

# ST340-15 Programming for Data Science

**20/21**

**Department**

Statistics

**Level**

Undergraduate Level 3

**Module leader**

Chenlei Leng

**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 runs in Term 2 and is available for students on a course where it is a listed option and as an Unusual Option to students who have completed the prerequisite module ST221 Linear Statistical Modelling.

There is a cap on student numbers for this module and pre-registration is essential. Information about prioritisation and the pre-registration form can be found at <http://go.warwick.ac.uk/ST340>

[Module web page](#)

### Module aims

To introduce students to algorithms suitable to the analysis of large datasets. In the modern world it is very easy to generate very large amounts of data. Capturing and exploiting the important information contained within such datasets poses a number of statistical challenges. It may not even be clear how much useful information the data contains. The module will cover a variety of algorithms developed to tackle some of these challenges.

## 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. Computational Complexity.
2. Principal components analysis and singular value decomposition.
3. Markov chains and PageRank.
4. Clustering, EM algorithm.
5. Bandit problems.
6. Supervised learning, k-Nearest neighbours.
7. Supervised and unsupervised learning. Penalised regression.
8. Support vector machines.
9. Artificial neural networks.
10. Gaussian processes.
11. Parallel and distributed algorithms.

## Learning outcomes

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

- Understand how to use a variety of practical algorithms when dealing with data analysis problems.
- Use R to implement data analysis algorithms.
- Interpret the output of various algorithms when applied to data sets.

## Indicative reading list

[View reading list on Talis Aspire](#)

## Subject specific skills

TBC

## Transferable skills

TBC

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## Study

## Study time

<b>Type</b>	<b>Required</b>	<b>Optional</b>
Lectures	20 sessions of 1 hour (13%)	2 sessions of 1 hour
Practical classes	10 sessions of 1 hour (7%)	
Private study	46 hours (31%)	
Assessment	74 hours (49%)	
Total	150 hours	

### **Private study description**

Weekly revision of lecture notes and materials, wider reading, practice exercises 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.

#### **Assessment group C1**

	<b>Weighting</b>	<b>Study time</b>
Assignment 3 Due in Term 2 Week 10. You will use R to implement and run algorithms on large datasets in response to a set of questions. You will present, discuss and evaluate the results. The number of words 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. 500 words is equivalent to one page of text, diagrams, formula or equations; your ST340 Assignment 3 should not exceed 25 pages in length.	17%	25 hours
Assignment 1 Due in Term 2 Week 5. You will analyse algorithms. You will use R to implement algorithms in response to a set of questions. You will present, discuss and evaluate the results. The number of words 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. 500 words is equivalent to one page of text, diagrams, formula or equations; your ST340 Assignment 1 should not exceed 24 pages in length.	16%	24 hours
Assignment 2 Due in Term 2 Week 8.	17%	25 hours

## Weighting

## Study time

You will use R to implement and run algorithms in response to a set of questions. You will present, discuss and evaluate the results. The number of words 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. 500 words is equivalent to one page of text, diagrams, formula or equations; your ST340 Assignment 2 should not exceed 25 pages in length.

Online Examination 50%

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

~Platforms - Moodle

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- Answerbook Pink (12 page)

## Assessment group R

### Weighting

### Study time

Assignment

50%

You will be asked to complete this assignment if you failed the module and you failed the coursework component of the original assessment. The reassessment will be similar in nature to the original assignments. 500 words is equivalent to one page of text, diagrams, formula or equations; your Assignment should not exceed 25 pages in length.

Online Examination - Resit 50%

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

~Platforms - Moodle

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- Answerbook Pink (12 page)

## Feedback on assessment

Marked assignments will be available for viewing at the support office within 20 working days of the submission deadline. Cohort level feedback will be provided, and students will be given the opportunity to receive feedback via face-to-face meetings.

Cohort level feedback will be provided for the examination.

[Past exam papers for ST340](#)

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# Availability

## Courses

This module is Optional for:

- UCSA-G4G1 Undergraduate Discrete Mathematics
  - Year 3 of G4G1 Discrete Mathematics
  - Year 3 of G4G1 Discrete Mathematics
- Year 3 of UCSA-G4G3 Undergraduate Discrete Mathematics
- 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:

- USTA-G302 Undergraduate Data Science
  - Year 3 of G302 Data Science
  - Year 3 of G302 Data Science
- Year 3 of USTA-G304 Undergraduate Data Science (MSci)
- Year 4 of USTA-G303 Undergraduate Data Science (with Intercalated Year)
- USTA-G1G3 Undergraduate Mathematics and Statistics (BSc MMathStat)
  - Year 3 of G1G3 Mathematics and Statistics (BSc MMathStat)
  - Year 4 of G1G3 Mathematics and Statistics (BSc MMathStat)
- Year 4 of USTA-G1G4 Undergraduate Mathematics and Statistics (BSc MMathStat) (with Intercalated Year)
- USTA-GG14 Undergraduate Mathematics and Statistics (BSc)
  - Year 3 of GG14 Mathematics and Statistics
  - Year 3 of GG14 Mathematics and Statistics
- Year 4 of USTA-GG17 Undergraduate Mathematics and Statistics (with Intercalated Year)
- USTA-Y602 Undergraduate Mathematics, Operational Research, Statistics and Economics
  - Year 3 of Y602 Mathematics, Operational Research, Stats, Economics
  - Year 3 of Y602 Mathematics, Operational Research, Stats, Economics
- Year 4 of USTA-Y603 Undergraduate Mathematics, Operational Research, Statistics, Economics (with Intercalated Year)

This module is Option list D for:

- USTA-G300 Undergraduate Master of Mathematics, Operational Research, Statistics and Economics
  - Year 4 of G30C Master of Maths, Op.Res, Stats & Economics (Operational Research and Statistics Stream)
  - Year 4 of G30C Master of Maths, Op.Res, Stats & Economics (Operational Research and Statistics Stream)

- Year 5 of USTA-G301 Undergraduate Master of Mathematics,Operational Research,Statistics and Economics (with Intercalated

This module is Option list E for:

- Year 4 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

This module is Option list F for:

- Year 3 of USTA-G300 Undergraduate Master of Mathematics,Operational Research,Statistics and Economics
- USTA-G301 Undergraduate Master of Mathematics,Operational Research,Statistics and Economics (with Intercalated
  - Year 3 of G30H Master of Maths, Op.Res, Stats & Economics (Statistics with Mathematics Stream)
  - Year 4 of G30H Master of Maths, Op.Res, Stats & Economics (Statistics with Mathematics Stream)