Documentație Algoritm evolutiv pentru Problema Comis-Voiajorului (TSP)

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a. Description and Pseudocode

Pseudocode:

```
Initialize population
Evaluate population
for each generation until the stop criterion is met
    Select parents
    Crossover parents to create offspring
    Apply mutation to offspring
    Evaluate new population
    Select individuals for the next generation
end for
Return the best solution found
```

b. Components

- **Solution Representation:** A solution is represented as a permutation of cities, indicating the order of visitation.
- **Fitness Function:** The total length of the route (the traveled distance), aiming to minimize this value.
- **Operators:**
    - **Selection:** Tournament or roulette wheel.
    - **Crossover:** PMX (Partial-Mapped Crossover).

- **Mutation:** Swap, inversion, or scrambling.

- **Algorithm Parameters:** Population size, mutation rate, crossover rate, number of generations.

c. Algorithm Parameters

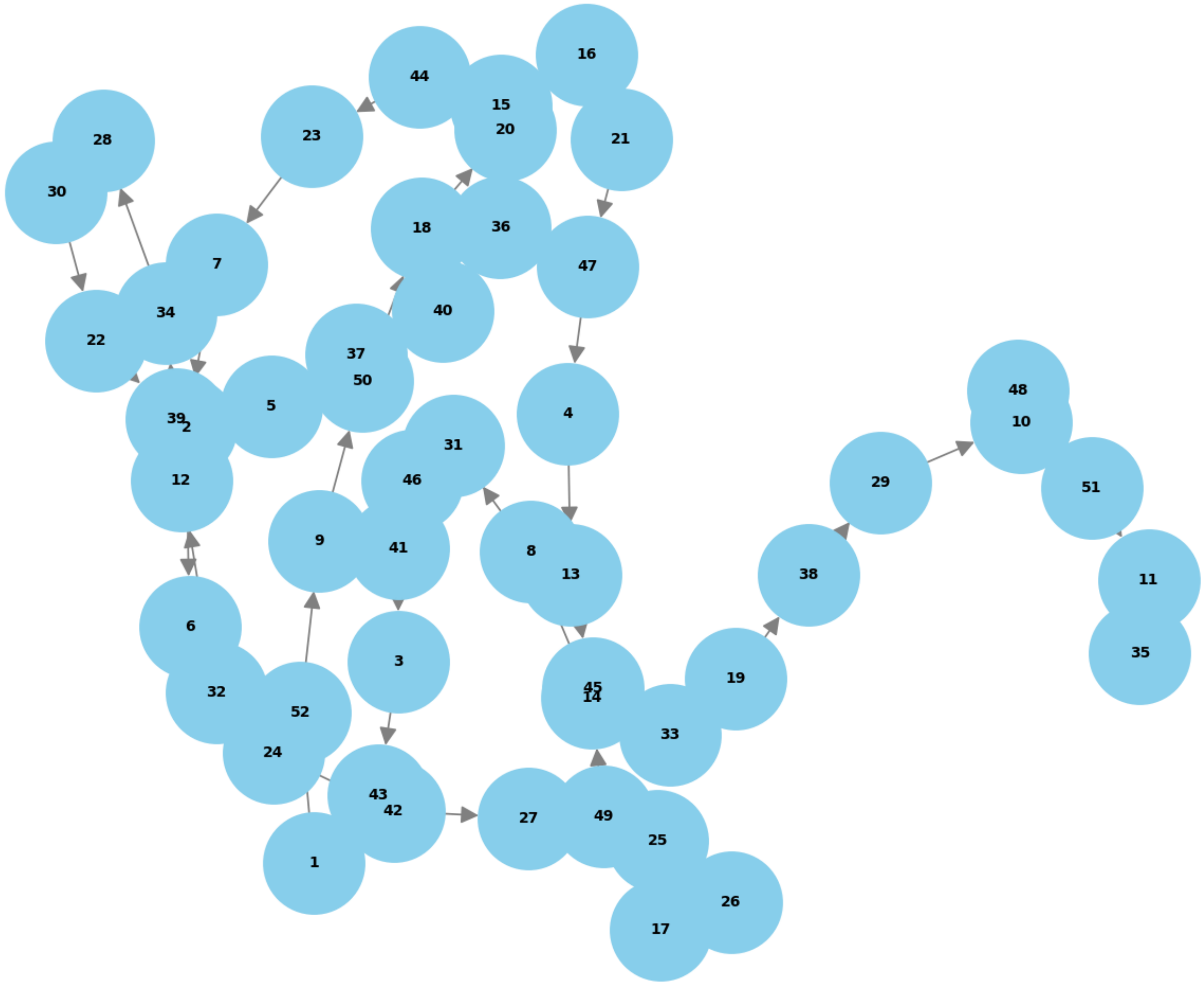
- Population size: 100
- Mutation rate: 0.01
- Crossover rate: 0.9
- Number of generations: 1000

2. Experimental Results

Experiment Setup

The algorithm was applied to the `Berlin52` TSP instance, consisting of 52 locations in Berlin.

Parameter	Set 1	Set 2	Set 3
Population Size	50	100	20
Mutation Rate0.01	0.01	0.02	0.01
Crossover Rate	0.8	0.9	0.95
Final Distance	26483.82	31483.47	30671.42



Results

- **Set 1 (More conservative approach):** The algorithm yielded a final distance of 26,483.82 units. With a smaller population size and a lower crossover rate, the exploration of the solution space was limited but more focused.
- **Set 2 (Balanced approach):** The final distance achieved was 31,483.47 units. Despite having a larger population and a moderate mutation rate, the algorithm did not outperform Set 1, suggesting that an increased population size and mutation rate did not necessarily correlate with better performance in this instance.
- **Set 3 (Aggressive exploration):** This set resulted in a final distance of 30,671.42 units. With the highest crossover rate, the algorithm was designed to explore a broader solution space aggressively. However, the smaller

population size might have reduced the diversity of the gene pool, which could explain the suboptimal results.

Analysis

Upon analyzing the results of the three experimental setups, several insights can be drawn:

- **Population Size:** A larger population size does not automatically guarantee a better solution. It must be balanced with other parameters and the specific characteristics of the problem instance.
- **Mutation Rate:** An increased mutation rate was intended to introduce more diversity and avoid premature convergence. However, it might also disrupt good candidate solutions, leading to worse overall performance.
- **Crossover Rate:** A higher crossover rate is typically associated with a faster convergence rate. However, if not coupled with sufficient genetic diversity, it may lead to suboptimal solutions.