UE 4 - Logistique et Gestion de la Supply Chain

UE 4 - Logistics and Supply Chain Management

Module 4.3 - Modélisation & optimisation de la Supply Chain

Module 4.3 - Supply chain modelling and optimization

EXAM

Part 2 – Second session

English version

EXAM INSTRUCTIONS

1. Write your name, surname and identification number
2. Perform the exam:
    a. For multiple choice questions (30 questions):
    Choose <u>one</u> answer among the alternatives.
    Correct answer: 1.5 point
    Wrong answer or no answer: 0 point
    b. For exercises (5 exercises):
    <u>Write your calculation</u> in the box and choose the correct answer.
    Correct answer: 5 points
    Wrong answer or no answer: 0 point
3. Give all the sheets of paper to the examiner

NAME: _____

SURNAME: _____

IDENTIFICATION NUMBER: _____

DATE: _____

Question 1
The objective of every supply chain should be to maximize the overall value generated (Supply chain surplus). What is the supply chain surplus?

- ☒ The difference between the customer value and the supply chain cost
- ☐ The sum of the customer value and the supply chain cost
- ☐ The ratio between the customer value and the supply chain cost

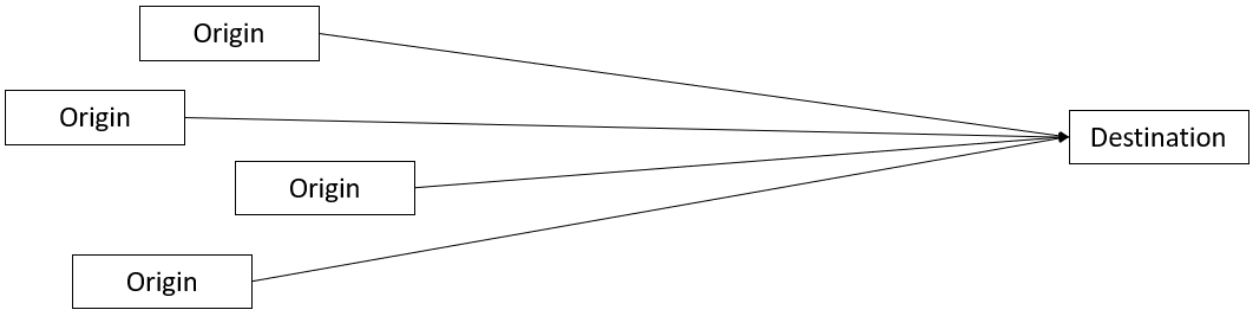
Question 2
What is one of the activities that is not performed in the supply chain strategy phase?

- ☐ Defining the configuration of the supply chain
- ☐ Planning the allocation of resources for the long term
- ☒ Managing individual daily customer orders

Question 3
What is the main aim of a carrier?

- ☐ It balances environmental, energy and social concerns
- ☒ It tries to minimize the total cost while providing an appropriate level of responsiveness to the customer
- ☐ It maintains an adequate level of quality of transport infrastructures

Question 4
The figure shows a supply network structure.

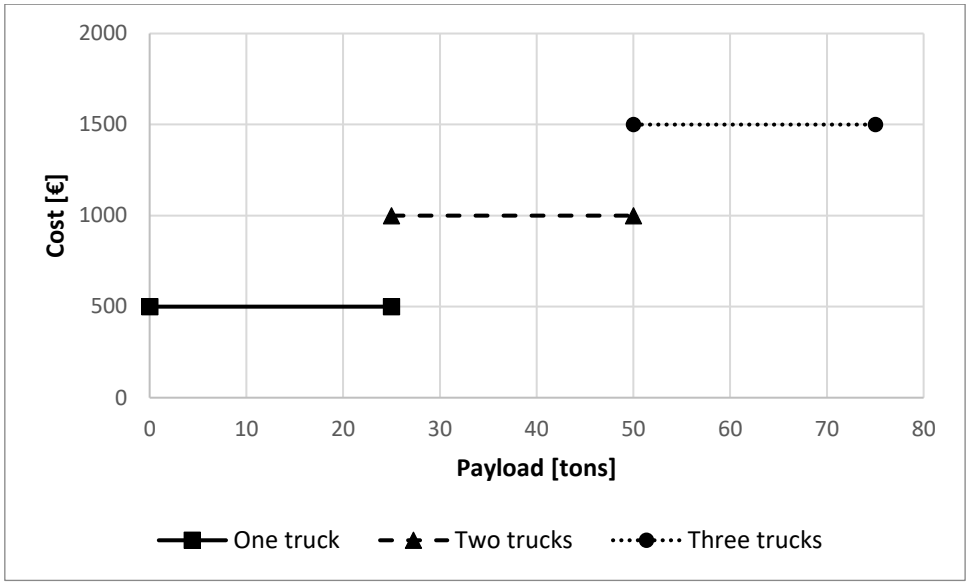


What is the correct answer?

- ☒ The destination requests a certain supply quantity, but the demand quantity is distributed over several origin locations
- ☐ The supply quantities are available at a single location (the origin) and the available supply quantity is requested completely or partially from a single location (the destination)
- ☐ Several origins provide supply quantities, but there are also several demanding destination locations

Question 5

The graph below shows the cost for hiring one, two and three trucks as a function of the carried payload.



What is the correct answer?

- ☒ To deliver 30 tons, two trucks are required
- ☐ To deliver 30 tons, one truck is required
- ☐ To deliver 30 tons, the total cost is 500€

Question 6

Consider the figure reported in the previous question. What is the correct answer?

- ☐ Two trucks can carry maximum 25 tons
- ☒ Two trucks can carry maximum 50 tons
- ☐ Two trucks can carry maximum 60 tons

Question 7

What is transshipment?

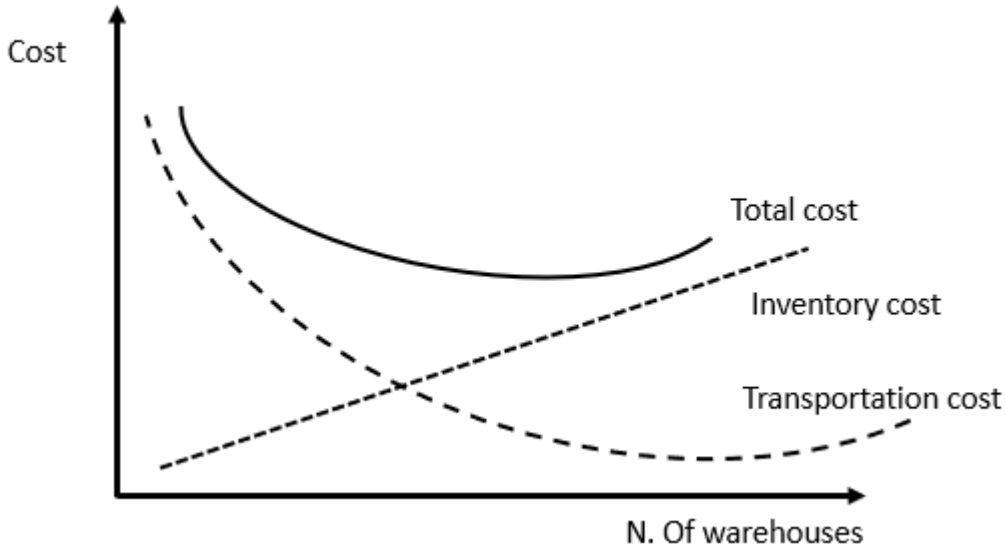
- ☐ It is the use of more than one loading unit in a trip
- ☒ Goods are transferred from one truck to another one, to increase the fill rate of trucks travelling long distances
- ☐ Goods are stored in multiple warehouses

Question 8

What is intermodal transportation?

- ☐ It is the use of more than one loading unit in a trip
- ☐ It is the crossing of more than one country
- ☒ It is the use of more than one mode of transportation to move a shipment to its destination

Question 9
The figure shows cost categories as a function of the number of warehouses.



What does the minimum value of total cost curve represent?

- ☐ The optimal number of trucks
- ☐ The optimal inventory level
- ☒ The optimal number of warehouses with the minimum cost

Question 10
What is the transport mode that can be used to deliver low volume with a high speed and a high cost?

- ☒ Airplane
- ☐ Cargo ship
- ☐ Rail

Question 11
What is the correct answer regarding truck transportation mode?

- ☒ The amount of cargo that a single truck can carry is limited by size and weight
- ☐ Its suitability can vary depending on the rail infrastructure
- ☐ It has very high capacity and very low cost, but transit times are slow, and large areas of the world are not directly accessible through water

Question 12
What is a backhaul?

- ☐ It is a distribution network where a hub represents the consolidation element in the distribution network, and spokes are the regional warehouses and customers
- ☒ It is the return movement of a transport vehicle from its original destination to its original point of departure
- ☐ It is a process in which goods are transferred from one truck to another one, to increase the fill rate of trucks travelling long distances

Question 13
What is a cross-dock?

- ☒ A warehouse that is simply a meeting place for products to move from inbound trucks to outbound trucks
- ☐ A plant where raw materials are produced
- ☐ A group of customers

Question 14
In a typical optimization problem, what does the objective represent?

- ☒ The objective is the goal of the optimization and the criteria we'll use to compare different solutions (e.g. minimizing cost)
- ☐ The objective defines the rules of a legitimate solution (e.g. which products may be made where, how much production capacity is available, how close your warehouses must be to customers)
- ☐ The type of considered products

Question 15
In a typical optimization problem, what do the constraints represent?

- ☐ The constraints are the goals of the optimization and the criteria we'll use to compare different solutions (e.g. minimizing cost)
- ☒ The constraints define the rules of a legitimate solution (e.g. which products may be made where, how much production capacity is available, how close your warehouses must be to customers)
- ☐ The type of considered products

Question 16
What is the correct statement regarding the Center of Gravity problem?

- ☐ A center of gravity solution suggests that facilities are located far from the center (the "center of gravity") of a collection of demand points (or in some instances, for firms with many suppliers, at the center of the supply points)
- ☐ A center of gravity solution suggests that facilities are distributed around the center (the "center of gravity") of a collection of demand points (or in some instances, for firms with many suppliers, at the center of the supply points)
- ☒ A center of gravity solution suggests that facilities are located at the center (the "center of gravity") of a collection of demand points (or in some instances, for firms with many suppliers, at the center of the supply points)

Question 17
What is the aim of a facility location planning problem?

- ☒ To locate a given (or the minimum) number of facilities, minimizing the cost
- ☐ To locate a given (or the minimum) number of facilities, maximizing the cost
- ☐ To locate a given (or the minimum) number of facilities, independently on the cost

Question 18
What is the inbound transport cost?

- ☒ It is the cost to get product into the facility, from a plant to a warehouse, before it moves on to a customer
- ☐ It is the cost to ship outbound from a facility
- ☐ It is the cost to pick up goods from the customer

Question 19
Consider a distribution network where customers are served directly from a facility. What kind of network is that?

- ☐ One-echelon supply chain
- ☒ Two-echelon supply chain
- ☐ Three-echelon supply chain

Question 20
What is the best operating level in capacity management and planning?

- ☐ It is an unexpected level of capacity for which the process was not designed and thus is the volume of output at which average unit cost is null
- ☐ It the level of capacity for which the process was designed and thus is the volume of output at which average unit cost is maximized
- ☒ It is the level of capacity for which the process was designed and thus is the volume of output at which average unit cost is minimized

Question 21
What is the correct definition of outsourcing?

- ☐ It is the process of procuring the proper requirement, at the necessary time, for the lowest possible cost from a reliable source
- ☒ It is the act of moving some of a firm's internal activities and decision responsibility to outside providers
- ☐ It is a strategic decision that determines that sourcing objects are internally made

Question 22
What is the correct definition of postponement in production strategies?

- ☐ It is an organizational concept whereby some of the activities in the supply chain are performed before customer orders are received
- ☐ It is an organizational concept whereby some of the activities in the supply chain are not performed until customer orders are delivered to the final location
- ☒ It is an organizational concept whereby some of the activities in the supply chain are not performed until customer orders are received

Question 23
As regards demand forecasting with time series methods, what is the correct sentence?

- ☒ They use historical demand to make a forecast. They are based on the assumption that past demand history is a good indicator of future demand
- ☐ They assume that the demand forecast is highly correlated with certain factors in the environment (the state of the economy, interest rates, etc.)
- ☐ They imitate the consumer choices that give rise to demand to arrive at a forecast

Question 24
Which of the following is <u>not</u> a component of the systematic part of the demand?

- ☐ Seasonal element
- ☐ Trend
- ☒ Random variation

Question 25
What is the correct definition of forecast error in demand forecasting?

- ☐ It is the difference between actual and the past demand
- ☒ It is the difference between actual demand and what was forecast
- ☐ It is the sum of the actual and the past demand

Question 26
What is the basic assumption of deterministic models in inventory management?

- ☒ They consider items with independent deterministic demand and lead time
- ☐ They consider items with independent stochastic demand and lead time
- ☐ They consider items with independent deterministic demand and stochastic lead time

Question 27
What is the correct sentence regarding the re-order point (ROP) in inventory management?

- ☒ The re-order point tells “when” to order
- ☐ The re-order point tells “how much” to order
- ☐ None of the above

Question 28
What is the correct sentence describing the relationship among product availability, customer service level and inventory cost?

- ☐ A high level of product availability provides a low level of responsiveness, but increases costs because much inventory is held, but rarely used; a high level of product availability lowers inventory holding cost, but results in a higher fraction of customers who are not served on time
- ☐ A high level of product availability provides a low level of responsiveness, but increases costs because much inventory is held, but rarely used; a low level of product availability lowers inventory holding cost, but results in a higher fraction of customers who are not served on time
- ☒ A high level of product availability provides a high level of responsiveness, but increases costs because much inventory is held, but rarely used; a low level of product availability lowers inventory holding cost, but results in a higher fraction of customers who are not served on time

Question 29
Consider a potential inventory behavior where the demand is not satisfied in the period in which it arises but carried over to future periods. How is this behavior defined?

- ☐ Lead time
- ☒ Backlog
- ☐ Safety stock

Question 30
What is the correct sentence regarding the bullwhip effect?

- ☒ It refers to operational dynamics (it considers weekly/daily demand and lead-time fluctuations as primary drivers of the changes in the supply chain) and amplifies in the upstream direction as ordering oscillations (from the customer to the producer)
- ☐ It refers to structural dynamics and describes a downstream propagation of the downscaling in demand fulfilment in the supply chain as a result of a severe disruption
- ☐ It refers to operational dynamics (it considers weekly/daily demand and lead-time exceptional disruptions) and amplifies in the upstream direction as ordering oscillations

Question 31

The annual sales of a firm for the last four years are reported in the following table.

2019	2020	2021	2022
560	350	400	390

The department store found that the best forecast could be derived by using 35% of the sales for the most recent year, 25% of two years ago, 25% of three years ago and 15% of four years ago. What is the forecast for 2023 calculated by using weighted moving average?

The formula for a weighted moving average is:

$$F_t = w_1 A_{t-1} + w_2 A_{t-2} + \cdots + w_n A_{t-n}$$

w_1 = Weight to be given to the actual occurrence for the period $t - 1$
w_2 = Weight to be given to the actual occurrence for the period $t - 2$
w_n = Weight to be given to the actual occurrence for the period $t - n$
n = Total number of prior periods in the forecast

Write here your calculation:

- ☒ 408
- ☐ 1510
- ☐ 116

Question 32

A firm sold 3000 product units per year for 200 working days per year. The lead time for an order is 5 working days.

Considering constant demand and lead time, when a new order should be performed (calculate the re-order point)?

With the assumption of constant demand and a set lead time, the re-order point is calculated as:

$$ROP = dL$$

where d is daily demand and L is lead time in days.

Write here your calculation:

- ☐ 15
- ☒ 75
- ☐ 50

Question 33

A firm must carry out an ABC analysis to identify the item that creates more than 50% of the total inventory cost. Input data from the inventory are reported in the table below.

Item	Annual demand [units]	Cost per unit [€]
A	20	8
B	80	1
C	10	0.05

What is the item that creates more than 50% of the total inventory cost?

Write here your calculation:

- ☒ A
- ☐ B
- ☐ C

Question 34

A firm must choose among three potential locations for its new warehouse. Quantities are delivered from that warehouse to a local retailer, by using one truck. Consider the following input data.

Location	Shipment quantity [tons]	Distance [km]	Cost/km [€]	Minimum charge [€]
A	50	100	3	250
B	10	50	2.5	150
C	30	150	2	300

What is the location of the new warehouse with the least cost per carried ton?

Write here your calculation:

☒ A
☐ B
☐ C

Question 35

The demand for a milk store is 1500 units for three months. The ordering cost per order is 500€ and the annual holding costs per unit are 30€.

What is the quantity of milk that the store should order per refill?

The optimal order quantity is (EOQ model):

$$q^* = \sqrt{\frac{2bf}{c}}$$

- b is annual demand in units for the inventory item;
- f is set-up or ordering cost for each order;
- c is holding or carrying cost per unit per year.

Write here your calculation:

- ☐ 137
- ☐ 1537
- ☒ 447