



MSC AI LAB: FIRST ASSIGNMENT

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ITERATED LOCAL SEARCH FOR TRAVELLING SALESMAN PROBLEM

Grade

The project grade, corresponding to 30% of your final grade, is given by a weighted average of your performance in the homeworks (10%, 25%, 30% and 35%).

Deadline

This assignment must be submitted by **23:59** (Lugano's time) on **18th October 2022**. The solution will be presented during the TA session following the assignment due.

Instructions

- Implement Iterated Local Search (ILS):** Develop the ILS algorithm using the three acceptance criteria as described in the paper *Iterated Local Search: Framework and Applications*:
 - **Better:** Accepts a new solution only if it is better than the current solution in terms of the objective function.
 - **Random Walk (RW):** Accepts any new solution irrespective of its quality. This encourages exploration of the search space.
 - **Large Step Markov Chain (LSMC):** Accepts new solutions based on a probabilistic rule that takes in consideration the difference between the new solution and the current solution. Typically, the probability decreases as the quality difference increases.
- Utilize Provided Resources:** The 2-opt local search is already supplied in a black-box format. For your experiments, leverage the notebooks:
 - [Introduction to the TSP](#)
 - [ILS for the TSP](#)
- Implementation & Evaluation:** Execute the *Double-Bridge perturbation* and the ILS on these instances:
 - d198 (small size problem)
 - pr439 (medium size problem)
 - u1060 (medium-large size problem)
- Testing Requirements:** For each problem and ILS variant, starting from at least three different seeds, present:
 - Statistics on the local search calls made during the search.
 - Gap percentage statistics from the optimal value.
 - The best result achieved during the search.

Note: The execution time for each instance should not exceed 3 minutes.

Submission

- **Format:** Submit your work as a **Python Jupyter notebook file**.
- **Report:** Accompany your code with a brief report discussing your findings. The report can either be a separate PDF or integrated within the Jupyter notebook. Ensure the report confirms the completion of all tasks above.