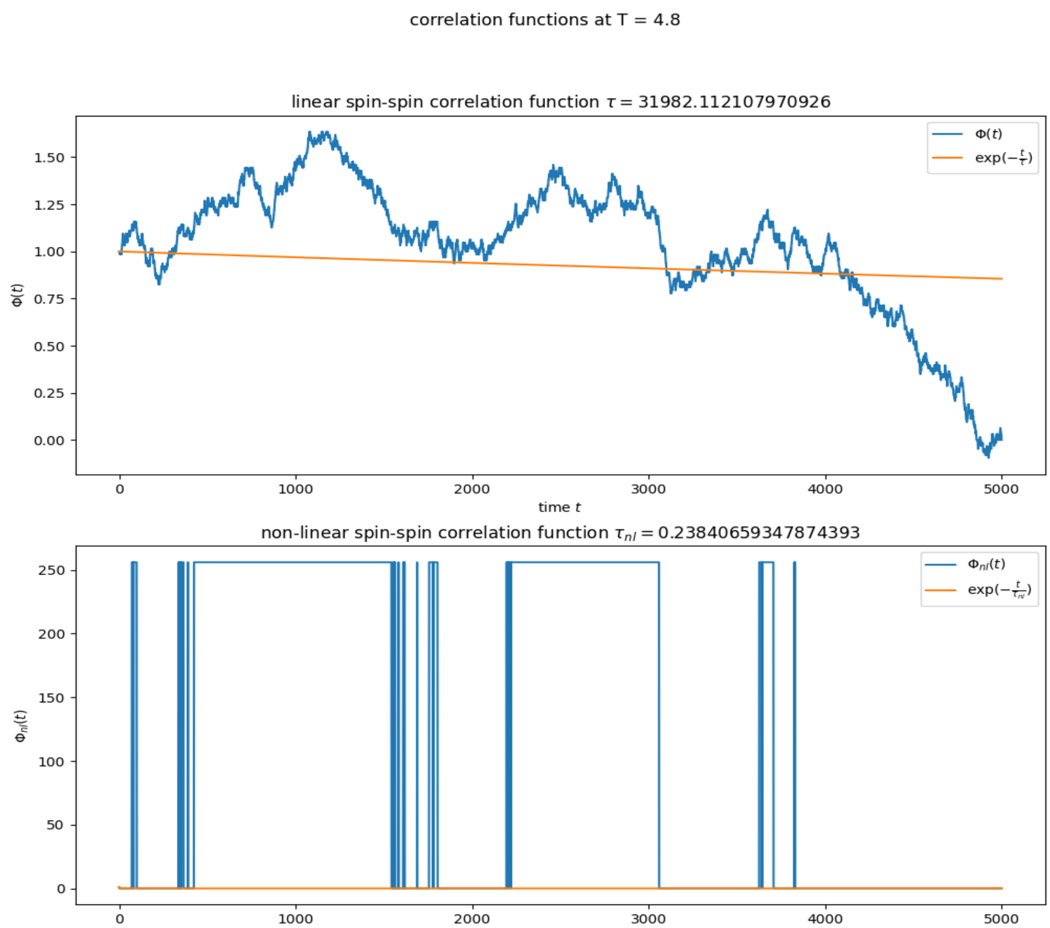
CSP Ex02

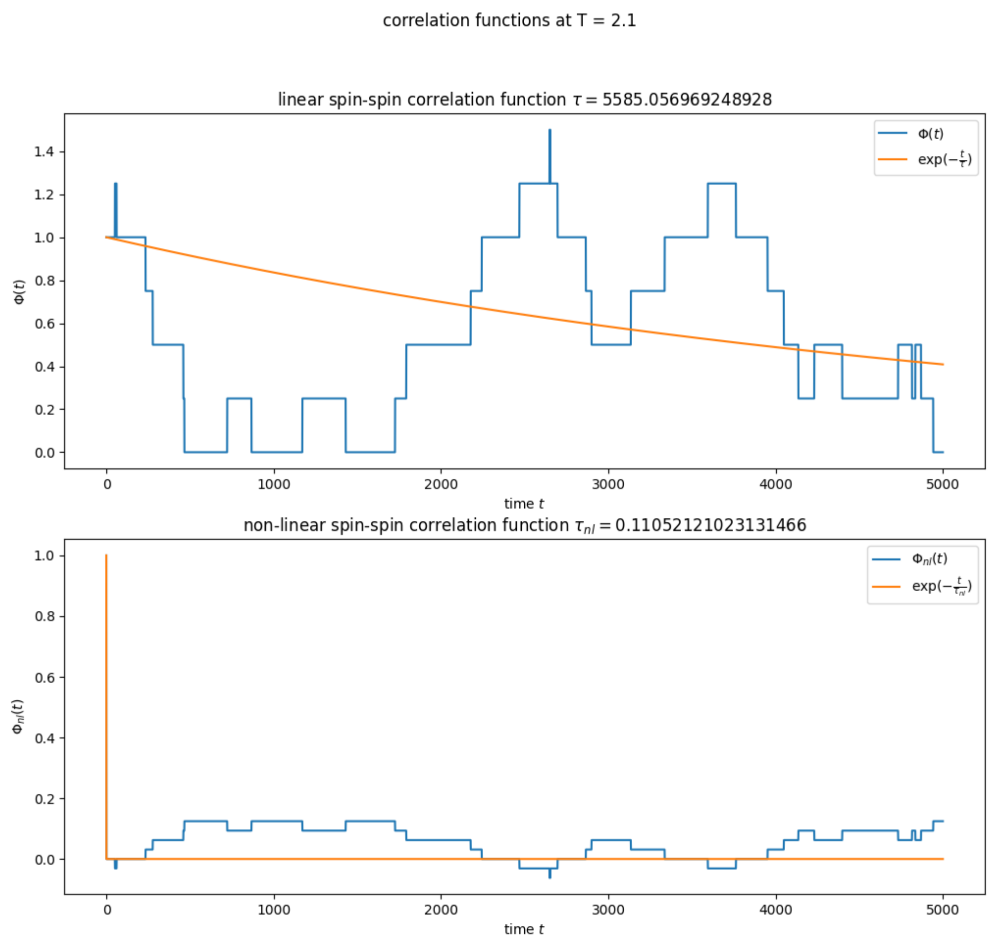
How to run: to compile type “make all”. To run task 1: “source run_task1.sh”, To run task 2&3: “source run_task2_3.sh”, to run task 4: “source run_task4.sh”

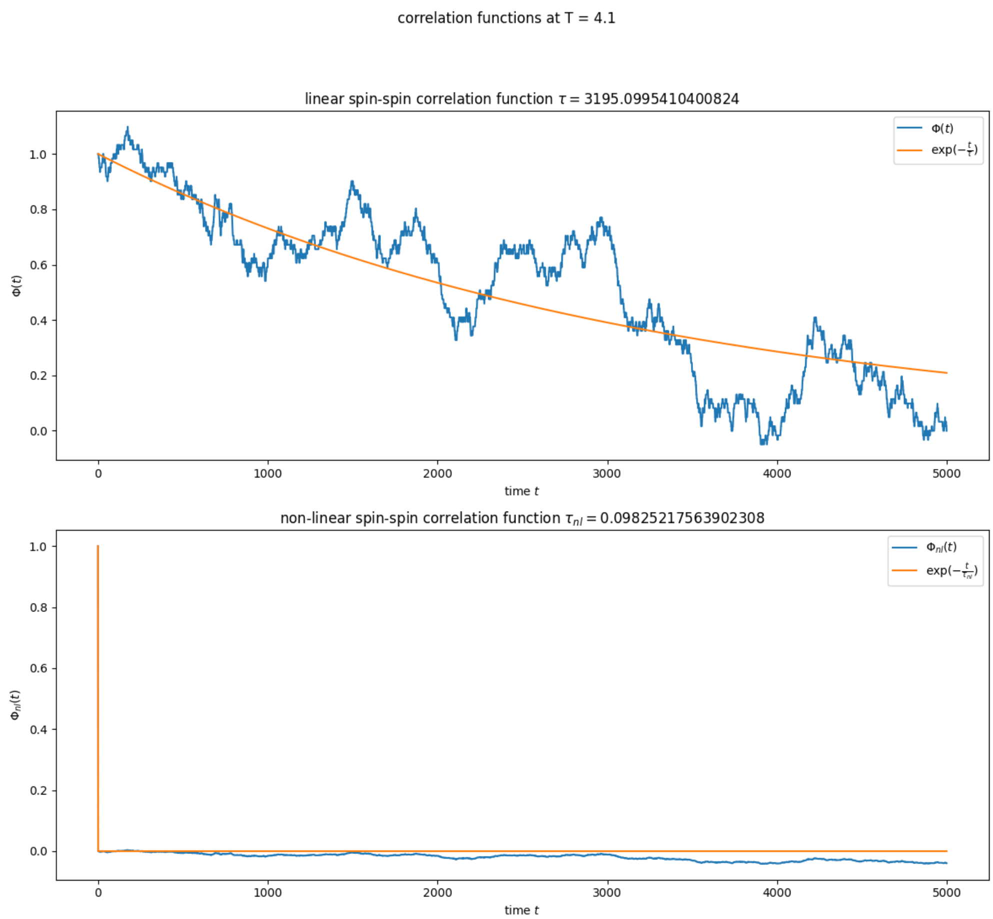
Discussion: Doing it in 3D wasn’t that much easier than how I thought it would be. I had to create a new type of container which accepts 3D arrays. I call this container type “lattice_3D<type>”. It is very basic but it also has very useful methods in it which are needed for the ising model. ATM the lattice_3D only supports cubic containers, but this can be easily extended. I began with Task 2 & 3 just to see if I am doing it right and then I did the other tasks. Note that I am asking questions inside the report, due to not having enough time to ask them to you via mail. I am writing this report one day before the deadline.

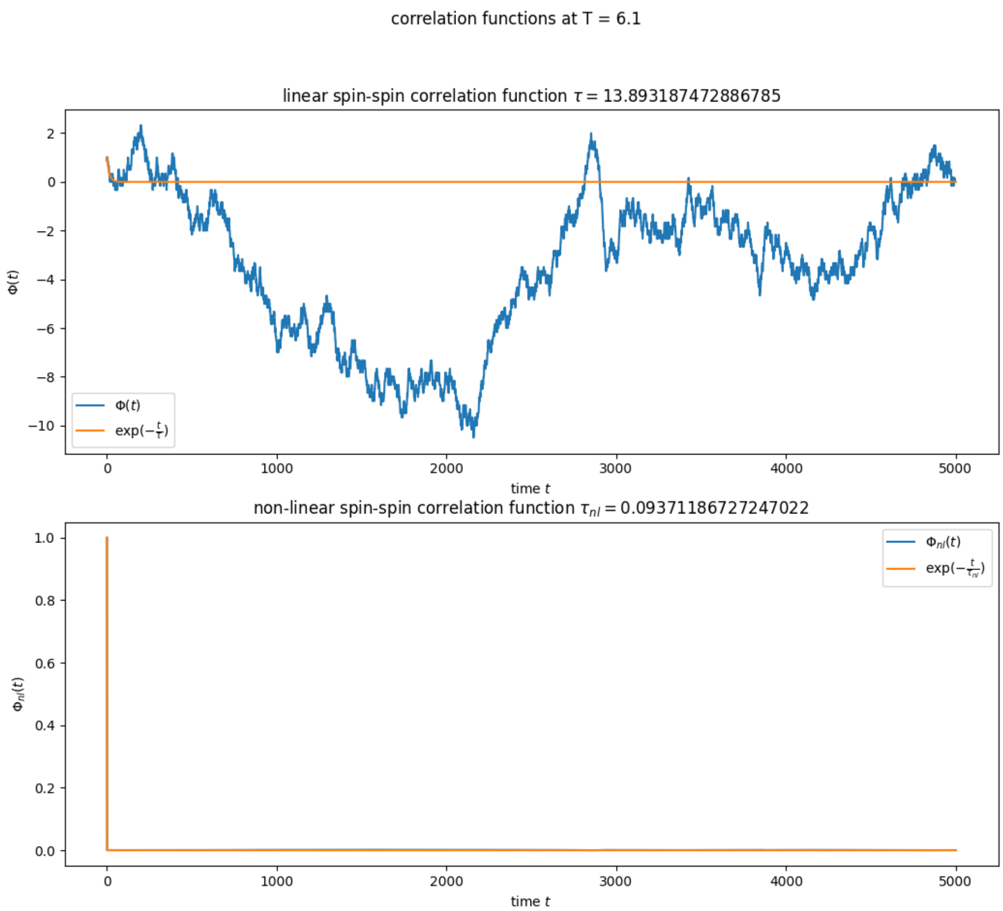
Issues: I worked pretty long on it (+8h) and unfortunately I think I did not get the intended results you whiched to see. Task 1 \tau_{nl} does not look right.
Task 4 data collapse did not work out for me. I tried to use matplotlib slider but unfortunately it does not collapse like I wanted (run “python3 plot_task4.py task4_data.csv” to see the slider working).

Task 1: I measure the correlation functions at 4 different temperatures: T = 2.1, 4.1, 4.8, 6.1 (2 far away from T_c and 2 close). In my opinion only the linear correlation function does look exceptionally right. For the non-linear ones I think I measured <sigma(t)sigma(t + dt)> not good enough. Thanks to Pascal I quite understood how I should measure it. But I think I still did it wrong. All of the correlation functions are fitted with a curve (in orange). Should I have fitted a curve of the form a*exp(-t/tau) or with a scalar in front of the exponent? I did it without, because correlation function should start from 1 and end at 0. The measured tau’s are on the subtitle of the respective plots. Btw: <sigma(t0)^2> = 1 (always right?).

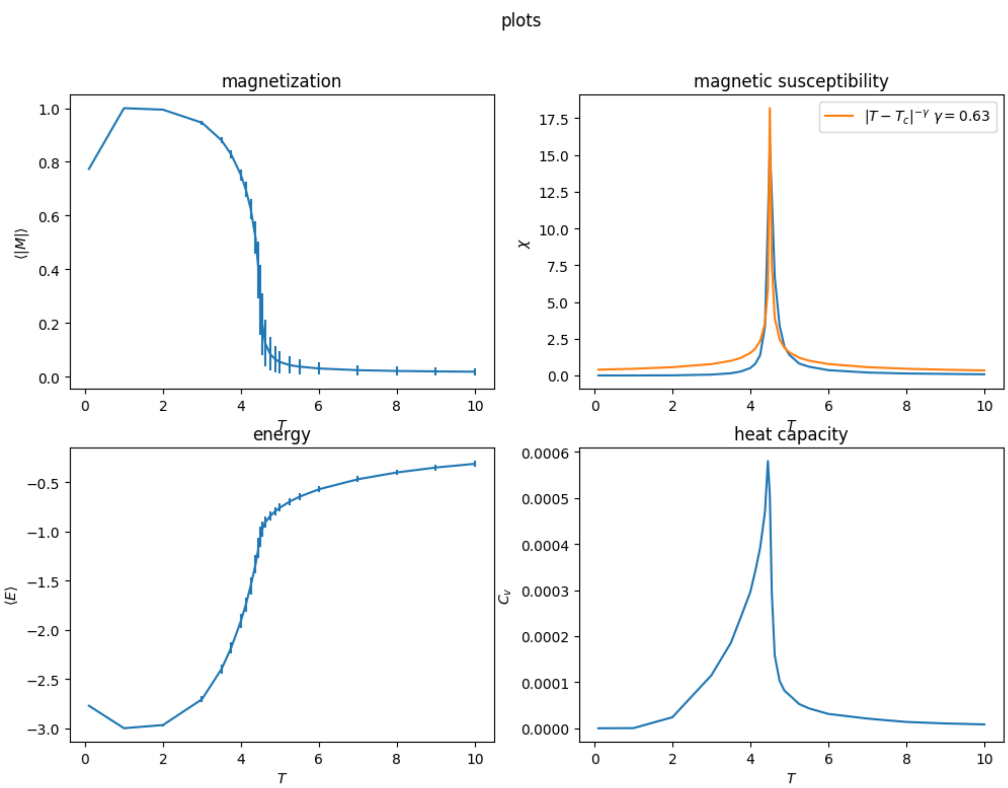



correlation functions at T = 2.1
linear spin-spin correlation function $\tau = 5585.056969248928$
$\Phi(t)$
$\exp(-\frac{t}{\tau})$
$\Phi(t)$
time t
non-linear spin-spin correlation function $\tau_{nl} = 0.11052121023131466$
$\Phi_{nl}(t)$
$\exp(-\frac{t}{\tau_{nl}})$
$\Phi_{nl}(t)$
time t


correlation functions at T = 4.1
linear spin-spin correlation function $\tau = 3195.0995410400824$
$\Phi(t)$
$\exp(-\frac{t}{\tau})$
$\Phi(t)$
time t
non-linear spin-spin correlation function $\tau_{nl} = 0.09825217563902308$
$\Phi_{nl}(t)$
$\exp(-\frac{t}{\tau_{nl}})$
$\Phi_{nl}(t)$
time t



Task 2&3: This was like the last time but this time I looked at your feedback and hope this time the axises are right. <M> & <E> do look good but please check the other two if they have the right y-axis. T_c = 4.45 in my case, measuring the argmax of \chi. The orange line in \chi represents the fitted |T - T_c|^-gamma curve for task4.



Task 4: I tried the method of collapsing (see issues), but unfortunately I did not make it. Run "python3 plot_task4.py task4_data.csv" to see the slider working. So I tried the method of just plotting \chi over time and then fitting the function |T-T_c|^-\gamma. We got gamma=0.62979458 (see plot for task2&3). Gamma is way off compared to the one on the slides. Maybe I should have increased the lattice even more. But then it would run for even longer. For \nu I would need to find the correlation function, but unfortunately I don't know how to calculate this function for the ising model (maybe this way?).