Introduction

- Problem description
- Heuristic algorithm
- Implementation
- Results (demonstration)

New types of cab-transport

- You rent only a seat, not the whole cab
- Origin and destination are free to be chosen (within a certain geographical region)
- You have to order a ride in advance
- There are service-rules for each contract
- It's cheap

Ride

- Desired time (pickup or delivery)
- Pickup location
- Delivery location
- Number of seats
- Dwell time
- Contract
- Exceptions

Vehicle

- Costs
- Number of seats
- Geographical range
- Workhours
- Allowed contracts

Contract

- Time window
- Detours
- Profits
- Allowed combinations

Heuristic algorithm

Insert ride i as follows:

1. Find all feasible insertions of ride i in the work-schedule of cab v. The cost of the cheapest insertion of ride i in the work-schedule of cab v is called C_v.

2. Find v^* such that $C_{v^*} \leq C_v$ for all v. If $C_{v^*} = \infty$ we call ride i a 'rejected ride'. Otherways ride i is inserted in the work-schedule of cab v^*.

Implementation

To implement this heuristic algorithm the following questions should be answered:

1. When is an insertion feasible?

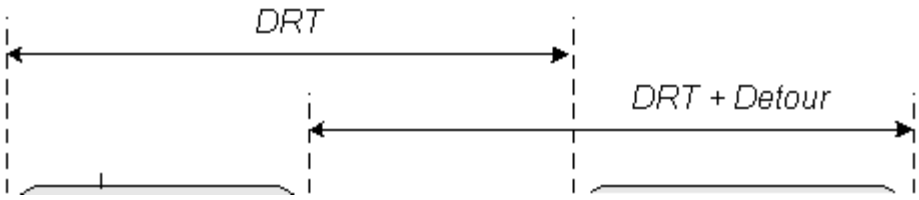
2. What does an insertion cost?

Feasibility

- Notations
- Quick feasibility-test
- Definitive test

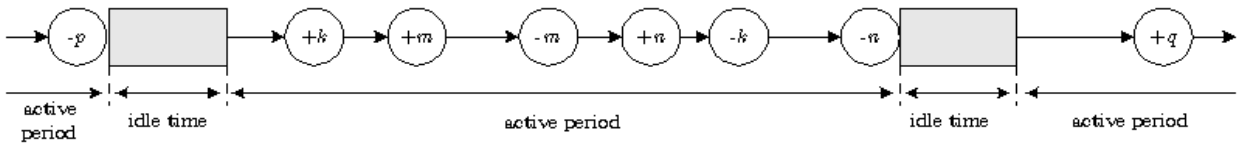
Time windows

(EPT, LPT)	pickup time
(EDT, LDT)	delivery time
DRT	direct ride time
$Detour$	$a \times DRT + b$



Active period

A work-schedule of a cab is a sequence of idle times and active periods.



Shift-variables

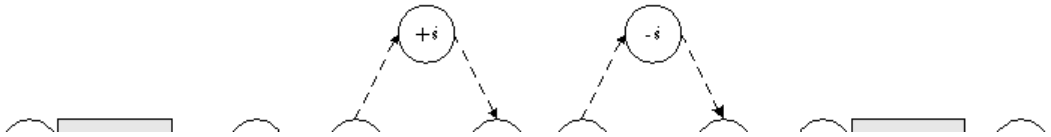
$$UP_\alpha = \min\left[\min_{1\leq j\leq\alpha}\left(AT_j - ET_j\right), WT_p\right]$$

$$DOWN_\alpha = \min\left[\min_{\alpha\leq j\leq d}\left(LT_j - AT_j\right), WT_q\right]$$

With:

WT_p	idle time before the active period
WT_q	idle time after the active period
d	number of locations in the active period

Quick feasibility test



Definitive feasibility check

This has to be checked after the quick feasibility test is passed:

- All detour times are within the limits?
- The capacity of the cab is large enough?
- Are the contract combinations allowed?

These checks require an algorithm in which each location in the active period is visited once.

Cost of an insertion

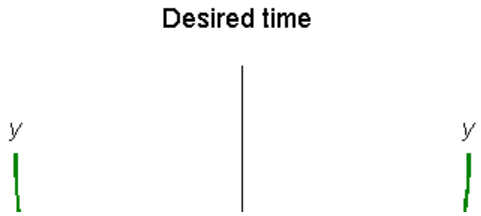
Real aspects:

- Distance
- Ride time
- Idle time

Virtual aspects:

- Service level
- Distance to origin

Service level



Calculation of insertion cost

Let W be the waiting time before the active period. The costs due to the distance and the ride time and the virtual cost due to detours are fixed for any W.

The cost due to idle time is a lineair function in W.

Declare all arrival times as an lineair function of W (the idle time before the active period). The cost due to service level are quadratic in W.

Conclusion

The use of active periods makes is possible to minimize an quadratic function in only one variable, instead of several variables.