

02450 Course Handbook - Spring 2025

January 30, 2025

1 Overview

Course description¹: The learning objectives and formal specifications are available in the DTU Course base.

DTU Learn: Students enrolled on the course can access material and participate in the course through the DTU learn homepage.

Reading material, lecture slides and exercises The course uses free lecture notes (as a book) and other freely available material. Lecture notes, slides, course assignment instructions etc. are available on DTU learn. We have developed several online demos which illustrates key concepts from the course. The topics discussed currently includes PCA, regression, classification and density estimation.

Assesment summary: Two mandatory project reports which must be approved to pass the course (see section 3.1) and an end-of-semester individual, 4 hour, multiple choice paper-based exam (with negative marking) (see section 3.2).

The lecturers:

- Bjørn Sand Jensen (BJJE): Use 02450@compute.dtu.dk for all course-related queries
- Georgios Arvanitidis (GEAR)

Syllabus and lecture schedule

| No | Date | | Subject | Reading | Homework |
|---|-------------------|------|--|-----------------|------------------------|
| 1 | 4 February, 2025 | BJJE | Introduction | C1,C2 | P2.1 |
| Data: Feature extraction, and visualization | | | | | |
| 2 | 11 February, 2025 | BJJE | Summary statistics, similarity and visualization | C4,C7 | P4.2, P4.3, P4.5, P7.1 |
| 3 | 18 February, 2025 | BJJE | Computational linear algebra and PCA | C3 | P3.1, P3.2 |
| 4 | 25 February, 2025 | BJJE | Probability and probability densities | C5,C6 | P5.1, P6.1, P6.2 |
| Supervised learning: Classification and regression | | | | | |
| 5 | 4 March, 2025 | BJJE | Decision trees and linear regression (Project 1 due before 13:00) | C8, C9 | P9.1, P8.1, P8.2 |
| 6 | 11 March, 2025 | GEAR | Overfitting, cross-validation and Nearest Neighbor | C10, C12 | P10.1, P10.2, P12.1 |
| 7 | 18 March, 2025 | GEAR | Performance evaluation, Bayes, and Naive Bayes | C11, C13 | P13.1, 13.2, P12.2 |
| 8 | 25 March, 2025 | GEAR | Artificial Neural Networks and Bias/Variance | C14, C15 | P15.1, P15.2, P15.3 |
| 9 | 1 April, 2025 | BJJE | AUC and ensemble methods | C16, C17 | P16.1, P16.2, P17.1 |
| Unsupervised learning: Clustering and density estimation | | | | | |
| 10 | 8 April, 2025 | BJJE | K-means and hierarchical clustering (Project 2 due before 13:00) | C18 | P18.1, P18.2, P18.3 |
| | | | <i>Holiday</i> | | |
| 11 | 22 April, 2025 | BJJE | Mixture models and density estimation | C19, C20 | P20.1, P19.1, P19.2 |
| 12 | 29 April, 2025 | BJJE | Association mining | C21 | P21.1, P18.2, P18.3 |
| Summary and wrap-up | | | | | |
| 13 | 6 May, 2025 | BJJE | Recap and discussion of the exam | C1-C21 | |

Cx refers to Chapter **x** of the course notes. **Px.y** refers to problem number **y** in chapter **x** of the course notes. The first listed problem will be that weeks discussion question at the exercises.

Significant changes to the above will be announced on DTU Learn and the course's public webpage.

¹Note: The course specification detailing the assessment in the course has likely been (or will soon be) updated compared to the time you enrolled in the course. The specification has (or will soon be) updated to read: "Approval of the reports is a prerequisite for passing the course" instead of "Approval of reports is a prerequisite for participation in the exam". This is a technicality, but it is ultimately a less strict rule (i.e., to your benefit as a student), thus we presume you can accept it. If you have concerns about this update, don't hesitate to get in touch with us via 02450@compute.dtu.dk

Project deadlines

All project reports must be submitted via DTU Learn (under Assignments). See details about assessment in section 3.1.

| Week | Date | |
|------|-----------------------|--|
| 5 | 6 March 2025 @ 17:00 | Project 1 (main) deadline |
| 7 | 20 March 2025 @ 17:00 | Project 1 feedback available (including whether it was approved/passed) |
| 8 | 25 March 2025 | Project 1 feedback - an opportunity for students to discuss feedback with the TA who evaluated the report in person. |
| 8 | 27 March 2025 @ 17:00 | Project 1 resubmission deadline |
| 10 | 10 April 2025 @ 17:00 | Project 2 (main) deadline |
| 11 | 24 April 2025 @ 17:00 | Project 2 feedback available (including whether it was approved/passed) |
| 12 | 29 April 2025 | Project 2 feedback - an opportunity for students to discuss feedback with the TA who evaluated the report in person. |
| 12 | 1 May 2025 @ 17:00 | Project 2 resubmission deadline |

Any change to the above will be announced on DTU Learn and the course's public webpage.

1.1 Exercises

Exercises take place after the lectures on Tuesdays from 15:00-17:00.

There is room capacity for all signed-up students at the exercises every week.

Please bring a laptop computer for the exercises. The exercises will be available in *Matlab*, *R*, and *Python* and we recommend selecting a language you are familiar with. If you are unfamiliar with any of the languages, we recommend *Python*. The exercise rooms are (room capacity square brackets and programming language in parentheses).:

The available rooms and TAs are kept up-to-date on the course's public webpage.

2 Learning activities and expectations

A variety of activities are in place to facilitate learning:

- Preparation: We expect students to come prepared for the weekly session, including reading the material in the book (and ideally also the preview version of the slides) before showing up for the lecture and exercises.
- Lectures: Two-hour lectures that combine concepts and explain some of the key aspects of the material. The lectures are live, in-person, in a main auditorium; however, we also stream to other rooms and via Zoom due to limited seats in the main room.
- In-class quizzes: Every lecture contains quizzes of easy/medium difficulty. You typically need to prepare before coming to the lecture to be able to solve them.
- Weekly exercises (we encourage group work): Build intuitions and practical problem-solving skills often by running computer programs in Matlab/R/Python, reflecting on the results, and modifying the programs to illuminate specific properties of the data/models. These skills are critical for compiling the reports and solving the exam efficiently.
- Assessed group reports: Apply problem-solving skills acquired during exercises on your own dataset and compile two reports.

We note that students who do well on the course (i.e., high grades) typically engage in all these activities.

Time commitment: We expect a student with the required prerequisite to spend nine hours per week on the course on average, a standard set by the Ministry of Education. Our interpretation is that a student should spend nine hours to meet their usual DTU standard (in similar courses), i.e., if a student gets a grade of 10 in a reasonably similar course, the same student needs to spend nine hours to get a 10 in 02450. This implies that some students may need to spend more than the nominal hours to meet their ambitions for a specific course if they are not entirely familiar with the prerequisites, lack practical coding experience, etc.

3 Assessment

The final grade (using the Danish 7-point scale) is based on an *overall assessment* of the group-based reports submitted during the semester and an individual end-of-semester written exam.

In the *overall assessment*, the two assessed reports count approximately a tenth and the exam approximately nine-tenths towards the final grade, respectively ².

3.1 Project reports

A student must hand in two reports during the semester, where three students work in a group on a project with a dataset of their choosing. The descriptions of the projects are available on DTU Learn. The intention is that the skills and most of the content needed to complete the reports are obtained during the weekly exercises, i.e., if students engage with the weekly exercises, they will be in an excellent position to compile the final reports.

Group-based projects: The projects and reports must be completed and submitted as a group (three students). Exceptions to this rule can be given by the main teacher (via e-mail) if there are extraordinary circumstances. Each student's contribution to the work must be clearly stated on the first page of the report, c.f., the specific project description; however, a student is responsible for the content of the full report and be expected to know and be able to defend the content of the full report. Students are evaluated individually based on the extent and quality of their contribution to the report (i.e., two students may get their contribution approved/passed, whereas one student needs to resubmit their part to pass the course).

Assesment and feedback: The reports are evaluated (not graded). Students *must have the reports approved/passed to pass the course* (i.e., the extent and the quality of your contribution must be approved pass the course).

You will get explicit feedback via DTU Learn indicating if your (contribution to the) report meets the required standard, i.e., have passed the specific report. If you have not passed the report, specific instructions will be given about which aspects of the report must be improved or which other activities should be completed for the resubmission.

Resubmission of reports: If the whole group or a member does not pass based on the primary submission of the report (i.e., the report submitted by the main deadline; see Project deadlines in page 2), it will be allowed to resubmit at a specified resubmission deadline (typically one week after the feedback is made available).

The evaluation used in deciding the final grade is based on the main report submission, i.e., students can not improve their evaluation by resubmitting in the same semester; only ensure that it is approved/passed so they can pass the course (based on reports and the exam).

Extensions: Official deadlines for reports are strict, but we will grant reasonable extensions to report deadlines if you contact the primary teacher in due time with a valid and documented cause (e.g., illness, bereavement, etc.). We typically do not accept poor time management or other course deadlines as valid reasons. Internal, unreasonable issues in your group issues must be flagged as soon as possible.

Transfer of reports from previous semesters: Reports submitted in previous semesters are automatically transferred if you enroll in the course again or sign up for the exam. Note they still need to be approved to pass the course.

Help/assistance from TAs for reports: The following principles apply in seeking help for projects from TAs: a) it is acceptable to get input on the choice of dataset; b) It is acceptable to get help getting code to run - as a starting point only to functions/code which is covered by the course material. So not for various alternative solutions found online; c) Reasonable yes/no questions can be answered; d) Fundamental questions can be answered with a reference to the appropriate section in the material.

²Before Spring 2024, the two reports used to be weighted slightly higher; however, we have reduced the weights of the reports in part due to generative AI being permitted when writing the reports.

Generative AI: It is allowed to use generative AI (e.g., ChatGPT, CoPilot, etc.) to complete the reports; however, the report must clearly describe which tools were used and how they were used (i.e., for which tasks).

3.2 Final Exam

In normal circumstances, the exam for the Spring 2025 semester will adhere to the following format/rules unless otherwise announced via DTU Learn:

- The exam is a **four-hour, no aids, multiple choice paper-based exam with negative marking for wrong answers**. The exam typically contains 27 multiple-choice questions. Examples of exam sets and solutions will be made available throughout the semester. Please notice the variability among exam sets and that every exam set contains unique questions not found in other exam sets (i.e., expect new types/variants of questions in the exam for this semester as well!). The exam is designed so a student expecting a 12 would typically need to spend four hours on the exam.
- The exam follows the DTU rules exam for an **no aids** exam; however, you can bring two A4 sheets of handwritten notes (back and forth).
- The exam is standard paper-based; therefore, apart from a digital calculator, students **must not** use any other electronic devices (e.g., laptops, tablets, mobile phones, etc).
- Submission of answers: You will be provided with the printed exam, and you are expected to fill in your answers on the **Answers** sheet. Please ensure that your answers are indicated clearly, e.g., avoid making multiple selections, do not provide argumentation for your answers, etc. Therefore, it is advisable to fill in your answers only once on the sheet and avoid unnecessary clutter. **An example is provided at the end of this document, where cases like Answers 5 and 7 should be avoided!**
- Test exam: We will make available an exam during the course to demonstrate the format.
- Once enrolled on the exam, you can find the exact exam time and location:
<https://eksamensplan.dtu.dk>

3.2.1 Issues at/with/after the exam - or concerns about the final grade

- Release date of final grades: The final grade is based on an **overall assessment** of your performance on the exam and the reports. The overall assessment is conducted with an external examiner, and all aspects of the exam and course will be considered. The process usually takes three to four weeks following the exam, after which you will receive your grade via the usual channels.
 - Urgent need to learn the grade: We can under *no circumstances* inform students of a grade/performance or tell them if they have passed before the external examiner has approved all the grades!
- No show at the exam: If a student is enrolled for the exam, the attempt counts and will receive a grade of not met, EM=ej mødt, if they do not show up. We recommend documenting the reasons for the absence in case an extract attempt must be applied later on.
- Illness during the exam: As teachers, we can not consider personal issues on the day of the exam. We can not judge how a student would have performed had they not been ill, etc. A student must consult the study administration/guidance office if they want their attempt to be voided or seek additional attempts.
- Reexams: A student can attend the exam three times yearly (December, May, and the re-exam in August). If possible, we strongly encourage students who have failed the course to enroll in the course again to ensure they can access the newest material/videos, etc.
- Formal complaints about the exam: Students can formally complain via the Study Administration if they feel the exam was unreasonably tricky, out of scope, or they feel mistreated in the grading process. We strongly suggest students; a) consult the grade distribution for the semester (and

historically), b) understand and reflect on their own performance, and c) discuss their issues and situation with one of the teachers on the course before filing their complaint.

- Three exam attempts: In Denmark, courses must be passed to get credit, and every student gets three attempts. You can apply for a fourth, fifth, and even sixth attempt. The teachers on the specific course have no control over this process or the outcome, and the student should contact the Study Administration/Study Guidance Office for assistance.
 - Support letters: We do not write support letters for additional exam attempts if a student already has documented reasons for failed/EM attempts (e.g., illness, bereavement, transport issues on the exam day). If there are not documented reasons for failing and you need to apply for an extra attempt, you can send an email with the general reasons of failing in the previous attempts (e.g., many courses in parallel, etc) and your arguments for getting an extra attempt. The reply to this email can be used as documentation with your application to the Study Administration.

4 FAQ

- **I am retaking the course/exam - has anything changed compared to past semesters?**
Yes! The reports are now mandatory and must be passed/approved for you to pass the course. Furthermore, the reports are weighted less in the overall assessment compared to previous semesters (prior to Spring 2024). Starting in the Fall 2024 semester, the exam is not digital with all aids (no internet), but paper-based with no aids, and you are only allowed to bring two A4 sheets of handwritten notes and a digital calculator. We strongly suggest you formally re-enroll in the course to gain access to the new material and guidance.

- **I am planning to start studying before the semester starts, when will the material be made available?**

We typically enable access to the material via DTU Learn one week before the first lecture.

- **When and where is the exam this semester?**

The exam date is available from DTU's exam timetable: <https://www.dtu.dk/english/education/examination> timetable - look for the timeslots found here: <https://kursen.dtu.dk/course/02450> (note 02450 sometimes has a special exam date). Once determined, the time and place will be available from: <https://eksamensplan.dtu.dk/>. We do not get any of this information before you do, nor do we have any influence on the date, time, or place.

- **Are the lectures and exercises mandatory / do you take attendance?**

The lectures and exercises are not mandatory thus we do not take attendance. The (group-based) reports and exam are the only mandatory components.

- **I have a question about lecture, topic, exercise or report. Can I send you an email or visit your office?**

Questions about course content/reports are best asked on the discussion forum so all students have access to the same information.

- **I have a question relating to the course regarding a personal matter. Who should I contact?**

Please e-mail or phone the main teacher listed above. Questions about the course material should ideally be posted on Piazza.

- **The semester has started but I would like to join it! Can you add me?**

We can (and will!) add you to the group so you can see the material, but to join the course (and be at the exam) you have to enroll. You can do this through your DTU study planner. If the study planner does not work, you have to contact the study administration by email. Our default position is to approve all new students. Always check the exam registration when they are published.

- **Can I get my reports transferred from a previous semester?**

Yes. Old reports are transferred by default (see description for project 1). From Spring 2024, reports must be passed/approved before you can pass the course. You can e-mail the main teacher, if you are in doubt whether your (old) reports were approved/passed. If any of the old reports were NOT passed/approved, you need to update them according to the usual deadlines in the course. Please do not upload old reports anew unless you have changed the content and make sure to indicate what has been changed (on the front page).

- **What is my grade for the report?**

Reports are not graded but evaluated. According to DTU rules, we cannot give you a numerical score. However, the feedback from TAs should provide a good indication of your performance. The feedback will explicitly state if your reports are passed/approved, which is a requirement to pass the course (starting in Spring 2024)

- **When do I get feedback on the reports (including whether it was "approved/passed")?**

Under normal circumstances, feedback should be available 2 weeks after you handed in project 1, and 2 weeks after you handed in project 2. It will allow you at least one week to update the reports in case you need to resubmit.

- **Are the reports mandatory and need to be "passed"/"approved"?**

Yes. Starting in the Spring 2024 semester, you need to get the reports approved to pass the course. You will receive an email 1-2 weeks before the exam if there are issues with your reports; no email, no problem. Note you can not resubmit at this point unless the problem is administrative.

- **The report deadline is in two days, can I get an extension?**

Probably not. We only give extensions in extraordinary circumstances. Poor teamwork, poor coordination, or poor time management does not count as a valid reason since you have several weeks to complete the reports. We expect any issues to be flagged early on.

- **How do I know I get credit for my reports?**

You will receive feedback via DTU Learn which will clearly state if your reports are passed/approved.

- **Can I resubmit a report if it was NOT approved/passed?**

You can resubmit once per semester (specific deadlines) if the report was not approved/passed in the first attempt. The contribution towards the final grade is based on the first submission. If you do not submit by the main deadline, you will not be able to pass the course.

- **Can I resubmit a report if it was approved/passed (and I just want to improve the evaluation)?**

No. The only exception is if you submitted your report in a *previous* semester (i.e. you did not pass the course).

- **Is there a penalty for late hand-ins?**

We are reasonable if you are handing in late due to extraordinary circumstances, but otherwise, we take the deadline seriously. It would not be fair to all those students who meet the deadline if we accepted late hand-ins without consequences. Unless extraordinary reasons have been agreed with the main teacher, we will not accept late reports (and you will not be able to resubmit by the resubmission deadline; see elsewhere)

- **How do I find a group?**

Attend the exercise sessions to connect with fellow students or use the discussion forum to find team members.

- **Can I do the projects alone?**

Probably not - and only after explicit written permission from the main teacher (via e-mail)

- **Can I bring a computer to the exam?**

No! Starting in the Fall 2024 semester, the exam is a paper-based with no aids (see question above). Therefore, apart from a basic digital calculator any other electronic device is not permitted.

- **I have another question about the exam**

Please look at the official FAQ about exams: <https://www.inside.dtu.dk/da/undervisning/regler/regler-for-eksamen/faq-om-skriftlig-eksaminer>

- **When is the re-exam?**

In the spring semester there is a re-exam in August. For the fall semester the next exam is in the following spring semester (typ. May).

- **My DTU Learn page does not seem to show all the items/information others student can see**

Make sure your DTU Learn profile is set to English (for this course)

- **I cannot log onto DTU Learn, DTU Inside, Panopto, or a specific functionality on the sites appear to be broken**

If you encounter IT problems and it appears that something is wrong with a DTU Learn page or your account please submit a ticket to the (usually very responsive) IT support: <https://itservice.ait.dtu.dk>

- **Can I be a TA?**

Possibly. After the course has completed, we will often make a call for teaching assistants among

qualified students (sometimes also among students from previous semesters). The call will only be made if we need TAs. Pay is more than 200DKR per hour and there is preparation time!

- **Is it true that the exam is a written 4 hour, no aids, multiple choice with negative marking?**

Yes. You can view previous exam sets on DTU Learn (some with full solutions) and individual questions in the book (with partial solutions).

- **The failure rate seems high for an introduction course? Is this intentional?**

The standards of the course have been the same for 10 years and we intentionally maintain these standards (similar to other DTU courses). The historical grade distribution can be observed from <https://kurser.dtu.dk/course/02450/info>.

- **I have used up my three exam attempts (including ;em¿Not met/Ej mødt¿/em¿) for this course - what should I do?**

Very carefully read and follow the rules/guidelines on DTU Inside on exam attempts (ask the Study Guidance office if in doubt).



02450 Exam Answers

Student ID

Name

Surname

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| Question 1 | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
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02450 Exam Answers

Not fine. Avoid similar.

Student ID

5123456

Name

JOHN

Surname

SMITH

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