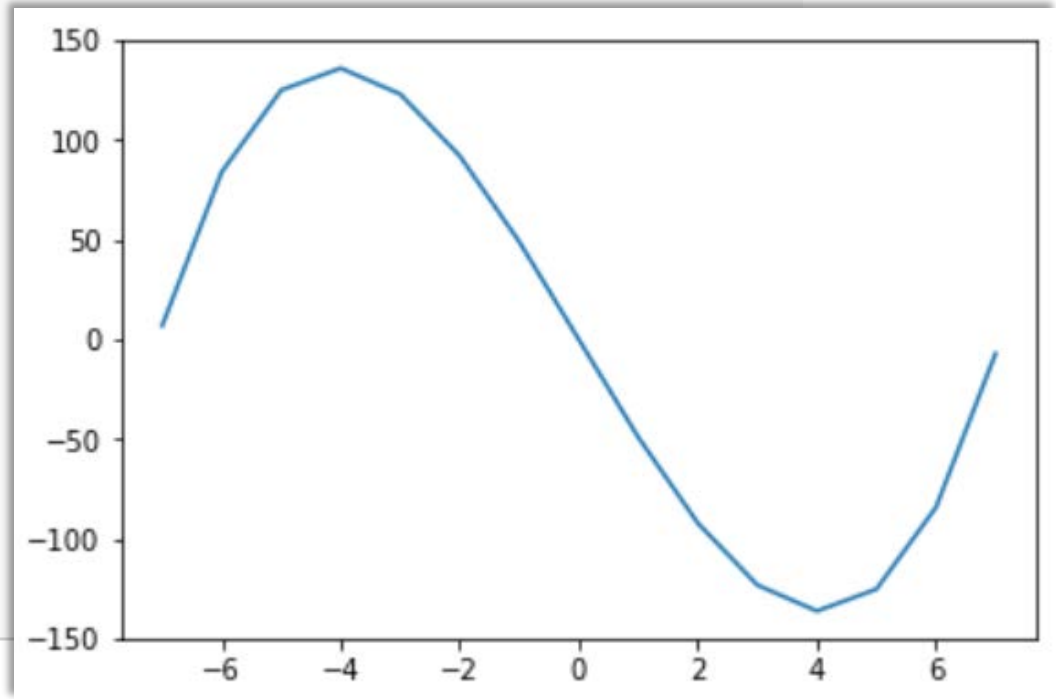
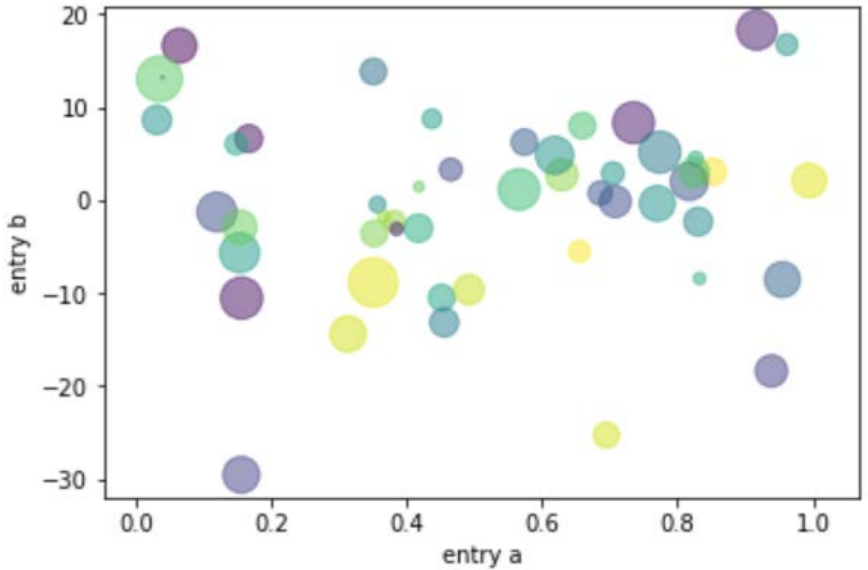


Gráfico de dispersión

```
import numpy as np
import matplotlib.pyplot as plt

N = 50
x = np.random.rand(N)
y = x + 10 * np.random.randn(N)
color = np.random.randint(0, N, N)
tamanno = np.abs(np.random.randn(N)) * 250

plt.scatter(x, y, c=color, s=tamanno, alpha=0.5)
plt.xlabel('entry a')
plt.ylabel('entry b')
plt.show()
```

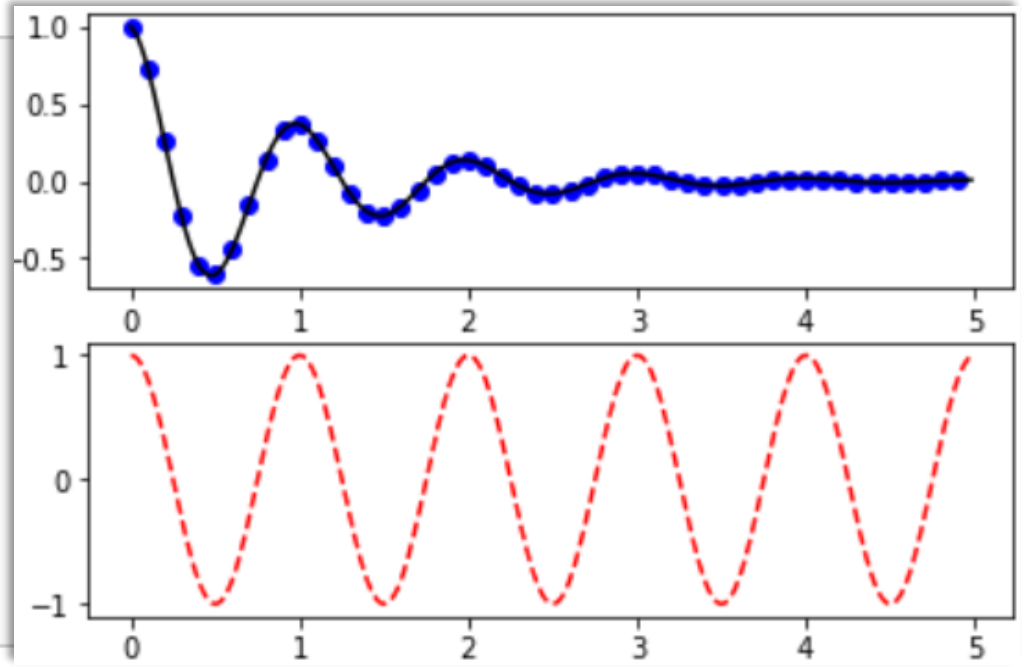


```
help(plt.scatter)
```

```
Help on function scatter in module matplotlib.pyplot:

scatter(x, y, s=None, c=None, marker=None, cmap=None, norm=None, vmin=Non
e, vmax=None, alpha=None, linewidths=None, verts=None, edgecolors=None, *,
data=None, **kwargs)
    A scatter plot of *y* vs *x* with varying marker size and/or color.

    Parameters
    ----------
    x, y : array_like, shape (n, )
        The data positions.

    s : scalar or array_like, shape (n, ), optional
        The marker size in points**2.
        Default is ``rcParams['lines.markersize'] ** 2``.

    c : color, sequence, or sequence of color, optional
        The marker color. Possible values:

        - A single color format string.
```

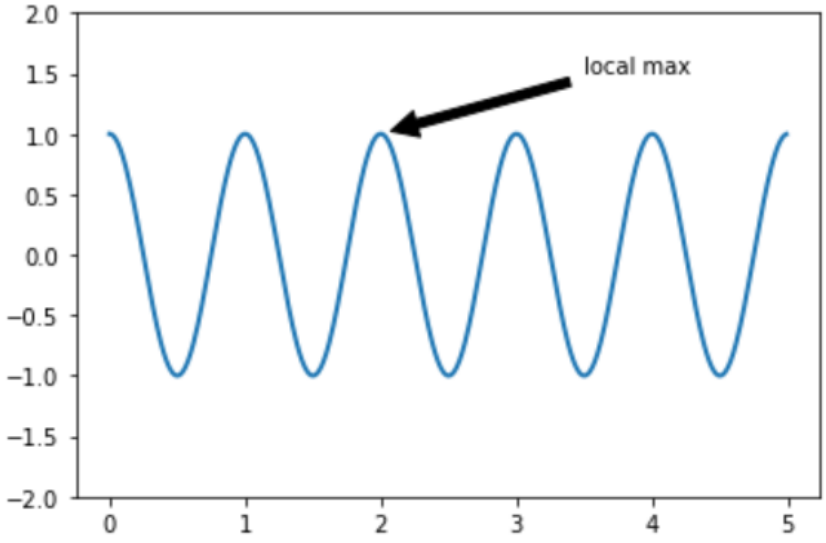
Varias gráficas separadas

```
def f(t):
    return np.exp(-t) * np.cos(2*np.pi*t)

t1 = np.arange(0.0, 5.0, 0.1)
t2 = np.arange(0.0, 5.0, 0.02)

plt.subplot(211)
plt.plot(t1, f(t1), 'bo', t2, f(t2), 'k')

plt.subplot(212)
plt.plot(t2, np.cos(2*np.pi*t2), 'r--')
plt.show()
```

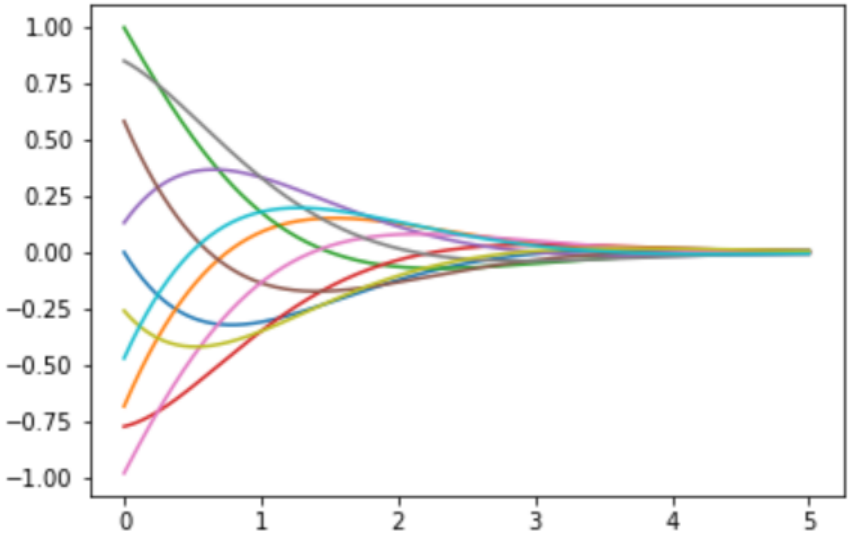


Con anotaciones

```
ax = plt.subplot(111)

t = np.arange(0.0, 5.0, 0.01)
s = np.cos(2*np.pi*t)
line, = plt.plot(t, s, lw=2)

plt.annotate('local max', xy=(2, 1), # La punta,
             xytext=(3.5, 1.5), #Posición del texto,
             arrowprops=dict(facecolor='black', shrink=0.05),
             )

plt.ylim(-2, 2)
plt.show()
```



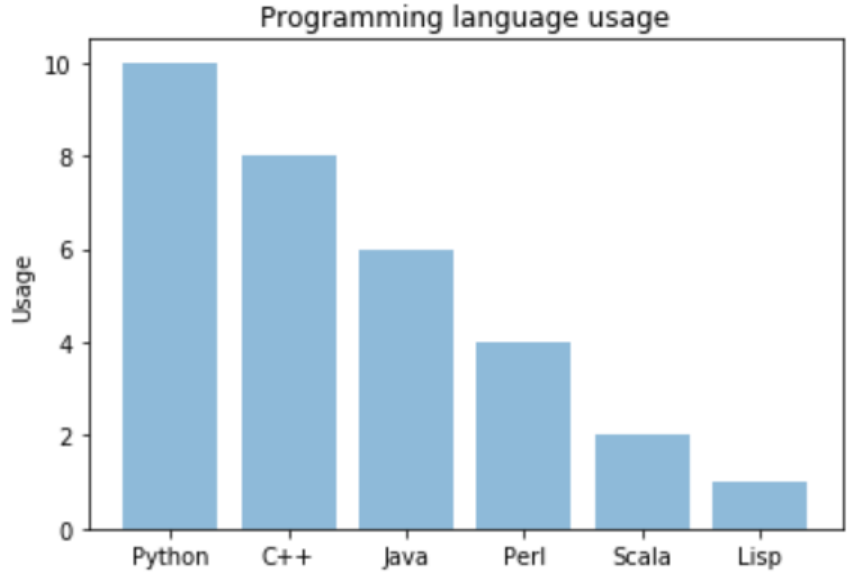
```
# La segunda variable se está simulando a base de elegir una decena de valor

def f(z,t):
    return np.exp(-z)*np.sin(t-z)

z = np.linspace(0,5,3001)
t = np.arange(0,40000,4000)     # array([0,  4000,  8000, 12000, 16000, 2000

for tval in t:
    plt.plot(z, f(z, tval))
plt.show()
```



Dos variables

Diagrama de barras

```
objects = ('Python', 'C++', 'Java', 'Perl', 'Scala', 'Lisp')
y_pos = np.arange(len(objects))
performance = [10,8,6,4,2,1]

plt.bar(y_pos, performance, align='center', alpha=0.5)
plt.xticks(y_pos, objects)
plt.ylabel('Usage')
plt.title('Programming language usage')

plt.show()
```



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```
objects = ('Python', 'C++', 'Java', 'Perl', 'Scala', 'Lisp')
y_pos = np.arange(len(objects))
performance = [10,8,6,4,2,1]

plt.barh(y_pos, performance, align='center', alpha=0.5)
plt.yticks(y_pos, objects)
plt.xlabel('Usage')
plt.title('Programming language usage')

plt.show()
```

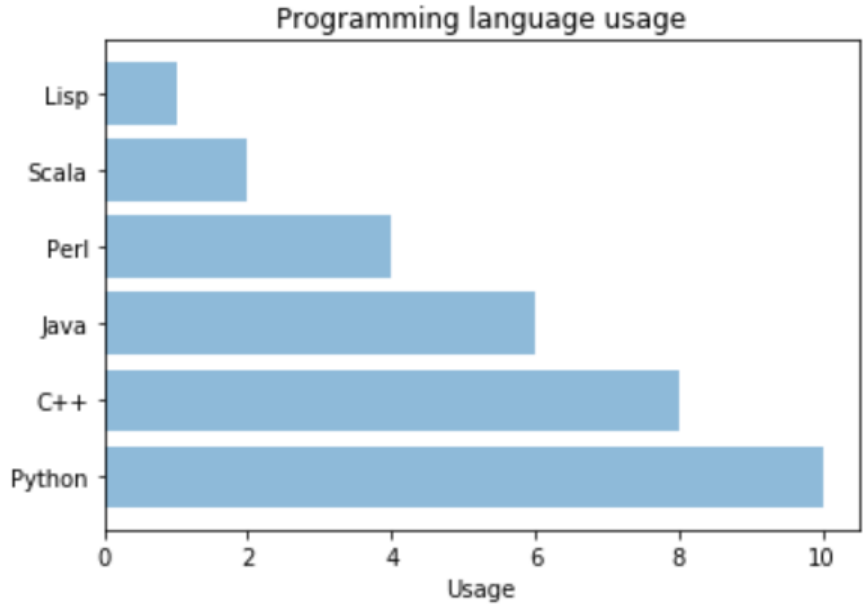
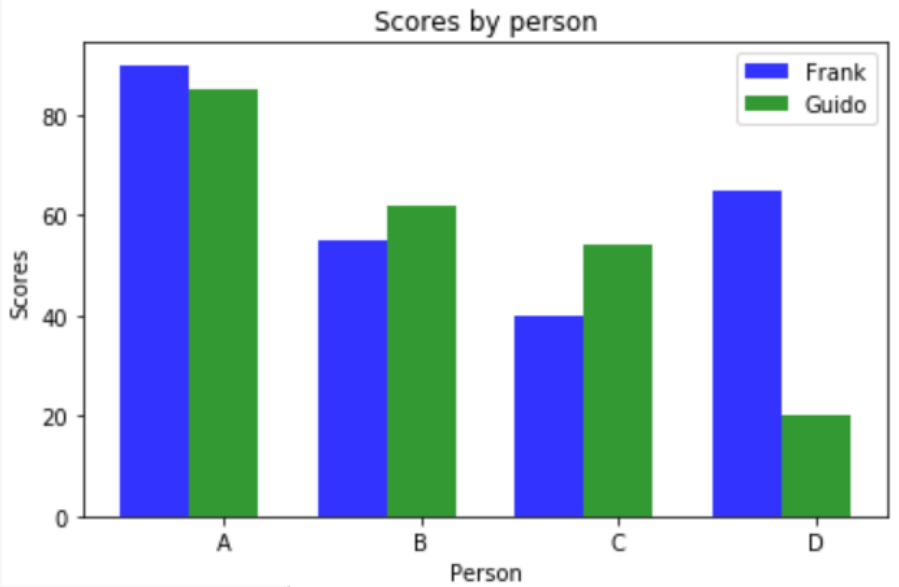


Diagrama de barras

```
# data to plot
n_groups = 4
means_frank = (90, 55, 40, 65)
means_guido = (85, 62, 54, 20)

# create plot
fig, ax = plt.subplots()
index = np.arange(n_groups)
bar_width = 0.35
opacity = 0.8

rects1 = plt.bar(index, means_frank, bar_width,
alpha=opacity,
color='b',
label='Frank')

rects2 = plt.bar(index + bar_width, means_guido, bar_width,
alpha=opacity,
color='g',
label='Guido')

plt.xlabel('Person')
plt.ylabel('Scores')
plt.title('Scores by person')
plt.xticks(index + bar_width, ('A', 'B', 'C', 'D'))
plt.legend()

plt.tight_layout()
plt.show()
```



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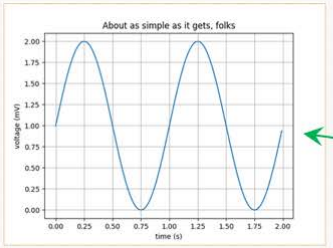

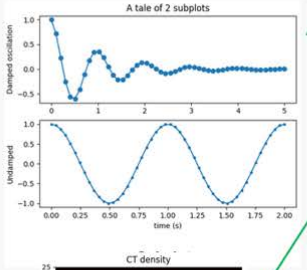

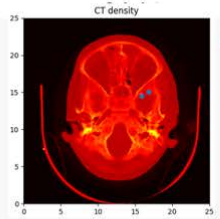

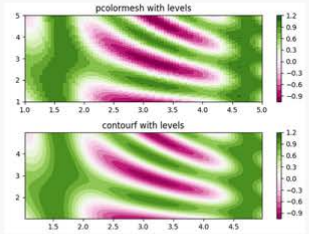

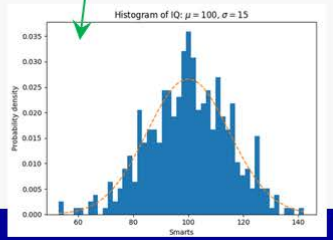

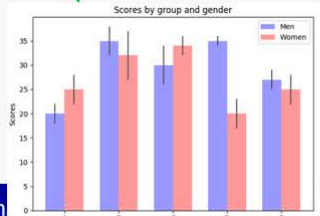

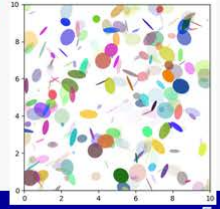

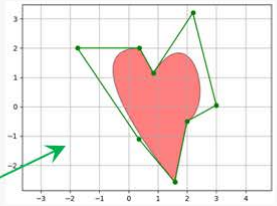

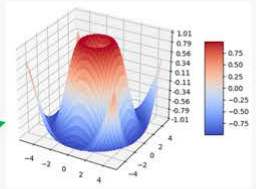

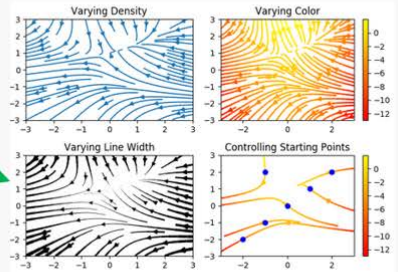

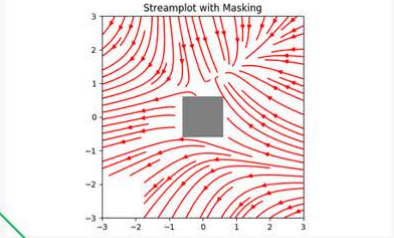

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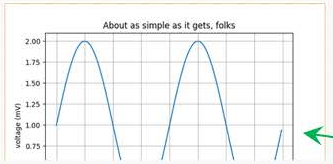
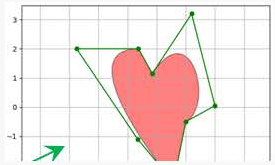
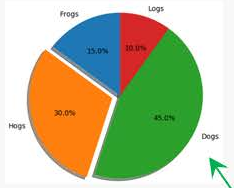
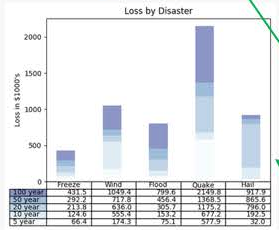
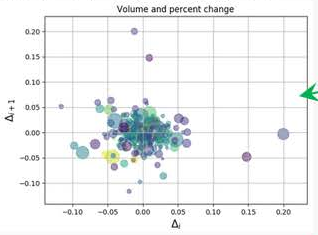
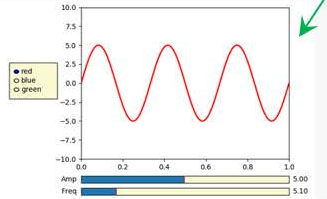


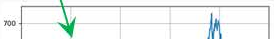


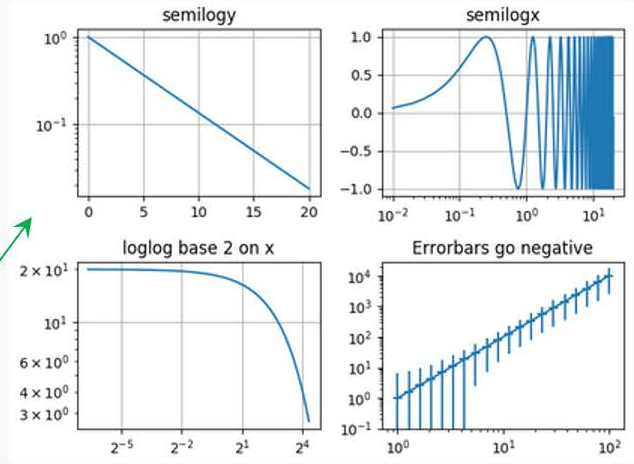


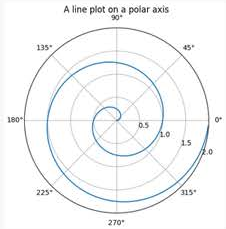


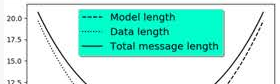




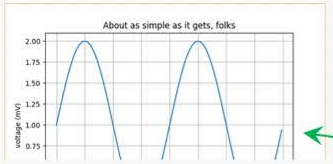


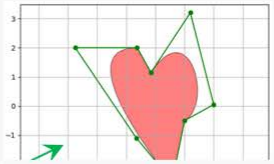






matplotlib





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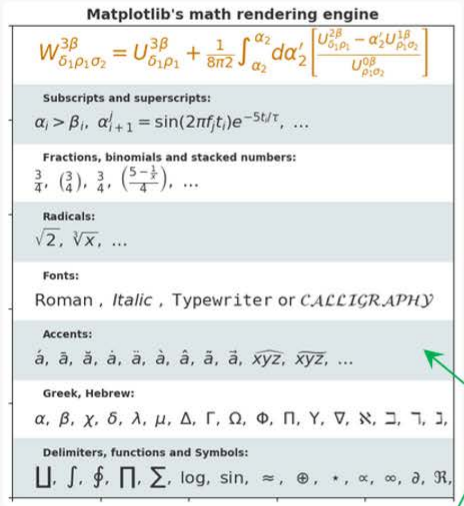

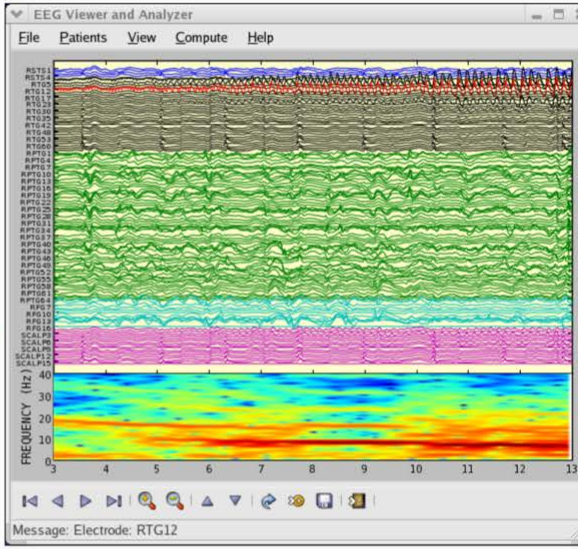

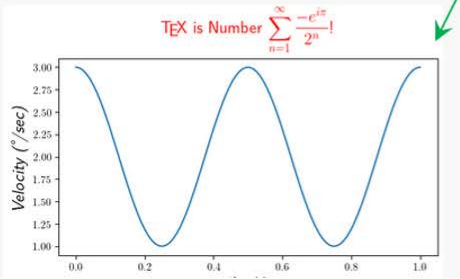

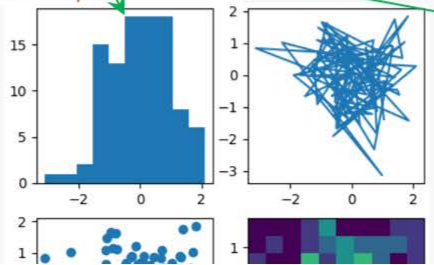

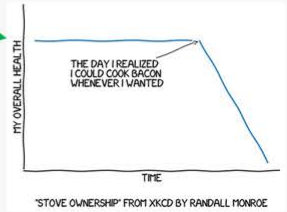

https://matplotlib.org/

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