

TNK099, Logistics networks and transports, 6 hp, VT1-2020

1 Course aim and content

1.1 Aim with course

The aim of the course is for the students to gain a deep understanding of how logistics systems can be modeled and analyzed from a network perspective, mainly by means of quantitative methods. In particular, the role of transportation is discussed as an enabler for competitive supply chains and logistics networks. After the course, students should be able to:

1. Understand how a logistics network can be structured, and the importance of inventory and transportation from a network perspective and for the individual company.
2. Understand how ERP-systems and advanced planning systems support planning in a network perspective.
3. Structure smaller planning problems, and develop smaller planning models or models for scenario analysis.
4. Solve logistics-related planning problems with optimization methods and analyze and draw conclusions about the problem from the solutions generated.
5. Be familiar with optimization methods to solve larger problems in the logistics field, such as Branch-and-Bound or column generation, and heuristics.
6. Know and understand the basic vehicle routing problem, as well as various variants and extensions to that problem.
7. Be able to analyze the effects of decisions within multi-tier inventory control and vendor-managed inventory.
8. Analyze and critically review results achieved in strategic network planning with the help of planning models.
9. Be able to quantitatively evaluate and analyze results related to different types of decisions that affect a supply chain.
10. Use mathematical models to propose cost allocation within logistics networks and transport collaboration.
11. Understand the impact of e-commerce on a supply chain.
12. Know different ways of measuring transports and transport efficiency.
13. Know basic transportation concepts.
14. Know and understand how collaboration and more efficient planning can contribute to increased sustainability.

1.2 Prerequisites

Basic courses in economic, logistics, optimization and simulation. Basic knowledge of AMPL or other mathematical modelling language. Basic programming skills.

1.3 Supplementary courses

Logistics Resource Planning, Logistics in Supply Chains, Project course in Communications- and transport systems, Master's Thesis

Seminars	approx. 22 h
Labs	approx. 8 h

2.4 Organization

The course uses lectures, seminars, filmed/animated material, labs and case work. No part of the course has mandatory attendance, but it is likely that several questions in the individual examination will relate to discussions and presentations on seminars and lectures, as well as on experiences drawn from the seminars.

2.4.1 Language

The course is planned to be held entirely in English. In teaching situations where only Swedish-speaking students are present, Swedish can be used. Lab reports, Cases and Individual Assignments may be answered in Swedish or English, even if the assignments only are available in English.

2.4.2 Lectures

The lectures are mainly used for an overview of theory in applicable areas.

2.4.3 Seminars

The seminars are mainly used for larger exercises, often with the aid of computers. In this sense a seminar might be very similar to a lab, even if seminars normally do not need explicit preparation (except following the course content), and that no direct examination is made at seminars. Some seminar time may also be used to introduce labs & cases.

2.4.4 Filmed/animated material

There may be some filmed/animated material (“Flipped classroom”). These may make up for lectures cancelled e.g. because of illness or VAB. Some lectures may also be filmed as they are held, even though in case of technical problems, there will not be any re-take made. There might also be some filmed material such as introduction to tools and theoretical background relating to labs, cases and/or seminar assignments. Information will follow.

2.4.5 Labs

There are two labs in the course. The focus here are the modelling & solving problems, including analyses of the results. There is an expectance of appropriate solutions and answers, even if several different solutions may be equally correct depending on made assumptions and connected motivation. The labs have a typical focus on modelling/developing computer code (in a wide sense).

In the first lab, AMPL/Cplex is used to formulate, model and solve a small Supply Chain Problem.

In the second lab, a Location-Routing problem should be solved and analyzed.

There are scheduled times (see Time Edit) for labs. However, there will not teacher present at all lab times (see course plan on LISAM). Tutorial on lab needs to be individually scheduled with the teacher.

See table 1, for preliminary dates related to labs.

Table 1. Content and preliminary dates for labs

Lab	Content	Out	In	Completion 1 (if needed) by	Max grading points
1	Production/Distribution, (Sub)optimization	Jan 27*	Feb 13*	Whichever is later of Mar 11*, and 2 weeks after feedback of initial report	10
2	Location-Routing	Feb 24*	Mar 11*	Whichever is later of Mar 31*, and 2 weeks after feedback of initial report	4

*Dates are all 2020

Labs are made in groups of 2 students. ONE group of 3 students may be acceptable, but this has to be cleared with the examiner before the lab starts. If there are 2 groups of 3 students, the groups need to regroup into groups of max 2. Expectations are slightly higher on groups with 3 students.

Labs are examined through written presentations of the results and related discussions, according to specifications for each lab. A lab needs to reach a level of pass, and once that level is reached, a grading point (see Table 1) is given, that is used as one of the bases for the course grade (see section 2.6). A lab that is not given a pass level, needs to be completed in order to give a pass level. It will get grading points based on the initial submission. Completed reports must meet the due date for completion (see Table 1). If completion is not handed in by that day, or if the first completion is not of enough quality, the lab will be given grade Fail (UK). One more completion per group is then possible, either by June 11, 2020 or by August 29, 2020. If still the completion is not of enough quality after the second completion, the full course module “Lab” must be remade in a following year, according to the specifications of that particular year.

Labs give 1 ECTS (hp). This is equivalent to roughly 27 hours, which also is the expected time that need to be spent on the labs, including relevant lectures & seminars. Most of this time is expected to be needed for lab 1, and on non-scheduled hours.

2.4.6 Case

In the course, there is one case to be solved. Cases often have the characteristic that there is not necessarily a right or wrong, but many different solutions can be equally good, given different assumptions and solution approaches. The discussions and motivations along with the solution process, and with respect to the achieved results, are then more important for the grading, than the solutions themselves (as long as the solutions are not evidently unreasonable.) Using the computer will be an important tool of the cases in the course, and it is expected to use relevant methods covered in the course, definitely including coding in a broad sense.

The case gives a total of 2 ECTS (hp). This is equivalent to roughly 54 hours per person, which is also the expected time that need to be spent on the cases, including relevant lectures & seminars.

The case deals with a two-stage vehicle routing problem, involving trucks and drones.

As examination, a technical report must be written, with reasonable requirements for such a report; including theoretical references (details in the specifications of the case).

See table 2, for preliminary dates, related to the case.

Table 2. Contents and preliminary dates related to the Case

Case	Content	Out	In	Completion 1 (if needed) by	Max grading points
1	Vehicle Routing with Drones	Jan 30*	Mar 6*	Whichever is later of Mar 31*, and 2 weeks after feedback of initial report	20

*Dates are all 2020

The case is solved in groups of 3 students. At most 2 groups of 4 students can be allowed, but this has to be cleared with the examiner before work starts. Possibly also groups of 2 students are possible. Expectations are slightly higher on groups with 4 students, while it is as high on groups with 2 students, as it is on groups with 3 students.

There will be pre-scheduled tutorials for the Case work. Bookings will be done on LISAM: Details will follow when case is presented.

The case needs to reach a level of pass, and once that level is reached, a grading point (see Table 2) is given, that is used as one of the bases for the course grade. A case that is not given a pass level, needs to be completed in order to give a pass level. It will get grading points based on the initial submission. Completed reports must meet the due date for completion (see Table 1). If completion is not handed in by that day, or if completion is not a sufficient quality, the case will be given grade Fail (UK). One more completion is then possible per group, either by June 11, 2020 or by August 29, 2020. If still the completion is not of sufficient quality after the second completion, the full course module will be given grade Fail (UK), and case(s) must be remade in a following year, according to the specifications of that particular year.

2.4.7 Tutoring

Tutoring is available via electronic communication or through appointments, for lab preparation, labs and the case. Also, some tutoring time will be available for booking on LISAM. Note that tutoring after the course have finished, (or, in practice after the first completion date of labs/cases) will be kept to a strict minimum. Therefore, be sure to finish the labs & cases during ordinary course time.

2.5 Individual assignments

There are two individual assignments. They are a mix of short-answers; questions that require discussion; and slightly larger exercises, usually requiring computations using e.g. Excel or AMPL. The individual assignments are mandatory, and they must be handed in by their due date. Individual assignments are corrected and given a grading point (see Table 3), that leads to a grade for the individual assignment. There will be 33 grading points per Individual assignment. Individual assignments are examined on their initial and only submission. There is no completion possibilities for individual assignments. If points are not enough to reach at least grade 3, individual assignments will be given grade UK. If individual assignments get a grade of UK, new assignment(s) will be given, if requested from the examiner at the latest by May 19, 2020 and August 7, 2020. In such a case, the assignment(s) will be available May 29, 2020 and August 17, 2020 respectively, where the preliminary due dates are June 11, 2020 and August 29, 2020, respectively. See table 3 for preliminary dates for individual assignments.

Table 3. Preliminary dates related to the Individual assignments

Assignment	Content	Out	In	Max grading points
1	Focus: First half of the course	Feb 7*	Feb 21*	33
2	Focus: Second half of the course (incl. material not covered when assignment is handed out.	Feb 23*	Mar 11*	33

*Dates are all 2020

Of course, there can be NO cooperation or even discussion whatsoever when solving the individual assignments. Consider the allowed level of discussions to be equal to that on a regular tenta. Any suspicion of cooperation will be dealt with, with utmost care. If you do have questions on interpreting the assignments etc., questions may only be posed to the examiner. It may be that I require the question to be posted on a discussion thread on LISAM, so that everyone will have access to the same information. Allow for some response time, so don't start the assignments too late. If urgent response is needed, text (SMS) the examiner.

Course grade is composed by individual assignments, cases and labs, but course grade can never be lower than the grade for individual assignments. For grading, see section 2.6.

2.6 Examination & Grading

2.6.1 Completion possibilities

Note that only labs & the case may be completed, a limited amount of times. Individual assignments cannot be completed, but must entirely be done again. If a particular question reappears, it is allowed to give the same (or a modified) answer as on a previous individual assignment, without being considered self-plagiarism.

Note also that completion possibilities for labs & case, and remaking of individual assignments coincide, and are at the same time as regular "tenta"-periods. If you have several labs, cases and/or individual assignments to remake, you need to plan carefully.

2.6.2 Cheating and plagiarism

As no examination in this course is supervised, it is important to understand the regulations on what may be considered as cheating or plagiarism. In short, plagiarism is whenever someone claims to have done the work that someone else actually did (or you did yourself in another context than this course), regardless if it is intentional or not. It can be to re-use a text without a proper reference to the source. Plagiarism is also if you use a text more or less word-by-word without citation marks, even if a reference is given (Translation, using synonyms or adding or removing a few words is not enough to evade the requirement of citation marks). Text written by others must be put (and most likely rewritten) into context of the report you produce, e.g., by analyzing or comparing it to other sources or to your own findings. Also pictures or program code follow the same general rules on what can be considered plagiarism.

Plagiarism is one way of cheating. Cooperation between individuals (Individual assignments), or between groups (Labs and Cases) is also considered cheating. Sharing work that is to be handed in for examination, between individuals or between groups are also considered cheating, unless specifically authorized by the examiner by sharing it with the entire course via LISAM, or via e-mail. This includes text in reports, codes and formulas developed to solve the assignments, labs and case, as well as data put into the programs and the results of programs. Thus, it is not allowed to

share reports or files between this or earlier years' groups, neither electronically nor in paper format. Note that also a group giving access to their files, may be considered participating in the cheating.

If in any doubt, ask the examiner for each specific situation, if you consider sharing information with another group or individual.

Suspicion of cheating or plagiarism will be reported to the disciplinary board, according to the instructions for teachers.

2.6.3 Course credits and grading

The course has three examination parts, see table 4.

Table 4. Examination parts

Examination part	ECTS (hp)	Grade	Grading points
Individual assignments	3	U, 3, 4, 5	0-66
Case	2	U, G	0-20
Labs	1	U, G	0-14

Grading of individual assignments is as in Table 5.

Table 5. Grading individual assignment

Total grading points, Individual assignments	Minimum grading points on each of the individual assignments	Grade
0–29,5	0–16	U
30–46,5	0–13,5	U
30–42,5	14	3
43–48,5	14	4
40–52,5	16	4
50–66	20	5

The course grade cannot be lower than the individual assignment grade. If labs & cases are well solved and the entire course is finished this year (in practice, by August 29, 2020), grading points from these can help raising the grade from 3 to 4 or from 4 to 5, according to table 6¹. If some of the course is finished another year, the course grading might be based on other results than the grading points above. Most likely the course grade will be equivalent to the grade of the Individual assignments.

Table 6. Course grade

Individual assignment grade	Total grading points	Course grade
U		None
3	30–62,5	3
3	63–76,5	4
4	40–74,5	4
4	75–86,5	5
5	50–100	5

¹ Please note that it *should* be given extra credit for just understanding the grading system ;-). It is the effect of an attempt to make it fair, giving credit for consistent good performance, giving credit for good work in labs and cases, while making it possible to get a grade of 5 regardless of how the groups in labs & cases perform.

2.7 Literature

The course literature will include excerpts from books, journal articles, etc. All material will be available electronically (incl. e-books, potentially with limited number of simultaneous access), or as reference literature at the University library, campus Norrköping, or it will be course literature from earlier years of KTS and TSL. Possibly there will be some handouts to complement the material further. All course documentation (labs, cases, seminar material, PowerPoints, etc.) are also considered as course literature. Literature references will be published continuously on LISAM.

The aim is to have course material (as well as definite literature references) available before each lecture/seminar or equivalent.

3 Course plan

Course plan is found, and continuously updated, on LISAM.

Note that there are a few more scheduled times than what will be needed, as a back-up for cancelled lectures e.g., due to illness or VAB.