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**Program Structures & Algorithms**

**Fall 2021**

**Assignment No. 1**

* **Task (List down the tasks performed in the Assignment)**

1. **Implement the uncompleted functions (move, randomWalk, and distance function).**
2. **Raise an assumption about the relationship between and ;**
3. **Design necessary experiments and show evidence to support the relationship;**
4. **Provide a screen shot of the unit tests all passing.**

* **Relationship Conclusion:**
* **Evidence to support the conclusion:**
* **Step 1: Do an experiment for observing.**
  + **Let steps range from to . For each , do 1000 random trials to reduce the bias.**
  + **Text

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  + **It is obvious that when or , .**
  + **When , let’s assume .**
  + **It is easy to prove in a mathematical way for and . Thus, the following steps will mainly focus on the cases.**
* **Step 2: Plot a graph for analysis.**
  + **The green dots stand for , while the blue dots stand for the actual data from the experiment of *Step 1*.**
  + **Chart, histogram

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  + **We can observe that the blue dots are always below the green dots. If holds, some of the blue dots should above the green dots.**
  + **Let’s add trendlines.**
  + **Histogram

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  + **It is clearer that . But the shapes of the two graphs are similar.**
  + **Thus, let’s assume where is a constant.**
* **Step 3: Do an experiment to obtain an average value of .**
  + **The experiment is quite the same as that of *Step 1*. For each steps , we calculate the constant . Finally, we can obtain an average value of .**
  + **A black screen with white text

    Description automatically generated with low confidence**
  + **Thus, .**
* **Step 4: Do an experiment to prove the assumption is acceptable.**
  + **Similar to the experiment of *Step 3, instead of calculating the average value of , we calculate the standard deviation where***
  + **By repeating it for 20 times, we obtain an average value of the standard deviation.**
  + **Text

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  + **is an acceptable bias.**
  + **From the graph, it can also show that the 2 curves are fitting.**
  + **Chart, line chart

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* **Step 5: Conclusion**
* **Unit tests result: All PASS.**

Text

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