

PHYS 210, Assignment 9

Create a new directory somewhere in your home directory with the name `yourusername_assignment_9` to store the files you will create for this assignment. To hand the assignment in, copy the directory with your results to `/home2/phys210/yourusername/`. Make sure it's there and has the right permissions (read and execute for everyone, write for you).

1 Monte Carlo II

- Modify your code for exercise 2 of assignment 7 (Monte Carlo I) to not use loops at all. Use the `ipython %timeit` command or the `time()` method to compare the runtime of the version of the code that uses `for` loops to that without loops.
- Make a scatter plot of the random point, colouring them depending on whether they are within the unit circle or not. This should look similar to figure 1 of assignment 7. Save your plot as `mc_scatter_plot.pdf`.

Put your commented code in a file called `mc2.py`.

2 Numpy Arrays and Functions

- Take the `my_sign(a)` function from the lecture notes 5.2 and rewrite it so that it works with numpy arrays. In practice, it means that you want the function `my_sign(a)` to work when `a` is a numpy array, and the function should return a numpy array of signs. You are NOT allowed to use the `vectorize()` numpy method.

3 Numpy Arrays versus For loops

In this exercise, you will calculate $\exp(-r^2)$ on a 2-dimensional (x, y) grid similar to the one used in the lecture notes 5.2.

- Building from the lecture note example, write a script `calc2dexp_array.py` with a (x, y) grid of size 6000x6000, covering the range -3 to +3 on both axes. The script should generate a 2-D plot similar to the one in the lecture called `2dexp_array.pdf`.
- Rewrite your script so that it uses two nested `for` loops instead of using `meshgrid()` and numpy array operations (keep the grid size 6000x6000 the same). You will call this script `calc2dexp_loops.py` and the plot should be called `2dexp_loops.pdf`.
- Use the `ipython %timeit` or the `time()` method, to calculate how long (in seconds) each of the above scripts take to run. Write your timing measurement in a text file `timing.txt`.