Sutiksh Verma (002122052)

Program Structure and Algorithms

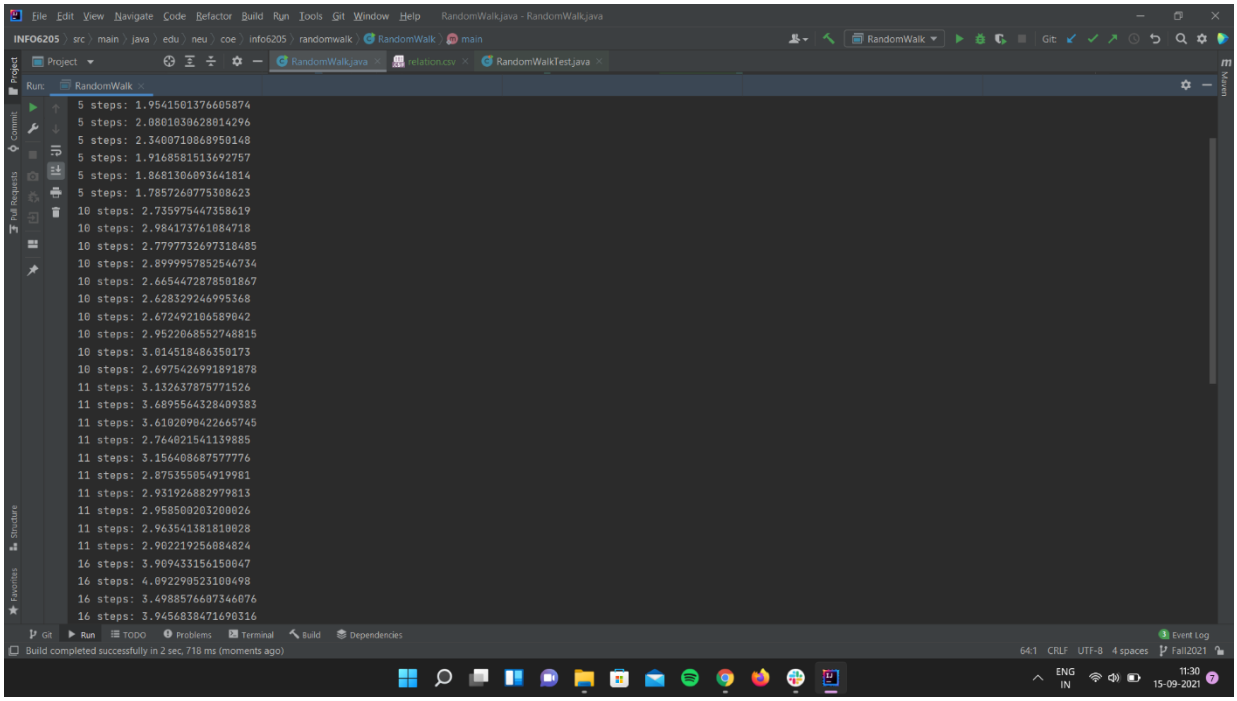
Assignment No. 1

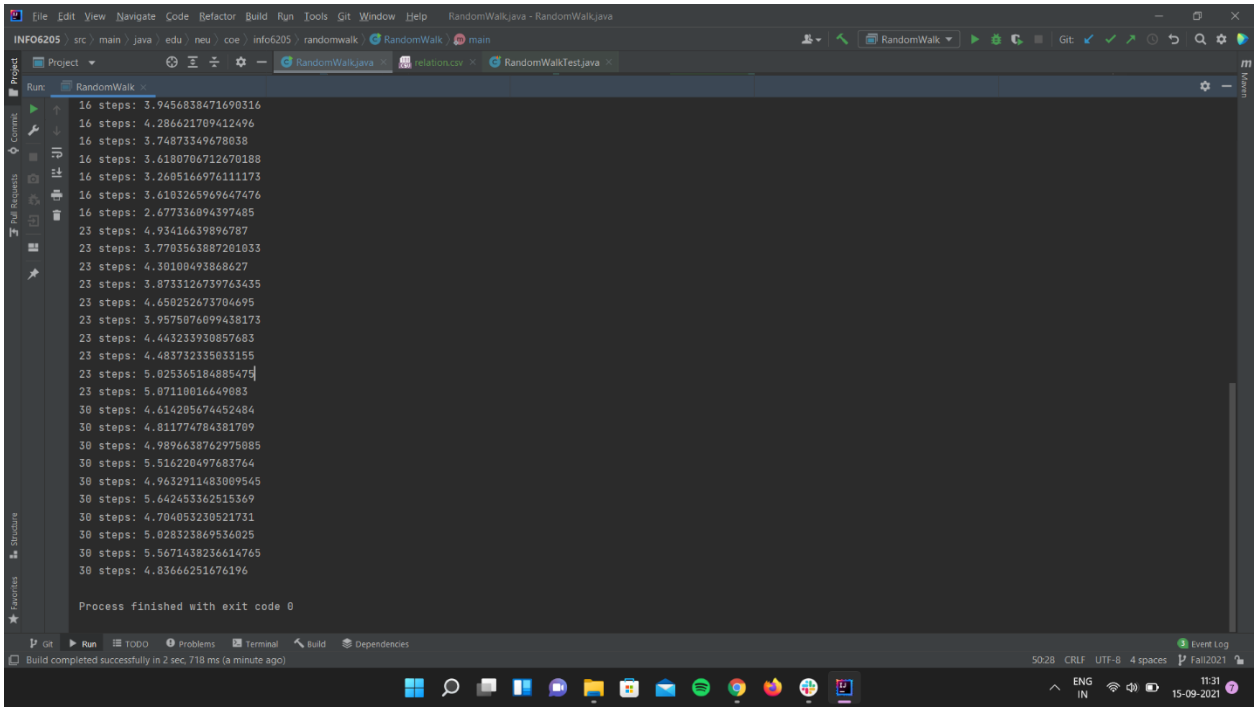
Task:

Imagine a drunken man who, starting out leaning against a lamp post in the middle of an open space, takes a series of steps of the same length: 1 meter. The direction of these steps is randomly chosen from North, South, East or West. **After n steps, how far (*d*), generally speaking, is the man from the lamp post?**

Output:

Below is the output received from **n** number of steps with 6 different values ran 10 times each to prove the relationship:

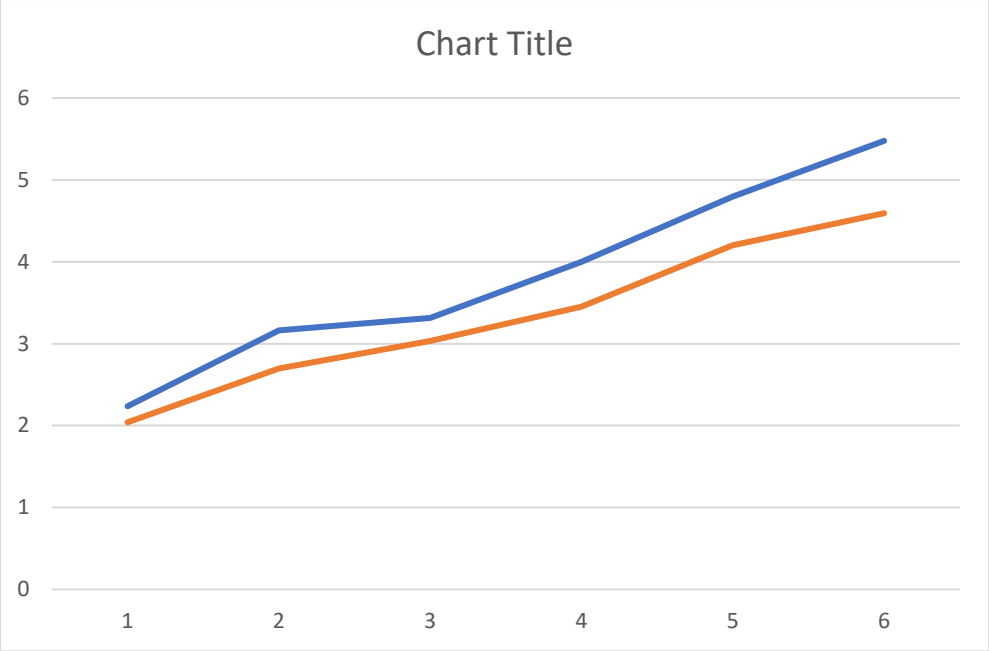




Relationship Conclusion: to conclude, the results of the experiments show that the Euclidean distance between the last position and the first position of a drunken man moving is approximately equal to the square root of the number of steps taken or in other words, the root mean square of the distance d, between the two points should be approximately root of the number of steps i.e. √ N. So **D = √ N**.

Evidence: I have attached a chart and a table showing the data of the different output observed for the different set of inputs of N. As a result, we can see proportionate increase in the distance covered. Hence supporting our observation that D is the root mean square of N.

Number Of Steps	Expected Distance	Mean of Actual Distance	Error(%)
5	2.236067	2.040362	8.7522
10	3.162277	2.697317	14.7033
11	3.316624	3.033947	8.52303
16	4.000000	3.453777	13.6556
23	4.795831	4.204211	12.3361
30	5.477225	4.593267	16.1388

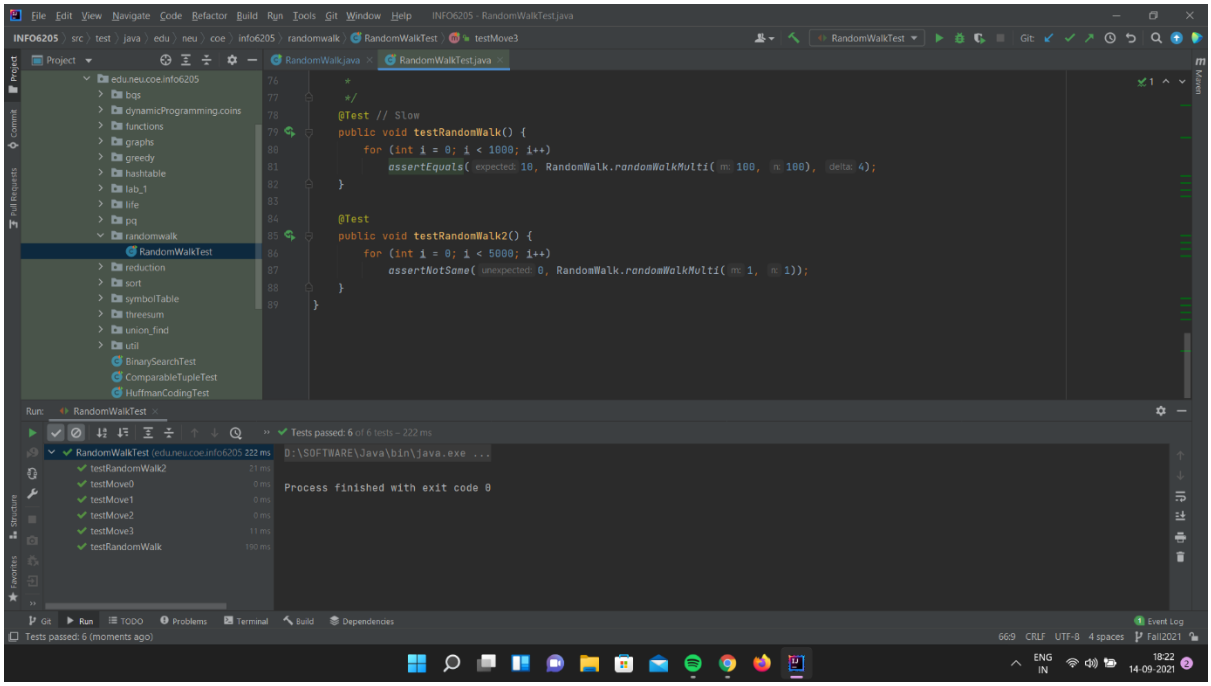


The Blue Line is the expected distance

The Orange Line is the actual distance

Passed Unit Test Cases:

All my test cases got accepted. Here is a screenshot of the passed test cases.



References I took:

Euclidean Distance:

1)https://en.wikipedia.org/wiki/Euclidean_distance

Random Walk

1)https://www.youtube.com/watch?v=stgYW6M5o4k

2)https://www.youtube.com/watch?v=BfS2H1y6tzQ

Files:

1) **Relation.csv**
2) **Observation.csv**