

Shrusti Rajesh Chheda

NUID : 002196756

Program Structures and Algorithms

Fall 2021

Assignment No. 1 – Random Walk Experiment

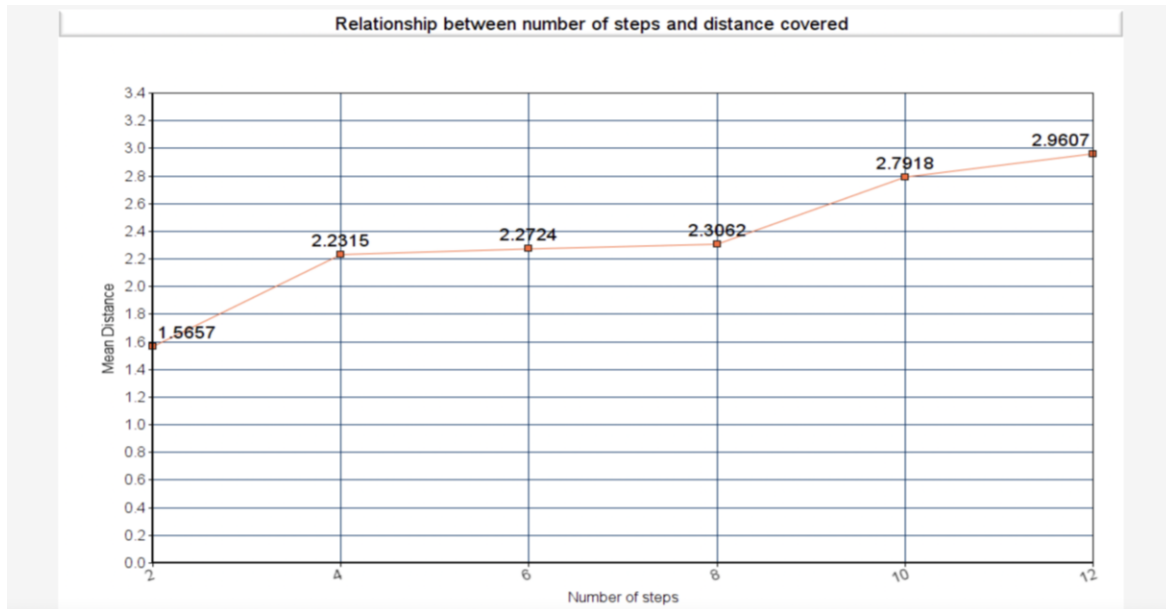
1.Tasks in the assignment:

1. Generate random values for steps taken in any of the 4 directions creating a random walk.
2. Here one move may be (+-1, 0) or (0, +-1).
3. Determining the final position after m steps.
4. Calculating the distance from the origin for m steps. Origin is considered from where the drunkard starts moving).
5. Calculating the mean distance for n ie the number of times the experiment is performed.
6. Running the experiment for 6 different values of m each taken n number of times.
7. Here m=6 ; n=10 thus the experiment was run 60 times.

2. Relationship between 'n' ie the number of steps taken and 'd' ie. the distance covered is

$$\underline{d=\sqrt{n}}$$

3. After running the experiment for 6 different values of number of steps for 10 times each the below graph of mean distance and number of steps is generated.



We notice that $\sqrt{2} = 1.414$, $\sqrt{4} = 2$, $\sqrt{6} = 2.44$, $\sqrt{10} = 3.16$ etc.

The values of mean distance obtained are close to the square root of the number of steps taken by the drunk man which verifies the relationship **$d = \sqrt{n}$** .

4. Code output

```
INFO6205 > src > main > java > edu > neu > coe > info6205 > randomwalk > RandomWalk > main
P... Newton.java x RandomWalk.java x RandomWalkTest.java x
INFO6205 -/IdeaProject: 79 return totalDistance / n;
Run: RandomWalk x
/Library/Java/JavaVirtualMachines/jdk-11.0.12.jdk/Contents/Home/bin/java ...
For experiment number: 1
Final position is: 3,3 and distance is: 4.242640687119285
For experiment number: 2
Final position is: -3,1 and distance is: 3.1622776601683795
For experiment number: 3
Final position is: -1,-1 and distance is: 1.4142135623730951
For experiment number: 4
Final position is: 1,-1 and distance is: 1.4142135623730951
For experiment number: 5
Final position is: 0,-4 and distance is: 4.0
For experiment number: 6
Final position is: -1,-1 and distance is: 1.4142135623730951
For experiment number: 7
Final position is: 0,0 and distance is: 0.0
For experiment number: 8
Final position is: 1,1 and distance is: 1.4142135623730951
For experiment number: 9
Final position is: 0,0 and distance is: 0.0
For experiment number: 10
Final position is: 0,6 and distance is: 6.0
8 steps: 2.3061772596780044 over 10 experiments
Process finished with exit code 0
```

5. All test cases passed successfully.

```
INFO6205 src test java edu neu coe info6205 randomwalk RandomWalkTest
P... Newton.java x RandomWalk.java x RandomWalkTest.java x
INFO6205 -/IdeaProject: 1 1,1,1
Idea 4
Run: RandomWalkTest x
Tests passed: 6 of 6 tests - 197 ms
RandomWalkTest (edu.neu.coe.info6205.randomwalk) 197 ms
  testRandomWalk2 17 ms
  testMove0 3 ms
  testMove1 5 ms
  testMove2 2 ms
  testMove3 6 ms
  testRandomWalk 164 ms
Process finished with exit code 0
```