Minimal LaTeXexample

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1 Introduction

1.1 Motivation

2 Method

We'll probably use Rastrigin's Function[2]:

$$f(x) = A \cdot n + \sum_{i=1}^{n} \left[x_i^2 - A \cdot cos(2\pi x_i) \right], A = 10, x_i \in [-5.12, 5.15]$$

3 Experiments

Some of the experiments we have tried as part of the optimization problem.

1. Genetic algorithm
   (a) Low crossover probability:
      - crossover probability: 0.1
      - bit mutation probability: 0.01
      - chromosome mutation probability: 0.1
      - selection: roulette

   (b) High crossover probability:
      - crossover probability: 0.6
      - bit mutation probability: 0.01
      - chromosome mutation probability: 0.1
      - selection: roulette

2. Hill Climbing
   (a) best selection
   (b) first selection

3. Hybrid Hill Climbing
   (a) 1a with 2a

4 Results

4.1 Griewangk

Experiment	Min	Max	Mean
1a	11.26	28.92	17.30
1b	12.33	29.62	19.89
2a	2.56-09	2.56-09	2.56-09
2b	0.03	2.56-09	0.40
3a	0.001	2.56-09	0.04

Figure 1: minimum, maximum and the mean values for each experiment

4.1.1 Genetic Algorithm

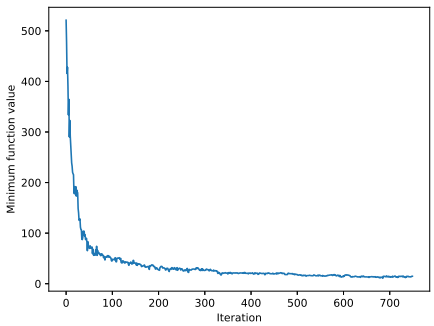

Figure 2: Function value

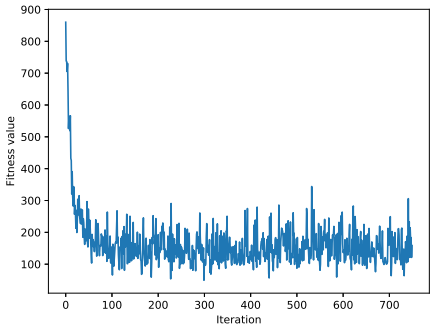

Figure 3: Fitness value

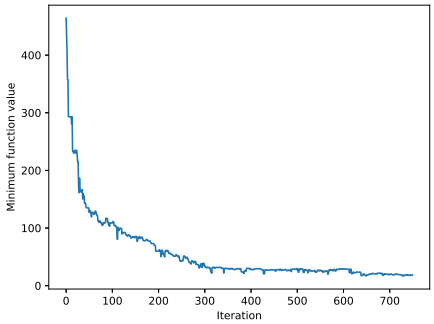

Figure 4: Function value

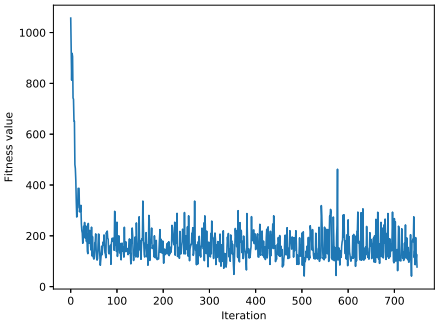

Figure 5: Fitness value

4.1.2 Hill Climbing

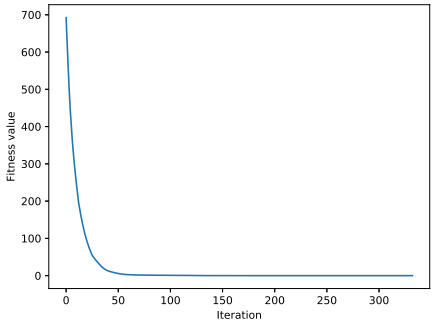

Figure 6: Best improvement

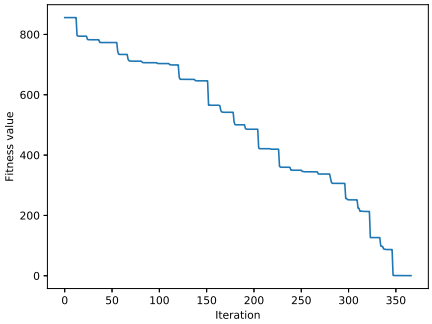

Figure 7: First improvement

4.1.3 Hybrid

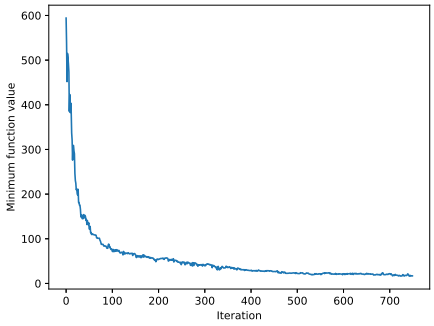

Figure 8: Genetic algorithm

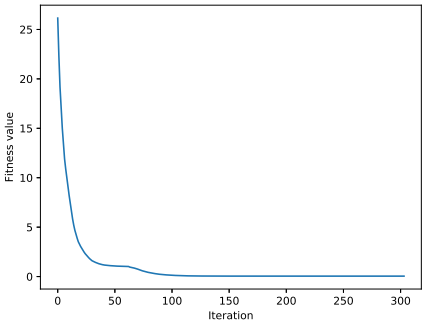

Figure 9: Hill Climbing

4.1.4 Interpretation

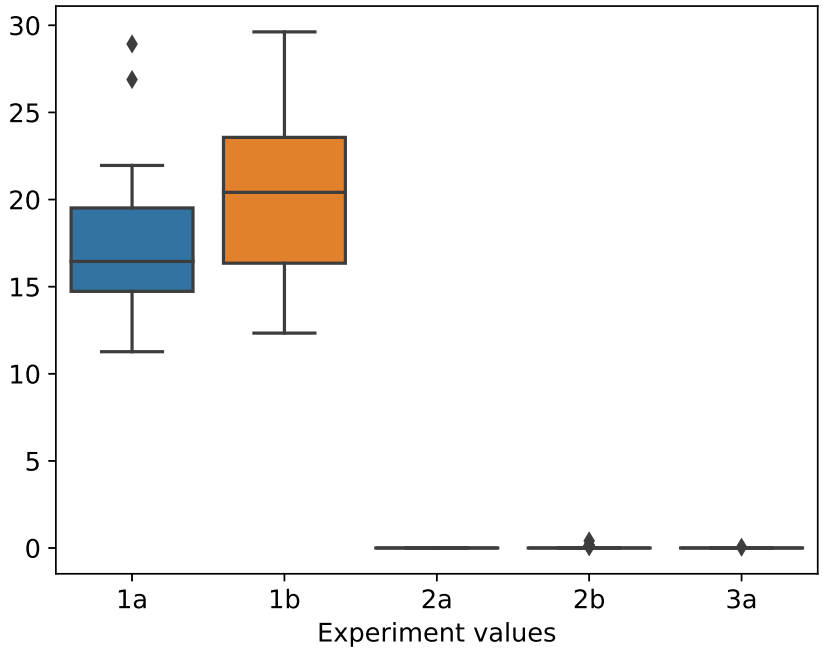

Figure 10: Griewangk experiments boxplot

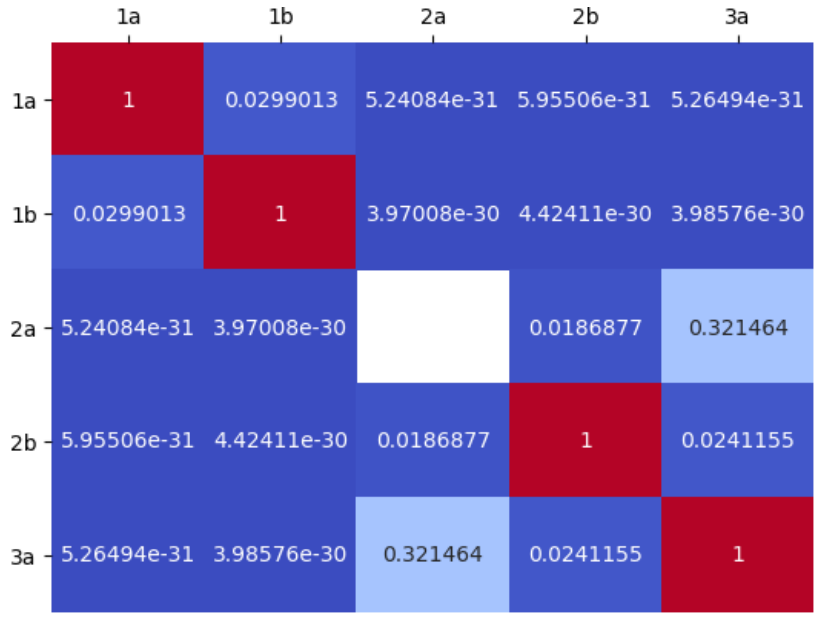

Figure 11: Griewangk experiments t test matrix

Observations We can observe in Fig. 10 that the experiments 1a and 1b have the worst results but we can't really say which of the other three is the best. The t test does not give a significant p value to affirm that the experiments means differ.

4.2 Rastrigin

Experiment	Min	Max	Mean
1a	44.09	85.05	64.57
1b	50.77	107.90	76.33
2a	26.78	59.28	44.77
2b	50.97	76.22	57.91
3a	24.30	39.43	32.16

Figure 12: minimum, maximum and the mean values for each experiment

4.2.1 Genetic Algorithm

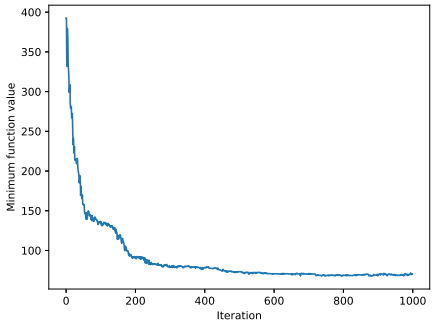

Figure 13: Function value

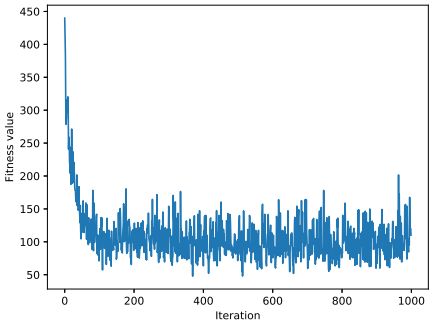

Figure 14: Fitness value

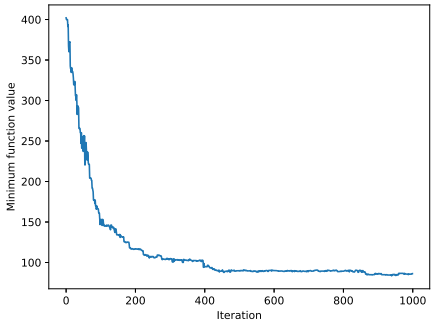

Figure 15: Function value

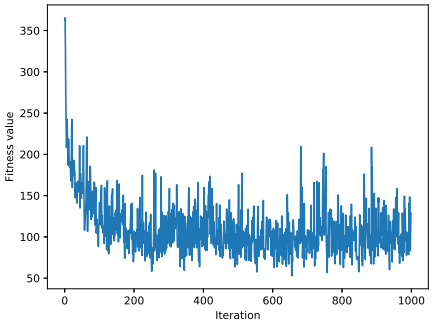

Figure 16: Fitness value

4.2.2 Hill Climbing

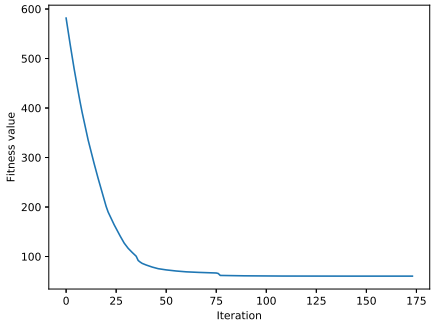

Figure 17: Best improvement

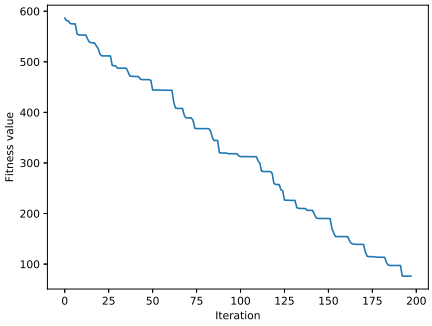

Figure 18: First improvement

4.2.3 Hybrid

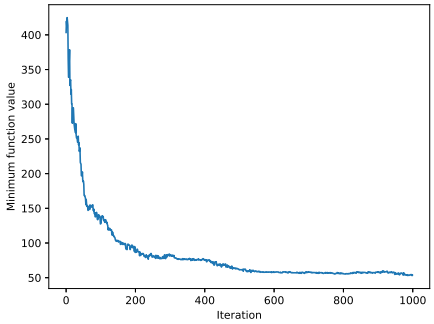

Figure 19: Genetic algorithm

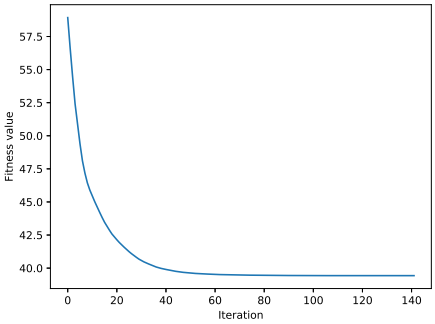

Figure 20: Hill Climbing

4.2.4 Interpretation

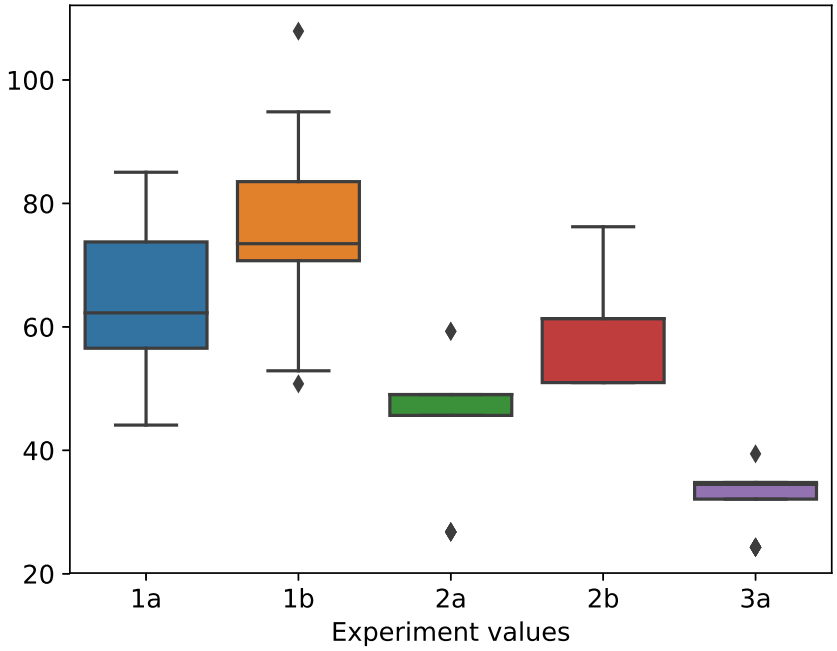

Figure 21: Rastrigin experiments boxplot

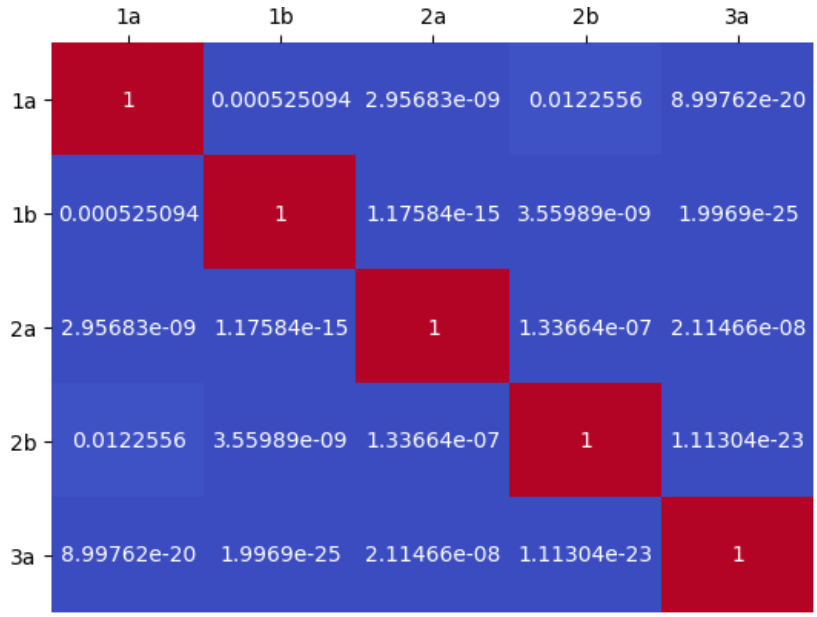

Figure 22: Rastrigin experiments t test matrix

Observations We can observe in Fig. 21 that the experiment 3a goes to the best minimum value. This conclusion is also verified using t test. We can see that in Fig. 22 which shows the p value between experiments.

4.3 Rosenbrock

Experiment	Min	Max	Mean
1a	154.07	398.18	253.27
1b	109.52	382.73	272.65
2a	28.13	122.93	37.68
2b	25.25	132.46	33.21
3a	23.09	136.88	26.88

Figure 23: minimum, maximum and the mean values for each experiment

4.3.1 Genetic Algorithm

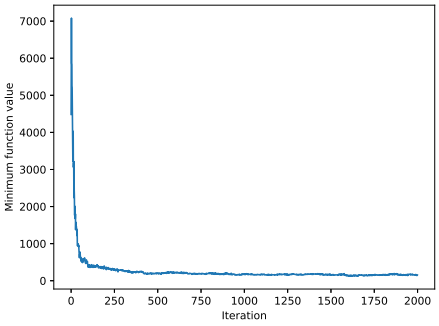

Figure 24: Function value

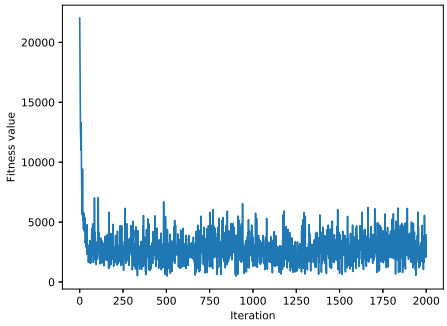

Figure 25: Fitness value

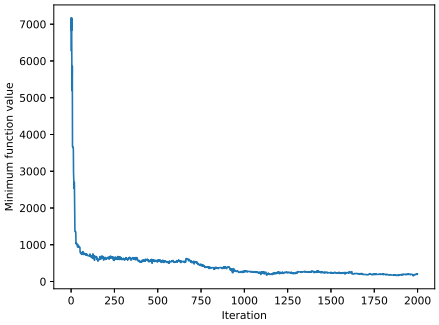

Figure 26: Function value

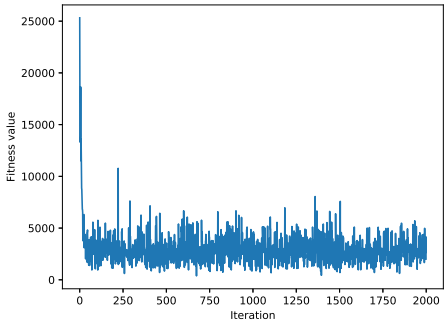

Figure 27: Fitness value

4.3.2 Hill Climbing

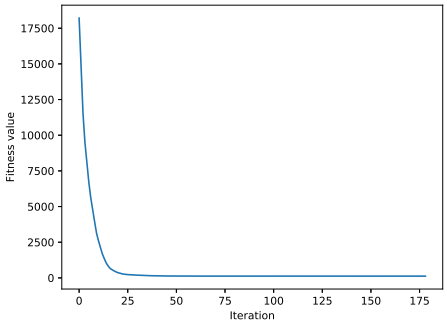

Figure 28: Best improvement

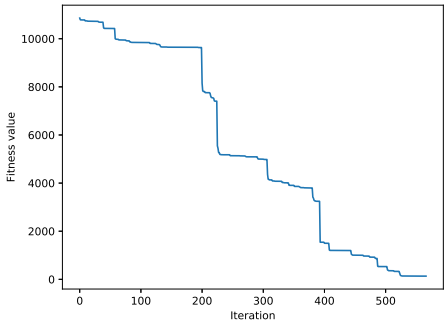

Figure 29: First improvement

4.3.3 Hybrid

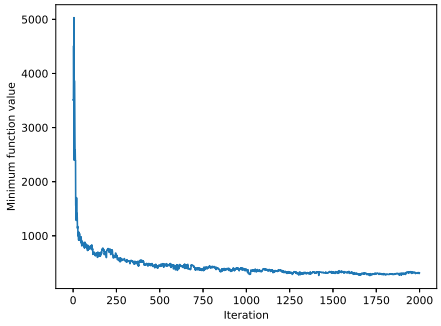

Figure 30: Genetic algorithm

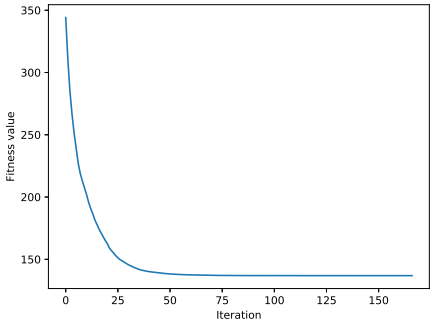

Figure 31: Hill Climbing

4.3.4 Interpretation

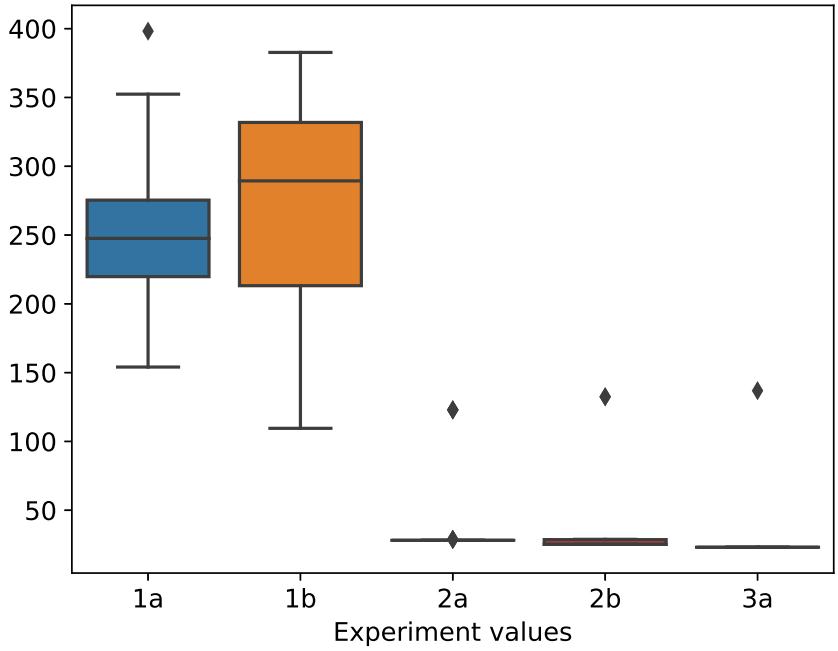

Figure 32: Rosenbrock experiments boxplot

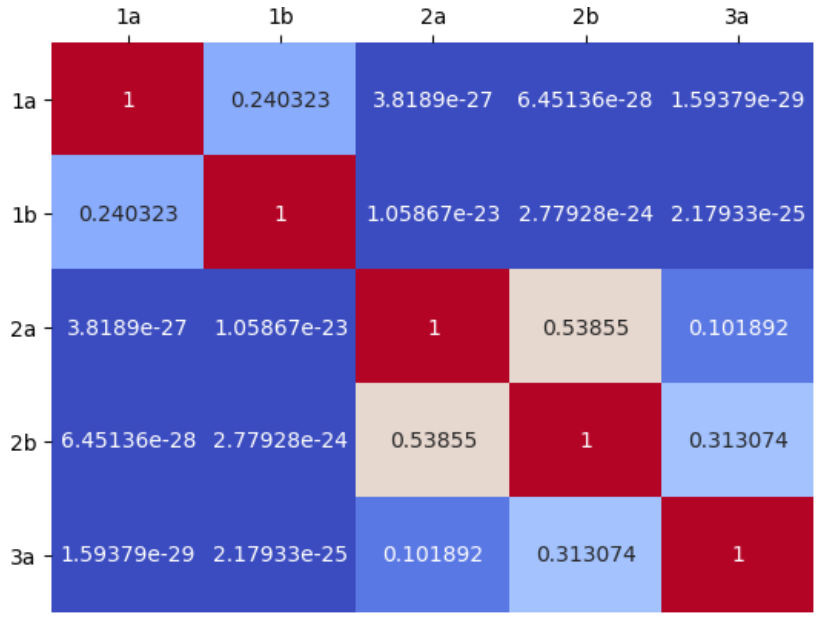

Figure 33: Rosenbrock experiments t test matrix

Observations //TODO:

5 Conclusions

References

[1] Wikipedia Commons
Rastrigin's Function rendered image. `https://commons.wikimedia.org/wiki/Main_Page`

[2] Rastrigin, L. A. "Systems of extremal control." Mir, Moscow (1974).