

# ST964-15 Introduction to Advanced Probability

**26/27**

**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:

- Evaluate measure-theoretic techniques and apply them to determine probabilities of events.
- Rigorously formulate and apply formal notions of probability, including computing probability, statistical independence and expectation, to a range of situations.
- Evaluate information to build probability models for random experiments.

## 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.
- 

## Study

### Study time

Type	Required	Optional
Lectures	30 sessions of 1 hour (20%)	
Tutorials	(0%)	5 sessions of 1 hour
Private study	80 hours (53%)	
Assessment	40 hours (27%)	
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 B1

	<b>Weighting</b>	<b>Study time</b>	<b>Eligible for self-certification</b>
--	------------------	-------------------	--

**Assessment component**

Centrally-timetabled examination (On-campus)

100%

40 hours

No

The examination paper will contain questions that cover the entire content of the module.

---

- 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:

- Year 1 of TSTA-G4P1 Postgraduate Taught Statistics
- Year 4 of USTA-G300 Undergraduate Master of Mathematics, Operational Research, Statistics and Economics

This module is Option list B for:

- Year 1 of TSTA-G4P1 Postgraduate Taught Statistics
- Year 4 of USTA-G304 Undergraduate Data Science (MSci)

This module is Option list F for:

- Year 4 of USTA-G300 Undergraduate Master of Mathematics, Operational

Research, Statistics and Economics