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Program Structures & Algorithms

Summer 2021

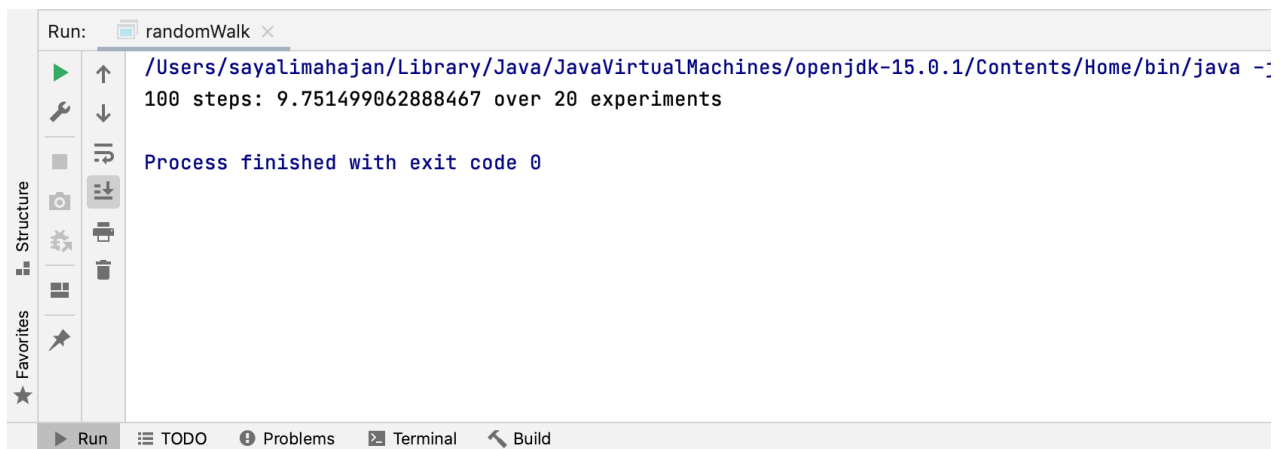
Assignment No. 1

- Task

Task is to deduce the relationship between Euclidean distance (d) and number of steps person has covered from original position (lamp post) to current position. Need to demonstrate this relationship using image or graph. Need to run the experiment for at least six values of n and will run each of these at least ten times.

- Output

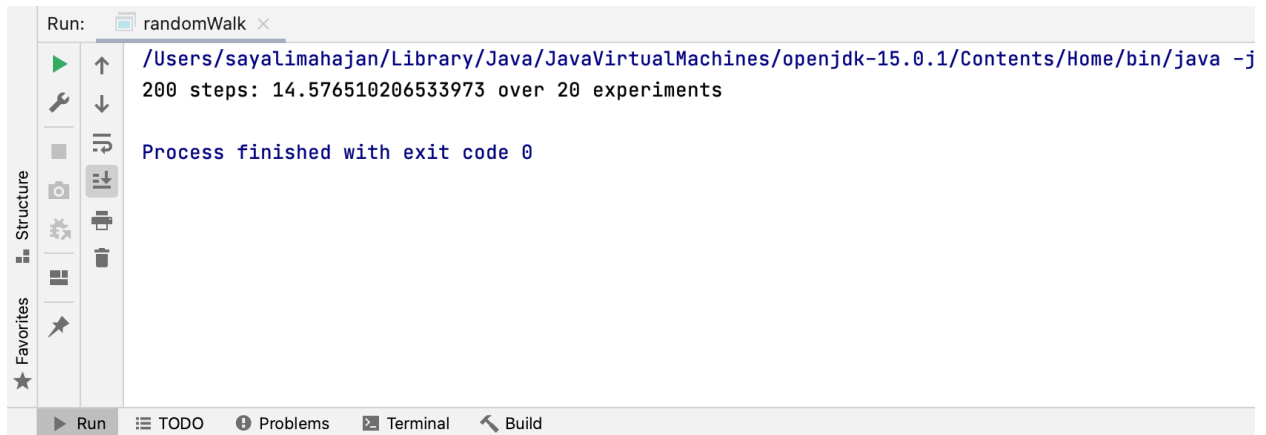
100 Steps 20 Experiments:



```
Run: randomWalk ×  
/Users/sayalimahajan/Library/Java/JavaVirtualMachines/openjdk-15.0.1/Contents/Home/bin/java -;  
100 steps: 9.751499062888467 over 20 experiments  
  
Process finished with exit code 0
```

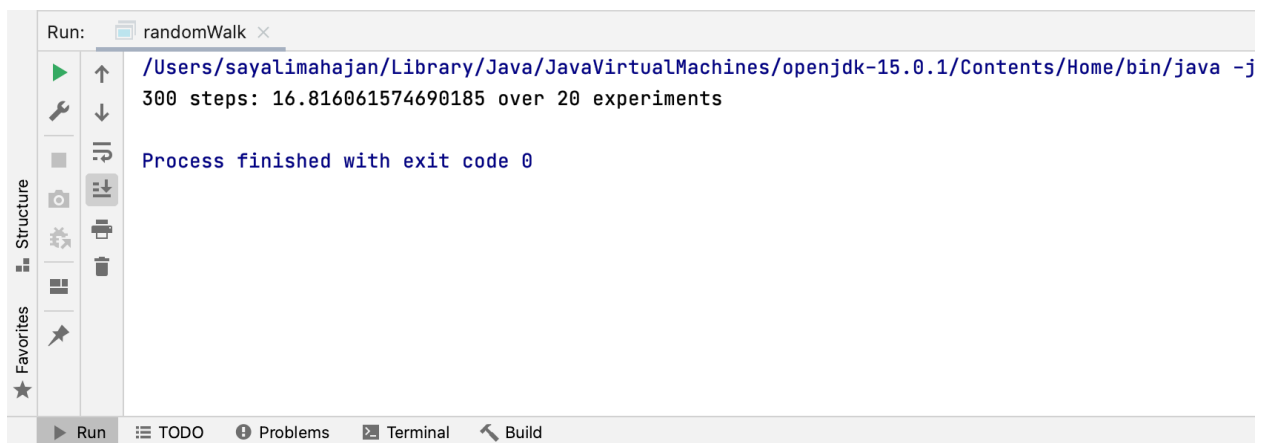
The screenshot shows an IDE interface with a terminal window. The terminal displays the command path for Java, the execution of a program named randomWalk, and the output of 100 steps over 20 experiments, resulting in a value of 9.751499062888467. The process finished with exit code 0. The IDE interface includes a sidebar with 'Structure' and 'Favorites' views, and a bottom bar with 'Run', 'TODO', 'Problems', 'Terminal', and 'Build' tabs.

200 Steps 20 Experiments:



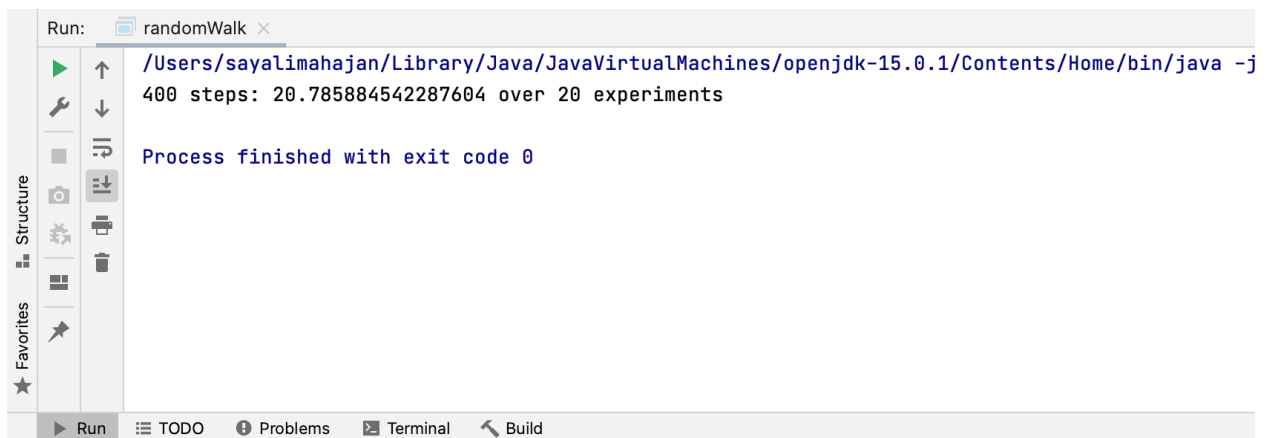
```
Run: randomWalk ×  
  
/Users/sayalimahajan/Library/Java/JavaVirtualMachines/openjdk-15.0.1/Contents/Home/bin/java -j  
200 steps: 14.576510206533973 over 20 experiments  
  
Process finished with exit code 0
```

300 Steps 20 Experiments:



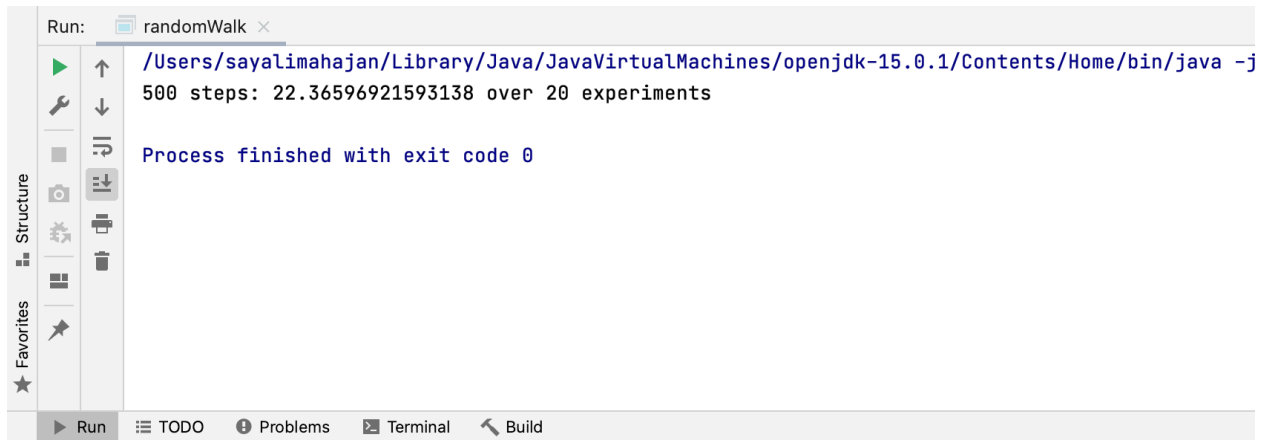
```
Run: randomWalk ×  
  
/Users/sayalimahajan/Library/Java/JavaVirtualMachines/openjdk-15.0.1/Contents/Home/bin/java -j  
300 steps: 16.816061574690185 over 20 experiments  
  
Process finished with exit code 0
```

400 Steps 20 Experiments:



```
Run: randomWalk ×  
  
/Users/sayalimahajan/Library/Java/JavaVirtualMachines/openjdk-15.0.1/Contents/Home/bin/java -j  
400 steps: 20.785884542287604 over 20 experiments  
  
Process finished with exit code 0
```

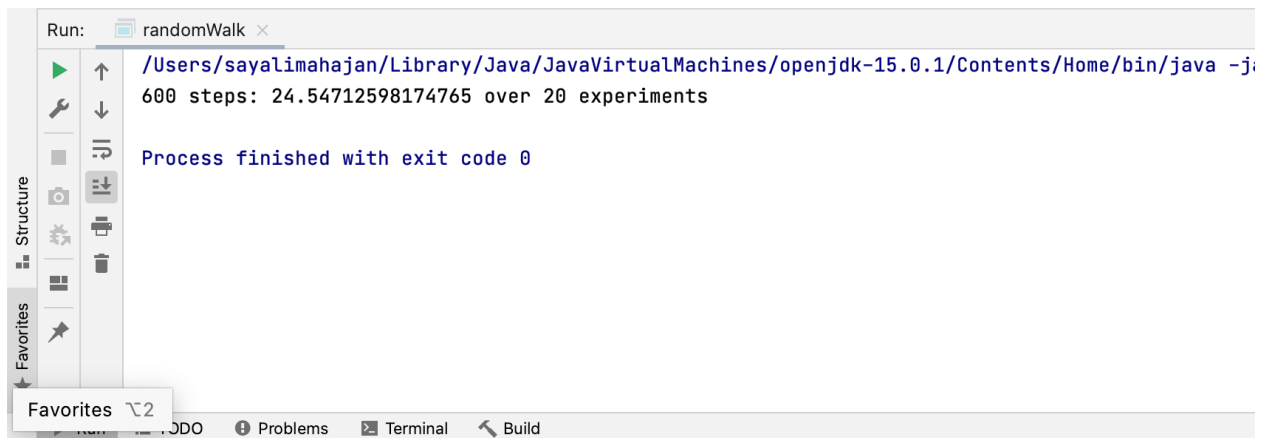
500 Steps 20 Experiments:



```
Run: randomWalk x
/Users/sayalimahajan/Library/Java/JavaVirtualMachines/openjdk-15.0.1/Contents/Home/bin/java -j
500 steps: 22.36596921593138 over 20 experiments

Process finished with exit code 0
```

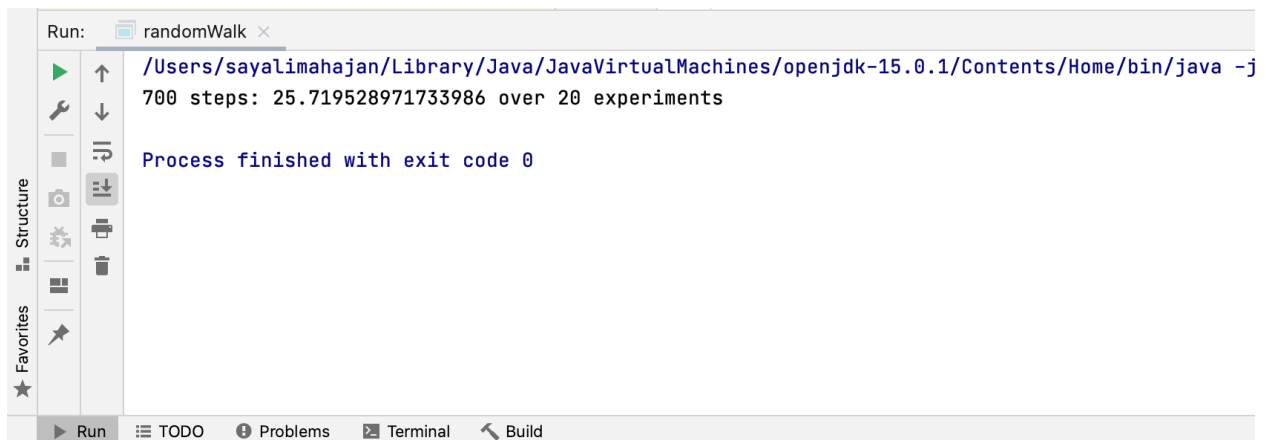
600 Steps 20 Experiments:



```
Run: randomWalk x
/Users/sayalimahajan/Library/Java/JavaVirtualMachines/openjdk-15.0.1/Contents/Home/bin/java -j
600 steps: 24.54712598174765 over 20 experiments

Process finished with exit code 0
```

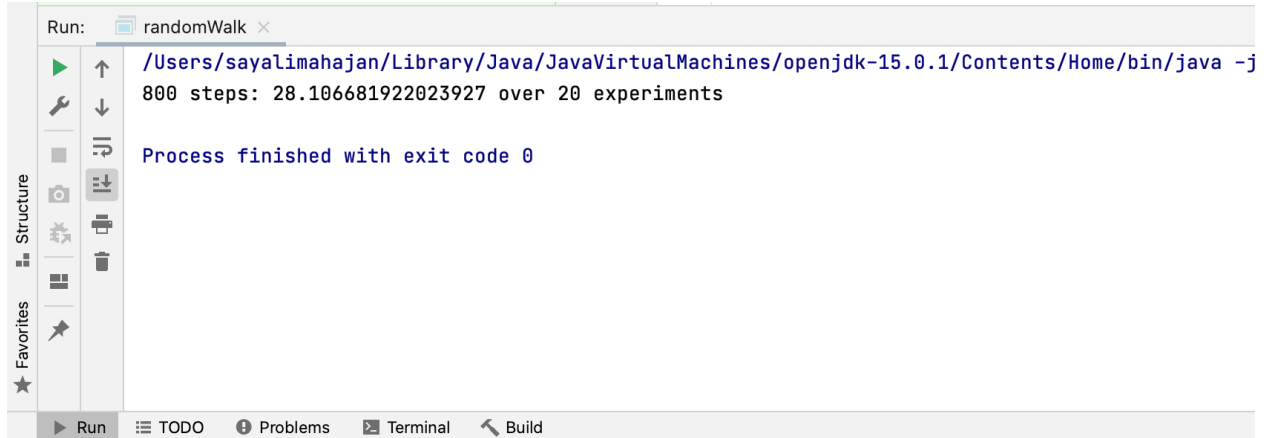
700 Steps 20 Experiments:



```
Run: randomWalk x
/Users/sayalimahajan/Library/Java/JavaVirtualMachines/openjdk-15.0.1/Contents/Home/bin/java -j
700 steps: 25.719528971733986 over 20 experiments

Process finished with exit code 0
```

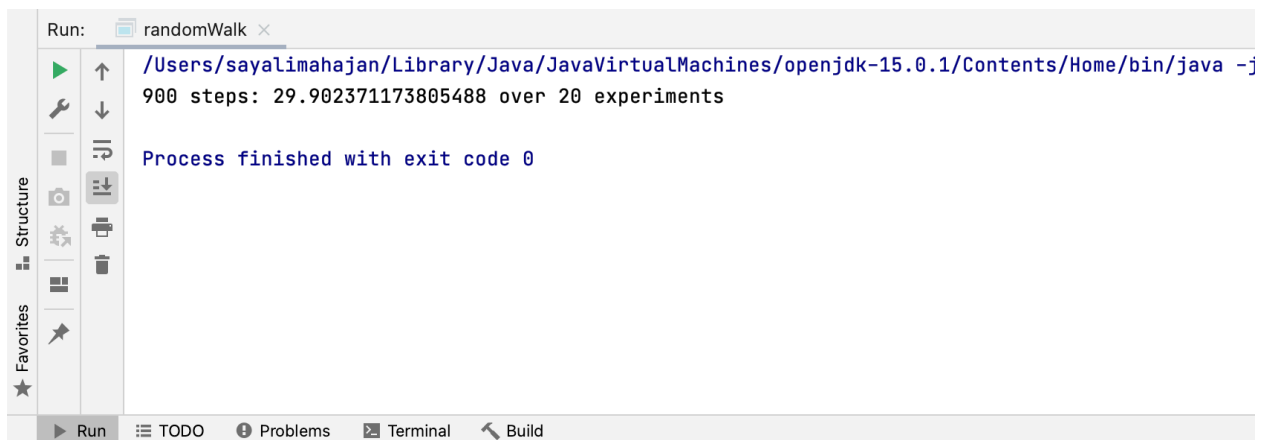
800 Steps 20 Experiments:



```
Run: randomWalk x
/Users/sayalimahajan/Library/Java/JavaVirtualMachines/openjdk-15.0.1/Contents/Home/bin/java -j
800 steps: 28.106681922023927 over 20 experiments

Process finished with exit code 0
```

900 Steps 20 Experiments:



```
Run: randomWalk x
/Users/sayalimahajan/Library/Java/JavaVirtualMachines/openjdk-15.0.1/Contents/Home/bin/java -j
900 steps: 29.902371173805488 over 20 experiments

Process finished with exit code 0
```

• Relationship Conclusion

Above experiments indicates that the distance (d) from origin to current position calculated is approximately square root of number of steps taken (n)

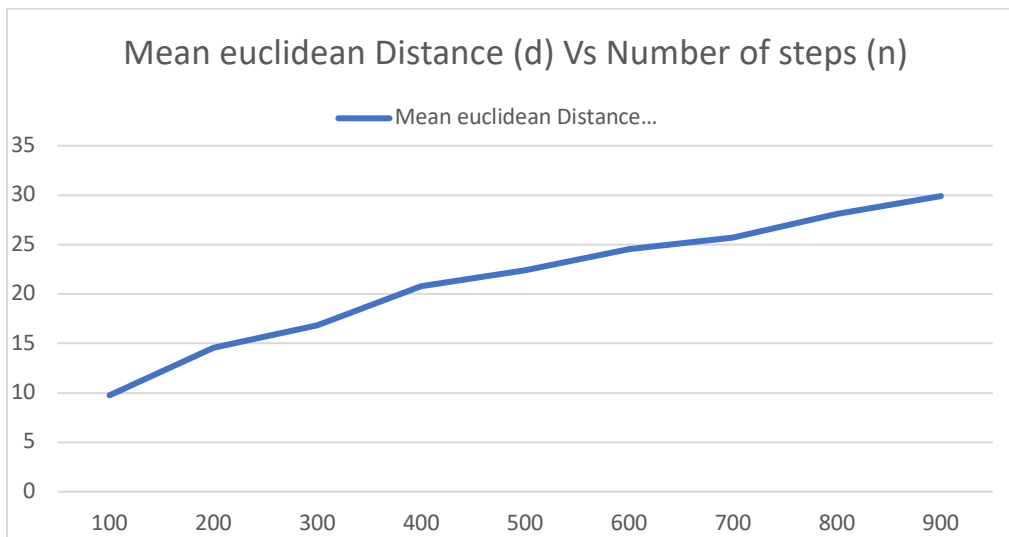
$$d=\sqrt{n}$$

where d is mean Euclidean distance & n is number of steps.

- Evidence to support the conclusion

| Number of steps(n) | Number of experiments | Mean of Euclidean distance (d) |
|--------------------|-----------------------|--------------------------------|
| 100 | 20 | 9.75 |
| 200 | 20 | 14.57 |
| 300 | 20 | 16.82 |
| 400 | 20 | 20.79 |
| 500 | 20 | 22.37 |
| 600 | 20 | 24.55 |
| 700 | 20 | 25.72 |
| 800 | 20 | 28.11 |
| 900 | 20 | 29.90 |

- Graphical representation



- Unit tests result

