

MATH-614

**Foundations of causal inference**

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Cursus	Sem.	Type
Mathematics		Opt.

Language of teaching	English
Credits	4
Session	
Exam	Oral presentation
Workload	120h
<b>Hours</b>	<b>84</b>
Courses	28
TP	56
<b>Number of positions</b>	

**Frequency**

Every year

**Remark**

Fall semester

**Summary**

This seminar will provide a survey of the canonical literature in causal inference. At the end of this course, students will gain a broad understanding of the most important methodological concepts and tools in this field, and will be equipped to critically engage and contextualize modern literature

**Content**

The seminar will be discussion-based and require that the student actively participate. Each week, the discussion will be organized around 2-4 papers or book chapters that are relevant to a selected topic. The sessions will begin with a twenty minute presentation by the lecturer, followed by 70 minutes of discussion moderated by two volunteer students. The two responsible students will work closely with course instructors during the preceding week to design an effective session.

The topics we cover will include:

- Statistical inference vs causal inference: Concepts and terminology
- Description, prediction and counterfactuals
- Identifiability of causal effects in the presence of unmeasured confounding
- Bounds and sensitivity analysis
- Mechanisms and mediation analysis
- Generalizability and external validity
- Collapsibility

**Keywords**

Causality, Causal graphs, Structural Equation Modelling, Identification, Data Science

**Learning Prerequisites****Required courses**

Familiarity with statistical theory, probability theory and linear algebra.

**Learning Outcomes**

By the end of the course, the student must be able to:

- Understand central concepts in causal inference, with a particular focus on their underlying ontology and on ideas that are not present in traditional statistical inference. Demonstrate familiarity with ongoing academic disagreements within causal inference, and meaningfully discuss the advantages and disadvantages of each perspective
- Read, evaluate and critique papers that introduce new ideas into the methodological literature

## Resources

### Bibliography

We will give a list of relevant articles and book chapters.

### Moodle Link

- <https://go.epfl.ch/MATH-614>