ST318-15 Probability Theory

26/27

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

Description

Introductory description

This module is available for students on a course where it is a listed option and as an Unusual Option to students who have the pre-requisite knowledge as covered in the pre-requisite modules.

Pre-requisite(s): MA359 Measure Theory, or ST350 Measure Theory for Probability.

Leads to: ST401 Stochastic Methods in Finance, ST348 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

Specific reading list for the module

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.

Study

Study time

Type	Required
Lectures	30 sessions of 1 hour (20%)
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.

Other activity description

Revision support.

Costs

No further costs have been identified for this module.

Assessment

You must pass all assessment components to pass the module.

Students can register for this module without taking any assessment.

Assessment group B7

	Weighting	Study time	Eligible for self-certification
Centrally-timetabled examination (On-campus)	100%		No

	Weighting	Study time	Eligible for self-certification

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

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

Assessment group R6

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

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

- 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

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)

This module is Core optional for:

- USTA-GG14 Undergraduate Mathematics and Statistics (BSc)

    - Year 3 of GG14 Mathematics and Statistics
    - Year 3 of GG14 Mathematics and Statistics
- Year 3 of USTA-GG17 Undergraduate Mathematics and Statistics (with Intercalated Year)

This module is Optional 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 3 of USTA-G305 Undergraduate Data Science (MSci) (with Intercalated Year)
- Year 3 of USTA-G303 Undergraduate Data Science (with Intercalated Year)
- UCSA-G4G1 Undergraduate Discrete Mathematics
    - Year 3 of G4G1 Discrete Mathematics
    - Year 3 of G4G1 Discrete Mathematics
- UCSA-G4G3 Undergraduate Discrete Mathematics
    - Year 3 of G4G1 Discrete Mathematics
    - Year 3 of G4G3 Discrete Mathematics
- Year 3 of UCSA-G4G4 Undergraduate Discrete Mathematics (with Intercalated Year)
- Year 4 of UCSA-G4G2 Undergraduate Discrete Mathematics with Intercalated Year
- UMAA-G105 Undergraduate Master of Mathematics (with Intercalated Year)
    - Year 3 of G105 Mathematics (MMath) with Intercalated Year
    - Year 5 of G105 Mathematics (MMath) with Intercalated Year
- USTA-G300 Undergraduate Master of Mathematics,Operational Research,Statistics and Economics
    - Year 3 of G30B Master of Maths, Op.Res, Stats & Economics (Econometrics and Mathematical Economics Stream)
    - Year 3 of G30C Master of Maths, Op.Res, Stats & Economics (Operational Research and Statistics Stream)
    - Year 3 of G30C Master of Maths, Op.Res, Stats & Economics (Operational Research and Statistics Stream)
    - Year 4 of G30B Master of Maths, Op.Res, Stats & Economics (Econometrics and Mathematical Economics Stream)
    - 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)
- 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 G100 Mathematics
    - Year 3 of G103 Mathematics (MMath)
    - Year 3 of G103 Mathematics (MMath)
    - Year 4 of G100 Mathematics

    - 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 5 of G106 Mathematics (MMath) with Study in Europe
- USTA-GG14 Undergraduate Mathematics and Statistics (BSc)
    - Year 4 of GG14 Mathematics and Statistics
    - Year 4 of GG14 Mathematics and Statistics
- Year 4 of USTA-GG17 Undergraduate Mathematics and Statistics (with Intercalated Year)
- Year 3 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 3 of USTA-Y603 Undergraduate Mathematics,Operational Research,Statistics,Economics (with Intercalated Year)