

**Parvataneni Mohith lalita Kumar (NUID : 001565574)**

## INFO 6205 - Fall 2021

### Assignment No : 1

**Task :** To implement the code for the experiment and to deduce the relationship between the  $d$  and  $n$  of a drunken man from lam post by different types of stochastic experiments

**Relationship Conclusion :** After performing a series of experiments by passing different arguments (5,10,15,20,25,30,35,40), it can be concluded that the Euclidean distance  $d$  of the man from the lamp-post is approximately equal to the square root of the number of steps walked  $n$ .

i.e;  **$d = \sqrt{n}$**

**Evidence to support conclusion :**

**Output Screenshot :**

```

52  * Method to compute the distance from the origin (the lamp-post where the drunkard starts) to his current position.
53  *
54  * @return the (Euclidean) distance from the origin to the current position.
55  */
56  public double distance() {
57      // TO BE IMPLEMENTED
58      double Distance_travelled;
59
60      Distance_travelled = Math.sqrt((Math.pow(x, 2) + Math.pow(y, 2)));
61      return Distance_travelled;
62  }
63
64
65  /**
66   * Perform multiple random walk experiments, returning the mean distance.
67   *
68   * @param m the number of steps for each experiment
69   * @param n the number of experiments to run
70   * @return the mean distance
71   */
72  public static double randomWalkMulti(int m, int n) {
73      double totalDistance = 0;
74      for (int i = 0; i < n; i++) {
75          RandomWalk walk = new RandomWalk();
76          walk.randomWalk(m);
77          totalDistance = totalDistance + walk.distance();
78      }
79      return totalDistance / n;
80  }
81
82  public static void main(String[] args) {
83      if (args.length == 0)
84          throw new RuntimeException("Syntax: RandomWalk steps [experiments]");
85      int m = Integer.parseInt(args[0]);
86      int n = 30;
87      if (args.length > 1) n = Integer.parseInt(args[1]);
88      double meanDistance = randomWalkMulti(m, n);
89      System.out.println(m + " steps: " + meanDistance + " over " + n + " experiments");
90  }
91
92
93

```

Synchronize Git Staging Git Reflog Properties Console Terminal JUnit  
 <terminated> RandomWalk [Java Application] N:\Library\Java\JavaVirtualMachines\jdk-16.0.2.jdk\Contents\Home\bin\java (Sep 15, 2021, 4:39:01 PM - 4:39:09 PM)  
 5 steps: 2.2076720273399544 over 30 experiments

**Evidence:**

I have taken average of  $d$  for 8 different values of  $n$  which is approximately equal to the root of  $n$

*For  $n = 5$*

5 steps: 2.4404351979941117 over 30 experiments  
 5 steps: 2.1599096923727887 over 30 experiments  
 5 steps: 2.0735175294416193 over 30 experiments  
 5 steps: 2.243913706912174 over 30 experiments  
 5 steps: 2.045593451447232 over 30 experiments  
 5 steps: 2.23801675260541 over 30 experiments  
 5 steps: 1.835722243590427 over 30 experiments  
 5 steps: 2.333043476025397 over 30 experiments

Average of  $d = 2.17$

Root of  $n = 2.23$

*For  $n = 10$*

10 steps: 2.8947480625564546 over 30 experiments  
 10 steps: 3.3031225538115407 over 30 experiments  
 10 steps: 2.7363398677471182 over 30 experiments  
 10 steps: 2.86759065482386 over 30 experiments  
 10 steps: 3.2044792087160348 over 30 experiments  
 10 steps: 2.848690170260767 over 30 experiments  
 10 steps: 2.448655977679259 over 30 experiments  
 10 steps: 3.090724617063153 over 30 experiments

Average of  $d = 2.93$ .

Root of  $n = 3.16$

*For  $n = 15$*

15 steps: 3.2114972193200186 over 30 experiments  
 15 steps: 3.3749132604505325 over 30 experiments  
 15 steps: 4.1871307702427645 over 30 experiments

15 steps: 3.2154853829957952 over 30 experiments  
15 steps: 3.136591424071291 over 30 experiments  
15 steps: 3.4490691856370277 over 30 experiments  
15 steps: 3.2417291838771987 over 30 experiments  
15 steps: 2.9586849878432724 over 30 experiments

Average of  $d = 3.35$   
Root of  $n = 3.87$

*For  $n = 20$*

20 steps: 3.9756369410483647 over 30 experiments  
20 steps: 4.254449057098475 over 30 experiments  
20 steps: 3.9263366224308234 over 30 experiments  
20 steps: 4.177243818906746 over 30 experiments  
20 steps: 4.1686999591202 over 30 experiments  
20 steps: 4.281253193774356 over 30 experiments  
20 steps: 4.118946945304919 over 30 experiments  
20 steps: 4.094462286438163 over 30 experiments

Average of  $d = 4.16$   
Root of  $n = 4.47$

*For  $n = 25$*

25 steps: 4.399948095923356 over 30 experiments  
25 steps: 4.29639370548835 over 30 experiments  
25 steps: 4.429085700892974 over 30 experiments  
25 steps: 4.909131363748447 over 30 experiments  
25 steps: 4.832626550055396 over 30 experiments  
25 steps: 4.0115709699359625 over 30 experiments  
25 steps: 4.2966137575891645 over 30 experiments  
25 steps: 4.635201343412346 over 30 experiments

Average of  $d = 4.48$   
Root of  $n = 5$

*For  $n = 30$*

30 steps: 3.996059922783582 over 30 experiments  
30 steps: 5.345150428646176 over 30 experiments  
30 steps: 5.287486569535915 over 30 experiments  
30 steps: 4.967214492364156 over 30 experiments  
30 steps: 5.58599828746368 over 30 experiments  
30 steps: 4.269415673256335 over 30 experiments  
30 steps: 5.407305959578097 over 30 experiments  
30 steps: 4.736065822574432 over 30 experiments

Average of  $d = 4.94$

Root of  $n = 5.47$

*For  $n = 35$*

35 steps: 6.089594378765369 over 30 experiments  
35 steps: 6.0117632501606435 over 30 experiments  
35 steps: 5.880830536636025 over 30 experiments  
35 steps: 4.994999923340216 over 30 experiments  
35 steps: 4.360754598463723 over 30 experiments  
35 steps: 5.274596440475872 over 30 experiments  
35 steps: 4.782787136068371 over 30 experiments  
35 steps: 4.7464631500480685 over 30 experiments

Average of  $d = 5.27$

Root of  $n = 5.91$

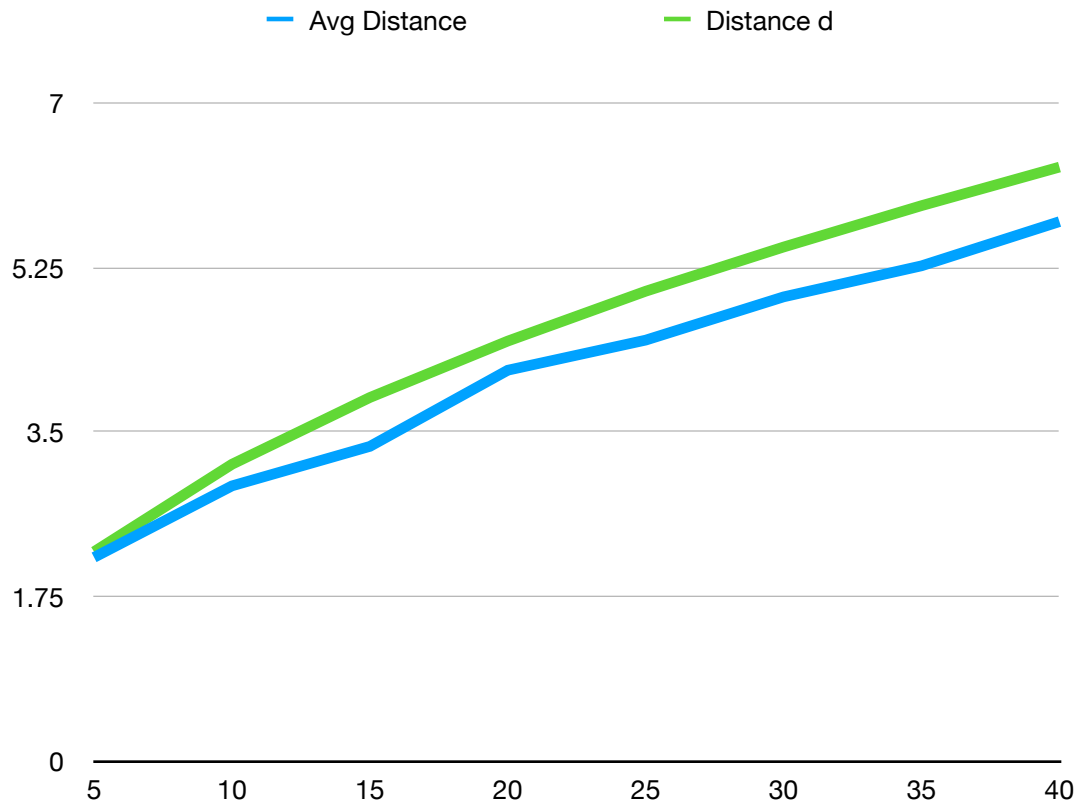
*For  $n = 40$*

40 steps: 5.48471208251342 over 30 experiments  
40 steps: 6.588566448988256 over 30 experiments  
40 steps: 5.62584780794113 over 30 experiments  
40 steps: 5.730634411295168 over 30 experiments  
40 steps: 5.342483268926903 over 30 experiments  
40 steps: 5.317888523824119 over 30 experiments  
40 steps: 5.728873791841779 over 30 experiments  
40 steps: 6.090605349294356 over 30 experiments

Average of  $d = 5.74$

Root of  $n = 6.32$

No. of steps $n$	$d = \sqrt{n}$	Avg distance calculated from experiments	Diff (%)
5	2.23	2.17	2.69
10	3.16	2.93	7.27
15	3.87	3.35	13.43
20	4.47	4.16	6.93
25	5	4.48	10.4
30	5.47	4.94	9.68
35	5.91	5.27	10.8
40	6.32	5.74	9.17



## Unit Tests Result :

The screenshot displays an IDE window with the following components:

- Left Panel (Project Explorer):** Shows a project structure with folders like `resources`, `test`, `edu`, `neu`, `coe`, and `info6205`. The `RandomWalkTest.java` file is selected under the `RandomWalk` folder.
- Editor:** Displays the source code of `RandomWalkTest.java`. The code includes a package declaration, imports, and three test methods: `testMove0()`, `testMove1()`, and `testMove2()`. Each method uses `RandomWalk` and `PrivateMethodTester` to verify specific movements and distances.
- Bottom Panel (JUnit Results):** Shows the execution results of the unit tests. The status bar indicates "Runs: 6/6", "Errors: 0", and "Failures: 0". The test results list includes:
  - `testRandomWalk2 (0.000 s)`
  - `testMove0 (0.000 s)`
  - `testMove1 (0.000 s)`
  - `testMove2 (0.000 s)`
  - `testMove3 (0.000 s)`
  - `testRandomWalk (0.096 s)`