Programme Specification

Mathematics with Statistics (2018-19)

This specification provides a concise summary of the main features of the programme and the learning outcomes that a typical student might reasonably be expected to achieve and demonstrate if s/he takes full advantage of the learning opportunities that are provided.

Awarding Institution: University of Southampton
Teaching Institution: University of Southampton
Mode of Study: Full-time
Duration in years: 3
Accreditation details: None
Final award: Bachelor of Science with Honours (BSc (Hons))
Name of award: Mathematics with Statistics
Interim Exit awards:
  - Bachelor of Science (Ordinary)
  - Certificate of Higher Education (CertHE)
  - Diploma of Higher Education (DipHE)

FHEQ level of final award: Level 6
UCAS code: G1G3
Programme code: 4709
QAA Subject Benchmark or other external reference: Mathematics, Statistics And Operational Research 2007

Programme Overview

Brief outline of the programme
Training in statistics offers a unique range of challenges and provides opportunities to work on a large variety of important problems in industry, environmental science, medical research and within the government. The technical skills that you will acquire are in great demand, as are the general skills of understanding and analysing problems and communicating the results to other scientists. This degree may lead to possible exemption from some Core Technical professional actuarial examinations depending on option choices made.

Transfer to this programme at the end of the first semester is possible from a number of other programmes within Mathematical Sciences.

Your contact hours will vary depending on your module/option choices. Full information about contact hours is provided in individual module profiles.
Learning and teaching
The Mathematical Sciences School uses a wide variety of modern learning and teaching methods involving problem classes, workshops and computer based learning that builds on what you learn in lectures.

Assessment
Assessment is varied enabling you to demonstrate your strengths and show what you have learnt. Students are provided with access to relevant software that they can use on their own personal computers to assist their studies.

Special Features of the programme
N/A

Please note: As a research-led University, we undertake a continuous review of our programmes to ensure quality enhancement and to manage our resources. As a result, this programme may be revised during a student’s period of registration; however, any revision will be balanced against the requirement that the student should receive the educational service expected. Please read our Disclaimer to see why, when and how changes may be made to a student’s programme.

Programmes and major changes to programmes are approved through the University's programme validation process which is described in the University's Quality handbook.

Educational Aims of the Programme
The aims of the programme are to:

- Introduce you to the main basic areas of mathematics;
- Develop your understanding of abstract mathematical concepts;
- Offer you the opportunity to study advanced mathematical concepts and techniques;
- Develop your modelling and problem solving skills;
- Offer you the opportunity to construct an individual programme of study within a coherent framework;
- Offer you the opportunity to study applications of mathematics in a variety of contexts which utilize mathematical and statistical models;
- Introduce you to theoretical statistical concepts;
- Develop your understanding of practical statistical methods;
- Prepare you for a career as a statistician in industry and commerce;
- Give you the statistical grounding required to prepare you for postgraduate study.
- Develop your subject specific and transferable skills including an analytical approach to problem solving, logical argument and deductive reasoning, abstraction and generalisation, and written communication skills in mathematics;
- Provide some of the basic IT skills necessary for further study and employment, including word processing and use of the internet;
- Help you to develop key skills: personal organisation, teamwork, problem solving and analysis, finding and using information, and written and oral presentation.

Programme Learning Outcomes
Knowledge and Understanding

On successful completion of this programme you will have knowledge and understanding of:

A1. The fundamentals of calculus, linear algebra, and statistics;
A2. The fundamentals of ordinary differential equations and their applications;
A3. The principles of mathematical proof and some of the techniques of proof;
A4. The fundamental concepts of real analysis of functions of one variable;
A5. The assumptions underlying statistical methods.

Teaching and Learning Methods

Acquisition of knowledge and understanding of A1 through A5 is through structured exposition based on lectures, tutorial classes, and private study, all of which are equally important. Increasing independence of learning is required as the programme progresses. Throughout the programme you are encouraged to use additional recommended reading material for private study to consolidate the formal learning process, and to broaden and deepen your understanding.

Assessment Methods

Assessment is undertaken in the first year by a mixture of unseen examinations, regular marked coursework, class tests and computer-based work, together with a small component of project and laboratory work. This variety of assessment relates to 2.1 through 2.3, and also to some of the skills described below. This varied approach to assessment continues in the remainder of the programme, with the relative emphasis depending on the options chosen (A4 - A5).

Subject Specific Intellectual and Research Skills

On successful completion of this programme you will be able to:

B1. Mathematical problem-solving skills for certain types of problems and their variants in a variety of mathematical contexts;
B2. The ability to undertake algebraic calculations accurately and with understanding;
B3. The ability to use computer packages (for example, R) as vehicles for mathematical exploration and understanding;
B4. The ability to understand and to construct mathematical proofs;
B5. The ability to appreciate, construct and analyse mathematical models of practical situations;
B6. The ability to apply statistical methods such as regression and analysis of variance to practical situations.
Teaching and Learning Methods

Problem-solving is at the heart of all mathematical activity, and so it is emphasised throughout the learning and teaching experience, as is the need for accurate calculation and logical argument. The use of specific mathematical and computational packages is a part of the curriculum, and the skills acquired there are used in later modules as appropriate. The statistical computing language R is used in the applications of statistics modules available within this programme.

Assessment Methods

The various methods of assessment described in section 2 involve problem-solving (B1) in addition to the assessment of knowledge and understanding (B2, B4 through B6). Fluency in computer packages (B3) is assessed by coursework.

Transferable and Generic Skills

On successful completion of this programme you will be able to:

C1. Communicate mathematical and statistical ideas in written form;
C2. Undertake oral presentations;
C3. Demonstrate group-working skills
C4. Use spreadsheets and show basic word-processing skills;
C5. Use and obtain information from a variety of different sources including the internet, books and other printed material;
C6. Use the skills you have acquired (e.g. time-management, organisation, problem-solving, critical analysis, independent learning, etc.) for life-long learning

Teaching and Learning Methods

The learning of transferable skills begins in the first year. The first year lecturers will set problems for which one of a range of computing packages, such as the statistics package R, will be useful, thereby developing transferable skills alongside subject specific skills. Other IT skills such as basic word processing are used alongside first year project work, particularly in statistics. Mathematics Workshop are offered during the first and second years, and extensive electronic resources on study skills are available through the Mathematics and University websites.

Further development of IT skills, written communication and general skills such as organisation and time-management is associated to optional second and third year modules which may have an element of coursework in their assessment. The second and third year project-based modules develop your portfolio of skills to include internet and library research, group working, and presentation skills.

Assessment Methods
Throughout the programme the clear communication of mathematics is part of the assessment criteria, either explicitly or implicitly. For project work, and for those modules which involve coursework assignments, a proportion of the assessment is allocated to communication (C1, C2, and C4). Project work and coursework assessment also relate to C5, and where appropriate, C3. The skills referred to in C6 refer to problem-solving, an integral component of all mathematical work, and other learning skills are implicit.

Programme Structure

The programme structure table is below:

Information about pre and co-requisites is included in individual module profiles.

Part I

This degree programme will provide you with the skills in mathematics and statistics and the communication skills that you will require for a career as a statistician.

In addition to this, our Curriculum Innovation Programme offers our students the chance to take optional modules outside their core disciplines. This allows you to personalise your education, to develop new skills and knowledge for your future.

The structure of the programme and the modules currently offered are set out below. Of the modules shown against each year of your programme, some are compulsory (ie enrolment is automatic) and others are optional. Against each year, you are directed to which modules are compulsory and which are optional. The optional modules listed constitute an indicative list. There will always be choice but the options might vary between years. A complete list of optional modules currently available on your programme can be found via the Student Record Self-Service system (https://studentrecords.soton.ac.uk/BNNRPROD/bwkkspgr.showpage?page=ESC_PROGCAT_FINDPR).

The programme comprises three parts, each corresponding to one year of full-time study. You will normally have to take 4 modules (30 ECTS/60 CATS) each semester (ie 8 modules (60 ECTS/120 CATS) in each year of the programme. Each credit can be considered as the equivalent of approximately ten hours of study. All the modules offered in this programme (except the dissertation) are 7.5 ECTS/15 CATS modules. This means that each module comprises around 150 hours of study divided into contact time (e.g. lectures, seminars, workshops) and non-contact time when you will be engaged in directed study (preparation for classes) and independent study when you will be involved in producing assignments and preparing and taking examinations.

Students must take at least 16 MATHxxxx modules in parts 1, 2 and 3, and at least 4 MATH3xxx modules in part 3.

The option modules shown below constitute an indicative list; there will always be choice but the options might vary between years. A full list of modules and rules will be available to you via the Student Record Self-Service system once you enrol at the University.

Part I Compulsory
<table>
<thead>
<tr>
<th>Code</th>
<th>Module Title</th>
<th>ECTS</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH1024</td>
<td>Introduction to Probability and Statistics</td>
<td>7.5</td>
<td>Compulsory</td>
</tr>
<tr>
<td>MATH1049</td>
<td>Linear Algebra II</td>
<td>7.5</td>
<td>Compulsory</td>
</tr>
<tr>
<td>MATH1060</td>
<td>Multivariable Calculus</td>
<td>7.5</td>
<td>Compulsory</td>
</tr>
<tr>
<td>MATH1058</td>
<td>Operational Research I and Mathematical Computing</td>
<td>7.5</td>
<td>Compulsory</td>
</tr>
</tbody>
</table>

**Part I Core**

<table>
<thead>
<tr>
<th>Code</th>
<th>Module Title</th>
<th>ECTS</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH1059</td>
<td>Calculus</td>
<td>7.5</td>
<td>Core</td>
</tr>
<tr>
<td>MATH1048</td>
<td>Linear Algebra I</td>
<td>7.5</td>
<td>Core</td>
</tr>
</tbody>
</table>

**Part I Optional**

You may choose EITHER ECON1001 OR ECON1003

<table>
<thead>
<tr>
<th>Code</th>
<th>Module Title</th>
<th>ECTS</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH1057</td>
<td>Dynamics and Relativity</td>
<td>7.5</td>
<td>Optional</td>
</tr>
<tr>
<td>ECON1001</td>
<td>Foundations of Microeconomics</td>
<td>7.5</td>
<td>Optional</td>
</tr>
<tr>
<td>DEMO1001</td>
<td>Introduction to Demographic Methods</td>
<td>7.5</td>
<td>Optional</td>
</tr>
<tr>
<td>MATH1001</td>
<td>Number Theory</td>
<td>7.5</td>
<td>Optional</td>
</tr>
<tr>
<td>ECON1002</td>
<td>Principles of Macroeconomics</td>
<td>7.5</td>
<td>Optional</td>
</tr>
<tr>
<td>ECON1003</td>
<td>Principles of Microeconomics</td>
<td>7.5</td>
<td>Optional</td>
</tr>
</tbody>
</table>

**Part II**

**Part II Compulsory**
<table>
<thead>
<tr>
<th>Code</th>
<th>Module Title</th>
<th>ECTS</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH2039</td>
<td>Analysis</td>
<td>7.5</td>
<td>Compulsory</td>
</tr>
<tr>
<td>MATH2038</td>
<td>Partial Differential Equations</td>
<td>7.5</td>
<td>Compulsory</td>
</tr>
<tr>
<td>MATH2011</td>
<td>Statistical Distribution Theory</td>
<td>7.5</td>
<td>Compulsory</td>
</tr>
<tr>
<td>MATH2010</td>
<td>Statistical Modelling I</td>
<td>7.5</td>
<td>Compulsory</td>
</tr>
<tr>
<td>MATH2012</td>
<td></td>
<td>7.5</td>
<td>Compulsory</td>
</tr>
</tbody>
</table>

**Part II Optional**

<table>
<thead>
<tr>
<th>Code</th>
<th>Module Title</th>
<th>ECTS</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH3087</td>
<td>Maths and your Future</td>
<td>7.5</td>
<td>Optional</td>
</tr>
<tr>
<td>MATH2014</td>
<td>Algorithms</td>
<td>7.5</td>
<td>Optional</td>
</tr>
<tr>
<td>UOSM2001</td>
<td>Business Skills for Employability</td>
<td>7.5</td>
<td>Optional</td>
</tr>
<tr>
<td>UOSM2020</td>
<td>Economics with Experiments</td>
<td>7.5</td>
<td>Optional</td>
</tr>
<tr>
<td>MATH2044</td>
<td>Fields and Fluids</td>
<td>7.5</td>
<td>Optional</td>
</tr>
<tr>
<td>MATH2040</td>
<td>Financial Mathematics</td>
<td>7.5</td>
<td>Optional</td>
</tr>
<tr>
<td>MATH2049</td>
<td>Geometry and Topology</td>
<td>7.5</td>
<td>Optional</td>
</tr>
<tr>
<td>UOSM2004</td>
<td>Global Health</td>
<td>7.5</td>
<td>Optional</td>
</tr>
<tr>
<td>MATH2003</td>
<td>Group Theory</td>
<td>7.5</td>
<td>Optional</td>
</tr>
<tr>
<td>MATH2013</td>
<td>Introduction to Operational Research</td>
<td>7.5</td>
<td>Optional</td>
</tr>
<tr>
<td>UOSM2011</td>
<td>The Management of Risk and Uncertainty</td>
<td>7.5</td>
<td>Optional</td>
</tr>
<tr>
<td>MATH2045</td>
<td>Vector Calculus and Complex Variable</td>
<td>7.5</td>
<td>Optional</td>
</tr>
</tbody>
</table>
Part III

Part III Compulsory
Students must have taken at least one of MATH3023, MATH3031, MATH3032 or MATH3087 during their programme.

<table>
<thead>
<tr>
<th>Code</th>
<th>Module Title</th>
<th>ECTS</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH3023</td>
<td>Communicating and Teaching Mathematics</td>
<td>7.5</td>
<td>Compulsory</td>
</tr>
<tr>
<td>MATH3014</td>
<td>Design and Analysis of Experiments</td>
<td>7.5</td>
<td>Compulsory</td>
</tr>
<tr>
<td>MATH3032</td>
<td>Mathematical Investigation and Communication</td>
<td>7.5</td>
<td>Compulsory</td>
</tr>
<tr>
<td>MATH3031</td>
<td>Mathematics Project</td>
<td>7.5</td>
<td>Compulsory</td>
</tr>
<tr>
<td>MATH3087</td>
<td>Maths and your Future</td>
<td>7.5</td>
<td>Compulsory</td>
</tr>
<tr>
<td>MATH3044</td>
<td>Statistical Inference</td>
<td>7.5</td>
<td>Compulsory</td>
</tr>
<tr>
<td>MATH3012</td>
<td>Statistical Methods II</td>
<td>7.5</td>
<td>Compulsory</td>
</tr>
</tbody>
</table>

Part III Optional

<table>
<thead>
<tr>
<th>Code</th>
<th>Module Title</th>
<th>ECTS</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH3063</td>
<td>Actuarial Mathematics I</td>
<td>7.5</td>
<td>Optional</td>
</tr>
<tr>
<td>MATH3066</td>
<td>Actuarial Mathematics II</td>
<td>7.5</td>
<td>Optional</td>
</tr>
<tr>
<td>MATH3083</td>
<td>Advanced Partial Differential Equations</td>
<td>7.5</td>
<td>Optional</td>
</tr>
<tr>
<td>MATH3080</td>
<td>Algebraic Topology</td>
<td>7.5</td>
<td>Optional</td>
</tr>
<tr>
<td>UOSM2001</td>
<td>Business Skills for Employability</td>
<td>7.5</td>
<td>Optional</td>
</tr>
<tr>
<td>MATH3023</td>
<td>Communicating and Teaching Mathematics</td>
<td>7.5</td>
<td>Optional</td>
</tr>
<tr>
<td>UOSM2004</td>
<td>Global Health</td>
<td>7.5</td>
<td>Optional</td>
</tr>
</tbody>
</table>
MATH3033  Graph Theory  7.5  Optional
MATH3052  Mathematical Biology  7.5  Optional
MATH3022  Mathematical Finance  7.5  Optional
MATH3031  Mathematics Project  7.5  Optional
MATH3018  Numerical Methods  7.5  Optional
MATH3016  Optimization  7.5  Optional
MATH3006  Relativity, Blackholes and Cosmology  7.5  Optional
MATH3013  Simulation & Queues  7.5  Optional
STAT3010  Statistical Methods in Insurance  7.5  Optional
MATH3085  Survival Models  7.5  Optional
UOSM2011  The Management of Risk and Uncertainty  7.5  Optional

Progression Requirements
The programme will follow the University's regulations for Progression, Determination and Classification of Results: Undergraduate and Integrated Masters Programmes or the University's regulations for Progression, Determination and Classification of Results: Standalone Masters Programmes as set out in the General Academic Regulations in the University Calendar: http://www.calendar.soton.ac.uk/sectionIV/sectIV-index.html

Support for student learning
There are facilities and services to support your learning some of which are accessible to students across the University and some of which will be geared more particularly to students in your particular Faculty or discipline area.

The University provides:
• library resources, including e-books, on-line journals and databases, which are comprehensive and up-to-date; together with assistance from Library staff to enable you to make the best use of these resources
• high speed access to online electronic learning resources on the Internet from dedicated PC Workstations onsite and from your own devices; laptops, smartphones and tablet PCs via the Eduroam wireless network. There is a wide range of application software available from the Student Public Workstations.
• computer accounts which will connect you to a number of learning technologies for example, the Blackboard virtual learning environment (which facilitates online learning and access to specific learning resources)
• standard ICT tools such as Email, secure filestore and calendars.
The Students’ Union provides
- an academic student representation system, consisting of Course Representatives, Academic Presidents, Faculty Officers and the Vice-President Education; SUSU provides training and support for all these representatives, whose role is to represent students’ views to the University.
- opportunities for extracurricular activities and volunteering
- an Advice Centre offering free and confidential advice including support if you need to make an academic appeal
- Support for student peer-to-peer groups, such as Nightline.

Methods for evaluating the quality of teaching and learning

You will have the opportunity to have your say on the quality of the programme in the following ways:

- Completing student surveys for each module of the programme
- Acting as a student representative on various committees, e.g. Staff Student Liaison Committees, Faculty Programmes Committee OR providing comments to your student representative to feed back on your behalf.
- Serving as a student representative on Faculty Scrutiny Groups for programme validation
- Taking part in programme validation meetings by joining a panel of students to meet with the Faculty Scrutiny Group

The ways in which the quality of your programme is checked, both inside and outside the University, are:

- Regular module and programme reports which are monitored by the Faculty
- Programme validation, normally every five years.
- External examiners, who produce an annual report
- A national Research Excellence Framework (our research activity contributes directly to the quality of your learning experience)
- Institutional Review by the Quality Assurance Agency

Further details on the University’s quality assurance processes are given in the Quality Handbook.
Career Opportunities

In a world surrounded by data statisticians are highly sought after to analyse and make sense of it, to provide usable information to businesses and governments. Pretty much every industry and organisation imaginable needs statisticians nowadays, including: the finance industry, the retail industry, the pharmaceuticals industry, government and local councils, and the manufacturing industry.

Employability is embedded into modules from the first year onwards and right from the first lecture. We explain the degree skills which are taught throughout the modules and offer a number of optional employability modules.

We place great importance on the development of graduate skills vital for future employment by adding transferrable skills into learning and teaching.

Our degrees are a passport to vocational and non-vocational careers alike, with recent graduates employed in roles ranging from actuaries and statisticians to crime analysts and medical researchers. A good number also stay at University to study for a Postgraduate degree, i.e. MSc or PhD.

External Examiner(s) for the programme

Name: Professor John Parker - University of Durham
Name: Dr Lawrence Pettit - Queen Mary College University of London
Name: Brad Baxter - Birkbeck College University of London
Name: Dolores Romero Morales - Copenhagen Business School
Name: Professor Malcolm Brown - University of Kent
Name: Professor Peter Duck - University of Manchester

Students must not contact External Examiner(s) directly, and external examiners have been advised to refer any such communications back to the University. Students should raise any general queries about the assessment and examination process for the programme with their Course Representative, for consideration through Staff: Student Liaison Committee in the first instance, and Student representatives on Staff: Student Liaison Committees will have the opportunity to consider external examiners' reports as part of the University's quality assurance process.

External examiners do not have a direct role in determining results for individual students, and students wishing to discuss their own performance in assessment should contact their Personal Academic Tutor in the first instance.

Please note: This specification provides a concise summary of the main features of the programme and the learning outcomes that a typical student might reasonably be expected to achieve and demonstrate if s/he takes full advantage of the learning opportunities that are provided. More detailed information can be found in the programme handbook.
Appendix 1:

Students are responsible for meeting the cost of essential textbooks, and of producing such essays, assignments, laboratory reports and dissertations as are required to fulfil the academic requirements for each programme of study. In addition to this, students registered for this programme also have to pay for:

Additional Costs

<table>
<thead>
<tr>
<th>Type</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Software Licenses</td>
<td>The software required for the programme is available on all public workstations on campus, and accessible from your own computer via VPN.</td>
</tr>
<tr>
<td>Stationery</td>
<td>You will be expected to provide your own day-to-day stationery items, e.g. pens, pencils, notebooks, etc.). Any specialist stationery items will be specified under the Additional Costs tab of the relevant module profile.</td>
</tr>
<tr>
<td>Textbooks</td>
<td>Where a module specifies core texts these should generally be available on the reserve list in the library. However due to demand, students may prefer to buy their own copies. These can be purchased from any source. Some modules suggest reading texts as optional background reading. The library may hold copies of such texts, or alternatively you may wish to purchase your own copies. Although not essential reading, you may benefit from the additional reading materials for the module.</td>
</tr>
<tr>
<td>Approved Calculators</td>
<td>Candidates may use calculators in the examination room only as specified by the University and as permitted by the rubric of individual examination papers. The University approved models are Casio FX-570 and Casio FX-85GT Plus. These may be purchased from any source and no longer need to carry the University logo.</td>
</tr>
<tr>
<td>Printing and Photocopying Costs</td>
<td>In the majority of cases, coursework such as essays; projects; dissertations is likely to be submitted on line. However, there are some items where it is not possible to submit on line and students will be asked to provide a printed copy. A list of the University printing costs can be found here: [insert link to relevant page]. For students undertaking modules with a high mathematical content, some assessed work will be submitted in handwritten hard copy format. Students are advised that they will need to bear the costs of the required stationery.</td>
</tr>
</tbody>
</table>

In some cases you'll be able to choose modules (which may have different costs associated with that module) which will change the overall cost of a programme to you. Details of such costs will be listed in the Module Profile. Please also ensure you read the section on additional costs in the University's Fees, Charges and Expenses Regulations in the University Calendar available at www.calendar.soton.ac.uk.