Lab Report 10

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Question 1 done by Juann Jeon
Question 2 done by Juann Jeon
Question 3 done by Seunghyun Park
Lab Report done by Seunghyun Park & Juann Jeon

Q1 (a)

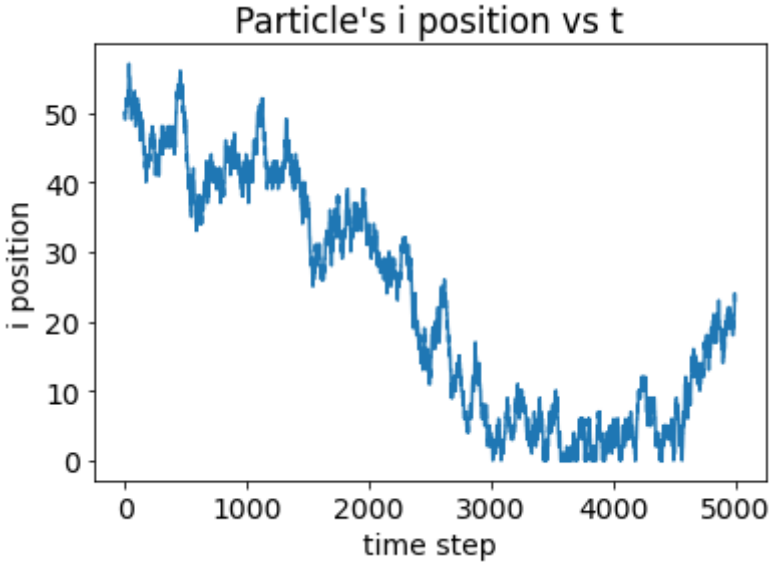

Figure 1: Particle's random movement in i position vs t

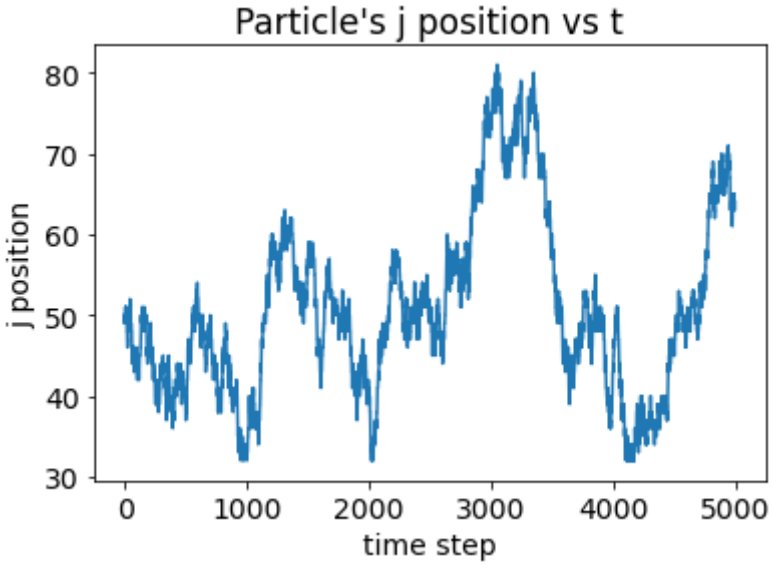

Figure 2: Particle's random movement in j position vs t

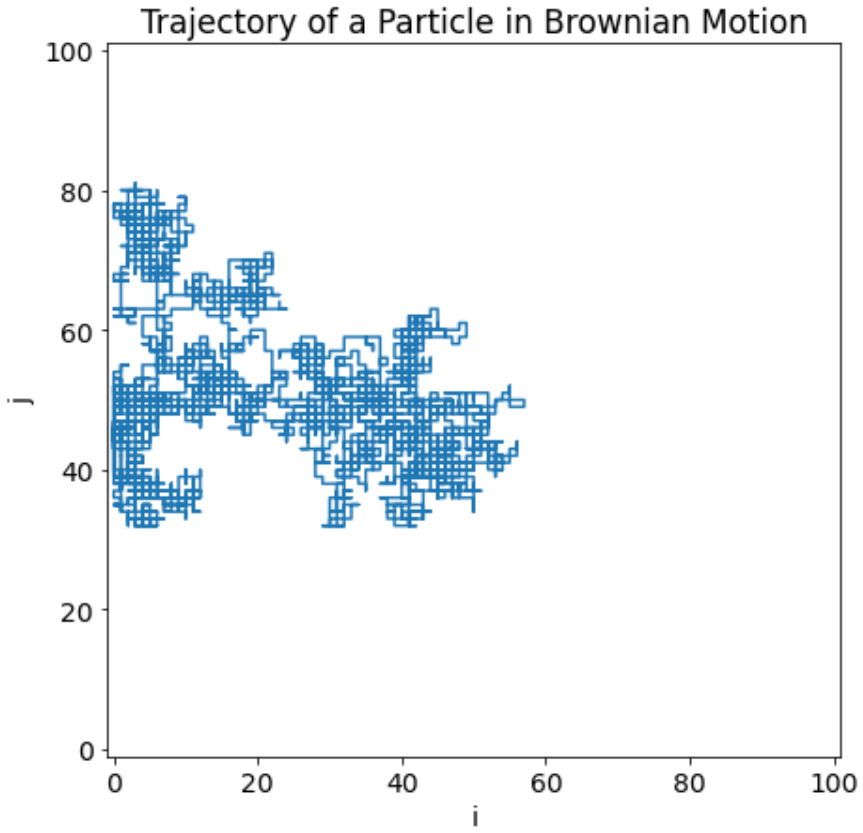

Figure 3: Trajectory of a particle in 2D Brownian motion (i vs j)

Q1 (b)

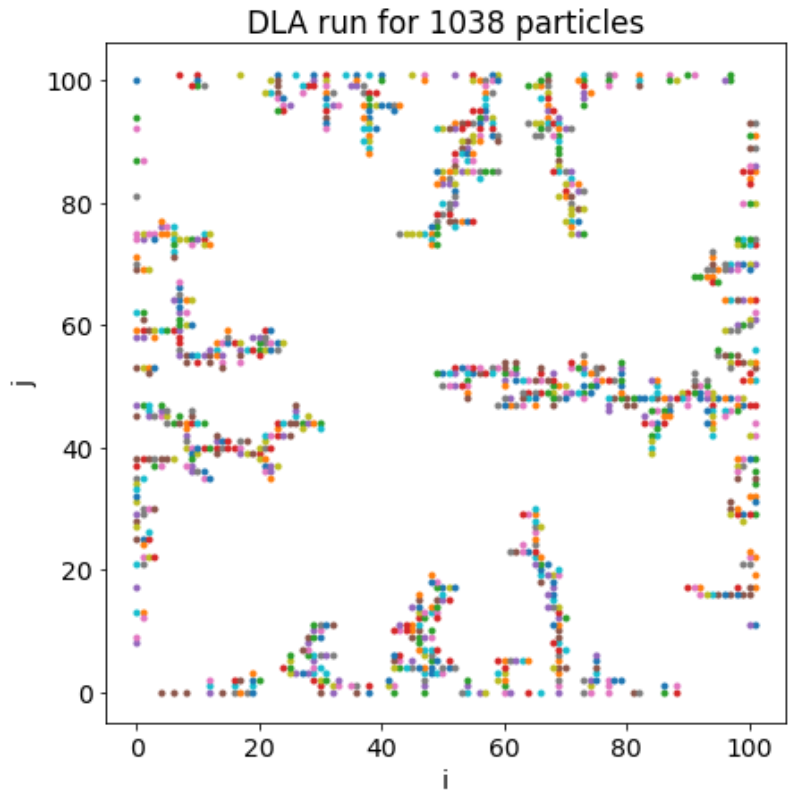

Figure 4: 2D DLA simulation for a certain number of particles until center particle is anchored

Q2
Code submitted.

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The Volume of a sphere of unit radius in 10 dimensions is: 2.512896
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Figure 5: Output of `Lab10_Q2.py`

Q3 (a)
Code submitted.

Q3 (b)
Code submitted.

Q3 (c)

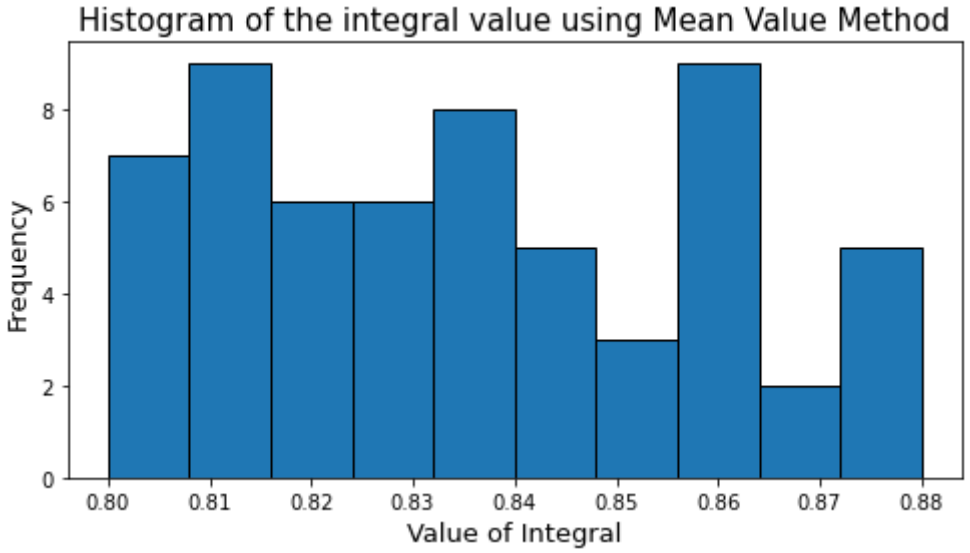

Figure 6: Histogram of the integral value calculated using the Mean Value Method

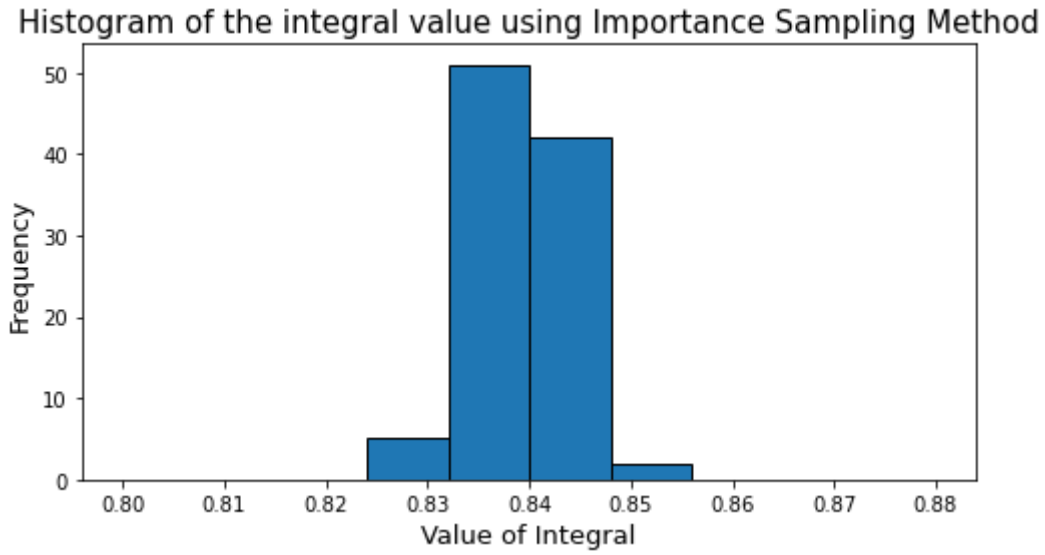

Figure 7: Histogram of the integral value calculated using the Importance Sampling Method

Figure 6 shows the histogram of the integral value calculated using the Mean Value method. From the histogram, we can see that the frequencies of each bin are similar. This happens because the Mean Value method uses x values that are chosen uniformly at random between the lower bound and the upper bound of the integral to estimate $\langle f \rangle$. However, the figure 7 shows that the integral values calculated using the Importance Sampling method are mostly gathered around 0.84. It is because when using the Importance Sampling method, the x values are drawn from the distribution $p(x)= \frac{1}{2\sqrt{x}}$. Since $\frac{1}{\sqrt{x}}$ is dominating both the integrand and the probability distribution, the x values drawn from the probability distribution would be similar to the values drawn from the distribution of the integrand. Therefore, the x values used in the Importance Sampling method gives better result than the x values used in the Mean Value method. Also, the weighting function that is used in the Importance Sampling method factors the divergence out of the integrand at $x = 0$ which also makes the result more accurate.