

The background of the top half of the page is an aerial view of a city, likely London, with a network of white lines and icons (such as a globe, a house, a person, and a bar chart) overlaid on the image, suggesting a global or interconnected theme.

# Subject Benchmark Statement: Mathematics, Statistics and Operational Research

## The Basics

This document is a summary of the Subject Benchmark Statement for Mathematics, Statistics and Operational Research. It is specifically designed to provide a short and accessible overview of the main statement for students, employers and academics. It is not intended to replace or alter the Subject Benchmark Statement, which should be referred to in the design and approval of courses and when any further detail is required.

Subject Benchmark Statements are an established part of the quality assurance arrangements in UK higher education as non-regulatory, sector-owned reference points, developed and written by academic communities on behalf of their subject. Subject Benchmark Statements describe the nature of study and the benchmark academic standards expected of graduates in specific subject areas, and in respect of particular qualifications. They provide a picture of what graduates in a particular subject might reasonably be expected to know, do and understand at the end of their course or programme.

Subject Benchmark Statements are presented in four sections. Section 1 outlines the contextual information - providing the operational landscape, and boundaries, of subject discipline. This includes consideration of the ways in which the discipline addresses wider social goals specifically in relation to: equality, diversity and inclusion (EDI); the requirements of disabled students; education for sustainable development (ESD); and, enterprise and entrepreneurship.

Section 2 covers distinctive features of the course, including curriculum design, partnership arrangements, flexibility of delivery, progression and ongoing monitoring processes. The third section explains any features relevant to teaching, learning and assessment activities for the subject. The final section describes the benchmark standards of achievement reached by all graduates with a bachelor's degree with honours in the subject, with some subjects also including achievement at master's level.



## Why study a degree in Mathematics, Statistics and Operational Research?

As a subject discipline, Mathematics, Statistics and Operational Research (MSOR) can be, on the one hand, abstract and theoretical and, on the other, applicable in a vast range of areas. Indeed, in the 21st century, there are few aspects of the physical and virtual world that are not better understood through the application of MSOR models and techniques. Despite this applicability across many disciplines, MSOR remains a distinctive discipline in its own right, giving opportunities for learners to develop creativity and logical thinking. MSOR subjects make a vast contribution to the economy and society. MSOR courses are an intellectual pursuit that develops wide-ranging academic and transferable skills, open up a range of further study opportunities, and provide an excellent route to employment in many important sectors of the economy and society.

MSOR has a vital role to play in achieving the United Nations' Sustainable Development Goals (SDGs). Graduates of MSOR degrees develop critical thinking, modelling and problem-solving skills that are useful in analysing and resolving issues in the complex systems relevant to many of the SDGs.

This breadth - from abstract to applied - which is fundamental to the nature of MSOR, is reflected in the nature of courses that can be studied. A wide spectrum of courses is available which may be characterised as running from theory-based courses to practice-based courses. The former are more focused on the way in which theory establishes general propositions leading to methods and techniques which can then be applied to a range of problems. The latter are more focused on the understanding and application of results, methods and techniques to a variety of situations in different contexts.

No matter where on this spectrum the course studied is placed, graduates of MSOR develop skills in logical thinking, abstraction, generalisation, problem-solving and the abilities to use specialist MSOR software and to write computer programs. Furthermore, MSOR graduates have gained enterprise and entrepreneurial skills including an enhanced capacity to generate and evaluate ideas, strategic thinking, curiosity, determination and resilience. All these make MSOR graduates highly sought after by a wide range of employers.



## What are the main teaching and learning approaches in MSOR?

In essence, MSOR is a practical discipline and successful learners are those who have actively, cognitively engaged with the practice of MSOR. Students of the discipline will encounter a wide range of teaching and learning methods including (but not limited to) lectures, small group tutorials and computer laboratories. These activities may model the practice of MSOR - for example, through the presentation of extended rigorous arguments (often in lectures). Such activity sits alongside students undertaking regular practice on standard exercises (to develop basic skills) and wrestling with larger, more open-ended problems where students may be required to interpret their findings (possibly in a context beyond MSOR). These larger problems are often suitable for collaborative learning. Students may also use specialist MSOR software or write their own computer programs. Presentation, discussion and critical analysis of MSOR content - both formally in-class and informally in peer groups - enhance learning.

As a result of the cumulative nature of MSOR, some topics may be revisited at different points in a course. This reinforces deeper learning and it is not unusual for students to gain greater insight into material previously studied when it is revisited at later points in a course.

Equality, diversity and inclusion (EDI) is essential for the health of MSOR. EDI values are reflected in teaching and learning approaches which seek to ensure that no group is disadvantaged and that all students have equitable access to all aspects of the curriculum. The nature of MSOR creates some discipline-specific barriers to accessibility. These challenges are being addressed by creativity of practice and technological advances.

A crucial goal is the development of independent MSOR scholars and practitioners, able to learn new content for themselves. To this end, many courses will give students the opportunity, in the final year, to undertake an extended piece of work such as a project or dissertation. Such work will typically take place over a period of at least one semester.



## How are students assessed?

Assessment in MSOR is designed to establish the student's:

- knowledge and understanding of a corpus of well-established material
- operational understanding of the conventions of the discipline - for example, the norms of mathematical proof or statistical inference
- ability to apply knowledge, work with abstract models, solve problems and to reason rigorously
- ability to communicate clearly and accurately in a variety of verbal and/or non-verbal formats, including appropriate use of mathematical symbols.

In addition, assessment in MSOR may establish the student's abilities to:

- pursue substantial independent projects and write reports
- use existing software and write code
- interpret, evaluate and critique the work of others
- work effectively within a team.

The assessment of MSOR courses includes a mix of methods that are accessible to disabled students and students from varying educational and cultural backgrounds within different learning situations. These methods include invigilated examinations, problem-solving exercises, written reports, oral presentations and production of posters.

The nature of MSOR means that for some tasks students can be expected to provide an answer which is very close to a model answer. In these circumstances, controlled conditions, such as those provided by an invigilated examination, are often essential to guarantee the validity and integrity of the assessment.

Furthermore, assessment marks can span the entire percentile range and students may fail some modules while still meeting the overall learning outcomes of the course. Consequently, some aspects of provider-wide assessment regulations might be less applicable in MSOR than other subjects and may need to be adapted to take account of the inherent nature of the discipline, otherwise the professional judgement of the examiners (internal and external) could be seriously compromised.

Where individual students may be disadvantaged by particular assessment methods, adjustments to those assessments are considered in conjunction with the provider's procedures, while ensuring fairness across the full cohort. The procedures used for assessment cover the subject knowledge (breadth and depth), abilities and skills developed through the degree course; and assessment design is aimed at alignment with teaching and learning approaches, and desired learning outcomes.



## Benchmark Standards

The minimum threshold standards that a student will have demonstrated when they are awarded an honours degree in Mathematics, Statistics and Operational Research are outlined on **pages 28-30** of the Subject Benchmark Statement. The vast majority of students will perform significantly better than the minimum threshold standards. Each higher education provider has its own method of determining what appropriate evidence of this achievement will be and should refer to [Annex D: Outcome classification descriptions for FHEQ Level 6 and FQHEIS Level 10 degrees](#). This Annex sets out common descriptions of the four main degree outcome classifications for bachelor's degrees with honours - 1st, 2.1, 2.2 and 3rd.

The full statement was developed by subject experts drawn from across the sector. Details of the Advisory Group can be found on **page 33** of the full Statement.

**Read the full Subject Benchmark Statement**

The [full Subject Benchmark Statement](#) is available on the QAA website.



Subject Benchmark Statements are published in QAA's capacity as an expert quality body on behalf of the higher education sector.

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