Report

How To Run 🏃

to run the file `solution.py` you'll need three parameters:
- **arg1** : *absolute path of ampl environment*
- **arg2** : *absolute path of the file model*
- **arg3** : *absolute path of the data file*

the enter the command :

```
python3 solution.py arg1 arg2 arg3
```

in case you prefer not to enter parameters and set their values directly in the python code you can open the `solution.py` file and switch the comment between this lines of code and changing the values of strings to the required one:

```
pathEnv = sys.argv[1]
pathModel = sys.argv[2]
pathData = sys.argv[3]
#pathEnv = "ABSOLUTE_PATH_AMPL_ENVIRONMENT"
#pathModel = "ABSOLUTE_PATH_FLP_MODEL.MOD"
#pathData = "ABSOLUTE_PARTH_DATA_FILE"
```

the flp_model.mod file is the one in this folder.

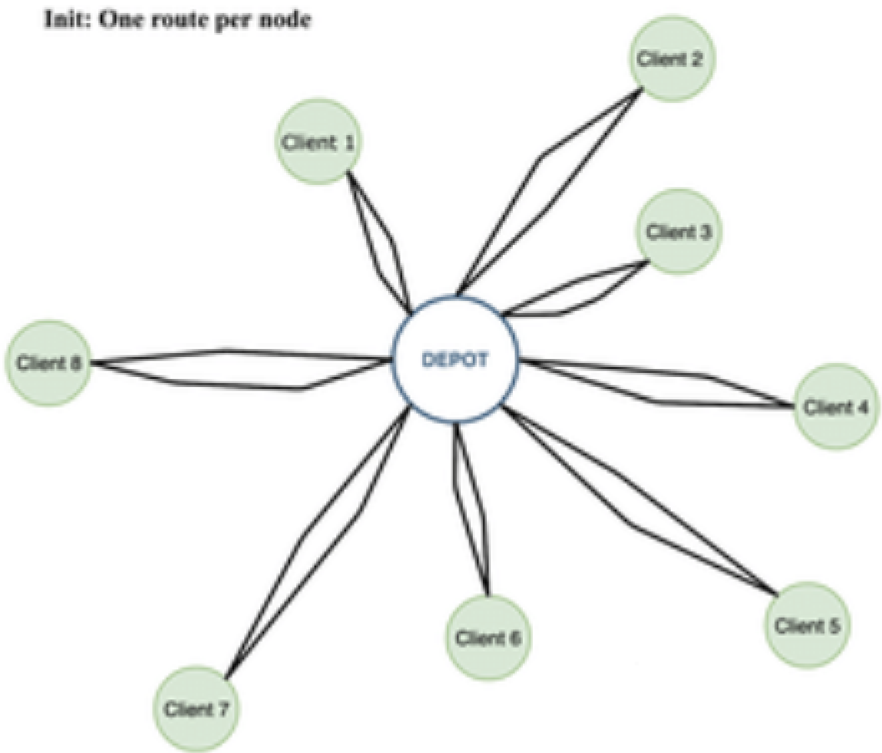
Heuristic Description 📖

the problem has been splitted in two parts :
- Facility Location Problem (FLP)
- Vehicle Routing Problem (VRP)

we first solved the FLP using the AMPL Python libraries (Amplpy) and then applied an heuristic for the VRP on the optiomal solution found by AMPL.

Vehicle Routing Problem Heuristic 🚚

we searched some option and at the end decided to use the Clarke-Wright Saving Algorithm.
The basic idea of this approach is to initially dispatch a truck for each node.



Now we calculate the saving amount in case we use a truck for two nodes and merge.

At the end we'll have a solution like this.

Steps of Clarke-Writght Saving Algorithm 🪜

STEP 1: calculate the savings `s(i, j) = d(depot, i) + d(depot, j) - d(i, j)` for every pair `(i, j)` of facility locations.

STEP 2: sort the savings `s(i, j)` in descending order to have the largest saving at the top of the list.

STEP 3: for the savings `s(i, j)` under consideration, include link `(i, j)` in a route if no route constraints will be violated through the inclusion of `(i, j)` in a route, and if:

1. Either, neither `i` nor `j` have already been assigned to a route, in which case a new route is initiated including both `i` and `j`.
2. Or, exactly one of the two points `i` or `j` has already been included in an existing route and that point is not interior to that route (a point is interior to a route if it is not adjacent to the depot D in the order of traversal of points), in which case the link `(i, j)` is added to that same route.
3. Or, both `i` and `j` have already been included in two different existing routes and neither point is interior to its route, in which case the two routes are merged.

STEP 4: If the savings list `s(i, j)` has elements return to *STEP 3*, processing the next element in the list. Otherwise stop.