

# ST229-10 Probability for Mathematical Statistics

**23/24**

**Department**

Statistics

**Level**

Undergraduate Level 2

**Module leader**

Paul Chleboun

**Credit value**

10

**Module duration**

10 weeks

**Assessment**

Multiple

**Study location**

University of Warwick main campus, Coventry

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## Description

### Introductory description

This module introduces core concepts in Probability and Statistics that are needed for further modules in both Probability and Statistics.

Pre-requisites: ST118 Probability 1, ST119 Probability 2, and ST117 Introduction to Statistical Modelling, or equivalents.

This module is core for students with their home department in Statistics. It is not available to other students, for whom ST232/ST233 (Introduction to Mathematical Statistics) is provided as an alternative.

This module is a pre-requisite for ST230 Mathematical Statistics and a number of ST3 and ST4 modules.

[Module web page](#)

### Module aims

The first-year modules “Probability 1 and 2” and “Introduction to Statistical Modelling” introduce,

respectively, a solid foundation in the mathematical formalisation of probability, and the fundamentals of statistical modelling and statistical inference. This module provides a bridge between these foundational topics, and the more advanced modules in year 3 and 4. Most of these advanced topics require the use of probability distributions over more than one random variable. This module focuses on the mathematical properties of such distributions, and the consequences of these properties in the context of statistical modelling and inference.

## 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 systematic study of the theory of mathematical statistics.

1. Statistical motivation for studying sample averages and joint distributions.
2. Definitions of joint, marginal and conditional distributions (discrete and continuous cases). Independent random variables. Conditional expectation and properties. Conditional variance and properties.
3. Multivariate Normal/Gaussian distribution, its properties and distributions related to it. Simulating Gaussian distributions.
4. Properties of finite sums and averages of random variables, expectation and variance of sample means, focusing on the Normal/ Gaussian distribution case.
5. Weak law of large numbers and the central limit theorem.

## Learning outcomes

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

- Derive properties of finite and infinite sums and averages of random variables, including the central limit theorem. Describe its significance in statistics.
- Demonstrate knowledge of joint and conditional probability distributions, conditional expectation and conditional variance.
- State/derive and use the properties of multivariate Normal/Gaussian distribution and distributions related to Normal/Gaussian distribution.
- Communicate solutions to problems accurately with structured and coherent arguments.

## Indicative reading list

Jim Pitman, Probability. 1999. Springer-Verlag New York Inc. ISBN: 9780387979748. (Available online and in print in the Main Campus Library.)

Allan Gut. An intermediate course in probability. 2009. Springer. ISBN: 9781441901620. Available online and in print in the Main Campus Library.)

[View reading list on Talis Aspire](#)

## Subject specific skills

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.

## 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 staff office hours.

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

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## Study

### Study time

Type	Required
Lectures	20 sessions of 1 hour (20%)
Seminars	4 sessions of 1 hour (4%)
Private study	66 hours (66%)
Assessment	10 hours (10%)
Total	100 hours

### Private study description

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

### Costs

No further costs have been identified for this module.

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## Assessment

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

### Assessment group D

	<b>Weighting</b>	<b>Study time</b>	<b>Eligible for self-certification</b>
Problem set 1	2%	2 hours	No
A problem sheet that include problem solving and calculations. Problem sheets will be set at fortnightly intervals. The problem sheets 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 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.			
Problem set 2	3%	2 hours	No
A problem sheet that include problem solving and calculations. Problem sheets will be set at fortnightly intervals. The problem sheets 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 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.			
Problem set 3	2%	2 hours	No
A problem sheet that include problem solving and calculations. Problem sheets will be set at fortnightly intervals. The problem sheets 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 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.			
Problem set 4	3%	2 hours	No
A problem sheet that include problem solving and calculations. Problem sheets will be set at fortnightly intervals. The problem sheets 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 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.			
Probability for Mathematical Statistics examination	90%	2 hours	No

You will be required to answer all questions on this examination paper.

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**Weighting****Study time****Eligible for self-certification**

- Answerbook Pink (12 page)

**Assessment group R**

	<b>Weighting</b>	<b>Study time</b>	<b>Eligible for self-certification</b>
In-person Examination - Resit	100%		No

You will be required to answer all questions on this examination paper.

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- Answerbook Pink (12 page)

**Feedback on assessment**

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

Cohort-level feedback will be available on the exam.

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 ST229](#)

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**Availability****Courses**

This module is Core for:

- Year 2 of USTA-G302 Undergraduate Data Science
- Year 2 of USTA-GG14 Undergraduate Mathematics and Statistics (BSc)
- Year 2 of USTA-Y602 Undergraduate Mathematics, Operational Research, Statistics and Economics