Exercise 13
MC and Parallelization
(handed out: 09.07.2025, hand in: 16.07.2025)

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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 *Random numbers (4 P)*
Perform the test for doublets and plot the fraction of empty cells over "t" (number of run) for $L = 10, 15$, and 20 together with the *expected function*. Use

a) the builtin `rand()` function

b) the `urandom` device

c) the linear congruential method with $a = 106, c = 1283, m = 6075$

Explain briefly how one could perform such a test for triplets.