PROGRAMME SPECIFICATION

This document describes Single Honours B.Sc. degree programmes in Computer Science (Software Engineering). 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 2017.

The aims of all these degree programmes 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, cost, 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 who can work effectively within teams;
- 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;
- to produce graduates who understand how business value can be delivered to their customers through the software they develop.

The B.Sc. degree programmes correspond to level 6 in the QAA framework. The length of these degrees varies from three years for standard B.Sc. programme to four years for the B.Sc. with a year in Industry programme.

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 120 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 mandatory and elective 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.

Team work will be emphasised in the curriculum of the first and second years. Students will also have extensive opportunities to engage companies, organisations and professionals.

The structure encourages students to develop their own interests through informed choice among specialist options. In the final stage of the B.Sc. programmes, students undertake a project, which accounts for 25% of their studies. There is a free choice of other final stage courses reflecting both core material, such as compiler theory, and currently important research areas such as machine learning, information security, software language engineering, intelligent agents, computational finance and bioinformatics.
Further information

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List of programmes, with details of awards, degree titles, accreditation and teaching arrangements

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.

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;
- an 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;
- an 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; 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;
- an understanding of the principles of Software Engineering and the importance of good design;
- an understanding of how to work within a team in developing a significant software system;
- an understanding of the principles of information security and its context in Computer Science;
• depending on their programme of studies, students may also gain a knowledge of the following key practical application technologies: operating systems; graphics; robotics, bioinformatics, applied artificial intelligence and human-computer interfaces; theoretical foundations of algorithms and programming;
• an understanding of how to work within a small software company and deliver software within required user specifications;
• an understanding of how to provide appropriately costed software which delivers value to a customer;

Additional for programme with a year in industry
• an 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;*
• manage small projects;

Additional for programme with a 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 individual 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 for the current academic year can be obtained from the Department.

<table>
<thead>
<tr>
<th>STAGE 1</th>
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<tbody>
<tr>
<td>CS1811</td>
<td>Object oriented programming</td>
<td>15 credits</td>
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<tr>
<td>CS1813</td>
<td>Software development</td>
<td>15 credits</td>
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<tr>
<td>CS1820</td>
<td>Computing laboratory (robotics)</td>
<td>15 credits</td>
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<tr>
<td>CS1830</td>
<td>Computing laboratory (games)</td>
<td>15 credits</td>
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<tr>
<td>CS1840</td>
<td>Internet services</td>
<td>15 credits</td>
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<tr>
<td>CS1860</td>
<td>Mathematical structures</td>
<td>15 credits</td>
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<tr>
<td>CS1870</td>
<td>Machine fundamentals</td>
<td>15 credits</td>
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<tr>
<td>CS1890</td>
<td>Software design</td>
<td>15 credits</td>
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<tr>
<th>STAGE 2</th>
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<tbody>
<tr>
<td>CS2800</td>
<td>Software engineering</td>
<td>15 credits</td>
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<tr>
<td>CS2815</td>
<td>Small enterprise team project</td>
<td>15 credits</td>
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<tr>
<td>CS2850</td>
<td>Operating systems</td>
<td>15 credits</td>
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<tr>
<td>CS2855</td>
<td>Databases</td>
<td>15 credits</td>
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<tr>
<td>CS2860</td>
<td>Algorithms and complexity</td>
<td>15 credits</td>
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<tr>
<td>CS2900</td>
<td>Multi-dimensional Data Processing</td>
<td>15 credits</td>
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<tr>
<td>CS2910</td>
<td>Introduction to Artificial Intelligence</td>
<td>15 credits</td>
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<tr>
<td>IY2760</td>
<td>Introduction to information security</td>
<td>15 credits</td>
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<tr>
<td>IY2840</td>
<td>Computer and network Security</td>
<td>15 credits</td>
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<tr>
<th>STAGE 3</th>
<th>Strand</th>
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<tr>
<td>CS3001</td>
<td>Year out in industry</td>
<td>30 credits</td>
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<tr>
<td>CS3821</td>
<td>Full unit project</td>
<td>30 credits</td>
</tr>
<tr>
<td>CS3110</td>
<td>Bioinformatics</td>
<td>15 credits</td>
</tr>
<tr>
<td>CS3220</td>
<td>Digital audio and applications</td>
<td>15 credits</td>
</tr>
<tr>
<td>CS3470</td>
<td>Compilers and code generation</td>
<td>15 credits</td>
</tr>
<tr>
<td>CS3490</td>
<td>Computational optimisation</td>
<td>15 credits</td>
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<tr>
<td>Course Code</td>
<td>Course Title</td>
<td>Credits</td>
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<tr>
<td>CS3510</td>
<td>Functional programming and applications</td>
<td>15</td>
</tr>
<tr>
<td>CS3870</td>
<td>Advanced Algorithms and Complexity</td>
<td>15</td>
</tr>
<tr>
<td>CS3250</td>
<td>Visualisation and exploratory analysis</td>
<td>15</td>
</tr>
<tr>
<td>CS3920</td>
<td>Machine learning</td>
<td>15</td>
</tr>
<tr>
<td>CS3930</td>
<td>Computational finance</td>
<td>15</td>
</tr>
<tr>
<td>CS3940</td>
<td>Intelligent agents and multi-agent systems</td>
<td>15</td>
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<tr>
<td>CS3945</td>
<td>Semantic Web</td>
<td>15</td>
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<tr>
<td>CS3580</td>
<td>Advanced data communications</td>
<td>15</td>
</tr>
<tr>
<td>CS3750</td>
<td>Concurrent and parallel programming</td>
<td>15</td>
</tr>
<tr>
<td>IY3501</td>
<td>Security Management</td>
<td>15</td>
</tr>
<tr>
<td>IY3606</td>
<td>Smart cards/Token security and applications</td>
<td>15</td>
</tr>
<tr>
<td>IY3609</td>
<td>Digital forensics</td>
<td>15</td>
</tr>
<tr>
<td>IY3612</td>
<td>Cyber security</td>
<td>15</td>
</tr>
<tr>
<td>IY3660</td>
<td>Applications of cryptography</td>
<td>15</td>
</tr>
<tr>
<td>IY3840</td>
<td>Malicious software</td>
<td>15</td>
</tr>
<tr>
<td>CS3003</td>
<td>IT project management</td>
<td>15</td>
</tr>
<tr>
<td>CS3480</td>
<td>Software language engineering</td>
<td>15</td>
</tr>
<tr>
<td>CS3846</td>
<td>Human-computer interaction</td>
<td>15</td>
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- Key to the strands of courses presented above:
  - AI – Artificial Intelligence
  - IS – Information Security
  - SE – Software Engineering
  - DNS – Distributed and Networked Systems

- At stage two or stage three, students may choose to substitute a 15 credit course for another one outside the department provided the department approves the external unit. Students taking an industrial year take additional course CS3001 and thus have 150 credits in their final year.

- While students are normally allocated a specific lab for any given course they are registered for, they may if they wish attend additional labs of that course where space allows.

- Students for each year are expected to take part in the Advanced Topics Seminar course (CS3010). This course is not part of the degree programme but attendance will be placed in the student’s transcripts.
The course units taken for each of these degree programmes are as follows:

### B.Sc. Single Honours Software Engineering G464

<table>
<thead>
<tr>
<th>Level</th>
<th>Courses</th>
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</table>
| First | CS1811 *non-condonable for the purposes of progression*  
        CS1813 *non-condonable for the purposes of progression*  
        CS1820, CS1830, CS1840, CS1860, CS1870, CS1890 |
| Second | CS2800 *non-condonable for the purposes of progression*  
         CS2815 *non-condonable for the purposes of progression*  
         CS2850, CS2855, CS2860, IY2760, IY2840  
         *One further non-project CS2XXX or IY2XXX elective course* |
| Final | CS3821, CS3846, IY3840  
        *Four further non-project CS3XXX or IY3XXX elective courses, of which at least two must be from the Software Engineering (SE) strand*** |

### B.Sc. Software Engineering with Year in Industry G462

<table>
<thead>
<tr>
<th>Level</th>
<th>Courses</th>
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</table>
| First | CS1811 *non-condonable for the purposes of progression*  
        CS1813 *non-condonable for the purposes of progression*  
        CS1820, CS1830, CS1840, CS1860, CS1870, CS1890 |
| Second | CS2800 *non-condonable for the purposes of progression*  
         CS2815 *non-condonable for the purposes of progression*  
         CS2850, CS2855, CS2860, IY2760, IY2840  
         *One further non-project CS2XXX or IY2XXX elective course* |
| Third | CS3001 *non-condonable for degree title*** |
| Final | CS3821, CS3846, IY3840  
         *Four further non-project CS3XXX or IY3XXX elective courses, of which at least two must be from the Software Engineering (SE) strand*** |

### Progression and award requirements

The [College's Undergraduate Regulations](#) include full details on progression and award requirements for all undergraduate programmes offered by the College. 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 and this will put
restrictions on courses in which failing marks can be condoned (see programme structure above for details). Additionally there are requirements on the number of courses that must be passed in order to qualify for particular joint or combined Honours degrees.

Students on degree programmes with Year in Industry need to fulfil the requirements set out in the departmental Year in Industry Handbook in order to progress to the placement and be eligible for the degree title.

Eligible students who wish to transfer to the equivalent MSci may do so at the end of stage two or the final stage of their BSc. To transfer from stage two to the following stage in the MSci, the student must meet the same criteria as a student already registered in the MSci would need to progress from the second to the third stage of that programme. To transfer from stage 3 of the BSc to the final stage of the MSci, the student must meet the same criteria as a student already registered in the MSci would need to progress from the third to the final stage of that programme, including achieving a grade of 55% or above in CS3821.

Students who are registered for BSc in Computer Science (Software Engineering) 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, and passed at least 120 Computer Science credits from either the first or the second year.

Students who are registered for BSc Computer Science (Software Engineering) but who fail to graduate will be eligible for the award of Diploma of Higher Education in Computer Science, if they have fulfilled the requirements to progress from second to third stage of their degree programme and passed at least 120 Computer Science credits from either the second or third year.

**Student support and guidance**

- **Tutors:** All students are allocated a personal academic tutor who meets with them regularly through the programme. The tutor's role is to advise on academic, pastoral and welfare issues. Students have tutorials with their tutor 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 student 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.**

- **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 and Employability Service and the Departmental Careers and Employability Tutor.**

- **Access to all College and University support services, including Student Counselling Service, Health Centre and the Disability and Dyslexia Service for students with disabilities and Specific Learning Difficulties.**
Admission requirements

The Department’s standard conditional offer is available on the Course Finder web page. However, the Department also has 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. For further guidance it may also be helpful to contact the Admissions Office.

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 BAE Systems. A large number enter careers with a management or financial slant, for example Accenture or large multi-national companies. The College Careers and Employability Service 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.

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 Excellence Framework (REF 2014) conducted by the Higher Education Funding Council (HEFCE). The scoring system for the REF 2014 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 and 3* indicating research that is internationally excellent. 81% of the College’s research profile was deemed to be within the 4* or 3* categories, an increase of over 20% since 2008. The results for the quality of our research outputs placed Royal Holloway 15th in the UK based on an overall Grade Point Average (GPA) score and 20th in the UK for 4* and 3* research.

The Department of Computer Science was ranked 11th in the UK for the quality of its research output, with 32.2% classified as 4* (world leading) and 54.5% as 3* (internationally excellent). This is an outstanding performance that reflects the department’s strong research culture and significant expansion in its research portfolio, which transmits to the inspiring teaching that delivered across the degree programmes. 40% of the Research Impact has also been classified as 4* (world leading), which reflects the strong engagement the department has with companies and the influence that its research has in the economy and society.

The single-honours degree programmes in Computer Science listed below are accredited by the British Computer Society and by the European Quality Assurance Network (EQANIE). The 2014 BCS accreditation visit panel also identified our teaching of Software Engineering as an area of best practice. Note that accreditation is given on an individual student basis as accrediting bodies apply specific criteria (e.g. conditional to certain courses being passed). Details can be found in the student handbook published by the department at the start of the academic year.

In the 2014 National Student Survey the Computer Science Department was joint sixth in the UK (third in England) rankings for Computer Science departments.

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. 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).

Specialist Honours Degree programmes within Computer Science – Software Engineering strand

- BSc (Hons) Computer Science (Software Engineering) (G464)
- BSc (Hons) Computer Science (Software Engineering) with Year in Industry (G462)

Diploma of Higher Education

(Only available to students registered for BSc in these subjects but who fail to graduate or choose to leave at the end of stage 2, 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

Certificate of Higher Education

(Only available to students registered for BSc in these subjects but who either fail the second stage or choose to leave at the end of stage 1, subject to passing required courses as detailed in the Progression and award requirements section. Not available for admission through UCAS)

- CertHE in Computer Science