Universidade Federal de Santa Catarina

Discipline: DAS410058

Genetic algorithm

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1 Introduction

This assignment required the implementation of a Genetic Algorithm aimed at maximizing equation (1) within the interval spanning from 0 to π. The corresponding code can be located within the provided zip file, labeled as "Ag". Notably, we opted not to utilize the provided functions in our implementation. This document will exhibit graphs depicting the outcomes achieved with varying population sizes (l), mutation rates (pm), and crossover probabilities (pc). It's worthy to mention that all the presented outcomes were derived from a total of 600 generations.

$$f(y) = y + |\sin(32y)| \quad \text{com} \quad 0 \leq y < \pi \tag{1}$$

2 Baseline: $l = 200$, $pm = 0.7$, $pc = 0.02$

To generate the results was choose this baseline configuration, using 200 individuals and mutation rates (pm), and crossover probabilities (pc) of 70% and 2% respectively.

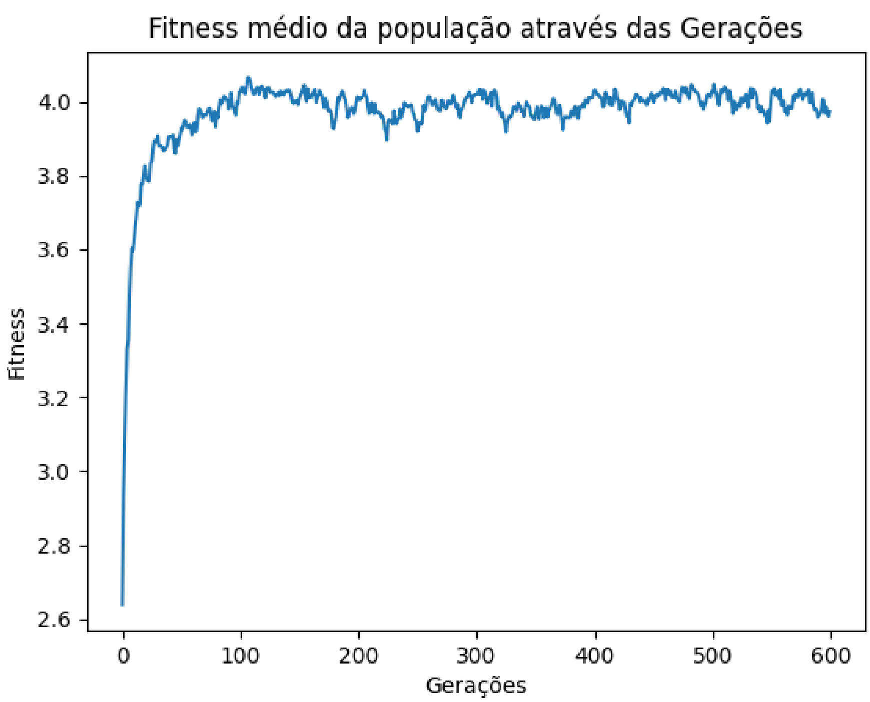
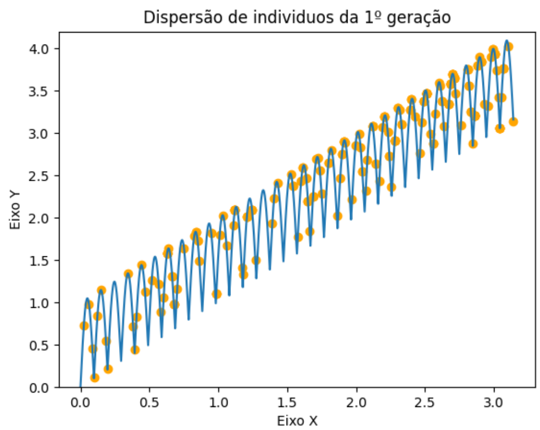
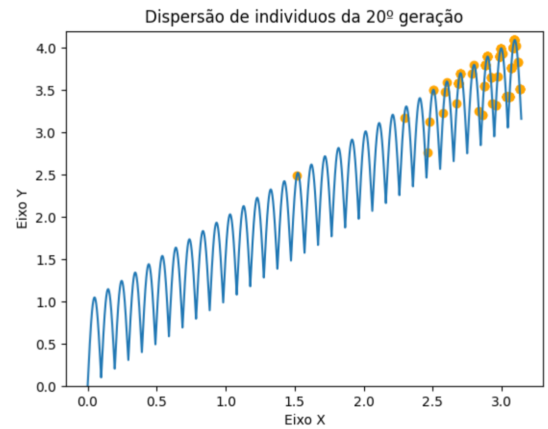


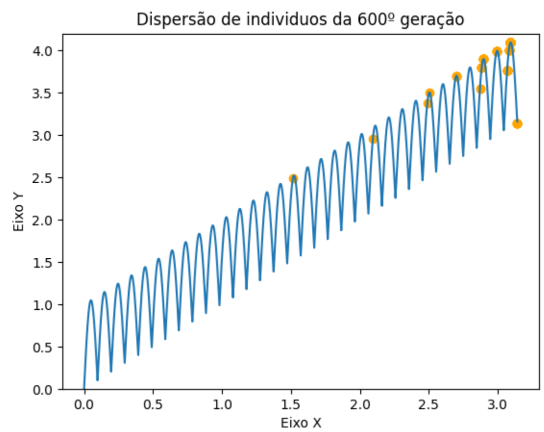
Figura 1 – Average fitness through generations



(a) First Generation



(b) 20^{th} Generation



(c) 600^{th} Generation

Figura 2 – Function to be maximized vs individuals

Through Figure 2 and 1 one can verify that the model converges to a fitness value around 4 but it has a lot of variance due to the mutations.

3 Varying its parameters

Varying the baseline parameters one can see the influence of each one of those in the final result.

3.1 Varying l

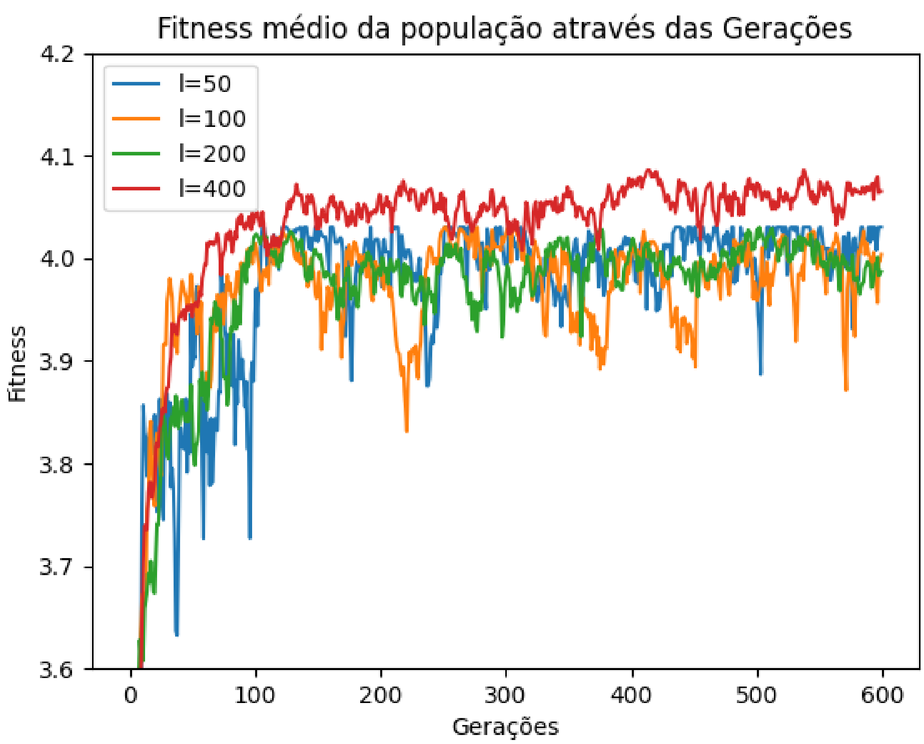
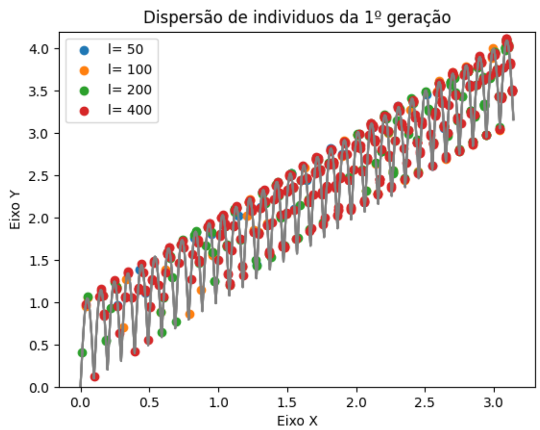
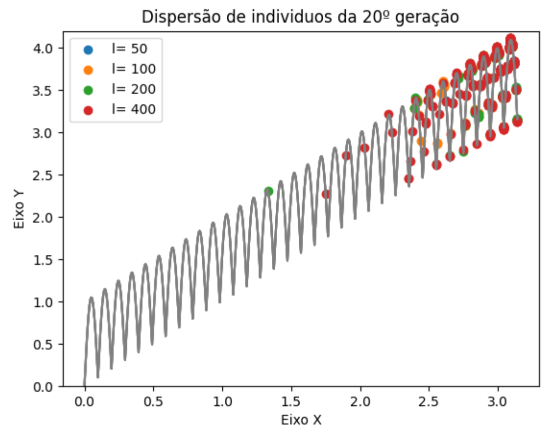


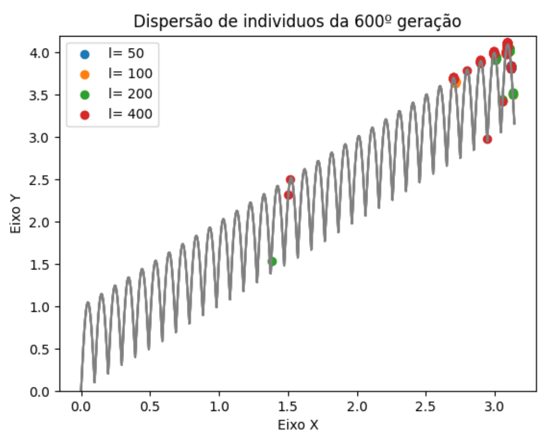
Figura 3 – Average fitness through generations for different values of l



(a) First Generation



(b) 20^{th} Generation



(c) 600^{th} Generation

Figura 4 – Function to be maximized vs individuals for different values of l

The model for the simulated population sizes presented a similar result, but from Figure 3 one can see a higher final fitness for a higher population size.

3.2 Varying *pc*

Varying the crossover probabilities lead to similar results but it seems that a higher *pc* resulted in a lower final fitness for this case (7), suggesting that maybe more advantageous for the model to clone higher fitness individuals in the offspring that operate the crossover.

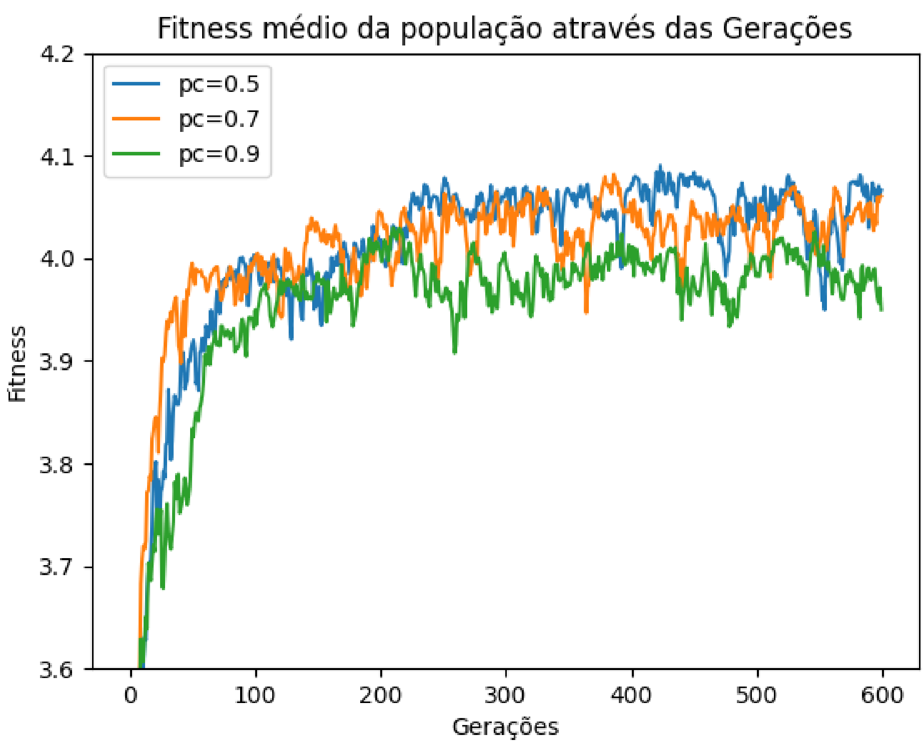
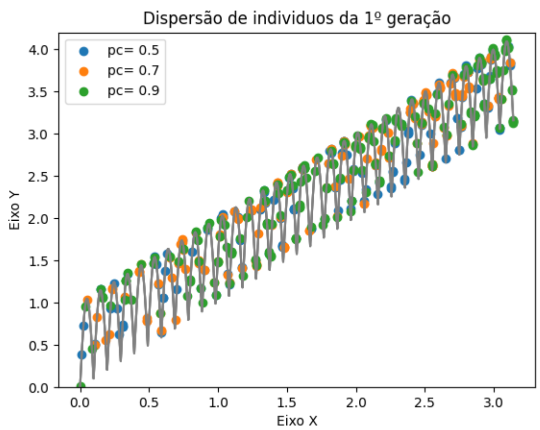
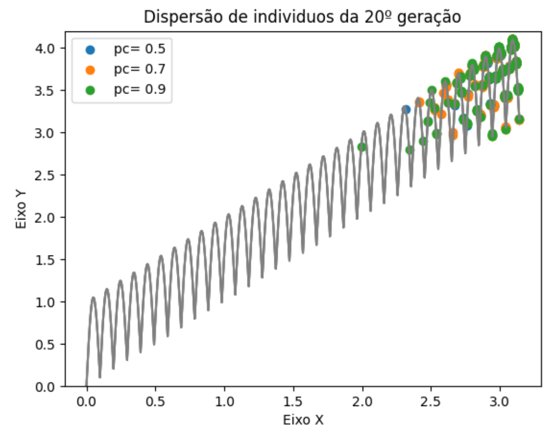


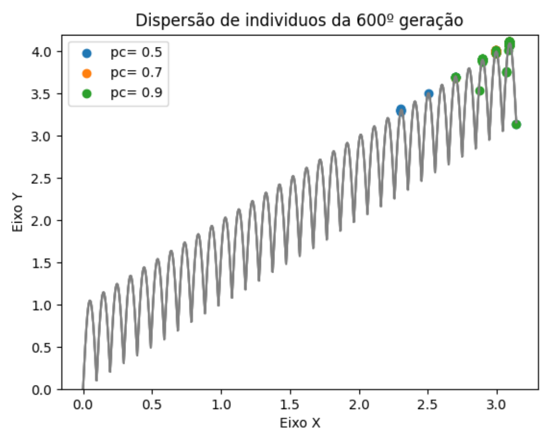
Figura 5 – Average fitness through generations for different values of *pc*



(a) First Generation



(b) 20^{th} Generation



(c) 600^{th} Generation

Figura 6 – Function to be maximized vs individuals for different values of pc

3.3 Varying pm

The mutation rate is the parameter that most influenced the final average fitness of the population. In the Figure 7 one can easily notice that a lower mutation rate in this case implies in more positive result in maximizing the fitness function.

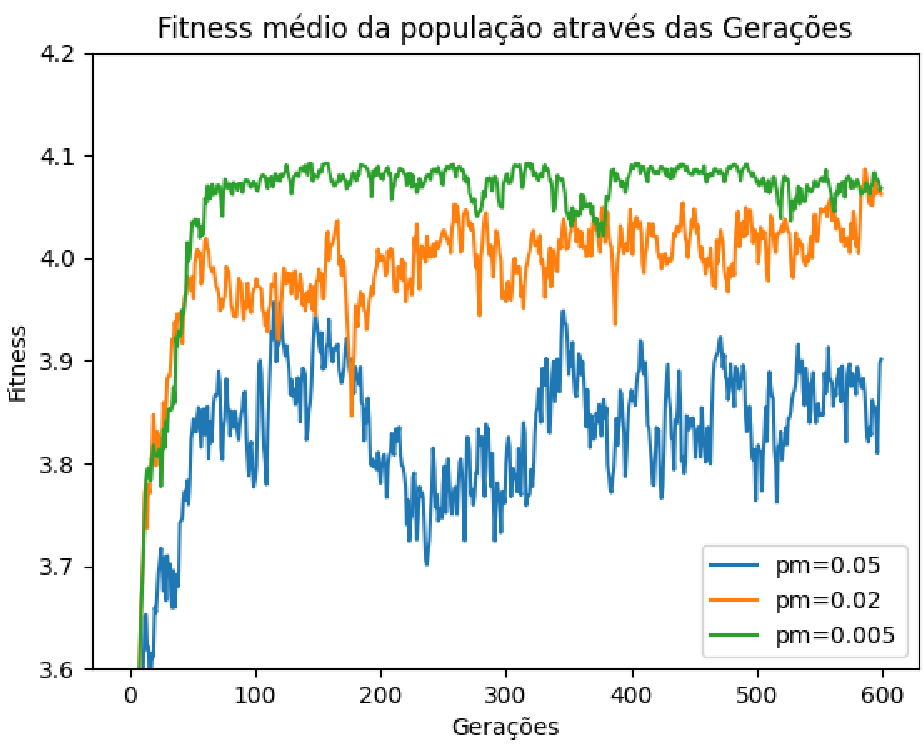
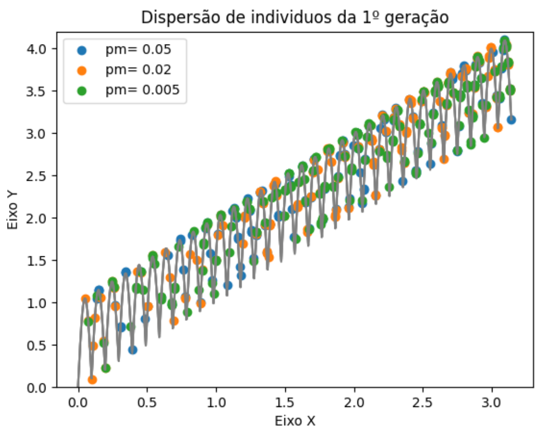
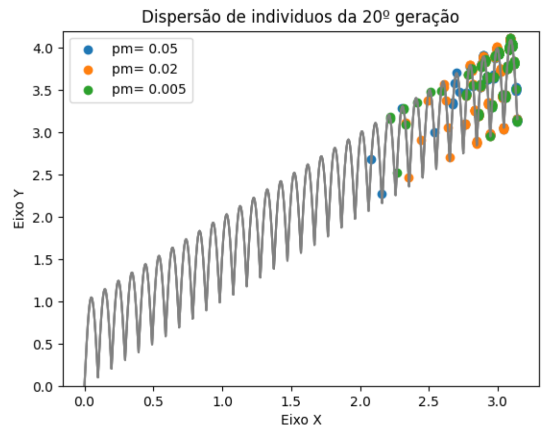


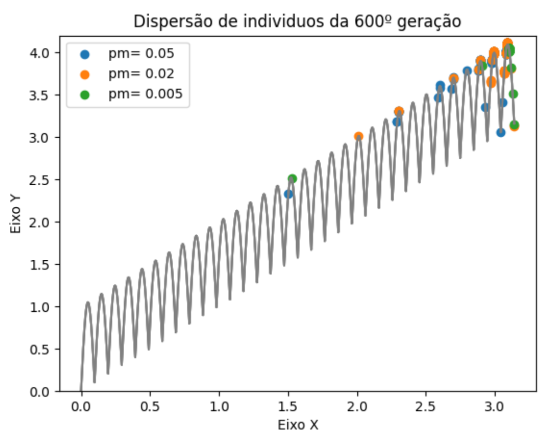
Figura 7 – Average fitness through generations for different values of pm



(a) First Generation



(b) 20^{th} Generation



(c) 600^{th} Generation

Figura 8 – Function to be maximized vs individuals for different values of pm