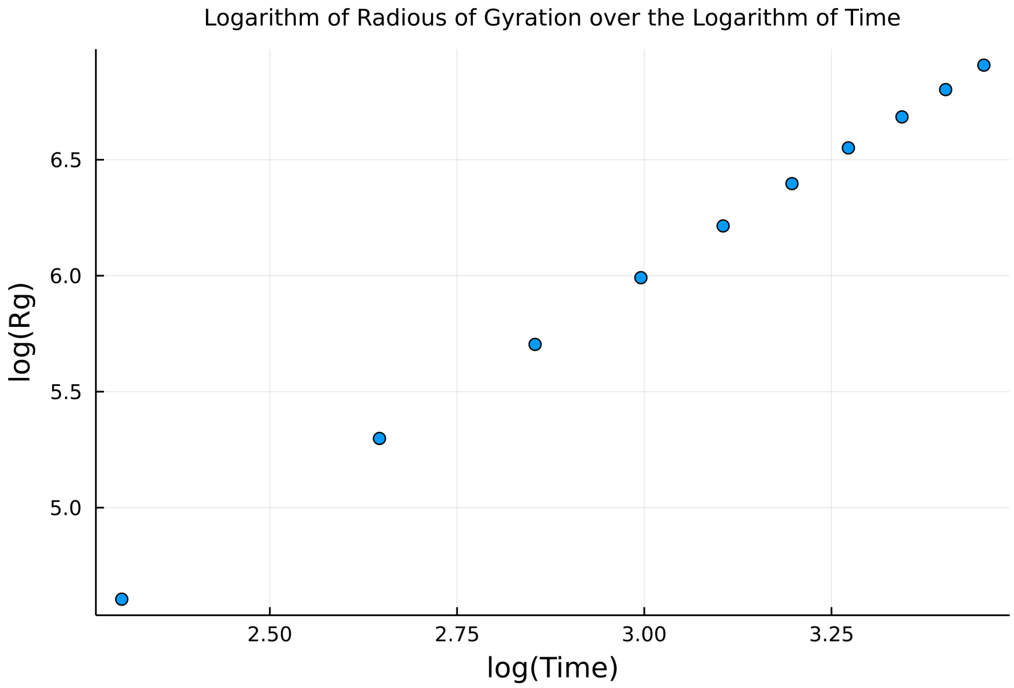
Homework 5

Maedeh Karkhane Yousefi

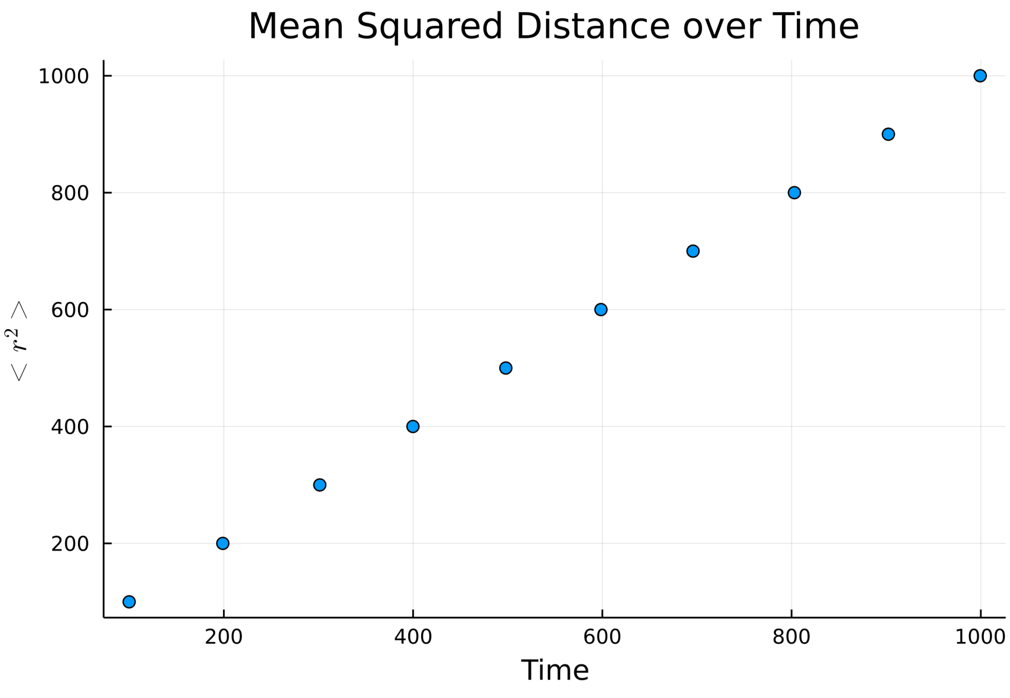
November 28, 2021

1. Exercise 4.5: 2D Random Walk

Expanding the direction choices of the previous example gives us the Essentials for this example. I plotted 2 figures by calculating the Radius of Gyration and the squared distance from the first position (0,0).



(a)



(b)

Figure 1: Figures regarding the confirmation of relations wanted in example 4.5. Which are: $R_g = \sqrt{< r^2 >} \sim t^{\nu}$ and $< r^2 >= 2dDt$. First position=(0,0), Number of run-times= 100000,

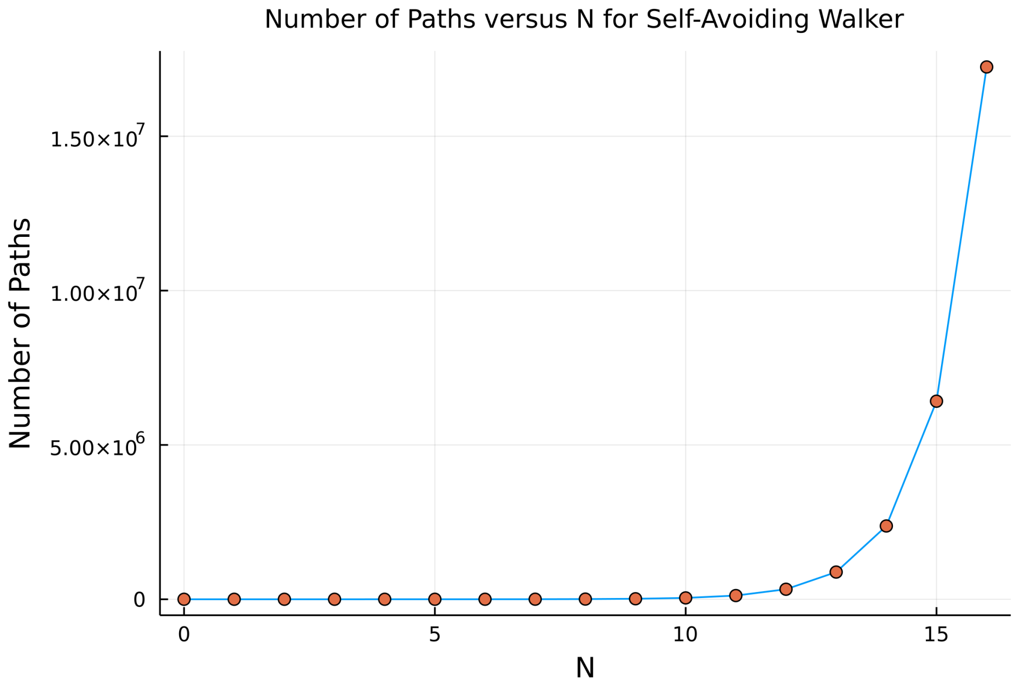
2. Exercise 4.6: Aggressive Layer Deposition

I set the boundary conditions, get the highest filled place in the network at each step, fill a position after 3 successful deposition(which happens after collision with a filled position). There are two limits which move with the peak of the layer at every step: The lowest, which we choose the random particle from this row of the network, and the top one, which is 5 entries away from the latter and emits every particle that moves beyond this limit.

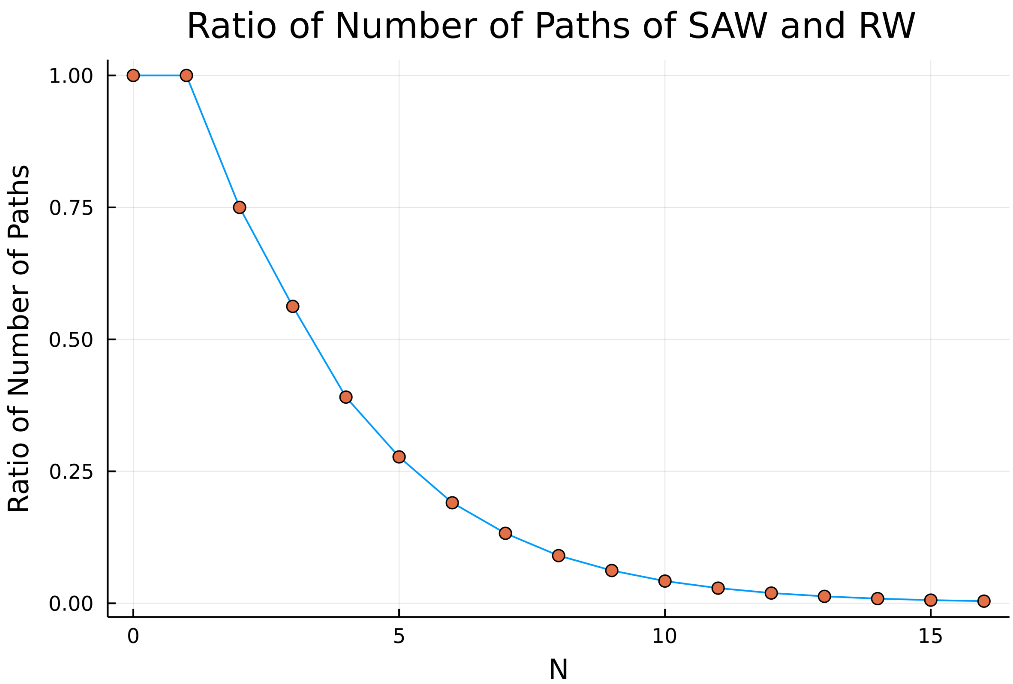
I tried so hard for the code to work and changed it so much, that I don't know what I'm looking at any more, so I just quit!The code is available though.

3. Exercise 4.7: Self-Avoid Random Walk

A simple 2D random walker has 4^N possible ways to walk around in a network. a self-avoiding random walker, though gives away the choices in order to avoid passing a previous crossed position. I learned to write the algorithm using a rescue function, a function calling itself N times.



(a)

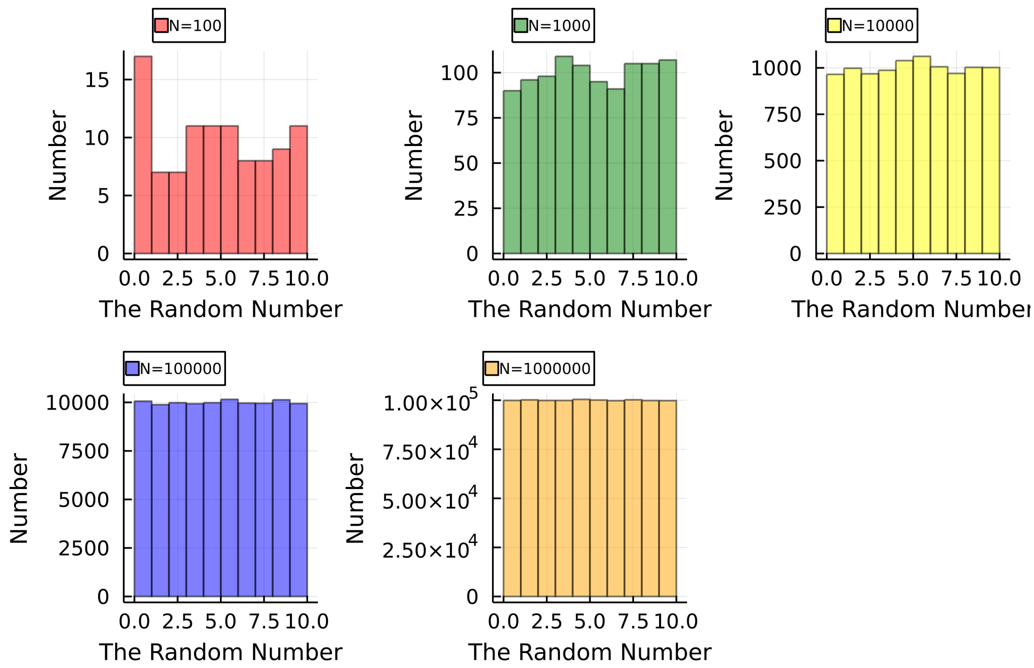


(b)

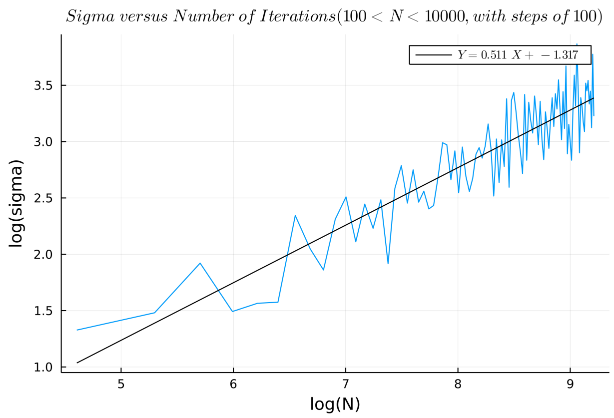
Figure 2: Figures wanted in example 4.7. N=16

4. Exercise 6.1: Generating Uniform Random Numbers

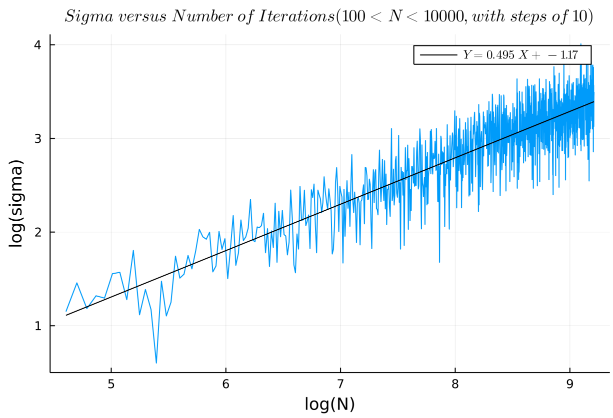
It's clear from the Fig.3.a that according to our expectations, the amount of numbers generated for $0 \leq \text{digit} \leq 9$ is about $\dfrac{1}{N}$. We intend to prove the following relation is acceptable: $\frac{\sigma}{N} \sim \frac{1}{\sqrt{N}} \rightarrow \log \sigma \sim \frac{1}{2} \log N$



(a)



(b)



(c)

Figure 3: Plots given for example 6.1. As you can see from the figures (a) and (b), the slopes of the plots are about 0.5, which confirms the relation above.

5. Exercise 6.2: Entanglement

Doing what the exercise told, and found out that there are no entanglement.

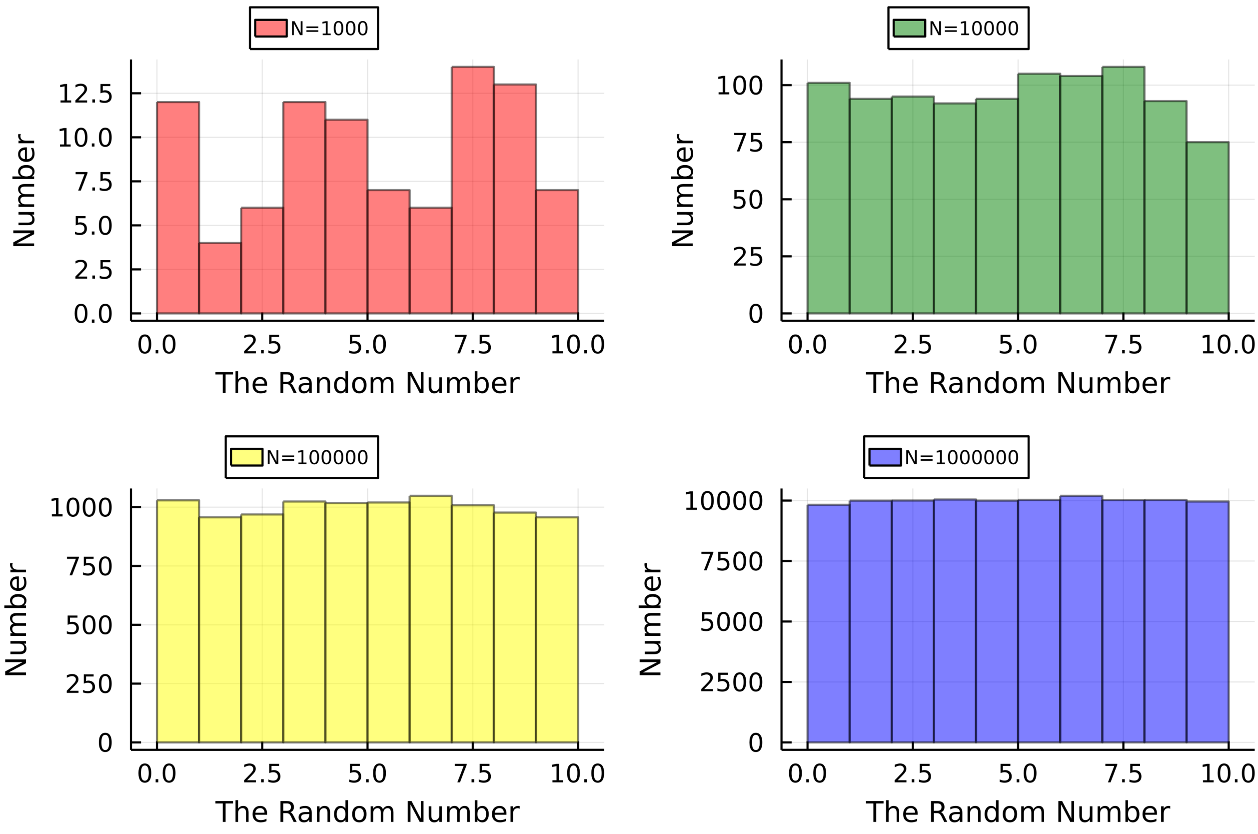


Figure 4: Figures confirming the uniform distribution function for exercise 6.2.