Introduction to Computational Science

Optimizing Traffic Lights in Urban Street Grids

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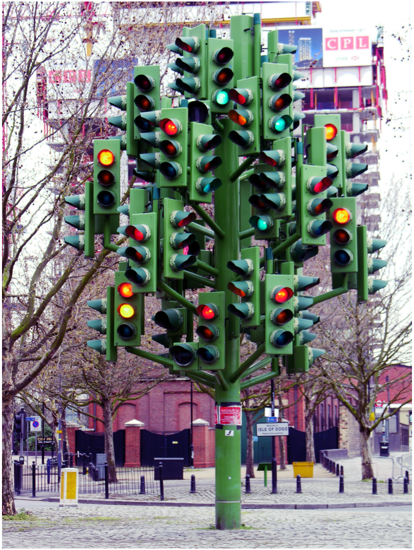
Introduction



The problem

- analyze different traffic light solutions
- "American city" grid
- uniform traffic

Method overview

- 9 intersection
- wrapped boundaries
- different traffic light heuristics
- gather data

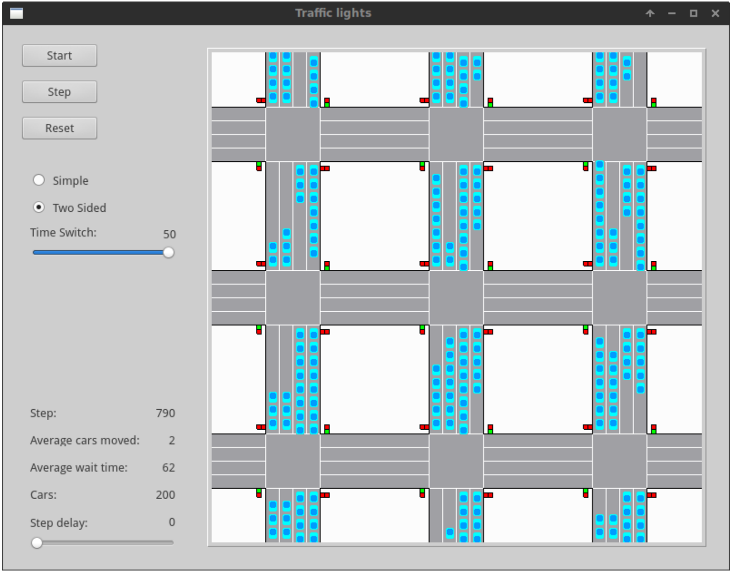
Intersection design

- intersections define the grid
- 8 lanes per intersection which resemble fixed length queues
  - 2 per direction:
  - 1 for turning left
  - 1 for forward and turning right
- traffic light controls lanes
- On queuing of a car, chooses randomly one of two lanes of the next intersection (if available)

Statistics gathering

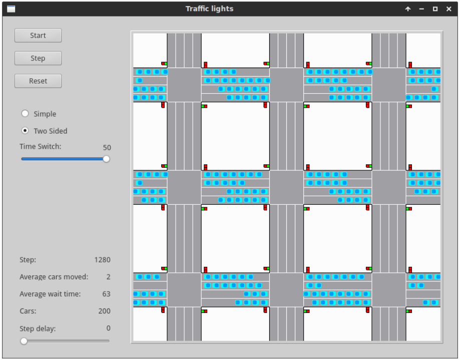
- average waiting time
- average throughput
- future: minima and maxima

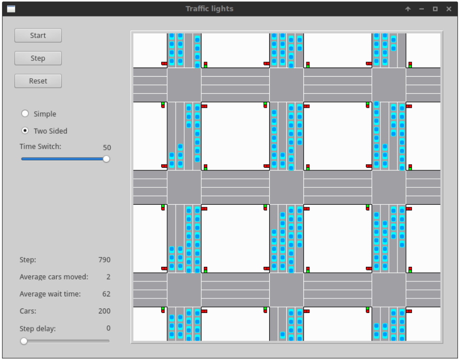
Demo


Traffic lights
Start
Step
Reset
Simple
Two Sided
Time Switch: 50
Step: 790
Average cars moved: 2
Average wait time: 62
Cars: 200
Step delay: 0

Results: pattern

- A pattern emerged with long switch timings on the two sided algorithm
- It would alternate between two states with 1 switch step of chaos





Results: mean car waiting time

Definition: cars that cannot move to the next field, either to a red traffic light or another car. Averaged over all lanes.

Measured using 200 cars simulating 5000 steps.

algorithm/switch time	1	4	8	16	32
simple	6	8	13	23	48
two sided	6	7	8	18	39

Results: cars moved per 9 intersections per step

Definition: total car count that passed a traffic light during a step. Averaged over all steps.

Measured using 200 cars simulating 5000 steps.

algorithm/switch time	1	4	8	16	32
simple	14	12	9	6	3
two sided	13	12	12	7	4

Conclusion

- No trade-off between average waiting time and throughput, both decrease with increasing waiting time
- Two sided algorithm performs better than the simple algorithm
- Car detection not yet tested, might yield other results

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