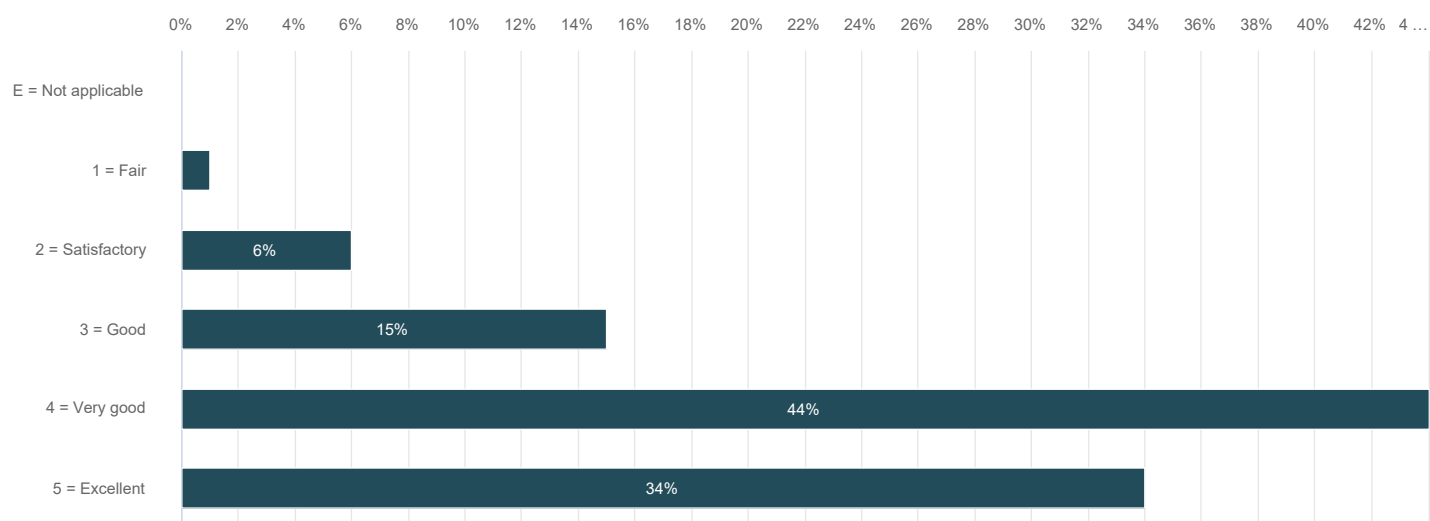


MS-E2121 Linear Optimization D, Lecture (2022-01-11 - 2022-04-07)

Vastaajien kokonaismäärä: 91

1. My overall assessment of the course

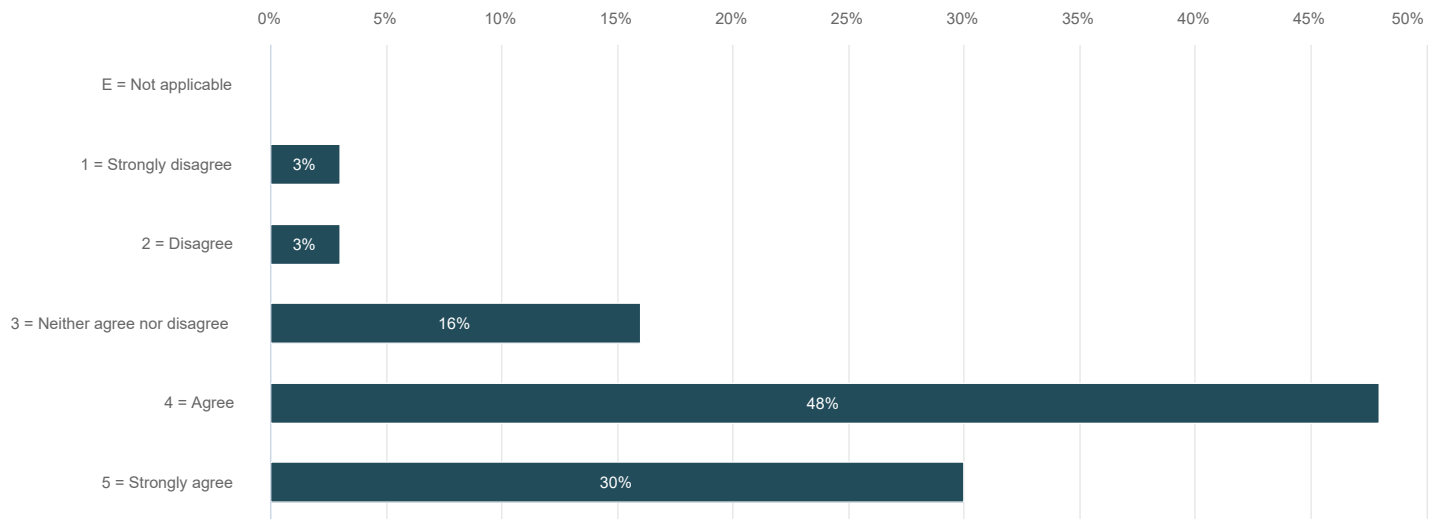
Number of respondents: 91



	n	Prosentti
E = Not applicable	0	0,0%
1 = Fair	1	1,1%
2 = Satisfactory	5	5,5%
3 = Good	14	15,4%
4 = Very good	40	43,9%
5 = Excellent	31	34,1%

2. The teaching methods (lectures, labs, group work, online study, assignments etc.) supported my learning

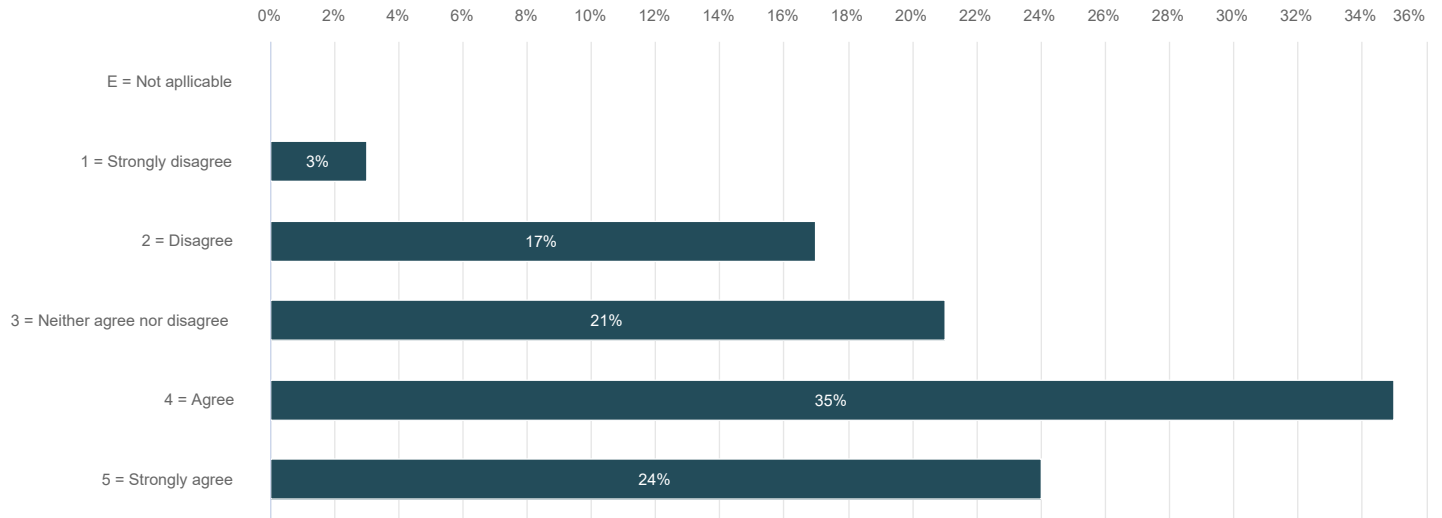
Number of respondents: 91



	n	Prosentti
E = Not applicable	0	0,0%
1 = Strongly disagree	3	3,3%
2 = Disagree	3	3,3%
3 = Neither agree nor disagree	14	15,4%
4 = Agree	44	48,3%
5 = Strongly agree	27	29,7%

3. I am pleased with my study effort on this course

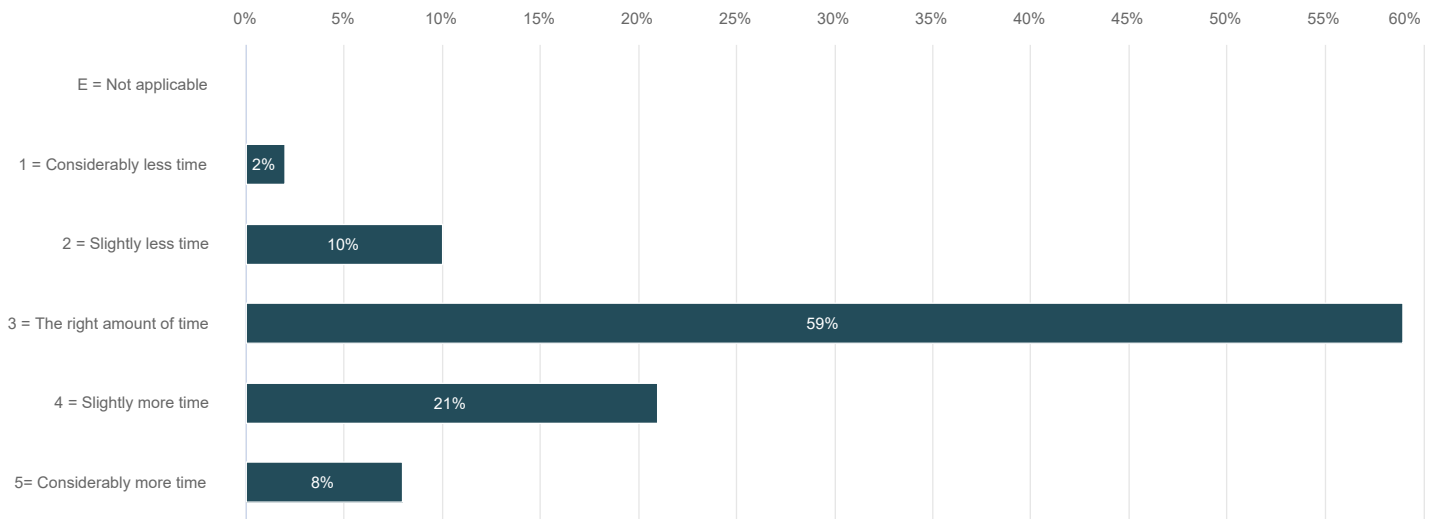
Number of respondents: 91



	n	Prosentti
E = Not applicable	0	0,0%
1 = Strongly disagree	3	3,3%
2 = Disagree	15	16,5%
3 = Neither agree nor disagree	19	20,9%
4 = Agree	32	35,1%
5 = Strongly agree	22	24,2%

4. According to the guidelines, one credit (ECTS) requires 27 hours of student work. Compared with this, the completion of the course required

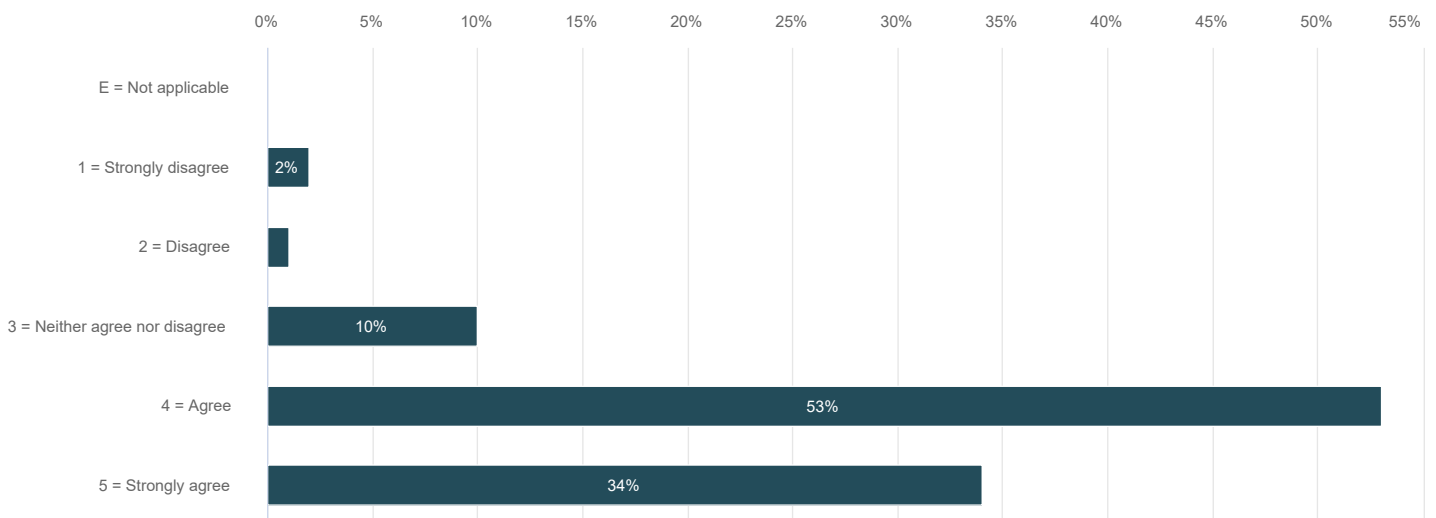
Number of respondents: 91



	n	Prosentti
E = Not applicable	0	0,0%
1 = Considerably less time	2	2,2%
2 = Slightly less time	9	9,9%
3 = The right amount of time	54	59,3%
4 = Slightly more time	19	20,9%
5 = Considerably more time	7	7,7%

5. I think I will benefit from the things learnt on the course

Number of respondents: 88



	n	Prosentti
E = Not applicable	0	0,0%
1 = Strongly disagree	2	2,3%
2 = Disagree	1	1,1%
3 = Neither agree nor disagree	9	10,2%
4 = Agree	46	52,3%
5 = Strongly agree	30	34,1%

6. What was good about the course? Which factors in particular supported your learning?

Number of respondents: 68

Vastaukset
Fabricio
Very pleased with the course :) Good balance with theory and practical stuff.
There was a lot of material and studying options available
Excellent professor plus assistants Helmi And Olli
The lecture recordings were very nice, and especially the fact that they held essentially the same contents as the lecture material only with verbal explanation supported my learning.
Recordings were great quality
Recordings were super helpful. Would have hoped for some sort of laskari type recordings as well. That wpuld have helped a lot with the very hard assignments of the course.
Recorder lectures are fine but Fabricio looked so sad in those that it affected my mood as well. I appreciate that we get to see the powerpoint before the lecture and also the pdf notes. Combined, it can give a good sources one can study from.
Homework assignments were enough but not too challenging
Lecture videos were nice
Lectures and exercises
Lectures were very well presented. Course assistants were very helpful.
The remote lectures and exercise sessions were great, even though they're not as involving as live lectures and live sessions. Assistants gave good feedback.
Lecturer was amazing, great lecture videos!
Phenomenal lecture notes, and interesting homeworks.
Pre-recorded lectures devided into smaller topic-wisely devided parts and active communication on zulip. This made it possible to quickly find a needed part of an lecture if needed. Also zulip was good because it gave valuable tips for homeworks.
I think the lecture notes were really good for the most part. Only some slight errors added confusion, but they were fixed pretty fast and informed on Zulip as well. TAs in this course were really good and gave some really thoughtout examples related to basically anything we asked in the sessions.
The problems in the assignments were interesting, and the recorded lectures were great.
The flipped classroom approach was good and I found the weekly sessions useful. I think that those types of sessions could work in on-campus format as well. I also liked that the grading is based on the homework assignments and not an exam, since this helps in dividing the study efforts more evenly throughout the course. I also feel that I really understood the topics only when doing the homework, so those problems had been selected very well! And lastly, thanks for the nice teaching assistants! :)
The homework assignments were very good. They were testing students on the key topics of the course. For example, the assignments where we implemented a basic dual simplex algorithm and Benders cut were so cool and I really felt like I understood the mechanics behind them after completing the tasks. The workload and difficulty were also reasonable. One large homework assignment every two weeks worked well. This way there never was any panic to get help with the assignment, as there were those weekly exercise sessions. Also a big thanks to the TAs. Every time a TA visited our breakout room, I got the help I sometimes needed. I think each time the TA visiting was Helmi so special thanks to her. I'm already looking forward to taking nonlinear optimization later this year, as it is taught by the same lecturer :D
I love courses which cater to people with different learning objectives. By offering multiple ways for learning (lecture notes, lecture videos, exercises, assignments, q&a's) and transparent grading policy, this course can be completed with various different approaches. For example, my motivation for this course was just to receive credits while learning some interesting approaches to optimization. But I can also understand easily that someone with more ambitious objectives in the field of optimization would enjoy this course. I just love the novel flipped classroom approach. Professor Oliviera noticeably makes concerted effort to teach in the best way possible from the students perspective. I appreciate that deeply. I received help from TA Olli Herrala multiple times quickly and personally. He was very polite and patient.
The weekly rhythm of the course was perfect. I really liked that the theory lectures were prerecorded videos published each Monday at 10:00 AM (one improvement comment on this coming ;-)), leaving enough time before the Thursday session to watch the lectures. The lecturer presented the theories such well that there would be no benefit from live lectures, as the lectures left little room for questions. Also, if there were some questions, the anonymous question bank was excellent concept and should be used on other sources as well, as it lowers the threshold for making questions well below the threshold that exists in live lectures. The Thursday sessions also helped me to learn the concepts. The structure of a Thursday session was excellent as it allowed room for questions, demos, and assisted solving of problems.
Professor took into consideration all student suggestions. The exercises were nicely arranged.
The lecture videos were great! Also the Julia notebook skeletons were pretty useful.
Lectures are quite clear and organized. TAs are helpful
The exercises and homework were interesting.
The lectures were amazing once again. Best online lectures thus far.
The prerecorded lectures were very informative. Tutorial files were good for understanding the homeworks.
Lecture videos were helpful
I think the homework problems were really great! There was a good mix of theoretical exercises and practical exercises with Julia. I liked the concept that the lectures are available on MyCourses each week and that the homework's had a nice 2 week time to do hem, so there was no hurry at any point.
Learning to use JUMP and the solvers. Coding was fun
The homework assignments were interesting and hands on implementations in Julia were fun. There was great support in Zulip and the exercise sessions. The lecture notes are well-written.
The online organising has been one of the better ones I have experienced. I prefer homework over an exam. Extra kudos for Olli for being so committed - several times I have received help from him on monday evening, just hours before homework deadline.

Vastaukset

The topic was interesting and the teaching staff was very supportive and understanding.

Exercise sessions supported learning, allowed questions etc

Prerecorder lectures were very good! Professor explained everything clearly and slowly enough to understand everything. It was very useful that students could ask for help with the homeworks on Zulip, and receive individual help. The pace of the course was also very good, and number of homeworks was just right, it was easy to keep up with the course.

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Great exercises

Great materials and teaching. I also got help from TAs when needed. Homework assignments were suitably challenging.

Connecting the dots between lecture notes and assignments was sometimes difficult but felt rewarding in the end.

The lecture material was the among the best I've encounter in Aalto during 5 yrs of studies. The exercise material was excellent and well prepared.

The course was organized in good fashion. Lectures and assignments were clear.

The teaching assistants (and Fabricio of course as well) and the supporting materials.

It really showed that the course staff had put a lot of thought on how to organize the course remotely. I appreciate that, even though the breakout rooms and zoom meetings didn't really work for me. Asking for help was made really easy and I found the lecture notes very good and helpful. I also liked how the homeworks progressed throughout the course. The tests and latex skeletons provided in the first homeworks helped a lot, since in the beginning I didn't really know what was going on :)

I would like to say that the quality of teaching and study material (notes and summarized lecture materials) were in central part to support my learning. Also the presence of teaching assistants was really helpful and they seemed very experienced and skilled. Lastly, I think that the division in homework problems to theoretical and practical problems was done very well.

The theory was mostly presented very nicely and elegantly.

The lecturer and TAs are all responsible and willing to answer my questions. I thank their efforts and excellent work.

Recorded lectures were good, they were also divided to reasonable short videos.

Fabricio and the rest of the teaching team were very positive, helpful and motivated. I very highly appreciated the effort the teaching team had put into thinking about new ways of connecting and assisting students in remote mode, even though for personal reasons I could not benefit much from them (I was always lagging about a week from the schedule :D)

Well-designed exercises and good lectures!

Lecture videos, exercises sessions, online teaching. Even though I rarely was particularly active in the breakout rooms, the mandatory exercise weekly sessions that went through the relevant applications and helped to keep track of what was going on during the course.

The lectures were awesome, the best recorded lectures I have seen so far. Also, the exercise sessions were well organized and the zulip channel worked well.

Recorded lectures are amazing. Intors from Fabricio into business applications, commercial and free solvers and overall connection to life is essential. Overall was good to see Fabricio at the exercises. Availability of the information in form of a book, slides, and videos was very helpful. Working groups in zoom were cool in the beginning, especially with the support from the assistants, but died closer to the exam week. I was just doing the homework at the self-study points, which supported my learning though :D Pacing of the course was nice, 2 weeks for a HW is good. No exam is warming my heart. Olli's tips were often helpful.

I really liked the Zulip chat. It was a good platform for asking questions from the TAs. I think that Presemo question bank was also useful! I really liked the exercise sessions and the fact that the TAs would visit different breakout rooms and make sure that everything was going well. It made it easier to ask simple questions and to make sure that you had understood the exercise correctly. Especially Helmi was super nice and helpful!

The lectures were great since you could watch them at your own pace.

The long pdf on lecture notes was extensive and very good. I spent a lot of time on it and finding the definitions of terms I didn't know/remember was always easy, thx to ctrl+f. The lecture videos were also quite good, I watched all of them at least once and took notes based on what was written and said in the lecture slides. This helped me remember the important stuff later when starting with the exercises as I saw that I had taken notes on them. Zulip was good to get help and read what others have thought. I didn't really interact with the TAs during the course so I don't have anything specific to say about them. I would guess they did a good job :) Also for the arrangements of the course itself I like that there is no exam or other projects on top of the homework. At least these homeworks were challenging enough that I feel I learned enough and spent enough time on them and an exam would be a bit too much. This could be of course compensated with slightly lighter exercises and an exam would work but I liked this style better with no exam.

I think the methods are suitable for everybody.

The materials were well thought of and used to support self studying. Homework was often appropriately challenging and provided skeletons made it more understandable,

The lecture and the materials are excellent, nice presentation combined with attention to detail. There is also of course the classic "proof is trivial and left for exercise" =) The discussion of the basic "problem families" (knapsack, TSP, facility location...) was particularly useful and interesting material. I have not run into such material in other optimization books. Although I have build MILP models in my work, I have not put any thought to strengthening them with valid inequalities. Based on the TSP in HW6, learning some of these tricks seems useful. Benders decomposition was another highlight of the course, although I feel we just scratched the surface.

Video lectures and lecture notes where well implemented as most of homework exercises. Overall course was good and worth taking.

The atmosphere overall was nice even though everything was remotely. I liked the colourful lecture slides and the way the lecturer was able to teach concepts, and the home assignments were highly useful for forcing one to learn the subject. Furthermore, Presemo was a quite handy way for shy ones to get their voices heard.

The head TA was very supportive.

Clear exercises, question-and-answer sessions. Good, working examples in code. The use of Julia, which could be expanded to many other courses, at least to replace the antiquated use of MATLAB. The course assistant Helmi Hankimaa was very helpful, a big thank you to her.

That there were lecture slides and lecture notes available.

I liked the recirded lectures, they were very clear. Also homework assignment were good, they supported my understanding.

The lectures were excellent, as usual. The notes helped my studying a lot, and were a good way to recap the previous topics before the next lecture.

Fantastic course organization, staff, everything. Was busy with life and could not properly do the assignments but stuck till the end nevertheless. See you next year!

Homeworks, the concise but sufficiently self-sustained slides, the pre-recorded lectures.

7. What needed improvement on the course? Which factors complicated your learning?

Number of respondents: 61

Vastaukset
Personally I would prefer to just get started with the theory in the beginning of the course. If I recall correctly some problem formulations were showcased already the first week. (Which wasn't to bad since we weren't expected to know that much theory for them.)
I think video lectures are not for me. Slides and lecture notes are sometimes hard to read since indices are not everytime explained. If you search for some specific topic in the notes you have to scroll back everytime to find the reference for indices used. I cant point out directly a spot in the notes but I face this issue of material hard to understand after watching the video and forgetting the notation already every week
-
The online exercise sessions were rather unhelpful and lacked interaction. However, I am not sure how they could be improved as I think the reason behind is the sheer fact that they were online. In addition, I think they were very well organized. Personally, the course could've gone deeper to the theoretical aspects. This is not to say that the theoretical parts covered were not enough for the contents of the course. Perhaps, there could've just been a bit more on top. Overall, excellent course and these are just minor notes. Thank you!
Breakoutrooms didn't work.
Exercise session were quite boring. Maybe it is because thursdays were just packed with other activities and I was tired all the time so I do not know what/who to blame.
Some of the homework were quite too challenging
I think none. Actually, this course is a little difficult for me, but the teacher and TAs support me a lot to help me finish the course.
Having to learn Julia, I wish there was some "get familiar with Julia" notes or something like that. I spent a lot of time just debugging my code for "simple problems"
The assignments were quite tedious, but there was enough time to finish them. There is a lot of material in this course.
Some of the grading of mathematical proofs was variable; there were some instances where I felt I had justified my argument sufficiently but was not awarded full points. The actual teaching of the course was brilliant though!
It would be maybe valuable if like some of the zulip answers to homework questions would also be communicated through mycourses.
Related to exercises and Homework, I am not sure how easy it really is to implement UnitTests for the scripts. But now there were many instances in both exercises and homework where one little typo or copy-paste error could lead to a completely unreasonable model, which still passed all the tests easily. This complicated my learning especially in the middle of the course with much implementation going on, since I was sure I was doing something ok but it later turned out to be wrong, even though tests were ok.
I truly do not understand the motivation of requiring Zoom presence in the exercise sessions. With an overall busy schedule and a learning style that does not benefit from such Zoom sessions, I just could not justify spending a significant amount of time in the exercise sessions for little to no benefit, and it feels wrong that only because of this I am automatically getting a grade one less than those who attended. Attendance points to me indicate that the course does not trust students to spend time learning otherwise (which I can't imagine is the case on a master's level course), or just chooses to disrespect people who learn better studying by themselves. Additionally, I felt that the grading delay for assignments was significant; In fact, I happened to have handed in all six assignments before receiving feedback on the third one. Quicker feedback (like perhaps getting the grades from the previous assignment around the deadline of the next one) would make it easier to evaluate my own learning.
-
There were some errors in the slides so that complicated my learning (only a few times). After asking about the slides I got clarifications on the issues in the exercise sessions. I would imagine the slides get better every year.
The tests implemented in assignment notebooks mislead me multiple time by offering false positives. Those could be improved.
The only improvement that I would have liked to see and benefitted from is the publication time of the lectures. Now the lectures were published on Mondays at 10:00 AM. I think that Monday is optimal day for publishing these lectures, but those could have been published earlier in the morning. This is because I am a morning person, and I had lectures of other courses on Mondays 10:00 onwards, leaving the morning before 10 o'clock the most optimal time slot to watch the lectures of this course for me as I had no other tasks for that time slot. Then after Monday I had multiple submissions to be made during the week. I know this is quite minor complaint, but in a course this perfect, little things matter :-D
The information was divided into too many channels
-
Hope the principles of algorithms can be included more.
Sometimes demos were a little complicated to follow. And not a big thing but the slow grading means that the feedback from the assignments does not help for other assignments.
More practical examples could have been nice.
Exercise sessions were not ideal, but they could work better when there is no online-teaching.
I think the course material / homeworks dont need improvement, but for me the exercises on thursdays were a little strange, maybe because of the online format. I felt like it was hard to keep up with the demos sometimes. Moreover, I really didn't like the break out rooms.
I didn't like the theoretical parts that much as I know they don't help me much in my future line of work
There was no motivation to participate in the exercise sessions. Of course, we should bring that with us, but some external motivation could help.
I am a minor student and my background knowledge was restricted, to say the least. Therefore I would have appreciated more of very basic numerical examples of topics of the lectures. I also acknowledge that for more advanced major students, which I assume most of the course attendants to be, it probably would not have been so beneficial. Also, as a minor student, I think a more practical approach with practical real-life applications would have been more beneficial for me in terms of my future career (which is not going to have to do with the theoretical background).
All online teaching is worse than contact teaching. We need to start getting back to regular classes.
Because lectures were pre recorded, no possibility to ask questions but that were pretty well compensated by presemo
As a suggestion, I would consider shifting deadlines for homework to Tuesday, since quite often me and many of my friends started working on them during weekend, but it was more difficult to get help with the homeworks during the weekend, so there was only one day left for asking for help.
-

More example exercises

I wouldn't change anything.

I was not expecting such an exercise favored grading for the course. Once I missed the 2nd homework submission completely, it was demotivating to know that the maximum grade would be 3-4 at that point even if maximum points would be obtained from the other 5 out of 6 homeworks.

Let's be honest, even though I'm personally majoring in applied math, minoring in CS, some of the Homeworks were HARD. The second Homework was insanely hard considering the course had just begun. I mean, practically the second HW was about proving many of the things that were just given you in the technical notes. I actually managed to do this round well, but it required immense concentration and time investment + researching multiple sources outside the course material. I can't even imagine what it is like for less technical students. I'm not necessarily saying that the course should be made easier, but my honest assessment is that I spent around 100h with Homeworks 1-3 including learning about the topics (and got full, or close to full points). After Homework 4 I wasn't able to complete the Homeworks fully. I'm an example of a student that has had some pause (years between Bsc and Msc) and I don't unfortunately have many student friends currently. So I guess my main critique/feedback here is that going the hard way (alone), probably spending around 200h in this course, wasn't enough time investment to complete all the Homeworks (which was my goal, of course). This course might be way easier for students who just practically solve the problems together and share the results. I didn't do this with anyone. On the positive side, I guess I also learnt a lot in this course. Just to soften the message, overall this was one of the best courses in Aalto, super interesting stuff. There were just multiple frustrating moments being stuck in small weird places for hours and hours (including stuff like, Julia syntax, vector/matrix indexing etc.). And then when you're finally done, you start to put together the Latex document, which takes another 3-6h including written thoughts. So in summary, one of the best courses, but also too much time investment for 5 credits.

The zoom breakout group work was not that great. The idea behind it was good but the actual outcome was not as good as originally intended.

Might be due to my background but I found some of the proofs very hard to do. Often the problem is two fold: - where to begin - how to know that the proof is solid

In many homework assignments, the LP problem formulation were often given as a priori. I think that it would've been good practice to, time to time, let the students themselves to formulate the problem. However, I guess that this approach would significantly increase the need of course assistants to check the students derivations, and therefore I'm not sure if this is practically possible with current staff capacity. Secondly, I would have hoped to have more homework assignments about duality theory and dual formulations, since for me it was maybe the most challenging topic in the course.

As an engineer who has forgotten most of linear algebra I would've required a bit more "this is what this really means" kind of material, but I understand the mathematically more literate operations research student might have found this boring. Especially from lecture 4 onwards I felt most of the time that things were just a bit too abstract to comprehend. Alternatively, I just should've started with Introduction to Optimization or some other similar course, so this is more a fault of the student than the course.

I wish we would finish the discussion earlier.

Motivation to do the class exercises would have been higher in present teaching

Mandatory exercise sessions did not suit my style of learning.

On-site teaching would definitely make the course worse for students even though organising remote teaching might be harder for the course staff, I really think it's worth it for the students' learning outcomes.

If the course is taught in live next year, it would be good to ensure that the demos work as well as they worked in the remote mode. Other than that, no complaints/concerns.

An assistant could not always really help with the questions related to the exercises - they checked the model solutions and they tried then to understand how it actually was supposed to work but seldom we went further.

There was very little time to do the exercises during the exercise sessions and I don't think I ever finished them before the model solution was shown. And when the homework deadline was close, I always focused on the homework during the exercise sessions and didn't really concentrate on the actual topics.

Working through Zoom is not my desired way of working, however I understand that there was nothing the course organizers could do about it.

As I'm writing this, it would have been nice to receive the grades for the previous two homeworks so I would know how much I need to focus on the 6th. This isn't to say I'm lazy, I just have other work and exams as well so need to prioritise. Especially round 4 has taken almost a month now, round 5 is fine as not 2 weeks has passed. I totally understand that grading takes time, especially for round 2 as one TA said that they basically had to go through 600 different proofs and this courses points relies on the homework so I think extra attention is spent on the grading. I have been a TA myself a lot so it's understandable and alright. I kinda want to criticise myself for being a bit behind the schedule I would have liked. But in the end I have always had good points from the exercises even though the last day or two might have been a bit hectic.

I think this course will benefit from live sessions :)

It was a shame we couldn't have any exercise sessions live, but what can you do during a pandemic $\sqrt{(\cup)}$? I don't know if I'm bad at reading math or is the way mathematics is written a bit too complicated. I guess there has gone a bit too long a time since my maths studies (especially matrices-course), so it took a while for me to understand A, b, x and such. Maybe there could be an even smaller document, which would have small numerical examples of different theorems and such, which would make them even more understandable. I don't like to see only letters when presenting a theorem or such.

Homeworks are a bit imbalanced. In particular, round two was much more difficult than the others. Homework and exercises are not quite at the same level of quality as the lectures. For instance, equations are sometimes "floating around", not formatted as part of sentences. Also, completing homework should not rely on hints that much. The course could focus more on integer optimization, since most problems of practical interest are MIPs.

Exercise sessions were not working as intended, I found following fast paced demonstrations very cumbersome and tiring, and I would rather be in classroom teaching, or at least teaching with more discussion approach. Also quality of Jupyter notebooks and homework was varying. For example in homework three, we were required to give numeric examples in our code, which is something that is never done in practice. I would have rather implemented them as tests using Julia's inbuilt testing library.

The Zoom sessions, or particularly the breakout rooms, were fairly useless since practically no one had the courage to say anything. But this could be helped by simply moving back to contact teaching: then it is more natural to ask something from a student sitting right beside oneself. Besides, there could have been more encouragement to ask questions in Finnish (they could be answered in English if need be) since for shy students it might be hard to express themselves in a foreign language if they are Finnish and have lived in Finland all their lives, thus having no international background.

Some examples in the lecture notes should have been more elaborated. Also, homework skeletons could have been uploaded without mistakes in the first place.

Some concepts, especially how to exactly construct a dual for any model from first principles was inferred in the material, but was not clear. Dantzig-Wolfe and Benders decompositions remained opaque--maybe the theory behind it is too complicated to be included in this course, but it would've clarified this a lot.

It was really difficult to ask questions and get answers. The fact that we don't have help to use Julia for the homework complicated my learning. The exercise sessions were totally useless and it was a waste of time to ask everyone to stay two hours on zoom.

I didn't like the breakout rooms system in exercise sessions. I was feeling pressured and a little bit uncomfortable to discuss exercises. Personally I like to solve something in peace, and discuss afterwards. But later the system changed and it became better, thank you!

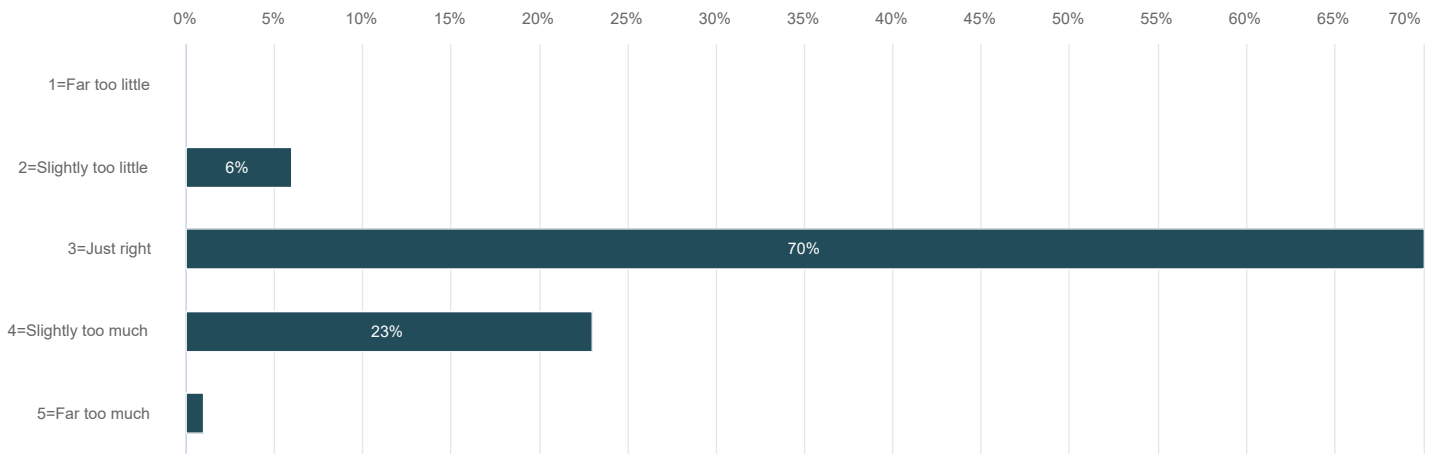
The home assignment solutions could've been gone through in the exercise sessions.

Cannot think of any. Next year this and the nonlinear version will probably be at the campus - I do hope that there is a possibility to also do them remotely. At the very least, please provide the fantastic video lectures in the future as well!

It was somehow in a hurry to follow exercise sessions every time.

8. The course presented theoretical background

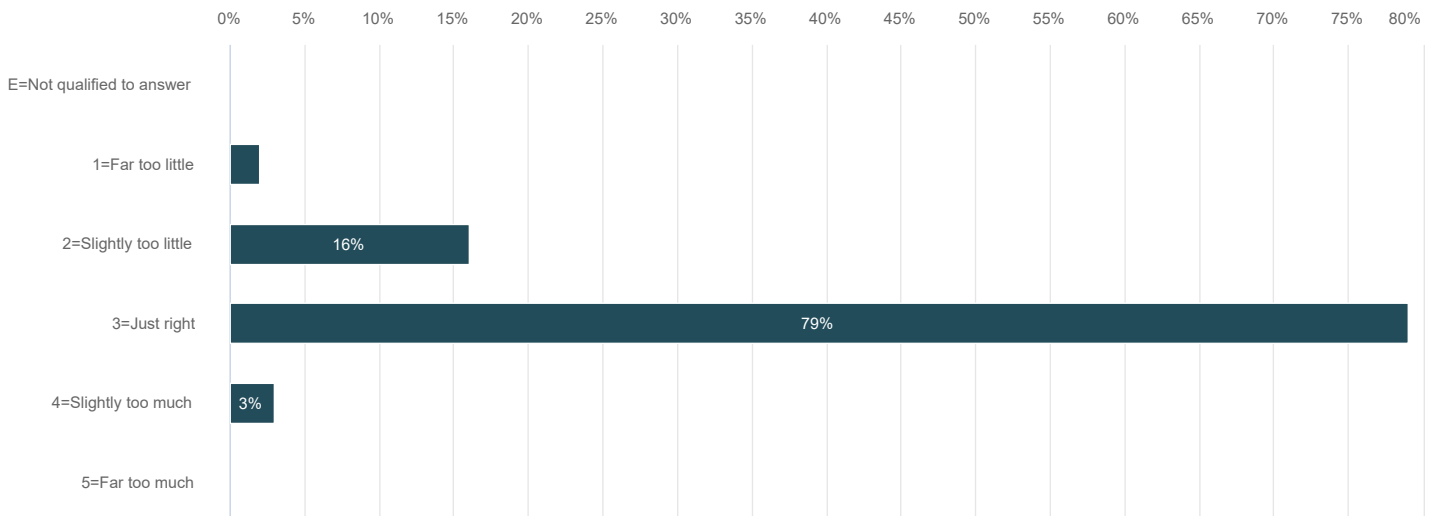
Number of respondents: 91



	n	Prosentti
1=Far too little	0	0,0%
2=Slightly too little	5	5,5%
3=Just right	64	70,3%
4=Slightly too much	21	23,1%
5=Far too much	1	1,1%

9. The course presented application possibilities

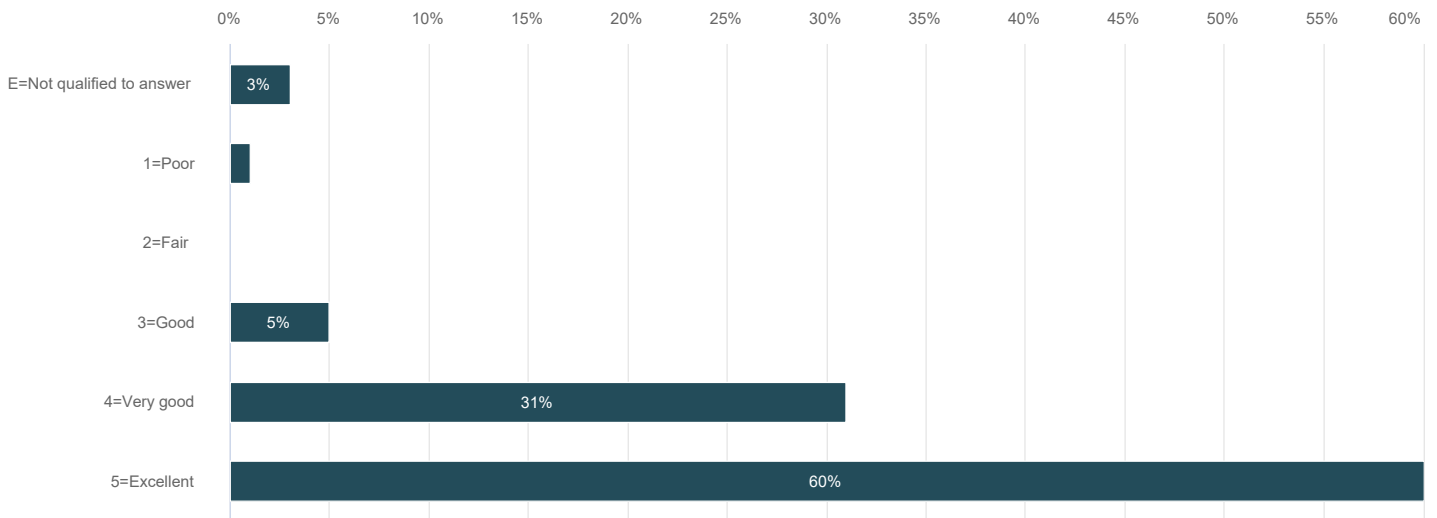
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E=Not qualified to answer	0	0,0%
1=Far too little	2	2,2%
2=Slightly too little	14	15,4%
3=Just right	72	79,1%
4=Slightly too much	3	3,3%
5=Far too much	0	0,0%

10. How well did the lecturer do?

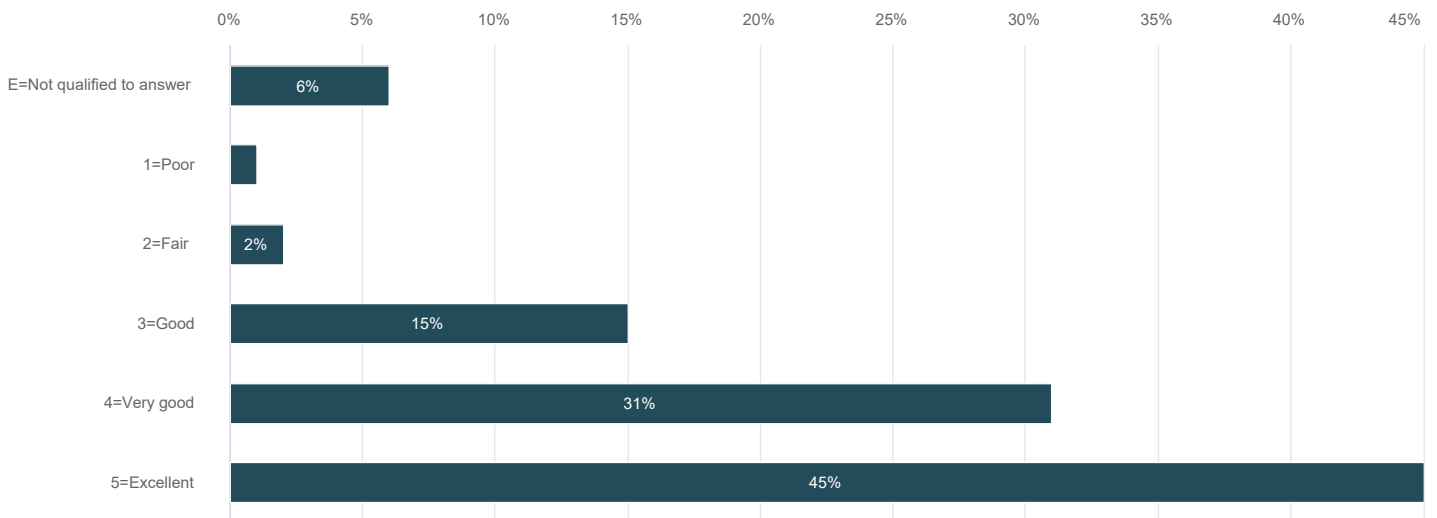
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1=Poor	1	1,1%
2=Fair	0	0,0%
3=Good	4	4,5%
4=Very good	28	31,1%
5=Excellent	54	60,0%

11. How well did the course assistants do?

Number of respondents: 91



	n	Prosentti
E=Not qualified to answer	5	5,5%
1=Poor	1	1,1%
2=Fair	2	2,2%
3=Good	14	15,4%
4=Very good	28	30,8%
5=Excellent	41	45,0%