VRP applications

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To be handed in Thursday 5/10 to bjorn@diku.dk

Question 1

Jacob Birkedal described a problem where trucks delivering goods need to arrive at the customers in a steady stream. In this exercise we try to build an IP-model for this problem.

Consider the VRPTW problem as described in Bjorns lecture. We have one depot $o$, a set of customers $C$, and $k$ identical vehicles of capacity $D$. Each customer has a demand $d_i$ and a time window $[a_i, b_i]$. The travel time between nodes $i, j$ is $\tau_{ij}$, and the cost is $c_{ij}$. All time stamps $t$ are positive integers.

Assume that each vehicle always delivers 1 unit to the customer at a given time $t$. A vehicle may deliver goods to more customers, and a customer may be serviced by more vehicles. If a customer has a demand of $d_i$ he needs to be visited by one or more vehicles, where the goods are delivered at times $t, t+1, \ldots, t+d_i-1$, and all delivery times are within the time window of the customer i.e. $a_i \leq t$ and $t + d_i - 1 \leq b_i$.

The objective is to minimize the overall travel distance. Build an integer programming model of the problem.