ST219-12 Mathematical Statistics Part B

21/22

Department
> Statistics

Level
> Undergraduate Level 2

Module leader
> Massimiliano Tamborrino

Credit value
> 12

Module duration
> 10 weeks

Assessment
> Multiple

Study location
> University of Warwick main campus, Coventry

Description

Introductory description

This module runs in Term 2 and is core for students with their home department in Statistics. It is not available to other students who should consider ST220: Introduction to Mathematical Statistics as an alternative.

Prerequisite(s): ST218 Mathematical Statistics Part A
Leads To: many ST3 and ST4 modules

[Module web page](#)

Module aims

To introduce the major ideas of statistical inference with an emphasis on likelihood methods of estimation and testing.

Outline syllabus

This is an indicative module outline only to give an indication of the sort of topics that may be covered. Actual sessions held may differ.

The notion of a parametrized statistical model for data.

The definition of likelihood and examples of using it compare possible parameter values.

Parameter estimates and in particular maximum likelihood estimates. Examples including estimated means and variances for Gaussian variables.

The repeated sampling principle: the notion of estimator and its sampling distribution. Bias and MSE. Examples of calculating sampling distributions.

Construction of confidence intervals.

Notion of a hypothesis test. Likelihood ratio tests. Neyman-Pearson Lemma. P-value.

Principle of data reduction: sufficient statistics, and applications to point estimation and hypothesis testing.

Asymptotic normality of MLEs. Examples.

Learning outcomes

By the end of the module, students should be able to:

- Understand the main notions of statistical inference including a (parametrized) statistical model, an estimator and its sampling distribution, and hypothesis tests.
- Be able to calculate maximum likelihood estimators in a variety of examples.
- Be able to use likelihood ratios to construct hypothesis tests in a variety of examples including the classical t and F tests.
- Be able to derive properties of sampling distributions of estimators in a variety of examples.

Indicative reading list

The main reference books for the course are:

1. Statistical Inference, G. Casella and R. L. Berger.
2. Introduction to the theory of Statistical Inference, H. Liero and S. Zwanzig.

Other possible books that you can refer at:
3. Probability and statistics by example: 1: Basic probability and statistics, Y. M. Suhov, M. Kelbert (available online through Warwick Reading Lists)
4. Introductory Statistics, S.M. Ross.
5. Introduction to Probability and Statistics for Engineers and Scientists, S. M. Ross

Note that 1-3 are already available through "Talis Aspire link"

[View reading list on Talis Aspire](#)

Subject specific skills

Among others, ability to recognise sufficient/complete statistics, computing the Fisher information about a parameter of a given statistical model

Transferable skills

Among others, ability to derive methods for standard point estimation, hypothesis tests and confidence intervals in different setting that the statistical models considered in the module, e.g.,

for linear models or for stochastic processes.

Study

Study time

Type	Required	Optional
Lectures	30 sessions of 1 hour (25%)	2 sessions of 1 hour
Tutorials	4 sessions of 1 hour (3%)	
Private study	62 hours (52%)	
Assessment	24 hours (20%)	
Total	120 hours	

Private study description

Weekly revision of lecture notes and materials, wider reading and practice exercises, working on problem sets and preparing for examination.

Costs

No further costs have been identified for this module.

Assessment

You do not need to pass all assessment components to pass the module.

Assessment group D2

	Weighting	Study time
Multiple Choice Quiz 1	3%	4 hours

A multiple choice quiz which will take place during the term that the module is delivered.

Multiple Choice Quiz 2	3%	4 hours

A multiple choice quiz which will take place during the term that the module is delivered.

Multiple Choice Quiz 3	4%	4 hours

A multiple choice quiz which will take place during the term that the module is delivered.

Written assignment	10%	12 hours

The assignment will contain a number of questions for which solutions and / or written responses will be required. The preparation and completion time noted below refers to the amount of time in

	Weighting	**Study time**

hours that a well-prepared student who has attended lectures and carried out an appropriate amount of independent study on the material could expect to spend on this assignment. You will write your answers on paper and submit to the Statistics Support Office.

	Weighting	
On-campus Examination	80%	

The examination paper will contain four questions, of which the best marks of THREE questions will be used to calculate your grade.

~Platforms - Moodle

- Answerbook Pink (12 page)
- students may use a calculator
- Cambridge Statistical Tables (blue)

Assessment group R1

	Weighting	**Study time**
Online Examination	100%	

The examination paper will contain four questions, of which the best marks of THREE questions will be used to calculate your grade.

~Platforms - Moodle

- Online examination: No Answerbook required
- students may use a calculator

Feedback on assessment

Answers to problems sets will be marked and returned to students in a tutorial or seminar taking place the following week when students will have the opportunity to discuss it.

Solutions and cohort level feedback will be provided for the examination.

[Past exam papers for ST219](#)

Availability

Post-requisite modules

If you pass this module, you can take:

- EC338-15 Econometrics 2: Microeconometrics
- EC306-15 Econometrics 2: Time Series
- ST409-15 Medical Statistics with Advanced Topics
- ST332-15 Medical Statistics

Anti-requisite modules

If you take this module, you cannot also take:

- ST220-12 Introduction to Mathematical Statistics

Courses

This module is Core for:

- Year 2 of USTA-G302 Undergraduate Data Science
- Year 2 of USTA-G304 Undergraduate Data Science (MSci)
- Year 2 of USTA-G300 Undergraduate Master of Mathematics,Operational Research,Statistics and Economics
- Year 2 of USTA-G1G3 Undergraduate Mathematics and Statistics (BSc MMathStat)
- Year 2 of USTA-GG14 Undergraduate Mathematics and Statistics (BSc)
- Year 2 of USTA-Y602 Undergraduate Mathematics,Operational Research,Statistics and Economics

This module is Optional for:

- Year 3 of UMAA-GL11 Undergraduate Mathematics and Economics
- Year 4 of UECA-GL12 Undergraduate Mathematics and Economics (with Intercalated Year)

This module is Option list B for:

- Year 2 of UCSA-G4G1 Undergraduate Discrete Mathematics
- Year 2 of UCSA-G4G3 Undergraduate Discrete Mathematics