ST202-12 Stochastic Processes

20/21

Department
Statistics
Level
Undergraduate Level 2
Module leader
Nicholas Tawn
Credit value
12
Module duration
10 weeks
Assessment
Multiple
Study location
University of Warwick main campus, Coventry

Description

Introductory description

This modules runs in Term 2.

This module is core for students with their home department in Statistics.
It is available as an option or unusual option for other students.

Pre-requisites:
Statistics Students: ST115 Introduction to Probability AND MA137 Mathematical Analysis
Non-Statistics Students: ST111 Probability A AND ST112 Probability B AND (MA131 Analysis I OR MA137 Mathematical Analysis)

Leads to: ST333 Applied Stochastic Processes and ST406 Applied Stochastic Processes with Advanced Topics.

Module web page

Module aims

Loosely speaking, a stochastic or random process is any measurable phenomenon which develops randomly in time. Only the simplest models will be considered in this course, namely those where the process moves by a sequence of jumps in discrete time steps. We will discuss:

Markov chains, which use the idea of conditional probability to provide a flexible and widely applicable family of random processes; random walks, which serve as fundamental building blocks for constructing other processes as well as being important in their own right; and renewal theory, which studies processes which occasionally "begin all over again." Such processes are common tools in economics, biology, psychology and operations research, so they are very useful as well as attractive and interesting theories.

The aims of this module are to introduce the idea of a stochastic process, and to show how simple probability and matrix theory can be used to build this notion into a beautiful and useful piece of applied mathematics.

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. Brief review of fundamental probability notions.
2. Introduction to Markov processes (Definitions, Chapman-Kolmogorov equations, notions of recurrence, transience, positive recurrence, transition probability matrices,
3. Long-run behaviour of Markov Chains, (equilibirum distributions, convergence to equilibrium)
4. Some applications.
5. Discussion of extensions to continuous settings and if time permits to non-Markov settings.

Learning outcomes

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

- Understand the notion of a Markov chain, and how simple ideas of conditional probability and matrices can be used to give a thorough and effective account of discrete-time Markov chains.
- Understand notions of long-time behaviour including transience, recurrence, and equilibrium.
- Be able to apply these ideas to answer basic questions in several applied situations including genetics, branching processes and random walks.

Indicative reading list

S.M. Ross, Introduction to Probability Models
G.R. Grimmett and D.R. Stirzaker, Probability and Random Processes
P.W. Jones and P. Smith, Stochastic Processes
J.R. Norris, Markov Chains

View reading list on Talis Aspire

Subject specific skills

TBC

Transferable skills

TBC

Study

Study time

Type	Required	Optional
Lectures	30 sessions of 1 hour (25%)	2 sessions of 1 hour
Tutorials	4 sessions of 1 hour (3%)	
Private study	62 hours (52%)	
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.

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 D2

	Weighting	Study time	Eligible for self-certification
Multiple Choice Quizzes	10%	12 hours	Yes (waive)
A number of multiple choice quizzes which will take place during the term that the module is delivered.			
Written assignment	10%	12 hours	Yes (extension)
The assignment will contain a number of questions for which solutions and / or written responses			

	Weighting	Study time	Eligible for self-certification

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 to the Statistics Support Office.

Online Examination	80%		No

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

~Platforms - Moodle

- Answerbook Pink (12 page)
- Graph paper
- Cambridge Statistical Tables (blue)

Assessment group R

	Weighting	Study time	Eligible for self-certification
Online 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.

~Platforms - Moodle

Feedback on assessment

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

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

Past exam papers for ST202

Availability

Courses

This module is Core for:

- Year 2 of USTA-G302 Undergraduate Data Science
- Year 2 of USTA-G304 Undergraduate Data Science (MSci)

- Year 2 of USTA-G300 Undergraduate Master of Mathematics,Operational Research,Statistics and Economics
- Year 2 of USTA-G1G3 Undergraduate Mathematics and Statistics (BSc MMathStat)
- Year 2 of USTA-GG14 Undergraduate Mathematics and Statistics (BSc)
- Year 2 of USTA-Y602 Undergraduate Mathematics,Operational Research,Statistics and Economics

This module is Option list A for:

- Year 2 of UCSA-G4G1 Undergraduate Discrete Mathematics
- Year 2 of UCSA-G4G3 Undergraduate Discrete Mathematics
- Year 2 of UMAA-G105 Undergraduate Master of Mathematics (with Intercalated Year)
- Year 2 of UMAA-G100 Undergraduate Mathematics (BSc)
- UMAA-G103 Undergraduate Mathematics (MMath)
    - Year 2 of G100 Mathematics
    - Year 2 of G103 Mathematics (MMath)
- Year 2 of UMAA-G106 Undergraduate Mathematics (MMath) with Study in Europe
- Year 2 of UMAA-G1NC Undergraduate Mathematics and Business Studies
- Year 2 of UMAA-G1N2 Undergraduate Mathematics and Business Studies (with Intercalated Year)
- Year 2 of UMAA-GL11 Undergraduate Mathematics and Economics
- Year 2 of UECA-GL12 Undergraduate Mathematics and Economics (with Intercalated Year)
- Year 2 of UMAA-G101 Undergraduate Mathematics with Intercalated Year