TSP with multiple drones

This paper showcases a solution for solving the 'TSP with multiple drones' problem. As this problem is known to be NP-hard, a deterministic approach for this problem would give a far from the optimum solution, a way too much time-consuming solution. For this reason, we are using a Genetic Algorithm to solve our problem.

Data Modelling

- Chromosome = $(permutation, drone\_visits) = (p, v)$
- $Permutation\ p$: a permutation of the list [1, . . . , n − 1], appending a 0 at the beginning and the ending of the permutation => p = [0, $i1$,$i2$, . . . , in−1, 0]
- Nodes visited by drone = v
    - A list of vehicle ids, each vehicle is mapped to the corresponding node from p
    - The mapping is done by index
        - e.g., the node p[idx] is visited by vehicle v[idx]

Genetic algorithm

For the genetic algorithm we are using the following probabilities:

CHROMOSOME_MUTATION_PROBABILITY=5%

TOUR_MUTATION_PROBABILITY=1%

DRONE_VISIT_MUTATION_PROBABILITY=5%

CROSSOVER_PROBABILITY=20%

The crossover and mutation are done in two steps: one for tour permutations and one for drone visits.

Selection

For the selection part we are using roulette selection where the best chromosomes get a higher chance of being selected.

Crossover

For the crossover operator we are using Partially Matched Crossover (PMX) to generate new permutations for tour and two point cut for drone assignments.

Mutation

For tour mutation we are using Shuffle Index Mutation which swaps two random cities from p(tour). The mutation on vehicle assignments is done by replacing the current vehicle with a different one from existing pool.

Evaluation