BSc Computational Mathematics **UCAS code: G1G4**
For students entering Part 1 in 2008/9

Awarding Institution:	University of Reading
Teaching Institution:	University of Reading
Relevant QAA subject Benchmarking group(s):	Mathematics, Statistics and Operational Research
Faculty:	Science Faculty
Programme length:	3 years
Date of specification:	04/Oct/2010
Programme Director:	Dr Karen Ayres
Programme Advisor:	Dr Titus Hilberdink Dr Gerard McKee
Board of Studies:	Maths/Met/Physics
Accreditation:	This programme will meet the education requirements of Chartered Mathematician designation awarded by the Institute of Mathematics and its Applications, when followed by subsequent training and experience in employment to obtain equivalent competencies to those specified by the Quality Assurance Agency (QAA) for taught masters degrees.

Summary of programme aims
The programme aims to provide a thorough degree-level education in Mathematics, with some emphasis on the computational aspects, along with topics from Computer Science which will support this and provide an appreciation of wider issues. It aims to produce mathematicians who have some experience of numerical techniques, an appreciation of wider computational issues and a range of appropriate subject-specific and transferable skills.

Transferable skills
During the course of their studies at Reading, all students will be expected to enhance their academic and personal transferable skills in line with the University's Strategy for Learning and Teaching. In following this programme, students will have had the opportunity to develop such skills, in particular relating to communication, information handling, numeracy, use of IT and problem-solving and will have been encouraged to further develop and enhance the full set of skills through a variety of opportunities available outside their curriculum.
As part of this programme students are expected to have gained experience and show competence in the following transferable skills: IT (word-processing, using standard and mathematical software, scientific programming), scientific writing, oral presentation, team-working, problem-solving, use of library resources, time-management, and career planning and management.

Programme content
The profile which follows states which modules must be taken (the compulsory part), together with one or more lists of modules from which the student must make a selection (the 'selected' modules). Students must choose such additional modules as they wish, in consultation with their programme adviser, to make 120 credits in each Part. The number of credits per module and the level of each module are shown after its title.

Part 1 (three terms)
Compulsory modules

Module	*Title*	*Credits*	*Level*
MA11A	Introduction to Analysis	20	C
MA11B	Calculus and Applications	20	C
MA11C	Matrices, Vectors and Applications	20	C
MA11D	Introduction to Algebra	20	C
SE1SA5	Programming	20	C
SE1SC5	Computer Science Roadmap	20	C

Part 2 (three terms)
Compulsory modules

Module	*Title*	*Credits*	*Level*
MA24F	Communicating Mathematics	20	I
CS2A6	Compilers	10	I
CS2G7	Essential Algorithms	10	I
CS2M7	Further Algorithms	10	I
MA24L	Differential Equations and Fourier Series	20	I
MA2LA	Linear Algebra	10	I
MA2CT	Coding Theory	10	I
MA2VC	Vector Calculus	10	I
MA2NA	Numerical Analysis	10	I
CS2J7	Programming with Java	10	I

Part 3 (three terms)
Compulsory modules

Mod Code	*Module Title*	*Credits*	*Level*
MA34A	Analysis	20	H
MA3NLE	Analysis of Numerical Techniques for Linear Equations and Eigenvalue Problems	10	H
MA3NIO	Analysis of Numerical Techniques for Integration and Ordinary Differential Equations	10	H

Optional modules:
(i) One of

MA37B	Topics in Applied Mathematics	20	H
MA37C	Topics in Pure Mathematics	20	H

(ii) Part 3 modules in Computer Science to the value of 40 credits, select two groups from:
Group A

CS3H7	Concurrent Systems	10	H
CS3W7	Multi-Agent Systems	10	H

Group B

CS3M6	Evolutionary Computation	10	H
CS3TZ4	Network Security	10	H

Group C

CS3U7	Image Analysis	10	H
CS4V10	Visual Intelligence	10	M

(iii) Additional modules at Level H or M to make a total of 120 credits in Part 3. These can be selected from the lists above or below of Mathematics and Computer Science modules, or from elsewhere in the University. Note that most modules have pre-requisites and co-requisites which students must undertake. Information regarding pre-requisites and co-requisites can be found in the appropriate module description.

MA3AL	Algebra	10	H
MA3DY	Dynamics	10	H
MA3C7	Boundary-value Problems	10	H
MA3HM	History of Mathematics	10	H
MA3W7	Control Systems	10	H
MA3Z7	Number Theory	10	H
MA3ASP	Applied Stochastic Processes	10	M
MA3SM	Modelling of Soft Matter	10	M
MA3CM	Classical Mechanics	10	H
MA3MB	Mathematical Biology	10	H
MA3FM	Fluid Mechanics	10	H
MA3AM1	Asymptotic Methods I	10	H
MA3DS	Dynamical Systems	10	H
MA3CV	Calculus of Variations	10	H
MA3MDE	Mathematics for the Digital Economy	10	H
CY3F8	Virtual Reality	10	H
CS3E6	Distributed Computing	10	H
CS3K7	Data Mining	10	H
CS3Y7	Robot Systems	10	H
CS4E7	Computational Robotics	10	M

Progression requirements
To gain a threshold performance at Part 1 and qualify for the CertHE a student shall normally be required to achieve an overall average of 40% over 120 credits taken in Part 1, where all the credits are at level C or above, and a mark of at least 30% in individual modules amounting to not less than 100 credits. In order to progress from Part 1 to Part 2, a student shall normally be required to achieve a threshold performance at Part 1, and to have obtained at least 40% in the Mathematics modules averaged together and at least 40% in each of the Computer Science modules and have no module mark below 30%.

To gain a threshold performance at Part 2 and qualify for the DipHE a student shall normally be required to achieve an overall average of 40% over 120 credits taken in Part 2, and a mark of at least 30% in individual modules amounting to not less than 100 credits. In order to progress from Part 2 to Part 3, a student shall normally be required to achieve a threshold performance at Part 2.

Part 2 contributes one third of the final assessment and Part 3 the remaining two thirds.

Summary of teaching and assessment
Teaching is organised in modules that typically involve both lectures and problems. The assessment is carried out within the University's degree classification scheme, details of which are in the programme handbooks. The pass mark in each module is 40%. Modules in Part 1 and 2 are assessed by a mixture of coursework and formal examination. There are some modules which are assessed wholly by coursework and others wholly by examination; the details are given in the module descriptions.

Admission requirements
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Entrants to this programme are normally required to have obtained:
Grade C or better in English in GCSE; and achieved
UCAS Tariff: A Level: 300 points including grade B in A Level Mathematics; or
International Baccalaureat: 30 points including 6 in Higher Mathematics; or
Advanced GNVQ: Merit in one of the following subject areas: Engineering, Information Technology or Science, accompanied by A Level Mathematics Grade B or
Scottish Highers: Grade A in Mathematics and two Bs and a C in three other subjects.
Irish Leaving Certificate: Grade A in Mathematics and three Bs and a C in four other subjects
Two AS grades are accepted in place of one A-Level except in Mathematics.

Admissions Tutor: Dr Graham Williams

Support for students and their learning
University support for students and their learning falls into two categories. Learning support includes IT Services, which has several hundred computers, and the University Library, which across its three sites holds over a million volumes, subscribes to around 4,000 current periodicals, has a range of electronic sources of information and houses the Student Access to Independent Learning (S@il) computer-based teaching and learning facilities. There are language laboratory facilities both for those students studying on a language degree and for those taking modules offered by the Institution-wide Language Programme. Student guidance and welfare support is provided by Personal Tutors, School Senior Tutors, the Students' Union, the Medical Practice and the Student Services Directorate. The Student Services Directorate is housed in the Carrington Building and includes the Careers Advisory Service, the Disability Advisory Service, Accommodation Advisory Team, Student Financial Support, Counselling and Study Advisors. Student Services has a Helpdesk available for enquiries made in person or online (www.risisweb.reading.ac.uk), or by calling the central enquiry number on (0118) 378 5555. Students can get key information and guidance from the team of Helpdesk Advisers, or make an appointment with a specialist adviser; Student Services also offer drop-in sessions on everything from accommodation to finance. The Carrington Building is open between 8:30 and 17:30 Monday to Thursday (17:00 Friday and during vacation periods). Further information can be found in the Student website (www.reading.ac.uk/student).

Within the contributing departments additional support is given though tutorials in Parts 1 and 2. The development of problem-solving skills is assisted by extensive provision of model solutions to problems. There are Programme Advisers to offer advice on the choice of modules within the programme.

Career prospects
This programme replaces the Mathematics and Computer Science programme. In recent years students who have followed that programme have gone into jobs in software development, teaching and the army as well as to postgraduate study. In recent years students who have followed this programme have gone into jobs as actuarial trainee, trainee chartered accountant, teaching, business analyst and postgraduate study.

Opportunities for study abroad or for placements
Although there are no formal arrangements for the Computational Mathematics programme, informal arrangements may be possible. The Department of Computer Science participates in a Socrates exchange under which students can spend time at the University of Merseburg in Germany.

Programme Outcomes
The programme provides opportunities for students to develop and demonstrate knowledge and understanding, skills, qualities and other attributes in the following areas:

Knowledge and Understanding

A. Knowledge and understanding of:	**Teaching/learning methods and strategies**
1. The fundamental concepts and techniques of calculus, analysis, algebra, dynamics and numerical mathematics 2. The use of the basic techniques of mathematics in applicable areas of mathematics, such as differential equations, coding theory and numerical analysis 3. A selection of more specialist optional topics 4. A mainstream programming language 5. Software engineering and theoretical issues in Computer Science	The knowledge required for the basic topics is delineated in formal lectures supported by problem sets for students to tackle on their own. In Part 1 these are supported by tutorials and practical classes through which students can obtain feedback on their non-assessed work. Feedback on programming is initially given through tutorials and formative assessed work. In the later parts of the course students are expected to work at additional problems on their own and seek help when required, using the office hours of staff. Model solutions are provided for problems set. *Assessment* Most knowledge is tested through a combination of coursework and unseen formal examinations,

although 4 is principally assessed by coursework. Dissertations and oral presentations also contribute in other parts of the programme.

Skills and other attributes

B. Intellectual skills - *able to:*	**Teaching/learning methods and strategies**
1. Think logically 2. Analyse and solve problems 3. Organise tasks into a structured form 4. Evaluate the evolving state of knowledge in a rapidly developing area 5. Transfer appropriate knowledge and methods from one topic within the subject to another 6. Conduct independent study of a chosen topic and report on the results	Logic is an essential part of the understanding and construction of mathematical proofs and structured computer programs and is embedded throughout the programme. The quality of a solution to a problem is substantially determined by the structure of that response; analysis, synthesis, problem solving, integration of theory and application, and knowledge transfer from one topic to another are intrinsic to high-level performance in the programme. The rapid evolution of modern Computer Science forms part of optional modules in Part 3. *Assessment* 1- 3 are assessed indirectly in most parts of Mathematics, while 5 contributes to the more successful work. 6 is assessed in the numerical analysis project report. 4 contributes to some Computer Science options.

C. Practical skills - *able to:*	**Teaching/learning methods and strategies**
1. Understand and construct mathematical proofs 2. Formulate and solve mathematical problems 3. Program a computer in a structured and effective way 4. Analyse numerical methods and respond to the issues of accuracy, stability and convergence 5. Write a report on a chosen topic	Mathematical proof is taught in Part 1 lectures and reinforced in practical classes. Problem solving is introduced in lectures in Part 1 and forms a large part of subsequent Mathematics. Numerical analysis courses introduce and develop the ideas of accuracy, stability and convergence, illustrated by practical tasks. Parts 1 and 2 Computer Science modules introduce various styles of programming and discuss their advantages. *Assessment* 1 and 2 are tested both formatively in coursework and summatively in examinations. 3 is assessed practically through coursework and the principles through formal examination. 4 and 5 are assessed through coursework and examination, also through the computational project report.

D. Transferable skills - *able to:*	**Teaching/learning methods and strategies**
1. Use IT (word-processing, using standard and mathematical software) 2. Communicate scientific ideas 3. Give oral presentations 4. Work as part of a team 5. Use library resources 6. Manage time 7. Plan their career	The use of IT is embedded throughout the computational side of the course. Oral presentations, team work and career planning are part of one Part 2 module. Communication skills are the focus of one module in Part 2, and these are deployed in the final year project. Time management is essential for the timely and effective completion of the programme. Library resources are required for the small project within one Part 2 module and the final year project, and contribute to the best performances throughout.

Assessment
1 and 2 are assessed through coursework. 3 - 5 contribute assessed coursework towards the Part 2 module Communicating Mathematics, and 2, 3 and 5 also in the project. The other skills are not directly assessed but their effective use will enhance performance in later modules.

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 he/she takes full advantage of the learning opportunities that are provided. More detailed information on the learning outcomes, content and teaching, learning and assessment methods of each module can be found in the module description and in the programme handbook. The University reserves the right to modify this specification in unforeseen circumstances, or where the process of academic development and feedback from students, quality assurance process or external sources, such as professional bodies, requires a change to be made. In such circumstances, a revised specification will be issued.