LUND UNIVERSITY
Faculty of Science

Centre for Mathematical Sciences
Division of Mathematics and Numerical Analysis

Course Analysis for BERN01 Modelling in Computational Science, Autumn 2023

Course Information

Lecturer: Philipp Birken, Anders Irbäck, Jan Forsman, Linda HartmanVictor Olariu, Wenxin Zhang
Teaching assistants: Niloofar Momemi
Number of students:
20 newly registered and 0 re-registered.
8 students answered the course evaluation.

Examination

Project: 18 students passed.
Oral presentation: 17 students passed.

Final grades:
In all, 17 students, including 0 re-registered students, have got their final grade.
8 passed with distinction.
9 passed.

Course Evaluation

Summary of student's answers:
The students were overall satisfied, and the course seems to have worked as intended. The answers also show that some aspects in the course should be improved and that the project were not of the same difficulty level.
They students gave a large amount of freetext answers that gave a lot of constructive criticism and that will be helpful in improving the course for the next round.

Teachers' comments:
This was the first time this course was given. The teaching consisted of a few lecture per project and an introductory lecture, as well as a few exercise sessions. Three compulsory projects carried out in small groups are included in the course. These are then presented to the whole group.

Changes from the previous course realisation:
This was the first time the course was given.

Suggestions for the next course realisation:
For the next course realisation, we will adjust the projects.
-The coding in project 1 will be made easier by giving more instructions, and adjusting the computational cost of the experiments
-Project 2 was considered easier than the others and will be made more difficult, for example by replacing the SIR model with a more complex one
-The coding in project 3 will be made easier by simplifying the data handling
We will discuss switching the order of projects 3 and 2.

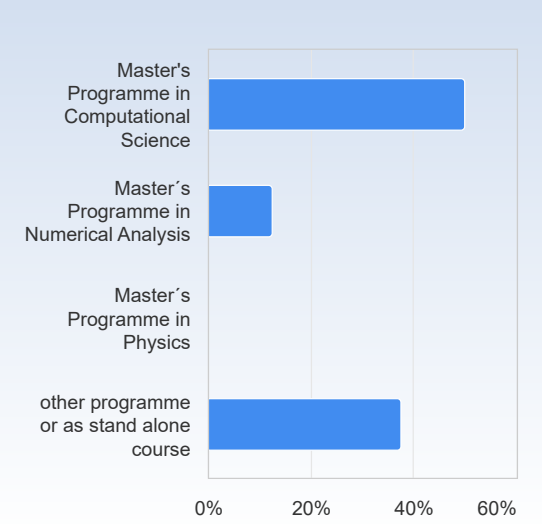
We will communicate the format for the projects more clearly and emphasize that all students have to participate in the presentation.
We will aim to organize things to allow students to start working on the project as soon as possible, in particular in project 3.

BERN01 Modelling in Computational Science HT23

Answer Count: 8

I have studied this course as part of

I have studied this course as part of	Number of responses
Master's Programme in Computational Science	4 (50,0%)
Master´s Programme in Numerical Analysis	1 (12,5%)
Master´s Programme in Physics	0 (0,0%)
other programme or as stand alone course	3 (37,5%)
Total	8 (100,0%)

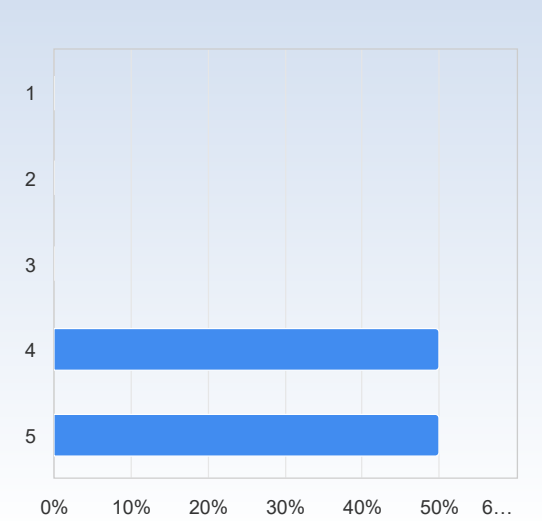


	Mean	Standard Deviation
I have studied this course as part of	5,6	2,0

On the scale 1-5 select the option that best matches your opinion: 1= disagree completely → 3= partly agree → 5= agree completely

2. My prior knowledge has been sufficient to assimilate the contents of this course.

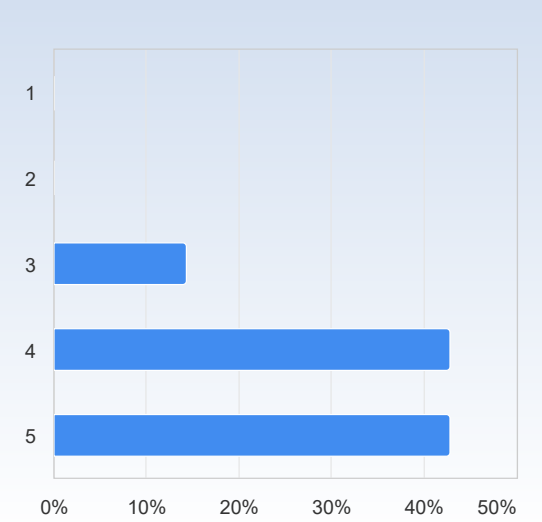
2. My prior knowledge has been sufficient to assimilate the contents of this course.	Number of responses
1	0 (0,0%)
2	0 (0,0%)
3	0 (0,0%)
4	4 (50,0%)
5	4 (50,0%)
Total	8 (100,0%)



	Mean	Standard Deviation
2.My prior knowledge has been sufficient to assimilate the contents of this course.	4,5	0,5

3.I have participated actively in the course.

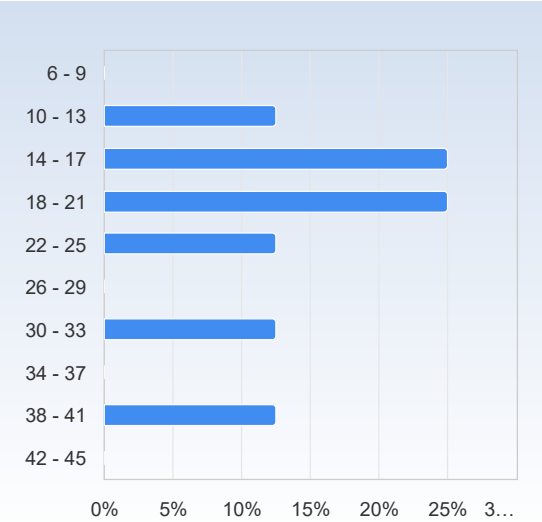
3.I have participated actively in the course.	Number of responses
1	0 (0,0%)
2	0 (0,0%)
3	1 (14,3%)
4	3 (42,9%)
5	3 (42,9%)
Total	7 (100,0%)



	Mean	Standard Deviation
3.I have participated actively in the course.	4,3	0,8

Average number of hours spent in total on the course per week (including scheduled activities):

Average number of hours spent in total on the course per week (including scheduled activities):	Number of responses
6 - 9	0 (0,0%)
10 - 13	1 (12,5%)
14 - 17	2 (25,0%)
18 - 21	2 (25,0%)
22 - 25	1 (12,5%)
26 - 29	0 (0,0%)
30 - 33	1 (12,5%)
34 - 37	0 (0,0%)
38 - 41	1 (12,5%)
42 - 45	0 (0,0%)
Total	8 (100,0%)

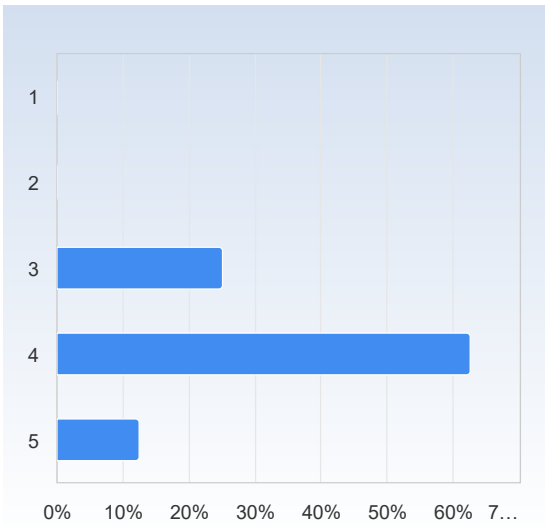


	Mean	Standard Deviation
Average number of hours spent in total on the course per week (including scheduled activities):	22,1	9,4

The course in general
On the scale 1-5 select the option that best matches your opinion:1= disagree completely → 3= partly agree → 5= agree completely

The way the course was taught and organised suited me.

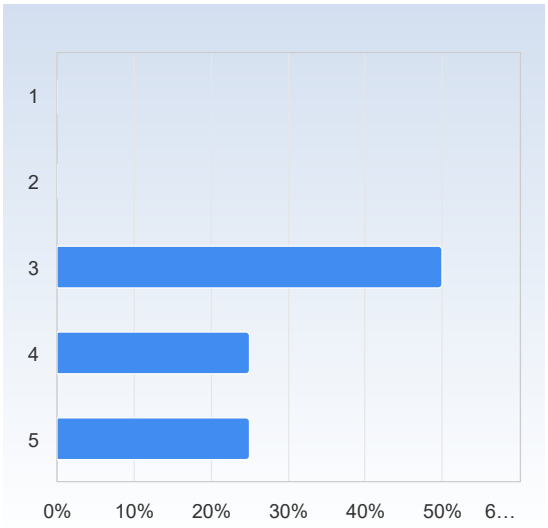
The way the course was taught and organised suited me.	Number of responses
1	0 (0,0%)
2	0 (0,0%)
3	2 (25,0%)
4	5 (62,5%)
5	1 (12,5%)
Total	8 (100,0%)



	Mean	Standard Deviation
The way the course was taught and organised suited me.	3,9	0,6

The number of teacher lead activities (lectures, seminars etc.) has been satisfactory.

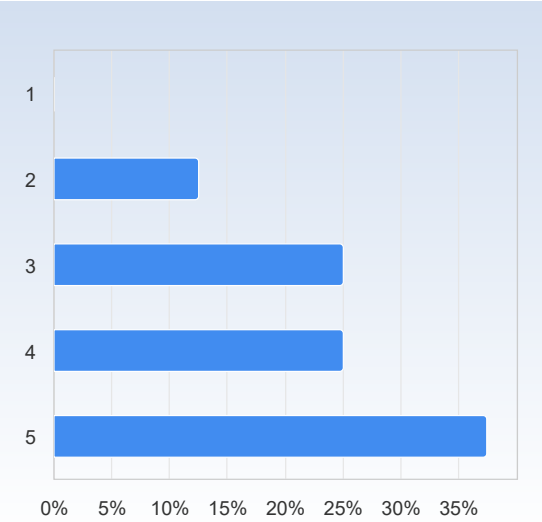
The number of teacher lead activities (lectures, seminars etc.) has been satisfactory.	Number of responses
1	0 (0,0%)
2	0 (0,0%)
3	4 (50,0%)
4	2 (25,0%)
5	2 (25,0%)
Total	8 (100,0%)



	Mean	Standard Deviation
The number of teacher lead activities (lectures, seminars etc.) has been satisfactory.	3,8	0,9

My own project presentations were valuable for my learning.

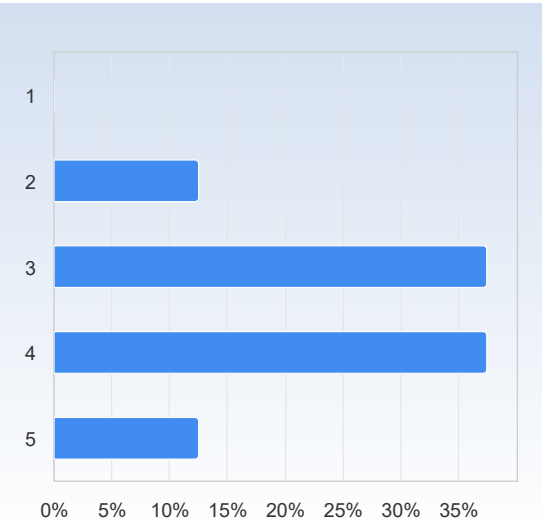
My own project presentations were valuable for my learning.	Number of responses
1	0 (0,0%)
2	1 (12,5%)
3	2 (25,0%)
4	2 (25,0%)
5	3 (37,5%)
Total	8 (100,0%)



	Mean	Standard Deviation
My own project presentations were valuable for my learning.	3,9	1,1

The presentation sessions were valuable for my learning.

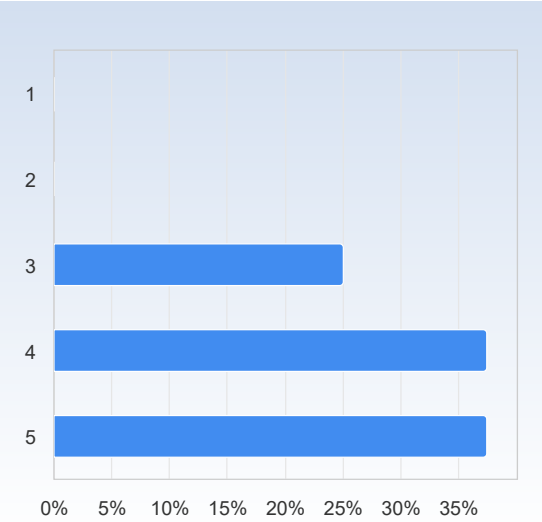
The presentation sessions were valuable for my learning.	Number of responses
1	0 (0,0%)
2	1 (12,5%)
3	3 (37,5%)
4	3 (37,5%)
5	1 (12,5%)
Total	8 (100,0%)



	Mean	Standard Deviation
The presentation sessions were valuable for my learning.	3,5	0,9

Studying on my own was valuable for my learning.

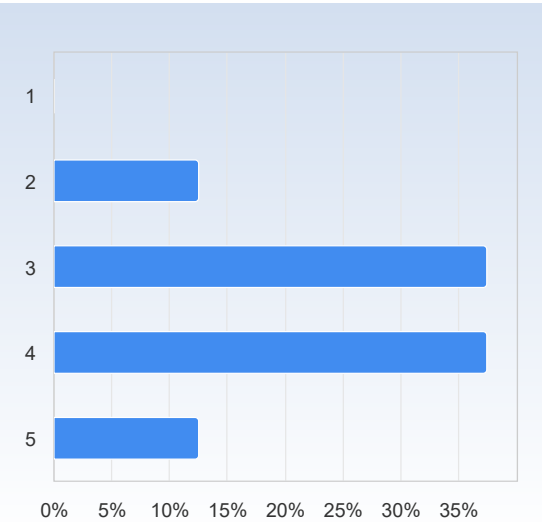
Studying on my own was valuable for my learning.	Number of responses
1	0 (0,0%)
2	0 (0,0%)
3	2 (25,0%)
4	3 (37,5%)
5	3 (37,5%)
Total	8 (100,0%)



	Mean	Standard Deviation
Studying on my own was valuable for my learning.	4,1	0,8

The course literature/material was a valuable learning resource.

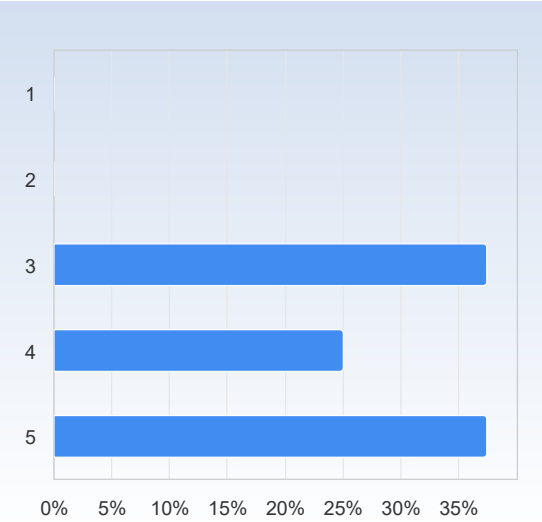
The course literature/material was a valuable learning resource.	Number of responses
1	0 (0,0%)
2	1 (12,5%)
3	3 (37,5%)
4	3 (37,5%)
5	1 (12,5%)
Total	8 (100,0%)



	Mean	Standard Deviation
The course literature/material was a valuable learning resource.	3,5	0,9

The information I received before the course start was satisfactory.

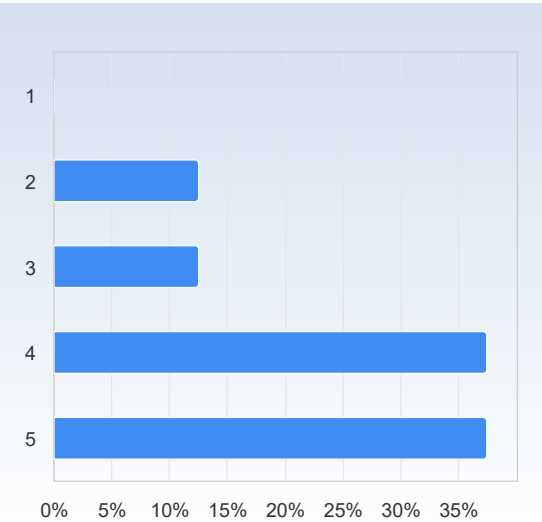
The information I received before the course start was satisfactory.	Number of responses
1	0 (0,0%)
2	0 (0,0%)
3	3 (37,5%)
4	2 (25,0%)
5	3 (37,5%)
Total	8 (100,0%)



	Mean	Standard Deviation
The information I received before the course start was satisfactory.	4,0	0,9

The communication with the teaching staff during the course was good.

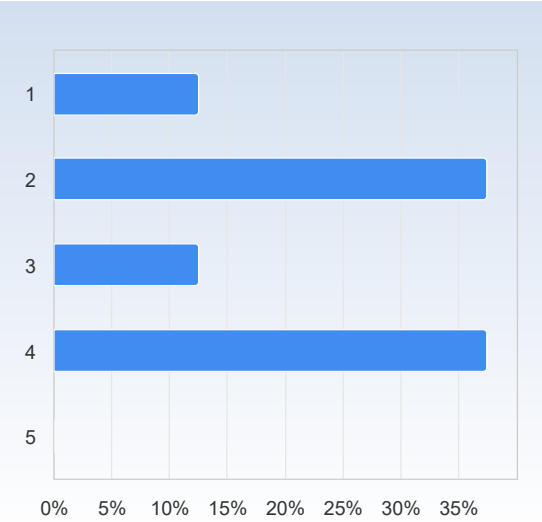
The communication with the teaching staff during the course was good.	Number of responses
1	0 (0,0%)
2	1 (12,5%)
3	1 (12,5%)
4	3 (37,5%)
5	3 (37,5%)
Total	8 (100,0%)



	Mean	Standard Deviation
The communication with the teaching staff during the course was good.	4,0	1,1

It was clear throughout the course what was expected of me.

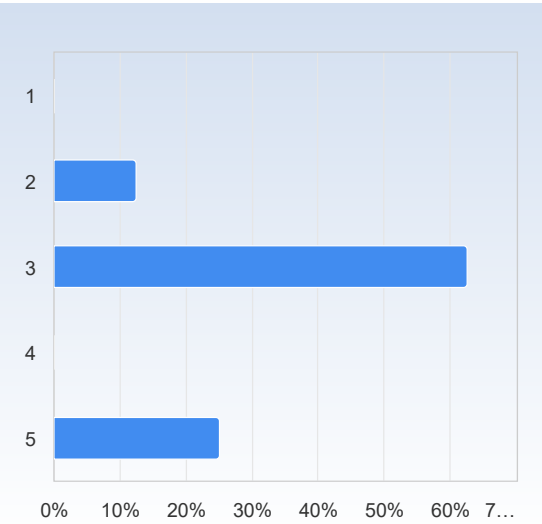
It was clear throughout the course what was expected of me.	Number of responses
1	1 (12,5%)
2	3 (37,5%)
3	1 (12,5%)
4	3 (37,5%)
5	0 (0,0%)
Total	8 (100,0%)



	Mean	Standard Deviation
It was clear throughout the course what was expected of me.	2,8	1,2

I have received valuable feedback from my teacher/teachers during the course.

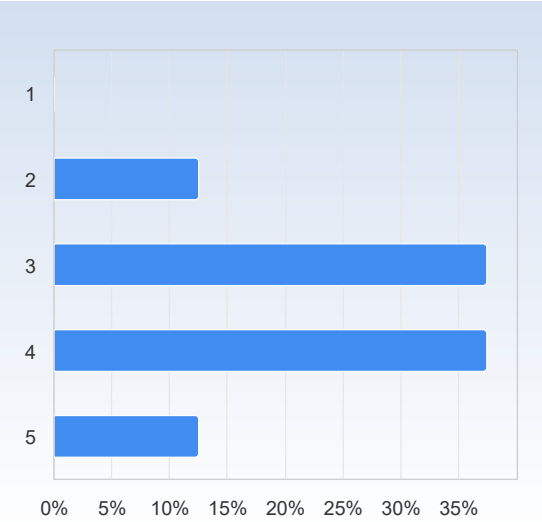
I have received valuable feedback from my teacher /teachers during the course.	Number of responses
1	0 (0,0%)
2	1 (12,5%)
3	5 (62,5%)
4	0 (0,0%)
5	2 (25,0%)
Total	8 (100,0%)



	Mean	Standard Deviation
I have received valuable feedback from my teacher/teachers during the course.	3,4	1,1

The course had a reasonable workload.

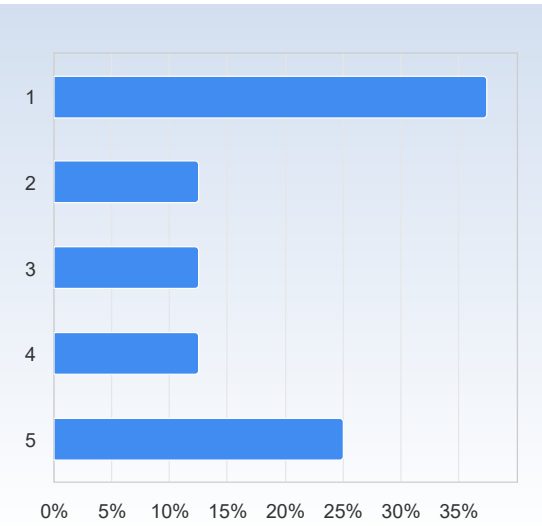
The course had a reasonable workload.	Number of responses
1	0 (0,0%)
2	1 (12,5%)
3	3 (37,5%)
4	3 (37,5%)
5	1 (12,5%)
Total	8 (100,0%)



	Mean	Standard Deviation
The course had a reasonable workload.	3,5	0,9

The workload was evenly distributed throughout the course.

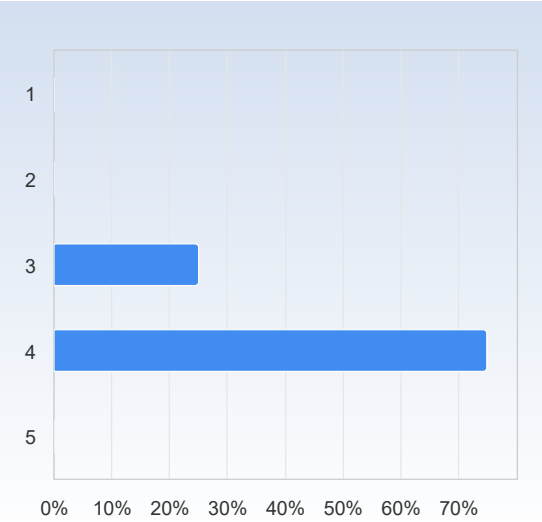
The workload was evenly distributed throughout the course.	Number of responses
1	3 (37,5%)
2	1 (12,5%)
3	1 (12,5%)
4	1 (12,5%)
5	2 (25,0%)
Total	8 (100,0%)



	Mean	Standard Deviation
The workload was evenly distributed throughout the course.	2,8	1,8

The examination matched the contents and level of the course.

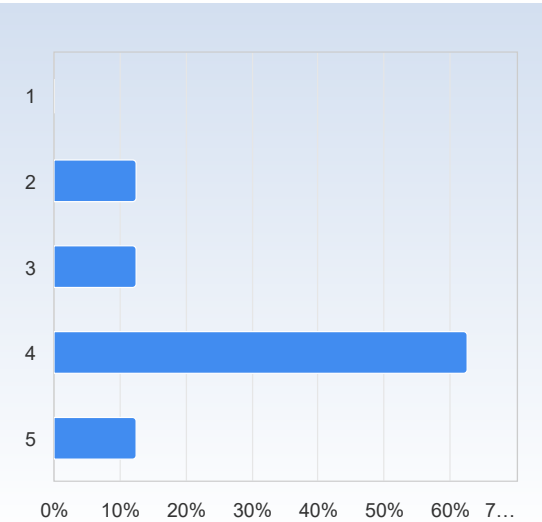
The examination matched the contents and level of the course.	Number of responses
1	0 (0,0%)
2	0 (0,0%)
3	2 (25,0%)
4	6 (75,0%)
5	0 (0,0%)
Total	8 (100,0%)



	Mean	Standard Deviation
The examination matched the contents and level of the course.	3,8	0,5

Overall, I am satisfied with the course.

Overall, I am satisfied with the course.	Number of responses
1	0 (0,0%)
2	1 (12,5%)
3	1 (12,5%)
4	5 (62,5%)
5	1 (12,5%)
Total	8 (100,0%)



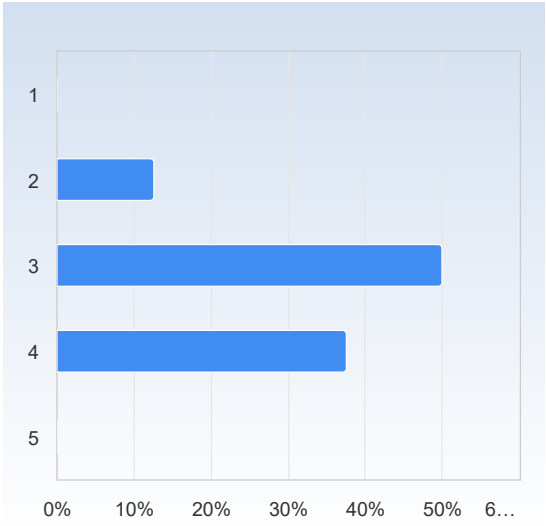
	Mean	Standard Deviation
Overall, I am satisfied with the course.	3,8	0,9

On the development of generic skills

On a scale 1-5 select the option that best matches your opinion: 1= disagree completely → 3= partly agree → 5= agree completely

The course has increased my ability to read a text in computational science.

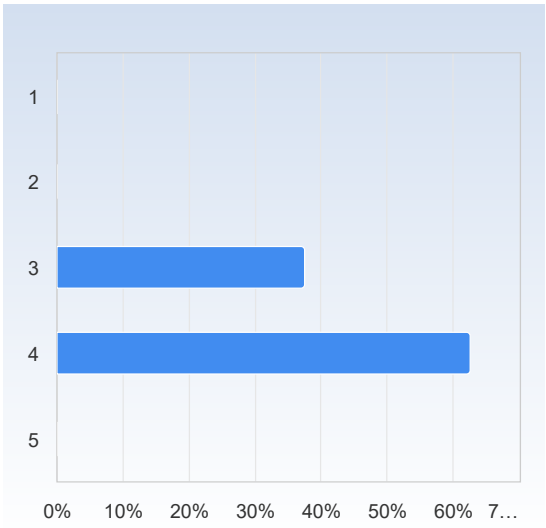
The course has increased my ability to read a text in computational science.	Number of responses
1	0 (0,0%)
2	1 (12,5%)
3	4 (50,0%)
4	3 (37,5%)
5	0 (0,0%)
Total	8 (100,0%)



	Mean	Standard Deviation
The course has increased my ability to read a text in computational science.	3,2	0,7

The course has increased my ability to communicate the subject in writing.

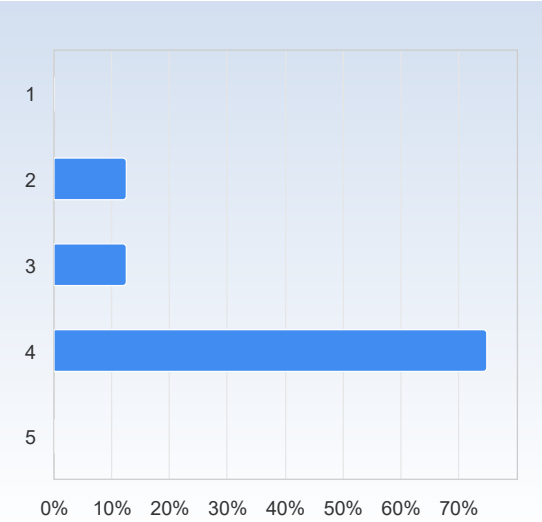
The course has increased my ability to communicate the subject in writing.	Number of responses
1	0 (0,0%)
2	0 (0,0%)
3	3 (37,5%)
4	5 (62,5%)
5	0 (0,0%)
Total	8 (100,0%)



	Mean	Standard Deviation
The course has increased my ability to communicate the subject in writing.	3,6	0,5

The course has increased my ability to communicate the subject orally.

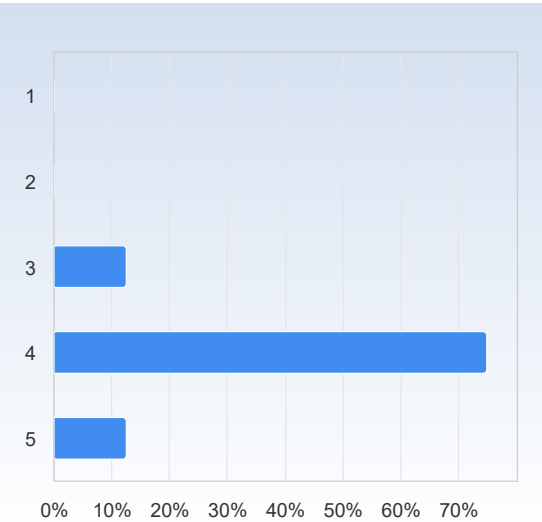
The course has increased my ability to communicate the subject orally.	Number of responses
1	0 (0,0%)
2	1 (12,5%)
3	1 (12,5%)
4	6 (75,0%)
5	0 (0,0%)
Total	8 (100,0%)



	Mean	Standard Deviation
The course has increased my ability to communicate the subject orally.	3,6	0,7

The course has increased my ability to collaborate.

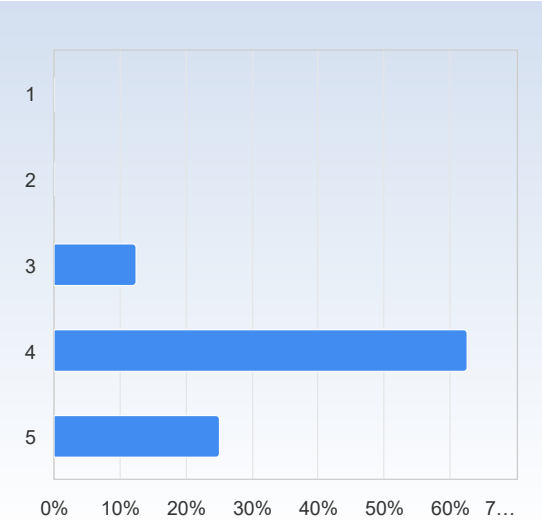
The course has increased my ability to collaborate.	Number of responses
1	0 (0,0%)
2	0 (0,0%)
3	1 (12,5%)
4	6 (75,0%)
5	1 (12,5%)
Total	8 (100,0%)



	Mean	Standard Deviation
The course has increased my ability to collaborate.	4,0	0,5

The course has increased my ability to search and process information.

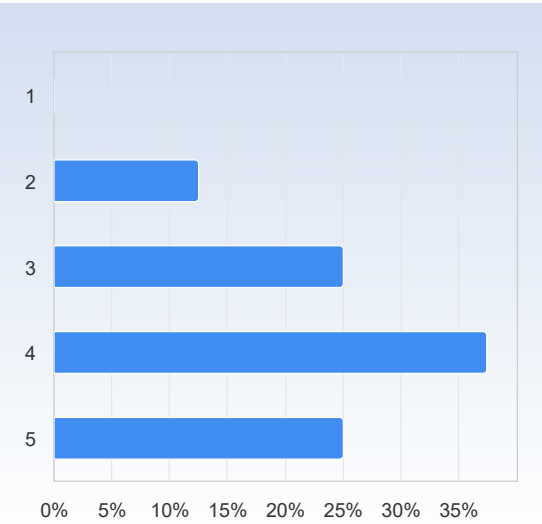
The course has increased my ability to search and process information.	Number of responses
1	0 (0,0%)
2	0 (0,0%)
3	1 (12,5%)
4	5 (62,5%)
5	2 (25,0%)
Total	8 (100,0%)



	Mean	Standard Deviation
The course has increased my ability to search and process information.	4,1	0,6

The course has increased my ability to analyze and solve problems.

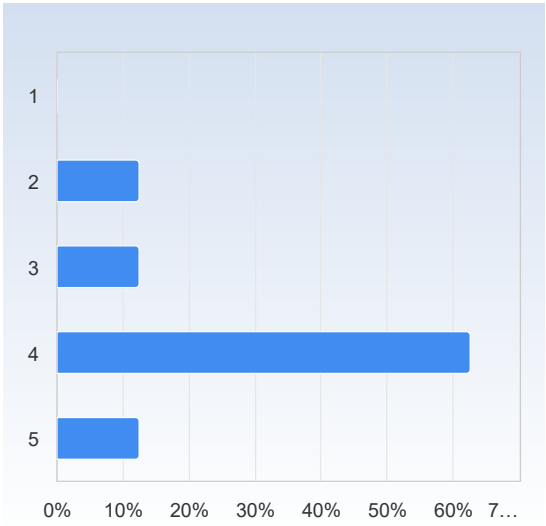
The course has increased my ability to analyze and solve problems.	Number of responses
1	0 (0,0%)
2	1 (12,5%)
3	2 (25,0%)
4	3 (37,5%)
5	2 (25,0%)
Total	8 (100,0%)



	Mean	Standard Deviation
The course has increased my ability to analyze and solve problems.	3,8	1,0

As a result of this course, I feel confident about tackling unfamiliar problems.

As a result of this course, I feel confident about tackling unfamiliar problems.	Number of responses
1	0 (0,0%)
2	1 (12,5%)
3	1 (12,5%)
4	5 (62,5%)
5	1 (12,5%)
Total	8 (100,0%)



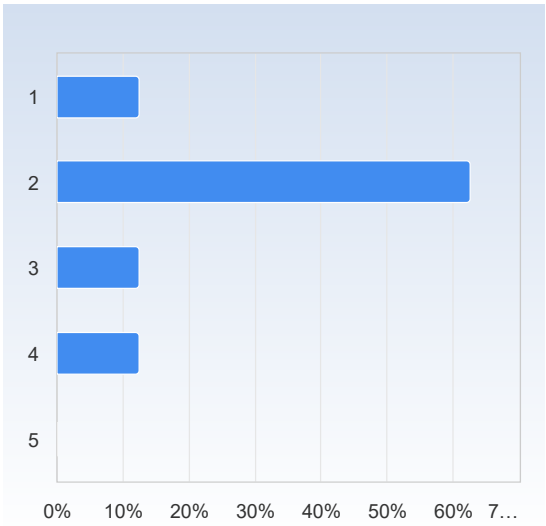
	Mean	Standard Deviation
As a result of this course, I feel confident about tackling unfamiliar problems.	3,8	0,9

Difficulty of Projects

On a scale 1-5 select the option that best matches your opinion: 1= very difficult → 3= just right → 5= very easy

Coding in project 1

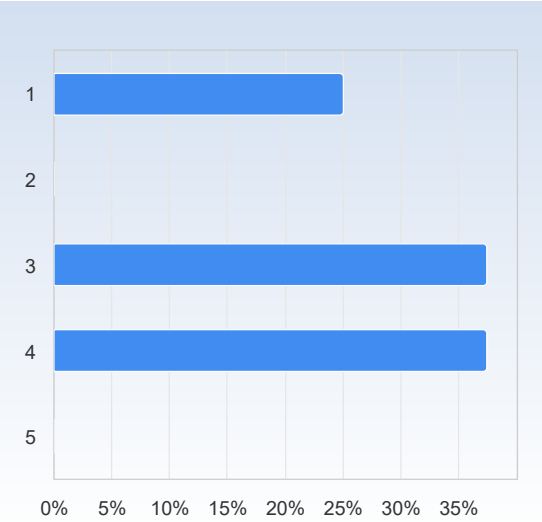
Coding in project 1	Number of responses
1	1 (12,5%)
2	5 (62,5%)
3	1 (12,5%)
4	1 (12,5%)
5	0 (0,0%)
Total	8 (100,0%)



	Mean	Standard Deviation
Coding in project 1	2,2	0,9

Understanding the science background in project 1

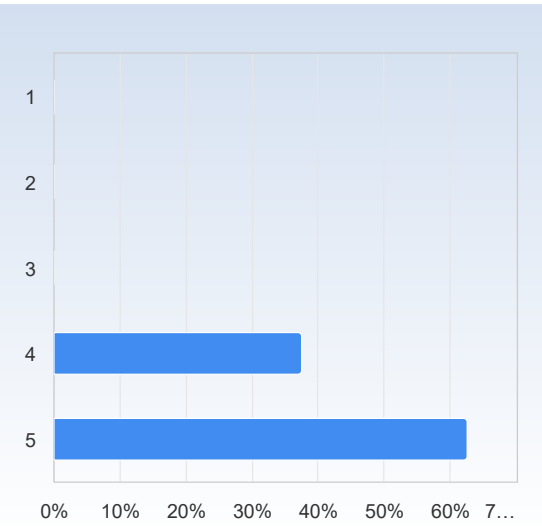
Understanding the science background in project 1	Number of responses
1	2 (25,0%)
2	0 (0,0%)
3	3 (37,5%)
4	3 (37,5%)
5	0 (0,0%)
Total	8 (100,0%)



	Mean	Standard Deviation
Understanding the science background in project 1	2,9	1,2

Coding in project 3

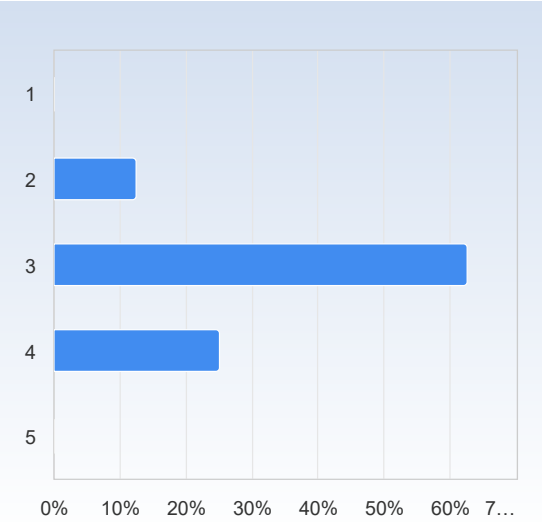
Coding in project 3	Number of responses
1	0 (0,0%)
2	0 (0,0%)
3	0 (0,0%)
4	3 (37,5%)
5	5 (62,5%)
Total	8 (100,0%)



	Mean	Standard Deviation
Coding in project 3	4,6	0,5

Understanding the science background in project 2

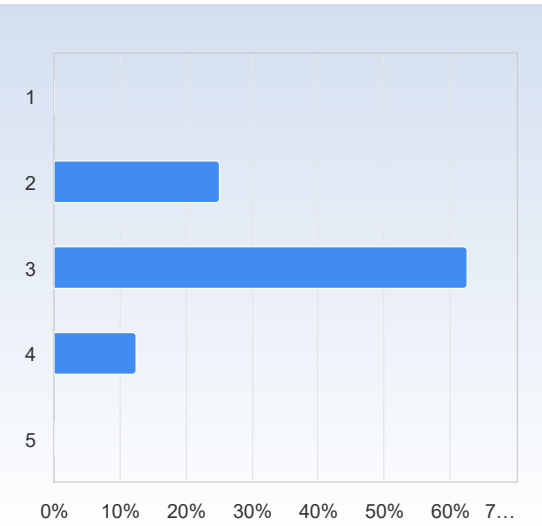
Understanding the science background in project 2	Number of responses
1	0 (0,0%)
2	1 (12,5%)
3	5 (62,5%)
4	2 (25,0%)
5	0 (0,0%)
Total	8 (100,0%)



	Mean	Standard Deviation
Understanding the science background in project 2	3,1	0,6

Coding in project 3

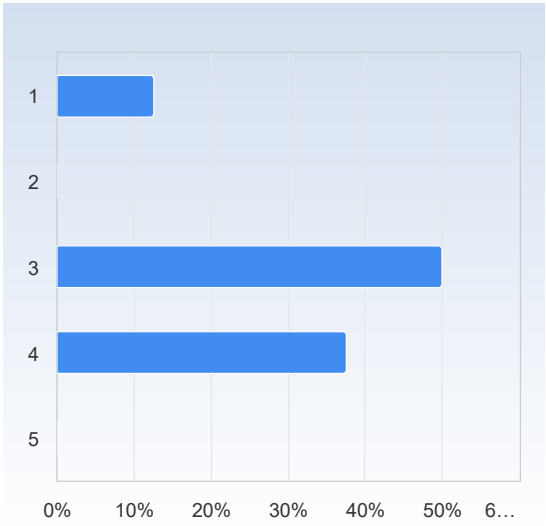
Coding in project 3	Number of responses
1	0 (0,0%)
2	2 (25,0%)
3	5 (62,5%)
4	1 (12,5%)
5	0 (0,0%)
Total	8 (100,0%)



	Mean	Standard Deviation
Coding in project 3	2,9	0,6

Understanding the science background in project 3

Understanding the science background in project 3	Number of responses
1	1 (12,5%)
2	0 (0,0%)
3	4 (50,0%)
4	3 (37,5%)
5	0 (0,0%)
Total	8 (100,0%)



	Mean	Standard Deviation
Understanding the science background in project 3	3,1	1,0

Do you have specific feedback on project 1?

Do you have specific feedback on project 1?
(my group was on the Lennard-Jones project) Project 1 was an interesting one. Spinning up the simulation was quite okay but running time was a huge issue at first, because of python idiosyncrasies. While this course is technically language agnostic, we as student are proficients mostly with python and this is the programming language that we will use as a group because of that. For this reason, I suggest having a PDF on how to make python code run fast, and why it is that way. The Numba tool was unknown to me and would have been a great help for this project. Otherwise, I feel like the project was quite clear. I have not taken the computational physic course and from my understanding one of the project is the same as in this course. While this did not affect me, it is understandable that some may be disappointed in seeing a project that they have already done. Thanks to Jan for his availability outside of lectures and the help we received.
We have discussed this already but som aspects of the project were too computationally expensive to run a desired number of iterations
In project 1 we chose the lennard-jones project. Overall the project was fun and i personally learned a lot both from the science and the computational modelling part of the project. There was however sometimes a bit of confusion how to interpret the results from our simulations such as knowing when an equilibrium is reached and when to measure averages etc. Adding to this the simulations ran very slow on python, especially before we learned to replace the for-loop iteration to calculate distances with a numpy matrix method. This led to a lot of waiting around when working with the project. There where also no scheduled exercise/teaching hours for working on the project which i think would've helped a lot!
The two projects to choose from were not balanced properly. If you got the Potts spin model you had a manageable project, but if you had Lennard-Jones you would struggle. We had Lennard-Jones and actually had to spent quite some extra time with Jan just to produce decent results. The instructions were also not very clear at all. There were some typos and the questions were posed in a confusing way, so that didn't help at all either.
My group worked on the chemistry project. Our main problem with the task was to figure out what we had to do exactly. The professor was very helpful when we came to him with questions.
Recommendations about how to tackle problems according to the time the algorithm takes would have been helpful since this was the major problem during coding. Besides this interesting project, especially if you have seen the models in theory before.

Do you have specific feedback on project 2?

Do you have specific feedback on project 2?
(My group was on the cell reprogramming project). It felt a bit rushed. While the subject matter is fascinating, this was for me the hardest project to grasp without prior knowledge. This lead to some some strangeness as the project could essentially be done by writing the given differential equation on python and asking a built-in solver to solve it, all without really understanding why this equation exists in the first place. I only understood what was happening when writing the report, because I had to google a lot of information. An additional lecture on the subject matter would have been welcome, but this would aggravate the unbalance between each project theory. Speaking of the other project, the same issue arise in that disease modelling was a project already done by a lot of people. And frankly, SIR is a bit boring. There was also the matter of the reference paper that was given having some strange mistakes, which lead us to believe there was something wrong with our program.
I think the numerical approximations were almost too easy (disease spread). If the focus was equally on the coding and the subject, disease spreading, I think it was balanced. But I think you could make disease spreading a little harder. maybe introduce larger models or specific (harder) tasks to solve?
This was the least extensive project. The paper on which the cell reprogramming project is based was a little flawed.
In project 2 we chose the disease spreading project. This project i feel was a bit to easy both coding and science wise. I think we finished the code in around 2-3 hours and the rest of the time was just spent tuning parameters and finding sources to compare our results to. The base of the project(solving ODEs) is however important, and i learned a lot from the lectures surrounding this project, i just felt that the project itself should have gone a little bit deeper or maybe concerned a different subject(A lot students have done similar disease spreading simulations in analysis courses).
In this project the coding was really easy so we finished that very fast. But we were happy to have the extra time for the writing. Since we spend less time on this project it did balance out the extra time spend on the first project, however it would have been nicer to have it more balanced.
The coding part of this project was way to easy.

Do you have specific feedback on project 3?

Do you have specific feedback on project 3?
This project piqued my interest in climate modeling. It was great to use RF as it was a tool I was aware of but did not get to use yet. One feedback I would have is that I feel that the amount of different instructions that the project had can be overwhelming. The data was also presented in a very confusing way, as we get a pile of files, only to use one that is ready made and does not need any major cleaning. This makes me feel that the file is actually a composite of different files, and the issue that we have is that we don't know which data is from the DVGM and which is observational data. What I would suggest is to start with the different files and observational data and that we'd clean and prepare the data ourselves, either through instructions(which could take a lot of time) or by running a pre-made script similar to the demo file. The benefits I see are twofolds: - We get a view of how the data is acquired and what variable comes from what. - We get to do a bigger part of the data science workflow of data preparation -> modeling -> evaluation -> communication. Otherwise, the question about comparing LPJ-guess output and biome_obs was super confusing, and still is to me. I understand conceptually that the goal is to see if we can replace process based model by ML ones, but I'm still confused by all of this. This may admittedly come from a lack of subject knowledge.
The project was fun, but next time it would be nice with clearer descriptions of the tasks/project. I also think it would be fun to be able to choose between two projects, like project 1 and 2.
This was the most extensive project. Perhaps it should be scheduled as the first project since it coincided with other exams which led to a lack of commitment of my other group members (at least in the coding part - not in the report part).
If only one file is needed for the project, you should not have given more files because the student does not know what to use. The other option is to explain that only one file is needed and that it collects all the information of the rest. Furthermore, the project cannot be summarised in a 8 pages report if everything is done. Finally, there are some tasks that could be better written.
This project was also fun and educational. It was less focused on coding and more on data analysis compared to the other two projects which is a good thing in my opinion to have some variation. Something that can be improved are the instructions and how the data is presented, which is a bit confusing in some cases, notably the tasks to compare machine-learning with LPJ-guess output(4.6 and 5.3).
There were so many questions posed for this project that everyone just kind of picked some questions to focus on because there was not enough time to do all of it. The instructions, not counting the introduction just the questions, was 3 and a half pages already. Then the report was originally set to be between 2-4 pages and luckily changed to around 8 pages. There is no way that if the questions are already 3,5 pages, the results would take less. So, it was very good that that was changed! It was interesting to see which questions people picked to focus on and the overall results, but it would have been nice if something was mentioned about not having to answer all. For example, that they know there are quite a lot of questions and you can still pass if you have answered all questions. Now we stressed about not having everything answered while what we delivered was still a good project.
The project was too large. Therefore it was hard to keep track of what exactly we had to do. Maybe it would have been better too have a smaller project were we could have played around with the model a bit more because now we had to rush through it too much.
Overall very interesting project to get a first insight into machine learning. Very helpful introduction lectures and demo codes. Task 4.6 was confusing and the explanation of the data set could have been more detailed (took a while to understand that except for the daily data, all other data is included in the big data set (index2), what the different obs_variables exactly mean, and what exactly is meant by the seasons).

What did you appreciate most with the course?

What did you appreciate most with the course?
It was really fun to have a cross disciplinary course and it made me understand more what modeling tool are used in practice. It was also nice to see other groups presentations and how every group did things slightly differently, and this should in my opinion be something that should be encouraged via the design of each project.
Machine learning, I havent worked with it before.
The looseness of the task descriptions meant one could try out different methods / approaches. It was also nice that we could use libraries.
It goes over three very different projects that cover a wide range of problems. Therefore, the course is a good introduction to computational modelling
I liked the variation of the different projects and also the "flow" of the course, having lectures->project x3 and working a lot in groups made the course very engaging.
I really liked having the project from different disciplines. It was very interesting to look into the other field and explore them while applying what we know. I asks for a different kind of problem solving that I really appreciate.
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High learning outcome since the projects varied a lot and thus one got a nice insight into different areas and modeling. Because of that the coding also did not feel repetitive since one had to deal with different kinds of problems and methods.

What do you think should be improved?

What do you think should be improved?
The overall course felt rushed for everybody involved. I figure this is part of growing pain of a course given for the first time. The lectures themselves are of good quality, the project instructions stands to be better explained, however. The projects that are repeated in other courses should also be changed, although I was not affected by this.
Overall I think the communication between teachers could improve between projects. It felt like different projects had different expectations of the presentation and report.
The grading scheme led to that people in my group tended to put more emphasis on their report rather than the coding part. The description of the dataset in project 3 was in parts not quite clear. To spread out the workload one could also put the deadline for the reports a week or so after the next project has started since the theoretical parts of the projects way were less time consuming than the coding and report writing.
Nothing other than the things i brought up on the individual projects.
The communication between the different fields for the different projects should have been better. That might help with balancing the workload better between the different projects. It really felt like not everyone was on the same page with what was expected for the projects and we were asked how it was done for the other projects and then some adjustment were made. Another point of improvement is definitely the clarity of the project instructions. In the first project for example, pressure was N and sometimes n, this gets very confusing and it took me a while to realise they were the same variable. The way some questions were posed was extremely confusing as well.
Better communication between teachers. For example when it comes too group size, report size and workload.
Since the presentations were very helpful in clarifying misunderstood things, and in getting some ideas about things that could be improved or additionally considered, it might be helpful to have some more time between the reports and the presentation to make some improvements.

Other comments

Other comments
For a course given for the first time, I expected it to be a bit disorganized and for the most part, this was handled above my expectations and I did not feel that this affected my learning at all. I appreciated the course structure being project based which was refreshing coming from standard courses. I feel that the course was a good introduction to computational science, and it can only get more mature in the coming years. Having the report to be done after the presentation is also better as the discussions lead me to have many ideas that I could implement in the report. The course pacing is a bit all over the place, because some project could only be meaningfully started after the last lecture, and it means that the weeks with lectures were a bit slow, and the week of the presentation to be fast.
Personally, I would prefer if the reports were written in groups too rather than individually.
I liked that the groups were formed by people with different backgrounds
No
It was very valuable to have the project in the different subjects and write reports for different fields. I enjoyed this course and think it can become great once better balanced :)
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Have you during this course experienced course literature, staff or teaching methods to be discriminatory in any way (gender, ethnicity, etc.)?

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No.
No.