

Course information 2025-26

ST2134 Advanced Statistics: Statistical Inference

General information

MODULE LEVEL: 5

CREDIT: 15

NOTIONAL STUDY TIME: 150 hours

MODE: Locally Taught, Independent Learner Route and Online Taught

Summary

To infer means to make general statements on the basis of specific observations. From an early age, human beings are experts at inference. It is such a fundamental part of our intelligence that we do it without even thinking about it. We learn to classify objects on the basis of a very limited set of examples. In statistical inference, we go from specific to general via a mathematical model. Our specific observations come from a data set; that is, a collection of numbers, or at least, information that can be represented numerically. The mathematical models that we use draw on distributions of probability that are described in the companion half course ST2133 Advanced statistics: distribution theory. Methods for using probabilistic models to make general statements on the basis of an observed set of data is the central topic of this half course.

Conditions

Please refer to the relevant programme structure in the EMFSS Programme Regulations to check:

- where this course can be placed on your degree structure; and
- details of prerequisites and corequisites for this course.

You should also refer to the Exclusions list in the EMFSS Programme Regulations to check if any exclusions apply for this course.

Aims and objectives

The aim of this course is to provide a thorough theoretical grounding in statistical inference. The course teaches fundamental material which is required for specialised courses in statistics, actuarial science and econometrics.

Learning outcomes

At the end of this half course and having completed the essential reading and activities students should be able to:

- explain the principles of data reduction
- judge the quality of estimators
- choose appropriate methods of statistical inference to tackle real problems.

Employability skills

Below are the three most relevant employability skills that students acquire by undertaking this course which can be conveyed to future prospective employers:

1. Complex problem solving
2. Decision making
3. Creativity and innovation

Essential reading

For full details, please refer to the reading list

Casella, G. and R.L. Berger Statistical Inference. (Duxbury, 2008) second edition [ISBN 978-8131503942]

Assessment

This course is assessed by a two-hour and fifteen-minute closed-book written examination.

Syllabus

Data reduction; Sufficiency, minimal sufficiency. Likelihood.

Point estimation; Bias, mean squared error, consistency. Rao–Blackwell theorem. Central limit theorem. Method of moments estimators. Order statistics. Minimum variance unbiased estimators, Cramér–Rao lower bound. Properties of maximum likelihood estimators.

Interval estimation; Coverage probability and length. Pivotal functions.

Hypothesis testing; Most powerful tests. Neyman–Pearson lemma. Likelihood ratio test.