- In this plot, I will explain how to draw a graph using the Jupyter notebook with the matplotlib plotting library, which is the standard 2D plotting library for Python.

- Although we will only introduce the very basic functions in this plot, matplotlib can produce various kinds of publication quality figures with minimal effort.

- If you are interested in obtaining more information, you should visit their gallery page to see examples of the various types of plots can be generated.

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- First, we should import the libraries needed to make the graphs.
- For this, type the following commands in a new cell and run them.

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- Note that Python will ignore anything that comes after the # symbol, it is just a comment that you add to make your code more readable.

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- So you do not have to type them to get the examples to work.

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- The 1st line is a ‘magic’ ipython command that controls the environment settings.
- Here we are instructing the system to output graphs inside the notebook itself.

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- If you do not include this command, the graphs will be plotted in separate window.

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- The 2nd line is used to import the "numpy" library, which we have already used previously.

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- The 3rd line is to import the "pyplot" library, which is a subset of "matplotlib" and provides a MATLAB-like plotting framework, use it with a shorter name "plt."

- The 4th line is to use a customized style sheet called "ggplot" which modifies the default plot settings to produce more beautiful plots.

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- These libraries will be extensively used in this course to plot all data and functions.

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- As the 1st example, let us try to draw a simple sin function.
- Create a new cell and type the following commands and run them.

- You will finally obtain a graph of sin(x) for x equlas from –3 to +3 in a linear scale.

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- Here the description of each command is not explained in detail but given as a short comment after #.

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- If you are unsure about any commands, please refer to one of the many free online resources, such as the official matplotlib or Python websites.

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- For the 2nd example we will draw several functions, which are simple powers of x in a log-log scale.

- First, define the functional form to be plotted using a “def” block as shown here.

- Create a new cell and type the following commands and run them.

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- The “def” keyword defines a new function, called “func,” which takes two parameters x and n.
- The function will return x to the power of n.

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- Then, type the following commands in a new cell and run them to draw the functions in a log-log scale.
- The description of each command is given after #.

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- The main part is between the 2nd and 4th lines where the three power functions, x, x^2, and x^3 are plotted versus x.

- By plotting them on a log-log scale, all three functions appear as straight lines, with slopes of one, two, and three respectively.

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- In this example, the labels and legends are also plotted together with the functions on the same graph.

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- The 3rd example is to draw a histogram of a collection of random-data points.

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- As you can see in the following cell, the 3rd line generates a sequence of 100,000 random numbers, uniformly distributed between 0 and 1, and then stores them in an array R.

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- The 4th line is the main part of this example, where the normalized histogram of R is calculated using 100 bins and plotted as a graph using a single command.

- Like this, the “hist” function allows us to calculate the histogram of any array data very easily.

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- Finally by plotting the histogram, we can confirm that the distribution of generated random numbers is really uniformly distributed between 0 and 1.

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- As you have seen here, Python has very powerful and easy-to-use graphical capabilities.

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- In particular, we will repeatedly use the “hist” function in this course.

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- The 4th example is to draw trajectories of random steps, which describes a process called a 1-dimensional random walk.

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- A trajectory means the sequence of temporal positions, usually as a function of time or number of steps.

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- In the code example shown here, the 6th line generates ten trajectories of 10,000 random steps of +1 or -1., and then stores them in an array named step.

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- The positions of ten independent random walkers are calculated at each step by accumulating the individual values of step, from zero to the number of steps.

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- Finally by plotting the position as a function of number of steps, we can visualize the trajectories of the random walkers.

静止してください