Università di Genova

RESEARCH TRACK – II

STATISTICAL ANALYSIS

(RT2-ASSIGNMENT 1)

SUBMITTED TO

PROF. CARMINE RECCHIUTO

An Analysis Report by,

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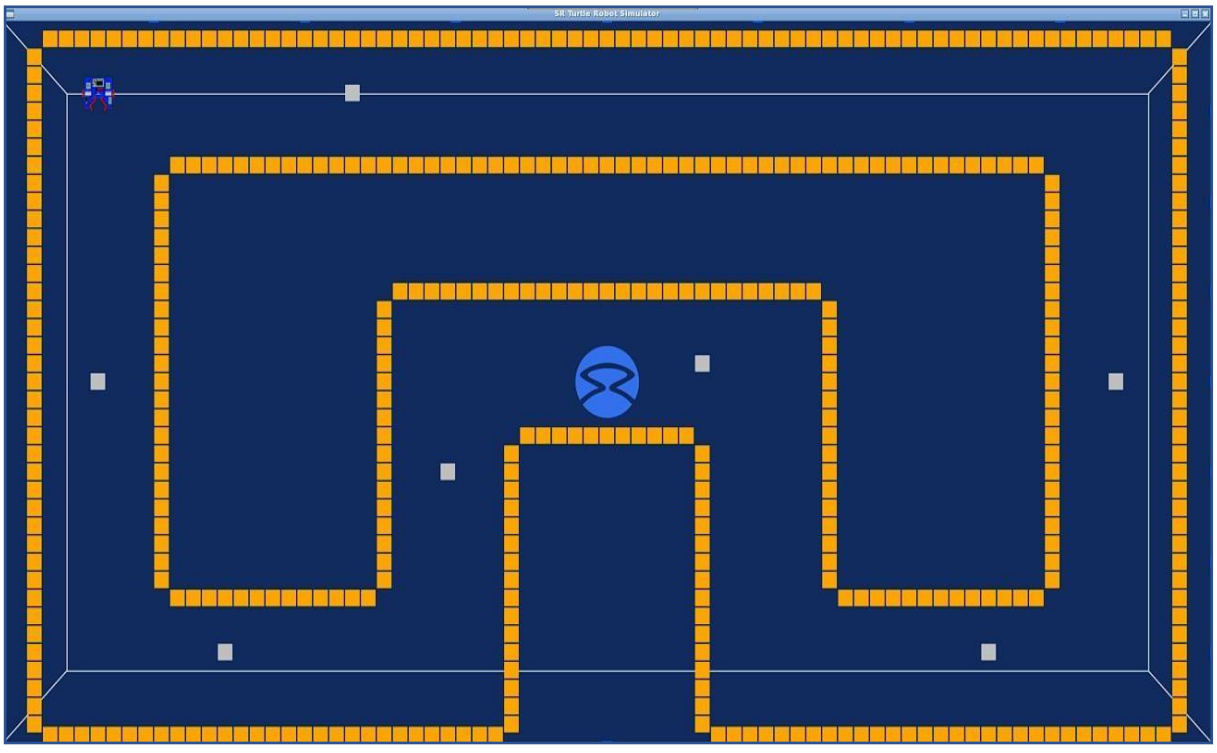
ABSTRACT

This report highlights the Performance of a statistical analysis on the first assignment of the RESEARCH TRACK-1, considering two different implementations of solutions (My code & professor's code) and testing which one performs better, when silver tokens are randomly placed in the environment in the circuit given. For this task the first assignment of the Research track – 1 is being considered. The Assignment-1 in RESEARCH TRACK-1, mainly concentrates on simulating the robot on the python simulator for executing a given task. In this, the robot must travel in the counterclockwise direction by grabbing up the nearest silver token and placing those silver token behind by turning the robot in any preferred direction without affecting the environment. The professor's code is referred from (CarmineD8/python_simulator at rt2 (github.com)). My code is referred from the submitted assignment (https://github.com/krishanttharun98/turtlebot).

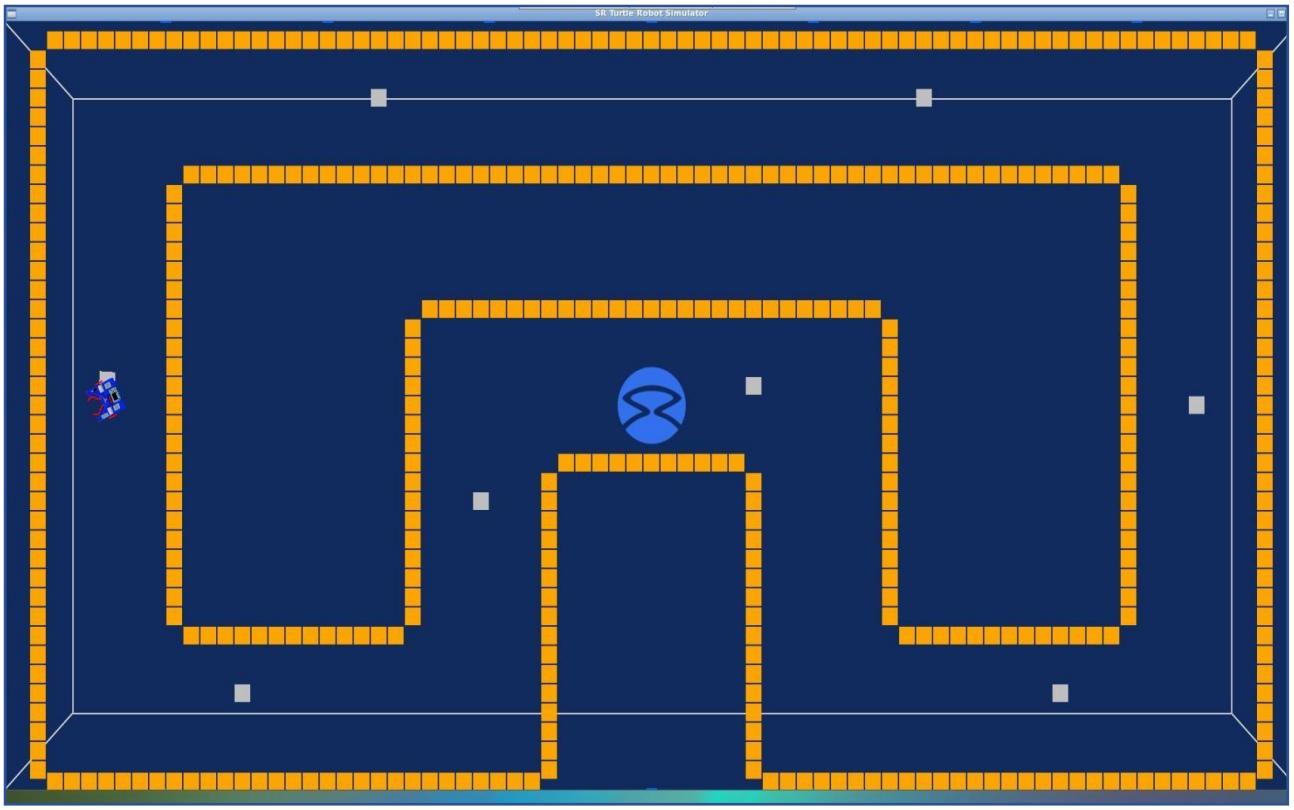
INTRODUCTION:

This report highlights the Performance of a statistical analysis on the first assignment of the RESEARCH TRACK-1, considering two different implementations of solutions (My code & professor's code) and testing which one performs better, when silver tokens are randomly placed in the environment in the circuit given.

The first assignment mainly concentrates on simulating the robot on the python simulator for executing a given task. In this, the environment consists of two different tokens. GOLDEN TOKEN - represents the wall in which the robot should avoid contact or collision with the wall. The SILVER TOKEN – represents the task to be carried out by the robot by grasping it and placing it behind the robot. With these criteria the robot should function within the environment.



This image represents the pygame environment, in which the robot is in its initial position



This image represents the additional silver token replaced for taking the observations

As discussed, these are the two different implementations in which the statistical analysis for testing the behaviours is carried out in different aspects.

FACTORS CONSIDERED & ANALYSIS:

To evaluate the performance we consider,

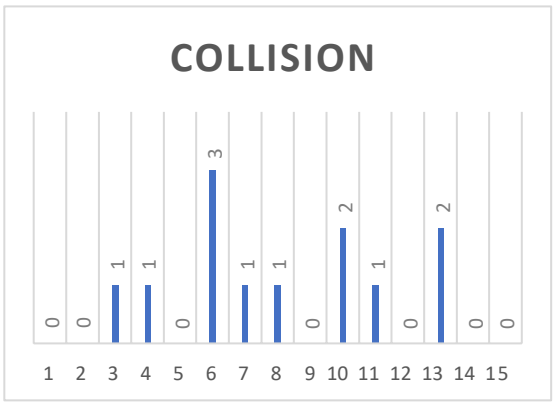
- the percentage of crashes
- collisions with the walls
- robot going in the wrong direction.
- the average time required to finish the circuit.
- the distance from the obstacles

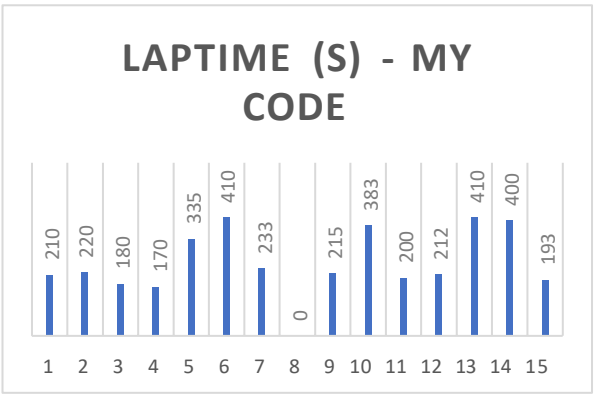
  These factors are being considered by adding up the silver tokens at the preferred location in the environment. These obstacles can be added by modifying the file: robot-sim/sr/robot/arenas/sunny_side_up_arena.py.

INDIVIDUAL ANALYSIS

MY CODE

No.of.observationas	COLLISION	WRONG DIRECTION	LAP (S)	TOKENS MISSED
1	0	0	210	1
2	0	0	220	0
3	1	1	180	1
4	1	1	170	1
5	0	1	335	1
6	3	2	410	1
7	1	0	233	1
8	1	failed	0	1
9	0	0	215	1
10	2	1	383	1
11	1	1	200	1
12	0	0	212	0
13	2	1	410	1
14	0	0	400	1
15	0	0	193	0
		mean or average	251.4	





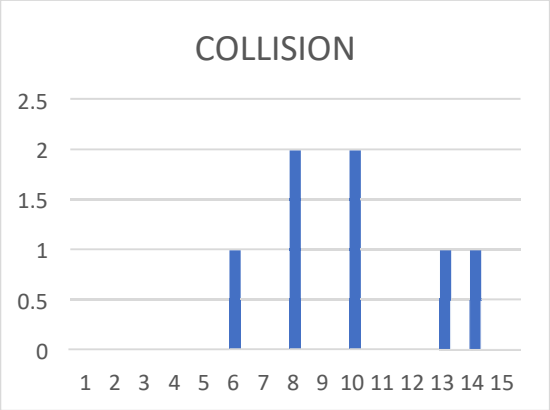
t-Test: Two-Sample Assuming Unequal Variances

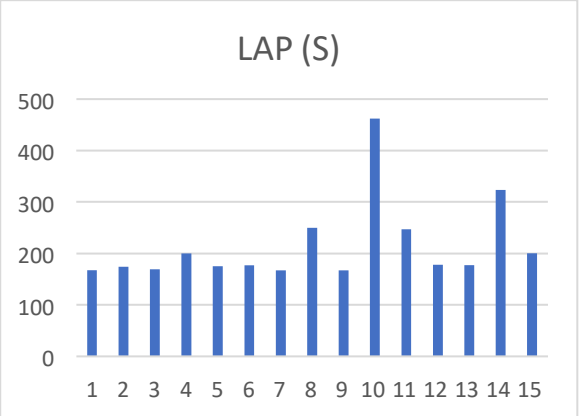
	MY CODE	
std. deviation	Mean	251.4
114.5150021	Variance	13113.69
	Observations	15
	Hypothesized Mean Di	15
	df	14
	t Stat	7.995225
	P(T<=t) one-tail	6.9E-07
	t Critical one-tail	1.76131
	P(T<=t) two-tail	1.38E-06
	t Critical two-tail	2.144787

INDIVIDUAL ANALYSIS

PROFESSORS CODE

No.of.observationas	COLLISION	WRONG DIRECTION	LAP (S)	TOKENS MISSED
1	0	0	167	0
2	0	0	174	0
3	0	0	169	0
4	0	1	200	1
5	0	0	175	0
6	1	0	177	0
7	0	0	167	0
8	2	rotating	250	2
9	0	0	167	0
10	2	1	462	1
11	0	1	247	1
12	0	0	178	0
13	1	0	177	0
14	1	1	323	1
15	0	0	200	0
		mean or average	215.5333	

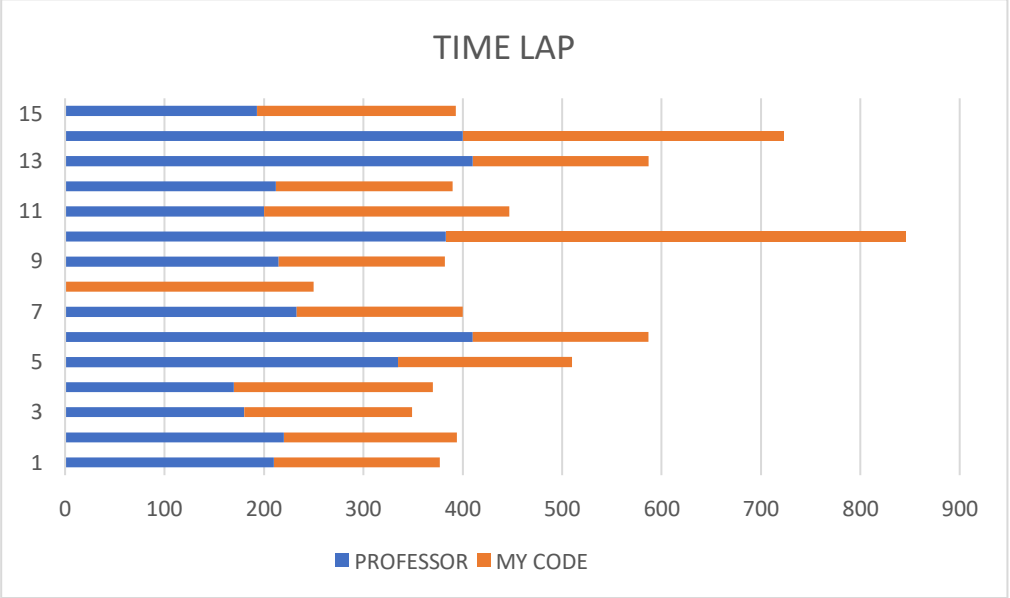




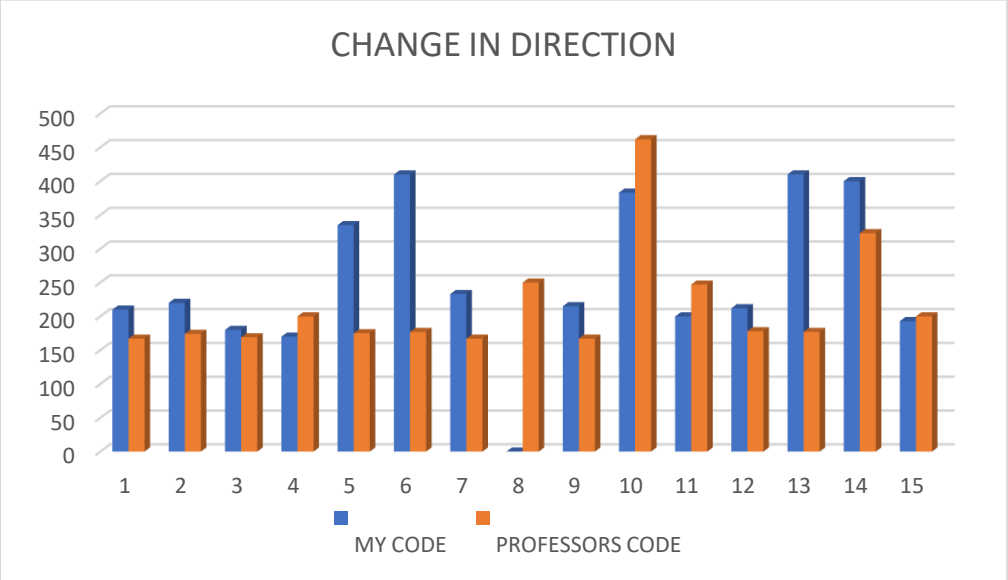
t-Test: Two-Sample Assuming Unequal Variances

	PROFESSORS CODE	
	Mean	215.5333
std. deviation	Variance	6566.695
81.0351	Observations	15
	Hypothesized Mean Di	15
	df	14
	t Stat	9.584264
	P(T<=t) one-tail	7.88E-08
	t Critical one-tail	1.76131
	P(T<=t) two-tail	1.58E-07
	t Critical two-tail	2.144787

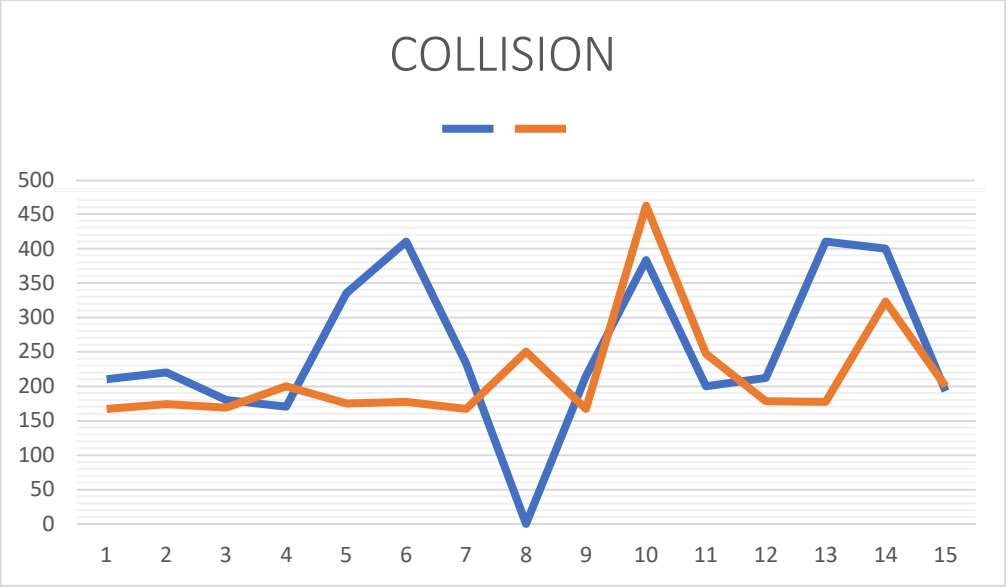
COMBINED ANALYSIS (PROFESSOR CODE vs MYCODE)



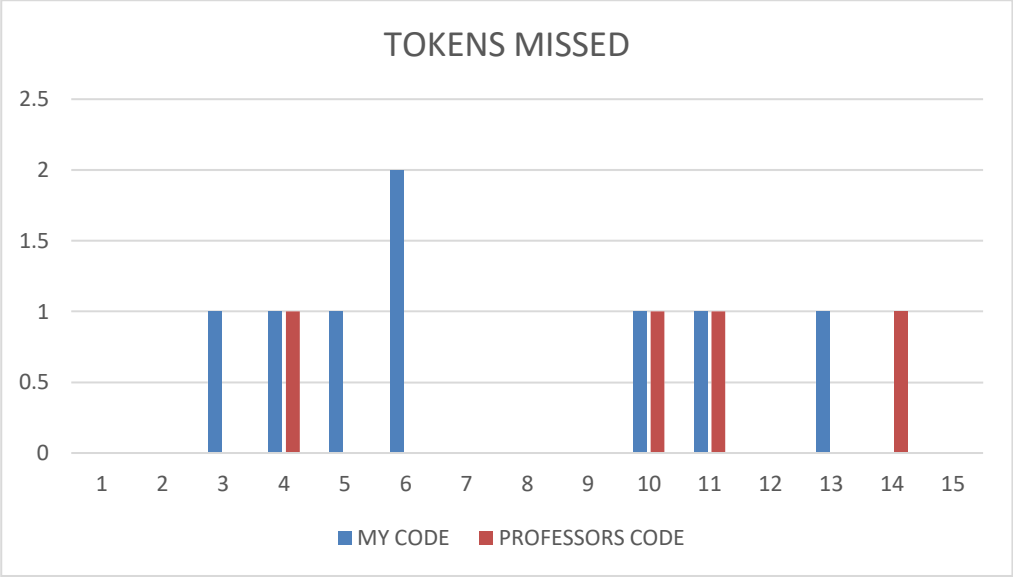
This graph represents the time difference between my code and the professors code for each lap. A total 30 observations were carried out. 15 observations for mine and rest for the professor's code. My code exhibited more run time than professor's code.



This graph represents the change in direction of the robot in the enironment. Silver Tokens placed near the wall is not that recognised by the robot. Both the implementations failed to pick and place the token behind. Some part of the observation was executed successfully.



Out of 15 observations carried out with my code, my implementations had more collision than the professor's code. This graph represents the collision of the robot according to the time lap (at which time the collision was made during the lap) instead of showing how many times it was colloided.



This graph represents the tokens missed at the specific time during the lap. These are some of the data's observed during this analysis.

CONCLUSIONS:

With the help of the provided formulas, we can be able to compute the follows-
sigma_pooled^2 =9840.18632
Standard deviation error (sigma_x1 – sigma_x2) = 36.2218

From the above data statistical analysis, we can be able to conclude that the t-test value for both professor's and my code is greater than t critical two tail value (2.145). Hence it falls on the rejection region in our t- distribution graph and the confidence level are 95% we can reject the null hypothesis (Ho). Therefore, there is a statistical difference between professor's and my code, my code consumes more time than his code.