Exercise 12
MC and Parallelization
(handed out: 17.07 .2023 , hand in: 24.07 .2023 )

1. Task Neutron transport III - Packets and geometries (4 P)
a) Modify your program from task 2 of exercise 10 so that summation for the probabilities is not done over single neutrons but over fractions (see lecture) and compare the results with those from task 2.b) of exercise 10 . (2 P)
b) A huge advantage of MC simulations is the possibility of prescribing any geometrical configuration. So consider now a sphere with radius $t=1$ and otherwise same parameters as in task 2.b) of exercise 10 and compare the results. (2 P)
2. Task Parallelization with OpenMP I - Hello world! (2 P)

Get more familiar with OpenMP: Write a program and (execute it on a multi-core computer) that contains a \#pragma omp parallel \{ \} section, in which the text "Hello world! I am thread number" followed by the number of the thread is printed out. How many threads are generated? What do you notice during the output?
3. Task Parallelization with OpenMP II - Neutron transport (2 P)

Parallelize the problem of neutron transport with OpenMP. Which section(s) should be parallelized? You also have to edit the makefile (Compiler call).
4. Task Parallelization with OpenMP III - Newton fractal (9 extra P)

Download the source code for the program newton_omp from the website.
a) Complete the source code at the indicated lines (YOURTASK) to implement the Newton method for solving $z^{3}-1=0$, with $z \in \mathbb{C} .(2 \mathrm{BP})$
b) Accelerate the program's execution by using OpenMP. Which section(s) should be parallelized? You also have to edit the makefile. (3 BP)
c) Try to measure the speed up. Does this scale with the number of threads (cores)? (2 BP)
d) A bottle neck in the execution of the program is the concurrent access of the threads on the World drawing area in the omp critical section. How can this be resolved? Measure again the speed up and check its scaling with the number of threads. (2 BP)

