**COMP 567 - Discrete Optimization II**
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Case Study

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ACEPT Co. LTD. is a large consumer products manufacturing company. Recently, the company has conducted a cost reduction program to reduce operation costs in supply chain process. Mr. Richardson, the Supply chain director of the company, has an idea to reduce the inventory and distribution costs. He thought the efficiency in inventory control and transportation planning are important factors which affect product cost. In the past, these areas are managed by different units and the costs are optimized separately. However, when reducing cost in one of these activities, the other will generally increase. For example, a small order quantity will lead to a low inventory holding cost but a transportation cost will increase due to more frequent deliveries required. On the other hand, the costs can be reduced when both activities are optimized simultaneously as the figure below.
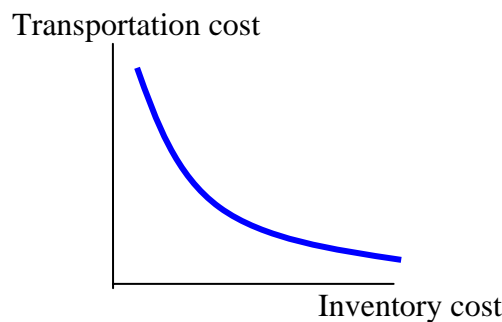
Relationship between transportation and inventory cost

By this reason, Mr.Richardson and the company decided to implement VMI (Vendor Managed Inventory) with their customers. In this system, the inventory management is transferred from the customer to the vendor. The vendor can control inventory replenishment and decide on the shipment date, the quantity and delivery routes to use. The decision maker has to determine shipping policies that minimize both inventory cost and transportation cost.

In order to implement this project effectively, Mr.Richardson realizes that the optimization planning tool is a key to the cost reduction. He decided to ask a consultant company to study and propose an application to optimize the costs of inventory and transportation. The application must be able to provide the solution as stated below, i.e.,

    (i) when to serve a customer
    (ii) how much to deliver to a customer when it is served
    (iii)which delivery routes to use.

The details of the problem of ACEPT are as follows.

Problem Characteristics

1. Distribution system

The system consists of a distribution center and several customers. The distribution center delivers multiple items to customers on a daily basis. The products are supplied with order-up-to level inventory policy which vehicles deliver the amount for the difference between the on-hand inventory and the maximum inventory level. Mr.Richardson proposed that the appropriate shipment planning period is 3 days.

2. Demand

A deterministic demand is considered in this study. Each customer has different consumption rate per day. The ACEPT Co. needs to ensure the customers will not run out of stock.

3. Costs

The cost consists of inventory holding cost and vehicle routing cost. The inventory holding cost, which occurs at the distribution center, is variable cost depended on the number of units. For the vehicle routing cost, it depends on the distance traveled.

4. Fleet and Vehicle

The company operates by one fleet type with a limited number of vehicles. The shipment quantity cannot exceed vehicle's capacity.

Sample of data

Transportation Network
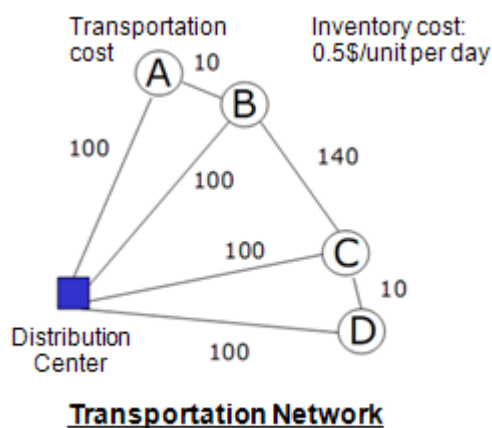
	Customer Capacity	Consumption (unit/day)
A	500	100
B	300	300
C	200	200
D	400	150

Fleet
X 3   Capacity: 600 units

Inventory cost: 0.5$/unit per day

***The full set of the data will be provided later to the consultant team*