Cool Food Logistics

The logistic company Cool Food Logistics (CFL) is specialised in temperature controlled transportation. CFL wants to increase the clientele specialized in temperature controlled food by approaching several grocery companies with similar transportation characteristics and combine their shipments. CFL wants to approach three large supermarket chains in The Netherlands to provide their grocery transportation: Albert Hijne (AH), Junco (J), Koop (K). To be specific, they focus on the transportation of tomatoes.

CFL headquarters first needs to study the tomatoes transportation needs of these supermarket chains. For this, they have collected data relating the size of the supermarket and the weekly demand (roll pallets) of tomatoes.

Question: Estimate the daily demand of each supermarket belonging to each chain to which CFL wants to provide its service.

CFL knows the capacity of the trucks employed by these supermarkets, their fixed costs and their variable costs, and the storage costs of tomatoes. Next to this, CFL has a list of all supermarkets of each chain. With this list, CFL can compute the travelling distance from the distribution centre to the various supermarkets and the travelling distance between supermarkets of that chain.

Question: Calculate the total costs that each supermarket incurs from individually storing and transporting the tomatoes: $C_0(\{AH\})$, $C_0(\{J\})$, and $C_0(\{K\})$.

First of all, CFL collects all demand information of the three supermarkets and the travelling distance from the distribution centre to the different supermarkets. With this data, CFL can calculate the minimum transportation costs of each supermarket separately, and of each group of them. This leads to seven numbers: $C(S)$, $S \subseteq \{AH, J, K\}$. If AH is the only supermarket to hire the services of CFL, the total cost savings is $C_0(\{AH\}) - C(\{AH\})$. If AH and J are the only supermarkets to accept the offer of CFL, the total cost savings will equal $C_0(\{AH\}) + C_0(\{J\}) - C(\{AH, J\})$.

Question: Calculate the total costs that each group of supermarkets incurs if CFL stores and transports the tomatoes, and the corresponding cost savings: $v(S)$, with $v(S) = \sum_{i \in S} C_0(\{i\}) - C(S)$, $S \subseteq \{AH, J, K\}$.

CFL retains 15% of the cost savings and determines how to share the remaining 85% among the supermarkets that accept the offer. Notice that only CFL has full information about all possible transportation costs, while the supermarkets only know their individual transportation costs.

CFL is going to approach each of the three supermarket chains separately. For this, CFL chooses an order, π, to approach them for negotiations (e.g. first AH, second J, and last K: $AH - J - K$).

Sequentially, a supermarket chain i receives an opening offer based on a share of the 85% of the cost savings of the coalition of supermarket chains S including i and those supermarket chains that have already committed to use CFL services (e.g., for the order $AH - J - K$ and $i = J$, if AH has accepted, J gets a share of $0.85v(\{AH, J\})$). Notice that the order in which CFL approaches the supermarket chains may determine what group of supermarket chains will accept the offer.

Questions: What should CFL offer the chains? What is the best order to approach these three supermarkets chains in order to obtain maximum cost savings? Given this optimal order, what group of supermarkets will accept its services, how much cost savings will CFL earn, and what is the five working days planning for this group of costumers?

Data:

- Data relating the size of the supermarket and the weekly demand (roll pallets) of tomatoes: see excel file.
- Transportation costs for supermarkets: see excel file.
- Transportation costs for Cool Food Logistics: see excel file.
- The storage location of each supermarket: see excel file.
- Location of the subsidiary supermarket and traveling time between different locations: see excel file.