People's Democratic Republic of Algeria
Ministry of Higher Education and Scientific Research
20 Août 1955-Skikda University
Sciences Faculty
Computer Science Department

Evolutionary Algorithms

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Tutorial Assignment n°1: Coding

Exercise 1. Knapsack Problem

Version 1. Subset Sum Problem

The Simple Knapsack problem takes a set of integers $S = \{w_1, \cdots, w_n\}$ and an integer w as inputs. The objective is to compute a subset $T \subseteq \{1, \cdots, n\}$ of items such that $\sum_{i \in T} w_i \leq w$ and $\sum w_i$ is maximum. That is, we want to fill our knapsack without exceeding its capacity w and putting the maximum total weight in it.

Solve this problem in case $S = \{5, 8, 11, 15, 20, 30, 32, 37, 41, 53, 56, 62\}$ and $b = 123$.

$$\text{Max } (\sum_{i=1}^{n} w_i * x_i) \text{ and } \sum_{i=1}^{n} x_i w_i \leq w;\ x_i \in \{0, 1\}, j \in \mathbb{N}^* .$$

Version 2.

There are n items; each item has its own benefit c_i and weight w_i.

There is a Knapsack of total capacity w.

We would like to maximize the benefit but not exceeding the capacity w of the Knapsack.

It means:

$$\text{Max } (\sum_{i=1}^{n} c_i x_i) \text{ and } \sum_{i=1}^{n} x_i w_i \leq w;\ x_i \in \{0, 1\}.$$

Instance of the problem

Item	Cost	Weight
Item 1	5	4
Item 2	12	10
Item 3	8	5
Item 4	17	7
Item 5	3	2
Item 6	11	9

Solve this problem in the case of Evolutionary Algorithms.

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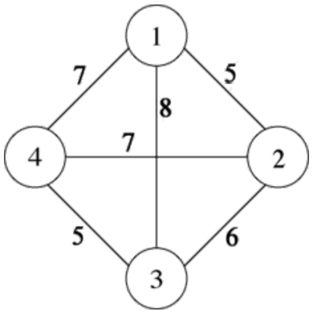
Exercise 2. Traveling Salesman Problem

The Traveling Salesman Problem (TSP) can be modeled using a graph consisting of a set of vertices and a set of edges. Each vertex represents a city, an edge symbolizes the passage from one city to another, and it is associated with a weight that can represent a distance, a travel time or even a cost.



$$d_{i,j} = \begin{cases} \sqrt{\left(x_i - x_j\right)^2 + \left(y_i - y_j\right)^2}, & if\ i \neq j \\ \infty, \quad otherwise \end{cases}$$

$$\text{Min}\left(\sum_{i=1}^{n} d_{ij}\right).$$

Solve this problem in the case of Evolutionary Algorithms.