

Program Structures & Algorithms

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Assignment No. 1

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- Task: Random Walk
- Output screenshot

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<terminated> RandomWalk (Java Application) /Library/Java/JavaVirtualMachines/jdk-17.0.1.jdk/Contents/Home/bin/java (Feb 1, 2022, 9:54:06 AM - 9:54:07 AM)
[1 times runs] Step: 1
Move ( 1, 0 ) After ( 1, 0 )
Step: 2
Move ( 1, 0 ) After ( 2, 0 )
Step: 3
Move ( 0, -1 ) After ( 2, -1 )
Step: 4
Move ( -1, 0 ) After ( 1, -1 )
Step: 5
Move ( 0, 1 ) After ( 1, 0 )
Step: 6
Move ( 0, -1 ) After ( 1, -1 )
[2 times runs] Step: 1
Move ( 0, -1 ) After ( 0, -1 )
Step: 2
Move ( 1, 0 ) After ( 1, -1 )
Step: 3
Move ( -1, 0 ) After ( 0, -1 )
Step: 4
Move ( 0, 1 ) After ( 0, 0 )
Step: 5
Move ( 0, -1 ) After ( 0, -1 )
Step: 6
Move ( 1, 0 ) After ( 1, -1 )
[3 times runs] Step: 1
Move ( 1, 0 ) After ( 1, 0 )
Step: 2
Move ( 1, 0 ) After ( 2, 0 )
Step: 3
Move ( 0, 1 ) After ( 2, 1 )
Step: 4
Move ( -1, 0 ) After ( 1, 1 )
Step: 5
Move ( -1, 0 ) After ( 0, 1 )
Step: 6
Move ( 1, 0 ) After ( 1, 1 )
[4 times runs] Step: 1
Move ( 1, 0 ) After ( 1, 0 )
Step: 2
Move ( 1, 0 ) After ( 2, 0 )
Step: 3
Move ( 0, -1 ) After ( 2, -1 )
Step: 4
Move ( -1, 0 ) After ( 1, -1 )
Step: 5
Move ( 0, 1 ) After ( 1, 0 )
Step: 6
Move ( 0, 1 ) After ( 1, 1 )
[5 times runs] Step: 1
Move ( 0, -1 ) After ( 0, -1 )
Step: 2
Move ( 1, 0 ) After ( 1, -1 )
Step: 3
Move ( -1, 0 ) After ( 0, -1 )
Step: 4
Move ( 0, -1 ) After ( 0, -2 )
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Step: 5
Move ( 0, -1 ) After ( 0, -3 )
Step: 6
Move ( 0, -1 ) After ( 0, -4 )
[6 times runs] Step: 1
Move ( 0, -1 ) After ( 0, -1 )
Step: 2
Move ( 1, 0 ) After ( 1, -1 )
Step: 3
Move ( 1, 0 ) After ( 2, -1 )
Step: 4
Move ( -1, 0 ) After ( 1, -1 )
Step: 5
Move ( -1, 0 ) After ( 0, -1 )
Step: 6
Move ( 1, 0 ) After ( 1, -1 )
[7 times runs] Step: 1
Move ( -1, 0 ) After ( -1, 0 )
Step: 2
Move ( 0, -1 ) After ( -1, -1 )
Step: 3
Move ( 0, -1 ) After ( -1, -2 )
Step: 4
Move ( -1, 0 ) After ( -2, -2 )
Step: 5
Move ( 0, 1 ) After ( -2, -1 )
Step: 6
Move ( 1, 0 ) After ( -1, -1 )
[8 times runs] Step: 1
Move ( -1, 0 ) After ( -1, 0 )
Step: 2
Move ( 0, 1 ) After ( -1, 1 )
Step: 3
Move ( 1, 0 ) After ( 0, 1 )
Step: 4
Move ( -1, 0 ) After ( -1, 1 )
Step: 5
Move ( 1, 0 ) After ( 0, 1 )
Step: 6
Move ( 0, -1 ) After ( 0, 0 )
[9 times runs] Step: 1
Move ( 1, 0 ) After ( 1, 0 )
Step: 2
Move ( 0, 1 ) After ( 1, 1 )
Step: 3
Move ( 0, 1 ) After ( 1, 2 )
Step: 4
Move ( 1, 0 ) After ( 2, 2 )
Step: 5
Move ( 0, 1 ) After ( 2, 3 )
Step: 6
Move ( 0, -1 ) After ( 2, 2 )
[10 times runs] Step: 1
Move ( -1, 0 ) After ( -1, 0 )
Step: 2

```

```

[10 times runs] Step: 1
Move ( -1, 0 ) After ( -1, 0 )
Step: 2
Move ( -1, 0 ) After ( -2, 0 )
Step: 3
Move ( -1, 0 ) After ( -3, 0 )
Step: 4
Move ( -1, 0 ) After ( -4, 0 )
Step: 5
Move ( 0, -1 ) After ( -4, -1 )
Step: 6
Move ( 1, 0 ) After ( -3, -1 )
6 steps: 1.8475986159153142 over 10 experiments

```

Relationship Conclusion

If you multiply the number of steps by ten, the distance will be roughly tripled

- Evidence / Graph

1 steps: 1.0 over 10 experiments

10 Steps: 2.7628968604236084 over 10 experiments

100 Seps: 11.91252458699898 over 10 experiments

1000 steps: 34.15720121289838 over 10 experiments

10000 steps: 98.64928184161637 over 10 experiments

100000 steps: 251.6052130123441 over 10 experiments

1000000 steps: 705.850690315702 over 10 experiments

10000000 steps: 2787.2327099682525 over 10 experiments

100000000 steps: 7906.183915606302 over 10 experiments

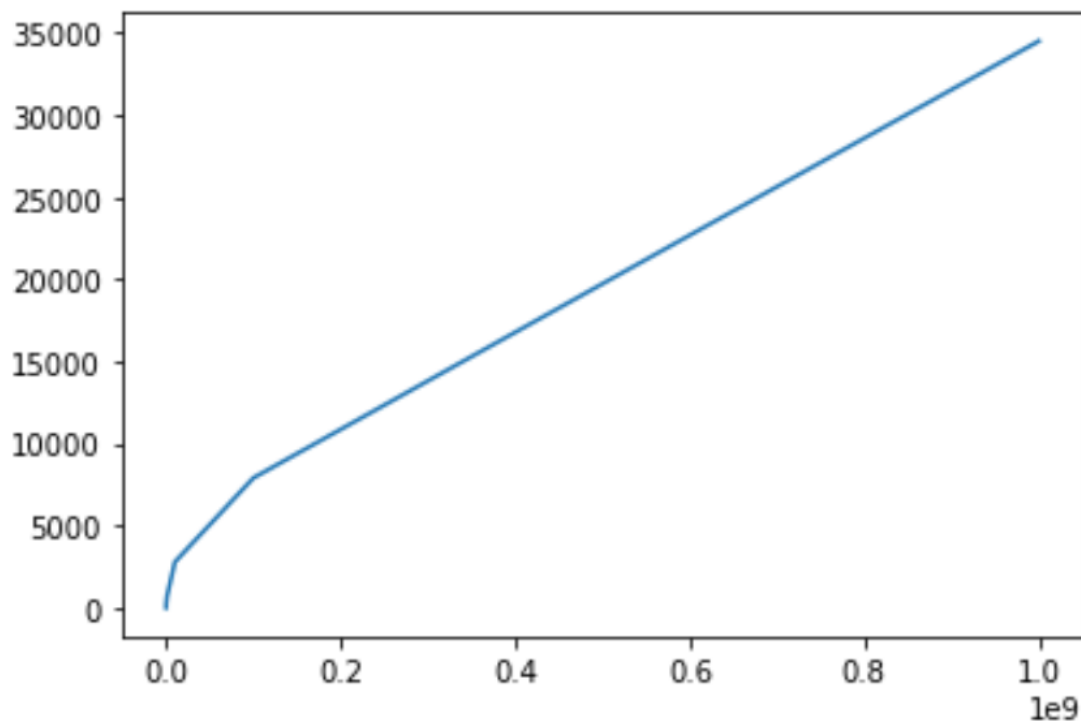
1000000000 steps: 34496.29480877763 over 10 experiments

```
[[9.85160244e+16 3.35239517e+12]
 [3.35239517e+12 1.16279403e+08]]
```

```

/Users/mchighlight/opt/anaconda3/lib/python3.9/site-
operators.py:36: FutureWarning: Pass the following var
s: x, y. From version 0.12, the only valid positional
ata`, and passing other arguments without an explic
in an error or misinterpretation.
    warnings.warn(

```



- **Unit tests result**

