

# Examen Supply Chain Management - Januari 2020

1. We have a 2-phase supply chain with a manufacturer and a retailer and this supply chain has more or less the monopoly for the market. The demand  $D$  for the market is 70 units per month and there is a deviation of 41.15. There is a very big lead time therefore the retailer can only place one order every year. When we order at January 1, we get the order at May 1.

The cost for production is 10€ for the manufacturer. This is sold to the retailer for €16 and the retailer himself sells it for €25. When the goods couldn't be sold, we get a salvage price of €5 (when it couldn't be sold before April 30).

a) Calculate the profits for the manufacturer and the profits for the retailer, and also the profit for the supply chain when there is not coordination. **(1 point)**

b) We see that this is not an optimal profit. What is the profit for the manufacturer and the retailer when we have coordination and what is the total supply chain profit. **(1 point)**

c) There can be an option contract. What is the interval ((lower bound), (upper bound)) to have the most optimal profit for both manufacturer and retailer with coordination? **(1 point)**

d) What is the option contract when we try to have the profits of the manufacturer equal to the profits of the retailer? **(2 points)**

2. This product from previous question has 2 components from the same supplier. For this one product we need 1 driveshaft and 2 cutting blades. There is an order cost of €100 when the manufacturer places an order. Additionally, we have a fixed cost of €250 for ordering the drive shaft and €150 for the cutting blades. The components themselves are relatively cheap and are €3,5 per cutting blade and €1,9 for the drive shaft. We have a holding cost of 0,15€/€/year. The monthly demand for the product is 70

a) Determine the order frequency for (a) independent control (b) complete aggregation and (c) tailored aggregation. Which of these would you choose? **(2 points)**

b) Determine a mathematical solution to determine whether the independent control or the complete aggregation is the cheapest, instead of doing all the calculations like above. **(2 points)**

c) When we keep all parameters the same except we double the cost of the cutting blades, which is going to be the cheapest? The independent control or the complete aggregation? **(1 point)**

3.

a) What is the difference between an unbalanced and unbalanced and infeasible problem in the demand allocation / transportation problem? **(1 point)**

b) Why are simple exponential smoothing and Winters model called adaptive forecasting methodologies? **(1 point)**

c) Choose 1 of 6 typical distribution networks. Give a real-time example of a company in the world that we know that uses this distribution model and explain it by giving any one service aspect and any one cost aspect. **(1 point)**

d) We have a production company for paint that has 4 (1, 2, 3, 4) production centers and delivers to 6 markets (A, B, C, D, E, F). There is some uncertainty in the market and the paint company has made some scenarios with the demands (neutral and optimistic where the probability of the optimistic scenario is 0,6). We have a table with the transportation costs per ton shipped from the manufacturing plant to the different markets and the different scenarios with their demands (in tons). **(2 points)**

Transportation costs	A	B	C	D	E	F
1	€1100	€600	€1300	€900	€600	€1100
2	€1100	€1300	€800	€1100	€1200	€900
3	€1300	€950	€950	€1200	€1000	€750
4	€850	€1100	€1100	€1000	€950	€1300
Demand scenario 1	1.000.000	1.000.000	18.000.000	17.000.000	23.000.000	10.000.000
Demand scenario 2	1.000.000	2.500.000	22.000.000	21.000.000	30.000.000	13.500.000

We observe that each plant is almost at their maximum capacity. We can give each manufacturing/ production plant an expansion. Here we see the costs for expansion, each with extra added capacity of 10.000.000.

Plant	Current capacity	Production cost /kg	Expansion cost.
1	30.000.000	€3,30	€12.000.000
2	20.000.000	€3,80	€10.000.000
3	10.000.000	€3,75	€12.000.000
4	10.000.000	€3,90	€10.000.000

We have a budget of €30 million to expand the plants. Create a linear program where we minimize all the costs, you don't need to solve this problem and we need to specify all variables used.

4. multiple choice ((5 points) - 1/3 per wrong answer)

4.1	...	4.2	...	4.3	...	4.4	...	4.5	...
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4.1. Which option is most sustainable when we need to transport 500kg of beer in 330ml bottles (this is 30 crates of 24 bottles with measures of 40x30x30 cm)

a) A diesel truck that can drive 2,55 km per liter fuel, that has 2,55kg of CO<sub>2</sub> per liter fuel, which can carry 20 tons and has a cargo space of 10 cubic meters

b) A van that can drive 7,65 km per liter fuel, that has 2,34 kg of CO<sub>2</sub> per liter fuel, which can carry 700kg and has a cargo space of 0,7 cubic meters.

c) A van that can drive 4,55 km per liter fuel, that has 2 kg of CO<sub>2</sub> per liter fuel, which can carry 1500 kg and has a cargo space of 2 cubic meters.

d) We didn't get enough information to answer this question.

4.2. We have a series of 24 observations for the demand of a seasonal structure. We can observe that the seasonality has a cycle of 4 periods. When the first 6 observations are: 7000 – 14.000 – 25.000 – 28.000 – 9000 – 15.000, what is the deseasonalised demand for period 3?

a) 16.600

b) 18750 -> this one?

c) 19125

d) We didn't get enough information to answer this question

4.3. Which statement is correct?

a) Trade promotion is a good idea because this decreases the total cycle inventory (??? not sure what this was)

b) Trade promotion is a bad idea because this gives incentive for forward buying -> i had this one (example soup)

c) Trade promotion is a bad idea because this increases the variance of inventory for the retailer (??? not sure what this was) -> i thought this one increased the variance of the manufacturer

d) Trade promotion is a good idea because this gives incentive for forward buying

4.4. We have a workforce  $W_t$  for a company and a Production of  $P_t$ . Every period we hire ( $H_t$ ) and fire ( $F_t$ ) workers. Now assume that after hiring workers, the company must send them to a training before they are fully operational. The effect of this training is that the workers' effective productivity is half during their first month. What is in a linear program to solve this aggregate planning problem the 'formulas' for  $W_t$  and  $P_t$ ? (→ 4 options slightly different from one another)

a)

b)

c)

d)

→ this was the right option:

$$W_t = W_{t-1} + H_t - F_t$$

$$P_t = (W_{t-1} - F_t) * K * n_t + 1/2 * H_t * K * n_t$$

( → With  $W_{t-1}$  = workforce previous period,  $W_t$  = workforce this period.  $K$  = productivity and  $n_t$  = amount of production days per period.  $H_t$  = hired employees,  $F_t$  = fired employees)

4.5. which one is not an aspect of Carroll's pyramid of corporate social responsibility?

- a) philanthropic responsibilities
- b) ethical responsibilities
- c) operational responsibilities**
- d) economic responsibilities