

# ST115-12 Introduction to Probability

**20/21**

**Department**

Statistics

**Level**

Undergraduate Level 1

**Module leader**

Zorana Lazic

**Credit value**

12

**Module duration**

10 weeks

**Assessment**

Multiple

**Study location**

University of Warwick main campus, Coventry

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## Description

### Introductory description

The module runs in Term 2 and provides elementary introduction to the theory of probability. The topics include axioms of probability, combinatorics, independent events, conditional probability, random variables, discrete and continuous probability distributions, expectation and variance, joint probability distributions, independence of random variables, sum of independent random variables, covariance and correlation.

This module is core for students with their home department in Statistics and is not available to students from other departments. Students from other departments should consider ST111 Probability A and ST112 Probability B instead.

[Module web page](#)

### Module aims

To lay the foundation for all subsequent modules in probability and statistics, by introducing the key notions of mathematical probability and developing the techniques for working with probability distributions and random variables.

### 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.

1. Experiments with random outcomes: the notions of random experiment, sample space and events. Operations with sets and their interpretation.
2. Axioms of probability. Properties of a probability measure: Boole's inequality, continuity of a probability measure, inclusion-exclusion formula.
3. Finite sample spaces with equally likely outcomes.
4. Independence of events. Conditional probabilities. Bayes theorem.
5. The notion of a random variable. Examples in both discrete and continuous settings. Indicator random variables.
6. The notion of the distribution of a random variable. Probability mass functions and density functions. Cumulative distribution functions.
7. Expectation of random variables. Properties of expectation.
8. Mean and variance of distributions. Chebyshev's inequality.
9. Independence of random variables. Joint distributions. Covariance and correlation. Cauchy-Schwartz inequality.
10. Addition of independent random variables: convolutions. Moment generating function and use to compute convolutions.
11. Important families of distributions: Binomial, Poisson, negative Binomial, exponential, Gamma and Gaussian. Their properties, genesis and inter-relationships.

## Learning outcomes

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

- Understand key notions of mathematical probability including random variables and their distributions
- Appreciate the role of randomness in mathematical modelling of real world situations.
- Use appropriate mathematical techniques to calculate the probabilities of events, and the expectations of random variables

## Indicative reading list

Ross, A first course in probability, Prentice Hall, 1994

Pitman, Probability, Springer texts in Statistics

Suhov and Kelbert, Probability and Statistics by Example: Basic Probability and Statistics.

[View reading list on Talis Aspire](#)

## Subject specific skills

Mathematical, analytical, problem solving

## Transferable skills

Analytical, problem solving, investigative skills, communication, good working habits.

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# Study

## Study time

Type	Required	Optional
Lectures	30 sessions of 1 hour (25%)	2 sessions of 1 hour
Seminars	8 sessions of 1 hour (7%)	
Tutorials	5 sessions of 1 hour (4%)	
Private study	53 hours (44%)	
Assessment	24 hours (20%)	
Total	120 hours	

## Private study description

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

Students can register for this module without taking any assessment.

## Assessment group D1

	Weighting	Study time
Written assignment	10%	12 hours
The assignment 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. You will write your answers on paper and submit as instructed.		
Multiple Choice Quizzes	10%	12 hours
A number of multiple choice quizzes which will take place during the term that the module is delivered.		
2 hour examination (Summer)	80%	

## Weighting

## Study time

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

Calculators are NOT permitted in this examination.

~Platforms - Moodle

## Assessment group R

### Weighting

### Study time

2 hour examination (September)

100%

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

Calculators are NOT permitted in this examination.

~Platforms - Moodle

## Feedback on assessment

Answers to problems sets will be marked and returned to students in a tutorial or seminar taking place the following week when students will have the opportunity to discuss it.

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

[Past exam papers for ST115](#)

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## Availability

## Courses

This module is Core for:

- Year 1 of USTA-G302 Undergraduate Data Science
- Year 1 of USTA-G304 Undergraduate Data Science (MSci)
- Year 1 of USTA-G300 Undergraduate Master of Mathematics, Operational Research, Statistics and Economics
- Year 1 of USTA-G1G3 Undergraduate Mathematics and Statistics (BSc MMathStat)
- Year 1 of USTA-GG14 Undergraduate Mathematics and Statistics (BSc)
- Year 1 of USTA-Y602 Undergraduate Mathematics, Operational Research, Statistics and Economics