

A close-up photograph of a person's hands working on a laptop. The person is wearing a grey and black horizontally striped long-sleeved shirt with blue ribbed cuffs. Their right hand is typing on the laptop keyboard, while their left hand holds a black pen over an open notebook. A stack of books, including one with a blue cover, is visible on the right side of the desk. The background is softly blurred, showing a green container and other desk items.

What is an MAT2000
project?

The bachelor thesis

UiO Bachelor's thesis

An extended template

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MAT2000 – Project work in Mathematics
10 ECTS study points

Supervised by Kris Shaw

Department of Mathematics
Faculty of Mathematics and Natural Sciences



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Abstract

The L^AT_EX document class **uiobachelorthesis** was created to facilitate the writing of your thesis according to the graphical guidelines of the University of Oslo. The extended template is adapted to the project courses MAT2000, STK-MAT2011 and MEK3200 at the Department of Mathematics.

The abstract is a short summary of your content, say 100–150 words, perhaps even less in the mandatory assignment. Readers use the abstract to decide whether this is worth to read or not. This is why you should use these words cleverly: put the topic and your results in context quickly, lay claim to new results, with a short description of methods used, followed by conclusions. Avoid special characters and do not cite in the abstract.

1 Introduction

sec:intro

The purpose of your introduction is to zoom in on your problem. Describe the history of the problem, mention how the problem has been studied by others, and motivate the reader for why your research and point of attack is worth it.

The introduction is where you set the ‘feel’ of the thesis. The style should be formal, so please avoid contractions like ‘don’t’ in formal writing. The introduction should be written at least twice; before you start your project - and the last thing you write before you hand it in. A useful trick is to use the ‘And-But-Therefore’-exercise when you write.

It is OK to postpone some notation to later sections, but you might want to reveal some of your results in the introduction as a teaser, and then you need most of the notation to be able to state that result in a proper way.

1.1 Structure

Your text should be subdivided into sections, subsections, paragraphs and sentences to make it easier to read. Sections and subsections should be numbered. Paragraphs are separated from one another by indented first line (differs in different languages).

A paragraph is build up by a claim, an argument or explanation, and finally a conclusion. Use complete, but short sentences. Break up sentences into smaller units. Note that mathematics (and citations) is usually presented as part of a sentence.

The scientific poster

My Bachelor Project

My name ¹

¹Department of Mathematics

Abstract

Aim for a slick poster friendly version of your project abstract.

Main Objects

Example I

Perhaps a figure?

Theorems/Results

Nam dui ligula, fringilla a, euismod sodales, sollicitudin vel, wisi. Morbi auctor lorem non justo. Nam lacus libero, pretium at, lobortis vitae, ultricies et, tellus. Donec aliquet, tortor sed accumsan bibendum, erat ligula aliquet magna, vitae ornare odio metus a mi. Morbi ac orci et nisl hendrerit mollis. Suspendisse ut massa. Cras nec ante. Pellentesque a nulla. Cum sociis natoque penatibus et magnis dis parturient montes, nascetur ridiculus mus. Aliquam tincidunt urna. Nulla ullamcorper vestibulum turpis. Pellentesque cursus luctus mauris.

Method

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Ut purus elit, vestibulum ut, placerat ac, adipiscing vitae, felis. Curabitur dictum gravida mauris. Nam arcu libero, nonummy eget, consectetur id, vulputate a, magna. Donec vehicula augue eu neque. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Mauris ut leo. Cras viverra metus rhoncus sem. Nulla et lectus vestibulum urna fringilla ultrices. Phasellus eu tellus sit amet tortor gravida placerat. Integer sapien est, iaculis in, pretium quis, viverra ac, nunc. Praesent eget sem vel leo ultrices bibendum. Aenean faucibus. Morbi dolor nulla, malesuada eu, pulvinar at, mollis ac, nulla. Curabitur auctor semper nulla. Donec varius orci eget risus. Duis nibh mi, congue eu, accumsan eleifend, sagittis quis, diam. Duis eget orci sit amet orci dignissim rutrum.

Example II

Consider a running example

Conclusions

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Ut purus elit, vestibulum ut, placerat ac, adipiscing vitae, felis. Curabitur dictum gravida mauris. Nam arcu libero, nonummy eget, consectetur id, vulputate a, magna. Donec vehicula augue eu neque. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Mauris ut leo. Cras viverra metus rhoncus sem. Nulla et lectus vestibulum urna fringilla ultrices. Phasellus eu tellus sit amet tortor gravida placerat. Integer sapien est, iaculis in, pretium quis, viverra ac, nunc. Praesent eget sem vel leo ultrices bibendum. Aenean faucibus. Morbi dolor nulla, malesuada eu, pulvinar at, mollis ac, nulla. Curabitur auctor semper nulla. Donec varius orci eget risus. Duis nibh mi, congue eu, accumsan eleifend, sagittis quis, diam. Duis eget orci sit amet orci dignissim rutrum.

References

Include a few of the main references you used

Acknowledgements

This project was prepared as part of MAT2000 - Project work in mathematics. I would like to thank my project supervisor **NAME**.

Contact information

Your email address?



Zooming in

The problem, broad terms

What others have done

What you will do
and how

The bulk of the thesis

Preliminaries, notation

Methodology

Results

Your main results

Zooming out

Summary of
your work

Limitations, weaknesses, future work

Your work in context, significance, overall picture

Structure your thesis (or an article)

Mathematics

- Title
- Abstract
- Introduction
- Notation and definitions
- Results and proofs
- Simulations and pseudocode
- Applications and examples
- Conclusive chapter
- List of references
- Appendices

Experimental sciences

- IMRaD
- Title
- Abstract
- Introduction
- Method
- Results
- Analysis and Discussion
- List of references
- Appendices

Familiarise yourself with the genre

- Read articles and theses
- Use [MathSciNet](#)
- Use [Google Scholar](#)
- [duo.uio.no](#) (Master theses / Ph.D. theses)
- [arXiv.org](#)
- Request from the [library](#)
 - Master theses from before 2007
 - Ph.D. theses

Familiarise yourself with writing resources

On the course webpage there are links to:

- Krantz: A Primer of Mathematical Writing (**A textbook!**)
- Halmos: How to write mathematics (**An opinion essay**)
- Fjordholm: A guide to writing mathematics (**A very useful technical guide by our very own Ulrik**)
- Poonen: Practical suggestions for mathematical writing (**Helpful lists of good and bad examples**)
- Lee: A Guide to Writing Mathematics (**Contains a useful checklist at the end!**)
- Kowalski: About citations (**Answers lots of your questions on how, when, and where to cite**)

Abstract

- Very short ~ 100-200 words
 - It is read first!
 - Avoid special characters
 - Do not cite in the abstract
- Summarizes the content
 - Lay claim to new results
 - Put the topic and your results in context quickly
 - Main results only, with conclusions
 - Mention techniques used
- Write-rewrite

Abstract bad example

New submissions for Thu, 27 Jan 22

[1] [arXiv:2201.10560](#) [[pdf](#), [ps](#), [other](#)]

Entire solutions of system of Fermat-type difference and partial differential-difference equations in $\mathbb{C}^2$

Goutam Haldar

Comments: arXiv admin note: text overlap with [arXiv:2201.10513](#)

Subjects: **Complex Variables** (math.CV)

In this paper we mainly study the existence and the form of entire solutions with finite order for the following system of Fermat-type difference and partial differential-difference equations

$$\begin{cases} f_1(z)^2 + (\Delta_c f_2(z))^2 = 1 \\ f_2(z)^2 + (\Delta_c f_1(z))^2 = 1, \end{cases}$$
$$\begin{cases} a_1^2 f_1(z)^2 + (a_2 f_2(z+c) + a_3 f_2(z))^2 = 1 \\ a_1^2 f_2(z)^2 + (a_2 f_1(z+c) + a_3 f_1(z))^2 = 1, \end{cases}$$
$$\begin{cases} (a_1 f_1(z+c) + a_2 f_1(z))^2 + (a_3 f_2(z+c) + a_4 f_2(z))^2 = 1 \\ (a_1 f_2(z+c) + a_2 f_2(z))^2 + (a_3 f_1(z+c) + a_4 f_1(z))^2 = 1, \end{cases}$$

and

$$\begin{cases} (\partial^I f_1(z) + \partial^J f_1(z))^{n_1} + f_2(z+c)^{m_1} = 1 \\ (\partial^I f_2(z) + \partial^J f_2(z))^{n_2} + f_1(z+c)^{m_2} = 1 \end{cases}$$

in several complex variables. Some of our results are improvements and extensions of the previous theorems given by Zheng-Xu \cite{Zheng-Xu & Analysis math & 2021}, Xu-Cao \cite{Xu & Cao & 2018}, Xu \textit{et. al.} \cite{Xu-Liu-Li-JMAA-2020} and Li \textit{et. al.} \cite{Li-Zhang-Xu & 2021 & AIMS}. Moreover, we give some examples which are relevant to the content of the paper.

Abstract good example

[arXiv:2401.03709](#) [[pdf](#), [ps](#), [other](#)]

Brauer and Neron-Severi groups of surfaces over finite fields

[Thomas H. Geisser](#)

Subjects: **Algebraic Geometry** (math.AG); **K-Theory and Homology** (math.KT); **Number Theory** (math.NT)

We give a version of the Artin-Tate formula for surfaces over finite fields not assuming Tate's conjecture. It gives an equality between terms related to the Brauer group on the one hand and terms related to the Neron-Severi group on the other hand. We give estimates on the terms appearing in the formula and use this to give sharp estimates on the size of the Brauer group of abelian surfaces depending on the p -rank.

Introduction

Content

- Explain the problem
- Put the problem in context (Cite!)
 - Background, history and motivation
 - Why is this interesting?
 - What have others done?
- Present what you will do and how (thesis/project)
- Present your main results (article)
- Enough technical background to make it readable for an interested reader
- Present an outline

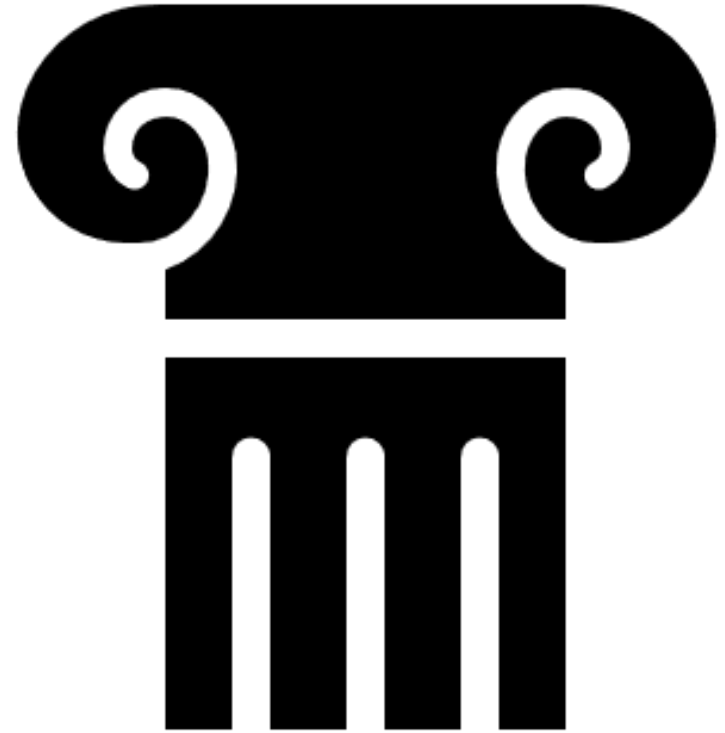
Why is it important?

- Most likely part to be read
- Set the «feel» of the thesis
- Adjust the language and mathematics
- Storytelling
 - ABT (and-but-therefore)
- **Tip!** Write, rewrite, dewrite the introduction several times!
 - The first you write – to create structure
 - The last you write – to reflect your structure and show your understanding!

Background and preliminaries

Could be a part of the introduction

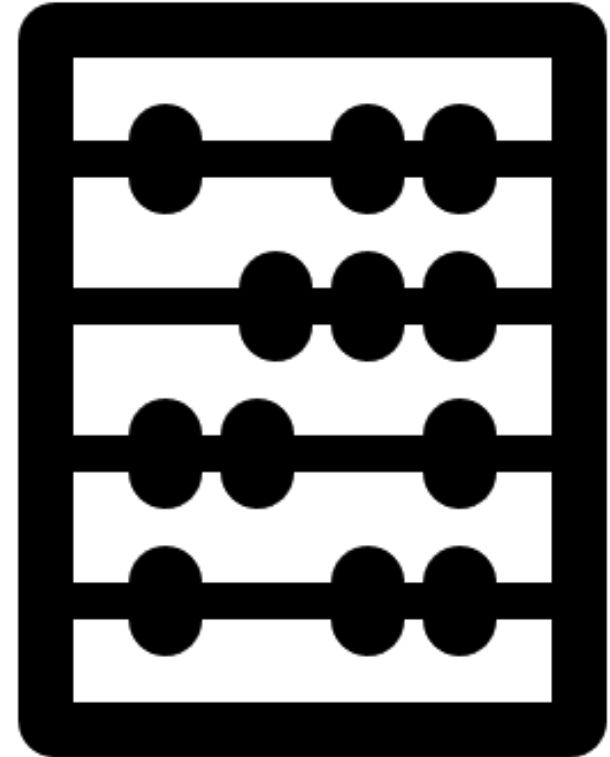
- You are not writing a textbook!
- Often based on a standard textbook in your field
- Don't go back to year 0 - keep an audience in mind
- Remember to cite!
- Introduce notation and definitions
- Stick to your context
- You need background to present your results coherently



Methods (if applicable)

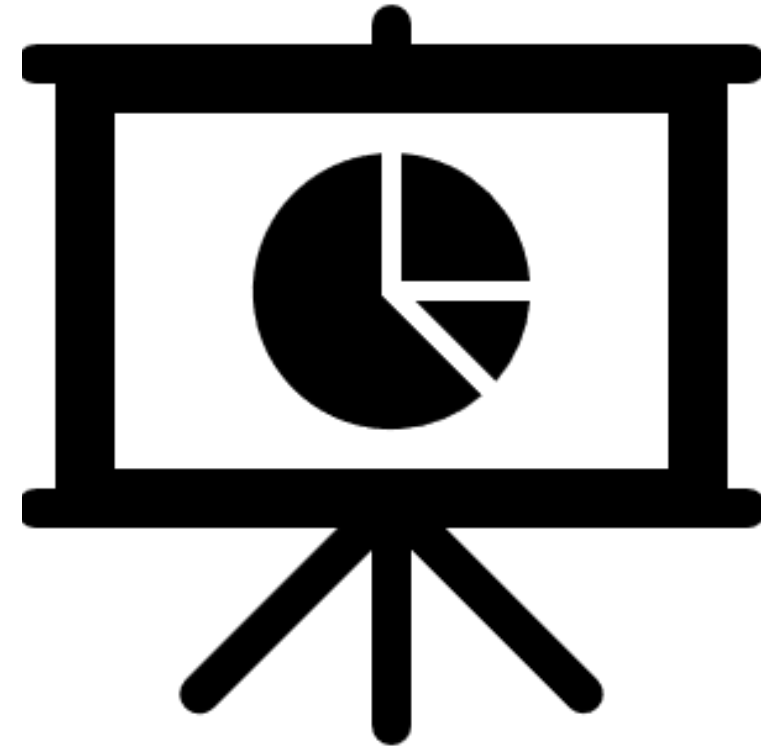
Could be a part of the introduction

- Describe the methods you use (Cite!)
- Advantages
- Limitations
- Applications
- What's new?



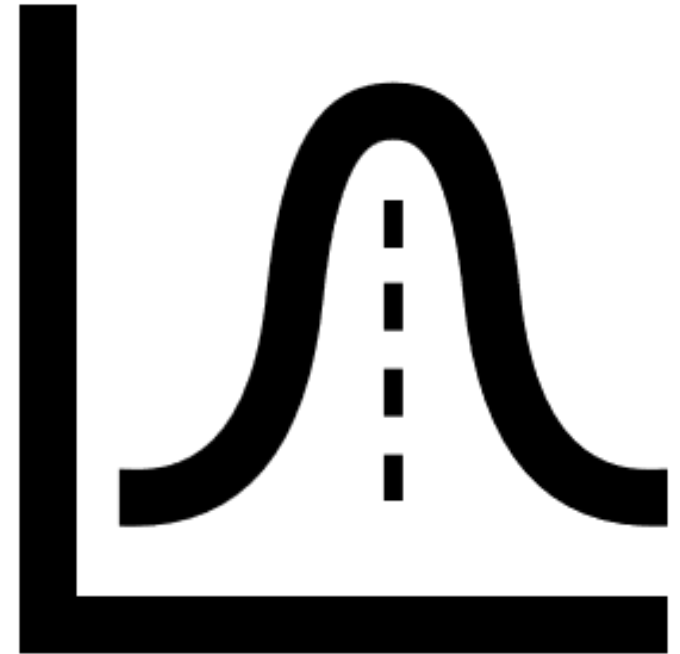
Theoretical results (if applicable)

- Build your result
- History
- What's new?
- What's great?
- The result itself
- Proof
- Corollaries



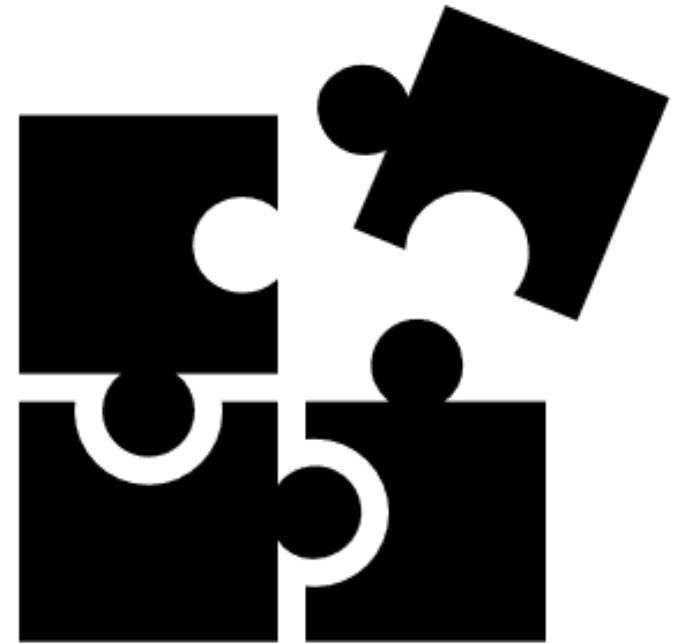
Applications and examples

- Applications and examples supporting your results
- Choose them wisely
- Argue for your choices!
- Presented with tables and figures - explain these in the text
- Captions and cross references are mandatory!



Discussion and conclusive chapter

- Your work in context
- Reflection on the topic and process
- Summary of your work
- Broader perspective
- Significance and limitations
- Identify open problems
- Point to future research possibilities
- Shows your maturity as a scientist



Appendix or permanent storage for your data

- Essential stuff that has no natural place in the project
- Code/Pseudocode
- Simulations
- Numerical results
- Complete tables
- Systematic/detailed overview
- UiO GitHub, Zenodo ++

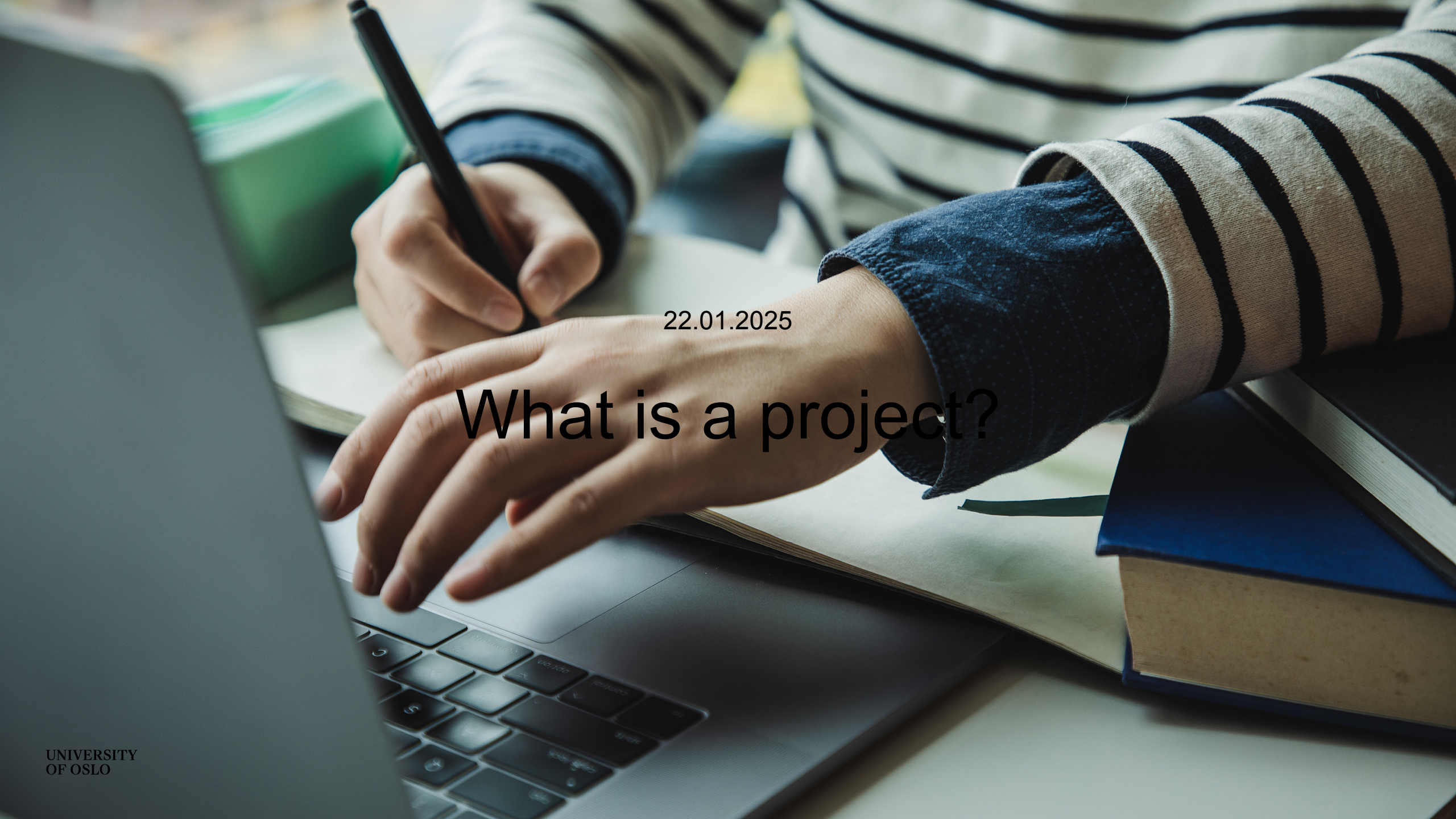


What are the projects?

Work in pairs

- Read the project descriptions on the semester page
- Discuss what the projects are about
- What do you expect from the project?



A close-up photograph of a person's hands and arms. The person is wearing a long-sleeved shirt with horizontal black and white stripes. Their right hand is holding a black pen and writing on a white notebook. Their left hand is resting on the keyboard of a dark-colored laptop. The laptop is open, and its keyboard is visible. To the right of the laptop, there is a stack of books, with a blue book on top. The background is slightly blurred, showing a desk and some other items. The overall lighting is soft and natural.

22.01.2025

What is a project?