ORDRE DES INGÉNIEURS DU QUÉBEC

MAY 2014 SESSION

All documentation allowed
Calculators : only authorized models
Duration: 3 hours

14-IN-B3 Logistics: Transportation aspects

Question 1 (10 points)

Name and explain the three sides of the triangle of logistics decision making and explain how they affect the customer service level.

Question 2 (10 points)

Describe the principle of differentiated distribution (4 pts). Explain how it is illustrated in the following situations:

a) Total distribution costs are minimized if back orders on field warehouse inventories are filled from plant inventories. Premium transportation is used to ship back orders directly from plant to customers. (2 pts)
b) The product items stocked in a warehouse are grouped so that different stock availability levels are set for each of the groups. (2 pts)
c) All products are grouped according to an *ABC* classification scheme, where *A* items have high sales volume, *B* items have moderate sales volume, and *C* items have low sales volume. *A* items are stocked in field warehouses, *B* items are stocked in regional warehouses, and *C* items are stocked only at plan locations. (2 pts)

Question 3 (12 points)

The logistic manager of an electrical motor company has just received a rate-reduction offer from a trucking company for the shipment of fractional horsepower motors to the company's field warehouse. The proposal is a rate of 3$ per hundredweight (cwt.) if a minimum of 40 000 pounds is moved in each shipment. Currently, shipments of 20 000 pounds or more are moved at a rate of 5$ per cwt. If the shipment size falls below 20 000 pounds, a rate of 9$ per cwt. applies. To help the logistic manager make a decision, the following additional information has been gathered:

Annual demand on warehouse	10 000 motors per year
Warehouse replenishment orders	75 orders per year
Weight of each motor, crated	180 pounds
Standard cost of motor in warehouse	200$ per motor
Stock replenishment order handling costs	15$ per order
Inventory holding cost	25% per year
Handling cost at warehouse	0.30$ per cwt
Warehouse space	Unlimited

Should the manager accept the new rate?

Question 4 (8 points)

The most important characteristics of the product that influence logistics strategy are the attributes of the product itself. Name and explain the four (4) attribute categories of a product with respect to logistics.

Question 5 (10 points)

The costs associated with producing, distributing, and selling an automotive component can be summarized as follows:

Cost type	Unit Cost ($)
Raw materials	25
Manufacturing labor	10
Overhead	5
Transportation	Varies by shipment size
Sales	8
Profit	5

Transportation costs vary as follows:

Purchase Quantity	Unit Cost ($)
1000 units or less	5
More than 1000 to 2000 units	4
More than 2000 units	3

Construct a price schedule, assuming the company would like to pass the transportation economies on to the customer. Indicate the discount percentage the customer will receive through buying at various quantities.

Question 6 (10 points)

For the following shipping situations, rank the basic transport modes in terms of (1) availability of service; (2) average transit time; (3) transit-time variability; (4) price of the service; and (5) loss and damage.

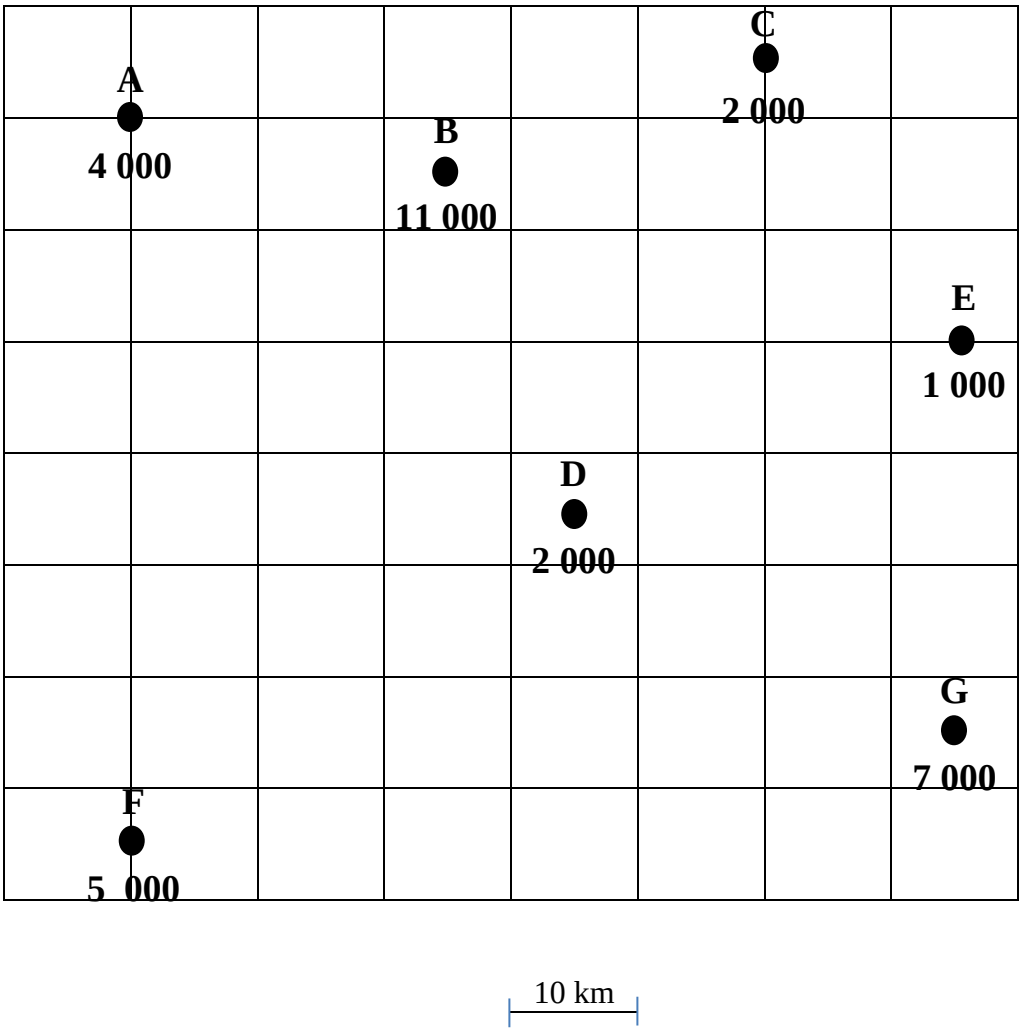
a) A 10 000 kg shipment of hardware items moving from Vancouver, British Colombia to Montreal, Quebec.
b) A container load of woman's clothing moving from Vietnam to Vancouver, British Colombia.
c) A 35 000 kg shipment of paper from Montreal, Quebec to Toronto, Ontario.
d) A 20 000 kg shipment of steel from Windsor, Ontario to Oshawa, Ontario.
e) A 2 000 kg shipment of fresh lettuce from the Okanagan Valley, British Colombia to Montreal, Quebec

Question 7 (20 points)

A humanitarian organization wishes to locate specialized medical clinics in a rural area of Latin America. Since traveling is difficult for the patients in this part of the world, proximity of such facilities often dictates their choice. Therefore, location is based on weighted distance (number of patients times distance from the clinic). Figure 1 shows the number of patient that will likely visit the clinic by location. A clinic can only be located among these locations. The estimated cost of travel for a patient is 0.75$ per kilometer (one-way trip).

a) Determine the best location for one clinic and calculate the cost. (10 points)
b) Determine the best location for two (2) clinics and calculate the cost. (10 points)

Figure 1



Question 8 (20 points)

The Canada Brewing company bottles beer in its Montreal plant and distributes to nine (9) warehouses in the province of Quebec. The product is shipped in full truckload to the warehouses. The shipment from the plant to a warehouse is as follow: a full load trailer of palletized beers is transported from the plant to the warehouse, the trailer is dropped off, and an empty trailer is taken to return empty pallets to the plant. It takes 15 minutes to change trailer. Travel times, time to change trailer, and break times are well known since the routes are traveled frequently. The number of trips needed to meet the weekly demand and the times are given in table 1.

Table 1 – Planned roundtrips

Destination	Distance roundtrip (km)	Number of trips per week	Driving time (hr.)	Change of trailer (hr.)	Break / Lunch (hr.)
Warehouse 1	30	43	1,00	0,25	0,00
Warehouse 2	560	5	9,00	0,25	1,25
Warehouse 3	130	8	2,00	0,25	0,00
Warehouse 4	190	21	3,25	0,25	0,25
Warehouse 5	295	12	4,50	0,25	0,75
Warehouse 6	335	5	5,00	0,25	0,75
Warehouse 7	145	43	2,50	0,25	0,00
Warehouse 8	600	6	9,00	0,25	1,25
Warehouse 9	685	5	10,00	0,25	1,50

A driver can leave the plant at or after 4:00 AM and return no later than 11:00 PM the same day. The warehouses are open from Monday to Friday from 6:30 AM to 11:00 PM and it is not possible to access the warehouse outside those hours. Actually, the company uses 10 trucks for the transportation.

Organize the routes in order to optimize the truck utilization and determine the minimum number of trucks that is needed to serve all warehouses.