

<b>1</b>	<b>Awarding Institution</b>	<b>University of Newcastle upon Tyne</b>
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<b>2</b>	<b>Teaching Institution</b>	<b>University of Newcastle upon Tyne</b>
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<b>3</b>	<b>Final Award</b>	<b>MMath Honours or MMathStat Honours</b>
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<b>4</b>	<b>Programme titles</b>	<b>G103 Mathematics GGC3 Mathematics and Statistics</b>
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<b>5</b>	<b>Programme Accredited by: GGC3 Mathematics and Statistics Accredited by Royal Statistical Society</b>	
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<b>6</b>	<b>UCAS Codes:</b>	<b>See 4.</b>
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<b>7</b>	<b>QAA Subject Benchmarking Group(s)</b>	<b>Mathematics, Statistics and Operational Research</b>
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<b>8</b>	<b>Date of production/revision</b>	<b>June 2002</b>
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<b>9</b>	<b>Programme Aims:</b>  The two programmes aim to provide an in-depth understanding of mathematics and statistics for those who wish to enhance their employability by acquiring greater technical skills than those provided by the BSc programme, or who may wish to proceed to postgraduate study. The structure aims to produce graduates who have a sound, broad knowledge of the fundamental aspects of mathematics and statistics, complemented by a knowledge of specialist areas, and an awareness of applications of these subjects. The structure allows students to develop the ability to reason logically and their capacity for mathematical and statistical thinking, and to equip students with a range of subject-related key skills.	
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**10(a) Programme Intended Learning Outcomes:**

**A Knowledge and understanding**

- A1 A broad understanding of fundamental concepts and methods of mathematics and statistics.
- A2 In areas of the student's specialization, a more in-depth understanding of mathematical and/or statistical concepts and methods.

**B Subject-specific/professional skills**

- B1 Further knowledge and experience of theoretical concepts and analytical techniques in mathematics and statistics
- B2 Further broad knowledge of a number of topics in mathematics and statistics or a more specialist knowledge of particular areas within these subjects, as appropriate to the pathway chosen and as reflected in the degree title awarded
- B3 More advanced knowledge of specialist topics relating to the research interests of the school.

**C Cognitive skills (for codes see Commentary: Key Skills Map).**

- C1 Logical deduction (all mathematics modules)
- C2 Problem formulation (all mathematics modules)
- C3 Problem solving (s6)
- C4 Organisation of data (all statistics modules)
- C5 Interpretation of data (all statistics modules)

**D Key (transferable) skills (for codes see Commentary: Key Skills Map).**

- D1 Written communication (s1)
- D2 Interpersonal communication (s2)
- D3 Oral presentation (s3)
- D4 Teamwork (s4)
- D5 Planning and organisation (s5)

D6 Initiative (s7)

D7 Adaptability (s8)

D8 Numeracy (s9)

D9 Computer Literacy (s10)

10(b)	Programme Intended Learning Outcomes:	Teaching and Learning Methods and Strategies
	<p>The School uses a variety of methods for teaching and learning. These include lectures, class tutorials, practical classes, homework assignments, mini-projects, directed reading and student seminars. See Commentary: Key Skills Map, for details of how the Cognitive and Key Skills listed in Section 10(a) C and D are introduced and practised throughout the degree programme.</p>	
	<ul style="list-style-type: none"> <li>• <b>Lectures</b> are the principal vehicle for presenting the essential material which defines the module, and provide the key element towards achieving the programme intended learning outcomes in Section 10(a) A and B. Notes taken by students are often supplemented by handouts.</li> <li>• <b>Class tutorials</b> are used to support lectures and to enhance students' learning by providing an opportunity to discuss previous or current homework problems, or to clarify issues arising from lectures. Together with lectures, tutorials are the main vehicle for developing the cognitive skills in Section 10(a) C. The arrangements for class tutorials were reviewed at one of our School Teaching Forums. Class tutorial groups are typically about 20 in Stage 1 and about 35 in subsequent stages. We have deliberately chosen to concentrate support on Stage 1 in order to strengthen the base for later study.</li> <li>• <b>Practical classes</b>, held in a computer teaching laboratory, introduce students to the use of computer packages. At Stage 1, students learn to use Minitab for data analysis and simulation studies and the computer algebra package Maple. In later stages, students may be expected to use the computer network for homework assignments. Practical classes contribute towards a number of key transferable skills listed in Section 10(a) D.</li> <li>• <b>Homework assignments</b> are designed to allow students to test and develop their understanding of the material presented in lectures. The assignments are usually set on a fortnightly rota. Typically, there are questions of varying difficulty; answers to some of the questions are handed in for marking and contribute to both formative and summative assessment. Other problems are provided for further practice or for discussion in the tutorial classes. Model solutions to all homework exercises are made available to students when the marked work is returned. The homework assignments develop cognitive and key skills in Section 10(a) C and D, while reinforcing knowledge and understanding and subject-specific professional skills in Section 10(a) A and B.</li> <li>• <b>In-class tests</b> are used in some courses, to give students practise in problem solving under exam-like conditions. Cognitive and Key Skills listed in Section 10(a) C and D are developed.</li> <li>• In a few courses, particularly in Applied Statistics, <b>mini-projects</b> (including group work) are used to encourage students to investigate and write a report on some topic. Cognitive and key skills in Section 10(a) C and D are developed by mini-projects, while knowledge and understanding, and subject specific professional skills in Section 10(a) A and B, are reinforced.</li> </ul>	

- The Stage 4 **project** requires students to undertake a substantial investigation involving a considerable amount of independent work and to write a dissertation and give both an oral and a poster presentation. This reinforces knowledge and understanding and subject specific professional skills in Section 10(a) A and B. A wider range of cognitive and key skills in Section 10(a) C and D are developed, to a greater depth.

<b>10(c) Programme Intended Learning Outcomes:</b>	<b>Assessment Strategy and Methods</b>
<p>The standard assessment format, used for the majority of lecture courses, is based on a written examination (counting for at least 80% of the assessment), together with an appropriate mixture of course assignments, in-course tests and mini-projects. These methods all enable assessment of the Programme Intended Learning Outcomes in Section 10(a) A and B, while the range of assessment techniques allows assessment of various Cognitive and Key Skills as listed in Section 10(a) C and D (see Commentary: Key Skills Map for details). Assessment by unseen examinations is seen as a valid and reliable method of assessing both ability and knowledge. Details of the specific assessment modes and weightings, for each module, are set out in the module specification in the Degree Programme Handbooks.</p>	<p>We use a standard format for examination papers in which there is a compulsory Section A, consisting of short, straightforward questions which cover the whole module, and a Section B, normally offering a choice of 2 out of 3 questions which are longer and designed to test a greater depth of understanding. Our external examiners have commented favourably on the merits of this structure. Science Faculty Teaching Committee and the University's internal Subject Review panel have also commended this approach as an example of good practice.</p> <p>In Stage 4 we use a different format with a single section. By removing the section of short straightforward questions, we focus on assessing the greater depth of understanding we would expect from students at this level</p> <p>The Stage 4 project is assessed in three parts, an oral presentation, a poster presentation, and a written report. The two presentations are designed to assess the student's ability to communicate the kind of work necessary for a major project to an audience in different formats commonly required in both professional and research environments (see the cognitive and key skills in section 10(a) C and D). The report is assessed both for content (see the knowledge and understanding and subject-specific/professional skills in section 10(a) A and B, and for presentation style, assessing the student's ability to present, and write coherently and informatively about, a substantial piece of independent work(see the cognitive and key skills in section 10(a) C and D).</p>

## **11 Programme Curriculum, Structure, and Features:**

### **Curriculum design strategy**

A distinctive feature of the School's curriculum is the flexible structure, operating within the University's modular system, in which students can choose pathways which provide either:

- a)** a broad mathematical and statistical education throughout their programme of study, or
- b)** a general mathematical and statistical background followed by more specialised study of chosen areas.

The balance of modules chosen by a student, through optional choices in Stages 2, 3 and 4 is reflected in the degree title awarded (MMath or MMathStat).

The mathematics and statistics curriculum was completely revised in preparation for university-wide modularisation and semesterisation in 1995. The MMath and MMathStat programmes were introduced in 1995, with the first students graduating in 1999. The programmes have been reviewed periodically by Board of Studies and School Teaching & Learning Committee. The School participates in the NEMAS (North of England Mathematics and Statistics) Forum which meets to discuss the changing needs of the mathematics and statistics curriculum.

### **Course structure by stage**

It is in the nature of the subjects of Mathematics and Statistics that there is progression in the material taught. In **Stage 1**, the School aims first to consolidate and reinforce the students' knowledge on entry, and to provide a sound body of introductory material in mathematical methods, and in the three subject areas of Applied Mathematics, Pure Mathematics and Statistics. This provides the foundation for subsequent study in these areas.

Also in Stage 1, students are required to study modules outside the School, which enables them to broaden their experience. These modules may be chosen freely, subject to the timetable; in practice, modules in Computing, Accounting or Education are most frequently chosen.

In **Stage 2**, all undergraduate students undertake further core study in each of Applied Mathematics, Pure Mathematics and Statistics. These modules develop relevant knowledge and experience of more theoretical concepts and further analytical techniques.

Also in Stage 2, students choose options within at least two subject areas. This allows some specialisation, if desired, although students may choose options in all three areas. Students may also elect to study further modules offered elsewhere in the University, in order to broaden their knowledge and skills.

In **Stage 3**, students are required to study certain modules in preparation for the project or advanced modules in Stage 4. Which modules these are depends on which area(s) the student intends to study in Stage 4. The remaining modules are mainly chosen from the Stage 3 B.Sc. programme. It is possible to take a small number of Stage 2 modules not yet taken.

In **Stage 4**, students are required to study advanced modules which are intended to take the students closer to the frontiers of research. They also undertake a substantial project in their chosen subject area which develops their skills of independent study and the presentation of results both orally and in writing. The remainder of their programme of study is chosen from the modules offered in the BSc programme; the choice of modules is extended by the use of a rolling programme of some Stage 3 modules.



## **12 Criteria for Admission:**

### **Overview**

To qualify for the MMath or MMathStat degrees, students follow the general admissions procedure for the BSc programmes (see below). Stages 1 and 2 are the same as for the BSc programmes. Transfer between the MMath/MMathStat and BSc degree programmes is possible up until the end of the Stage 2. Thereafter the MMath/MMathStat programmes and the BSc programmes diverge, and transfer is not possible. We recommend that students who are at all likely to want to follow the MMath or MMathStat programmes register for one of these programmes from the outset. To qualify for Stages 3 and 4 of the MMath and MMathStat programmes, students must normally have obtained at least an upper second class average mark in their second year. At the of each academic year a list of stage 2 students who are eligible to proceed to the MMath or MMathStat programmes is published, and these students are contacted and encouraged to consider proceeding with one of these programmes.

### **General Procedure**

The university enrolls approximately 110 students each year to single honours degree programmes in Mathematics and Statistics, including MMath and MMathStat degrees. Admission of these students is conducted by the admissions staff in the School: currently 2 lecturers and one secretary with 3 undergraduates who assist with open days.

### **Applications**

An academic member of the admissions staff considers each application (UCAS form). Based on this information it is decided whether to offer the applicant a place and if so what the terms of the offer are to be. Offers are intended to indicate a minimum standard that we require of our new students and are the primary mechanism by which we control the quality of our intake. This year our standard offer is a grade A in A-level mathematics with a total of 24 grade points from 3 A-levels. Similar offers are made to applicants taking other combinations of A and AS-levels or other forms of UK or overseas exams. At least 60% of our intake have qualifications at or above the offer level, the remainder coming very close.

Mature students, or those with non-standard qualifications, are interviewed whenever this is practical (by telephone if necessary) before any offer is made. In the past, we interviewed all applicants before sending out offers. However, we have recently changed our policy to one where we issue offers solely on the basis of the UCAS form, as we found that interviews gave us little additional information, slowed our response to applicants and discouraged those who received all their other offers before ours.

Once a decision has been made the applicant is informed (informally), by letter, of the offer that they will eventually receive from UCAS. The letter includes an invitation to a School Open Day. We strongly encourage applicants to attend an open day and, to this end, we offer a contribution to travel expenses. We also enclose details of the University's "Access Fund" for mature or disabled applicants, and others who may be eligible for financial support under this scheme.

### **Open Days**

The School holds 5 open days between November and March. The Open Day programme covers an afternoon and involves informative talks, one-to-one meetings with lecturing staff, tours of the campus and city, and contact with undergraduates. Help with travel expenses is provided for students travelling long distances.

### **Bursaries**

The School offers bursaries of £100 towards tuition fees for all applicants who confirm degree programmes in Mathematics and Statistics at Newcastle as their first choice and achieve their asking grades.

### **Other recruiting activities**

The School contributes two one-hour sessions for potential applicants and their relatives at the University Visit Days. The School also hosts two annual conferences for teachers and either Year 11 or Year 12 pupils of local schools. The conferences, intended to give pupils an impression of University life and provide contact between staff and school-teachers, involve an afternoon of lectures and, particularly for the Year 12 conference, discussions with both pupils and teachers.

## **13 Support for Students and their Learning:**

### **Induction**

The School provides a comprehensive induction programme for new students, which introduces the facilities for study available both at University and School level. On acceptance, students are sent a copy of the student handbook and its contents are discussed with them at induction. Students are also offered general advice about the course structure and the choices open to them at Stage 1. The handbook includes information about the School, and on the respective roles and responsibilities of staff and students. In other sessions, guidance is given on study skills and IT skills using the booklets “Winning at Mathematics” and “Introduction to the Oracle cluster”, which are issued to all new students. A senior teacher from a local school addresses new students on the transition from School/College to University life. The School’s handbooks were identified as examples of “good practice” by both the Faculty Teaching Committee and the Subject Review panel.

At subsequent stages, advice is provided about course structure, and the pathways open to students, at general meetings held in April; this allows students to pre-register their choice of modules in early May, for the following academic year, so that the timetable can be organised to allow the maximum number of student choices. Further detailed advice about modules is available during Induction Week at the start of the next academic year. Students also discuss their choices with their personal tutors and, where necessary, with the Degree Programme Directors (DPDs). Changes of module choices from pre-registration are allowed subject to the constraints of the timetable. Revision sessions on key material taught the previous year are provided to help students to prepare for their new modules. Towards the end of Stage 3, advice is given to MMath/MMathStat students about the choice of a project and what is expected of them in carrying out the project.

General help on academic problems is available in class tutorials (see Section 2) and from lecturers individually.

Each student has a personal tutor who is responsible for providing access to pastoral care. Students identified on entry as requiring particular support (e.g. mature students, international students, students with disabilities, or those with an unusual background) are assigned to more experienced tutors. In a change of policy arising from a Teaching Forum on pastoral care, tutors meet their tutees at the start of the year and at the end of terms 1 and 2, rather than at the start of each semester. Support for students who encounter serious personal difficulties is provided by the University’s Student Counselling Service. In addition, more general advice is available from the Student Advice Centre.

The School has a Degree Programme Director and three Assistant DPDs who each take responsibility for particular stages of study. They monitor the progress of students as described below.

### **Monitoring Student Progress**

The performance of all students is carefully monitored. Records of work handed in and marks obtained on all modules are held by the Degree Programme Directors. In Stage 1, attendance at tutorials is also checked, and absentees contacted, in order to encourage good work habits.

The progress of all students is reviewed regularly by the DPDs; students, who give cause for concern (whether by failing to hand in work or by poor performance), are called in by the relevant DPD. The problems are discussed, and help and advice are offered. Persistent offenders may be required to demonstrate regular attendance at all classes by obtaining lecturers' signatures. Personal tutors are advised when a tutee's progress is giving cause for concern.

### **Careers Advice**

The University Careers Service provides support and advice for students throughout their course of study. One of the careers advisers gives an introductory talk to Stage 1 students at induction and further talks in subsequent stages. At Stage 2, students are invited to assess their personal skills and are given guidance as to ways in which their skills profile might be improved. Also in Stage 2, students are given advice on how to prepare a draft CV.

Early in their final year, students are given further advice on the career opportunities available and are encouraged to use the Careers Service facilities. Personal tutors, and one or two members of staff with particular experience, are also able to offer guidance.

For those students wishing to proceed to further academic study or research, a presentation is organised by the Director of Postgraduate Teaching.

**Learning Resources: Physical**

Many lectures take place in Merz Court. The lecture and tutorial rooms within the School are of a good standard and suitable for their purpose.

The computer cluster in Merz Court has 40 fast PCs (running WindowsXP) and 2 laser printers. It is conveniently situated within the School and is used as the primary teaching laboratory for practical classes. Mathematics and Statistics students also use the cluster when carrying out homework assignments and for general IT purposes, such as word-processing.

The cluster provides access to campus-wide facilities such as the central file space servers, electronic mail and the internet. Extensive software is available, ranging from the general, such as standard Microsoft applications (Word, Excel etc.), to the technical, such as the statistical package Minitab and the general symbolic algebra package Maple. The campus-wide windows network ensures that software and data sets used in our modules are accessible from any cluster (including the Halls of Residence), which is of great convenience to all users, both staff and students. A teaching room in the School has been designated as a reading room for private study by students; this facility is well-used. Students have access to a full-range of library services provided by the award-winning Robinson library.

**Learning Resources: Staff**

The academic staff are the primary teaching and learning resource. Staff have a wide range of experience in Mathematics and Statistics, with particular expertise in the research areas of functional analysis, group theory, fluid dynamics, cosmology, applied statistics, medical statistics and applied probability. Some staff also have extensive consultancy experience. This expertise informs our teaching, especially at the more advanced levels. All experienced staff act as personal tutors to students.

PhD students in the School also contribute to teaching by marking homework and conducting some first-year tutorials.

The academic staff and students are supported by the clerical staff in the General Office. The secretaries deal with many student enquiries on a day-to-day basis and they provide a helpful and friendly service.

The Computer Officer is responsible for maintaining the School's computing facilities and in advising on the purchase of hardware and software.

## **14 Methods for evaluating and improving the quality and standards of teaching and learning:**

### **Monitoring Quality**

Recently, the School has moved to a web-based questionnaire where students are asked to comment on all the modules they are taking in that Semester. If students do not reply fairly quickly they are sent email reminders and this has led to a greatly increased response rate compared to the previous paper-based system. At the end of the questionnaire the students are asked to comment on the overall structure of their degree course. Summaries of the responses are discussed at Staff-Student Committee, School Teaching and Learning Committee and the Board of Studies. New staff, and staff giving a new module, typically give out module questionnaires part way through the module to gain more immediate feedback from the students.

The School participated in the University's biennial "Taught Programme Review", until this was replaced by a scheme of Degree Programme Review, under which the school reviews its degree programmes and reports to the Faculty Teaching Committee. There is also a less frequent process of "subject review" in which a panel, which includes a QAA trained reviewer and external reviewers, assess the nature and quality of provision.

### **Committees for Monitoring Quality**

The **Board of Studies** has a membership which includes all teaching staff, together with three students nominated by the Staff/Student committee. It is responsible for the undergraduate programme, and all proposals for new courses, or for changes to regulations or practices, must be approved by the Board before being sent on (where appropriate) to Faculty Teaching & Learning Committee and University Teaching & Learning Committee.

The **School Teaching and Learning Committee** meets frequently to initiate, discuss or respond to current teaching and learning issues. The agenda and minutes are circulated to all staff, thereby ensuring wide debate before proposals are brought to Board of Studies.

The **Board of Examiners** meets, primarily, to discuss the examination results of each student and to determine or advise on the progress after the current stage. Matters of concern raised by the External Examiners, or by the Board, are discussed by School Teaching & Learning Committee and Board of Studies. Faculty Teaching & Learning Committee reviews External Examiners' reports, and the School responses thereto, annually.

The **Staff/Student Committee** normally meets six times a year to discuss matters of mutual concern, both those raised by the students and any items referred to it by the School & Learning Teaching Committee or the Board of Studies. The outcome from these discussions is reported to the Head of School or School Teaching & Learning Committee or Board of Studies, as appropriate. E-mail is used to broadcast messages to targeted groups of students, e.g. to give information relating to a module or year group. The **MMath/MMathStat** project monitoring groups meet annually to ensure consistency of project marking within and between each of the MMath and MMathStat programmes.

**15 Regulation of Assessment**

All work is marked against the University mark scheme for which the 'pass mark' is 40. Modules use a common set of published marking criteria supplemented, as appropriate, for specific pieces of work, with additional criteria.

Most modules are assessed by a combination of in-course assessment and a written examination taken at the end of the semester in which the module finishes. A variety of assessment methods are used, including: assessment of worked exercises, individual mini-projects, unseen examinations and open book examinations. The methods of assessment, their relative weighting and their timing appear in every module description.

The Stage 4 project is assessed in three parts. The student makes an oral presentation of their work early in Semester 2, which constitutes 10% of the total credit for the module. The student submits a written report towards the end of Semester 2, which constitutes 80% of the total credit for the module (60% for content, 20% for presentation). Finally, the student is required to make a poster presentation of the project, at the end of Semester 2, which constitutes 10% of the total credit for the module. Each component of the module is assessed by a team of assessors.

The final honours average is calculated on the basis of the Stage 2, Stage 3 and stage 4 average, weighted in the ratio 20:40:40. Honours marks are based on the University scale:

<b>Mark</b>	<b>Degree Class</b>
≥ 70	First
60-69	Upper Second
50-59	Lower Second
40-49	Third
<40	Fail

Module marks are combined in proportion to their credit value. The module class criteria are detailed in Commentary: Degree Classification Criteria.

Assessment is overseen by a Board of Examiners that interprets marks and makes recommendations regarding progression and, ultimately, the class of degree to be awarded. The Board consists of all staff who examine modules on the programme, plus three External Examiners: one from each of the areas Pure, Applied and Statistics.

The External Examiners are independent of the School. Their role is to:

- Comment on honours examination papers
- Comment on the marking of examination scripts
- Comment on coursework, including mini-projects
- Contribute to the discussion at the Board of Examiners
- Report to the University regarding standards used

## **16 Indicators of Quality and Standards:**

The School of Mathematics and Statistics was awarded an excellent **23 out of 24** points in the QAA Subject Review in 2000. We were particularly commended for *excellent teaching, student support and guidance, learning resources*, and for having a *well structured curriculum*.

In the 2001 Research Assessment Exercise, the Statistics and Pure Mathematics submissions were each awarded **5**, and the Applied Mathematics submission was awarded **4**.

## **17 Other Sources of Information**

This specification provides a concise summary of the main features of the programme and of the learning outcomes that a typical student might reasonably be expected to achieve if she/he takes full advantage of the learning opportunities provided. The accuracy of the information contained is reviewed by the University and may be checked by the Quality Assurance Agency for Higher Education.

In addition, information relating to the course is provided in:

The University Prospectus

The School Prospectus

The University Degree Programme Regulations

The School Degree Programme Handbook: <http://www.ncl.ac.uk/math/internal/>

The QAA Subject Review Report

Newcastle Programme Specification

School of Mathematics and Statistics web page: <http://www.ncl.ac.uk/math/undergrad/>