Report - SF2812 - 2020-04-03

Respondents: 1
Answer Count: 1
Answer Frequency: 100.00%

Please note that there is only one respondent to this form: the person that performs the course analysis.

Course analysis carried out by (name, e-mail):

Gianpiero Canessa, canessa@kth.se

DESCRIPTION OF THE COURSE EVALUATION PROCESS

Describe the course evaluation process. Describe how all students have been given the possibility to give their opinions on the course. Describe how aspects regarding gender, and disabled students are investigated.

We have used the LEQ course evaluation. In addition, students have had the opportunity to see me and the teaching assistant continuously throughout the course. We have not specifically addressed aspects regarding gender and disabled students, except following standard KTH practice.

DESCRIPTION OF MEETINGS WITH STUDENTS

Describe which meetings that has been arranged with students during the course and after its completion. (The outcomes of these meetings should be reported under 7, below.)

Meeting with the students can be divided in two different types: questions about their projects or doubts about the subjects seen in the lecture. Usually the former were much shorter in length than the latter, but in both cases my focus was to let the student understand the problem and how to solve it, instead of just giving the answer straight away.

COURSE DESIGN

Briefly describe the course design (learning activities, examinations) and any changes that have been implemented since the last course offering.

The course covers linear and integer programming. The course is based on projects, where students get training in modeling and analysis of practical problems, in addition to lectures and tutorials, where students get understanding of theory and methods.

The project part of the course consisted of two project exercise in the form of modeling exercises, which were modeled in GAMS. Larger problems were successfully solved with the use of NEOS. The projects had parallel exercises, four each for exercises one and two. The group sizes were two or three persons and the groups were selected by me. The projects are presented at a particular lecture. This presentations lecture is devoted to discussion between students. First, students having worked on the same project sat together and discussed. As a second part of the lecture, students having worked on different projects sat together and discussed, three persons in each group. In addition, we have the "follow-up" discussions with the groups after the presentation lectures.

I was new to the course. I basically followed the setup from perivous years, I used laptop and project as support for the teaching. This gives a "skeleton" of the course material. The slides are written using LaTeX. By the laptop I could also illustrate some example problems by using GAMS and Matlab.

THE STUDENTS' WORKLOAD
Does the students' workload correspond to the expected level (40 hours/1.5 credits)? If these is a significant deviation from the expected, what can be the reason?

Counting for ten weeks and 7.5 credits would give 20 hours per week. The students report a workload which is less, 14-16 hours a week would be the average. I think that the students think about the projects even when they do not work actively with them, so the workload is slightly higher. In contrast to previous years, there seemed not to be a rather large group of students reporting 6-8 hours per week.

THE STUDENTS' RESULTS
How well have the students succeeded on the course? If there are significant differences compared to previous course offerings, what can be the reason?

The results on the exam were a bit better than the previous year. First exam, in March, had 28 pass and 17 failed, out for 45. We are still waiting for the results of June's re-exam.
The setup of the course is such that it suits students who want to take the course. I think this is valid for an advanced master course. It seems, however, that there is a group of students who are not that interested. The course being compulsory for some students is not something I prefer.

STUDENTS´ANSWERS TO OPEN QUESTIONS
What does students say in response to the open questions?

I am very pleased that both the teaching assistant David Ek and I get very favorable comments in general. The students really seem to appreciate the efforts we have put into the course.

SUMMARY OF STUDENTS' OPINIONS
Summarize the outcome of the questionnaire, as well as opinions emerging at meetings with students.

Students seem to be happy with the course design and material. Their comments praise the structure of the Latex lectures, and the availability of them from day 1 on Canvas. They also highlighted their interest in the projects and the extra feedback session given afterwards.

OVERALL IMPRESSION
Summarize the teachers' overall impressions of the course offering in relation to students' results and their evaluation of the course, as well as in relation to the changes implemented since last course offering.

As being my first time teaching in KTH, as was overwhelmingly impressed with the high quality of the students, their dedication and their end results on the projects. They were able to tackle highly difficult modeling problems in a very short time, and every question directed to me showed me they were fully invested in their work. I am extremely happy giving the course and would love to repeat the feat next year.

No big changes from last year, besides changing the lecturer.

ANALYSIS
Is it possible to identify stronger and weaker areas in the learning environment based on the information you have gathered during the evaluation and analysis process? What can the reason for these be? Are there significant difference in experience between:
- students identifying as female and male?
- international and national students?
- students with or without disabilities?

Seems the biggest issue that was pointed out was the scarce availability of online classes and the use of GAMS.

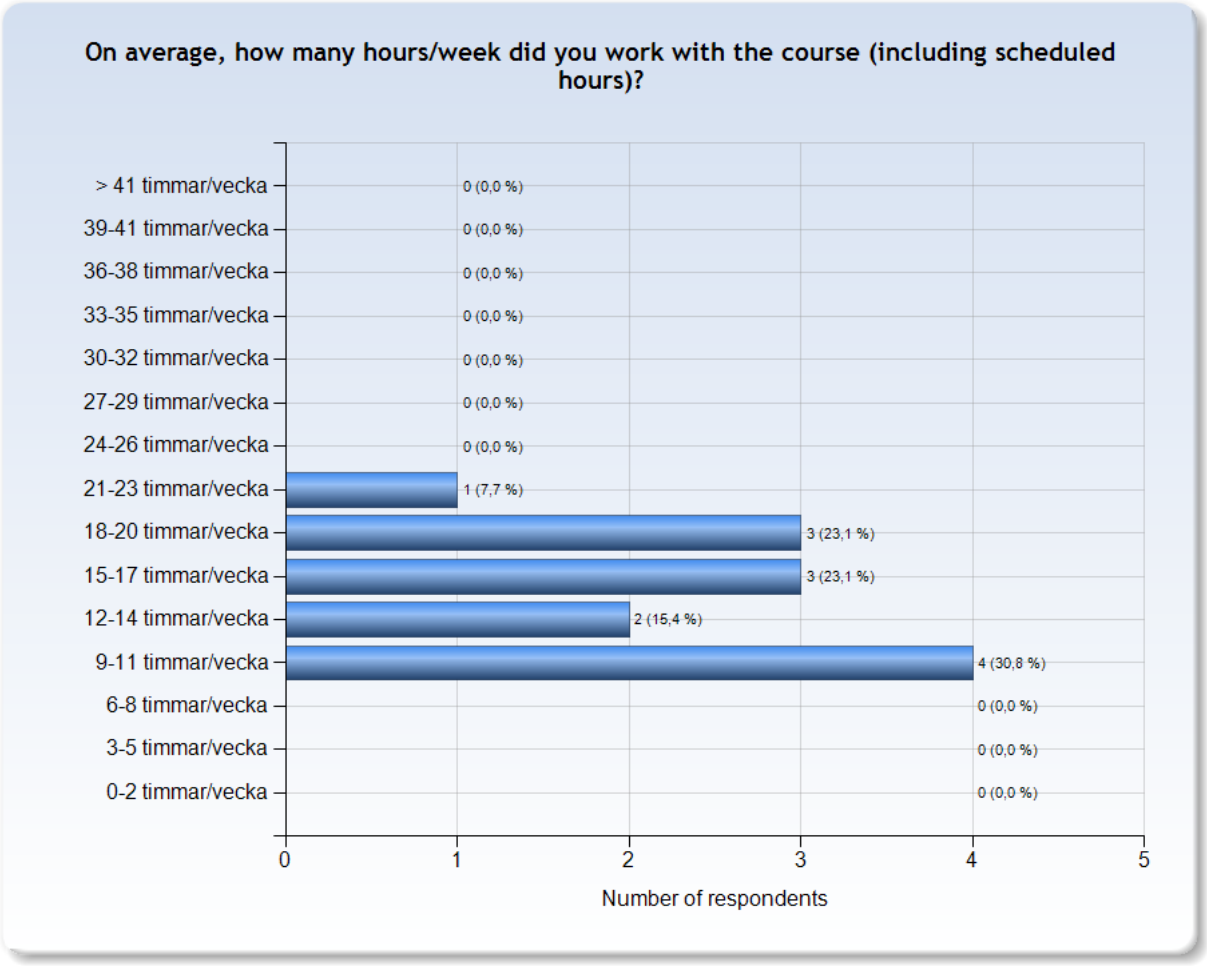
PRIORITIZED COURSE DEVELOPMENT
What aspects of the course should be developed primaily? How can these aspects be developed in short and long term?

New projects are always useful. I would also be interested in developing some basic exercises for the students to do prior to the course, and maybe change the modeling language to AMPL or Python with the use of an academic license of a solver such as Gurobi.

SF2812 - 2020-02-28

Antal respondenter: 51
Antal svar: 14
Svarsfrekvens: 27,45 %

ESTIMATED WORKLOAD



Comments

Comments (I worked: 9-11 timmar/vecka)
Not sure about this.
Lectures and little self reading. The projects took quite a lot of time

Comments (I worked: 12-14 timmar/vecka)
The projects take more time than expected

Comments (I worked: 15-17 timmar/vecka)
Difficult to estimate
The course took the right amount of time in my opinion.

Comments (I worked: 18-20 timmar/vecka)
A course that was challenging in a stimulating way. Required time to be put into the projects and understanding the different concepts by e.g. working on the theory questions.
The workload duration increased during the group project phases.

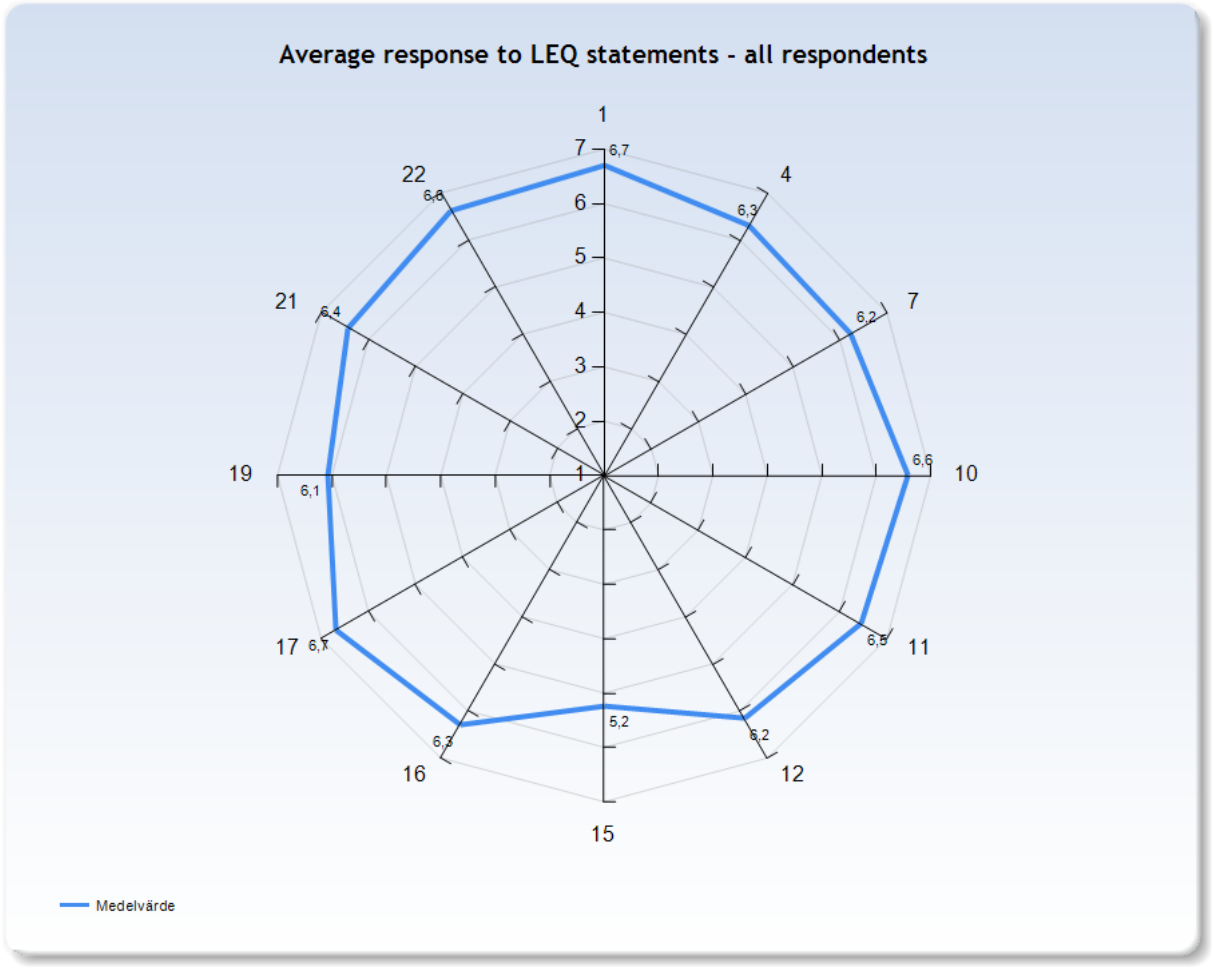
Comments (I worked: 21-23 timmar/vecka)
The projects took most of the time during the course.

LEARNING EXPERIENCE

The polar diagrams below show the average response to the LEQ statements for different groups of respondents (only valid responses are included). The scale that is used in the diagrams is defined by:

1 = No, I strongly disagree with the statement
4 = I am neutral to the statement
7 = Yes, I strongly agree with the statement

Note! A group has to include at least 3 respondents in order to appear in a diagram.


Average response to LEQ statements - all respondents
1
7
6
5
4
3
2
1
6,7
4
6,3
7
6,2
10
6,6
11
6,5
12
6,2
15
5,2
16
6,3
17
6,7
19
6,1
21
6,4
22
6,8
Medelvärde

KTH Learning Experience Questionnaire v3.1.4

Meaningfulness - emotional level

Stimulating tasks

1. I worked with interesting issues (a)

Exploration and own experience

2. I explored parts of the subject on my own (a)
3. I was able to learn by trying out my own ideas (b)

Challenge

4. The course was challenging in a stimulating way (c)

Belonging

5. I felt togetherness with others on the course (d)
6. The atmosphere on the course was open and inclusive (d)

Comprehensibility - cognitive level

Clear goals and organization

7. The intended learning outcomes helped me to understand what I was expected to achieve (e)
8. The course was organized in a way that supported my learning (e)

Understanding of subject matter

9. I understood what the teachers were talking about (f)
10. I was able to learn from concrete examples that I could relate to (g)
11. Understanding of key concepts had high priority (h)

Constructive alignment

12. The course activities helped me to achieve the intended learning outcomes efficiently (i)
13. I understood what I was expected to learn in order to obtain a certain grade (i)

Feedback and security

14. I received regular feedback that helped me to see my progress (j)
15. I could practice and receive feedback without being graded (j)
16. The assessment on the course was fair and honest (k)

Manageability - instrumental level

Sufficient background knowledge

17. My background knowledge was sufficient to follow the course (f)

Time to reflect

18. I regularly spent time to reflect on what I learned (l)

Variation and participation

19. The course activities enabled me to learn in different ways (m)
20. I had opportunities to influence the course activities (m)

Collaboration

21. I was able to learn by collaborating and discussing with others (n)

Support

22. I was able to get support if I needed it (c)

Learning factors from the literature that LEQ intends to examine

We tend to learn most effectively (in ways that make a sustained, substantial, and positive influence on the way we think, reflect, act or feel) when:

a) We are trying to answer questions, solve problems or acquire skills that we find interesting, exciting or important

b) We are able to speculate, test ideas (intellectually or practically) and learn from experience, even before we know much about the subject

c) We are able to do so in a challenging and at the same time supportive environment

d) We feel that we are part of a community and believe that other people have confidence in our ability to learn

e) We understand the meaning of the intended learning outcomes, how the environment is organized, and what is expected of us

f) We have adequate prior knowledge to deal with the current learning situation

g) We are able to learn inductively by moving from concrete examples and experiences to general principles, rather than the reverse

h) We are challenged to develop a true understanding of key concepts and gradually create a coherent whole from the content

i) We believe that the work we are expected to do will help us to achieve the intended learning outcomes

j) We are able to try, fail, and receive feedback before, and separate from, each summative assessment of our efforts

k) We believe that our work will be considered in an honest and fair way

l) We have sufficient time for learning and devote the time needed to do so

m) We believe that we have control over our own learning, and not that we are being manipulated

n) We are able to collaborate with other learners struggling with the same problems

Literature

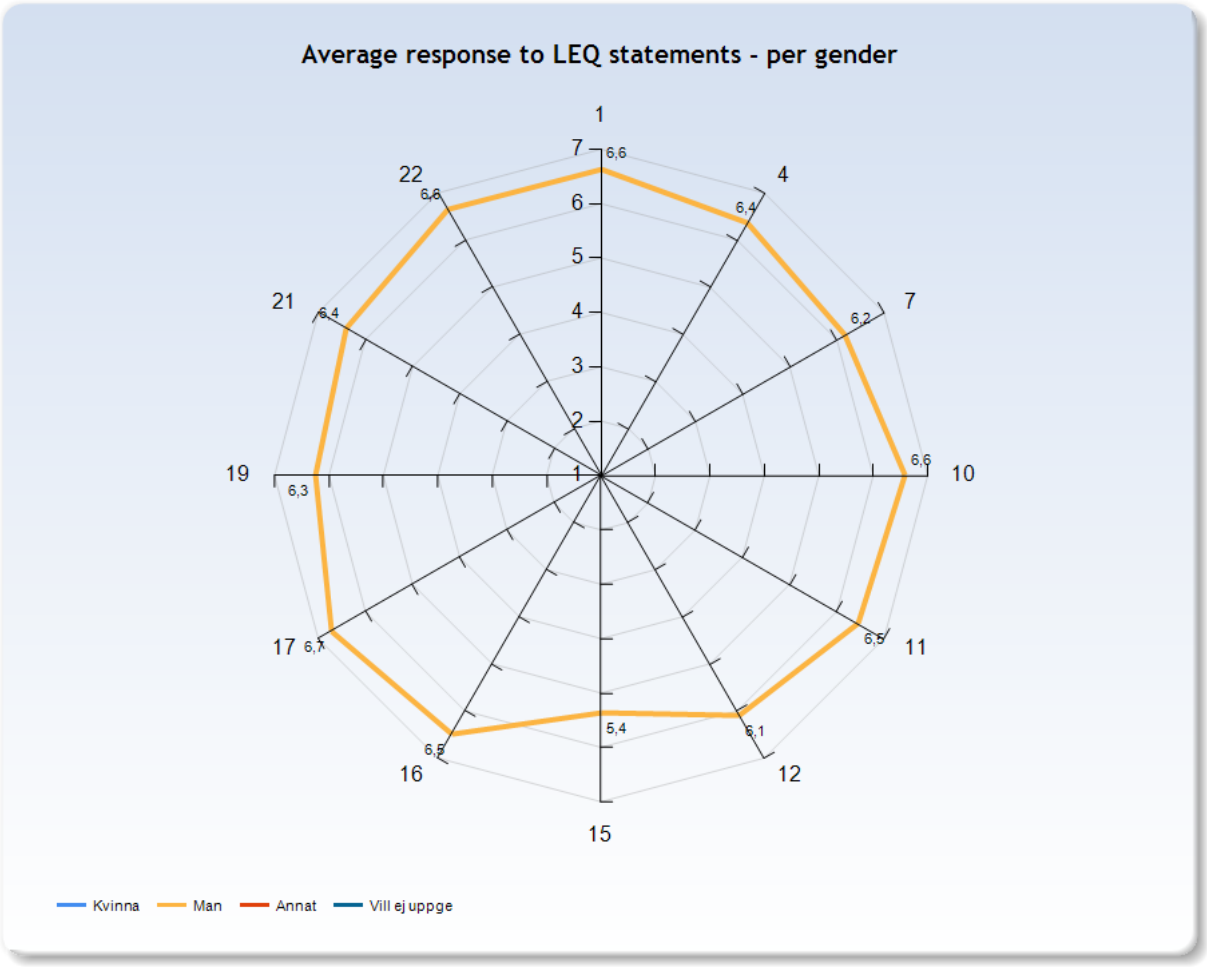
Bain, K. (2004). *What the Best College Teachers Do*, Chapter 5, pp. 98-134. Cambridge: Harvard University Press.

Biggs J. & Tang, C. (2011). *Teaching for Quality Learning at University*, Chapter 6, pp. 95-110. Maidenhead: McGraw Hill.

Elmgren, M. & Henriksson, A-S. (2014). *Academic Teaching*, Chapter 3, pp. 57-72. Lund: Studentlitteratur.

Kember, K. & McNaught, C. (2007). *Enhancing University Teaching: Lessons from Research into Award-Winning Teachers*, Chapter 5, pp. 31-40. Abingdon: Routledge.

Ramsden, P. (2003). *Learning to Teach in Higher Education*, Chapter 6, pp. 84-105. New York: RoutledgeFalmer.


Average response to LEQ statements - per gender
1
7
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11
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21
6,4
22
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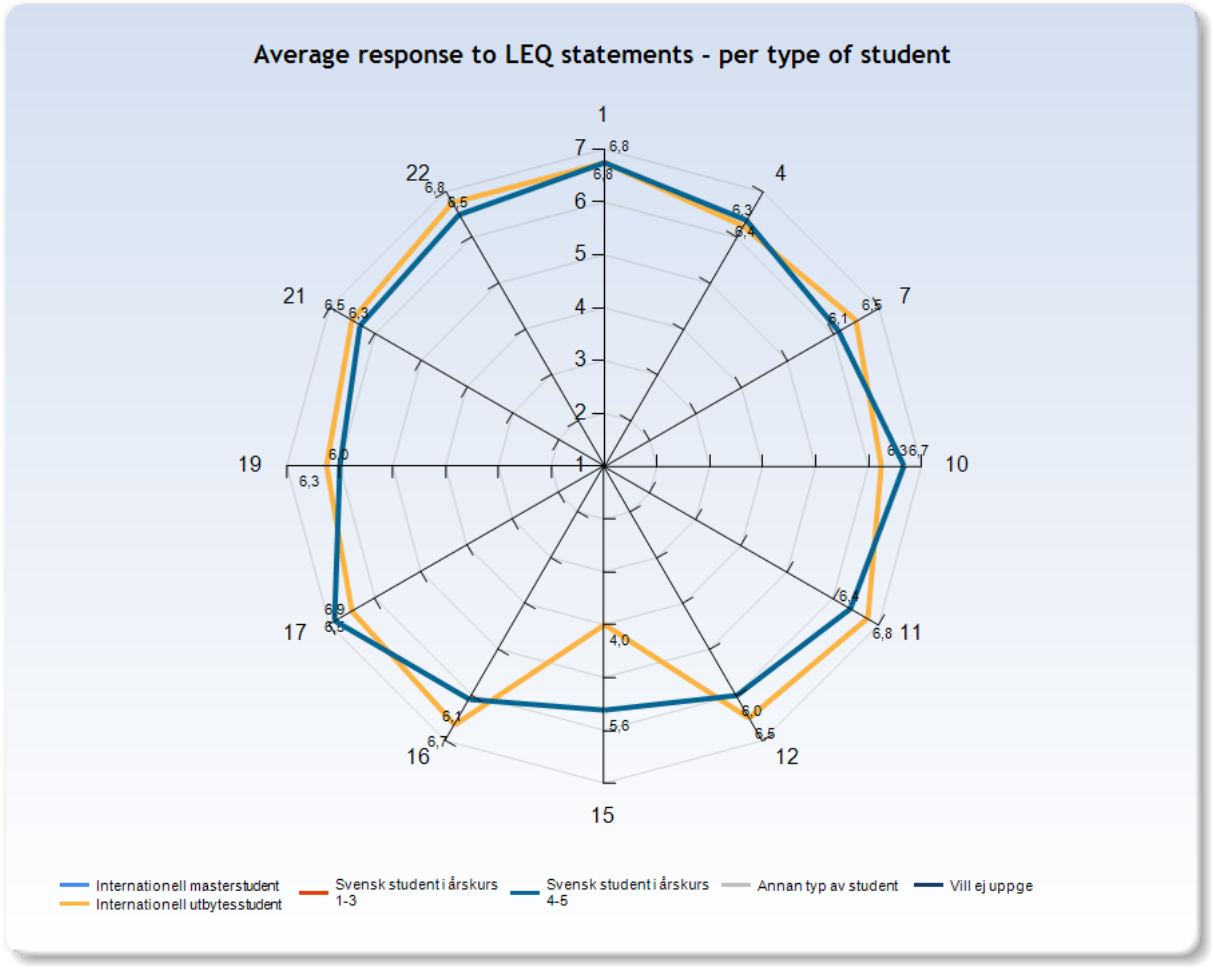
Kvinna
Man
Annat
Vill ej uppge

Comments


Average response to LEQ statements - per type of student
1
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22
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6,5
4,0
5,6
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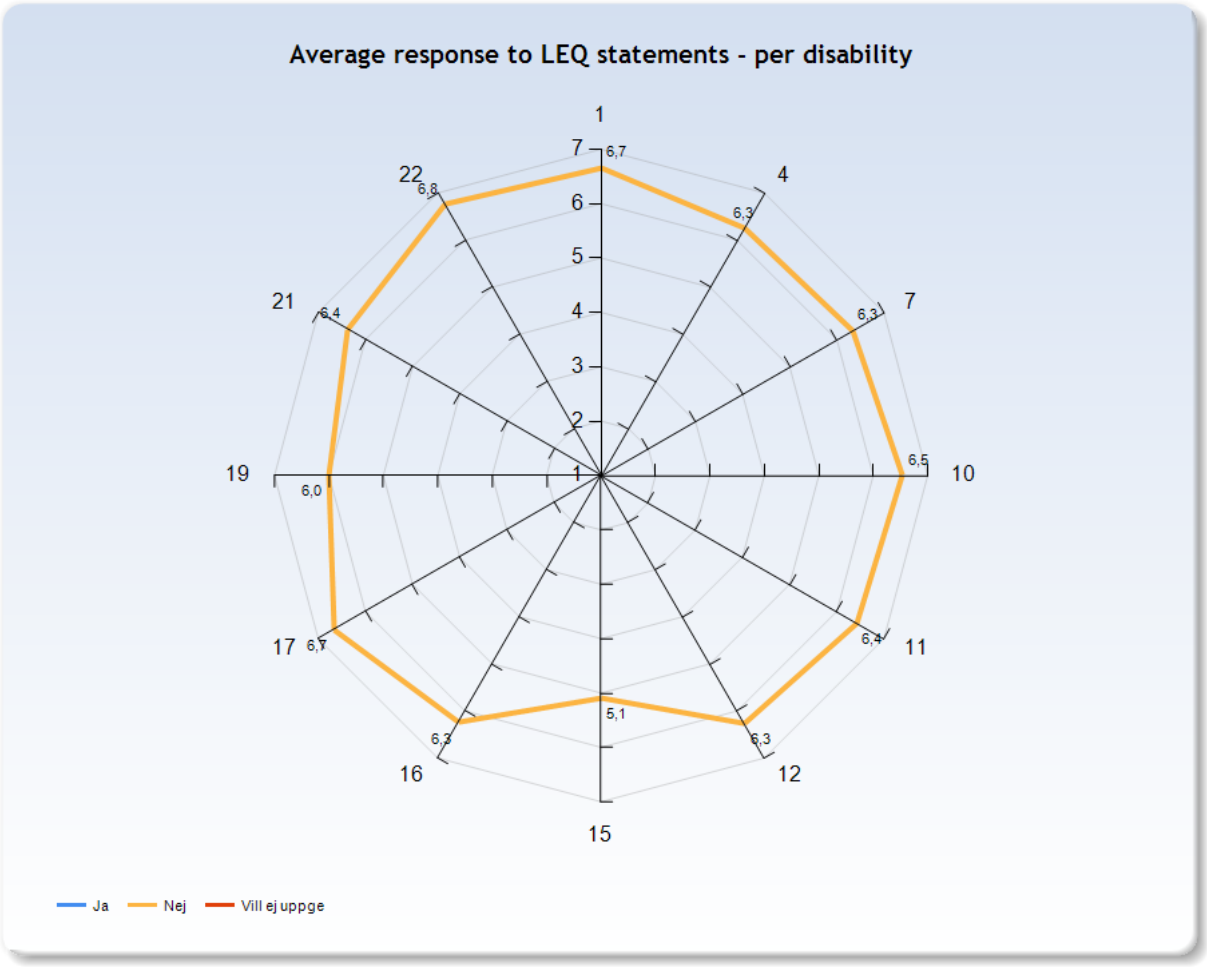
6,9
6,5
6,0
6,3
6,5
6,3
6,8
6,5
Internationell masterstudent
Internationell utbytesstudent
Svensk student i årskurs 1-3
Svensk student i årskurs 4-5
Annan typ av student
Vill ej uppge

Comments


Average response to LEQ statements - per disability
1
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4
3
2
1
6,7
6,3
6,3
6,5
6,4
6,3
5,1
6,3
6,7
6,0
6,4
6,8
Ja
Nej
Vill ej uppge

Comments

GENERAL QUESTIONS

What was the best aspect of the course?

What was the best aspect of the course? (I worked: 9-11 timmar/vecka)
Very precise information from lectures, felt like everything was kind of necessesary and valuable, which usually isn't the case for SF courses. Easy to follow lectures, interesting aswell. First time in a long while I was at 90% of the lectures.
Lectures had focus on intuition and understanding

What was the best aspect of the course? (I worked: 12-14 timmar/vecka)
it was interesting and challenging to learn a new language (GAMS)
Our Lecturer were enthusiastic which encouraged me a lot. He is hands down one of the best teachers i've had at kth, answering e-mail rapidly and Carling för students overall! I liked the projects that really showed examples of the practical purpose with optimisation!

What was the best aspect of the course? (I worked: 15-17 timmar/vecka)
- Combination of theory and projects - Davids explanations at the beginning of the excercises helped a lot (personally sometimes even more than the ones from the lecture) - Really interesting topic
Gianpiero's lecture, really charismatic and great lecturer, was very fun to attend the lectures.
I liked the projects which help to understand some concepts. Also the teacher is passionate about the topic which is very nice during lectures.

What was the best aspect of the course? (I worked: 18-20 timmar/vecka)
The best aspect of the course was that it combined practice with theory. You learned a lot by working on the projects and applying the different concepts.
The applied part
I really enjoyed the two group projects we did the course, along with the discussion sessions for them. Because there was not too much pressure on the workload for the project, and in terms of assessment, I was able to actually enjoy doing and learning from the projects. I learned much more from those projects, then for example, cramming some concepts a few days before an exam for some course.

What was the best aspect of the course? (I worked: 21-23 timmar/vecka)
The lecturer. Possibly the best, funniest and most pedagogic lecturer I have experienced at KTH. He made the lecurers beyond interesting. I do find optimization intriguing in general, but his very relaxed and down-to-earth learning style made it so much better. With quick responses and continuous support aswell, no matter the issue. Also I want to mention the projects, as they worked great in applying the theories to real cases. Lastly, I want to note my appreciation for good lecture notes available for download, since I want to maximize my listening and understanding during lectures, rather than having to write down every little detail.

What would you suggest to improve?

What would you suggest to improve? (I worked: 9-11 timmar/vecka)
Perhaps a little bit more clear information regarding GAMS.
Maybe a little bit more time on projects
A course on a black board is always better to me

What would you suggest to improve? (I worked: 12-14 timmar/vecka)
make it easier for people on exchange to complete the course at a distance (eg. let them present online)
The adjustments to The Course was sometimes made a bit last minute, which made it difficult to plan härad.

What would you suggest to improve? (I worked: 15-17 timmar/vecka)
- Update the lecture slides if you decide to do it in a different way. Having the slides and then doing it differently is a bit confusing. Try to integrate your (definitely good) talks on the blackboard better with the slides - Idk how others see this, but I found Interior Point Methods hardest to grasp. Maybe focus a bit more on them and try to explain a bit more detailed (e.g. connection between Primal Dual Nonlinear Equations and Log Barrier) - A session how to use the learned advanced topics in practice (e.g. small example of how to use Decomposition and Lagrangian Relaxation in practice with gams or gurobipy)
Getting better instructions for the grading of the projects, which concrete criteria are desired for each grade step.
The second project was a bit repetitive regarding the first one. Both my projects had a deterministic and stochastic part so it felt quite similar. Maybe it could be nice to have the second project related to methods seen in the second part of the course (branch and bound, lagrangian relaxation, decomposition methods,...) although it might not be easy with the timing. Also, for the exam at the last question I did not know how much I was expected to write (for sensitivity analysis). The last question took me as much time as the fourth first questions together (but we don't have the grades yet so maybe I misunderstood something).

What would you suggest to improve? (I worked: 18-20 timmar/vecka)
-
Add some more past exam/papers for students to study on. Maybe stick to only one important exercise per exercises session, and go into more depth on the problem? (Not sure about this one)

What would you suggest to improve? (I worked: 21-23 timmar/vecka)
In the projects, having to deal with GAMS was sometimes annoying. While I appreciate learning a language that is actually used in the industry, the lack of support whenever some bug appeared or the like was annoying. While using Python probably would make this less of a problem, I still appreciated learning GAMS.

What advice would you like to give to future participants?

What advice would you like to give to future participants? (I worked: 9-11 timmar/vecka)
Go to the lectures and listen. Try to get intuition about the algorithms

What advice would you like to give to future participants? (I worked: 12-14 timmar/vecka)
Try to be active on the lecture!

What advice would you like to give to future participants? (I worked: 15-17 timmar/vecka)
- Work on the theory questions - Try to do every question on the projects - Go to the lectures and excercises - Have fun
Do the recommended exercises weekly to keep up with the material.
Enjoy

What advice would you like to give to future participants? (I worked: 18-20 timmar/vecka)
Start early with the projects and work simultaneously on the theory questions and recommended exercises.
Start with the theory questions straight away
The lecturers are very gentle when it comes to the assessment of the projects. This is a good thing, and you should take advantage of it by genuinely learning the theory behind the projects, and find some enjoyment in solving them. Just go to all the lectures, and especially the exercise classes. Do the usual, if you don't understand, just write everything down and bring to the teacher in the future. He will help.

What advice would you like to give to future participants? (I worked: 21-23 timmar/vecka)
Do the theory questions throughout the course, as suggested by the "recommended prerequisites" to each lecture. Also, begin with projects right away. They are difficult and time-consuming, but take time to discuss with others, do research and ask around if necessary. Focus less on exams and more on understanding and following the lectures and exercise sessions.

Is there anything else you would like to add?

Is there anything else you would like to add? (I worked: 9-11 timmar/vecka)
I really liked your lectures Gianpiero! /student that are very hard on judging this

Is there anything else you would like to add? (I worked: 12-14 timmar/vecka)
make it easier for people on exchange to complete the course at a distance (eg. let them present online)

Is there anything else you would like to add? (I worked: 15-17 timmar/vecka)
- Maye state a bit clearer that integer variables were allowed in P1. Personally (comparing it to the lectures) it would have made sense, that in P1 only continous variable are allowed and in P2 we need to use integer variables - Why are we using gams (where we can only get a demo version), if Gurobi and IBM CPLEX offer free licences for student, and at least CPLEX also has some modeling language (similar to GAMS?)?
The exercise session were nice as well. The course is well structured. I found the literature recommended in the slides interesting and in link with what is seen during lectures so it helps a lot to understand concepts. I liked the presentation lectures for the projects, it was nice to compare with other groups and present our work to others.

Is there anything else you would like to add? (I worked: 18-20 timmar/vecka)
Great course that combines theory with practice. Big thanks to Gianpierro who made the lectures and the material easy to follow. Always tried to give intuitive explanations of different concepts. Great teaching skills! Also, thanks to David for the great exercise sessions.
-

Is there anything else you would like to add? (I worked: 21-23 timmar/vecka)
The interview sessions following the projects were a great complement to the hand-in and discussion with other students. It allowed for direct feedback and questioning from both parties in a rather relaxed setting, which I appreciated. Lastly, I again want to emphasise how great the lecturer has been. It felt like both the assistant teacher and lecturer were 'one of us' students, making the course so much more fun to follow. A fresh breeze in contrast to most other courses and conservative lecturers at KTH.

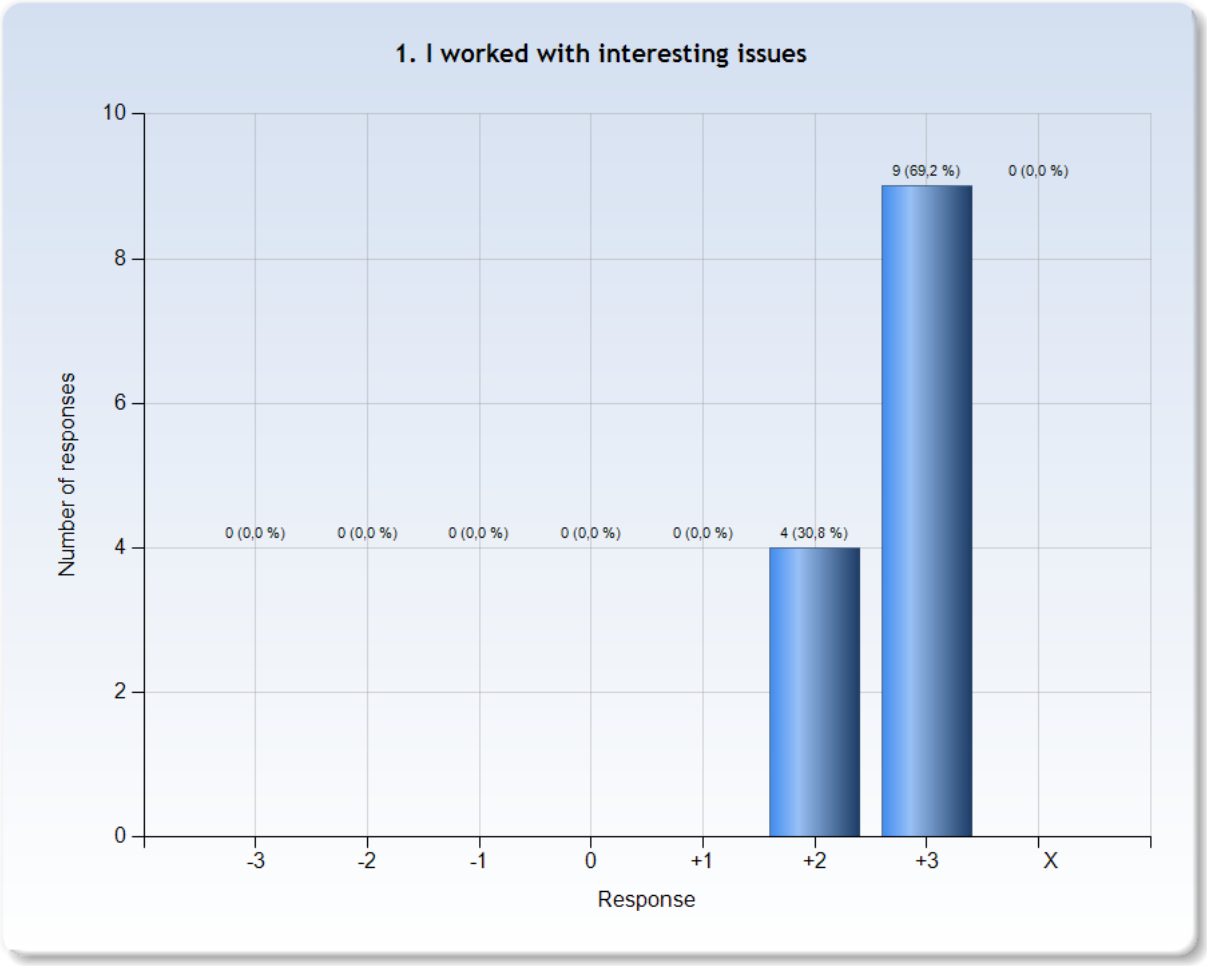
SPECIFIC QUESTIONS

RESPONSE DATA

The diagrams below show the detailed response to the LEQ statements. The response scale is defined by:

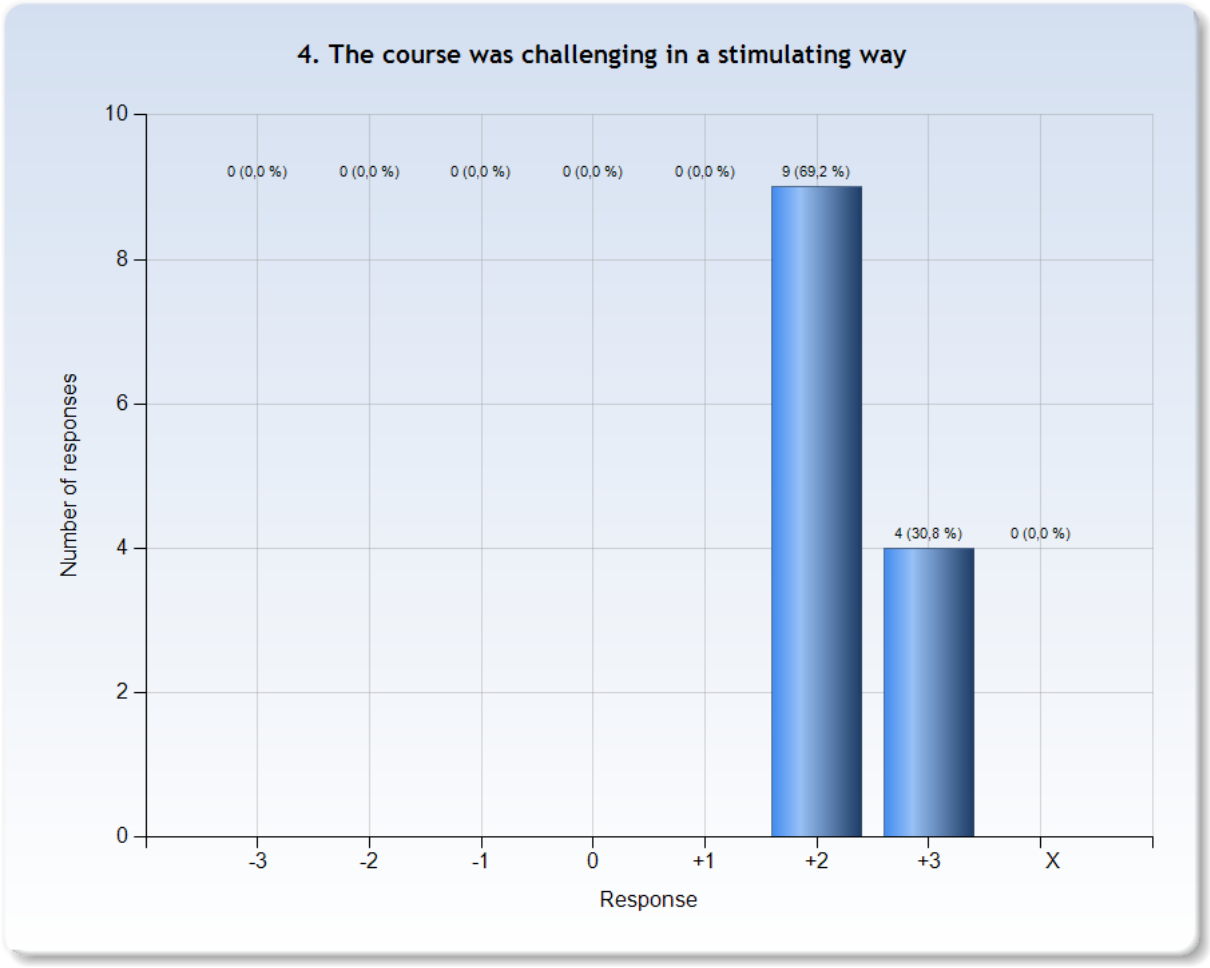
-3 = No, I strongly disagree with the statement
0 = I am neutral to the statement
+3 = Yes, I strongly agree with the statement

X = I decline to take a position on the statement



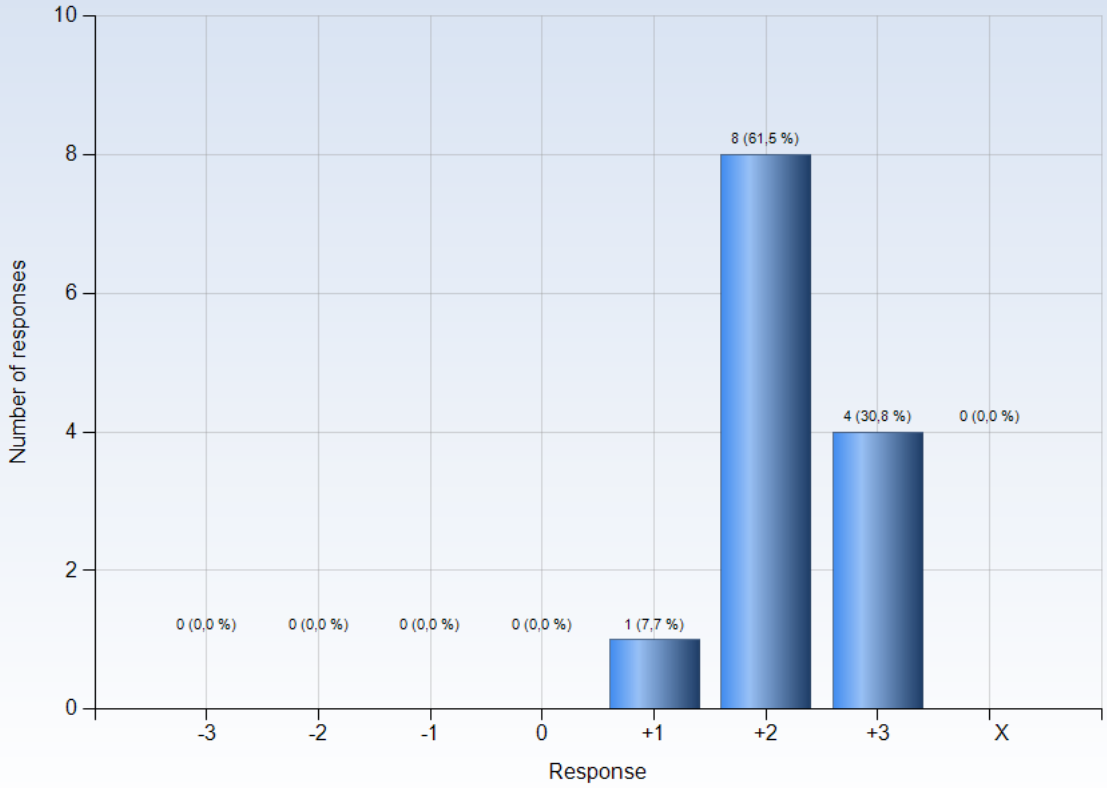
Comments

Comments (My response was: +3)
I appreciated the very different project formulations.

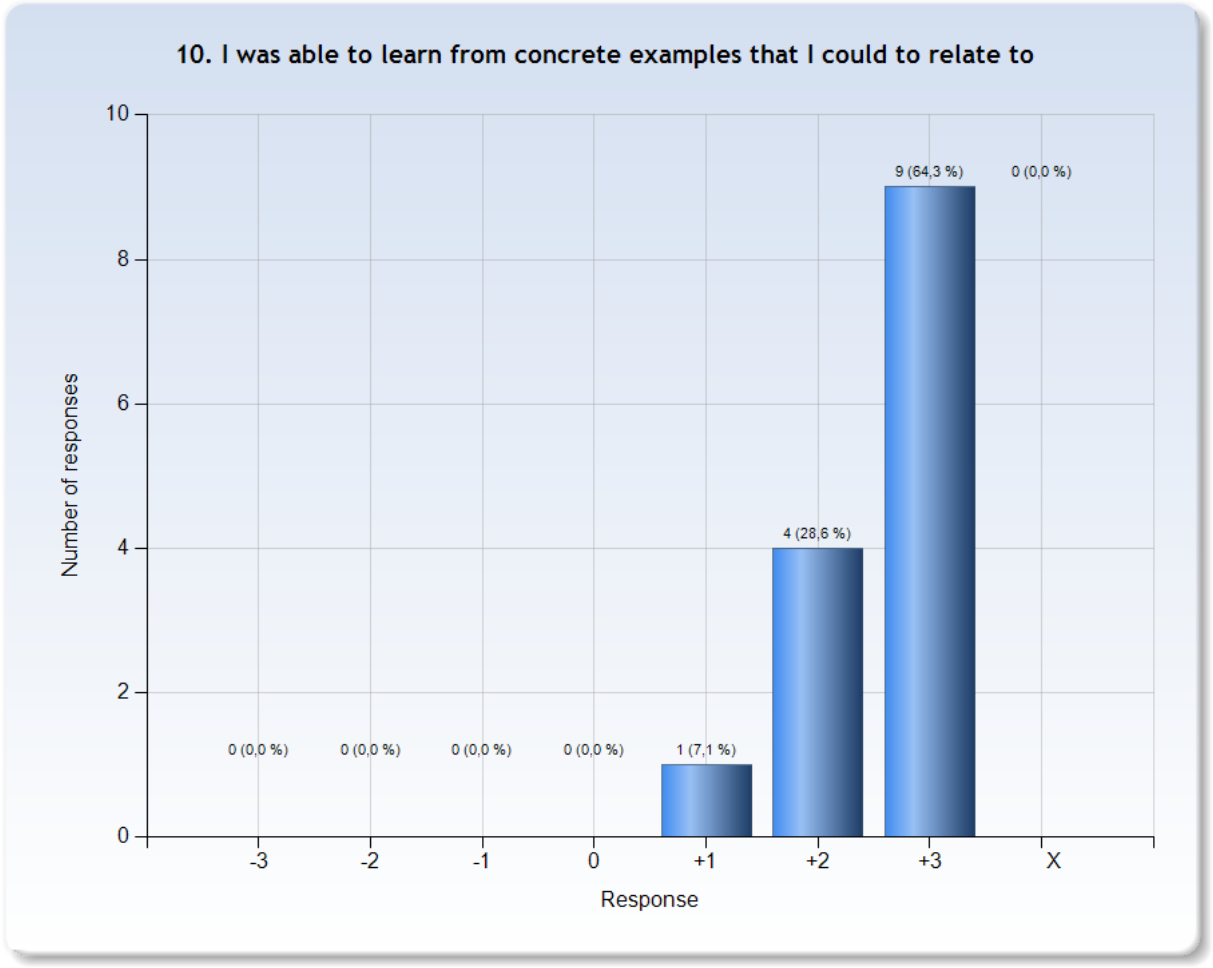

4. The course was challenging in a stimulating way
Number of responses
10
8
6
4
2
0
0 (0,0 %)
0 (0,0 %)
0 (0,0 %)
0 (0,0 %)
0 (0,0 %)
9 (69,2 %)
4 (30,8 %)
0 (0,0 %)
-3
-2
-1
0
+1
+2
+3
X
Response

Comments

7. The intended learning outcomes helped me to understand what I was expected to achieve

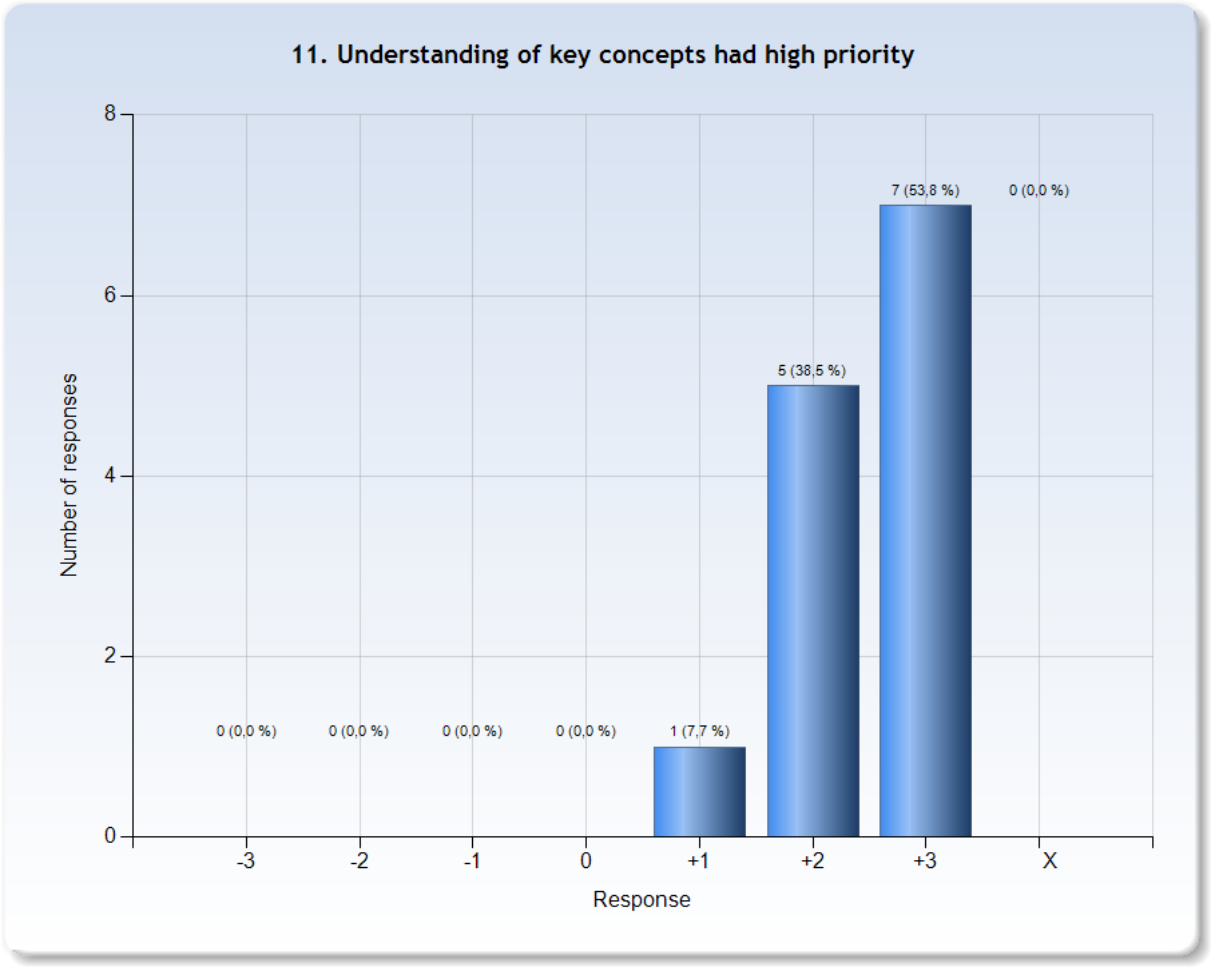


Comments



Comments

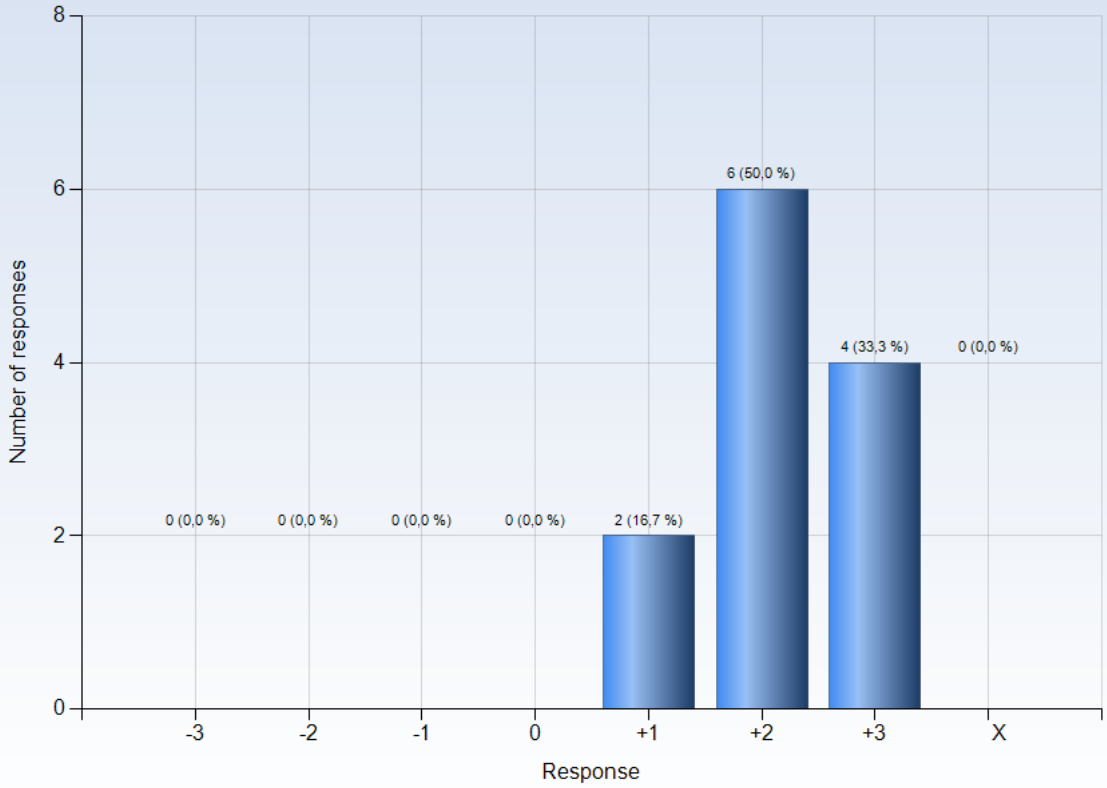
Comments (My response was: +3)
I appreciated the strong connection to real cases throughout the course; it is an applied course.



Comments

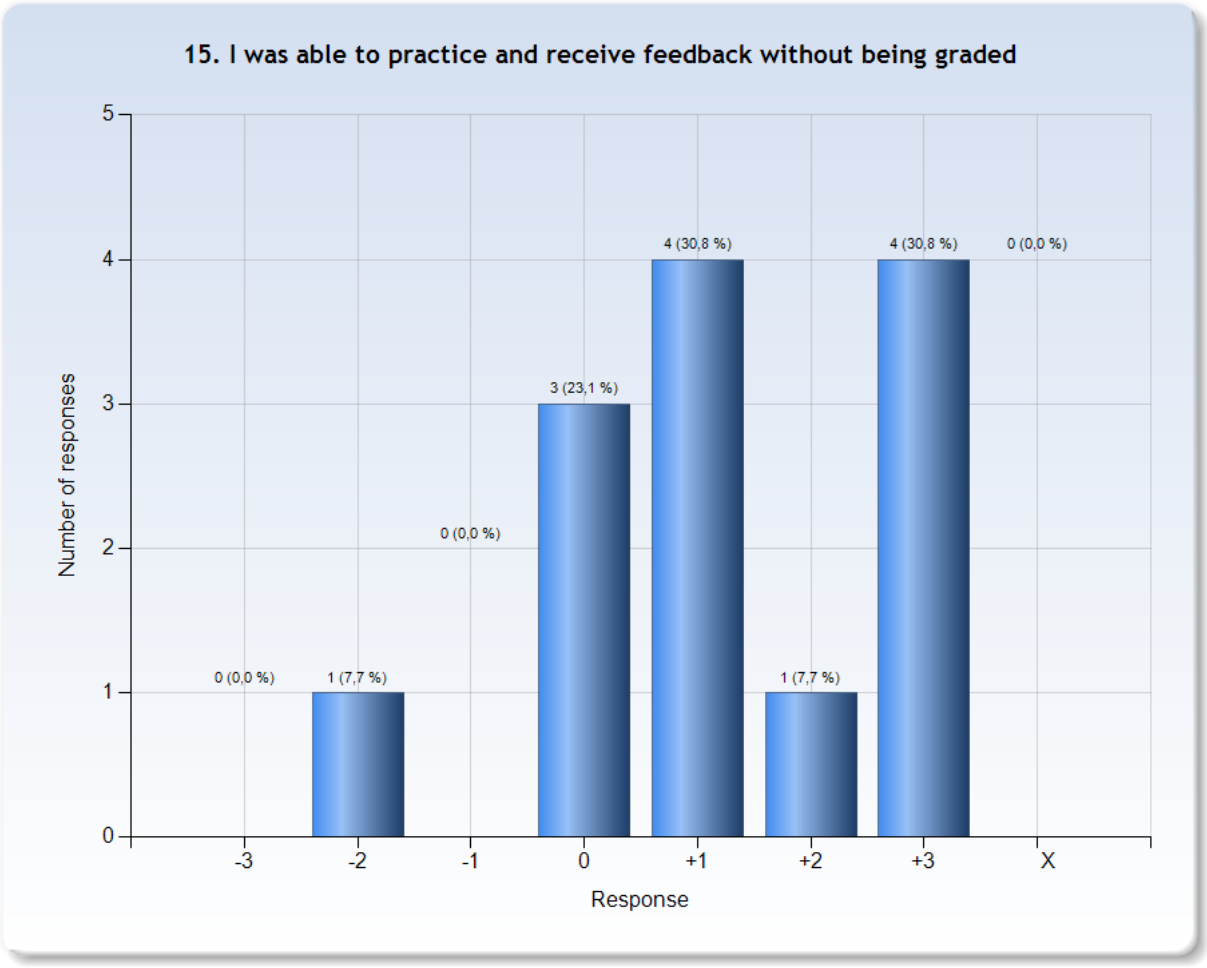
Comments (My response was: +1)
I sometimes missed the deeper knowledge in why certain methods worked etc, before applying them.

12. The course activities helped me to achieve the intended learning outcomes efficiently

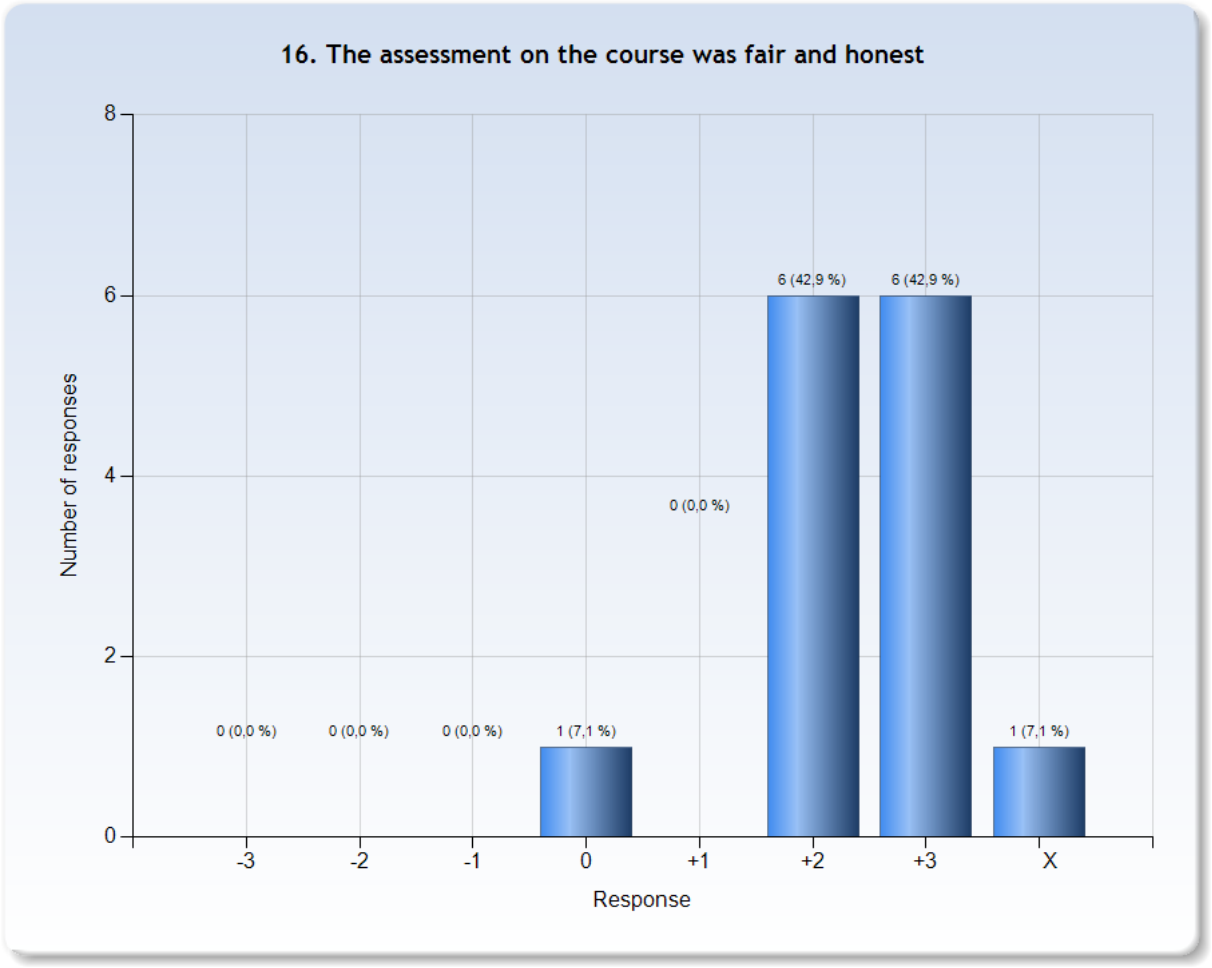


Comments

Comments (My response was: +3)
The projects helped me to have a better understanding of some concepts

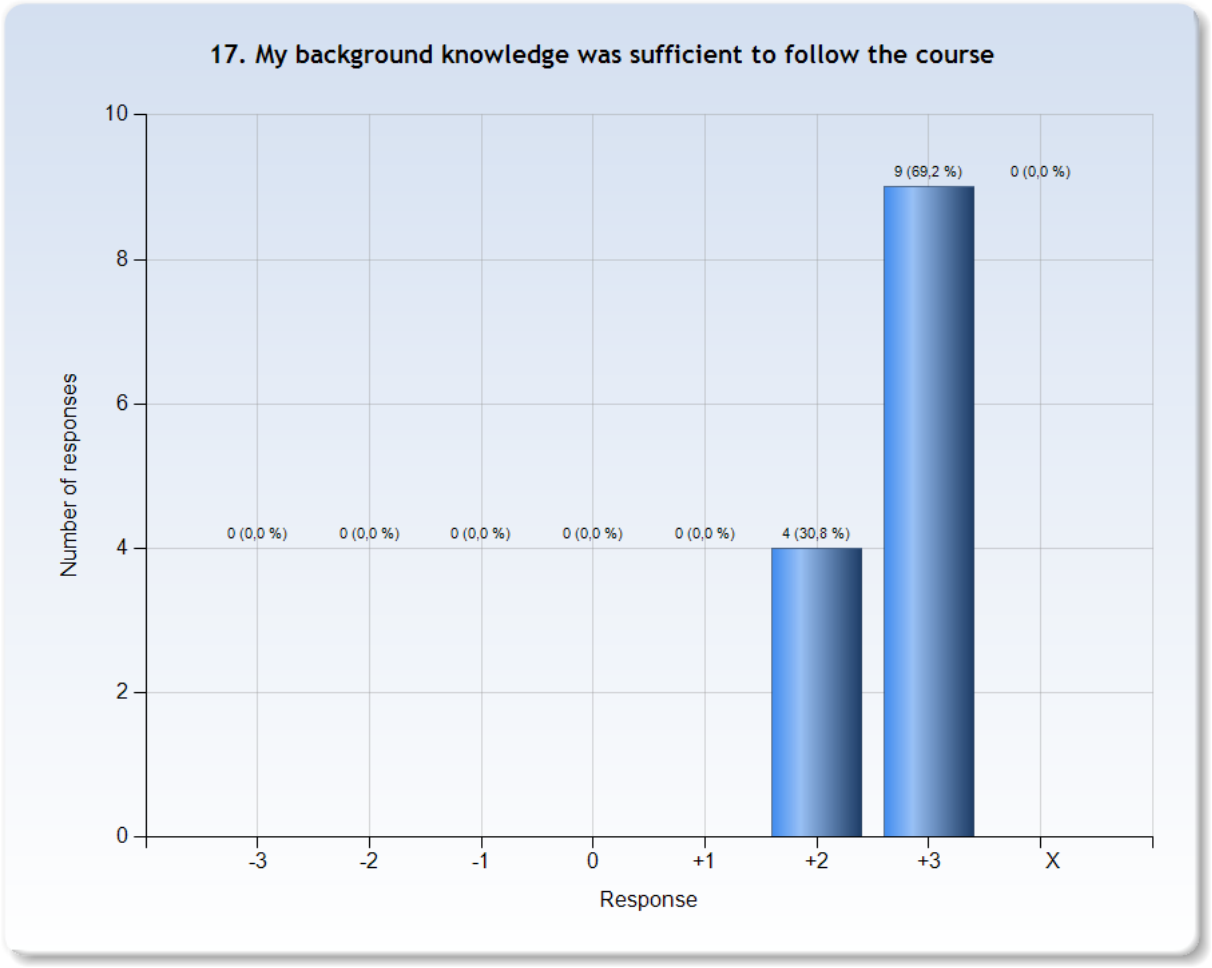

15. I was able to practice and receive feedback without being graded
Number of responses
Response
0
1
2
3
4
5
-3
-2
-1
0
+1
+2
+3
X
0 (0,0 %)
1 (7,7 %)
0 (0,0 %)
3 (23,1 %)
4 (30,8 %)
1 (7,7 %)
4 (30,8 %)
0 (0,0 %)

Comments



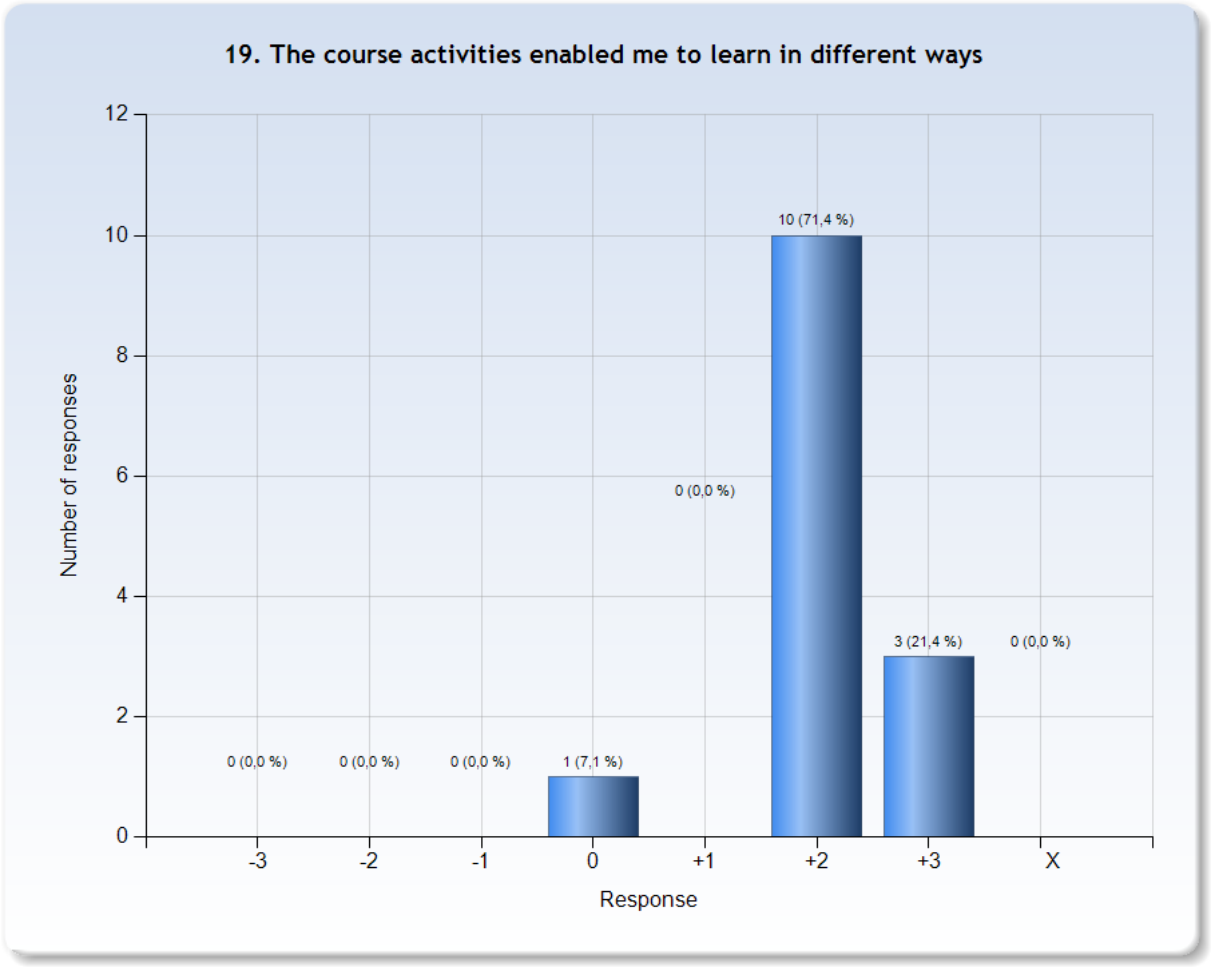
Comments

Comments (My response was: +3)
Regarding Projects, cannot evaluate Exam grading because exam not graded yet, but the exam seemed to be really fair

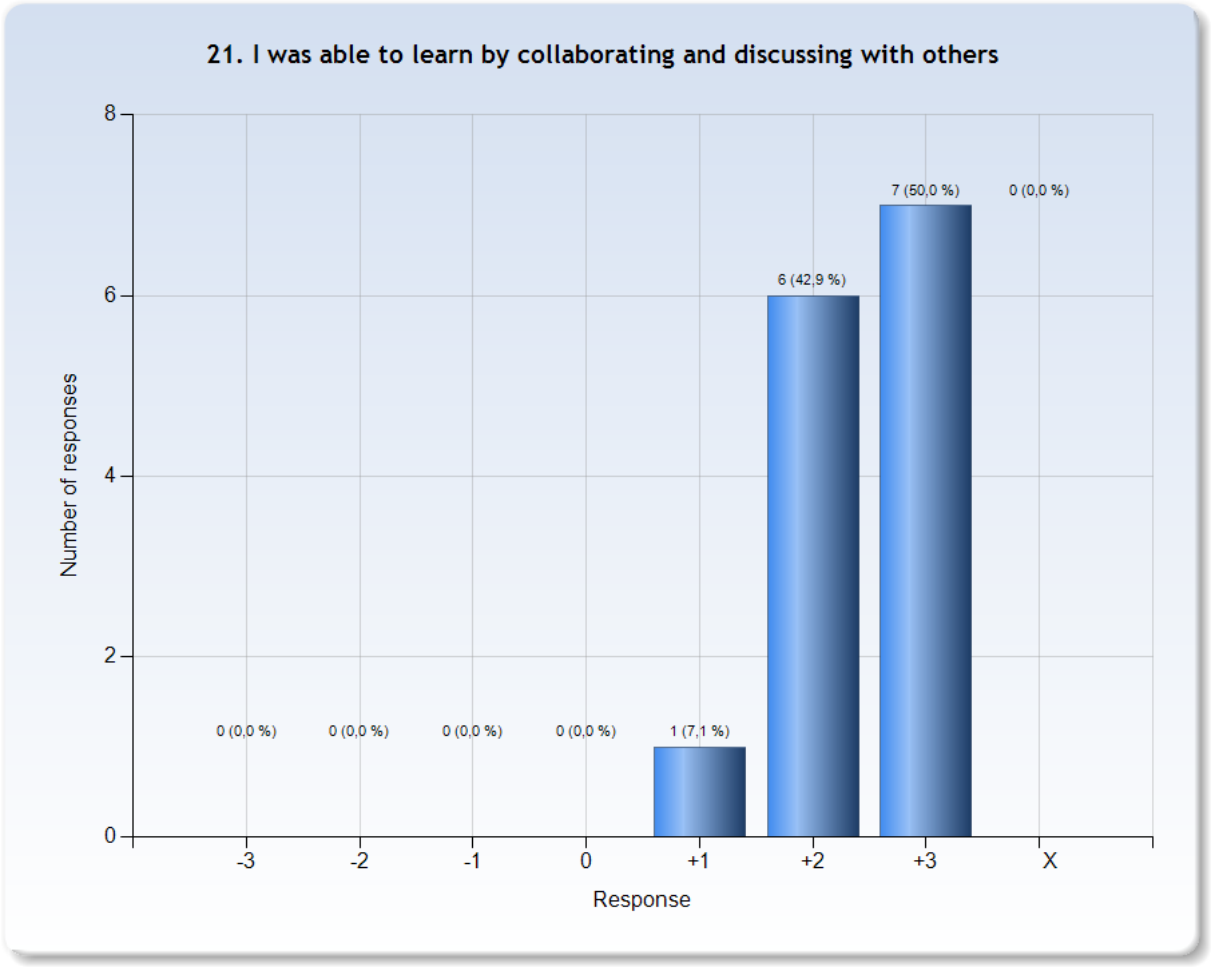


Comments

Comments (My response was: +3)
I was surprised to learn that the introductory course in optimization really was not needed to follow.


19. The course activities enabled me to learn in different ways
Number of responses
12
10
8
6
4
2
0
0 (0,0 %)
0 (0,0 %)
0 (0,0 %)
1 (7,1 %)
0 (0,0 %)
10 (71,4 %)
3 (21,4 %)
0 (0,0 %)
-3
-2
-1
0
+1
+2
+3
X
Response

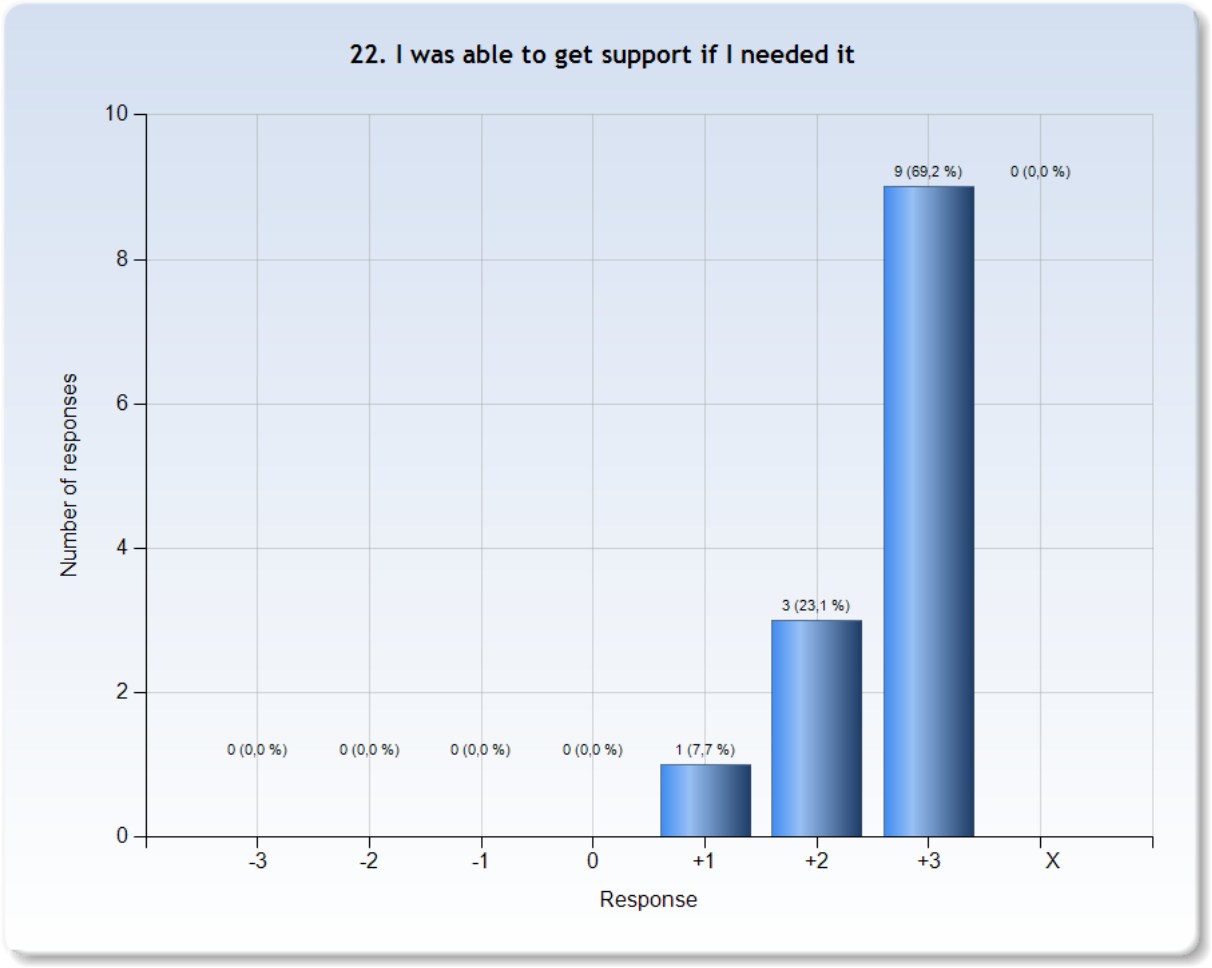
Comments



Comments

Comments (My response was: +2)
While the randomized project groups are annoying; I had the luck to be with very collaborative partners.

Comments (My response was: +3)
Very nice to work with others for the project



Comments

Comments (My response was: +1)
Had some problems with GAMS that the lecture har trouble answering.

Comments (My response was: +3)
The lecturer was fantastic in quick and effective responses.
The teacher answers fast emails and seems happy to help you

Course PM

Edit More

Feedback

News

SF2812 Applied Linear Optimization, 7.5hp, 2019/2020

Instructor and examiner

Gianpiero Canessa (canessa@kth.se), room 3733, Lindstedtsv. 25.
Office hours: Monday 11-12. (Or by agreement.)

Exercise leader and project leader

David Ek (daviek@kth.se), room 3734, Lindstedtsv. 25.
Office hours: By agreement.

Course material

- *Linear and Nonlinear Optimization*, second edition, by I. Griva, S. G. Nash och A. Sofer, SIAM, 2009.
  (The book can be ordered from several places. Please note that you can become a SIAM member for free and obtain a discount at the SIAM bookstore.)
- *Exercises in applied linear optimization, 2019/2020*. Available via Canvas.
- *Lecture notes in applied linear optimization, 2019/2020*. Available via Canvas.
- *Supplementary course material in applied linear optimization, 2019/2020*. Available via Canvas.
- *Theory questions in applied linear optimization, 2019/2020*. Available via Canvas.
- *GAMS, A user's guide*. Available at the GAMS web site.
- *GAMS*. GAMS is installed in the KTH linux computer rooms. It may also be downloaded from the GAMS web site for use on a personal computer.
- Two project assignments that are handed out during the course, January 30 and February 13 respectively.

Additional notes that may be handed out during the course are also included.

Course goals

After completed course, the student should be able to:

- explain fundamental concepts of linear programming and integer linear programming;
- explain how fundamental methods for linear programming and integer linear programming work;
- illustrate how these methods work by solving small problems by hand calculations;
- starting from a suitably modified real problem, formulate a linear program or an integer linear program; make a model in a modeling language and solve the problem;
- analyze the solutions of the optimization problem solved, and present the analysis in writing as well as orally;
- interact with other students when modeling and analyzing the optimization problems.

Examination

The examination is in two parts, projects and final exam. To pass the course, the following requirements must be fulfilled:

- Pass project assignment 1, with presence at the compulsory presentation lecture on Wednesday February 12 and presence at the following discussion session.
- Pass project assignment 2, with presence at the compulsory presentation lecture on Wednesday February 26 and presence at the following discussion session.

- Pass final exam.

Course registration

Due to the project based nature of this course, students must register no later than January 31. Registration is made by the students online following KTH standard procedures.

Project assignments

The project assignments are performed in groups, where the instructor determines the division of project groups. This division is changed between the two assignments. The assignments are carried out by the modeling language GAMS. The project assignments *must* be carried out during the duration of the course and completed by the above mentioned presentation lectures. It is the responsibility of each student to allocate time so that the project group can meet and function. Presence at the presentation lectures is compulsory. For passing the projects, the following requirements must be fulfilled:

- No later than the night before the presentation lecture, each project group must hand in a well-written report which describes the exercise and the project group's suggestion for solving the exercise through Canvas as a pdf file. Suitable word processor should be used. The report should be on a level suitable for another participant in the course who is not familiar with the group's specific problem.
- At the beginning of the presentation lecture, each student should hand in an individual sheet with a brief self-assessment of his/her contribution to the project work, quantitatively as well as qualitatively.
- At the presentation lecture, all assignments will be presented and discussed. The presentations and discussions will be made in small presentation groups, first in presentation groups where each student has worked on the same project assignment, and then in presentation groups where the students have worked on different project assignments. Each student is expected to be able to present the assignment of his/her project group, the modeling and the solution. In particular, each student is expected to take part in the discussion. The presentation and discussion should be on a level such that students having had the same assignment can discuss, and students not having had the same assignment can understand the issues that have arisen and how they have been solved. Each student should bring a copy of the project group's report to the presentation lecture, either in paper or electronically.
- Each project group should make an appointment for a discussion session with the course leaders. There is no presentation at this session, but the course leaders will ask questions and give feedback. There will be time slots available the days after the presentation session. One week prior to the presentation lecture, a list of available times for discussion sessions will be made available at Doodle, announced via Canvas. Each project group should sign up for a discussion session prior to the presentation lecture.

Each project assignment is awarded a grade which is either fail or pass with grading E, D, C, B and A. Here, the mathematical treatment of the problem as well as the report and the oral presentation or discussion is taken into account. The exercises are divided into basic exercises and advanced exercises. Sufficient treatment of the basic exercises gives a passing grade. Inclusion of the advanced exercises is necessary for the higher grades (typically A-C). Normally, the same grade is given to all members of a project group. A student who has not worked on the advanced exercises says so in the self assessment form.

Each project group must solve their task independently. Discussion between the project groups concerning interpretation of statements etc. are encouraged, but each project group must work independently without making use of solutions provided by others. All project groups will not be assigned the same exercises.

Final exam

The final exam consists of five exercises and gives a maximum of 50 points. At the exam, the grades F, Fx, E, D, C, B and A are awarded. For a passing grade, normally at least 22 points are required. In addition to writing material, no other material is allowed at the exam. Normally, the grade limits are given by E (22-24), D (25-30), C (31-36), B (37-42) and A (43-50).

The grade Fx is normally given for 20 or 21 points on the final exam. An Fx grade may be converted to an E grade by a successful completion of two supplementary exercises, that the student must complete independently. One exercise among the theory exercises handed out during the course, and one exercise which is similar to one exercise of the exam. These exercises are selected by the instructor, individually for each student. Solutions have to be handed in to the instructor and also explained orally within three weeks of the date of notification of grades.

The final exam is given Monday March 9 2020, 8.00-13.00.

Final grade

By identitying A=7, B=6, C=5, D=4, E=3, the final grade is given as

round((grade on proj 1) + (grade on proj 2) + 2 * (grade on final exam)) / 4),

where the rounding is made to nearest larger integer in case of a tie.

Preliminary schedule

"L" means lecture, "E" means exercise session, "P" means project session.

Type	Day	Date	Time	Room	Subject
L1	Wed	Jan 15	15-17	Q2	Introduction. Linear programming models.
L2	Thu	Jan 16	8-10	Q2	Linear programming. Geometry.
L3	Fri	Jan 17	8-10	Q2	Lagrangian relaxation. Duality. LP optimality.
L4	Tue	Jan 21	15-17	Q2	Linear programming. The simplex method.
E1	Thu	Jan 23	8-10	Q2	Linear programming. The simplex method.
L5	Fri	Jan 24	15-17	Q2	More on the simplex method.
P1	Tue	Jan 28	15-17	Q2	Introduction to GAMS.
P2	Wed	Jan 29	10-12	Q2	GAMS excercise session.
E2	Thu	Jan 30	8-10	Q2	Linear programming. The simplex method.
L6	Fri	Jan 31	15-17	Q2	Stochastic programming.
E3	Tue	Feb 4	15-17	Q2	Stochastic programming.
L7	Thu	Feb 6	8-10	Q2	Interior methods for linear programming.
E4	Fri	Feb 7	15-17	Q2	Interior methods for linear programming.
L8	Tue	Feb 11	15-17	Q2	Integer programming models.
P3	Wed	Feb 12	10-12	Q2	Presentation of project assignment 1.
L9	Thu	Feb 13	8-10	Q2	Branch-and-bound.
E5	Fri	Feb 14	15-17	Q2	Integer programming.
L10	Tue	Feb 18	15-17	Q2	Decomposition and column generation.
E6	Thu	Feb 20	8-10	Q2	Decomposition and column generation.
L11	Fri	Feb 21	15-17	Q2	Lagrangian relaxation. Duality.
E7	Tue	Feb 25	15-17	D3	Lagrangian relaxation. Duality.
P4	Wed	Feb 26	10-12	D3	Presentation of project assignment 2.
L12	Thu	Feb 27	8-10	Q2	Subgradient methods.
E8	Fri	Feb 28	15-17	Q2	Subgradient methods.

Mapping of exercises to lectures

The sections in the exercise booklet may roughly be mapped to the lectures as follows:

1. The simplex method. After L4.
2. Sensitivity analysis. After L4.
3. Interior point methods. After L7.
4. Decomposition and column generation. After L10.

5. Linear programming - remaining. After L7.
6. Stochastic programming. After L6.
7. Formulation - integer programming. After L8.
8. Lagrangian relaxation and duality. After L11.
9. Subgradient methods. After L12.

Overview of course contents

- **Linear programming**
  Fundamental LP theory with corresponding geometric interpretations. The simplex method. Column generation. Decomposition. Duality. Complementarity. Sensitivity. Formulations of LPs. Interior methods for linear programming, primal-dual interior methods in particular.
  (Chapters 4-7 in Griva, Nash and Sofer, except 5.2.3, 5.2.4, 5.5.1, 6.5, 7.5, 7.6. Chapter 9.3 in Griva, Nash and Sofer. Chapter 10 in Griva, Nash and Sofer, except 10.3, 10.5.)
- **Stochastic programming**
  Fundamental theory. (Supplementary course material.)
- **Integer programming**
  Formulations of integer programs. Branch-and-bound. Lagrangian relaxation and subgradient methods applied on integer programs with special structure.
  (Supplementary course material.)

Support for students with disabilities

Students with disabilities may have the right to certain compensatory support for example during examination.
KTH has coordinators for students with disabilities, Funka, who deals with issues relating to functional disabilities. You should turn to Funka at funka@kth.se for information about support.

Welcome to the course!

Instructions for GAMS

- GAMS at the KTH linux computers.
  - Type "module add gams" or add it to a suitable login file.
  - Use an editor, for example emacs, to create/modify model files (".gms") and reading output files (".lst").
  - Put the model files in your home catalog. Run GAMS from that catalog, e.g. "gams trans1".
  - Please note that there is a whole library of example files at GAMS subdirectory "modlib".
- GAMS on your own computer.
  - The demo version of GAMS (which we use) can be downloaded from the GAMS website.
- GAMS resources
  - GAMS documentation
  - GAMS user's guide

Show earlier events (1) ›

Teacher Anders Forsgren changed the permissions 11 December 2018

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Accessible to the whole world.

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