INF 421 PROJECT

Evolutionary Algorithms
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CONTENTS

1 INTRODUCTION

This report presents a solution to the programming project **Evolutionary Algorithms** for the course INF421: Design and Analysis of Algorithms at École Polytechnique. Each task is developed in a section of the report which also contains the code implemented using the Nim programming language.

The source code can be accessed on the project's Github repository.

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TASK 1: INDIVIDUALS AND BENCHMARK FUNCTIONS

Write code that allows to use individuals as well as the three functions `OneMax`, `LeadingOnes`, and `Jump_k` . For individuals, do not use libraries but implement a data type that fully utilizes the memory. That is, do not store each bit value of an individual in a byte but in an actual bit.

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TASK 2: RUNTIME ANALYSIS

Prove mathematically (preferably rather tight) upper bounds on the expected run time of the $(1+1)$ EA on `OneMax` and on `LeadingOnes`.

We use the fitness levels approach (1).

3.1 Theoretical bound for OneMax

3.2 Theoretical bound for LeadingOnes

Complement your theoretical bounds with empirical results and compare them.

Furthermore, run empirical tests for the $(\mu+1)$ EA on `OneMax` with various, self- chosen values of μ. Visualize the expected run time. What do you see? What μ would you recommend?

In your report, do not forget to add a brief discussion about the parameter choices you made yourself, especially the number of tries for each value of μ you chose.

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TASK 3

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TASK 4

6
TASK 5

REFERENCES

[1] Doerr, B., Kötzing, T. Lower Bounds from Fitness Levels Made Easy. Algorithmica (2022). https://doi.org/10.1007/s00453-022-00952-w