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

## Written exam in

# TEK122 Freight Transport Systems

Monday, January 11th, 2016; 14.00-18.00; in HA, HB and HC

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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; ≤ 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

Examiner: Violeta Roso, ph: 0739-196775, violeta.roso@chalmers.se

Violeta shall visit the exam-room around 15:00 and 16:30

The exam results will be available after January 30th.

**The exam review will be available ONLY on following two occasions 23rd of February and 1st of March 12:00-13:00 at the department of Logistics and Transportation.**

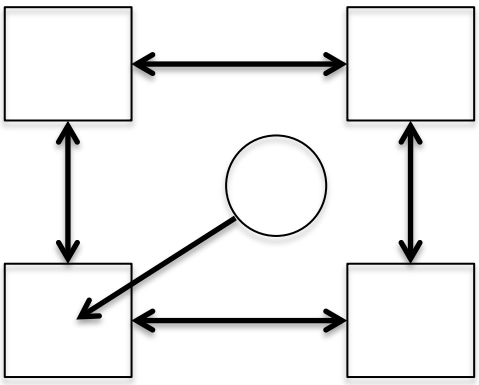
**QUESTION 1 (10 points)**

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

a) Active node time (Cna)
b) TEU
c) Intermodal transport
d) Wagon-design-dependent separation
e) Beluga (air transport)
f) Crossdocking
g) Regional environmental effect
h) Slurry pipeline
i) Structural imbalance (resource utilization)
j) Saving value (Sij)

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

Sjöstedt's model



a) Define all terms in the model (all frames and arrow-links) (5p)
b) Describe how the frames (terms) are related as indicated by the arrows (5p).

**QUESTION 3 Road (6 points)**

Explain the concept of LCV, what are the advantages and disadvantages of the concept and show comparison of Sweden and other EU countries (illustrate). (6p)

**QUESTION 4 Rail (8 points)**

a) Explain cost structure of rail transportation (4p)
b) Block train principle design- explain and illustrate (4p)

**QUESTION 5 Sea transport (10 points)**

a) Explain RORO and LOLO vessels and their advantages and disadvantages (2x3p).
b) Capacity utilization in shipping is influenced by external and internal factors. Choose one external and one internal factor and describe them (2x2p)

**QUESTION 6 Terminals (6 points)**

Explain 3 functions of a transport terminal, you may choose those according to Rodrigue et al 2013 (not terminal functions) (3x2p)

**QUESTION 7 Intermodal transport (6p)**

What is a dry port concept (2p); explain two models of directional development of dry ports (4p).

**QUESTION 8 Environment and sustainability (14 points)**

a) During the AHCEP seminar, you assessed your host company's environmental proactivity. Describe two factors that influenced this assessment and explain how these influenced your host company's environmental proactivity. (You can use factors described in the framework of González-Benito and González-Benito (2006), but you can also use other factors) (4p)
b) During Kristina's lectures, we discussed different causes of food waste in the food supply chains. Describe three causes in terms of how they create food waste in the food supply chains. (6p)
c) Jason Palmer (ICA) described 5 areas of enablers for ICA national freight system. Choose two of these areas and describe them. (4p)

**QUESTION 9 Route planning (7p)**

A terminal manager is trying to plan how his two trucks are to drive 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:

| **Lorry** | **Max. payload (tons)** | **Max. operating time (minutes/day)** |
|---|---|---|
| A | 12 | 140 |
| B | 10 | 90 |

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

| **Customer:** | C1 | C2 | C3 | C4 | C5 |
|---|---|---|---|---|---|
| **Quantity (tonnes):** | 5 | 13 | 4 | 5 | 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**:

**C3-C4 ----** **C1-C5 8**

**C1-C3 44** **C1-C2 8**

**C2-C3 36** **C2-C4 6**

**C1-C4 ----** **C4-C5 3**

**C2-C5 15** **C3-C5 ----**

a) Calculate the saving values for the case (1p).
b) 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 (8p)**

Fico Auto Co has factories in Atlanta, Tulsa and New Orleans that supply distribution centres in Los Angeles and New York. Transport costs ($/unit), the DCs demands (units) and the factories productions (units) are following:

| | **Los Angeles** | **New York** | Supply |
|---|---|---|---|
| **Atlanta** | **14** | **11** | 600 |
| **Tulsa** | **9** | **12** | 900 |
| **New Orleans** | **9** | **10** | 500 |
| Demand | 800 | 1200 | |

a) Using transport algorithm allocate the products from the factories to the DCs so that the transport cost is minimized (5p) and calculate the final transport cost (optimal) (1p).
b) If New Orleans for some reason should supply only Los Angeles, how to approach that problem (2p)?

*Good luck!*