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

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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

\[ C \rightarrow C_1 \rightarrow C \]

\[ C \rightarrow C_2 \rightarrow C \]
Inventory situations can be distinguished by

- Total amount of all inventory in all depots
- The distribution of this amount among the depots

\[ D < I_{\text{total}} < 2D \]

*Equal, good, bad*
Effect of different inventory situations on routing costs
What does this mean for the combined cost of inventory holding and routing?
What happens, if not all products are stocked in all depots?
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![Graph showing additional costs in % vs available inventory (I^g) for 2, 3, and 4 depots. The graph indicates different scenarios such as 3 products per depot, 1 depot missing 1 product, 1 depot missing 2 products, and all depots missing 1 product.](image-url)
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.