ST351-15 Linear Statistical Modelling (For Finalists)

26/27

Department
Statistics
Level
Undergraduate Level 3
Module leader
Jon Forster
Credit value
15
Module duration
10 weeks
Assessment
Multiple
Study location
University of Warwick main campus, Coventry

Description

Introductory description

This module builds from ideas introduced in Year 1 Statistical Laboratory and embeds them into the framework of linear models. Linear regression models are widely used in statistical practice and aim to explain or predict a continuous response variable using a collection of explanatory variables. Students will learn the theoretical background of such models, how to fit linear models to a given data set using R and how to interpret and evaluate the results.

Availability This module is only available to Year 3 students. Year 2 students must take ST240 Linear Statistical Modelling.

You **cannot** take this module if you have taken either ST231 Linear Statistical Modelling with R or ST240 Linear Statistical Modelling .

Pre-requisistes:

- ST120 Introduction to Probability and ST121 Statistics Laboratory, and either ST232/ST233 Introduction to Mathematical Statistics or ST352 Introduction to Mathematical Statistics (for Finalists).

Leads to

- ST332 Medical Statistics
- ST340 Programming for Data Science
- ST346 Generalised Linear Models for Regression and Classification.

Other third-year statistics modules.

Module web page

Module aims

1. Introduce the application of statistical modelling and statistical model exploration.
2. Use of R software and its use as a tool for statistical modelling, specifically for working with linear models in a variety of different scenarios.

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.

This module introduces the theory of normal linear models and their practical application in R.

1. Normal linear models: definition and model assumptions.
2. Estimators for normal linear models and their sampling distributions.
3. Diagnostics and model building.
4. Confidence intervals and t-tests for normal linear models.
5. F-tests and analysis of variance; model selection and diagnostics.
6. Variable selection.

Learning outcomes

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

- Define a (normal) linear model and describe its modelling assumptions;
- Use results from linear algebra and statistical distribution theory to derive the properties of estimators, test statistics and diagnostics for normal linear models;
- Compute confidence intervals and perform hypothesis tests for normal linear models;
- Fit, diagnostically check, improve and compare regression models in R;
- Interpret and critically evaluate various linear models;
- Communicate solutions to problems accurately with structured and coherent arguments.
- Describe how the linear model can be extended in at least one substantive area, for example for non-normal or dependent data and fit such models to data in R.

Indicative reading list

Reading lists can be found in Talis

Specific reading list for the module

Research element

Students complete guided exploration of data sets as part of the coursework which provides a foundation for applied statistics research in later years.

Interdisciplinary

While not explicitly interdisciplinary, students are exposed to dataset from a variety of application contexts.

Subject specific skills

Demonstrate facility with advanced mathematical and probabilistic methods.

Demonstrate knowledge of key mathematical and statistical concepts, both explicitly and by applying them to the solution of mathematical problems.

Select and apply appropriate mathematical and/or statistical techniques

Create structured and coherent arguments communicating them in written form.

Select and applyappropriate computational techniques in a statistical programming language (for example, R)to build and evaluate linear models.

Transferable skills

Problem solving skills: The module requires students to solve problems presenting their conclusions as logical and coherent arguments.

Written communication skills: Students complete written assessments that require precise and unambiguous communication in the manner and style expected in mathematical sciences.

Verbal communication skills: Students are encouraged to discuss and debate formative assessment and lecture material within small-group tutorials sessions.

Students can continually discuss specific aspects of the module with the module leader. This is facilitated by statistics staff office hours.

Team working and working effectively with others: Students are encouraged to discuss and debate formative assessment and lecture material within small-group tutorials sessions.

Professionalism: Students work autonomously by developing and sustain effective approaches to learning, including time-management, organisation, flexibility, creativity, collaboratively and intellectual integrity.

Study

Study time

Type	Required
Lectures	30 sessions of 1 hour (20%)
Seminars	5 sessions of 1 hour (3%)
Private study	83 hours (55%)
Assessment	32 hours (21%)
Total	150 hours

Private study description

Reviewing lecture material, working through exercises set in lectures and lecture notes, working through exercise sheets, supplementary reading, preparing for seminars and practicing R work, preparing for the exam.

Other activity description

Revision support.

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 D1

	Weighting	Study time	Eligible for self-certification
In term assessment	30%	30 hours	No
A set of exercises provided during the term. The exercises will require the application of problem-solving, inferential methods, reporting or coding to derive a justified outcome.			
Centrally-timetabled examination (On-campus)	70%	2 hours	No
Students are required to answer all questions in the relevant sections of the exam paper. The study time noted refers to the length of the exam in hours.			

	Weighting	Study time	Eligible for self-certification

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

Assessment group R1

	Weighting	Study time	Eligible for self-certification
In-person Examination - Resit	100%		No

Students are required to answer all questions in the relevant sections of the exam paper.

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

Feedback on assessment

Individual feedback will be provided on problem set by class tutors.

Solutions and cohort level feedback will be provided for the examination

Students are actively encouraged to make use of office hours to build up their understanding, and to view all their interactions with lecturers and class tutors as feedback.

Past exam papers for ST351

Availability

Anti-requisite modules

If you take this module, you cannot also take:

- ST231-10 Linear Statistical Modelling with R
- ST240-15 Linear Statistical Modelling

Courses

This module is Option list B for:

- Year 4 of UMAA-G105 Undergraduate Master of Mathematics (with Intercalated Year)
- Year 3 of UMAA-G100 Undergraduate Mathematics (BSc)

- UMAA-G103 Undergraduate Mathematics (MMath)
    - Year 3 of G100 Mathematics
    - Year 3 of G103 Mathematics (MMath)
- Year 4 of UMAA-G101 Undergraduate Mathematics with Intercalated Year