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## INFO 6205 - Assignment 1

### 1) Implementations/Changes Made:

Implemented Methods move, randomWalk and distance. Modified main method to run all experiments in one shot. Also added code to generate CSV.

```
/**
 * Private method to move the current position, that's to say the drunkard moves
 *
 * @param dx the distance he moves in the x direction
 * @param dy the distance he moves in the y direction
 */
private void move(int dx, int dy) {
    this.x += dx;
    this.y += dy;
}

/**
 * Perform a random walk of m steps
 *
 * @param m the number of steps the drunkard takes
 */
private void randomWalk(int m) {
    for (int i = 0; i < m; i++) {
        randomMove();
    }
}
```

```
/**
 * Method to compute the distance from the origin (the lamp-post where the drunkard starts) to his current position.
 *
 * @return the (Euclidean) distance from the origin to the current position.
 */
public double distance() {
    return Math.sqrt(this.x*this.x + this.y*this.y);
}
```

```
public static void main(String[] args) {
    if (args.length == 0)
        throw new RuntimeException("Syntax: RandomWalk steps [experiments]");
    StringBuilder outputBuilder = new StringBuilder();
    outputBuilder.append("No of Steps(n),")
        .append("No of Experiments,")
        .append("Mean Distance (d),")
        .append("\n");

    int n = 25;
    if (args.length > 1) n = Integer.parseInt(args[1]);
    int m = 0;
    for (String s : args[0].split("\\s+")) {
        m = Integer.parseInt(s);
        double meanDistance = randomWalkMulti(m, n);
        System.out.println(m + " steps: " + meanDistance + " over " + n + " experiments");
        outputBuilder.append(m).append(",")
            .append(n).append(",")
            .append(String.format("%.2f", meanDistance)).append("\n");
    }

    try {
        PrintWriter writer = new PrintWriter(
            new FileOutputStream(
                new File("../src/main/java/edu/neu/coe/info6205/randomwalk/random-walk-ekg.csv")
            ));
        writer.write(outputBuilder.toString());
        writer.close();
    } catch (FileNotFoundException e) {
        e.printStackTrace();
    }
}
```

## 2) Conclusion:

From the values obtained from the experiment, by plotting & interpolating the values on a graph it can be observed that the mean distance (d) is approximately equal to square root of no of steps (n).

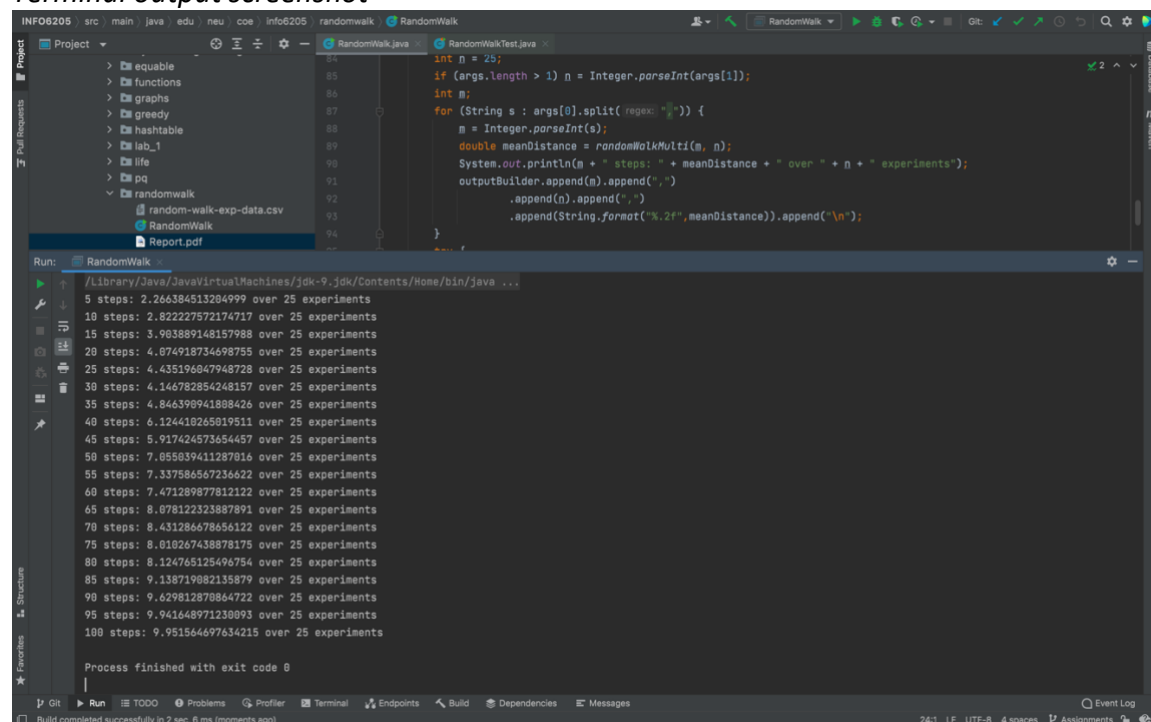
$$d \approx \sqrt{n}$$

Where d = mean Euclidean distance from the lamp, n = number of steps.

## 3) Evidence:

A graph was plotted using the obtained values and then interpolated. The values of an interpolated line are approximately equal to the values of the square root of the number of steps made(n).

### Terminal output screenshot



The screenshot shows an IDE with a project named 'RandomWalk'. The code in 'RandomWalkTest.java' defines a method 'randomWalkMulti' that performs multiple random walks for a given number of steps (n) and calculates the mean distance. The terminal output shows the results of 100 experiments, each with 25 steps, displaying the mean distance for each step count from 5 to 100. The output is as follows:

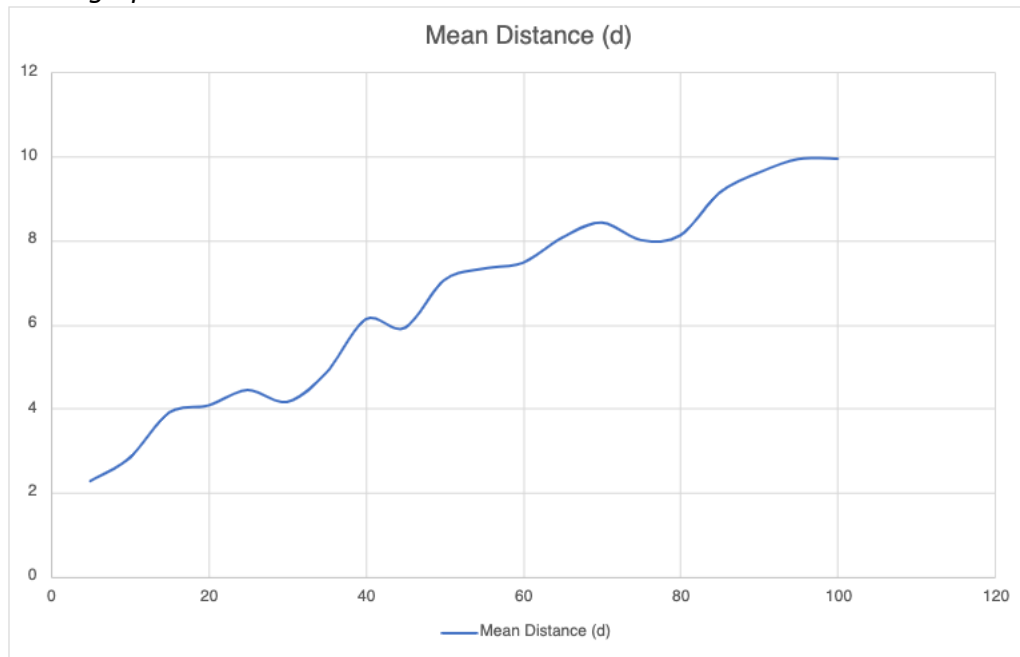
```
5 steps: 2.264384513284999 over 25 experiments
10 steps: 2.822227572174717 over 25 experiments
15 steps: 3.903889148157988 over 25 experiments
20 steps: 4.874918734698755 over 25 experiments
25 steps: 4.435196847948728 over 25 experiments
30 steps: 4.146782854248157 over 25 experiments
35 steps: 4.846398941888426 over 25 experiments
40 steps: 6.124418265019511 over 25 experiments
45 steps: 5.917424573654457 over 25 experiments
50 steps: 7.055839411287816 over 25 experiments
55 steps: 7.337586567236622 over 25 experiments
60 steps: 7.471289877812122 over 25 experiments
65 steps: 8.078122323887891 over 25 experiments
70 steps: 8.431286678655122 over 25 experiments
75 steps: 8.018267438878175 over 25 experiments
80 steps: 8.124765125496754 over 25 experiments
85 steps: 9.138719882135879 over 25 experiments
90 steps: 9.629812870864722 over 25 experiments
95 steps: 9.941648971230093 over 25 experiments
100 steps: 9.951564697634215 over 25 experiments
```

The process finished with exit code 0.

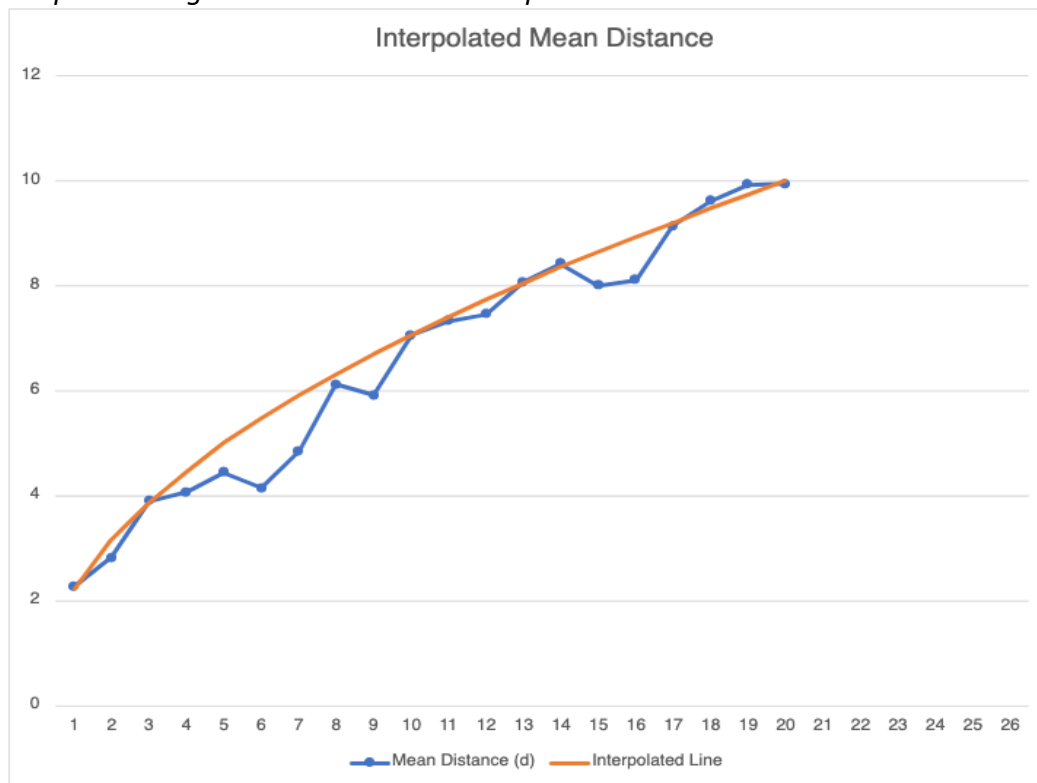
For plotting the graph values are rounded off to 2 decimals.

Excel sheet URL: [https://northeastern-my.sharepoint.com/:x/g/personal/vemula\\_v\\_northeastern\\_edu/EV\\_TYOS0WIJCpAHWZxazdFQBPI9Cf7XNWib5CX3Vjq-pqA?e=b5tAIV](https://northeastern-my.sharepoint.com/:x/g/personal/vemula_v_northeastern_edu/EV_TYOS0WIJCpAHWZxazdFQBPI9Cf7XNWib5CX3Vjq-pqA?e=b5tAIV)

*d vs n graph*



*Graph showing Mean distance and interpolated line*



## 4) Unit Tests:

### Unit tests screenshot

