Combinatorial Optimization Problem: Model and Implementation

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Introduction

This document describes combinatorial optimization problems including models (mixed integer programming, constraint programming) and its implementation by MIP solver, CP solver, CBLS solver, etc.

Chapter 2

Case study

2.1 Capacitated Vehicle Routing Time Windows Problem

2.1.1 Problem description

There are N delivery requests 1,2, ..., N. Request i $(i = 1, ..., N)$ has

- w(i): weight of item
- e(i): early delivery time
- l(i): late delivery time
- d(i): delivery duration
- delivery location is point i

There are K trucks for delivering. Truck $k(k = 1, \ldots, K)$ has

- c(j): capacity of the truck (total weight of items on the truck cannot exceed its capacity)
- e(j): start working time

- l(j): end working time

-depot location is point 0

$d(i, j)$ and $t(i, j)$ are respectively distance and travel time from point i to point j $(i, j = 0, 1, ..., N)$.

Objective is to minimize total distance of the routes of trucks.

2.1.2 Mixed Integer Programming model

Variables

- Binary variable $X(k, i, j) \in \{0, 1\}$ in which $X(k, i, j) = 1$ indicates that truck k traverse from point i to point j
  $(\forall k \in \{1, \ldots, K\}, i, j \in \{0, 1, \ldots, N\})$.

Constraints

Objective functions