

Course information sheet 2023-24

ST104b Statistics 2 (half course)

General information

COURSE LEVEL: 4

CREDIT: 15

NOTIONAL STUDY TIME: 150 hours

Summary

The course provides a precise and accurate treatment of probability, distribution theory and statistical inference at the introductory level.

Conditions

This course must be taken at the same time as or after:

- ST104a Statistics 1.

Exclusions: Students cannot take this course with:

- ST1215 Introduction to mathematical statistics

Aims and objectives

The aim of this half course is to develop 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.

Learning outcomes

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

- compute probabilities of events, including for univariate and multivariate random variables
- apply and be competent users of standard statistical operators and be able to recall a variety of well-known distributions
- derive estimators of unknown parameters using method of moments, least squares and maximum likelihood estimation techniques, and analyse the statistical properties of estimators
- be familiar with the fundamental concepts of statistical modelling, with an emphasis on analysis of variance models.

Please consult the current EMFSS Programme Regulations for further information on the availability of a course, where it can be placed on your programme's structure, and other important details.

Employability outcomes

Below are the three most relevant skill outcomes for students undertaking this course which can be conveyed to future prospective employers:

1. Complex problem-solving
2. Decision making
3. Communication

Recommended reading

A comprehensive subject guide will provide all the essential reading this course. A recommended textbook for additional exposition and practice problems is:

- Larsen, R.J. and M.J. Marx (2017) *An Introduction to Mathematical Statistics and Its Applications*, Pearson Education, 6th edition.

Assessment

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

Syllabus

Probability theory: Set theory: the basics; Axiomatic definition of probability; Classical probability and counting rules; Conditional probability and Bayes' theorem.

Discrete probability distributions: Probability distribution; Binomial distribution, Cumulative distribution function; Poisson distribution; Poisson approximation to the binomial; Expected value of a discrete random variable; Variance of a discrete random variable; Distributions related to the binomial distribution.

Continuous probability distributions: Probability density function and cumulative distribution function; Continuous uniform distribution; Exponential distribution; Normal distribution; Normal approximation to the binomial.

Multivariate random variables: Joint probability functions; Marginal distributions; Conditional distributions; Covariance and correlation; Independent random variables; Sums of random variables.

Sampling distributions of statistics: Random samples; Statistics and their sampling distributions; Sample mean from a normal population; The central limit theorem; Some common sampling distributions.

Estimator properties: Estimation criteria – bias, variance and mean squared error; Unbiased estimators.

Point estimation: Method of moments estimation; Least squares estimation; Maximum likelihood estimation.

Analysis of variance: One-way analysis of variance; Two-way analysis of variance.

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