PROGRAMME SPECIFICATION FOR MSc IN COMPUTER SCIENCE

1.	**Awarding institution/body**	**University of Oxford**
2.	**Teaching institution**	**University of Oxford**
3.	**Programme accredited by**	**Currently accredited by the BCS**
4.	**Final award**	**Masters**
5.	**Programme**	**Computer Science**
6.	**UCAS code**	
7.	**Relevant subject benchmark statement**	**Computing**
8.	**Date of programme specification**	**Students entering in October 2012**

9. Educational aims of the programme

As in other branches of applied mathematics and engineering, improvements in the practice of programming require determined and meticulous application of methods of mathematical understanding, calculation and proof. Recognising this, the MSc in Computer Science at Oxford has been designed to teach the mathematical principles of specification, design and efficient implementation of both software and hardware.

The course is intended as a graduate conversion course, both for those who have already been trained and/or employed as programmers, and for graduates of other numerate disciplines who have had less previous exposure to the subject.

The course aims:

- To provide a challenging and supportive learning environment that encourages high quality students to reach their full potential, personally and academically;
- To provide the foundation for a professional career in the computing-based industries - including telecommunications, process control, business-, mission-, and safety-critical fields;
- To enhance the skills of a professional who is already working in one of these industries;
- To provide a foundation for research into the theory and practice of programming and the design of computer-based systems;
- To present knowledge, experience, reasoning methods and design and implementation techniques which are robust and forward-looking

The QAA Computing Benchmarking Statement relates to a bachelors degree with honours rather than to a masters degree. However, the course is broadly in line with the criteria set out in that statement.

10. Programme outcomes

Students will develop the knowledge, skills and attitudes to be able, in subsequent employment

1. To select techniques most appropriate to their working environment, adapt and improve them as necessary.

2. To establish appropriate design standards and sound practices for both hardware and software, and to pass on these standards and sound practices to colleagues and subordinates.

3. To keep abreast of research and recent developments.

A. Students will develop a knowledge and understanding of:

4. A formal disciplined approach to computer science

5. A range of relevant concepts, tools and techniques

6. The principles underpinning these techniques and the ability to apply them in novel situations.

Related teaching/learning methods and strategies

Teaching for each topic is organised into formal lectures supported by problem sheets and practicals for individual study. Feedback (to students, supervisors, the Course Director and the Academic Administrator) is initially given through graded classwork and supervised practical sessions. Students are able to build on their understanding and develop their communication skills during class discussions of the problems set. Model solutions are provided for this classwork.

Each of the long-established and proven methods of teaching described above contributes to the students' knowledge and understanding, but the problem sheets and practicals in particular develop their skills in the use and understanding of tools, techniques and applications. Problem sheets and practical work are designed to involve a mix of creative activity and selection of appropriate knowledge to be applied to particular problems.

Assessment

Formative assessment of classwork and practical exercises provides regular feedback both to the student and to the supervisor, thus enabling regular discussion of progress and identification of areas of weakness. Where a problem is identified, additional tuition may be provided either by the supervisor or, with the Course Director's approval, by the class tutor.

Summative assessment of the taught part of the course is through a combination of take-home assignments or sit-down examinations and, where appropriate, reports on practical work.

Candidates are required to

1. submit coursework assignments/written examinations on a total of between 28 and 34 units of topics with no more than 12 units from Schedule A, and
2. submit a project dissertation which must demonstrate an appreciation of the role of methods studied in the course, and
3. attend an examination viva voce, unless individually dispensed.

To satisfy the examiners a candidate must:

- attain an average of ≥ 50 (pass) in assignments/written examination in their best 28 units of topics, and
- pass the project, and
- pursue an adequate course of practical work and achieve an overall pass in practicals

Successful candidates must pass both the taught courses and the dissertation, and, if required, an oral examination.

B. Skills and other attributes

Students will have the opportunity to develop the following skills during the course:

I. Intellectual skills

- The ability to demonstrate knowledge of key concepts and topics within Computer Science, both explicitly and implicitly in the solution of problems.
- An understanding of how computing concepts and theories may be applied to the solution of problems including, where appropriate, an understanding of their limitations.
- The ability to select and apply appropriate techniques and processes.
- The ability to construct and develop logical arguments, with clear identification of assumptions and conclusions, and to present arguments and conclusions with clarity and accuracy.

Teaching/learning methods and strategies

Logical thinking is developed throughout the course as it is essential to the understanding and application of the conceptual techniques studied.

Problem analysis, formulation and solving are introduced in lectures and further developed through problem sheets during classes and in practical work.

The ability to present arguments is developed both verbally in classes, and with the supervisor, and in written form, including classwork, practical reports and assignments.

The syllabus is constructed so that there is a cumulative dimension of much of the work. Knowledge acquired in some courses is applied or extended in others. Much of the knowledge is of sufficient abstraction that it can be applied to different fields.

Lectures on presentation skills are provided and these skills prove particularly useful in the dissertation.

Assessment

Intellectual skills are assessed formatively through classwork and practical exercises, and summatively in practical reports, assignments and the dissertation.

II. ***Practical skill***s ***(where relevant)***

- The ability to program
- The ability to apply skills and knowledge gained through lectures, classes and project work to designing and implementing computer systems.
- The ability to apply relevant techniques learned in the taught part of the course to practical and project work.

Teaching/learning methods and strategies

These practical skills are developed throughout the course, in the classes, in the supervised practical work that is attached to most lecture courses, and in the project work that is supervised and directed by a senior member of the academic staff.

Assessment

These are tested formatively through classes and in the practical exercises, and summatively in the practical report for each topic.

III. Transferable skills

Transferable skills	***Teaching/learning methods and strategies***
The ability to study and learn independently	A learning process that requires students to assimilate material from several sources, including lectures, classes, practical exercises, books and online sources.
The ability to analyse and think critically about problems and their solutions.	Weekly problem sheets with class support, often requiring significant development of ideas beyond material found in lectures or books.
Effective verbal and written communication and presentation skills, including the ability to communicate scientific ideas.	Weekly class assignments, with discussion (and sometimes defence) of written work and presentation of solutions in classes.
The ability to use IT	Required throughout the course.
Independent time management.	Requirement to produce substantial amounts of written work to strict deadlines for classes, practical exercises, assignments and dissertation. The need to balance academic and non-academic activities.
The ability to use library and World-Wide-Web resources.	Required throughout the course as part of the process of independent learning and for assignments and the project.

Assessment

These skills are tested both formatively in the classwork, practical exercises and project presentations, and summatively in the assignments, practical reports and in the dissertation.

11. Programme Structures and Features

This is a full-time one-year course.

Students must attain an average of ≥ 50 (pass) in assignments/written examinations in their best 28 units of topics, but can take no more than 34 units. . Topics must be chosen from the published list with no more than 12 units from Schedule A. Most of these taught courses take place in the first two terms. Assignments are handed out at the end of each lecture course and usually have to be completed within three weeks.

Every lecture course is supported by problem sheets and classes; most are also supported by practical exercises.

Normally, students will start work on their project after completing most of the taught part of the course. A student's project supervisor will not necessarily be the same as the supervisor on the taught part of the course. Before starting work on the project students submit a formal project proposal to be approved by their project supervisor and the Course Director. The supervisor will offer advice and guidance on the project and dissertation. Typically, five months will be spent on the project.

Guidance on the course is provided in the students' Handbook, in the University Regulations, and in the Notes of Guidance for Graduate Students.

Learning

Subjects

Schedule A (4 units)
Concurrency
Concurrent Programming
Functional Programming
Foundations of Computer Science
Introduction to Specification
Object Oriented Programming

Schedule B (4 units)
Bioinformatics & Computational Biology
Computational Complexity
Computer Aided Formal Verification
Computer Security
Computers in Society
Databases
Intelligent Systems
Knowledge Representation and Reasoning
Lambda Calculus & Types
Machine Learning
Principles of Programming Languages

Schedule C (6 units)
Advanced Security
Automata, Logic and Games
Categories, Proofs and Processes
Computer Animation
Computational Linguistics
Database Systems Implementation

Information Retrieval
Probabilistic Model Checking
Probability and Computing
Quantum Computer Science
Requirements
Software Verification
Theory of Data and Knowledge Bases

Assessment

Summative assessment of the taught part of the course is through a combination of take-home assignments or sit down examinations, and (where appropriate) reports on practical work.

Students must attain an average of ≥ 50 (pass) in assignments/written examination in their best 28 units of topics, but cannot take no more than 34 . Topics must be chosen from the published list with no more than 12 units from Schedule A. In addition, the dissertation, which must demonstrate a link to the taught part of the course, is a major part in the assessment. Successful candidates must pass both the taught courses and the dissertation (and, if required, an oral examination).

12. Support for students and their learning

Each student is provided with support both in the department and at his or her college. In the department, the student is appointed a supervisor, with whom they will meet regularly, and an advisor. In case of any sort of difficulty, the student may also turn to the Course Director, the Academic Administrator or the Post Graduate Taught Course Administrator for help and advice. Within college there will also be a Tutor for Graduates or a Senior Tutor and college advisors who will provide support, including welfare, pastoral and financial provision.

Lecture notes, problem sheets and practical exercises can be obtained from the relevant Web pages. These can be accessed from college facilities. Colleges have computer rooms and most student rooms provide a link to the university computer network.

The department has its own technical support team to ensure the efficient running of the dedicated facility for Computer Science. Each supervised practical session allocates one machine per student. Machines are updated approximately every 3 years.

There is library provision within the department, and at college and university level. The department circulates the subject reading list to all college and university libraries, and to main bookshops, during the summer vacation to ensure that relevant books are available.
All lecture rooms are equipped with data and transparency projectors.

13. Criteria for Admission

Applicants are normally expected to have achieved an upper second class or first class honours degree (or equivalent) with a significant component of mathematics and/or computing. Candidates with substantial programming experience in employment and an honours degree in a mathematical, scientific, or engineering subject will be considered. Applicants need to possess the necessary background to cope with mathematical notation, and to have basic skills in computer programming.

Applicants whose first language is not English are required to provide evidence of proficiency in English. Candidates are normally expected to meet one of the following criteria:

For IELTS an overall score of 7.5 with at least 7.0 in each component. For TOEFL an overall score of 630 with a Test of Written English (TWE) of 5.0, or for the computer-based TOEFL test, an overall score of 267 with an Essay Writing score of 5.0. For the new internet based test we require a minimum overall score of 109. Cambridge Certificate of Proficiency in English (CPE) Grade B.

At least three satisfactory academic references from people who are familiar with the applicant’s work or study achievements.

14. Methods for evaluating and improving the quality and standards of learning

Examiners' reports, both internal and external.

A Supervisory Committee that includes a student representative and a representative from industry. This committee considers and approves the schedule of taught modules, and considers student feedback and examination reports. The Committee meets once a term and reviews and compares pass rates and other relevant statistics, both termly and annually. It also proposes changes in regulations and provides clarification in procedural matters. It is also responsible for publishing annually a course handbook and detailed syllabuses, synopses and reading lists for each lecture course.

Student questionnaires that cover all aspects of the taught part of the course. These are considered by the Course Review Committee to ensure that appropriate action is taken where necessary.

The Graduate Studies Committee for the Department of Computer Science monitors the standard and content of the course, and ensures that it is consistent with other Masters degrees within the Mathematical and Physical Sciences Division.

Regular accreditation by the British Computer Society (BCS)

The Department of Computer Science External Advisory Panel, which includes representatives from industry, meets once a year and, among other things, considers and advises on this course.

Regulation of assessment

Final Examination

The Board of Examiners meets every term to consider marks for assignments, and again at the end of the year to consider the overall award. Its five members are appointed by the Divisional Board; each serves a three-year term. An External Examiner is appointed who attends the final meeting and provides a separate report to the University each year.

The Examiners are formally independent from the Department and from those who lecture the courses, but they may, and almost always do, appoint Assessors to assist in the setting and marking to ensure that the examination is closely tied to the taught material.

Assignments and practical reports (anonymous) are marked by an appointed Assessor (usually the lecturer). The assessments are then moderated by the Examiners.

Each dissertation is marked at least twice, once by an appointed Assessor and again by one of the Examiners. The two markers' reports are then considered by the full Board of Examiners.

The decision of the examiners may be contingent upon the results of a *viva voce* (oral) examination. All candidates are required to attend such an examination unless individually dispensed. In cases where there is any doubt as to a candidate's ability or the originality of their work, this part of the examination process is particularly important.

To be awarded an MSc, a candidate must submit at least 28 units and at most 34 units of assignments and achieve $\geq$ (50) pass or above in their best 28 units, and pass the associated practical reports. They must also achieve a pass or above for their dissertation.

A distinction is awarded where the candidate has achieved an excellent performance in both the taught part of the course and the dissertation.

External Examiners are appointed in order:

1. To verify that standards are appropriate to the award, in part by comparison with the standards of comparable institutions, and to ensure that the assessment procedures and the regulations governing them are fair and otherwise appropriate.

2. To ensure that the conduct of the examination and the determination of awards has been fairly conducted, and that individual student performance has been judged in accordance with the regulations and conventions of the Examining Board. This will entail signing the Class List as an endorsement that the processes of examination and classification have been fairly conducted.

External Examiners are expected to report to the Vice-Chancellor in each year in which they act. Their reports are expected to cover all the following points:

- the standards demonstrated by the student
- the extent to which standards are appropriate for the award
- the design, structure and marking of assessments
- the procedures for assessment and examinations
- whether or not external examiners have had sufficient access to, and the power to call upon, any material necessary to make the required judgments
- students' performance in relation to their peers in comparable courses
- the coherence of the policies and procedures relating to external examiners and their consonance with the explicit roles required of them
- the basis and rationale for any comparisons made
- the strengths and weaknesses of the students as a cohort
- the quality of teaching and learning which may be indicated by student performance

The report is addressed to the Vice-Chancellor, and will be considered by the relevant divisional board, the faculty/department and by the University's Educational Policy and Standards Committee.

Where an external examiner's report contains particular suggestions or criticisms, it is the responsibility of the faculty/department to ensure that full consideration is given to these, to institute further discussion or action, and to inform the external examiner within a reasonable time of what is done.

The University Proctors have ultimate authority regarding examination conduct and other disciplinary matters.

Marking Scale

90-100: The candidate shows remarkable ability and true insights. Dissertations in this band will be worthy of publication.

80-89: The candidate shows outstanding problem-solving skills and outstanding knowledge of the material over a wide range of topics, and is able to use that knowledge innovatively and/or in unfamiliar contexts.

70-79: The candidate shows excellent problem-solving skills and excellent knowledge of the material over a wide range of topics, and is able to use that knowledge innovatively and/or in unfamiliar contexts.

60-69: The candidate shows good or very good problem-solving skills, and good or very good knowledge of much of the material over a wide range of topics.

50-59: The candidate shows basic problem solving skills and adequate knowledge of most of the material.

40-49: The candidate shows reasonable understanding of at least part of the basic material and some problem solving skills. Although there may be a few good answers, the majority of answers will contain errors in calculations and/or show incomplete under-standing of the topics.

30-39: The candidate shows some limited grasp of basic material over a restricted range of topics, but with large gaps in understanding. There need not be any good quality answers, but there will be indications of some competence.

0-29: The candidate shows inadequate grasp of the basic material. The work is likely to show major misunderstanding and confusion, and/or inaccurate calculations; the answers to most of the questions attempted are likely to be fragmentary only.

16. Indicators of quality and standards

The course attracts large numbers of applicants (273 for entry in October 2011).

Students rarely withdraw from the course; when they do so it is usually for personal or financial reasons. Between 0 and 7% of students fail the course each year.

We expect about 10-20% of students to proceed with doctoral studies, some of them within the department.

The reports of External Examiners regularly address issues of quality and standards.

This course has recently been accredited as meeting the educational requirement for CITP Further Learning registration and accredited as partially meeting the educational requirement for CSi registration for a period not exceeding five intakes from 2008 (subject to 90 day response on query raised by BCS).

At the last QAA assessment visit, the Department of Computer Science was awarded an 'excellent' rating.

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