Course number	U-LAS11 10010 LE55		
Course title (and course title in English)	Mathematical Statistics-E2 Mathematical Statistics-E2	Instructor's name, job title, and department of affiliation	Research Institute for Mathematical Sciences Associate Professor,Croydon, David Alexander
Group	Natural Sciences	Field(Classification)	Data Science(Foundations)
Language of instruction	English	Old group	Group B
Number of credits	2		
Number of weekly time blocks	1	Class style	Lecture (Face-to-face course)
Year/semesters	2025・First semester		
Days and periods	Thu.1	Target year	Mainly 2nd year students
Eligible students	For science students		

[Overview and purpose of the course]

This course will develop the theory of statistical inference, which has applications across the natural and social sciences, and beyond. It will focus on the key topics of parameter estimation and hypothesis testing. As well as presenting the theoretical justification for various techniques covered, it will also be a goal to show how these can be applied in examples.

[Course objectives]

- To understand the basic concepts of, and mathematical justification for, point estimation and hypothesis testing
- To be able to apply key techniques of statistical inference in applications

[Course schedule and contents)]

The following indicates possible topics that will be covered and the approximate schedule, though the precise details may vary depending on the students ' proficiency level and background.

(1) Review of probability theory [3 weeks]
Outcomes and events, probability spaces, conditional probability, independence, random variables, probability mass functions, probability density functions, expectation and variance, multivariate distributions, common families of distributions

(2) Point estimates [5 weeks]
Parameterized statistical models, statistics and estimators, sampling distribution, bias, mean-squared error, maximum likelihood estimates (computation and properties), confidence intervals, point estimation for linear models

(3) Hypothesis testing [4 weeks]
Null and alternative hypotheses, likelihood ratio tests, methods of evaluating tests, goodness-of-fit tests, tests for comparing mean and variance of two samples, tests for independence, p-values

(4) Applications [2 weeks]
Example applications will be explored in exercise sheets covering the main aspects of the course, and the solutions of these will be discussed in class.

Total: 14 classes and 1 week for feedback.

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Mathematical Statistics-E2(2)

[Course requirements]

No statistical knowledge will be assumed. However, some basic calculus (e.g. finding the maximum of a function using differentiation) will be helpful.

[Evaluation methods and policy]

There will be 3 exercise sheets throughout the course, for which students will be expected to return work and present some of their answers in class. This will account for 30% of the final mark. The remaining 70% will be based on a final exam.

[Textbooks]

There will be no set textbook for the course, as the lectures will contain all the material needed for the homework and exam. However, students might find the books listed in the reference section useful as additional reading. (All of these references contain much more than will be covered in the course.)

[References, etc.]

（References, etc.）

Casella and Berger 『Statistical Inference』 （Duxbury, 2002）
McKean, Hogg and Craig 『Introduction to Mathematical Statistics』 （Pearson, 2020）
Rossi 『Mathematical Statistics: An Introduction to Likelihood Based Inference』 （Wiley, 2018）

[Study outside of class (preparation and review)]

The lecturer will present the basic concepts in class, upon which exercise sheets will be set. The time required to complete these exercise sheets will vary from assignment to assignment and student to student, but the lecturer estimates that they will take 4-5 hours each.

[Other information (office hours, etc.)]