UNIVERSITY OF WATERLOO
DEPARTMENT OF MANAGEMENT SCIENCES
MSCI 434: SUPPLY CHAIN MANAGEMENT
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PROJECT STATEMENT

A grocery store chain is composed of three tiers; suppliers, warehouses and (retail) stores. Because of the limited storage space in each grocery store, everyday each store places a consolidated order from a warehouse to replenish its inventory in order to avoid loss of sales. Warehouses forecast the demand of grocery stores and order the appropriate amount from supplier(s). Forecasting should be as accurate as possible since ordering too much would result in an increase in inventory cost at the warehouses, and ordering too little might not be enough to fulfill the daily orders of stores.

Each product can be supplied by three suppliers, each with a different cost structure (price/unit) depending on the order amount. The grocery store chain consists of 10 stores and two warehouses. For simplicity, assume that you are placing orders for five products (or product groups) only. You are given demand historical data for 30 days for the five products at each store. Also, you are given warehouse capacities, holding costs and the location of each warehouse and each store.

All demand is given in pallets. A pallet is transport structure of a unit load that keeps goods stable and allows handling and storage efficiencies. It is assumed that a pallet is divisible, which may not be the case in some real-life scenarios. The actual number of units in a pallet differs from one product to another. A truck has a maximum capacity to fit 40 pallets. All necessary data is given in the Excel file titled “MSCI434_S18_Project Data".

Your goal is to determine a supply chain policy for the grocery store chain that minimizes the total cost over the whole supply chain, while ensuring that demand is met. That includes the following:

1. **Forecasting**: Using the previous month demand data of the five products, use some forecasting technique to estimate the demand of each of the five products in each of the stores for the next 10 days. Based on the forecasted retail demand, determine the order quantity and the order frequency of each product for each warehouse.

2. **Sourcing and Inventory**: Based on the computed forecast in Part 1, choose a supplier, for each of the five products, such that the total cost of the amount ordered and the inventory at the warehouse is minimized, while ensuring that capacity constraints are not violated. Assume that the cost of products provided also includes transportation cost, and there is a lead time of one day. Find the optimal inventory policy for an infinite planning horizon.

3. **Store Allocation**: Based on the forecasted demand, warehouse capacities and distances, determine which warehouse should serve each store for each product. Note that single allocation of warehouse to store is not required, but for a particular product, demand is not divisible. In other words, demand of a given store for a product can only be fulfilled by one warehouse. For example, store 1 can have its order of product 1 fulfilled by warehouse 1, and product 3 fulfilled by warehouse 2, and so on. However, store 1 cannot have both warehouse 1 and 2 sending partial orders of product 1.

4. **Transportation and Routing**: Given the forecasted order amount of each store, determine the number of trucks needed to fulfill the daily order of stores. If the total order of the store is less than a truck load, the order may be consolidated with other store orders such that transportation cost is minimized and the optimal routing is determined.