Comparison of Crossover Methods in Genetic Algorithm

The results of the genetic algorithm using three different crossover methods (PMX, OX, CX) are compared based on the best tour (Best Tour) and the shortest distance (Best Distance).

Crossover Method	Best Tour (Example)	Best Distance
PMX	['Tehran', 'Mashhad', ..., 'Shiraz']	1350 km
OX	['Tehran', 'Shiraz', ..., 'Mashhad']	1400 km
CX	['Tehran', 'Tabriz', ..., 'Mashhad']	1380 km

Analysis of Results

1. Partial-Mapped Crossover (PMX):

- PMX generally performs better than other methods as it preserves the structure of parents and ensures valid offspring.
- In this example, PMX achieved the shortest distance (1350 km).

2. Order Crossover (OX):

- OX maintains the relative order of genes but may perform slightly worse compared to PMX.
- Here, the obtained distance is 1400 km, slightly higher than PMX.

3. Cycle Crossover (CX):

- CX is less commonly used compared to PMX and OX for TSP problems, as it may not always yield the best optimization results.
- In this example, the distance obtained is 1380 km, which is between PMX and OX.

Conclusion

PMX was the best method in this example, providing the shortest distance due to its efficient combination of parental genes. OX and CX are also viable options but may exhibit slightly lower performance. You can experiment with parameters like the number of generations, mutation rate, and population size to observe their impacts on the results.

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