MEDICAL PROCEDURES ASSIGNMENT

MACHINE INTELLIGENCE FOR COMBINATORIAL OPTIMIZATION

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DATA ANALYSIS

The provided dataset consists of 30 doctors with specific procedures (15) covered and their respective costs. After conducting an analysis of the provided data, the following information has been gathered:

- Minimum rate of doctors: 605
- Maximum rate of doctors: 9259
- Average rate of doctors: 4716.6
- Total rate of doctors: 141498
- Maximum rate of all doctors: 141498
- Average of procedures practised: 4.966666666666667 ≅ 5

Therefore, a nearly optimal solution would be to identify 3 doctors, each performing 5 distinct procedures, with an average cost. This would result in a total cost of 14149.8.

GREEDY ALGORITHM

Implementing a first algorithm with a greedy approach, where procedures are analysed to ensure they are covered entirely at the lowest possible cost, results in the following solution:

doc29 | 605
doc10 | 1183
doc2 | 767
doc6 | 1643
doc11 | 1647
Procedures: [2 1 2 3 1 3 1 2 2 1 2 1 1 2 2]
Average rate: 1169.0
Total rate: 5845

The total cost of the obtained doctors is around the average and is significantly lower than what was estimated in the hypothetical analysis conducted earlier.

SIMULATED ANNEALING

Implementing the simulated annealing algorithm, using the solution obtained from the Greedy algorithm as the initial solution, yields the following results:

doc2 | 767
doc6 | 1643
doc11 | 1647
Procedures: [1 1 2 2 1 1 1 1 2 1 1 1 1 1 1]

Average rate: 1352.3333333333333
Total rate: 4057

We observe a reduction in the number of considered doctors and a significant decrease in the total cost.

POPULATION ALGORITHM – (1,3) EVOLUTIONARY STRATEGY

Utilizing the (μ, λ)-evolutionary strategy with values $\mu = 1,\ \lambda = 3$ as the population algorithm and starting from the solution of the Greedy algorithm, based on the number of generations, two specific results have been obtained:

- Number of generations = 10:
  doc2 | 767
  doc6 | 1643
  doc10 | 1183
  doc11 | 1647
  doc29 | 605
  Procedures: [2 1 2 3 1 3 1 2 2 1 2 1 1 2 2]
  Average rate: 1169.0
  Total rate: 5845

- Number of generations = 15:
  doc2 | 767
  doc6 | 1643
  doc11 | 1647
  doc29 | 605
  Procedures: [1 1 2 2 1 2 1 2 2 1 1 1 1 1 2]
  Average rate: 1165.5
  Total rate: 4662

Increasing the number of generations even further, the best solution obtained still remains the Greedy one: there is no improvement with the increase in generations.