

ST964-15 Introduction to Advanced Probability

27/28

Department

Statistics

Level

Taught Postgraduate Level

Module leader

Larbi Alili

Credit value

15

Module duration

10 weeks

Assessment

100% exam

Study location

University of Warwick main campus, Coventry

Description

Introductory description

This module provides a strong foundation to the measure theory underpinning probability and fundamental results in measure theoretic probability.

It covers probability/applied theory, suitable for areas such as analysis, statistical finance, and theoretical statistics.

This module is not available for undergraduate students.

[Module web page](#)

Module aims

This course aims to give a rigorous presentation of measure theoretic probability and provides 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.

This module will cover measure-theoretic probability and its application. Specifically:

Algebras, sigma-algebras and measures. Algebra and contents, sigma-algebra and measures, pi-systems, examples of random events and measurable sets.

Lebesgue integration. Simple functions, standard representations, measurable functions, Lebesgue integral, properties of integrals, integration of Borel functions, Fatou's lemma, monotone convergence, dominated convergence theorem.

Product measures. Sections, product sigma-algebras, product measures, Fubini theorem.

Independence and conditional expectation. Independence of sigma-algebras, independence of random variables, conditional expectation with respect to a sigma-algebra.

Convergence and modes of convergence. modes of convergence of random variables, weak and strong laws of large numbers and central limit theorems (CLT).

Learning outcomes

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

- demonstrate a rigorous understanding of measure-theoretic probability, including probability measures and spaces, expectation and independence with respect to sigma-algebras;
- construct and analyse probabilistic models for random experiments, applying probability inequalities and related techniques to investigate stochastic phenomena;
- demonstrate creative problem-solving in the application of major probabilistic limit theorems to sequences of random variables;
- understand and apply discrete-time martingale theory to evaluate probability quantities;
- explain and apply selected key concepts and methods in advanced probability theory.

Indicative reading list

[Reading lists can be found in Talis](#)

Subject specific skills

- Demonstrate facility with rigorous probabilistic methods.
- Evaluate, select and apply appropriate mathematical and/or probabilistic 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
Lectures	30 sessions of 1 hour (20%)
Tutorials	5 sessions of 1 hour (3%)
Private study	113 hours (75%)
Assessment	2 hours (1%)
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 equivalent to approximately 2 hours.

Costs

No further costs have been identified for this module.

Assessment

You must pass all assessment components to pass the module.

Assessment group B2

Assessment component	Weighting	Study time	Eligible for self-certification
Centrally-timetabled examination (On-campus)	100%	2 hours	No

The examination paper will contain questions that cover the content of the module.
The study time noted refers to the length of the exam in hours.

- Answerbook Pink (12 page)

Reassessment component is the same

Feedback on assessment

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

[Past exam papers for ST964](#)

Availability

Courses

This module is Core for:

- TSTA-G4P1 Postgraduate Taught Statistics
 - Year 1 of G40C Statistics with Finance (Taught)
 - Year 1 of G40A Statistics with Probability (Taught)

This module is Optional for:

- TSTA-G4P1 Postgraduate Taught Statistics
 - Year 1 of G4P1 Statistics (Taught)
 - Year 1 of G40B Statistics with Data Science (Taught)
 - Year 1 of G40B Statistics with Data Science (Taught)
 - Year 1 of G40C Statistics with Finance (Taught)
 - Year 1 of G40A Statistics with Probability (Taught)