



Unit information 2009–10

134 Advanced statistics: statistical inference (half unit)

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 unit 133 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 unit.

Prerequisite

If taken as part of a BSc degree, units which must be passed before this half unit may be attempted:

04a Statistics 1 and 04b Statistics 2.

This half unit must be taken at the same time as, or after half unit 133 Advanced statistics: distribution theory.

Aims and objectives

The aim of this half unit is to provide a thorough theoretical grounding in statistical inference. The unit teaches fundamental material that is required for specialised units in statistics, actuarial science and econometrics.

Essential reading

Casella, G. and R.L. Berger *Statistical Inference*. (Duxbury, 2002) second edition [ISBN 9780534243128].

Hogg, R.V. and E.A. Tanis *Probability and Statistical Inference*. (Pearson/Prentice Hall, 2006) seventh edition [ISBN 9780131464131].

Learning outcomes

At the end of this half unit and having completed the essential reading and activities students should:

- be familiar with the principles of data reduction
- understand how the quality of estimators is judged
- be able to choose appropriate methods of inference to tackle real problems.

Assessment

This half unit is assessed by a two hour unseen written examination.

Students should consult the *Programme Regulations for degrees and diplomas in Economics, Management, Finance and the Social Sciences* that are reviewed annually. The Prerequisites, Exclusions, and Syllabus are subject to confirmation in the *Regulations*. Notice is also given in the *Regulations* of any units which are being phased out and students are advised to check unit availability.

Syllabus

This is a description of the material to be examined, as published in the *Regulations*. On registration, students will receive a detailed subject guide which provides a framework for covering the topics in the syllabus and directions to the essential reading.

Data reduction; Sufficiency, minimal sufficiency. Likelihood.

Point estimation; Bias, consistency, mean square error. Central limit theorem. Rao-Blackwell theorem. Minimum variance unbiased estimates, Cramer-Rao bound. Properties of maximum likelihood estimates.

Interval estimation; Pivotal quantities. Size and coverage probability.

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