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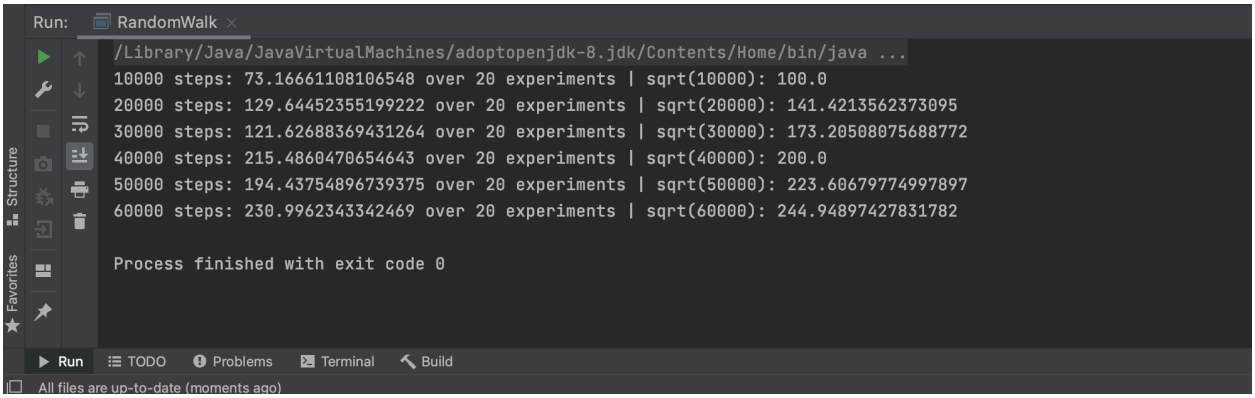
Program Structures & Algorithms

Spring 2021

Assignment No. 1

- **Task :** Deducing the relationship between distance(d) and steps taken(n) for the Random Walk algorithm in 2D space.

- **Output**



- **Relationship Conclusion:** From my analysis I believe distance(d) tends to $\sqrt{n}$ as the number of experiments increases. It does seem to go above and below $\sqrt{n}$ but mostly revolves around this value.

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

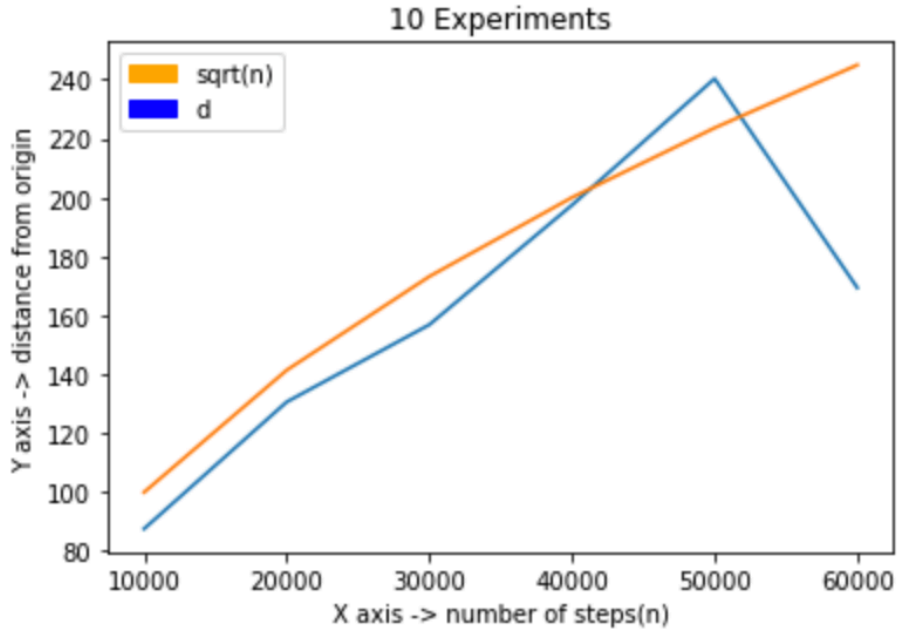
- **Evidence to support the conclusion:** I have tabulated the value of distance from origin(d), total steps taken(n), $\sqrt{n}$ and number of experiments to see the trend to establish that $d \approx \sqrt{n}$

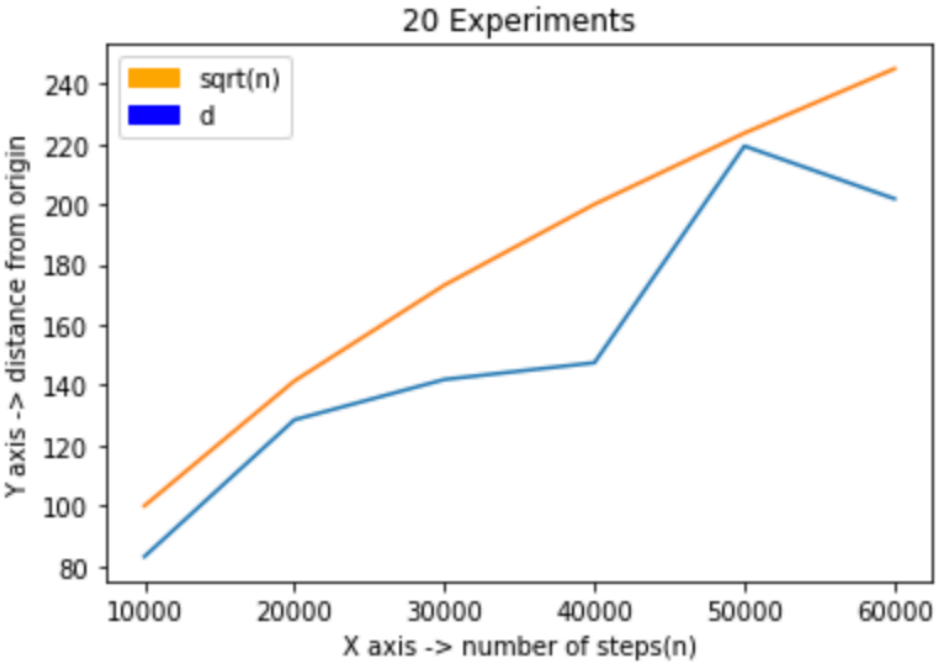
	no of steps	d	sqrt(n)	no of experiments
0	10000	87.599381	100.000000	10
1	20000	130.640500	141.421356	10
2	30000	156.844697	173.205081	10
3	40000	197.418640	200.000000	10
4	50000	240.325248	223.606798	10
5	60000	169.398240	244.948974	10

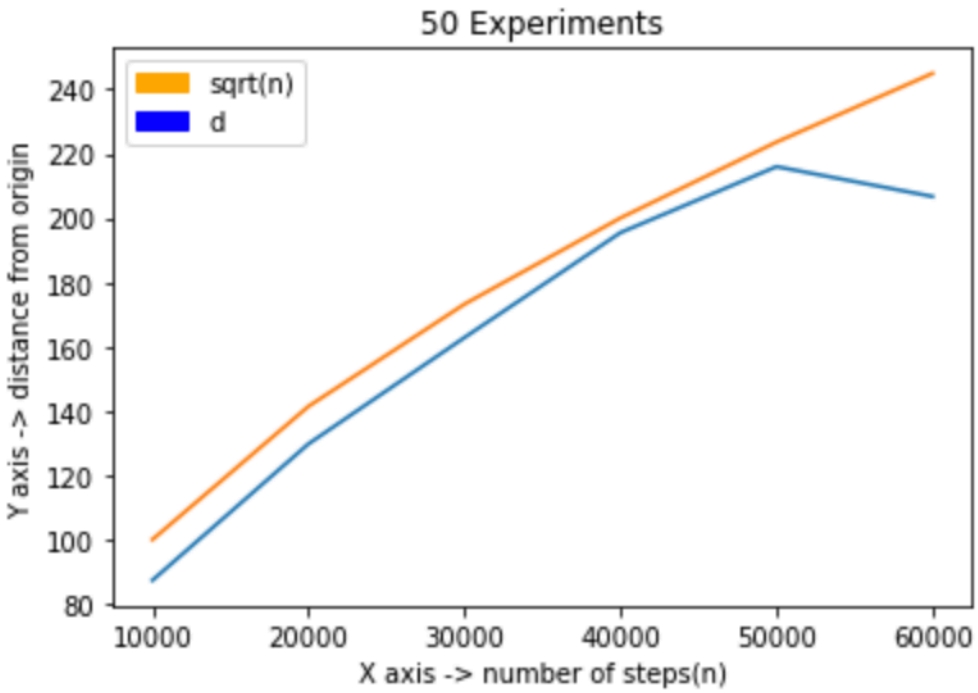
	no of steps	d	sqrt(n)	no of experiments
0	10000	83.175622	100.000000	20
1	20000	128.531647	141.421356	20
2	30000	141.909917	173.205081	20
3	40000	147.448028	200.000000	20
4	50000	219.317182	223.606798	20

	no of steps	d	sqrt(n)	no of experiments
0	10000	87.346398	100.000000	50
1	20000	129.753245	141.421356	50
2	30000	162.818828	173.205081	50
3	40000	195.443042	200.000000	50
4	50000	215.965151	223.606798	50
5	60000	206.677797	244.948974	50

- **Graphical representation:** We can get a better idea from the graphs that the $d \approx \sqrt{n}$. This is clearer when the number of experiments increases







- **Unit tests result:**