

# MA930-15 Data Analysis and Machine Learning

**23/24**

**Department**

Warwick Mathematics Institute

**Level**

Taught Postgraduate Level

**Module leader**

Robin Thompson

**Credit value**

15

**Module duration**

5 weeks

**Assessment**

20% coursework, 80% exam

**Study location**

University of Warwick main campus, Coventry

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## Description

### Introductory description

N/A.

[Module web page](#)

### Module aims

This is a core module for the MSc in Mathematics of Systems. The main aims are to provide the students with a broad knowledge of modern techniques of exploratory data analysis, time series modelling and forecasting, and a short introduction to machine learning.

### 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.

Basic probability: distributions, characteristic functions

Basic statistics: sample mean and variance, law of large numbers and central-limit theorem

Frequentist statistics: point estimation, confidence intervals, type-I and II errors, hypothesis tests

Bayesian statistics: likelihood, maximum likelihood, Bayes theorem, conjugate priors, credible intervals

Time-series analysis: Autocovariance, parameter inference using time-series, time-series forecasting

Machine-learning approaches to data analysis

## Learning outcomes

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

- By the end of this module, the students will be able to quantitatively summarise and critically assess data from real-world systems.
- By the end of this module, the students will be able to use modern methods of parameter estimation to model and forecast time-series data.

## Indicative reading list

G. R. Grimmett and D. R. Stirzaker, Probability and Random Processes (3rd edition, OUP, 2001)

J. R. Norris, Markov Chains (CUP, 1997)

M. J. Keeling and P. Rohani, Modeling infectious diseases in humans and animals (Princeton University Press, 2007)

C.M. Bishop, Pattern Recognition and Machine Learning, Springer 2006

J.D. Hamilton, Time Series Analysis, Princeton University Press 1994

G.E.P. Box, G.M. Jenkins and G.C. Reisel, Time Series Analysis: Forecasting and Control, Wiley 2016 (fifth ed.). Available as an e-book through the Library.

[View reading list on Talis Aspire](#)

## Subject specific skills

See learning outcomes.

## Transferable skills

Students will acquire key reasoning and problem solving skills which will empower them to address new problems with confidence.

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## Study

### Study time

Type	Required
Lectures	10 sessions of 2 hours (13%)
Tutorials	10 sessions of 2 hours (13%)
Total	150 hours

<b>Type</b>	<b>Required</b>
Private study	110 hours (73%)
Total	150 hours

## **Private study description**

Self-study and preparation for exam.

## **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.

### **Assessment group D1**

	<b>Weighting</b>	<b>Study time</b>
Assessed Coursework	20%	33 hours
Written Examination	40%	58 hours 30 minutes

Examination may be delivered online depending on local and national restrictions in place at the time as a result of the COVID-19 pandemic.

Oral Examination	40%	58 hours 30 minutes
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### **Feedback on assessment**

Written feedback on written assignments plus informal oral feedback during classwork sessions.

Oral feedback on the oral examination.

Written feedback on the written examination.

[Past exam papers for MA930](#)

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## **Availability**

### **Courses**

This module is Core for:

- RMAA-G1PG Postgraduate Research Mathematics of Systems
  - Year 1 of G1PG Mathematics of Systems
  - Year 1 of G1PG Mathematics of Systems
- TMAA-G1PF Postgraduate Taught Mathematics of Systems
  - Year 1 of G1PF Mathematics of Systems
  - Year 1 of G1PF Mathematics of Systems

This module is Optional for:

- Year 2 of TPXA-F345 Postgraduate Taught Modelling of Heterogeneous Systems (PGDip)
- Year 1 of TESA-H1B1 Postgraduate Taught Predictive Modelling and Scientific Computing

This module is Option list B for:

- Year 1 of TPXA-F345 Postgraduate Taught Modelling of Heterogeneous Systems (PGDip)