

1. STATISTICAL ANALYSIS

1.1. INTRODUCTION

The task of this project is to statistically determine the superiority between two distinct algorithms in accomplishing a specific task. The specific task in this case is a simulation of a robot in a pygame environment with the objective of completing laps through the designed track, while occasionally moving silver tokens through its lifting mechanism to a spot behind it, as it makes its way through the circuit.

1.2. APPROACH

Given the python environment, the two algorithms - One given by the professor, and one from a student (Which I will refer to as Algorithm-P and Algorithm-S respectively) - compared pass instructions to the robot in the simulated environment to move through the circuit while grabbing and dropping silver tokens and avoiding golden tokens. A clear indication of performance - considering all environment variables remain constant (token positions and robot starting point) will be the time factor. A measure of the time between each silver token grabbing and releasing events can be measured, as they distinctively define the amount of distance travelled due to their being equally spaced within the environment, and the efficiency of task execution, and overall time taken to lap the circuit. For this experiment, we will consider the results with a level of significant of and above 5%

1.3. HYPOTHESIS

We will appreciate the results with the given hypotheses moving forward:

- Null hypothesis: Algorithm-P is faster than Algorithm-S
- Alternative Hypothesis: Algorithm-S is faster than Algorithm-P

1.4. DATA

60 observations of each algorithm were observed with the time(s) taken to complete the robot tasks. Each observation was obtained automatically through embedding instructions in the python script to save time data. The following are the first 5 observations of Algorithm-S and Algorithm-P respectively.

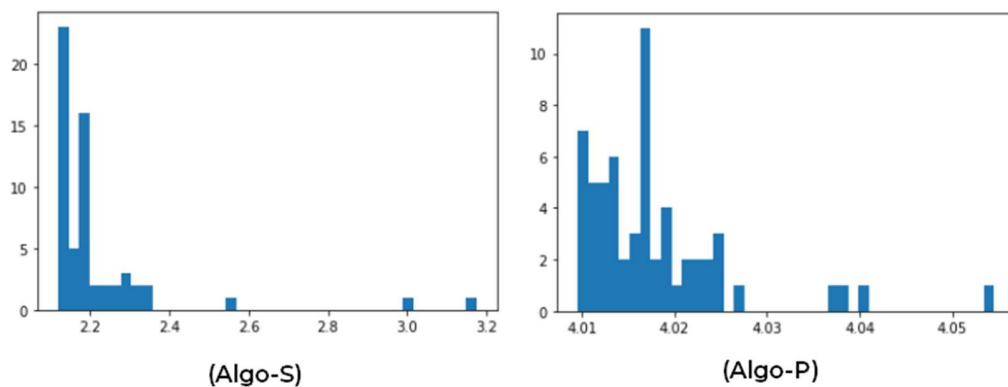
	time(s)
0	2.166024
1	2.152169
2	2.203467
3	2.131859
4	2.193075

(Algo-S)

	time(s)
0	4.009535
1	4.019174
2	4.054525
3	4.010038
4	4.014200

(Algo-P)

It is immediately apparent that Algorithm-S has time superiority over Algorithm-P, exhibiting lower runtimes and hence ending the lap faster.



Observing the histogram which shows the distribution of lap times, it is also apparent that Algorithm-S maintains most observations in the lower timings, and is less sparsely distributed, while Algorithm-P distributes more over several bins, and can be described as less finetuned.

1.5. RESULTS & CONCLUSIONS

For statistical analysis and evaluation of our results, the T-test has been selected. Using the SciPy library, the `ttest_rel` method was used to give required results corresponding to a two-tailed test.

The outcomes:

- t-value: -76.55989940503063
- p-value: 0.0

Where the p-value is less than our significance value and with a negative t-value, the null hypothesis will be rejected and the alternative sustained.