Zürcher Hochschule
für Angewandte Wissenschaften

School of
Engineering
IAMP Institut für Angewandte
Mathematik und Physik

Lecture 2: Exercises

MSE Algorithms - Metaheuristics

Exercises

*** Relevant for Exam**

*** Task 1: Time Complexity of TSP Heuristics (15 min)**

a) What is the complexity of the Nearest Neighbor heuristic for the TSP?

b) Same question for the pilot method, if the Nearest Neighbor heuristic is used as pilot.

c) Same question for a beam search procedure, if B branches are retained at each level, and the tree is examined up to k levels ahead, but the retained branches are only extended by one node per step.

Exercises

Note that sample data and implementation for TSP heuristics is provided in Moodle.

Task 2: Comparing Heuristics for TSP (45 min)

a) Implement the Nearest Neighbor heuristic for TSP
Note the following:

- A stub `tsp_nearest_neighbor.py` is provided in the Python framework in the subfolder `Python -> heuristics`. This stub is integrated in the runnable main demo script `demo_tsp_nearest_neighbor.py` on the top-level folder `Python`.
- There are several ready-to-use TSP instances provided in the subfolder `Python -> heuristics -> problems -> tsp -> instances`, which may be selected in the main demo script `demo_tsp_nearest_neighbor.py`.
- Check the file `instance.py` in subfolder `Python -> heuristics -> problems -> tsp -> utils`, to get familiar with the data structure used to represent a TSP instance.

b) Compare the computational time and the quality of the solutions of

- *Nearest Neighbor (from part a)),*
- *Random Sampling* (provided ready-to-use: `demo_tsp_random_sampling.py`),
- *Random Best Insertion* (provided ready-to-use: `demo_tsp_greedy_insertion_random.py`).

Exercises

Task 3: "Good" Algorithm for TSP (60 min)

Implement a good heuristic algorithm for TSP. You can develop and implement own ideas, or use some of the methods presented in the lecture so far.

Evaluate your heuristic on the provided instances data sets in the Python framework in subfolder `Python -> heuristics -> problems -> tsp -> instances`.

Submit your results at

https://docs.google.com/forms/d/e/1FAIpQLSc-cccexnHYw5nOcI7aPh9oKlwXUjtuKKinpHSswgbw0faBZw/viewform?usp=sf_link