ROYAL HOLLOWAY
University of London

PROGRAMME SPECIFICATION

This document describes **Honours Degree programmes in Computer Science**. For Joint and Combined Honours Degree programmes, please also refer to the equivalent document(s) for the other subject(s). This specification is valid for new entrants from **September 2008.**

The aims of all Honours Degree programmes in Computer Science are:
- to produce graduates with the ability to engage in the lifelong learning and with the skills required for a professional career in a computer-based environment or for a research career in Computer Science and related areas;
- to develop computing-related cognitive abilities and skills as described in the QAA Computer Science benchmark statement;
- to develop, in a flexible and progressive structure, students knowledge and understanding of essential facts and theory, with the ability to use this knowledge to devise, specify, design, implement, test, document and critically evaluate computer-based systems;
- to develop an understanding of professional and ethical issues involved in the deployment of computer technology;
- to produce graduates with a range of personal attributes relevant to the world beyond higher education, including information retrieval and use, numeracy, the ability to devise and present logical arguments to inform and support actions, and organisational skills.

Programmes comprise three, or for courses with a year in industry four, years of study. Apart from the year in industry, each stage comprises one year of full-time study during which the student must follow courses to the value of four units (one unit is equivalent to 30 national credits).

The programmes provide progressive structures in which students are able to gain ever-wider knowledge and understanding, and appropriate skills. The programmes contain a combination of compulsory, core and optional courses to introduce students to the theory and practice of Computer Science, including software development techniques and the technologies underlying specific application areas such as gaming and robotics.

The structure encourages students to develop their own interests through informed choice among specialist options. In the final stage students undertake a project, which accounts for 25% of their studies. There is a free choice of other final stage courses reflecting (i) core material, such as compiler theory, operating systems and concurrent programming, (ii) modern applications such as computer games technology, web design and digital sound and music, and (iii) currently important research areas such as machine learning, information security, intelligent agents, computational finance and bioinformatics.

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This document provides a summary of the main features of the programme(s), and of the outcomes which a student might reasonably be expected to achieve if full advantage is taken of the learning opportunities provided. Further information is contained in the College prospectus, the College Regulations and in various handbooks issued to students upon arrival. Whilst Royal Holloway keeps all its information for prospective applicants and students under review, programmes and the availability of individual courses are necessarily subject to change at any time, and prospective applicants are therefore advised to seek confirmation of any factors which might affect their decision to follow a specific programme. In turn, Royal Holloway will inform applicants and students as soon as is practicable of any substantial changes which might affect their studies.

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Learning outcomes

Teaching and learning in the programmes are closely informed by the active research of staff, particularly in the areas of computer learning, information security, compiler algorithm design and analysis, languages and computer architectures, combinatorial algorithms and complexity, and bioinformatics. The programmes provide opportunities for students to develop and demonstrate knowledge of both core subject material and specialised research areas.

The students will have an opportunity to develop and demonstrate the following learning outcomes:

Knowledge and understanding

- knowledge and understanding of the essential facts, concepts, principles and theories relating to computing and computer applications;

- understanding of the implications of recent research in Computer Science, artificial intelligence and related fields, and how such research results can be incorporated into computer-based systems;

- understanding of the professional, moral and ethical aspects of the use of computer-based systems, and ability to recognise any risks or safety aspects in a given context;

- knowledge of how computers are programmed and used; advanced programming; software engineering and team work for developing a significant software system; the fundamental technologies used for artificial intelligence; the functioning of the Internet and the World Wide Web; the main concepts of database technology and design; background theory necessary for a deeper understanding of computing and computers;

- depending on their programme of studies, students may also gain a knowledge of the following key practical application technologies: operating systems; graphics; robotics, bioinformatics, information security, applied artificial intelligence and human-computer interfaces; theoretical foundations of algorithms and programming.

Additional for Computer Science (Year in Industry)

- appreciation of the importance of computing and information technology for commerce and industry and an understanding of expected industry changes and the effects they will have.

Skills and other attributes

- ability to deploy appropriate theory, practices and tools for the modelling, specification, design, implementation and evaluation of computer-based systems (including stand-alone computer systems, information systems, embedded systems, distributed systems and web-based systems) to meet given requirements under practical constraints;

- employ the research skills needed to investigate a defined topic under supervision, through an extended individual project;*

- interpersonal skills, including the ability to work as a member of a development team, recognising/respecting the viewpoints of others, recognising the different roles within a team and the different ways of organising teams;*

- problem identification, analysis and solution using critical assessment and reasoned argument;*

- taking responsibility for own learning and developing habits of reflection on that learning;*

- skills in written communication, project documentation, verbal presentation; numeracy and computation*

- use of information technology (including spreadsheets, databases, word processing, email and WWW);*

- information handling and retrieval (including the use of libraries and computer technology);*

- ability to work autonomously, and to demonstrate time management and organisational skills.*

Additional for Computer Science (Year in Industry)

- ability to apply knowledge and skills in computing to large-scale practical applications.

* transferable skills

Teaching, learning and assessment

Teaching and learning is mostly by means of lectures, small-group tutorials, practical and problem classes, supervised computing laboratory work, group work, completion of coursework and private study, guided independent study and research in the stage three independent project.

Assessment of knowledge and understanding is typically by formal, unseen written examination, coursework assignments, project reports, oral presentations, and the final stage project report. Transferable skills are also inherently assessed through the assignments, reports and oral presentations. Feedback is provided on students' performance in coursework, both assessed and non-assessed, and during tutorial and practical sessions. Full details of the assessments for individual courses can be obtained from the Department.

Details of the programme structure(s)
Please note that the list of available courses offered is subject to change and not all courses run each year. A full list of courses including optional courses for the current academic year can be obtained from the Department.

STAGE 1		
CS1801	Object oriented programming	Full
CS1820	Computing laboratory (robotics)	Half
CS1830	Computing laboratory (games)	Half
CS1840	Internet services	Half
CS1850	Databases	Half
CS1860	Mathematical structures	Half
CS1870	Machine fundamentals	Half

STAGE 2		
CS2800	Software engineering	Half
CS2810	Team project	Half
CS2812	Team project in artificial intelligence (G4G7 only)	Half
CS2820	Programming paradigms	Half
CS2830	Robotics	Half
CS2840	Graphics and HCI	Half
CS2850	Network operating systems	Half
CS2860	Algorithms and complexity I	Half
CS2870	Algorithms and complexity II	Half
IY2820	Team project in secure computing (G493 only)	Half
IY2760	Introduction to information security	Half

STAGE 3 / 4		
CS3001	Year out in Industry	Full
CS3110	Bioinformatics	Half
CS3120	Computational methods in bioinformatics	Half
CS3210	Image processing	Half
CS3220	Fundamentals of digital sound and music	Half
CS3230	Computer games technology	Half
CS3330	Embedded and realtime systems	Half
CS3460	Compiling for embedded systems	Half
CS3470	Compilers and code generation	Half

CS3480	Software Engineering with Metamodels	Half
CS3490	Computational optimisation	Half
CS3520	Neural networks	Half
CS3580	Advanced data communications	Half
CS3620	HCI, visualisation and web design	Half
CS3750	Concurrent and parallel programming	Half
CS3760	Information security *(cannot be taken with IY2760)*	Half
CS3810	Half unit project *(cannot be taken with CS3821, CS3822 or IY3821)*	Half
CS3821	Full unit project *(cannot be taken with CS3810, CS3822 or IY3821)*	Full
CS3822	Individual project in artificial intelligence *(G4G7 only)*	Full
CS3920	Computer learning	Half
CS3930	Computational finance	Half
CS3940	Intelligent agents and multi-agent systems	Half
IY3770	Trusted computing platforms	Half
IY3780	Secure software engineering	Half
IY3821	Individual project in Information Security *(G493 only)*	Full

At stage two or stage three, students may choose to substitute a half (½) unit course for another half unit course outside the department provided the department approves the external course. Students taking an industrial year take additional course CS3001 and thus have five units in their final year.

The course units taken for each of the Degree Programmes in Computer Science are as follows:

Single Honours Computer Science G400

First	CS1801 *compulsory for progression* CS1820, CS1830, CS1840, CS1850, CS1860, CS1870
Second	CS2800 *core pass required* CS2810 *core pass required* CS2860 *core* Five further non-project CS2XXX courses
Final	CS3821 *core* Six further non-project CS3XXX courses

Computer Science (Year in Industry) G402

First	CS1801 *compulsory for progression* CS1820, CS1830, CS1840, CS1850, CS1860, CS1870	
Second	CS2800 *core pass required* CS2810 *core pass required* CS2860 *core* Five further non-project CS2XXX courses	
Third	CS3001 *core pass required*	
Final	CS3821 *core* Six further non-project CS3XXX courses	

Specialist degree – Computer Science (Artificial Intelligence) G4G7

First	CS1801 *compulsory for progression* CS1820, CS1830, CS1840, CS1850, CS1860, CS1870
Second	CS2800 *core pass required* CS2810 *core pass required* CS2830 *core* CS2860 *core* Four further non-project CS2XXX courses
Final	CS3822 *core*

	CS3920 *core* Five further non-project CS3XXX half units

A year out in industry (CS3001) may be taken between second and final year.

Specialist degree – Computer Science (Information Security) G493

First	CS1801 *compulsory for progression* CS1820, CS1830, CS1840, CS1850, CS1860, CS1870
Second	CS2800 *core pass required* CS2810 *core pass required* IY2760 *core* CS2850 *core* CS2860 *core* Three further non-project CS2XXX courses
Final	IY3821 *core* IY3770 *core* IY3780 *core* Four further non-project CS3XXX half units

A year out in industry (CS3001) may be taken between second and final year.

Computer Science with Management G4N2

First	CS1801 *compulsory for progression* CS1830, CS1840, CS1850, CS1860 MN1001 or MN1041 *compulsory for progression*
Second	CS2800 *core pass required* CS2810 *core pass required* CS2860 *core* Three further non-project CS2 courses 1 unit MNXXXX (see Management Handbook for options)
Final	CS3821 *core* OR CS3810 *core* Four or five further non-project CS3 courses to a total of 3 units of Computer Science 1 unit MNXXXX (see Management Handbook for options)

A year out in industry (CS3001) may be taken between second and final year.

Computer Science with French G4R1

First	CS1801 *compulsory for progression* CS1830, CS1840, CS1850, CS1860 FR1001, FR1002 (total 1 unit French)
Second	CS2800 *core pass required* CS2810 *core pass required* CS2860 *core* Three further non-project CS2XXX courses FR2001, FR2002 (total 1 unit French)
Final	CS3821 *core* OR CS3810 *core* Four or five further non-project CS3XXX courses to a total of 3 units of Computer Science FR3001, FR3002 (total 1 unit French)

A year abroad between second and final year, organised by the French Department.

Computer Science and Mathematics GG41

First	CS1801 *compulsory for progression* Either (CS1840 and CS1850) OR (CS1860 and CS1870) MT1710, MT1720, MT1801, MT1820 (total 2 units Mathematics)
Second	CS2800 *core pass required* CS2810 *core pass required* Two further non-project CS2XXX courses, **excluding CS2870 starting from September 2011.** MT2630, MT2800 and 1 other unit MTXXXX (total 2 units Mathematics)
Final	CS3821 *core* OR CS3810 *core* Two or three further non-project CS3XXX courses to a total of 2 units of Computer Science, **excluding CS3490 starting from September 2012.** 2 units MTXXXX (see Mathematics Handbook for options)

A year out in industry (CS3001) may be taken between second and final year.

Computer Science and Physics GF43†

First	CS1801 *compulsory for progression* CS1840, CS1860 and CS1870 PH1110, PH1120, PH1310
Second	CS2800 *core pass required* CS2810 *core pass required* Two further non-project CS2XXX courses PH1530, PH1620, PH2310, PH2420
Final	CS3821 *core* OR CS3810 *core* OR Physics project PH2210, PH2610, PH3320 Three or four further non-project CS3XXX courses to a total of 4 units

A year out in industry (CS3001) may be taken between second and final year.

Computing and Business GN41

First	CS1801 *compulsory for progression* CS1840, CS1850 MN1001 *compulsory for progression*, MN1041 (total 2 units Management)
Second	CS2800 *core pass required* CS2810 *core pass required* Two further non-project CS2 courses MN2001 *compulsory for progression*, 1 MN2XXX unit (see Management Handbook for options)
Final	CS3821 *core* OR CS3810 *core* Two or three further non-project CS3 courses to a total of 2 units of Computer Science 2 MNXXXX units (see Management Handbook for options)

A year out in industry (CS3001) may be taken between second and final year.

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Progression and award requirements

The progression and award requirements are essentially the same across all Honours Degree programmes at Royal Holloway. Students must pass units to the value of at least three units on each stage of the programme. On some programmes there may be a requirement to pass specific courses in order to progress to the next stage, or to qualify for a particular degree title (see programme structure above). Students are considered for the award and classified on the basis of a weighted average. This is calculated from marks gained in courses taken in stages two and three, and gives twice the weighting to marks gained in stage three. In order to qualify for the award, students must gain a weighted average of at least 35%.

Students who are registered for BSc in Computer Science but who fail the second stage of their programme will be eligible for the award of Certificate of Higher Education in Computer Science, if they have fulfilled the requirements to progress from first to second stage of their degree programme, including passes in CS1801 and passed at least four Computer Science units from either the first or the second year.

Students who are registered for BSc in Computer Science or Computer Science with Management but who fail to graduate will be eligible for the award of Diploma of Higher Education in Computer Science or Diploma of Higher Education in Computer Science with Management, if they have fulfilled the requirements to progress from second to third stage of their degree programme and passed at least four CS units from either the second or third year, *including* passes in CS2800 and CS2810.

Alternatively students who are registered for BSc in Computer Science or Computer Science with Management but who fail to graduate will be eligible for the awards of Diploma of Higher Education in Computing Studies or Diploma of Higher Education in Computing with Management Studies, if they have fulfilled the requirements to progress from second to third stage of their degree programme and passed at least three Computer Science units from either the second or third year, including passes in both CS2800 and CS2810.

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Student support and guidance

- Advisors: All students are allocated a personal academic advisor who meets with them regularly through the programme. The advisor's role is to advise on academic, pastoral and welfare issues. Students have tutorials with their advisor during the first year.
- The programme co-ordinator, the director of pastoral care, the director of undergraduate studies and the head of department provide a back-up system of academic, pastoral and welfare advice.
- All staff are available and accessible. Initial contact can be arranged via email or through the departmental office.
- A detailed programme handbook is supplied to every student, and course notes and other learning resources are available either in hard copy or on the department's web site.
- There is 24-hour card access to the Computer Science dedicated computing laboratory, which has CCTV security.
- Induction sessions are run at the start of each academic year by technical support staff on the use of the departmental computing systems.
- Technical back up is provided by the systems support staff for problems with using the departmental computing system.
- Extensive supporting materials and learning resources are available in the College libraries and the Computer Centre.
- Careers advice is provided by the College Careers Service and the departmental careers service liaison officer.
- Students have access to all College and University support services, including Student Counselling Service, Health Centre and the Educational Support Office for students with special needs.

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Admission requirements

The Department's standard conditional offer is available on the Course Catalogue web page. However, the Department also has considerable flexibility in its admissions and offers policy and strongly

encourages applications from non-standard applicants. Students whose first language is not English may also be asked for a qualification in English Language at an appropriate level. It may also be helpful to contact the Admissions Office for specific guidance on the entrance requirements for particular programmes.

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Further learning and career opportunities
Computer Science opens up a wide range of career opportunities for graduates and the department has a number of important links with industry. Computer Science graduates from the Department have found employment in a wide range of jobs. Many have gone into software houses such as Logica, while others have entered larger organisations such as British Telecom, Texas Instruments and British Aerospace. A large number enter careers with a management or financial slant, for example in Andersen Management Consultancy and Lehman Brothers, or large multi-national companies. The College Careers Office organises recruitment visits by companies and there are a number of careers fairs during the year when final year students can make useful contacts with prospective employers. In addition, the industrial year programme allows students to work within a company for one year between the second and final years. Students taking this option often find that the employer will encourage them to apply for posts at the completion of their degree. For further details please refer to the Careers Service.

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Indicators of quality and standards
Royal Holloway's position as one of the UK's leading research-intensive institutions was confirmed by the results of the most recent Research Assessment Exercise (RAE 2008) conducted by the Higher Education Funding Council (HEFCE). The new scoring system for the RAE 2008 measures research quality in four categories, with the top score of 4* indicating quality that is world-leading and of the highest standards in terms of originality, significance and rigour. 60% of the College's research profile is rated as world-leading or internationally excellent outperforming the national average of 50%. The College is ranked 16th in the UK for research of 4* standard and 18th for 3* and 4* research. 65% of the Computer Science Department's research profile is of 3* and 4* standard.

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List of programmes
All the programmes are taught by staff at Royal Holloway, University of London, and either lead to degree awards of the University of London or alternatively Diploma of Higher Education awards of Royal Holloway and Bedford New College. Programmes in Computer Science are subject to accreditation by the British Computer Society. Subject to passing a prescribed set of courses, single honours Computer Science graduates are granted exemption from Parts I and II of the British Computer Society Examinations. They will therefore be eligible for membership of the Society, an important professional qualification. Combined honours students can gain exemption from Part I of the examinations, again subject to having passed certain prescribed courses. The QAA subject benchmark statement in Computer Science describes the general features which one might expect from Honours Degree programmes in the subject, and can therefore be used as a point of reference when reading this document (see www.qaa.ac.uk). UCAS codes are given in parentheses (see www.ucas.ac.uk).

Single Honours Degree programmes in Computer Science

>   BSc Computer Science (G400)
>   BSc Computer Science (Year in Industry) (G402)

Specialist Honours Degree programmes within Computer Science

>   BSc Computer Science (Artificial Intelligence) (G4G7)
>   BSc Computer Science (Information Security) (G493)

Combined Honours Degree programmes with Computer Science as a major component

>   BSc Computer Science with Management (G4N2)

BSc Computer Science with French (G4R1)
BSc Computer Science with Management (Year in Industry) [Exit Award only]

Joint Honours Degree programmes with Computer Science as an equal component

BSc Computer Science and Mathematics (GG41)
BSc Computer Science and Physics (GF43)†
BSc Computing and Business (GN41)
BSc Computing and Business (Year in Industry) [Exit Award only]

† Note: Indicates programmes to be withdrawn with effect from September 2011

Diploma of Higher Education
(Only available to students registered for BSc in these subjects but who fail to graduate, subject to passing required courses as detailed in the Progression and award requirements section. Not available for admission through UCAS)

DipHE in Computer Science
DipHE in Computing Studies
DipHE in Computer Science with Management
DipHE in Computing with Management Studies

Certificate of Higher Education
(Only available to students registered for BSc in these subjects but who fail the second stage, subject to passing required courses as detailed in the Progression and award requirements section. Not available for admission through UCAS)

CertHE in Computer Science

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