Project : Session 1
Knapsack x Genetic Algorithm

Problem Definition

Knapsack Problem

Definition: The Knapsack problem is a classic optimization challenge in computer science. It involves selecting items to maximize value while staying within a weight limit. Let **X** be a set of n items X=**{I_1, I_2, … I_n}**, each Item **I_i** has a value **v_i** and a weight **w_i**. **W** is the total knapsack capacity to not exceed. What are the items to take (put in the knapsack) to maximize its total value with respect to the total weight constraint ?

Benchmark: http://artemisa.unicauca.edu.co/~johnyortega/instances_01_KP/
Select the "Large_scale" folder and pick 4 different instance sizes.

Resolution Method

Genetic Algorithm

Metaheuristics are optimization techniques that help find approximate solutions within a reasonable time. They are particularly useful when traditional methods cannot be applied due to the problem's size or complexity.
In this project you are asked to define A solution, the solution space and its size, and the fitness function for the given problem. Then to implement and solve the problem using the Genetic Algorithm (GA).

Each group of three must submit a detailed report of the work completed before the deadline of **March 2, 2025**. The report, with a maximum of **15 pages**, must include at least:

- Description of the inspiration behind the metaheuristic
- Functioning and algorithm of the metaheuristic
- Experimentation for metaheuristic parameter tuning
- Experimentation on different problem instances (sizes)
- Comparison (Graphs/Tables, Analysis, and Discussion)
- Comparison with DFS
- Visualisation of a solution

The group will also present its work during the PW session of **March 02, 2025** within à maximum timing of **30min** that includes **PPT** presentation and execution of their code, followed by some questions (other students are highly encouraged to ask questions).

The last page of the report should contain each member's contribution to the project.

Each member of the group should be able to respond to any question on the project.

Good Luck!