

## Programme Specification

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### Operational Research and Statistics (2020-21)

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	1
Accreditation details	None
Final award	Master of Science (MSc)
Name of Award	Operational Research and Statistics
Interim Exit awards	Postgraduate Certificate Postgraduate Diploma
FHEQ level of final award	Level 7
UCAS code	
Programme Code	6978
QAA Subject Benchmark or other external reference	Mathematics, Statistics And Operational Research 2007
Programme Lead	Hou-Duo Qi
Pathway Lead	

### Programme Overview

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#### Brief outline of the programme

The MSc programme in Operational Research and Statistics provides students with the ideal skill sets in mathematical modelling, experimental design, statistical analysis, and computation. These prepare students to pursue a wide variety of career opportunities in industry, business or in the public sector. This programme, with its vocational focus, is designed to provide training in a broad range of analytical skills as well as soft skills (e.g. in communicating results to managers/executives). The MSc programme is also an excellent preparation for embarking on a PhD programme in either Operational Research or Statistics.

A highlight of the programme is the three-month summer project: it may be either in Operational Research or Statistics (or the interface between the two). You will have the option to bid for an external project which is usually based at a nearby company and requires working on a real problem of practical importance to that company. You also have the option to work on an internal project which might involve data from external sources. The MSc project consists of an individual investigation and is under the supervision of a member of staff. This project enables students to integrate and consolidate skills learned on the course (and to fulfil deliverables for the sponsoring company in the case of an external project).

A dissertation on the project work must be submitted soon after the end of the taught period of study and students are required to complete their work by the middle of September. The award of the degree of MSc in Operational Research and Statistics requires a satisfactory performance in the instructional part of the course and the project.

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 full-time MSc is completed over a 12-month period. There are two semesters of taught material, which account for 60 ECTS (120 CATS), together with an MSc project (typically undertaken in the summer), which accounts for 30 ECTS (60 CATS).

The structure of the programme provides you with a foundation in both Operational Research and Statistics. It also allows you to select several optional modules from a broad range of topics in Semester 2 so that you can specialise in either Operational Research or Statistics (or to choose a balanced portfolio of options). These are complemented by careers talks, with speakers from a wide range of organisations providing an appreciation of the developments in, and use of, Operational Research and Statistics in practice, and presentations on employability skills.

Training and education in the theory and methods of Operational Research and Statistics is provided, with an emphasis on practical problems arising in organisational contexts. The skill sets include mathematical

modelling, numerical computation and computer programming, experiment design, and collecting and analysing scientific data.

While studying for your degree, you will develop key transferrable skills, such as written and oral communication, presentation skills, teamwork, the use of IT (e.g. some Optimisation, Simulation, and Statistical software), time management, and basic research skills including the use of the web and the library.

In summary, the learning and teaching aims of the programme are:

1. To give you knowledge of operational research techniques and applied statistical theory and methods at an advanced level;
2. To train you for careers as either an operational researcher or as a statistician.
3. To enable you to develop oral and written communication skills.
4. To give you experience of applications of operational research and statistical methods.

### Assessment

The taught element of the programme comprises two semesters of taught material, with assessment via coursework assignments and examinations, which take place at the end of each semester. The MSc programme is completed, subject to achievement of progression requirements, with a project lasting over 3 months.

By the end of the programme you should be able to demonstrate:

- 1 Knowledge and understanding of operational research techniques and statistical theory at an advanced level;
- 2 Knowledge and understanding of the application of operational research and statistical methods to practical problems;
- 3 The ability to carry out and interpret statistical analyses;
- 4 The ability to write a statistical report on a data analysis topic;
- 5 The ability to programme either in SAS and R to analyse data sets or in Python.

Students who undertake the dissertation stage of the programme should also be able to demonstrate:

- 6 An in-depth knowledge and understanding of an individually researched topic studied as the main project;
- 7 Skill in organising their research work and in presenting their findings by the production of a substantial dissertation on their chosen project topic.

## Special Features of the programme

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The CORMSIS Business Advisory Board: This Business Advisory Board is a good indicator of the high regard in which the Southampton MSc programmes involving OR are held by outside organisations. Its purpose is to ensure that the MSc programmes produce graduates with the requisite skills for the needs of industry. It also provides a focal point for liaison between the OR Group and industry. You have the chance to meet the Committee several times during the year. Major companies including Shell, British Airways, BAA, the AA, Dstl and HM Revenue & Customs are represented on the Advisory Board.

**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**

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The aims of the programme are to:

1. introduce you to the ideas of mathematical model building;
2. train you in the theory and methods of applied statistics to an advanced level;
3. introduce you to the main techniques, methods and approaches of operational research, emphasising both the underlying concepts and their practical application;
4. introduce you to the main statistical techniques, methods and approaches used in a variety of applications;
5. offer you the opportunity to study more specialised topics selected from a range of options, but within a coherent framework;
6. develop your operational research and statistical skills for problem solving, including (a) mathematical modelling of deterministic and stochastic systems, and designing solution approaches, and (b) statistical modelling using generalised linear modelling techniques;
7. give you the opportunity of gaining practical experience of applying the problem-solving skills you have learned, by working on a project with an external organisation;
8. develop key transferable skills, including personal organisation, teamwork, finding and using information, and written and oral communication.

## **Programme Learning Outcomes**

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### **Knowledge and Understanding**

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

- A1. operational research methodology including the role of mathematical models in problem solving;
- A2. statistical theory at an advanced level;
- A3. a range of deterministic and stochastic operational research techniques that are required for tackling a variety of quantitative management problems;
- A4. the application of statistical methods to practical problems in new or unfamiliar environments;
- A5. statistical modelling techniques used in the analysis of statistical data;
- A6. the use of IT resources, including optimisation package and major statistical analysis packages such as SAS and R;
- A7. an individual research topic.

### **Teaching and Learning Methods**

Acquisition of knowledge and understanding is through structured exposition based on lectures (A1 - A6), computer workshops (A1, A3, A4, A5, A6), tutorials (A1, A2, A3, A4, A6), individual and group work (A1, A3, A4), private study (A1 - A7), seminars and case studies (A1, A3, A4), and a supervised project (A7).

## Assessment Methods

Every module is assessed, either by an examination or coursework, or a combination of both. Some of the coursework requires the use of specialist optimisation, simulation or statistical software to solve problems and to build models. Other key requirements are to write reports and to give oral presentations.

Examinations will primarily assess learning outcomes A1, A2, A3, coursework will primarily assess A1, A3, A4, A5, and A6 and the dissertation will assess A7 (and others, depending on the nature of the topic).

## Subject Specific Intellectual and Research Skills

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

- B1. evaluate quantitative management problems and to construct appropriate mathematical or statistical models;
- B2. use computer packages for certain operational research and statistical techniques including interpretation of the output;
- B3. apply operational research and/or statistical techniques and approaches to a real-life project;
- B4. discuss and communicate ideas/results orally and in written form to specialist and non-specialist audiences;
- B5. analyse mathematical models and select a suitable solution methodology;
- B6. synthesise various statistical techniques to carry out and interpret statistical analyses;
- B7. synthesise relevant materials acquired from the library and internet.
- B8. For students who choose to specialise more on operational research:

apply core operational research techniques, such as mathematical programming (linear, nonlinear integer programming), game theory, simulation and statistical methods.

- B9. For students who choose to specialise more on statistics:

Design a statistical experiment and conduct the appropriate analysis in new or unfamiliar environments, and critically assess the use of particular statistical techniques in practice.

## Teaching and Learning Methods

The use of mathematical and statistical models and their interpretation by applying suitable techniques is fundamental in operational research and statistics, and so this is emphasised throughout the teaching and learning experience. Computer work is an integral part of the programme, and specialist computer packages are used for mathematical programming, simulation and statistics. Computer programming is taught through Visual Basic for Applications, statistical analysis through SAS and R, and spreadsheet modelling through Excel. The subject specific skills are covered in lectures, computer workshops, tutorials, seminars and group work.

## Assessment Methods

The various methods of assessment described involve analysis, modelling and problem solving (B1, B4-B9). Where computer work is involved, coursework is the vehicle whereby the skills learned are assessed (B2). The project involving the practical application of operational research and statistics is assessed by a dissertation (B3).

## Transferable and Generic Skills

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

- C1. write reports on your analysis of a problem together with your results and conclusions to specialist and non-specialist audiences;
- C2. present the results of your work by means of oral presentations;
- C3. manage an individual research project;
- C4. demonstrate teamwork skills;
- C5. collect and synthesise information from a variety of sources including the internet, textbooks and journal articles;
- C6. apply IT skills and use various optimisation, simulation and statistical software packages;
- C7. organise your research work and the presentation of findings by the production of a substantial dissertation on an individual research topic;
- C8. contribute confidently and appropriately to discussion;
- C9. practice the skills you have acquired (organisation, time management, problem solving, critical analysis, independent learning, etc.) that will support lifelong learning.

## Teaching and Learning Methods

A variety of methods of teaching and learning are used, appropriate to the learning outcomes as described above. An induction programme teaches written and oral communication skills, and teamworking, and these skills are used in several modules. Written and oral communication skills are developed further in the modules Presenting Reports or Research Communication Skills. The use of IT plays an important role throughout the programme. During the project, your portfolio of skills, including library research, time management and communication, is developed further.

## Assessment Methods

Throughout the programme, the clear communication of your analysis and problem-solving approach is part of the assessment criteria, either implicitly or explicitly. For the coursework and project work, a proportion of the assessment is related to communication (C1 and C2) and where appropriate to the appropriate use of IT (C6) and to internet and library research (C5). Some coursework involves working in groups, and a proportion of the assessment is assigned to teamwork skills (C4). The dissertation will assess the skill set in (C1, C2, C3, C5, C6, C7, C8 and C9). The skills referred to in C9 are implicit in all modules, and their mastery will contribute to the overall standard of your work.

## Programme Structure

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The programme structure table is below:

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

Where optional modules have been specified, the following is an indicative list of available optional modules, which are subject to change each academic year. Please note in some instances modules have limited spaces available.

## Pathway

### Part I

#### Programme details

The structure of the programme and the modules currently offered are set out below. Of the modules shown, some are compulsory (i.e. enrolment is automatic) and others are optional. Against each semester, 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](https://studentrecords.soton.ac.uk/BNNRPROD/bwkkspgr.showpage?page=ESC_PROGCAT_FINDPR)).

A flexible and inclusive approach to learning and teaching will enable any student who meets the entry requirements to access the curriculum and demonstrate achievement of all the intended learning outcomes. This approach should minimise the need for individual alternations to be made for students with particular learning needs.

The University works within a Credit Accumulation and Transfer Scheme (CATS) and the European Credit Transfer Scheme (ECTS), full details of which are in the University Calendar (<http://www.calendar.soton.ac.uk/sectionIV/cats.html>).

The programme is normally studied over 12 months full-time. The taught component of the programme consists of 30 study weeks divided into two semesters during which time students study 60 ECTS/120 CATS. Students who successfully complete the taught component undertake a three-month period of supervised research for a Master's dissertation at a value of 30 ECTS/60 CATS.

### Part I Compulsory

In addition to the following modules, MATH6167 (CORMSIS practitioner talks and project briefings) is also Compulsory (0 credits).

Code	Module Title	ECTS	Type
MATH6002	Deterministic OR Methods	7.5	Compulsory
MATH6152	Statistical Computing	5	Compulsory
MATH6170	Statistical Inference for Data Scientists	7.5	Compulsory
MATH6004	Stochastic OR Methods	7.5	Compulsory

### Part I Option - Rule 1

You must select 65 credits from the following list of optional modules.

You must select EITHER MATH6145 Presenting Reports OR STAT6099 Research Skills which are considered COMPULSORY for your programme.

A total of 65 credits must be selected across Rule 1 Group 1 and Rule 1 Group 2. When making your choices, you should ensure an even balance of credits across semester 1 and semester 2.

#### Part I Option - Rule 1 Group 1

Select between 7.5 credits and 10 credits (1 module).

You must select one of the following modules which are COMPULSORY for your programme.

Code	Module Title	ECTS	Type
MATH6145	Presenting Reports	3.75	Optional
STAT6099	Research Communication Skills	5	Optional

#### Part I Option - Rule 1 Group 2

If you selected MATH6145 above, you must select 52.5 credits from the following list.

If you selected STAT6099 above, you must select 50 credits from the following list.

Code	Module Title	ECTS	Type
MATH6119	Analytical Consultancy Skills	3.75	Optional
MATH6112	Computer-based statistical modelling	3.75	Optional
MATH6147	Data Analytics	3.75	Optional

COMP6234	Data Visualisation	7.5	Optional
MATH6027	Design of Experiments	7.5	Optional
MATH6169	Flexible Regression	7.5	Optional
MATH6011	Forecasting	3.75	Optional
MANG6100	Game Theory for Business	3.75	Optional
STAT6083	Generalised Linear Models	10	Optional
MATH6005	Introduction to Python	3.75	Optional
MATH6120	Nonlinear Optimisation	3.75	Optional
MATH6146	Revenue Management	3.75	Optional

#### Part I Option - Rule 2

You must select either MATH6001 Operational Research Project or MATH6031 Statistics Project.

The module selected will then become CORE for your programme.

Code	Module Title	ECTS	Type
MATH6001	Project	30	Optional/Core
MATH6031	Statistics Project	30	Optional/Core

## Progression Requirements

The programme follows the University's regulations for [\*Progression, Determination and Classification of Results : Undergraduate and Integrated Masters Programmes\*](#) or [\*Progression, Determination and Classification of Results: Postgraduate Master's Programmes\*](#). Any exemptions or variations to the University regulations, approved by AQSC are located in [\*section VI of the University Calendar\*](#).

## 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.
- access to key information through the MySouthampton Student Mobile Portal which delivers timetables, Module information, Locations, Tutor details, Library account, bus timetables etc. while you are on the move.
- IT support through a comprehensive website, telephone and online ticketed support and a dedicated helpdesk in the Hartley Library.
- Enabling Services offering support services and resources via a triage model to access crisis management, mental health support and counselling. Support includes daily Drop In at Highfield campus at 13.00 – 15.00 (Monday, Wednesday and Friday out of term-time) or via on-line chat on weekdays from 14.00 – 16.00. Arrangements can also be made for meetings via Skype.
- assessment and support (including specialist IT support) facilities if you have a disability, long term health problem or Specific Learning Difficulty (e.g. dyslexia)
- the Student Services Centre (SSC) to assist you with a range of general enquiries including financial matters, accommodation, exams, graduation, student visas, ID cards
- Career and Employability services, advising on job search, applications, interviews, paid work, volunteering and internship opportunities and getting the most out of your extra-curricular activities alongside your degree programme when writing your CV.
- Other support that includes health services (GPs), chaplaincy (for all faiths) and 'out of hours' support for students in Halls and in the local community (18.00-08.00).
- A Centre for Language Study, providing assistance in the development of English language and study skills for non-native speakers.

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

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

- Completing student evaluation questionnaires for each module of the programme.
- Acting as a student representative on various committees, e.g. Staff/Student Liaison Committees, School Programmes Committee OR providing comments to your student representative to feedback 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.

Further details on the University's quality assurance processes are given in the [Quality handbook](#).

## Career Opportunities

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OR is the application of scientific methods to the study of complex organisational problems. Even within the same organisation, OR tends to be highly varied because of its project-driven nature. This breadth of experience offers an exciting and rewarding career in many organisations, enabling many OR workers to progress to a career in general management. Moreover the nature of the work brings an OR graduate into early contact with senior management and it can offer opportunities for rapid career advancement.

Statistics is a rewarding and often exciting career choice. Statisticians work with the data that are all around us and the opportunities for work are endless. Statistics is concerned with decision-making in the face of uncertainty, and lies at the heart of the type of quantitative reasoning necessary for making important advances

in the sciences, such as medicine and genetics, and for making important decisions in business and public policy.

Here is a (by no means complete) list of typical careers for Operational Research and Statistics graduates:

- Consultancy as an Operational Researcher or a Statistician
- Operational Researcher (to provide strategic planning or improving operation in an organisation, in Business and Governments)
- Investment Banking, Data analysis, Revenue Management
- Medical Statistician, Pharmaceutical Statistician, Government Statistician, Financial Statistician, Statistician in insurance.
- Environmental Statistician (e.g. in Government environmental organisations)
- Market Research Statistician (e.g. at the market research department of a big company)
- Study for a PhD in Operational Research or Statistics
- University Lecturer

## External Examiner(s) for the programme

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Name: Professor Miguel Anjos – University of Edinburgh

Name: Professor Jeremy Oakley – University of Sheffield



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 they take 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

Type	Details
Approved Calculators	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.
IT	There are computer labs around the University for the students to use. All software needed for the course is provided. Some software might be available to be installed in the students' personal computers.
Placements (including Study Abroad Programmes)	Students who are allocated to summer projects with external companies outside Southampton might receive reallocation support. Details will be arranged between the student, the company and the MSc programme coordinator.
Printing and Photocopying Costs	In some modules, coursework such as essays; projects is to be submitted online. However, there are some items where it is not possible to submit online and students will be asked to provide a printed copy. A list of the University printing costs can be found here: <a href="http://www.southampton.ac.uk/isolutions/services/copying_for_students_and_visitors/faq.php">http://www.southampton.ac.uk/isolutions/services/copying_for_students_and_visitors/faq.php</a>
Stationery	You will be expected to provide your own day-to-day stationary items, e.g. pens, pencils, notebooks, etc). Any specialist stationery items will be specified under the Additional Costs tab of the relevant module profile.
Textbooks	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.

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](http://www.calendar.soton.ac.uk).