Program Structures and Algorithms
Spring 2024

NAME: Kartikey Vijayakumar Hebbar
NUID: 002276938
GITHUB LINK: https://github.com/kartikeyhebbar/INFO6205

Task: Assignment 1 (Random Walk)

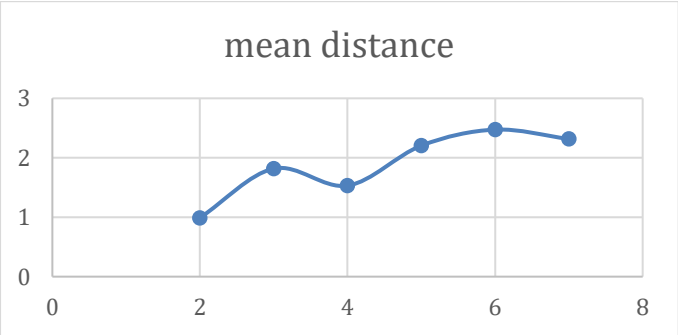
Relationship Conclusion:
Let's assume that the lamp post or the starting point of the man is at the origin (0,0) on a 2-dimensional cartesian plane. As per the problem description, 'm' signifies the number of steps the person walks in any given iteration 'n'. These 'm' steps would be taken from the origin position.

The steps can be taken on either X or Y coordinates. After each step taken the man's position on the cartesian plane changes as the X or Y value changes due to the addition of 'dx' and 'dy' to them which signify the step in X and Y coordinates respectively. After completing 'm' steps the man would be at a particular coordinate (X, Y) from where the total walk distance ('d') can be computed using **the Distance Formula** $\sqrt{x^2 + y^2}$

In general, as the 'm' increases, the distance from the lamp post must also increase. But since, we are dealing with random numbers here where the next step taken by the man may not be always further away from the lamp post, the general conclusion might not always hold true. However, a true conclusion would be that there would be a high probability of seeing a higher distance value for higher 'm' values. Thus, we can say, **'d' increases as 'm' increases**.

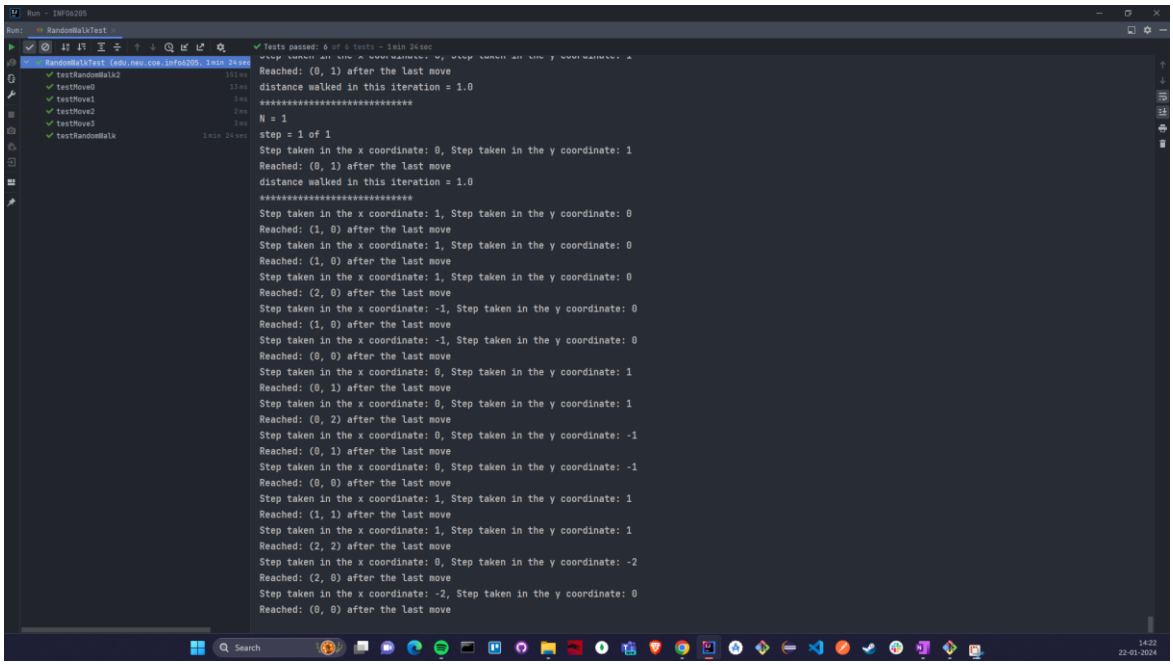
Evidence to support that conclusion:
To visualize the conclusion, here is a sample data of the result derived when 'm' was kept between 2 and 7. The number of iterations ('n') in each of the cases was set to 10. Distance from lamp post after walking 'm' steps was calculated for each iteration 'n' (1-10) and a mean total distance was calculated for each value of 'm'. Here is the data of how the mean distance varied with increase in the value of 'm'.

m (no. of steps)	mean distance
2	0.989949494
3	1.818033989
4	1.53137085
5	2.204241211
6	2.473728333
7	2.317105597

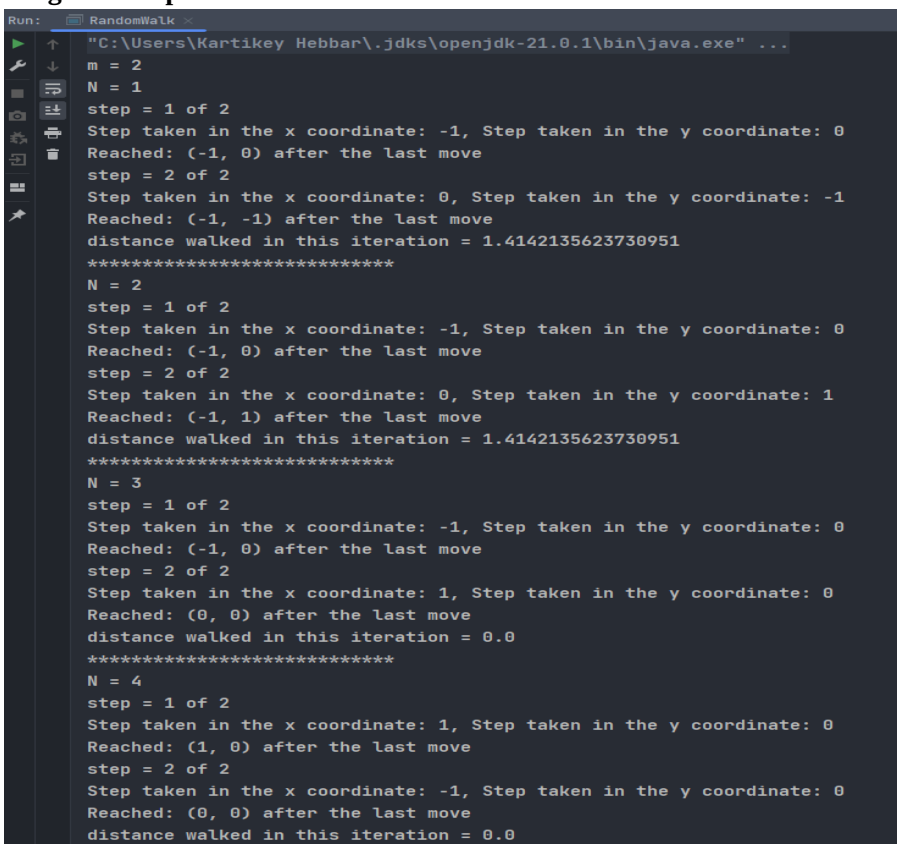


As discussed earlier, since it is a random walk, there is not a clear indication of a linear increment in the mean distance when the value of ‘m’ increases. However, after performing these tests multiple times on different sets of increasing ‘m’ values, I could support the above conclusion with quantitative data showing an increase in the mean distance when ‘m’ increases in most cases.

Unit Test Screenshots:



Program Output:



A complete log of the output is added to the repository along with this report for your reference.