Société de Calcul Mathématique SA
Outils d'aide à la décision

Fédération Française des
Jeux Mathématiques

Mathematical Competitive Game 2017-2018

Distribution of Goods

Fédération Française des Jeux Mathématiques
(French Federation of Mathematical Games)

and

Société de Calcul Mathématique SA
(Mathematical Modelling Company, Corp.)

Comments, by Bernard Beauzamy

First, let me congratulate the two winners :

Individual :
Alexis MONTOISON et Pierre-Yves BOUCHET, Ecole polytechnique de Montréal, Canada.

Group:
Taylor Arnold, Alex Baker, Alden Duquette, Nirali Jantrania, David Josephs, Charlie Maier, School of Engineering, University of Virginia, USA.

The total number of participants was smaller than during the previous years. This is probably due to the nature of the problem, which was far from an academic presentation.

Indeed, as the problem stated, the idea was that an industry has a new owner, and this owner has at his disposition only data from the past, of course. These data may consist in existing plants, warehouses, shops, and, at best, some information about what was sold during a previous year. Everything else is part of the problem.

The game made some simplification, for example the fact that the plants and the workers may treat both products (a heater and an air-conditioner) with no time to switch between them. Also, constraints in weight were neglected, and dimensions for transportation were reduced to an information of volume.

Despite these simplifications, the problem is still quite complicated, and one cannot hope to solve it precisely, nor completely. Therefore, the approach I would suggest is as follows.

First, define the sales for the new year (2018), for each shop. This must be done for each shop and each day of the year (not on a weekly basis, not on a monthly basis). One can start with the sales which were observed for 2015, and possibly build 3 scenarios : same sales, same with -10%, same with $+10\%$. At least, this will give a basis for further reasoning.

One may divide the shops into two categories, depending on a distance to each warehouse. This is not academic optimization, but will simplify the problem. Several candidates used this approach. Let us say "East" and "West", close to W1 or W2.

When this is done, we may compute the amount of each product which must be, respectively, in W1 and W2, each day of the year, for each of the 3 scenarios.

Since there is no cost, no penalty, for "overstocking", the rough idea is to maintain maximum availability, for both products, in all shops and both warehouses. But a truck should be filled with what is needed: the truck should not bring back any product, neither to the warehouses nor to the plants.

The routes are easy to define, but one should keep in mind that a truck should carry both products (in variable proportion) and may visit several shops at once, starting with each warehouse. So the routes may be different each day, depending on the demand. Since this is impossible to handle in practice, the best is to define standard routes, for usual deliveries, which will not be optimal mathematically speaking : the truck might not be completely full each time, and the route might not be the shortest. This is how things work in practice : a postman has a standard route, which he follows each day, no matter what parcels he has to deliver.

A "delivery route" has to be established for each day, connecting all the shops to the warehouses. Hopefully, most of these delivery routes should be "stable", meaning they do not change constantly. Conversely, what is inside each truck, each day, will be adjusted to the demand.

Real life situations are never the result of a complete and precise mathematical optimization, because the necessary data are not available, because the computing time is not sufficient, and, above all, because people want "routines", which they will follow without further thinking, once they have been established.