CS275-15 Probability and Statistics

24/25

Department
> Computer Science

Level
> Undergraduate Level 2

Module leader
> Florin Ciucu

Credit value
> 15

Module duration
> 10 weeks

Assessment
> Multiple

Study location
> University of Warwick main campus, Coventry

Description

Introductory description

The module provides a systematic and fully fledged introduction into Probability and Statistics topics, which are particularly relevant for Computer Scientists.

[Module web page](#)

Module aims

This module aims to provide the necessary background into Probability and Statistics which is essential for many Year 3 and 4 modules.

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.

Foundations of Probability based on Measurable Sets
Conditional Probability (Chain Rule, Independence, Law of Total Probability, Bayes' Rule)
Discrete Random Variables (Moments, Sums, Independence, Common Examples)
Continuous Random Variables (Density Functions, Independence, Sums, Moments, Common

Examples)
Conditional Distributions and Expectations
Multiple Random Variables (Joint and Marginal Distributions, Covariance and Correlation)
Law of Large Numbers, Central Limit Theorem
Markov Chains (Chapman-Kolmogorov Equations, Classification of States, Classification of Chains, Stationarity Distribution, Limit Theorems)
Poisson Process
Random Samples (Generating from PDFs)
Frequentist vs Bayesian Statistics
Estimation (MLE, MAP)
Confidence and Prediction Intervals
Hypothesis Testing

Learning outcomes

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

- Understanding basic concepts in Probability: (conditional) probability, discrete and continuous random variables along their multivariate extensions, densities and distribution functions along with the concept of independence and the computation of moments, elementary Laws of Large Numbers and the Central Limit Theorem
- Understanding basic concepts in Stochastic Processes: the Poisson process and Markov chains
- Understanding the basic concepts in Statistics: the Frequentist and Bayesian approaches, Estimation, and Hypothesis Testing
- Demonstrating the ability to formalize simple systems in terms of Probability and Statistics models
- Solving elementary problems and communicating their solutions in a rigorous manner.

Indicative reading list

Mor Harchol-Balter, Introduction to Probability for Computing, Cambridge University Press 2023 (Available online and in print in the Main Campus Library)

Larry Wasserman, All of Statistics: A Concise Course in Statistical Inference, Springer 2004 (Available online and in print in the Main Campus Library)

[View reading list on Talis Aspire](#)

Subject specific skills

Achieving a thorough understanding of basic yet fundamental concepts in Probability and Statistics.

Demonstrating the ability to formalize simple systems in terms of Probability and Statistics models.

Developing the ability to solve Probability and Statistics simple problems in a rigorous manner.

Transferable skills

Enhance the students' ability for problem solving skills involving mathematical problems.

Enhance the students' ability to develop abstract/mathematical models for real-world systems.

Written and verbal communication skills: the ability to reason about Mathematical models and problems in a rigorous and coherent manner. This will be facilitated through assessed works, class engagement, and office hours.

Study

Study time

Type	Required
Lectures	30 sessions of 1 hour (20%)
Seminars	9 sessions of 1 hour (6%)
Private study	96 hours (64%)
Assessment	15 hours (10%)
Total	150 hours

Private study description

Revising the lectures material.

Working not only on the assessed works but also on additional problems from the main textbook.

Exam revision .

Costs

No further costs have been identified for this module.

Assessment

You do not need to pass all assessment components to pass the module.

Assessment group D

	Weighting	Study time	Eligible for self-certification
Problem Set 1	5%	3 hours	Yes (extension)

	Weighting	Study time	Eligible for self-certification

Summative problem sheet. This assessment is eligible for self-certification (extension).

| Problem Set 2 | 5% | 3 hours | Yes (extension) |

Summative problem sheet. This assessment is eligible for self-certification (extension).

| Problem Set 3 | 5% | 3 hours | Yes (extension) |

Summative problem sheet. This assessment is eligible for self-certification (extension).

| Problem Set 4 | 5% | 3 hours | Yes (extension) |

Summative problem sheet. This assessment is eligible for self-certification (extension).

| Problem Set 5 | 5% | 3 hours | Yes (extension) |

Summative problem sheet. This assessment is eligible for self-certification (extension).

| Quizzes | 5% | | No |

A number N (about 15) of multiple-choice-answer type of short quizzes will be given during the lectures. Students are expected to submit their answers via MS Forms using either their laptops or smart phones/devices; in the exceptional circumstances when no such devices are available, handing in the answers on a piece of paper would be acceptable. Where a class/quiz is missed, a mark of 0 for that quiz will be given. The best N-5 scores will count towards the grade of the assessment (to account for situations when students may miss some of the classes or may want to skip some quizzes).

| In-person Examination | 70% | | No |

- Answerbook Green (8 page)

Assessment group R

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

Feedback on assessment

Feedback to the problem sheets will be provided in the the Seminars.

[Past exam papers for CS275](#)

Availability

Courses

This module is Optional for:

- Year 2 of UCSA-I1N1 Undergraduate Computer Science with Business Studies

This module is Option list A for:

- Year 2 of UCSA-G500 Undergraduate Computer Science
- UCSA-G503 Undergraduate Computer Science MEng
  - Year 2 of G500 Computer Science
  - Year 2 of G503 Computer Science MEng