Project2 - FYS4460

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(Dated: April 22, 2021)

f) Estimate n

Remove "percolating cluster"?.

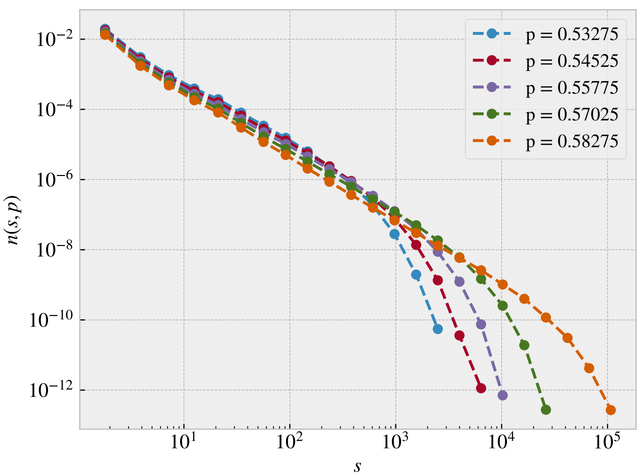

FIG. 1. $n(s,p)$ with p approaching $p_c = 0.59275$ from below in a $L \times L = 1000 \times 1000$ system. The results are averaged over 300 Monte Carlo cycles with a logaritmic binsize of 1.6^i for bin i.

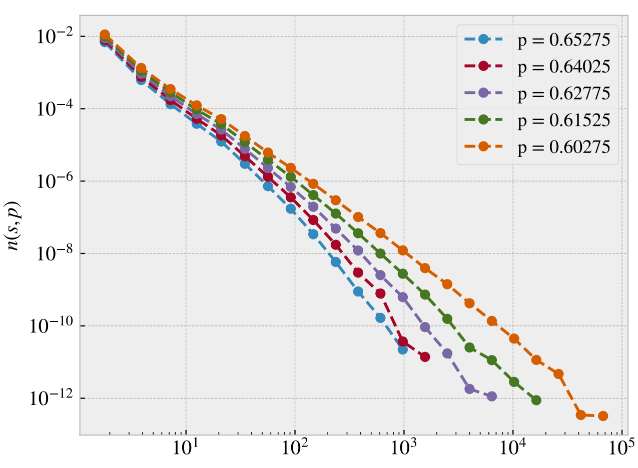

FIG. 2. $n(s,p)$ with p approaching $p_c = 0.59275$ from above in a $L \times L = 1000 \times 1000$ system. The results are averaged over 300 Monte Carlo cycles with a logaritmic binsize of 1.6^i for bin i.

g)

Antagelse

$$n(s,p) = s^{-\tau} F\left(\frac{s}{s_\xi}\right), \quad s_\xi \propto |p - p_c|^{-1/\sigma}$$

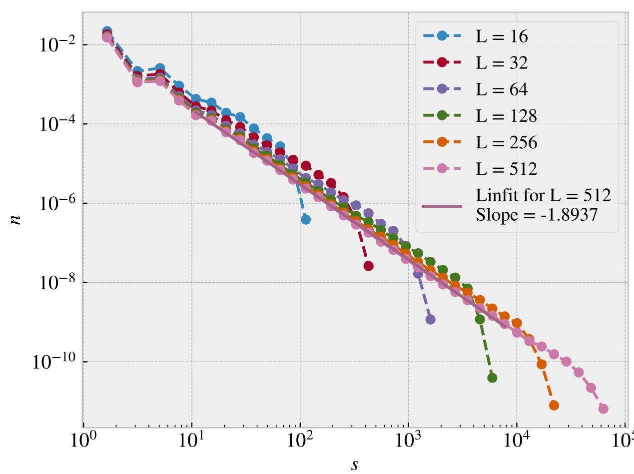

FIG. 3. $n(s,p)$ with $p = p_c = 0.59275$ with $L = 2^k$ for $k = 4, \cdots, 9$ The results are averaged over 1000 Monte Carlo cycles with a logaritmic binsize of 1.1^i for bin i. By making a linear fit on the first part of the datapoints for $L = 512$ we estimate τ as 1.89.

Result from book is $\tau_{book} = 187/91 \approx 2.05$ giving a relative error

$$\eta_\tau = \left|\frac{187/91 - 1.89}{1.89}\right| = 0.087$$

h)

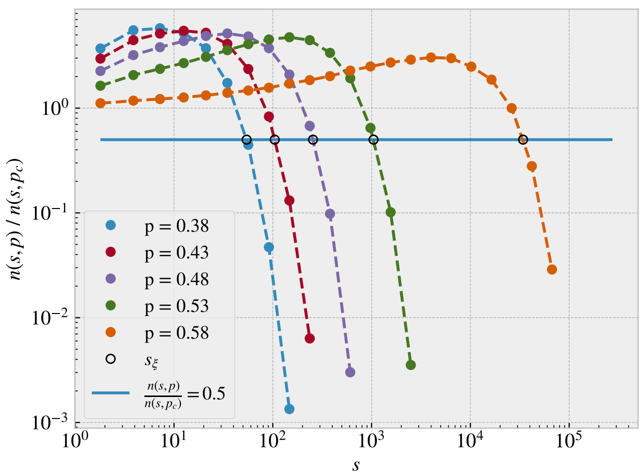

FIG. 4. L = 1000, MC = 500, a = 1.6

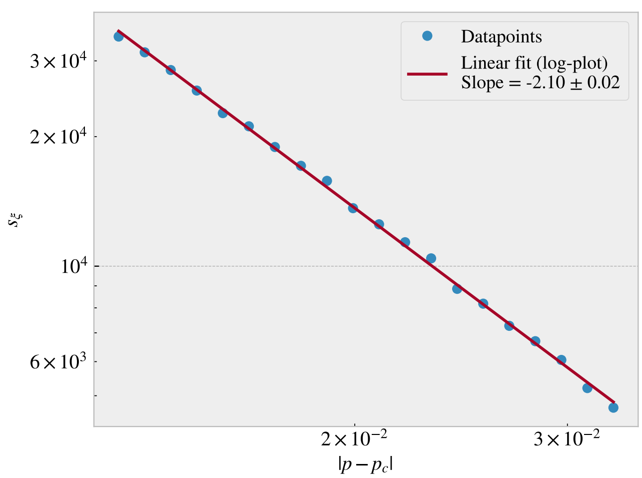

FIG. 5. s_ξ defined as $n(s,p)/n(s,p_c) = F(s/s_\xi) = 0.5$ as a function of $|p-p_c|$ for 20 equally distributed values in the interval $p \in [0.56, 0.58]$. For each value of p we used a system size of $L = 1000$, a logaritmic binsize of 1.6^i for bin i and averagede the result for 500 MC cycles. Notice that choosing $0.58 < p \leq p_c$ gave more unreliable results as the relations diverges near p_c

From the linear fit on 5 we find

$$\sigma = -\frac{1}{\text{slope}} = 0.475 \pm 0.004$$

By experience I found the second decimal to vary beetween runs and reduce my estimate to

$$\sigma = 0.4(8)$$

Result from book is $\sigma_{book} = 36/91 \approx 0.40$ giving a relative error

$$\eta_\sigma = \left|\frac{36/91 - 0.48}{0.48}\right| = 0.18$$

i)

Handles multiple spanning cluster by mean value.

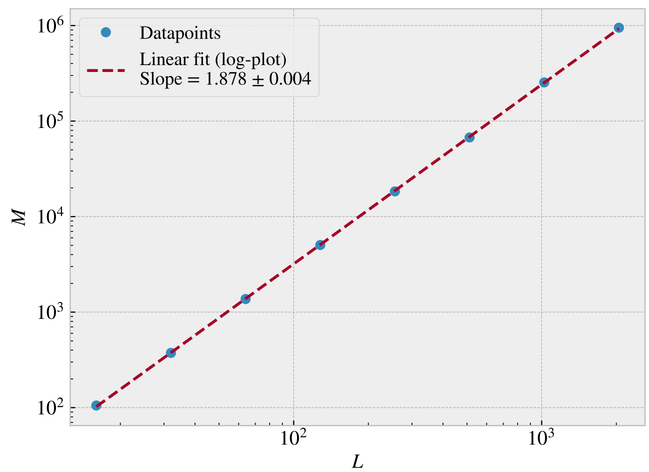

FIG. 6. $MC_cycles = 500$

We find that $M(L)$ goes as

$$M = L^D, \qquad D = 1.878 \pm 0.03$$

Result from book is $D_{book} = 91/48 \approx 1.896$ giving a relative error

$$\eta_D = \left|\frac{91/48 - 1.878}{1.878}\right| = 0.009$$

[1]