RESEARCH TRACK 2

Title: STATISTICAL ANALYSIS

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Introduction

This is a report which compares my code My_Repository and professor's code rt2 branch Prof._Repository and provides a detailed statistical analysis based on the time taken by a robot to cover a lap, number of collisions made by the robot and finally the distance travelled. Before taking the data a NULL HYPOTHESIS and an ALTERNATIVE HYPOTHESIS is proposed and then certain tests are conducted to prove or disprove the null hypothesis.

Data Collection

The data is collected on 6 different maps which contain 2, 3, 5, 7, 9, 11 as number of silver_tokens. A robot is made to run twice on each map. The whole analysis is based on three different data, which are as follows:-

1.) Time: "The less the time taken to complete the lap the better algorithm used". Time for each robot run is recorded using the "time python" function from terminal, then a mean time of the two readings is taken for further analysis. Both the robots were not able to successfully complete any of the two laps for 11 token map, Thus by default it is considered that the time taken and distance travelled by robots is equal to 0.

2.) Number of collisions: "The less times a robot collides more safe it is, thus a better algorithm". Number of collisions are observed manually for each lap and then again mean value is considered.

3.) Distance Travelled: "The less distance travelled the better the algorithm". Note that there was no specific function for determining distance travelled, so (time*speed) is used to find out distance travelled. As mentioned above 0 distance means the robots weren't able to successfully complete even a single lap out of the the two runs.

To make the analysis fair speed of professor's robot is reduced and matched with speed of my robot

Data Analysis

Null Hypothesis: H_o = My robot performs better than professors robot.
Alternative Hypothesis: H_a = Professor's robot performs better than my robot.

Significance level: The level of significance is chosen to be 5%, since looking at my data for execution time and distance covered it seems to be lot more fluctuating than professor's execution time for completing the lap.

Figure 1: Execution times of my code and prof code

Since there are data values, an overall mean and standard deviation of the data can be taken and then a paired T-test can be easily performed. Another reason for choosing this test is that robots are run on each track twice, therefore, better results can be expected.
The results from the paired T-test shows that H_o has to be rejected and on the contrary H_a has to be expected since we get a **T-statistic: 1.4975545590790063 and P-value: 0.1484602878328056**, since it can be seen that p-value gives almost 14% indicating the dif-

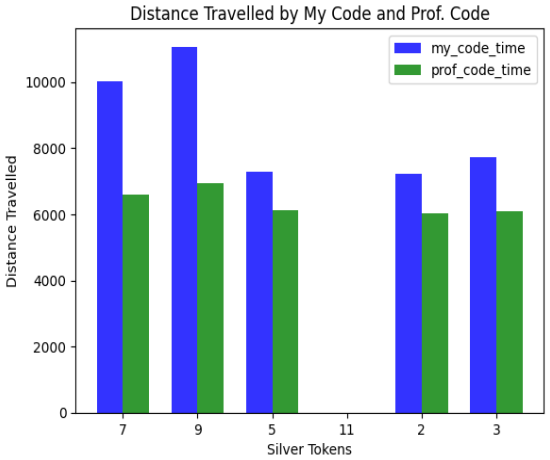

Figure 2: Distance Travelled by My Code and Prof. Code

ference between the means is not that significant from the data where 0 is considered. So, we run another paired T-test excluding the 0 and got **T-statistic: 5.638964843369027 and P-value: 0.0003180412235241155**. and now the P-value suggests easily to discard H_o and thus automatically except H_a.
For the distance travelled we get **T-statistic: 1.497554559079006 and p-value: 0.14846028783280574** again suggesting that the distance mean difference between the two robots is not significant including the 0. So, again we discard the 0 which indicates that robot never completed the lap. We get better and satisfactory results **T-statistic: 4.287710031208971 and p-value: 0.0004430064870561576**3 again suggesting to discard H_o.
Looking at the graph below for number of collisions again it is clear that algorithm that professor's robot uses is way better than my algorithm making H_o to be discarded.

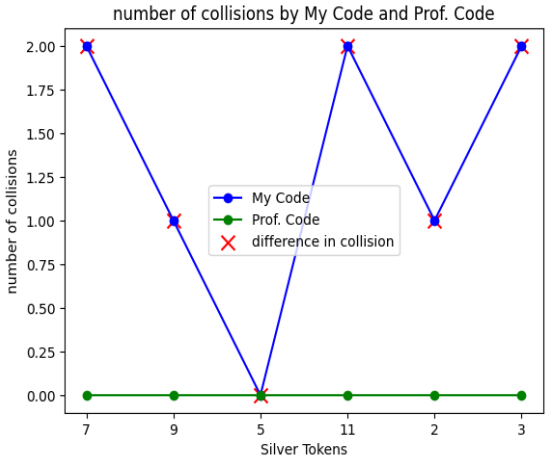

Figure 3: number of collisions by My Code and Prof. Code

Result

From the above analysis it is clear that Algorithm used by professor to run the robot is much better since it takes less time travels less distance and also has 0 collision with the wall.