Optimisation Problems Collection

SOICT - HUST (IT3052E)

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1 Introduction

This is a collection of solvers developed during the optimisation course at SOICT - HUST (IT3052E). Note that these implementations draw from various external resources due to the complexity of constraint programming.

2 Capacitated Vehicle Routing Problem

2.1 Problem Statement

Consider a fleet of K identical trucks with capacity Q that must deliver packages from a central depot (0) to clients (1,2,. . .,n). Each client i requires d[i] packages, with distances c[i,j] between locations i and j.

Constraints:

- Each client must be visited exactly once

- Total package load per truck cannot exceed capacity Q

Objective: Minimize total travel distance

2.2 Input Format

```
Line 1: n,K,Q (2<=n<=12,1<=K<=5,1<=Q<=50)
Line 2: d[1],...,d[n] (1<=d[i]<=10)
Lines 3-(n+3): Distance matrix c[i,j] (1<=c[i,j]<=30)
```

2.3 Example

Input:

```
4 2 15
7 7 11 2
0 12 12 11 14
14 0 11 14 14
14 10 0 11 12
```

```
10 14 12 0 13
10 13 14 11 0
```

Output:

```
70
```

2.4   Solution Approach

Using Constraint Programming (CP) with Google OR-Tools, the key constraints are:

1. Client visitation constraint

2. Capacity constraint

3. Flow conservation

4. Subtour elimination