1. **Title of the module**

MAST4011 - Statistics

1. **School or partner institution which will be responsible for management of the module**

School of Mathematics, Statistics and Actuarial Science

1. **The level of the module (Level 4, Level 5, Level 6 or Level 7)**

Level 4

1. **The number of credits and the ECTS value which the module represents**

15 credits (7.5 ECTS)

1. **Which term(s) the module is to be taught in (or other teaching pattern)**

Spring

1. **Prerequisite and co-requisite modules**

Pre-requisite: MAST4009: Probability

1. **The course(s) of study to which the module contributes**

BSc Mathematics, BSc Mathematics and Statistics, BSc Financial Mathematics, BA Mathematics, Accounting and Finance, BSc Actuarial Science, BSc Data Science (including courses with a Year in Industry), BSc Mathematics with Secondary Education, BSc Mathematics with a Foundation Year, BSc Data Science with a Foundation Year, MMath Mathematics, MMathStat Mathematics and Statistics

1. **The intended subject specific learning outcomes.  
   On successfully completing the module students will be able to:**

8.1 demonstrate knowledge of the underlying concepts and principles associated with statistics;

8.2 demonstrate the capability to make sound judgements in accordance with the basic theories and concepts in the following areas, whilst demonstrating a reasonable level of skill in calculation and manipulation of the material: graphical and numerical summaries of data using R, point estimation, including maximum likelihood estimation for discrete data, interval estimation, hypothesis testing, association between variables;

8.3 apply the underlying concepts and principles associated with introductory statistics in several well-defined contexts, showing an ability to evaluate the appropriateness of different approaches to solving problems in this area;

8.4 make appropriate use of the statistical computer package R.

1. **The intended generic learning outcomes.  
   On successfully completing the module students will be able to:**

Demonstrate an increased ability to:

9.1 manage their own learning and make use of appropriate resources;

9.2 understand logical arguments, identifying the assumptions made and the conclusions drawn;

9.3 communicate straightforward arguments and conclusions reasonably accurately and clearly;

9.4 manage their time and use their organisational skills to plan and implement efficient and effective modes of working;

9.5 solve problems relating to qualitative and quantitative information;

9.6 make use of information technology skills such as R, online resources (moodle), internet communication;

9.7 communicate technical and non-technical material competently.

9.8 demonstrate an increased level of skill in numeracy and computation;

9.9 give an oral presentation;

9.10 work in small groups.

1. **A synopsis of the curriculum**

Introduction to R and investigating data sets. Basic use of R (Input and manipulation of data). Graphical representations of data. Numerical summaries of data.

Sampling and sampling distributions. χ² distribution. t-distribution. F-distribution. Definition of sampling distribution. Standard error. Sampling distribution of sample mean (for arbitrary distributions) and sample variance (for normal distribution) .

Point estimation. Principles. Unbiased estimators. Bias, Likelihood estimation for samples of discrete r.v.s

Interval estimation. Concept. One-sided/two-sided confidence intervals. Examples for population mean, population variance (with normal data) and proportion.

Hypothesis testing. Concept. Type I and II errors, size, p-values and power function. One-sample test, two sample test and paired sample test. Examples for population mean and population variance for normal data. Testing hypotheses for a proportion with large n. Link between hypothesis test and confidence interval. Goodness-of-fit testing.

Association between variables. Product moment and rank correlation coefficients. Two-way contingency tables. χ² test of independence.

1. **Reading list (Indicative list, current at time of publication. Reading lists will be published annually)**

J. Devore and R. Peck. Introductory Statistics. (West 1990)

F. Daly et al. Elements of Statistics. (The Open University 1995)

G.M. Clarke and D. Cooke. A Basic Course in Statistics. (5th edition. Arnold. 2004)

D.V. Lindley and W.F. Scott. New Cambridge Statistical Tables (2nd edition. C.U.P. 1995)

J. Verzani. Using R for Introductory Statistics (2nd edition, CRC Press, 2014)

1. **Learning and teaching methods**

Total contact hours: 47

Private study hours: 103

Total study hours: 150

1. **Assessment methods**
   1. Main assessment methods

Assessment 1 Group project, report and presentation, requiring on average between 10 and 15 hours to complete 15%

Assessment 2 Exercises, requiring on average between 10 and 15 hours to complete 15%

Examination 2 hours 70%

The coursework mark alone will not be sufficient to demonstrate the student’s level of achievement on the module.

13.2 Reassessment methods

Like-for-like

1. **Map of module learning outcomes (sections 8 & 9) to learning and teaching methods (section12) and methods of assessment (section 13)**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Module learning outcome** | *8.1* | *8.2* | *8.3* | *8.4* | *9.1* | *9.2* | *9.3* | *9.4* | *9.5* | *9.6* | *9.7* | *9.8* | *9.9* | *9.10* |
| **Learning/ teaching method** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Private Study and Assessment | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** |
| Lectures/exercise classes | **X** | **X** | **X** | **X** |  | **X** | **X** |  | **X** |  | **X** | **X** | **X** |  |
| Terminal classes | **X** | **X** | **X** | **X** | **X** | **X** | **X** |  | **X** | **X** | **X** | **X** |  | **X** |
| Tutorials | **X** | **X** | **X** | **X** |  | **X** | **X** |  | **X** |  | **X** | **X** |  | **X** |
| Revision classes | **X** | **X** | **X** |  |  |  |  |  |  |  |  |  |  |  |
| **Assessment method** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Examination | **X** | **X** | **X** |  | **X** | **X** | **X** | **X** | **X** |  | **X** | **X** |  |  |
| Coursework | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** |

1. **Inclusive module design**

The School recognises and has embedded the expectations of current equality legislation, by ensuring that the module is as accessible as possible by design. Additional alternative arrangements for students with Inclusive Learning Plans (ILPs)/declared disabilities will be made on an individual basis, in consultation with the relevant policies and support services.

The inclusive practices in the guidance (see Annex B Appendix A) have been considered in order to support all students in the following areas:

a) Accessible resources and curriculum

b) Learning, teaching and assessment methods

1. **Campus(es) or centre(s) where module will be delivered**

Canterbury

1. **Internationalisation**

Statistics as a branch of mathematics is an international language with techniques developed and refined by statisticians across the globe. Mastery of the subject-specific learning outcomes, 8.1 to 8.4, will equip students to apply the theories and techniques of this module in a wide range of international contexts. The module team is drawn from the School of Mathematics, Statistics and Actuarial Science, which includes many members of staff with international experience of teaching and research collaboration.

In compiling the reading list, consideration has been given to the range of texts that are available internationally and a selection of texts has been identified to complement the delivery of the material.

Examples with an international dimension are included in the module where appropriate.

The support SMSAS provides to its students is also internationally attuned given our international student body.

**FACULTIES SUPPORT OFFICE USE ONLY**

**Revision record – all revisions must be recorded in the grid and full details of the change retained in the appropriate committee records.**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Date approved | Major/minor revision | Start date of the delivery of revised version | Section revised | Impacts PLOs (Q6&7 cover sheet) |
| July 2023 | Minor | September 2023 | 13 | No |
|  |  |  |  |  |