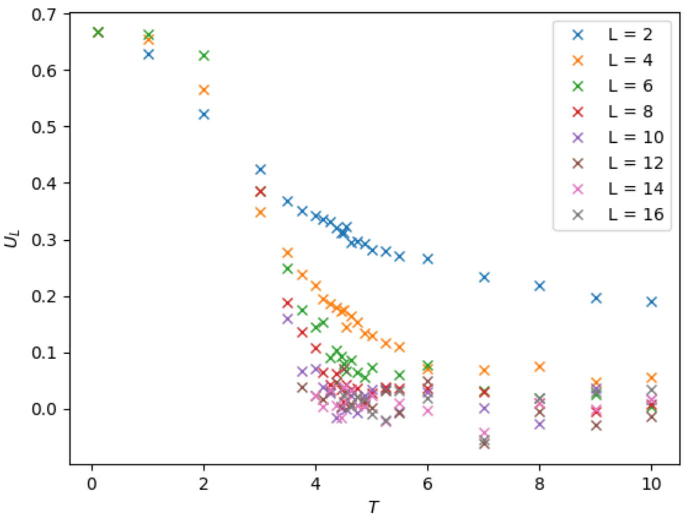
CSP Ex04

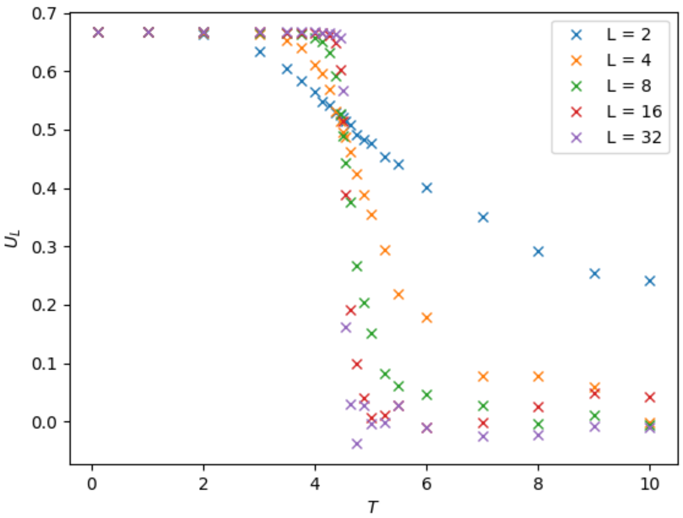
How to run task2: compile “make wolff” & “make mr2t2” and run “source run_task2.sh”
Choose the algo type inside the bash script.

How to run task3: compile “make wolff_task3” & “make mr2t2_task3” and run “source run_task3.sh”

Task1: For the potts model q=2 it is the same (obviously). But the higher q goes the smaller p gets until p = 0 for q = inf.

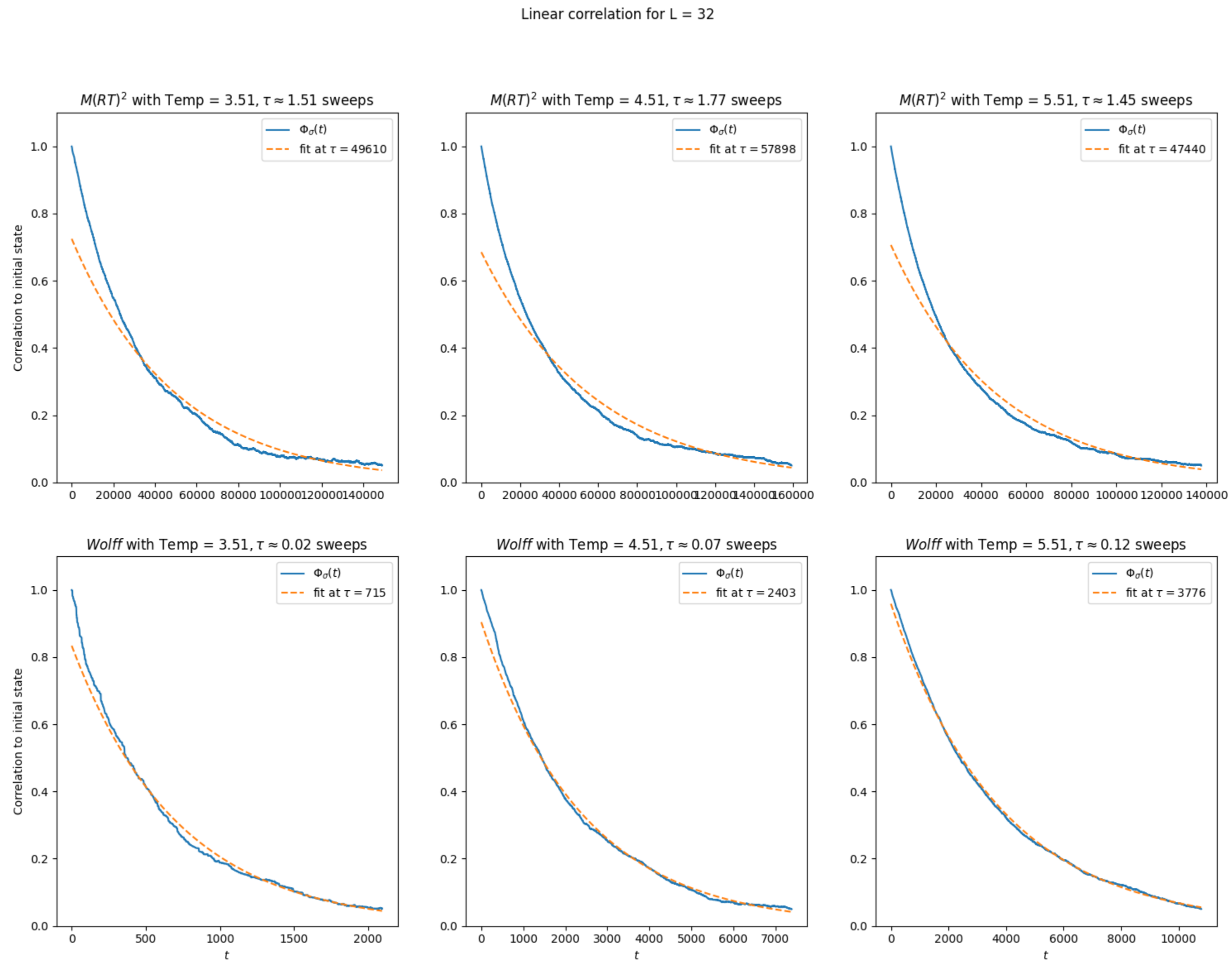
Task2: Plot left is Wolff and plot right is M(RT)^2. Looks like I did something wrong in the Wolff algorithm. Idk what. Also, Wolff takes too long. All of the lines in M(RT)^2 are colliding exactly at the critical temperature T_c = 4.51.





Task3: First, I tried to measure the autocorrelation function for the energy. Unfortunately it did not work (it looked bad). So I used the method we used like in Ex02 with the spins. This worked well for both types of algorithms. I only plotted for L=32 because it was the smoothest. Performance wise I tested all sizes from L=4,..,32. Wolff is always slower than M(RT)^2. Probably due to the recursive method. In the table “Runtime” describes the average runtime for one step (one move). Hence, MC_speed = 1/(runtime*tau)? It is obvious that when the lattice size gets bigger, the longer it runs. Wolff runs O(n) for each move, whereas M(RT)^2 takes O(1) per move. This is due to the recursive checking part. But looking at the plots, we realise it is much faster in uncorrelating than M(RT)^2! In other

words: tau is much smaller! MC_speeds are very comparable for my case.



algorithm	L	T	runtime	tau	MC_speed
M(RT)^2	4	3.51	5.34E-08	28.17150027	664909.6591
M(RT)^2	4	4.51	5.58E-08	21.52444183	832937.0326
M(RT)^2	4	5.51	5.90E-08	60.3901754	280802.5894
Wolff	4	3.51	6.54E-07	3.334411702	458847.8859
Wolff	4	4.51	4.69E-07	5.355785227	398448.9706
Wolff	4	5.51	3.16E-07	4.028055942	785275.974
M(RT)^2	8	3.51	5.21E-08	1817.845766	10562.18199
M(RT)^2	8	4.51	5.24E-08	683.9223187	27887.79608
M(RT)^2	8	5.51	4.91E-08	515.6957348	39466.51316
Wolff	8	3.51	1.41E-06	20.52004354	34456.972
Wolff	8	4.51	6.53E-07	34.62356206	44209.49926
Wolff	8	5.51	4.57E-07	55.36937018	39537.14195
M(RT)^2	16	3.51	3.11E-08	4690.889481	6860.724815
M(RT)^2	16	4.51	3.27E-08	5006.948434	6106.636999

M(RT)^2	16	5.51	3.41E-08	5459.113396	5366.997791
Wolff	16	3.51	1.89E-06	97.75827847	5421.801402
Wolff	16	4.51	6.10E-07	268.1761677	6116.648009
Wolff	16	5.51	3.84E-07	455.7697512	5710.386337
M(RT)^2	32	3.51	3.15E-08	49609.70102	640.2999846
M(RT)^2	32	4.51	3.60E-08	57898.33437	479.3500676
M(RT)^2	32	5.51	3.56E-08	47440.02924	592.4897553
Wolff	32	3.51	2.05E-06	714.8676607	681.9484093
Wolff	32	4.51	7.99E-07	2402.531904	521.1958953
Wolff	32	5.51	5.79E-07	3776.296789	457.1225032