

INFO 6205 – Spring 2022

Program Structures and Analysis

Assignment 1

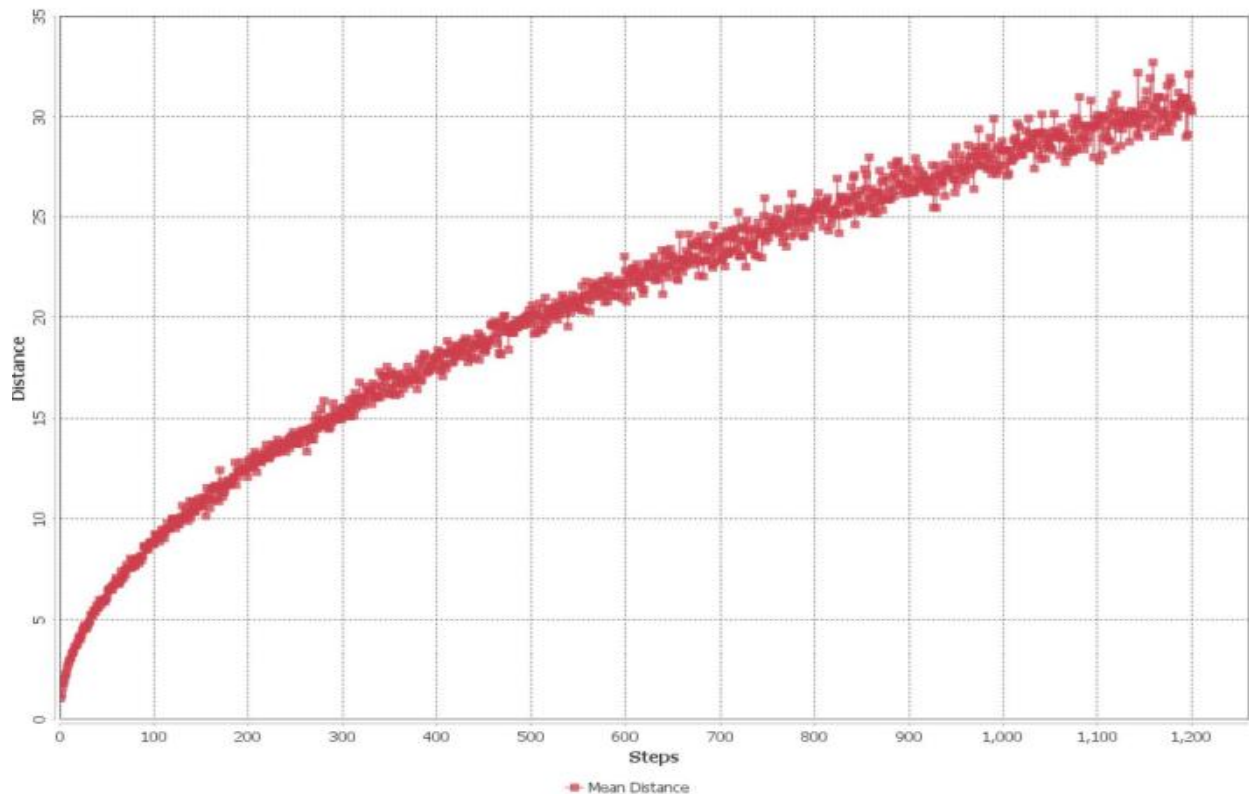
1. Task:

The task was to deduce the relationship between number of steps and distance travelled in a two-dimensional random walk scenario.

2. Output:

To conclude the relationship, I ran the program for the Steps range of {1 to 1200} repeating each experiment 500 times and averaging the values for every individual value of steps. This would run the program for 60000 times and would yield us enough data to analyze the relationship between the mean distance and steps.

```
Problems @ Javadoc Declaration Console ×  
<terminated> RandomWalk [Java Application] C:\Program Files\Java\jdk-17.0.2\bin\javaw.exe (1200 steps: 30.340055061492905 over 500 experiments
```



3. Relationship Conclusion:

The relationship we can conclude is the following

$$\text{Average Euclidean Distance} \propto \sqrt{\text{Number of Steps}}$$

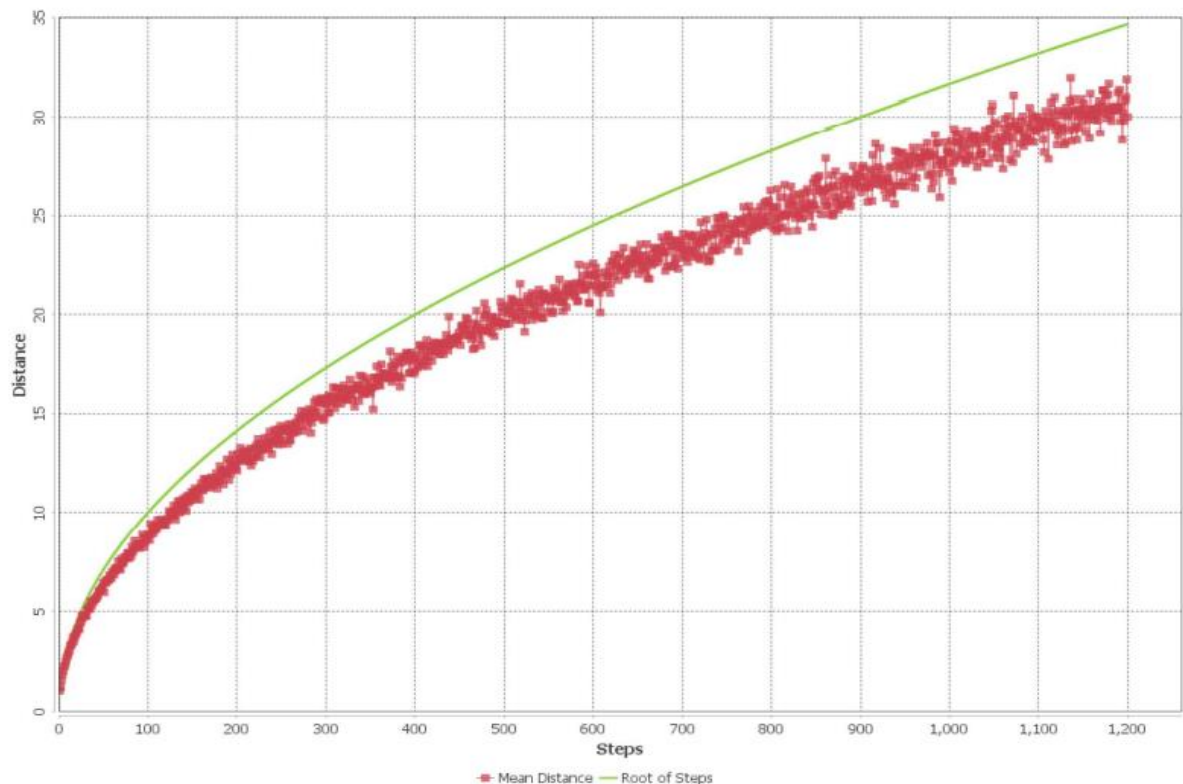
OR

$$\text{Average Euclidean Distance} = k * \sqrt{\text{Number of Steps}}$$

$$\text{Where } k = 0.8865675444083764 \text{ or } \sqrt{\pi}/2$$

4. Evidence to support the relationship:

I noticed that the Euclidean distance is proportional to the square root of the steps drunkard walked. I plotted the graph of the square root of steps against Euclidean distance to further explore the relationship.

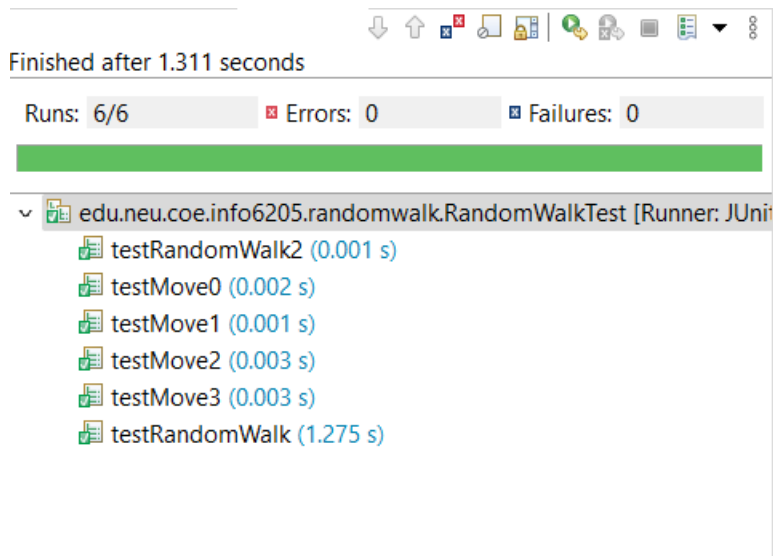


From the above graph we can conclude that Euclidean Distance of random steps is proportional to the square root of the number of steps, but not exactly equal. Hence, we can state that

$$\text{Average Euclidean Distance} = k * \sqrt{\text{Number of Steps}}$$

To calculate the value of the coefficient k , I took the ratio between the Euclidean distance and the square root which yielded value 0.8865675.

5. Unit Tests:



6. References:

<https://www.wired.com/2017/03/hey-can-find-pi-random-walk-heres/>