Traffic Light Signaling

Project 1: Brief presentation
Artificial Intelligence, L.EIC

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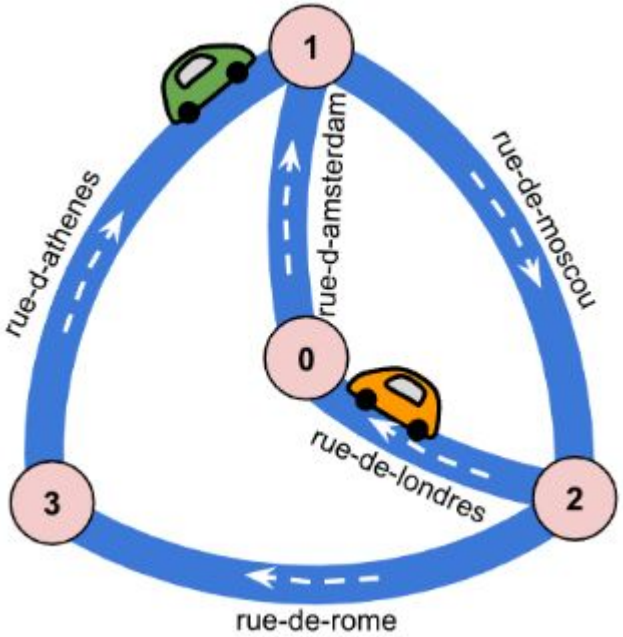
The problem

Maximize the number of cars that reach their destination in time, in a city composed of streets connected through intersections, by changing the schedule where the intersections green lights turn on and off for each incoming street.

The problem's full description can be found here.



Related work

The presented problem served as the qualification round for Google Hash Code 2021. Participants had less than 5 hours to come up with solutions.

We validated our simulation function by comparing the results to a third party's and had a look at community solution proposals:

- A local search method based on Hill Climbing
- Try to make most use of green lights for each iteration; brute force search neighbours

Problem Formulation

- Solution Representation
  - Schedule - {i0: [s1,s2,...,sn], … ,in: [s1,...,sn]} where i represents each intersection and s each incoming street with the green traffic light on at the nth second
- Neighborhood/mutation and crossover functions
  - Generate a new random schedule for a random intersection
  - Pick half intersections from each parent and join schedules
- Hard constraints
  - Can only schedule green lights for intersection incoming streets
  - Green light schedule time must be greater than 0; preferably less than simulation time
- Evaluation Function
  - Car path simulation
  - Calculate simulation score, f(x) to maximize

Work Already Carried Out

- Programming language:
  - Python
- Work developed:
  - City and schedule file parsing
  - Solution evaluation via path simulation
  - Genetic Algorithm with random start
  - Starting view of the roads developed in pygame

- Development Environment:
  - VSCode
  - MVC architectural pattern
- Python Data Structures:
  - Deque, List, Dictionary, Set