



Course information 2011–12

ST104b Statistics 2 (half course)

This half course requires the student to develop the concepts introduced in ST1004a Statistics 1 of measurement and hypothesis testing.

Rule

ST104a Statistics 1 must be taken before or at the same time as ST104b Statistics 2.

Aims and objectives

The aim of this half course is to develop the students' knowledge of elementary statistical theory. The emphasis is on topics that are of importance in applications to econometrics, finance and the social sciences. Concepts and methods that provide the foundation for more specialised courses in statistics are introduced.

Essential reading

For full details please refer to the reading list.

Lindley, D.V. and W.F. Scott. *New Cambridge Statistical Tables*. (Cambridge: Cambridge University Press)

Newbold, P. *Statistics for Business and Economics*. (London: Prentice-Hall).

Assessment

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

Learning outcomes

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

- ✓ be competent be a competent user of standard statistical operators and be able to recall a variety of well-known distributions and their respective moments
- ✓ be able to explain the fundamentals of statistical inference and be able to apply these principles to justify the use of an appropriate model and perform tests in a number of different settings
- ✓ appreciate that statistical techniques are based on assumptions and in any analysis of real problems the plausibility of such assumptions must be thoroughly investigated.

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 courses which are being phased out and students are advised to check course 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.

Probability: Random experiment, sample space, event; Complement, union, intersection; Probability and its axioms; conditional probability; independence; Law of total probability, Bayes' theorem; Permutations and combinations; Sampling without replacement

Random variables and distributions: Random variables; Discrete and continuous distributions; cumulative distribution function; Probability mass function; Common discrete distributions; Probability density function; Properties of continuous random variables; Common continuous distributions

Expectation and variance: Expectation; Expectation of a function; Properties of expectation; Variance; Expectation and variance of common distributions

Bivariate distribution: Two random variables; Independence; Expected values; Covariance

Sampling: Mean and variance of a sample mean; sampling for a normal population; The Central Limit Theorem

Point estimation

Interval estimation: Intervals for the mean of a normal population; Intervals for mean differences; Confidence intervals for proportions; confidence intervals for variance

Hypothesis testing: Hypotheses; Test statistics and critical regions; Type I and type II errors; Level and power; Testing hypotheses about population means; Link to Confidence Intervals; Two-sample tests; p -values; Tests for binomial probabilities of success; Testing hypotheses about population variances; One-sample test; Two-sample test

Analysis of variance: One-way analysis of variance; Confidence intervals and tests for population group means; Two-way analysis of variance; Tests for row effects and column effects; Confidence intervals; Fitted values and residuals; Sum of squares identity

Least squares: Response variable and explanatory variable; Estimation of α and β ; Sums of squares identity; Sample covariance and sample correlation

Simple linear regression: The model for linear regression; Means and variances of $\hat{\alpha}$ and $\hat{\beta}$; Interval estimates for fitted values; Spotting difficulties

Correlation: Correlation between two random variables; Regression and the coefficient of determination R^2 ; Testing $\rho = 0$ for a bivariate normal distribution

Multiple Regression: The model for linear regression; Least squares fitting; Sum of squares identity; Coefficient of Determination; Computation; Extrapolation; Collinearity; Diagnostic Plots

Tests for goodness-of-fit: Basic counting model; A goodness-of-fit statistic; Testing when there are unknown parameters; Testing for association in two-way tables