



## ARTIFICIAL INTELLIGENCE

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### HOMEWORK 2 GENETICS ALGORITHMS FOR THE DE JONG FUNCTIONS OPTIMISATION

#### Grade

The project grade, corresponding to 30% of your final grade, is given by a weighted average of your performance in the homeworks (10%, 25%, 30% and 35%).

#### Deadline

This homework must be submitted **Tuesday 8 November 2022** at **23:59** (time in Lugano). The solution will be presented during the TA session following the assignment due.

#### Instructions

Starting from the notebook [GA\\_for\\_F0.ipynb](#), implement a *Genetic Algorithm* (GA) to search for the global minimum of four De Jong functions (n.1, n.2, n.3, n.5). More details on the implementation can be found in the paper "[Optimization of Dejong Function using GA](#)". Each function is defined in the class `AI2022MA.DeJongFunctions` and differ from the others in their range, resolution factor and dimension.

To implement the *Genetic Algorithm* (GA), you are required to use the following **settings**:

1. Population size: 20
2. Crossover: Single-Point
3. Mutation: Bit string, with a rate of 1%
4. Iterations: 600
5. Three starting seeds (optional)

To encode and decode the population individuals, use the functions `gray_encode` and `gray_decode` available in that class. To evaluate the population, use the function `evaluate`.

Test your implementation with four combinations of **parameters**:

1. Selection rule: Rank
2. Selection rule: Roulette
3. Selection rule: Rank + Elitism
4. Selection rule: Roulette + Elitism

For each combination of parameters and function (and eventually seed), show:

1. A plot with the minimum, the average and the standard deviation population's objective value during the iterations
2. The best result and solution obtained in the search

#### Submission

Deliver your code as a **Python Jupyter notebook file** and briefly discuss your results and concisely provides evidence that you have accomplished each of the tasks listed above. Please do not include in the submission images of your plots nor the files in the `AI2022MA` folder.

Before submitting, rename your file as: `<Name Surname>_MSCAI22_hw2.ipynb`.

If you wish to deliver more than one file (code and report), please submit them in a single compressed folder with the same file name format: `<Name Surname>_MSCAI22_hw2.zip`.