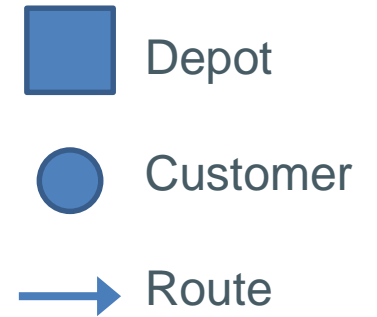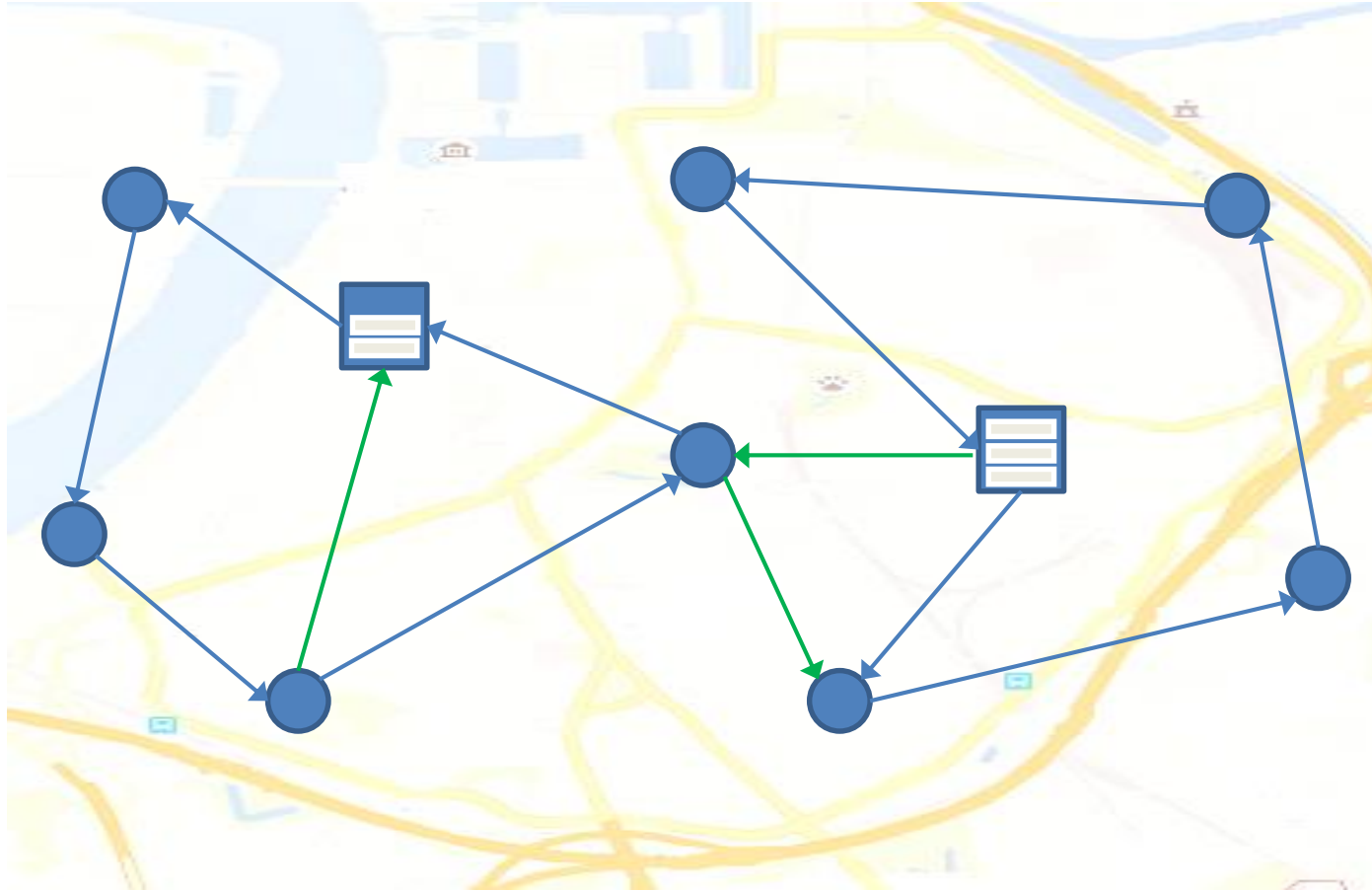# From storage to shipment
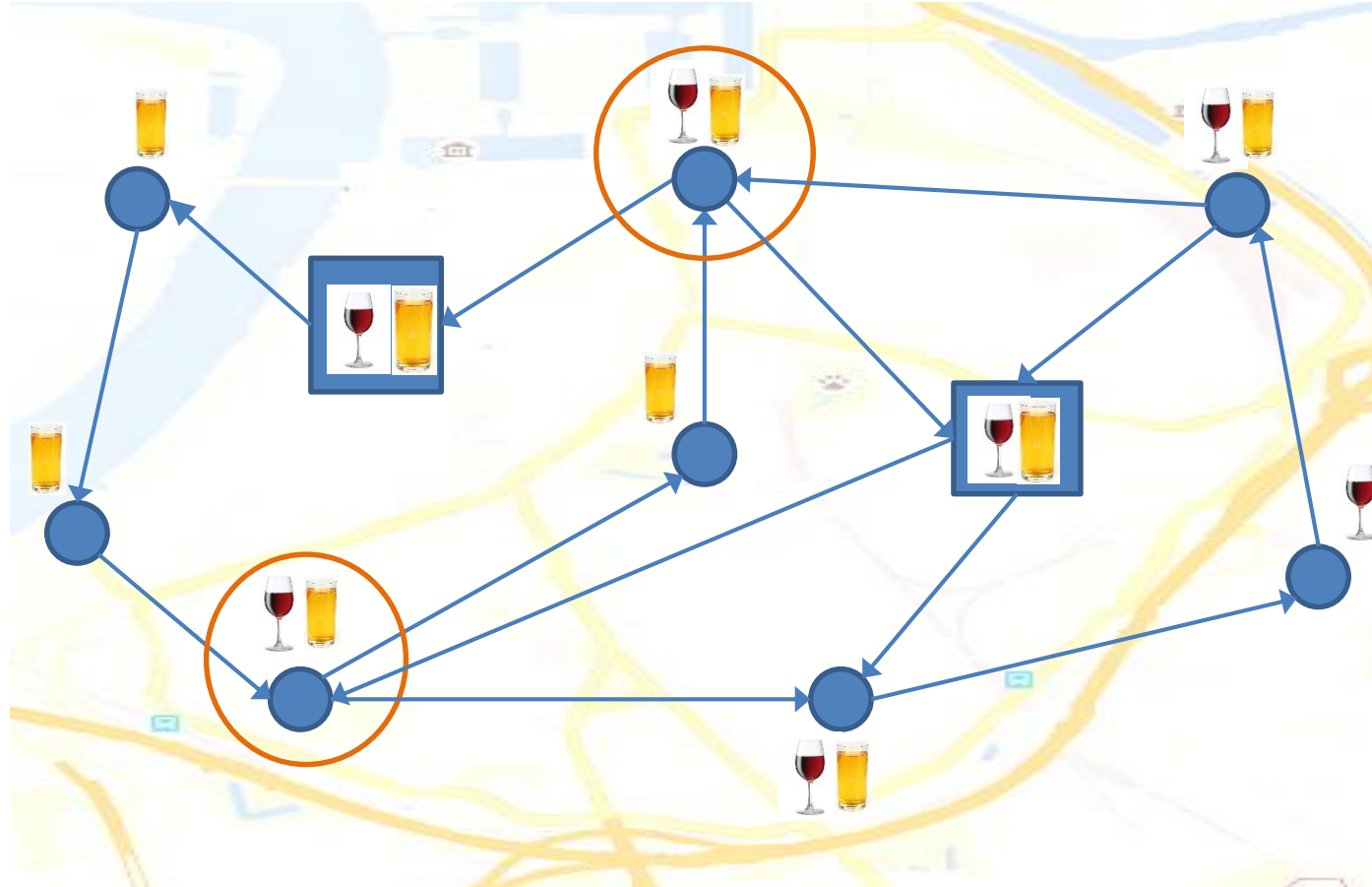The effect of ignoring inventory when planning routes

Florian Arnold

Doctoral Day, 30.11.2016
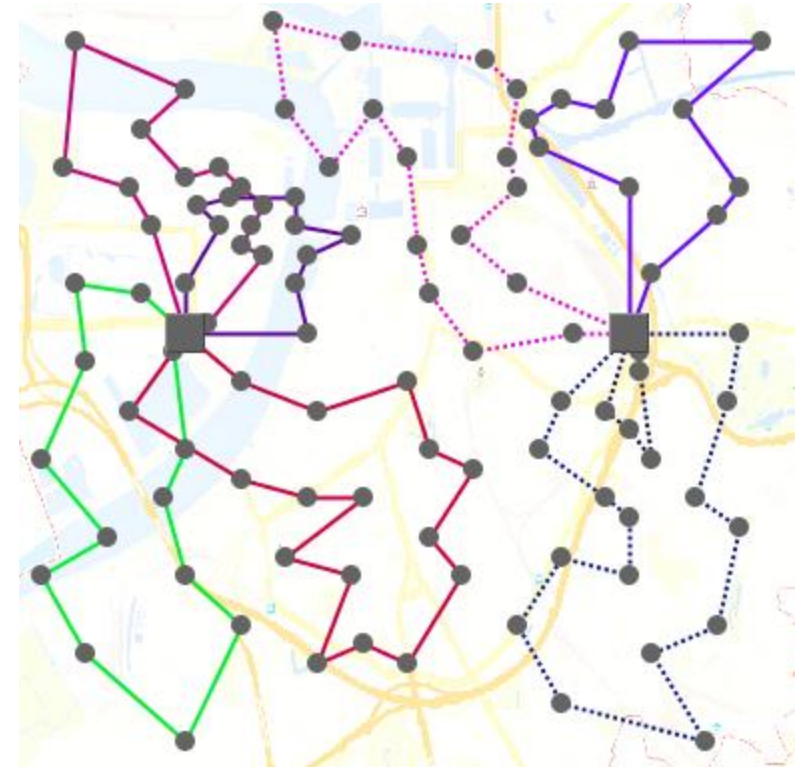
Inventory affects routing decisions

In reality, companies supply more than one (type of) product

Routing in reality

1. Inventory restricts routing
2. Multiple products are delivered and stored
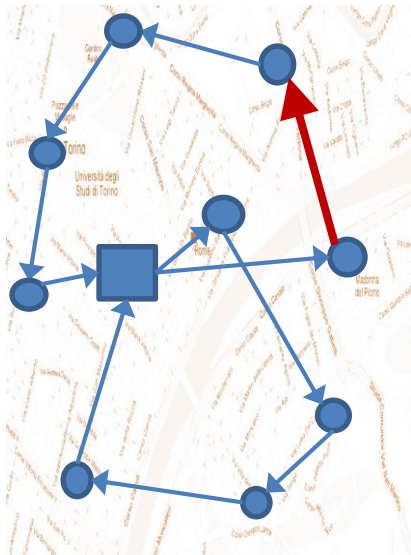3. Not all products might be stored in all depots
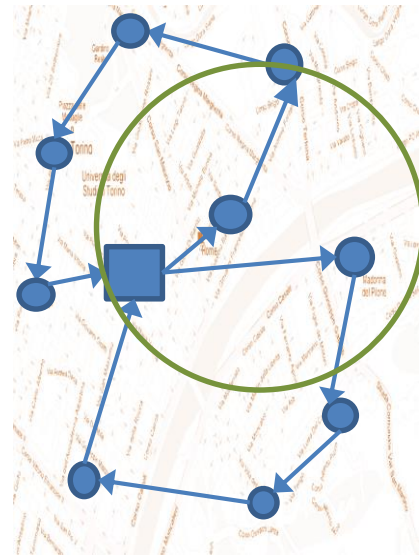
Contributions

1. Develop a heuristic to compute solutions
   for inventory-restricted routing

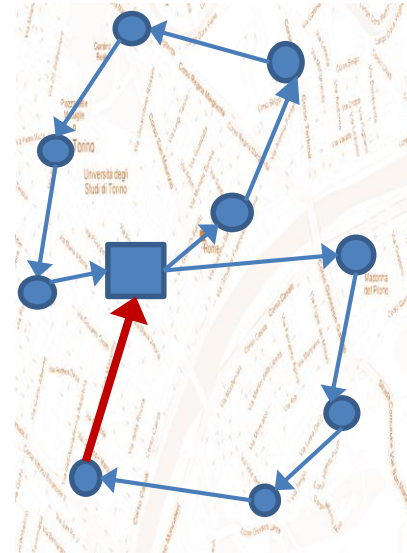2. Explore interdependencies between
   routing and inventory
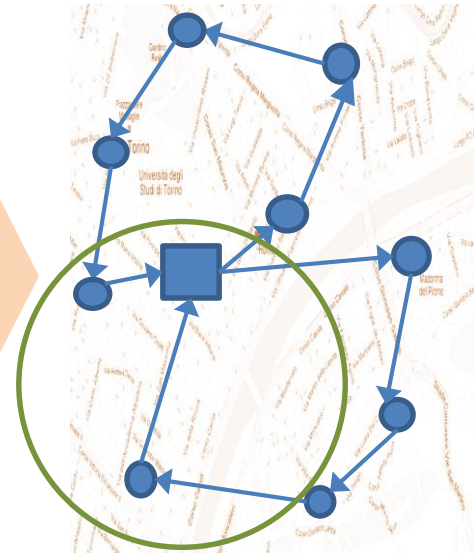
A general heuristic for routing problems

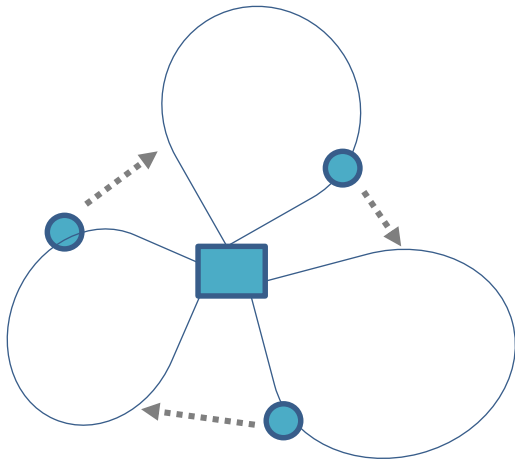Penalize Edge   Local Search   Penalize Edge   Local Search
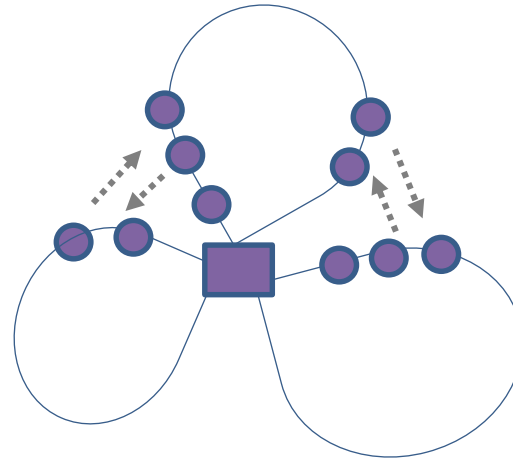
Local Search operators
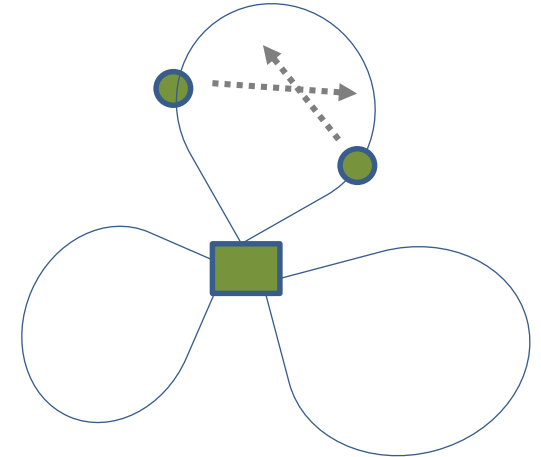
Ejection chain

Relocate Individual nodes
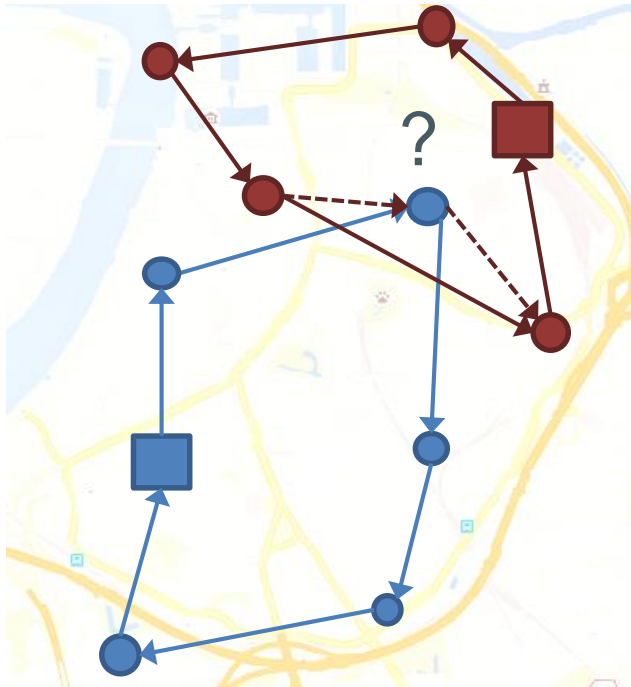
Multi-Swap (chain)

Relocate multiple nodes

Lin-Kernighan
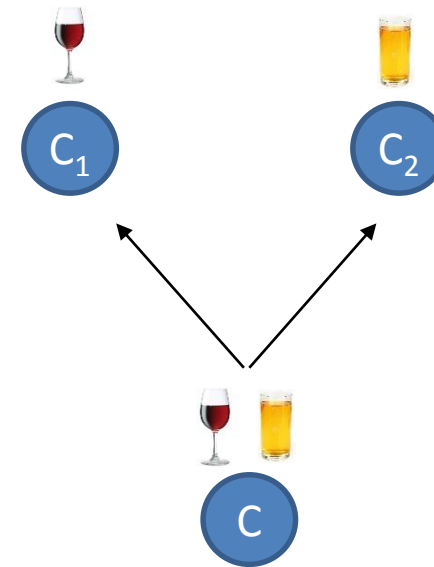
A Route is always optimal in itself

Including inventory constraints

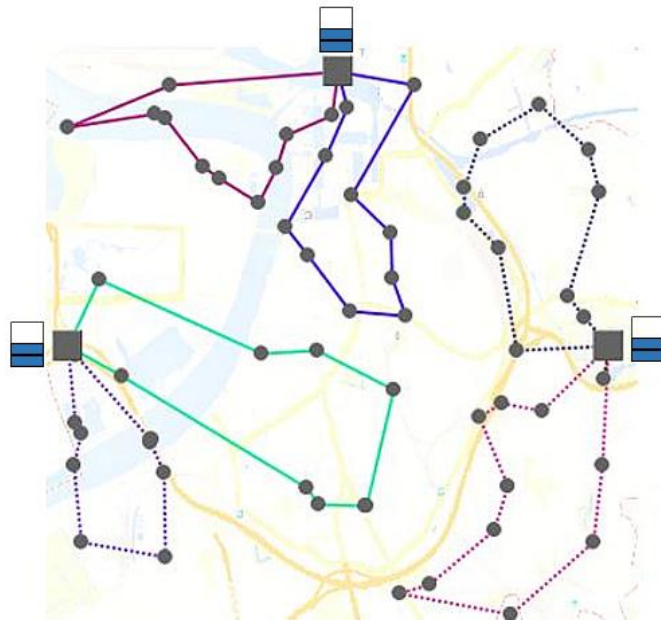Inter-depot changes need to fulfill inventory constraints

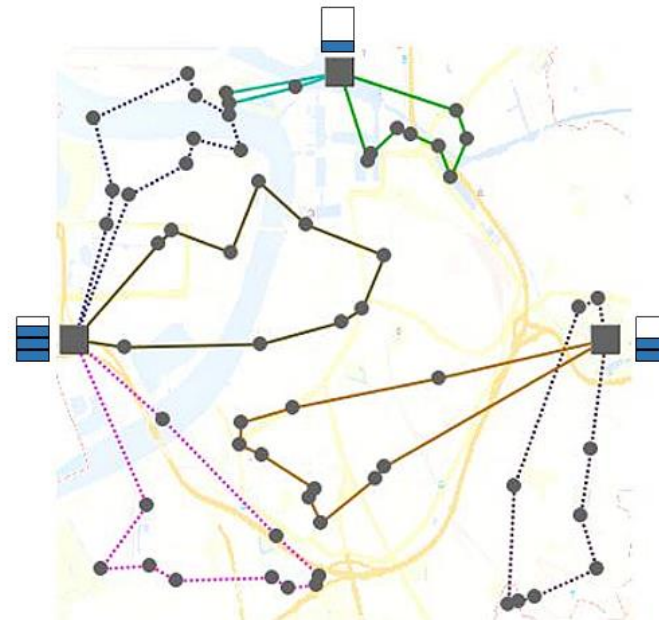Customers with multiple demand are splitted

Inventory situations can be distinguished by

- Total amount of all inventory in all depots $D < I_{total} < 2D$
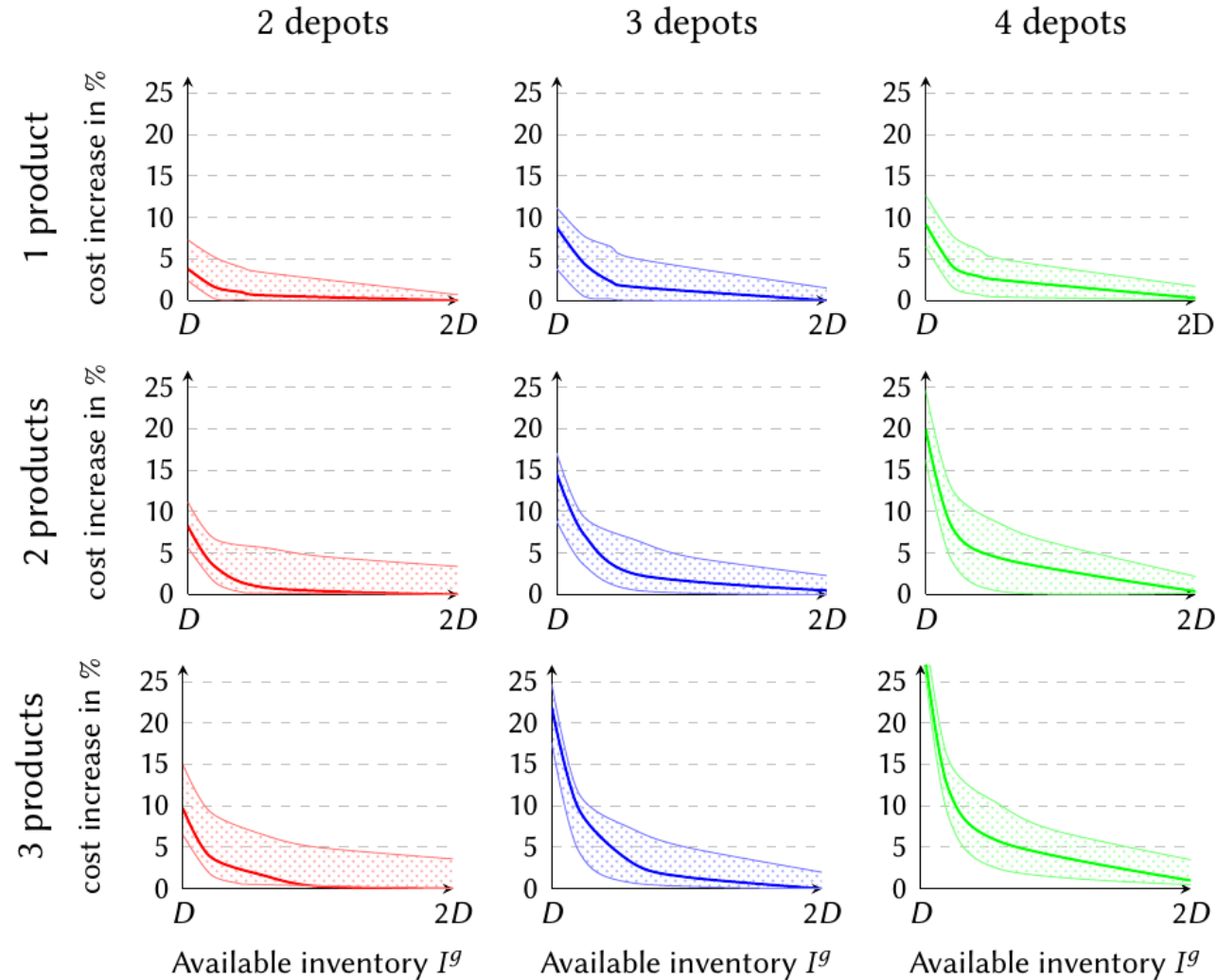- The distribution of this amount among the depots   *Equal, good, bad*
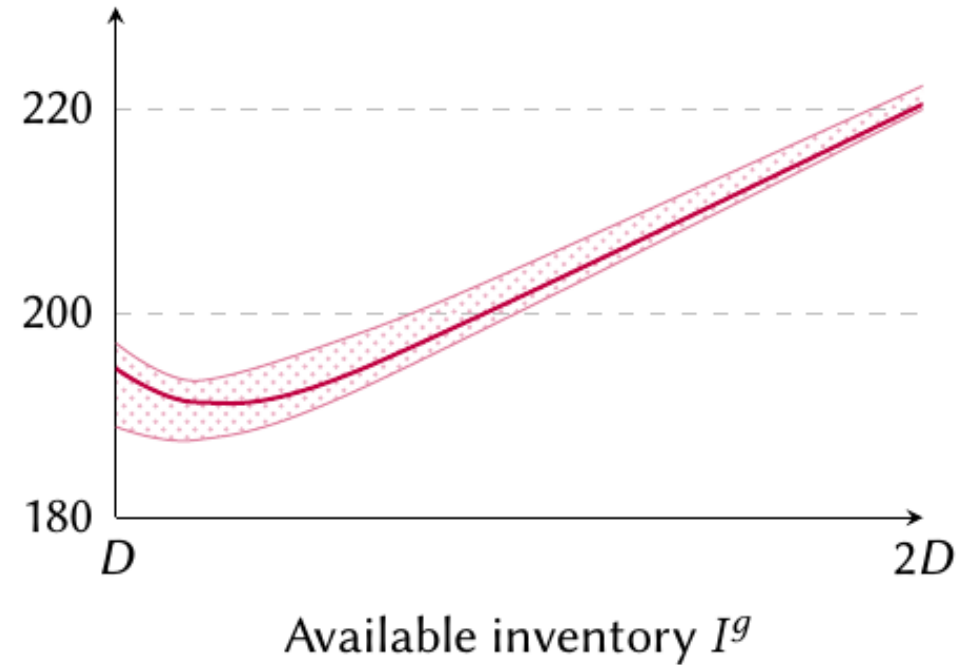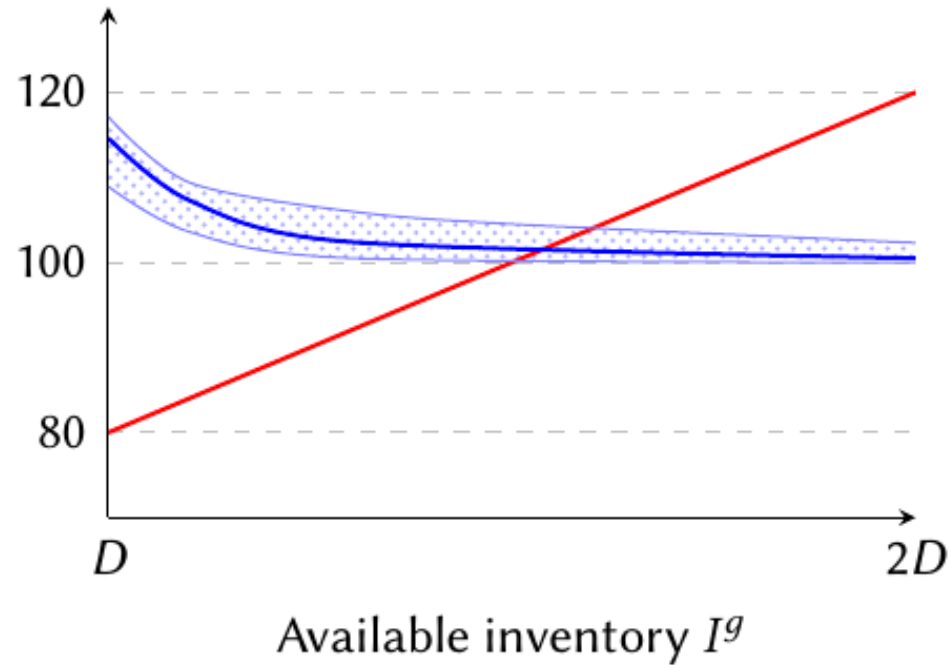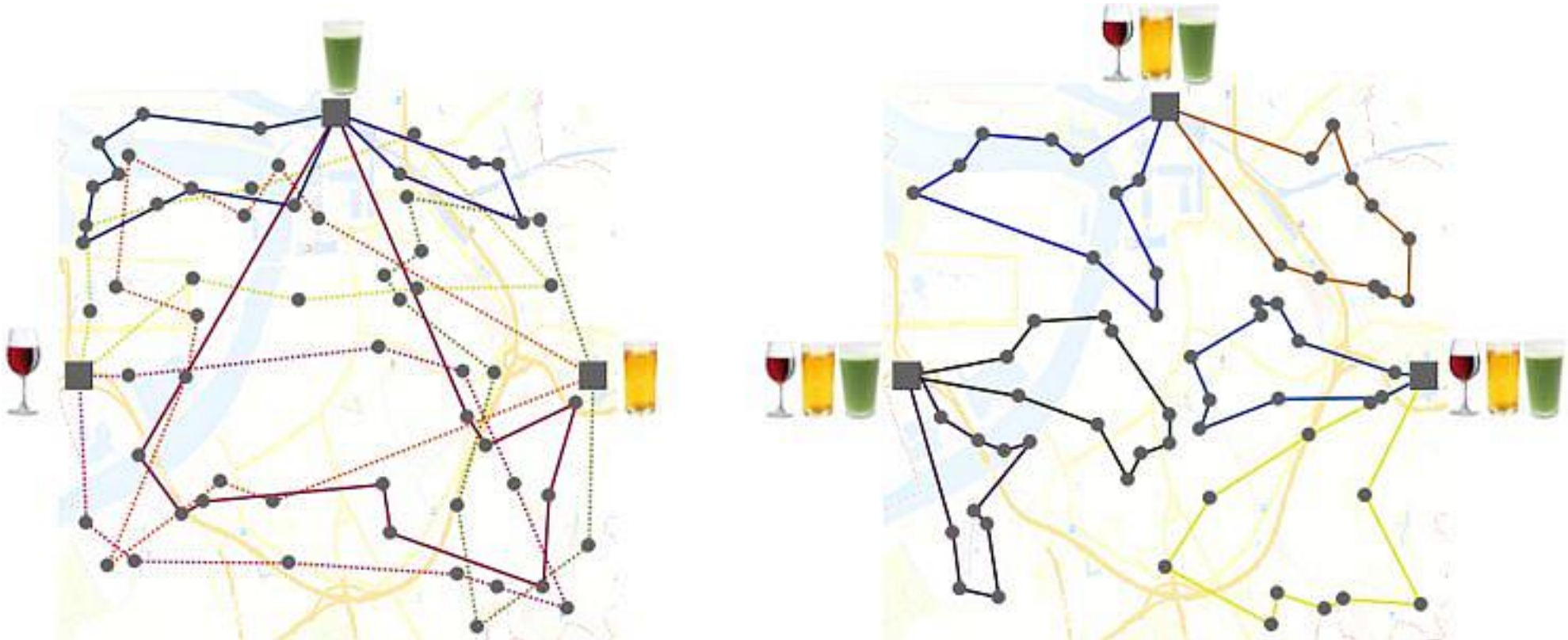

Equal distribution

Bad distribution

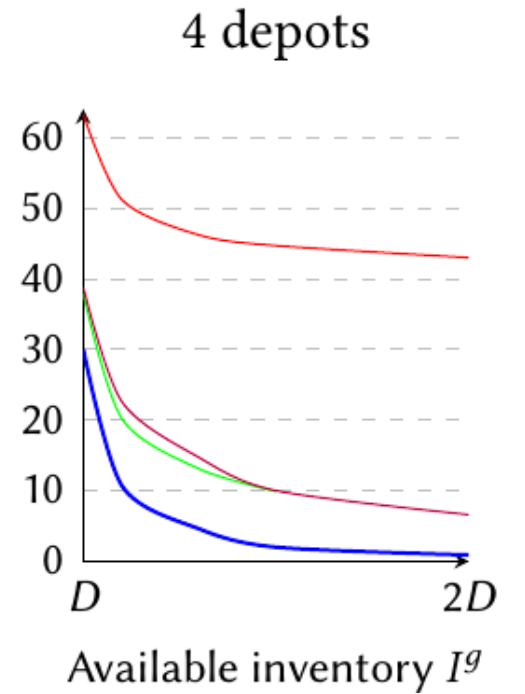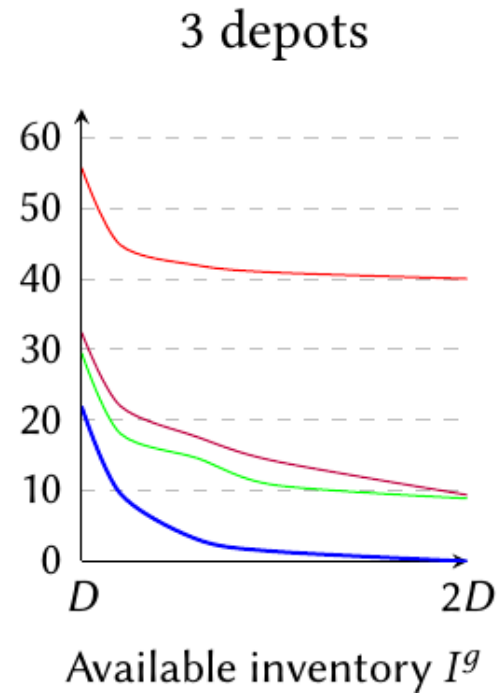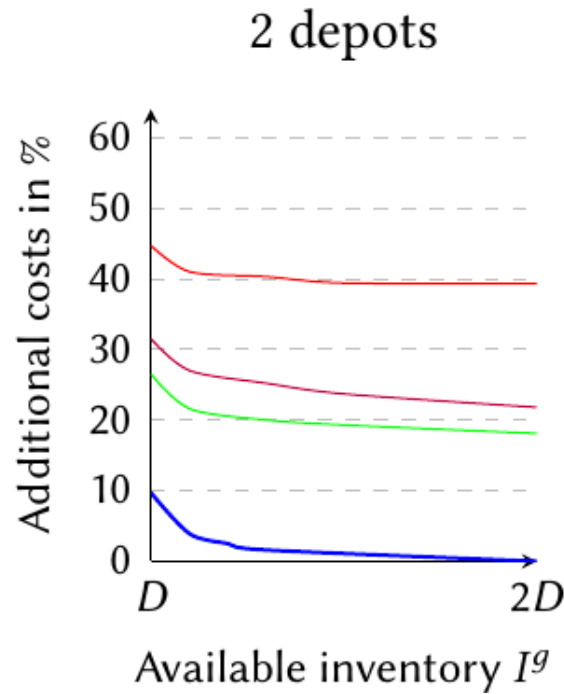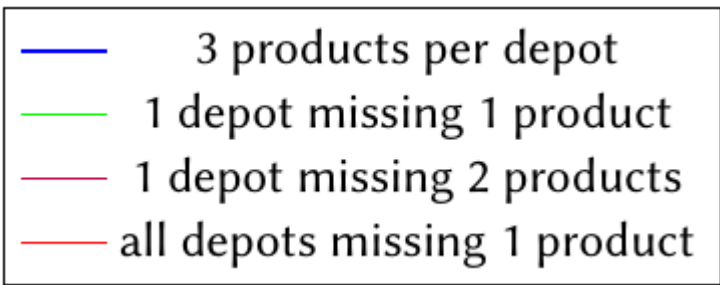# Effect of different inventory situations on routing costs

What does this mean for the combined cost of inventory holding and routing?

Available inventory I^g

Available inventory I^g

What happens, if not all products are stocked in all depots?

What happens, if not all products are stocked in all depots?

Take away

✓ Few inventory and/or a bad inventory allocation can increase routing costs by up to 30%

✓ If not all products are stocked in all depots, routing costs increase drastically by up to 60%

✓ There is a need to combine inventory and routing decisions