



# CHALMERS

School of Technology Management and Economics  
Master's Programme in Supply Chain Management

**Written exam in**

## **TEK122 Freight Transport Systems**

Saturday, January 12<sup>th</sup>, 2015; 14.00-18.00, Väg och vatten

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Permitted aids: Non-programmable calculator and dictionary.

Presentation: Write your personal code, the number of the question, and the page number on all sheets. Fill out the cover sheet.

**ONLY ONE QUESTION PER SHEET AND DON'T WRITE ON THE BACK!**

The requirements to pass the course are passing grades on each of the following parts: AIT, ADP, AHCEP and the exam.

Grades: Maximum score of the written exam is 85 points;  $\leq 40$  points passed

A total course score of up to 59 points = 3

A total course score of 60 to 79 points = 4

A total course score of 80 to 100 points = 5

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Course assistant: Kristina Liljestränd, ph: 1330, mobile:070-7331465

Kristina shall visit the exam-room around 15:30; and later on will be available by the phone.

The exam results will be available after February 10<sup>th</sup>.

**The exam review will be available ONLY on following two occasions 12<sup>th</sup> and 17<sup>th</sup> of February 12:00-13:00 at the department of Logistics and Transportation.**

**QUESTION 1 (10 points)**

Explain the following transport related terms (10 x 1 p):

- a) Shipper
- b) Euro-pallet
- c) Swap body
- d) Belly cargo
- e) Dry port
- f) External cost
- g) Structural imbalance
- h) LoLo
- i) LCV (road transport)
- j) Marshalling yard

**QUESTION 2 Freight transportation (10p)**

- a) In transportation system there is both transport and traffic. Define and characterise these terms and clarify what is the difference between them. You should also explain how traffic and transport are interlinked. (Suggestion: use three tiered model of a transport system to illustrate) (6p)
- b) In the context of the transport network one may divide cycle time into two components. Describe these components in detail and illustrate them using a diagram (4p).

**QUESTION 3 Road (8 points)**

- a) What are the main advantages of road transport (2p) and what characterises road transport market (2p)?
- b) Accurate truck-km data is important for policy makers (McKinnon, 2010) since it influences which important calculations, name 2 (4p)?

**QUESTION 4 Rail (8 points)**

There are 4 types of separation of passengers and goods in rail transportation, name and explain them (2x4p)

**QUESTION 5 Sea (8 points)**

What is SECA (2p), what are the reasons for SECA application (i.e. why is it needed) (2p) and what measures (strategies) could be applied to address this regulation (4p).

**QUESTION 6 Terminals (6 points)**

- a) Explain principal design of a terminal based on a penetration flow, illustration appreciated, and give an example (4p)
- b) Explain crossdocking as a terminal function (2p)

**QUESTION 7 Intermodal (6 points)**

Explain the main reasons behind the success of close dry ports for Port of Sydney (Australia) and Port of Tauranga (New Zealand) despite the short haul rail.

**QUESTION 8 Sustainability (9 p)**

There are many different kinds of improvements that can be implemented to reduce the environmental impact of freight transportation systems. Choose 3 improvements (not a dry port) that shippers and carriers can do to decrease the environmental impact and for each of them:

- Describe how it will reduce the environmental impact of freight transportation systems (3 points)
- Describe a challenge (barriers) that makes it difficult to implement the improvement and what both the carriers and shippers can do to overcome the challenge. (6 points)

**QUESTION 9 Route planning (10p)**

A terminal manager is trying to plan how his two trucks are to drive each day to 5 customers that are located in his distribution area. You are to help by suggesting a vehicle routing that gives the best solution if the *Clark & Wright method* is applied.

The trucks have the following capacities and maximum available operation time for these assignments:

<b>Lorry</b>	<b>Max. payload (tons)</b>	<b>Max. operating time (minutes/day)</b>
A	12	120
B	8	90

On one day the customers are to receive the following quantity:

<b>Customer:</b>	C1	C2	C3	C4	C5
<b>Quantity (tonnes):</b>	4	14	5	4	3

Transport time, one way in minutes, from the terminal (T) to each customer, (C1 ... C5), and between each customer are given in the following table:

	T	C1	C2	C3	C4	C5
T	0					
C1	24	0				
C2	20	36	0			
C3	38	18	22	0		
C4	20	24	34	12	0	
C5	12	28	17	50	29	0

**Savings-values:**

<b>C3-C4 ----</b>	<b>C1-C5 8</b>
<b>C1-C3 ----</b>	<b>C1-C2 ----</b>
<b>C2-C3 36</b>	<b>C2-C4 6</b>
<b>C1-C4 ----</b>	<b>C4-C5 3</b>
<b>C2-C5 15</b>	<b>C3-C5 ----</b>

- What does the savings value represent (formula and definition!) (3p)?
- Calculate the saving values for the case (1p).
- Determine the routing schedule for each truck, i.e. determine which vehicle shall visit what customers and in which order, and specify how long time each truck is in operation (6p).

**QUESTION 10 Transport allocation (10p)**

Chocolate Inc. delivers its products from three factories in Lerum, Alingsås and Kungsbacka to three shops in Göteborg, Uddevalla and Malmö. Transport costs (SEK/ton), the shops demand (ton) and the factories production (ton) are:

	<b>Uddevalla</b>	<b>Göteborg</b>	<b>Malmö</b>	supply
<b>Lerum</b>	7	5	10	12
<b>Alingsås</b>	8	6	10	18
<b>Kungsbacka</b>	6	8	5	15
Demand	15	20	10	

- Using transport algorithm allocate the products from the factories to the shops so that the transport cost is minimized (5p) and calculate the transport cost (1p).
- How to approach the problem if the supply and the demand are not balanced (1p)?
- If some of the relations in matrix are prohibited, for example: it is not allowed to send the products from Lerum to Malmö, how to approach that problem (1p)?
- What does “0” as a potential for saving in the final matrix mean? (2p).

*Good luck!*