

# ST318-15 Probability Theory

24/25

**Department**

Statistics

**Level**

Undergraduate Level 3

**Module leader**

Martyn Parker

**Credit value**

15

**Module duration**

10 weeks

**Assessment**

Multiple

**Study location**

University of Warwick main campus, Coventry

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## Description

### Introductory description

This module runs is available for students on a course where it is a listed option and as an Unusual Option to students who have completed one of the prerequisite modules.

**Pre-requisite(s):** MA359 Measure Theory, or ST342 Mathematics of Random Events/ST350 Measure Theory for Probability..

**Leads to:** ST401 Stochastic Methods in Finance, ST402 Risk Theory, ST403 Brownian Motion, ST411 Dynamic Stochastic Control

[Module web page](#)

### Module aims

This course aims to give the student a rigorous presentation of some fundamental results in measure theoretic probability and an introduction to the theory of discrete time martingales. In so doing it aims to provide a firm basis for advanced work on probability and its applications.

### 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.

- Independence and zero-one laws
- Modes of convergence for sequences of random variables
- Limit theorems: law of large numbers (LLN) and central limit theorems (CLT)
- Conditioning and discrete time martingales

## Learning outcomes

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

- understand the different modes of convergence for sequences of random and the relationship between these different modes;
- state and prove the Central Limit Theorem via the method of characteristic functions and understand how this result can be applied;
- understand some basic results on discrete -time martingales, including the martingale convergence theorem and optional stopping theorem, and show how these results can be used to obtain various characteristics of simple random walks.
- understand the ideas relating to independence and zero-one laws and be able to apply these ideas in simple contexts;

## Indicative reading list

[View reading list on Talis Aspire](#)

## Subject specific skills

- Demonstrate facility with rigorous probabilistic methods.
- Evaluate, select and apply appropriate mathematical and/or probabilist techniques.
- Demonstrate knowledge of and facility with formal probability concepts, both explicitly and by applying them to the solution of mathematical problems.
- Create structured and coherent arguments communicating them in written form.
- Construct logical mathematical arguments with clear identification of assumptions and conclusions.
- Reason critically, carefully, and logically and derive (prove) mathematical results.

## Transferable skills

- Problem solving: Use rational and logical reasoning to deduce appropriate and well-reasoned conclusions. Retain an open mind, optimistic of finding solutions, thinking laterally and creatively to look beyond the obvious. Know how to learn from failure.
- Self awareness: Reflect on learning, seeking feedback on and evaluating personal practices, strengths and opportunities for personal growth.
- Communication: Present arguments, knowledge and ideas, in a range of formats.

- Professionalism: Prepared to operate autonomously. Aware of how to be efficient and resilient. Manage priorities and time. Self-motivated, setting and achieving goals, prioritising tasks.
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## Study

### Study time

Type	Required	Optional
Lectures	30 sessions of 1 hour (20%)	2 sessions of 1 hour
Tutorials	5 sessions of 1 hour (3%)	
Private study	115 hours (77%)	
Total	150 hours	

### Private study description

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

### Costs

No further costs have been identified for this module.

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## Assessment

You must pass all assessment components to pass the module.

Students can register for this module without taking any assessment.

### Assessment group B5

	Weighting	Study time
In-person Examination	100%	

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

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- Answerbook Pink (12 page)
- Students may use a calculator

## Assessment group R4

	Weighting	Study time
In-person Examination - Resit	100%	

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

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- Answerbook Pink (12 page)
- Students may use a calculator

## Feedback on assessment

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

[Past exam papers for ST318](#)

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## Availability

### Courses

This module is Core for:

- USTA-G300 Undergraduate Master of Mathematics, Operational Research, Statistics and Economics
  - Year 3 of G30A Master of Maths, Op.Res, Stats & Economics (Actuarial and Financial Mathematics Stream)
  - Year 3 of G30D Master of Maths, Op.Res, Stats & Economics (Statistics with Mathematics Stream)
- USTA-G301 Undergraduate Master of Mathematics, Operational Research, Statistics and Economics (with Intercalated)
  - Year 3 of G30E Master of Maths, Op.Res, Stats & Economics (Actuarial and Financial Mathematics Stream) Int
  - Year 3 of G30H Master of Maths, Op.Res, Stats & Economics (Statistics with Mathematics Stream)
  - Year 4 of G30E Master of Maths, Op.Res, Stats & Economics (Actuarial and Financial Mathematics Stream) Int
  - Year 4 of G30H Master of Maths, Op.Res, Stats & Economics (Statistics with Mathematics Stream)

This module is Optional for:

- UCSA-G4G1 Undergraduate Discrete Mathematics

- Year 3 of G4G1 Discrete Mathematics
- Year 3 of G4G1 Discrete Mathematics
- Year 3 of UCSA-G4G3 Undergraduate Discrete Mathematics
- Year 4 of UCSA-G4G4 Undergraduate Discrete Mathematics (with Intercalated Year)
- Year 4 of UCSA-G4G2 Undergraduate Discrete Mathematics with Intercalated Year
- USTA-G300 Undergraduate Master of Mathematics, Operational Research, Statistics and Economics
  - Year 3 of G300 Mathematics, Operational Research, Statistics and Economics
  - Year 4 of G300 Mathematics, Operational Research, Statistics and Economics

This module is Core option list A for:

- Year 3 of USTA-G1G3 Undergraduate Mathematics and Statistics (BSc MMathStat)
- Year 4 of USTA-G1G4 Undergraduate Mathematics and Statistics (BSc MMathStat) (with Intercalated Year)

This module is Option list A for:

- UMAA-G105 Undergraduate Master of Mathematics (with Intercalated Year)
  - Year 3 of G105 Mathematics (MMath) with Intercalated Year
  - Year 4 of G105 Mathematics (MMath) with Intercalated Year
  - Year 5 of G105 Mathematics (MMath) with Intercalated Year
- UMAA-G100 Undergraduate Mathematics (BSc)
  - Year 3 of G100 Mathematics
  - Year 3 of G100 Mathematics
  - Year 3 of G100 Mathematics
- UMAA-G103 Undergraduate Mathematics (MMath)
  - Year 3 of G100 Mathematics
  - Year 3 of G103 Mathematics (MMath)
  - Year 3 of G103 Mathematics (MMath)
  - Year 4 of G103 Mathematics (MMath)
  - Year 4 of G103 Mathematics (MMath)
- UMAA-G106 Undergraduate Mathematics (MMath) with Study in Europe
  - Year 3 of G106 Mathematics (MMath) with Study in Europe
  - Year 4 of G106 Mathematics (MMath) with Study in Europe
- USTA-G1G3 Undergraduate Mathematics and Statistics (BSc MMathStat)
  - Year 3 of G1G3 Mathematics and Statistics (BSc MMathStat)
  - Year 4 of G1G3 Mathematics and Statistics (BSc MMathStat)
- USTA-G1G4 Undergraduate Mathematics and Statistics (BSc MMathStat) (with Intercalated Year)
  - Year 4 of G1G4 Mathematics and Statistics (BSc MMathStat) (with Intercalated Year)
  - Year 5 of G1G4 Mathematics and Statistics (BSc MMathStat) (with Intercalated Year)
- USTA-GG14 Undergraduate Mathematics and Statistics (BSc)
  - Year 3 of GG14 Mathematics and Statistics
  - Year 3 of GG14 Mathematics and Statistics
- Year 4 of USTA-GG17 Undergraduate Mathematics and Statistics (with Intercalated Year)
- Year 4 of UMAA-G101 Undergraduate Mathematics with Intercalated Year

- USTA-Y602 Undergraduate Mathematics,Operational Research,Statistics and Economics
  - Year 3 of Y602 Mathematics,Operational Research,Stats,Economics
  - Year 3 of Y602 Mathematics,Operational Research,Stats,Economics
- Year 4 of USTA-Y603 Undergraduate Mathematics,Operational Research,Statistics,Economics (with Intercalated Year)

This module is Option list B for:

- Year 1 of TMAA-G1PE Master of Advanced Study in Mathematical Sciences

This module is Option list C for:

- USTA-G302 Undergraduate Data Science
  - Year 3 of G302 Data Science
  - Year 3 of G302 Data Science
- Year 3 of USTA-G304 Undergraduate Data Science (MSci)
- Year 4 of USTA-G303 Undergraduate Data Science (with Intercalated Year)
- Year 3 of USTA-G300 Undergraduate Master of Mathematics,Operational Research,Statistics and Economics
- USTA-G301 Undergraduate Master of Mathematics,Operational Research,Statistics and Economics (with Intercalated
  - Year 3 of G30F Master of Maths, Op.Res, Stats & Economics (Econometrics and Mathematical Economics Stream) Int
  - Year 4 of G30F Master of Maths, Op.Res, Stats & Economics (Econometrics and Mathematical Economics Stream) Int

This module is Option list D for:

- USTA-G300 Undergraduate Master of Mathematics,Operational Research,Statistics and Economics
  - Year 4 of G30C Master of Maths, Op.Res, Stats & Economics (Operational Research and Statistics Stream)
  - Year 4 of G30C Master of Maths, Op.Res, Stats & Economics (Operational Research and Statistics Stream)
- Year 5 of USTA-G301 Undergraduate Master of Mathematics,Operational Research,Statistics and Economics (with Intercalated