



# FSF3962 Causal Inference in Statistics 7.5 credits

Kausal inferens i statistik

This is a translation of the Swedish, legally binding, course syllabus.

## Establishment

Course syllabus for FSF3962 valid from Autumn 2016

## Grading scale

G

## Education cycle

Third cycle

## Specific prerequisites

First or second cycle courses in probability, in differential and integral calculus. Boolean logic of propositions. Statistical inference FSF3961 and/or Bayesian networks FSF3970 recommended.

## Language of instruction

The language of instruction is specified in the course offering information in the course catalogue.

## Intended learning outcomes

To pass the course, the student should be able:

- to recognize a situation, where causal inference is required
- apply intervention calculus
- to identify causal parameters,
- to find the scientific conditions it is possible to estimate causal parameters from data
- to analyse interaction of causes in genetic epidemiology
- to know the main interpretations counterfactuals and their equivalence
- to place causal inference in the general picture of statistical learning theory
- to present clearly a topic in causal inference

## Course contents

Conditional Independence, Structural causal models, graphical statistical models, d-separation, the adjustment formula, truncated product formula, the backdoor criterion, front-door criterion, mediation. Counterfactuals, structural interpretation, axiomatic of counterfactuals, probabilities of counterfactuals, three interpretations of probability of causation and counterfactuals.

Applications of to genetic epidemiology, statistical interaction analysis, sufficient cause interactions.

## Disposition

The course will consist of one weekly meeting with theory lectures (2 x 45 min) by the teacher and/or presentations (1 X 45) of book chapters or papers by the students. Homework presentation will be at the last weeks of the course.

## Course literature

- J.Pearl, M. Glymour & N.P: Jewell: Causal inference in statistics. A Primer. J. Wiley & Sons 2016, ISBN: 9781119186847
- S.L. Morgan & C.Winship: Counterfactuals and causal inference. 2nd Edition. Cambridge Univ. Press, 2015, ISBN 978-1-107-06507-9
- T.J. Vanderweele: Explanation in Causal Inference. Oxford University Press, 2015 ISBN: 978-0-19-932587-0
- K.J. Rothman, S. Greenland, T.L. Lash: Modern Epidemiology. Third Edition. Wolters Kluwer, 2008, ISBN-13: 978-0-7817-5564-1

## Examination

Based on recommendation from KTH's coordinator for disabilities, the examiner will decide how to adapt an examination for students with documented disability.

The examiner may apply another examination format when re-examining individual students.

If the course is discontinued, students may request to be examined during the following two academic years.

Presentations of papers and book chapters or homework.

## **Other requirements for final grade**

Presentations or homework.completed.

## **Ethical approach**

- All members of a group are responsible for the group's work.
- In any assessment, every student shall honestly disclose any help received and sources used.
- In an oral assessment, every student shall be able to present and answer questions about the entire assignment and solution.