Case The VRP Spreadsheet Solver

Course: **Integrated Supply Chain Cases**
Part: **Model Building, Assignment 2**
Delivery Date Report: **Friday 28 February 2025 on Brightspace (report and models)**

In Operations Research good software tools are important in solving quantative problems. You are familiar with the Excel Solver for Linear Programming, and perhaps with Shortrec for distribution problems or with LEKIN for scheduling problems. Also in SCM software many OR-techniques are used, but not always directly visible for a user.

This assignment is designed to test a relatively new OR tool in Excel around VRP problems: the VRP Spreadsheet Solver designed by Güneş Erdoğan. You can download his open-source software and a manual and look at Youtube for more information about the tool[1].

But first, let's dive a little bit deeper in de VRP-world. We studied a specified VRP-problem in class and looked at the savings algorithm of Clarke and Wright. But there is a lot more theory, and there are a lot more applications of VRP. Also start reading the article of Güneş Erdoğan, which you receive together with this assignment.

The assignment

Normally, I give a OR problem and you have to find the best solution by puzzling or modelling. This assignment is very open: Basically, I want you to find or design a VRP problem, solve it with the VRP Problem Solver and reflect on it. Afterwards, you will have a good idea of the rich world of VRP and have an opinion about the tool. On the other hand I will have a lot of case studies and/or test problems.

Assignment: Find (or construct) a VRP problem with the following minimal requirements

- Between 100 and 150 addresses for collecting or delivering goods
- Between 10 and 20 trucks who deliver between 8.00 and 17.00
- Demand requirements of the customers (number of items delivered or collected), drop times (load or unload time at the customer)
- The capacity of the trucks
- About 20% of the customers have time windows varying from 1.5 hours to 4 hours

The data file must be a separate file in Excel. By finding a problem, I mean a case on the internet with context. By construct you design the data file yourself. You can add many extra's if you want. 200 customers and 20 trucks are upper bounds in the software. The distribution problem can be in the Netherlands, but also in Germany, Romania or whatever

[1] https://people.bath.ac.uk/ge277/vrp-spreadsheet-solver/

country you want. It is also possible to take a Benelux data sets (international distribution). *The complexity of the case is taken into consideration for your mark.*

If you have your data make a good (= readable, consistent) case description for the reader with all relevant planning information.

Now you are going to solve your problem with the Solver. Explain how you translated the planning problem into The Spreadsheet Solver and analyze your solution[2]. Perhaps it is possible to find alternative solutions, see what happens if you make longer computer runs et cetera.

When you are done, please reflect also on the VRP Spreadsheet Solver as a tool.

So your final report contains:

1. A data set and a description of your problem. ***Keep in mind the case design is marked as well: the context of the problem, the richness in describing a real world problem, the complexity of the problem and the alternatives. So, do not deliver just addresses and trucks!!***
2. An explanation how the problem is translated in the VRP Spreadsheet Solver
3. A solution and analysis of this solution (including the Excel files)
4. One alternative scenario e.g. more than 1 depot, cost savings if there are no time windows, delivery and collection apart from each other. Compare the result with your first result!
5. Reflection on the tool itself and in general on VRP problems in practice.

A few tips and remarks:

- Make a tab Raw Data from where you can copy the relevant data in the VRP Spreadsheet Solver
- First calculate with a small data set e.g. 20 locations to finetune your settings: 1 or more dc's, 1 or more vehicle types, the right speed per vehicle et cetera. If you have your settings correct, do it again with your full data set (and again check if your locations are correct)
- Calculations can take a long time: don't do it in the cloud or on external disks, but from your computer's internal hard disk. Get a cup of coffee or play with your smartphone

[2] If no solution is possible due to your distances and driving times and/or impossible time constraints; please redesign your dataset