# ST337-15 Bayesian Forecasting and Intervention

## 26/27

**Department**
Statistics
**Level**
Undergraduate Level 3
**Module leader**
Adrien Corenflos
**Credit value**
15
**Module duration**
10 weeks
**Assessment**
Multiple
**Study location**
University of Warwick main campus, Coventry

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## Description

## Introductory description

This module is available for students on a course where it is a listed option and as an Unusual Option to students who have the required background as specified in the pre-requisite modules.

**Prerequisites:**

- Statistics UG Students:
    - ST229 Probability for Mathematical Statistics and ST230 Mathematical Statistics.
- External UG students:
    - ST121 Statistical Laboratory, AND
    - ST232/ST233 Introduction to Mathematical Statistics or ST352 Introduction to Mathematical Statistics (for Finalists).

**Recommended:** As the module considers models that generalise from linear regression models, you may find it helpful to take a module on Linear Statistical Modelling such as ST231, ST240 or ST351 before taking this module.

For anti-requisite modules please check under the availability tab and in the course handbook.

Module web page

## Module aims

This course is concerned with the theory and practice of short-term forecasting, using both data and subjective information. The course focuses on Dynamic Linear Models (DLM). DLM's are a class of Bayesian Forecasting Models which generalise linear regression models and static statistical linear models. Some extensions to nonlinear dynamic models are also considered. Forecasting is a vital prerequisite to decision making. This course offers a very powerful fundamental probabilistic approach to forecasting, controlling and learning about uncertain commercial, financial, economic, production, environmental and medical dynamic systems. The theory will be illustrated by real examples from industry, marketing, finance, government, agriculture etc.
A familiarity with the material in this module will be very useful to all students planning a career involving a component of industrial, business or government statistics.

## 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.

- State space modelling
- Bayesian updating of beliefs
- Specifying Dynamic Linear Models
- Updating Dynamic Linear Models, forecasting
- Building Dynamic Linear Models, accommodating external information
- ARIMA models, stationarity

## Learning outcomes

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

- Acquire an appreciation of forecasting recurrences and be able to calculate these for special cases.
- Know how to select an appropriate model in simple scenarios.
- Have an acquaintance with the most useful models in the class of DLMs for statistical forecasting in a business environment.
- Know how to intervene in these processes in the light of external information.
- Have an appreciation of diagnostic methods and estimation techniques for this model class.

## Indicative reading list

Specific reading list for the module

## Subject specific skills

- Demonstrate facility with rigorousstatistical methods.
- Evaluate, select and apply appropriate mathematical and/or statistical techniques.
- Demonstrate knowledge of and facility with formal statistical concepts, both explicitly and by applying them to the solution of mathematical problems.
- Create structured and coherent arguments communicating them in oral/written form.
- Construct logical arguments with clear identification of assumptions and conclusions.
- Reason critically, carefully, and logically.

## 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.

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## Study

## Study time

| Type | Required |
|---|---|
| Lectures | 30 sessions of 1 hour (20%) |
| Private study | 120 hours (80%) |
| 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.

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## Assessment

You must pass all assessment components to pass the module.

Students can register for this module without taking any assessment.

### Assessment group B5

| | Weighting | Study time | Eligible for self-certification |
|---|---|---|---|
| Centrally-timetabled examination (On-campus) | 100% | | No |

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

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- Answerbook Pink (12 page)
- Cambridge Statistical Tables (blue)
- Students may use a calculator

### Assessment group R4

| | Weighting | Study time | Eligible for self-certification |
|---|---|---|---|
| In-person 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.

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- Answerbook Pink (12 page)
- Cambridge Statistical Tables (blue)
- Students may use a calculator

### Feedback on assessment

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

Past exam papers for ST337

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# Availability

### Anti-requisite modules

If you take this module, you cannot also take:

- ST405-15 Bayesian Forecasting and Intervention with Advanced Topics

# Courses

This module is Optional for:

- Year 3 of UCSA-G4G1 Undergraduate Discrete Mathematics
- UCSA-G4G3 Undergraduate Discrete Mathematics
  - Year 3 of G4G1 Discrete Mathematics
  - Year 3 of G4G3 Discrete Mathematics
- Year 4 of UCSA-G4G4 Undergraduate Discrete Mathematics (with Intercalated Year)
- Year 4 of UCSA-G4G2 Undergraduate Discrete Mathematics with Intercalated Year
- USTA-G300 Undergraduate Master of Mathematics,Operational Research,Statistics and Economics
  - Year 3 of G300 Mathematics, Operational Research, Statistics and Economics
  - Year 4 of G300 Mathematics, Operational Research, Statistics and Economics

This module is Option list A for:

- Year 3 of USTA-G300 Undergraduate Master of Mathematics,Operational Research,Statistics and Economics
- Year 5 of USTA-G301 Undergraduate Master of Mathematics,Operational Research,Statistics and Economics (with Intercalated
- Year 4 of USTA-G1G3 Undergraduate Mathematics and Statistics (BSc MMathStat)
- Year 3 of USTA-GG14 Undergraduate Mathematics and Statistics (BSc)
- Year 4 of USTA-G140 Undergraduate Mathematics and Statistics (MMathStat)
- Year 4 of USTA-GG17 Undergraduate Mathematics and Statistics (with Intercalated Year)
- Year 3 of USTA-Y602 Undergraduate Mathematics,Operational Research,Statistics and Economics
- Year 4 of USTA-Y603 Undergraduate Mathematics,Operational Research,Statistics,Economics (with Intercalated Year)

This module is Option list B for:

- Year 3 of USTA-G302 Undergraduate Data Science
- Year 3 of USTA-G304 Undergraduate Data Science (MSci)
- UMAA-G105 Undergraduate Master of Mathematics (with Intercalated Year)
  - Year 4 of G105 Mathematics (MMath) with Intercalated Year
  - Year 5 of G105 Mathematics (MMath) with Intercalated Year
- Year 4 of USTA-G301 Undergraduate Master of Mathematics,Operational Research,Statistics and Economics (with Intercalated

- Year 3 of UMAA-G100 Undergraduate Mathematics (BSc)
- UMAA-G103 Undergraduate Mathematics (MMath)
    - Year 3 of G100 Mathematics
    - Year 3 of G103 Mathematics (MMath)
    - Year 4 of G103 Mathematics (MMath)
- Year 4 of UMAA-G107 Undergraduate Mathematics (MMath) with Study Abroad
- UMAA-G106 Undergraduate Mathematics (MMath) with Study in Europe
    - Year 3 of G106 Mathematics (MMath) with Study in Europe
    - Year 4 of G106 Mathematics (MMath) with Study in Europe
- Year 3 of USTA-G1G3 Undergraduate Mathematics and Statistics (BSc MMathStat)
- Year 3 of USTA-G140 Undergraduate Mathematics and Statistics (MMathStat)
- Year 4 of UMAA-G101 Undergraduate Mathematics with Intercalated Year

This module is Option list E for:

- Year 3 of USTA-G300 Undergraduate Master of Mathematics,Operational Research,Statistics and Economics

This module is Option list F for:

- Year 4 of USTA-G300 Undergraduate Master of Mathematics,Operational Research,Statistics and Economics
- Year 4 of USTA-G301 Undergraduate Master of Mathematics,Operational Research,Statistics and Economics (with Intercalated