



UNIVERSITY OF LINCOLN

Programme Specification

Title:

Computer Science

Final Award: **Bachelor of Science with Honours (BSc (Hons))**

With Exit Awards at:

Certificate of Higher Education (CertHE)

Diploma of Higher Education (DipHE)

Bachelor of Science with Honours (BSc (Hons))

To be delivered from: 1 Sep 2014

Level	Date
Level 1 or Certificate of Higher Education (CertHE)	2019-20
Level 2 or Diploma of Higher Education (DipHE)	2020-21
Level 3 or Bachelor of Science with Honours (BSc (Hons))	2021-22

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1. Introduction

This document describes one of the University of Lincoln's programmes using the protocols required by the UK National Qualifications Framework as defined in the publication *QAA guidelines for preparing programme specifications*.

This programme operates under the policy and regulatory frameworks of the University of Lincoln.

2. Basic Programme Data

Final Award:	Bachelor of Science with Honours (BSc (Hons))
Programme Title:	Computer Science
Exit Awards and Titles	Certificate of Higher Education (CertHE) Diploma of Higher Education (DipHE) Bachelor of Science with Honours (BSc (Hons))
Subject(s)	Computing
Mode(s) of delivery	Full Time Part Time
Is there a Placement or Exchange?	Yes
UCAS code	G403
Awarding Body	University of Lincoln
Campus(es)	KDU Penang University College - Dual Award, Lincoln Campus
School(s)	School of Computer Science
Programme Leader	Derek Foster (DeFoster)
Relevant Subject Benchmark Statements	
Professional, Statutory or Regulatory Body Accreditation	BCS the Chartered Institute for IT
Programme Start Date	2019-20

3. Programme Description

3.1 Overview

Studying Computer Science at Lincoln provides you with the experience and transferable industry skills to design and develop a variety of computing solutions for contextualised real-world problems. Particular attention is paid to contemporary academic and industry-relevant topics, such as the Internet of Things (IoT), Big Data and Analytics, and Cyber Security, alongside other core computer science disciplines. This ensures that your studies are at the forefront of research in the field and that you can apply your knowledge to a wide range of areas in the computing industry or for progression to postgraduate study. The programme underpins the theoretical computer science concepts necessary to give you a solid conceptual foundation on which to become an effective computing practitioner. Bringing theory and practice together in individual and group work activities replicates real-world work environments and gives you the opportunity to develop valuable team building skills. In addition, you are encouraged to work with academics on cutting-edge research and industry focused projects.

3.2 Aims and Objectives

Educational aims of the programme:

BSc (Hons) Computer Science aims to provide students with an academic and industry relevant learning experience that will equip them to operate on graduation as autonomous computing professionals or progress to postgraduate study. To be an effective professional and pursue a successful career in computing requires the ability to maintain currency and relevance against a backdrop of constantly changing technologies, with competencies to apply these technologies. The programme aims to instil knowledge and to develop critical and intellectual abilities applicable to problem solving and solution specifying in technologically and socially diverse environments. The programme also aims to develop professional and industry transferable skills in a wide range of methods, techniques and practices appropriate for the task domain of a computing professional, including software development, systems architecture design, and security.

BSc (Hons) Computer Science is distinctive in that it provides a strong conceptual and methodological grounding and seeks to develop a rich and up-to-date set of practices and techniques which students can deploy in state-of-the-art software and hardware contexts. To do this the programme provides a rigorous and engaging curriculum that is informed by the research and teaching expertise in the computing subject area, as well as informed by industry collaboration and partnerships. The programme aims to encourage intellectual curiosity, the ability to apply computational thinking for problem solving, and the capacity for creative computing in the development of innovative solutions.

QAA Subject Benchmark Statement:

This programme responds to the United Kingdom QAA benchmark statements for the subject of Computing. Benchmarking analysis provides a detailed specification of the relationship between this programme's curriculum and the relevant QAA benchmark(s).

Internal contexts:

Programmes in the School of Computer Science can be taken as three-year BSc (Hons) awards or four year BSc (Hons) awards that include an optional sandwich work placement. Programmes are also available as four-year MComp (Master of Computing) awards or five-year MComp awards if the optional sandwich placement is also taken. The School is the home for research centres concerned with Vision Engineering, Autonomous Systems including Robotics, Machine Learning, and

Human-Computer Interaction. Study programmes have been structured to exploit this expertise and to ensure that wherever possible, teaching is informed by current research. Opportunities for students to become familiar with and ultimately involved in research activity are actively promoted. The School is located in the College of Science and integrates with other Colleges, Schools and Departments through the provision of collaborative awards at undergraduate and postgraduate level. This integration is further consolidated through the College's committee structures, through Research seminar programmes and through cross college staff and student development and other collaborative activities.

External contexts:

BSc (Hons) Computer Science is part of an ongoing response to changes in the discipline of computer science and its emerging and volatile application contexts. The programme particularly seeks to acknowledge and formalise relationships between the maturing theory and practice of computing, and how it is applied across various industry contexts. The programme's curriculum is partly a response to the UK governments Science and Innovation Strategy (2014), and more recently the UK's Digital Skills Strategy (2017). The objectives of both publications are to develop a more diverse digital workforce and strategically develop important new computing skills in areas such as Cyber Security, Cloud computing, Mobile, and Big Data. Additionally, the programme closely aligns itself with the UK governments Made Smarter Review (2017), where digital industrialisation will play a key role in the UK's economic growth. In the review, technology pillars in the emergent Industry 4.0 space, such as Artificial Intelligence and Internet of Things are strategically important for the UK economy, with graduates playing a key role in meeting industry skills demand.

A range of successful technology companies, including Siemens and CoolDC, operate within easy reach of the University and regularly engage with students of the College of Science through project briefs, work experience and industrial liaison. In addition to local companies, the College has been successful in engaging business from outside the region to work with staff and student groups, including Google and Microsoft for the development of industry certification and learning resources. As the School's international research portfolio develops the number of international, national and regional partnerships with commercial, academic, charitable and other institutions has seen huge growth. An example of this is the multi-million Pound project Pravda funded by EPSRC and Wellcome Foundation to develop new and better treatments for cancer. The College is also growing its relationship with industry through Knowledge Transfer Partnerships, and through its relationship with Sparkhouse, a business support centre situated at the university.

3.3 Variations to Standard Regulations and Guidance

Yes - see the Approved Variations to the University's Undergraduate Regulations:

<http://secretariat.blogs.lincoln.ac.uk/university-regulations/>

4. Programme Outcomes

Programme-level learning outcomes are identified below.

Refer to *Appendix I – Curriculum Map* for details of how outcomes are deployed across the programme.

4.1 Knowledge and Understanding

On successful completion of this programme a student will have knowledge and understanding of:

- 1 modelling and design of computer-based systems for the purposes of comprehension, communication, prediction and the understanding of trade-offs
- 2 the application and design of machine learning technologies to support computing systems
- 3 the criteria, requirements, specifications and practical constraints appropriate to specific problems in computer systems, information systems, embedded systems and distributed systems, and planning strategies for their solution
- 4 research methods and the tools that support scientific inquiry into large quantitative and qualitative social media datasets
- 5 the extent to which a computer-based system meets the criteria defined for its current use and future development
- 6 the theory, methods, tools and practices for the specification, design, implementation and evaluation of general computing based systems
- 7 the professional, legal, moral and ethical issues and considerations involved in the exploitation of computer technology
- 8 identify emergent technology trends and their impact on the design and implementation of computing and software systems
- 9 the design and implementation of scalable software systems in the context of industrial digitalisation
- 10 contemporary tools and techniques used in interface design
- 11 industry-standard methods in human-computer interaction that inform the development of interface design and enhanced user experience
- 12 security implications and mitigation strategies in the protection of connected software systems
- 13 mathematical techniques in the design and development of software
- 14 tools and techniques used in the production of a computer science deliverable
- 15 abstracted models of systems structure, behaviour and purpose
- 16 the theoretical and practical capabilities of scalable non-relational and relational database systems
- 17 network communication and security in service oriented architectures
- 18 current and emerging standards in the design of server-based web technologies
- 20 the specification, design, implementation and evaluation of computer-based systems
- 21 evaluation mechanisms for problem solving strategies

- 22 abstracted models of systems structure, behaviour and purpose
- 23 industry-standard methods in human-computer interaction that inform the development of usable interfaces and enhance user experience
- 27 the theoretical and practical capabilities of artificial intelligence
- 30 the various operating systems and paradigms available for use in the field of computer science
- 33 the communication principles of a range of digital and computer communication technologies and wireless networking systems.
- 35 the role and function of networked systems in operational, strategic and societal contexts.
- 36 the principle processes and methods of implementation and design and how these pertain to specific computer communication processes and network systems.
- 37 the evaluative mechanisms for establishing quality and performance characteristics of network systems.

and students following the Sandwich variant of the award will, in addition, have knowledge and understanding of:

- 99 organisational structures and processes in context

4.2 Subject Specific Intellectual Skills

On successful completion of this programme a student will be able to:

- 101 evaluate systems in terms of general quality attributes and possible trade-offs presented within the given problem
- 102 evaluate any risks inherent in the operation of computer-based systems with emphasis on ethical and privacy considerations
- 103 solve a range of different problems using appropriate academic and industry-centric strategies
- 104 engage appropriately in the production of a computer science deliverable
- 106 characterise systems implementation strategies in the context of contemporary business requirements
- 107 solve network problems using a range of contemporary tools and techniques
- 108 evaluate and characterise security risks in software systems
- 109 solve system development problems that require internet scale deployment
- 110 characterise and evaluate large scale, heterogeneous data structures in the context of online storage and analysis
- 210 solve a range of different problems using appropriate strategies
- 218 utilise appropriate quality assurance techniques

4.3 Subject Specific Practical Skills

On successful completion of this programme a student will be able to:

- 201 design, implement and evaluate computer-based systems
- 202 deploy the tools used for the construction and documentation of computer-based applications
- 203 assess and deploy a range of data science tools and techniques for data analysis
- 204 work as a member of a development team, recognising the different roles within a team and different ways of organising teams
- 205 select and apply tools and techniques appropriate to a range of service oriented architecture developments
- 206 apply models of systems structure, behaviour and purpose to organisational systems
- 207 select and apply standard user-centred design methods in the development and evaluation of prototypes and software applications across different platforms
- 208 implement scalable non-relational and relational databases that address the requirements of organisational information requirements
- 209 Assess and formulate the development of web services and connectivity using industry standard techniques
- 211 formulate a project plan, and update it appropriately in the course of its execution
- 213 use mathematical techniques for the analysis and manipulation of computer image data
- 214 implement industry standard techniques in the control of robotics systems
- 219 use wireless and network equipment safely and effectively in each stage of network systems development
- 221 implement scalable, sensor-driven systems for connected Internet-of Things devices
- 222 assess and deploy a range of machine learning techniques to evaluate their performance and effectiveness

and students following the Sandwich variant of the award will, in addition, be able to:

- 220 adopt a professional approach in fulfilling work tasks

4.4 Transferable Skills and Attributes

On successful completion of this programme a student will be able to:

- 301 research public, industry and academic problem domains using appropriate methods and techniques
- 302 identify material from multiple published sources relevant to a chosen topic, and from it synthesise theories, principles or designs relevant to a practical, problem-solving project
- 303 deliver a presentation using appropriate professional standards with supporting documentation suitable for a wider audience
- 304 manage one's own learning and development including time management and organisational skills
- 305 evaluate the need for continuing professional development and lifelong learning
- 306 communicate succinctly to a range of audiences (orally or in writing) using rational and reasoned arguments
- 307 work effectively as a member of a team

310 meet the skill needs of contemporary industry with a wide range of development skills with emphasis on computer science

and students following the Sandwich variant of the award will, in addition, be able to:

320 adopt a professional approach in fulfilling work tasks

For details of each module contributing to the programme, please consult the module specification document.

5. Learning, Teaching and Assessment Strategies

5.1. Learning and Teaching Strategy

The teaching and learning strategy derives from the programme learning outcomes and is influenced by a school initiative to emphasize optionality and student choice in the context of an integrated suite of related programmes. This approach facilitates the alignment of employment and career pathways through selecting option modules in the final year of the programme.

Knowledge and understanding are developed in a number of ways: student engagement and participation in scheduled activities such as lectures and workshops; following directed reading and undertaking wider reading and study; through primary and secondary research activity such as using the physical library or the stock of on-line journals and e-books. Access to online, self-directed learning platforms are also available, such as Lynda.com and Microsoft Imagine Academy.

Subject specific intellectual skills are developed in a number of ways: by engaging with the formative and summative assessment tasks; by peer review, self-appraisal and self-evaluation; viva voce; being challenged to justify assumptions and recommendations made.

Subject specific practical skills are developed in a number of ways: by using industry-standard software development tools and programming environments; using both standard and less-popular applications for generation of documents; developing research techniques to analyse, evaluate and justify solutions. Transferable skills and attributes are developed in a number of ways: planning and executing activities; undertaking individual and group project work; managing time in routine and deadline situations; working as a member and as a leader of a team.

Each student is assigned a personal tutor at the start of their programme. Students will have regular meetings throughout the academic year with their tutor to discuss progress and to monitor performance and engagement and provide a forum for frank exchange and to ask questions and raise concerns. Meetings will often take place in small groups of students but will occasionally be on an individual basis to promote open and free discussion. Personal Tutors will encourage students to develop their transferable skills in particular communications and study skills. Throughout all levels of study students are presented with opportunities to engage in tutorial support, either physically or virtually to ensure appropriate transferable and subject specific skills are appropriately developed. Students continue to have access to their tutor on a scheduled basis throughout their programme.

All personal tutors monitor the engagement of their tutees both in terms of attendance, engagement and academic performance. Tutors will discuss engagement with their tutees both informally and at certain key points in the calendar, on a more formal basis of progress review. Module tutors all publish surgery hours for students taking their modules and undertake to be available for these times to deal with questions about the content of the material.

All modules host a site on the online Virtual Learning Environment (VLE) where students can access information such as lecture slides, workshop tasks, hand-in dates for assignment work etc.

Programme briefing documents, study and assessment materials for all modules are delivered via the VLE as part of a responsive, University managed, service.

In the early stages of the programme emphasis is placed on managed approaches to knowledge acquisition and the development of core understanding. The primary delivery vehicles at this stage are lectures. Plenary workshop activities provide an opportunity for review of material and significant practical application. These approaches attempt to establish important conceptual frameworks; to instil an appropriate value set and to provide a map of the discipline and those aspects that will be key foci for further study. Workshops and practical exercises more usually support skill development curricula and learning materials are used extensively to facilitate individually paced skill acquisition and development. The programme is largely common with other programmes in the first year, giving a broad basis of understanding, and the possibility of transfer to other related programmes

dependent upon the completion of specific modules to that point in the first year.

As the study programme progresses project-based and student-led/tutor directed approaches are introduced to encourage the notion of learner independence and to promote application of developing competencies. The tendency at this stage is for more modules to challenge student assimilation, ability to apply and critique. Options are introduced, allowing students to tune the programme to their own interests abilities and career aspirations, drawing upon the material available from other programmes in the School. Throughout all levels of study students are presented with opportunities to engage in tutorial support, either physically or virtually to ensure appropriate transferable and subject specific skills are appropriately developed.

Learning in project-based modules is typically negotiated between supervisor and student in an effort to establish scope and to specify assessment requirements. Opportunities for students to become familiar with and ultimately involved in research activity are actively promoted and supported by the University's "Student As Producer" initiative.

5.2. Assessment Strategy

A wide range of assessment vehicles and styles are deployed; the assessment mode for each module is chosen to appropriately respond to subject content and learning outcomes, and for the programme level it is situated in. Throughout the programme, but particularly at the early stages of Level 1, students are introduced to formative in-class testing as a means of both self-assessment and rehearsal of assessment technique.

Examinations as tests of knowledge and understanding are deployed where appropriate. The curriculum also includes instances of multiple-choice, open book, closed book and practical/research-based time constrained assessment. Wherever an examination or a time-constrained test is scheduled a mock or sample test is always run to give students as an indication of the style and level of the test employed.

In-course assessment techniques are equally varied and are targeted at individuals and, where appropriate, group submissions. Coursework portfolios are widely used at Level 1 and in practical modules as a mechanism for managing breadth and complexity, and as an instrument for providing ongoing feedback. In their final level students undertake a substantial project activity that affords the opportunity for significant practical and research focused activity and assessment.

Submissions of all coursework items take place by upload to the Virtual Learning Environment. Wherever appropriate, submissions are subject to plagiarism detection software: students are made aware of this and are provided with support and guidance concerning plagiarism and other academic offences. Students are provided with coursework marks via the VLE and feedback to students is provided through the same medium.

The Assessment Map gives a top-level indication of the scheduling and distribution of assessment modes within the programme. Details of module assessment strategy are included with each module specification.

6. Programme Structure

The total number of credit points required for the achievement of Certificate of Higher Education (CertHE) is 120.

The total number of credit points required for the achievement of Diploma of Higher Education (DipHE) is 240.

The total number of credit points required for the achievement of Bachelor of Science with Honours (BSc (Hons)) is 360.

Level 1

Title	Credit Rating	Core / Optional
Maths for Computing 2019-20	15	Core
Problem Solving 2019-20	15	Core
Operating Systems 2019-20	15	Core
Computer Architectures 2019-20	15	Core
Algorithms and Complexity 2019-20	15	Core
Object-Oriented Programming 2019-20	30	Core
Programming Fundamentals 2019-20	15	Core

Level 2

Title	Credit Rating	Core / Optional
Artificial Intelligence 2020-21	15	Core
Study Period Abroad: Computer Science 2020-21	0	Optional
Team Software Engineering 2020-21	30	Core
Advanced Programming 2020-21	15	Core
Scalable Database Systems 2020-21	15	Core
User Experience Design 2020-21	15	Core
Network Fundamentals 2020-21	15	Core
Internet of Things 2020-21	15	Core

Level 3

Title	Credit Rating	Core / Optional
Image Processing 2021-22	15	Optional
Autonomous Mobile Robotics 2021-22	15	Optional
Cross-Platform Development 2021-22	15	Optional
Cloud Computing 2021-22	15	Optional
Physics Simulation 2021-22	15	Optional
Project 2021-22	45	Core
Machine Learning 2021-22	15	Core
Big Data 2021-22	15	Core
Parallel Programming 2021-22	15	Core
Cyber Security 2021-22	15	Optional
Virtual and Augmented Reality 2021-22	15	Optional
Graphics 2021-22	15	Optional

Appendix I - Curriculum Map

This table indicates which modules assume responsibility for delivering and ordering particular programme learning outcomes.

Key: Delivered and Assessed Delivered Assessed

Level 1

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Algorithms and Complexity 2019-20	<input checked="" type="checkbox"/>											
Computer Architectures 2019-20			<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>							
Maths for Computing 2019-20												
Object-Oriented Programming 2019-20	<input checked="" type="checkbox"/>					<input checked="" type="checkbox"/>						
Operating Systems 2019-20	<input checked="" type="checkbox"/>				<input checked="" type="checkbox"/>							
Problem Solving 2019-20												
Programming Fundamentals 2019-20	<input checked="" type="checkbox"/>					<input checked="" type="checkbox"/>						

	PO13	PO14	PO15	PO16	PO17	PO18	PO20	PO21	PO22	PO23	PO27	PO30
Algorithms and Complexity 2019-20	<input checked="" type="checkbox"/>						<input checked="" type="checkbox"/>					<input checked="" type="checkbox"/>
Computer Architectures 2019-20												
Maths for Computing 2019-20	<input checked="" type="checkbox"/>											
Object-Oriented Programming 2019-20	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>				<input checked="" type="checkbox"/>					
Operating Systems 2019-20												<input checked="" type="checkbox"/>
Problem Solving 2019-20								<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>			
Programming Fundamentals 2019-20	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>				<input checked="" type="checkbox"/>					

	PO33	PO35	PO36	PO37	PO99	PO10 1	PO10 2	PO10 3	PO10 4	PO10 6	PO10 7	PO10 8
Algorithms and Complexity 2019-20						<input checked="" type="checkbox"/>						
Computer Architectures 2019-20												
Maths for Computing 2019-20												
Object-Oriented Programming 2019-20												

Operating Systems 2019-20								✓					
Problem Solving 2019-20									✓				
Programming Fundamentals 2019-20										✓			

	PO10 9	PO11 0	PO20 1	PO20 2	PO20 3	PO20 4	PO20 5	PO20 6	PO20 7	PO20 8	PO20 9	PO21 0
Algorithms and Complexity 2019-20								✓				
Computer Architectures 2019-20												
Maths for Computing 2019-20												
Object-Oriented Programming 2019-20												
Operating Systems 2019-20				✓					✓			
Problem Solving 2019-20						✓						✓
Programming Fundamentals 2019-20												

	PO21 1	PO21 3	PO21 4	PO21 8	PO21 9	PO22 0	PO22 1	PO22 2	PO30 1	PO30 2	PO30 3	PO30 4
Algorithms and Complexity 2019-20												
Computer Architectures 2019-20												
Maths for Computing 2019-20												
Object-Oriented Programming 2019-20												
Operating Systems 2019-20												
Problem Solving 2019-20											✓	✓
Programming Fundamentals 2019-20						✓				✓		

	PO30 5	PO30 6	PO30 7	PO31 0	PO32 0
Algorithms and Complexity 2019-20					
Computer Architectures 2019-20		✓			
Maths for Computing 2019-20					
Object-Oriented Programming 2019-20				✓	
Operating Systems 2019-20				✓	
Problem Solving 2019-20	✓		✓		
Programming Fundamentals 2019-20				✓	

Level 2

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Advanced Programming 2020-21	✓		✓			✓						
Artificial Intelligence 2020-21			✓									
Internet of Things 2020-21			✓			✓		✓	✓			✓
Network Fundamentals 2020-21												
Scalable Database Systems 2020-21					✓							✓
Study Period Abroad: Computer Science 2020-21												
Team Software Engineering 2020-21	✓		✓		✓	✓	✓		✓	✓		
User Experience Design 2020-21	✓		✓		✓					✓	✓	

	PO13	PO14	PO15	PO16	PO17	PO18	PO20	PO21	PO22	PO23	PO27	PO30
Advanced Programming 2020-21	✓	✓					✓					
Artificial Intelligence 2020-21							✓				✓	
Internet of Things 2020-21		✓				✓						
Network Fundamentals 2020-21					✓							
Scalable Database Systems 2020-21			✓	✓								
Study Period Abroad: Computer Science 2020-21												
Team Software Engineering 2020-21		✓					✓					
User Experience Design 2020-21									✓	✓		

	PO33	PO35	PO36	PO37	PO99	PO10 1	PO10 2	PO10 3	PO10 4	PO10 6	PO10 7	PO10 8
Advanced Programming 2020-21						✓			✓			
Artificial Intelligence 2020-21						✓						
Internet of Things 2020-21	✓	✓	✓			✓		✓			✓	✓
Network Fundamentals 2020-21	✓	✓	✓	✓								

Scalable Database Systems 2020-21													✓
Study Period Abroad: Computer Science 2020-21													
Team Software Engineering 2020-21					✓	✓	✓	✓	✓				
User Experience Design 2020-21						✓				✓			

	PO10 9	PO11 0	PO20 1	PO20 2	PO20 3	PO20 4	PO20 5	PO20 6	PO20 7	PO20 8	PO20 9	PO21 0
Advanced Programming 2020-21			✓	✓				✓				
Artificial Intelligence 2020-21			✓	✓								
Internet of Things 2020-21	✓		✓	✓					✓		✓	
Network Fundamentals 2020-21											✓	
Scalable Database Systems 2020-21	✓		✓					✓		✓		
Study Period Abroad: Computer Science 2020-21												
Team Software Engineering 2020-21			✓			✓						
User Experience Design 2020-21			✓	✓			✓		✓			

	PO21 1	PO21 3	PO21 4	PO21 8	PO21 9	PO22 0	PO22 1	PO22 2	PO30 1	PO30 2	PO30 3	PO30 4
Advanced Programming 2020-21												
Artificial Intelligence 2020-21			✓									
Internet of Things 2020-21					✓		✓					
Network Fundamentals 2020-21												
Scalable Database Systems 2020-21												
Study Period Abroad: Computer Science 2020-21												
Team Software Engineering 2020-21						✓			✓	✓	✓	
User Experience Design 2020-21										✓		✓

	PO30 5	PO30 6	PO30 7	PO31 0	PO32 0
Advanced Programming 2020-21				✓	

Artificial Intelligence 2020-21												
Internet of Things 2020-21												
Network Fundamentals 2020-21												
Scalable Database Systems 2020-21												
Study Period Abroad: Computer Science 2020-21												✓
Team Software Engineering 2020-21		✓				✓		✓		✓		
User Experience Design 2020-21								✓				

Level 3

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Autonomous Mobile Robotics 2021-22			✓		✓							
Big Data 2021-22	✓	✓		✓		✓		✓	✓			
Cloud Computing 2021-22			✓			✓		✓	✓			✓
Cross-Platform Development 2021-22			✓									
Cyber Security 2021-22					✓		✓	✓	✓			✓
Graphics 2021-22					✓							
Image Processing 2021-22												
Machine Learning 2021-22		✓				✓						
Parallel Programming 2021-22	✓		✓									
Physics Simulation 2021-22												
Project 2021-22			✓		✓	✓	✓					
Virtual and Augmented Reality 2021-22					✓	✓						

	PO13	PO14	PO15	PO16	PO17	PO18	PO20	PO21	PO22	PO23	PO27	PO30
Autonomous Mobile Robotics 2021-22											✓	
Big Data 2021-22		✓										
Cloud Computing 2021-22		✓				✓						
Cross-Platform Development 2021-22												
Cyber Security 2021-22									✓			
Graphics 2021-22												

Image Processing 2021-22	✓												
Machine Learning 2021-22			✓	✓					✓		✓	✓	
Parallel Programming 2021-22	✓	✓						✓	✓				
Physics Simulation 2021-22													
Project 2021-22		✓						✓					
Virtual and Augmented Reality 2021-22		✓											

	PO33	PO35	PO36	PO37	PO99	PO10 1	PO10 2	PO10 3	PO10 4	PO10 6	PO10 7	PO10 8
Autonomous Mobile Robotics 2021-22								✓				
Big Data 2021-22						✓	✓					
Cloud Computing 2021-22	✓	✓	✓			✓	✓	✓			✓	
Cross-Platform Development 2021-22										✓		
Cyber Security 2021-22							✓					✓
Graphics 2021-22						✓						
Image Processing 2021-22												
Machine Learning 2021-22						✓		✓		✓		
Parallel Programming 2021-22						✓	✓	✓	✓			
Physics Simulation 2021-22						✓						
Project 2021-22						✓	✓		✓			
Virtual and Augmented Reality 2021-22						✓		✓	✓			

	PO10 9	PO11 0	PO20 1	PO20 2	PO20 3	PO20 4	PO20 5	PO20 6	PO20 7	PO20 8	PO20 9	PO21 0
Autonomous Mobile Robotics 2021-22												
Big Data 2021-22		✓	✓	✓	✓	✓						
Cloud Computing 2021-22			✓	✓					✓			
Cross-Platform Development 2021-22			✓	✓			✓			✓		
Cyber Security 2021-22									✓			
Graphics 2021-22												
Image Processing 2021-22			✓									
Machine Learning 2021-22			✓	✓								✓
Parallel Programming 2021-22			✓	✓			✓		✓			

Physics Simulation 2021-22				✓								
Project 2021-22			✓	✓					✓			
Virtual and Augmented Reality 2021-22			✓	✓					✓			

	PO21 1	PO21 3	PO21 4	PO21 8	PO21 9	PO22 0	PO22 1	PO22 2	PO30 1	PO30 2	PO30 3	PO30 4
Autonomous Mobile Robotics 2021-22			✓									
Big Data 2021-22											✓	
Cloud Computing 2021-22					✓							
Cross-Platform Development 2021-22												
Cyber Security 2021-22												
Graphics 2021-22				✓								
Image Processing 2021-22		✓										
Machine Learning 2021-22								✓				
Parallel Programming 2021-22									✓	✓		
Physics Simulation 2021-22				✓								
Project 2021-22	✓					✓			✓	✓		✓
Virtual and Augmented Reality 2021-22												

	PO30 5	PO30 6	PO30 7	PO31 0	PO32 0
Autonomous Mobile Robotics 2021-22				✓	
Big Data 2021-22					
Cloud Computing 2021-22					
Cross-Platform Development 2021-22					
Cyber Security 2021-22					
Graphics 2021-22					
Image Processing 2021-22					
Machine Learning 2021-22					
Parallel Programming 2021-22					
Physics Simulation 2021-22					
Project 2021-22		✓		✓	✓
Virtual and Augmented Reality 2021-22					

Appendix II - Assessment Map

This table indicates the spread of assessment activity across the programme. Percentages indicate assessment weighting.

Level 1

	01	02	03	04	05	06	07	08	09	10	11	12
Algorithms and Complexity 2019-20												
Computer Architectures 2019-20												
Maths for Computing 2019-20												
Object-Oriented Programming 2019-20												
Operating Systems 2019-20												
Problem Solving 2019-20												
Programming Fundamentals 2019-20							50					
	13	14	15	16	17	18	19	20	21	22	23	24
Algorithms and Complexity 2019-20												
Computer Architectures 2019-20											50	
Maths for Computing 2019-20							40					
Object-Oriented Programming 2019-20							20				10	
Operating Systems 2019-20												
Problem Solving 2019-20												
Programming Fundamentals 2019-20	50											
	25	26	27	28	29	30	31	32	33	34	35	36
Algorithms and Complexity 2019-20	60						40					
Computer Architectures 2019-20												
Maths for Computing 2019-20												
Object-Oriented Programming 2019-20						70						
Operating Systems 2019-20		40										
Problem Solving 2019-20	100											
Programming Fundamentals 2019-20												

	37	38	39	40	41	42	43	44	45	46	47	48	
Algorithms and Complexity 2019-20													
Computer Architectures 2019-20													
Maths for Computing 2019-20													
Object-Oriented Programming 2019-20													
Operating Systems 2019-20													
Problem Solving 2019-20													
Programming Fundamentals 2019-20													
								49	50	51	52	EP 1 (Wk 16)	EP 2 (Wks 33, 34, 35)
Algorithms and Complexity 2019-20													
Computer Architectures 2019-20												50	
Maths for Computing 2019-20													60
Object-Oriented Programming 2019-20													
Operating Systems 2019-20													60
Problem Solving 2019-20													
Programming Fundamentals 2019-20													

Level 2

	01	02	03	04	05	06	07	08	09	10	11	12
Advanced Programming 2020-21												
Artificial Intelligence 2020-21												
Internet of Things 2020-21												
Network Fundamentals 2020-21								40				
Scalable Database Systems 2020-21								50				

Study Period Abroad: Computer Science 2020-21													
Team Software Engineering 2020-21									20				
User Experience Design 2020-21													
	13	14	15	16	17	18	19	20	21	22	23	24	
Advanced Programming 2020-21	100												
Artificial Intelligence 2020-21													
Internet of Things 2020-21													
Network Fundamentals 2020-21													
Scalable Database Systems 2020-21	50												
Study Period Abroad: Computer Science 2020-21													
Team Software Engineering 2020-21													
User Experience Design 2020-21													
	25	26	27	28	29	30	31	32	33	34	35	36	
Advanced Programming 2020-21													
Artificial Intelligence 2020-21			40										
Internet of Things 2020-21						100							
Network Fundamentals 2020-21													
Scalable Database Systems 2020-21													
Study Period Abroad: Computer Science 2020-21								100					
Team Software Engineering 2020-21		20				60							
User Experience Design 2020-21						50							
	37	38	39	40	41	42	43	44	45	46	47	48	
Advanced Programming 2020-21													
Artificial Intelligence 2020-21													
Internet of Things 2020-21													
Network Fundamentals 2020-21													
Scalable Database Systems 2020-21													

Study Period Abroad: Computer Science 2020-21													
Team Software Engineering 2020-21													
User Experience Design 2020-21													
								49	50	51	52	EP 1 (Wk 16)	EP 2 (Wks 33, 34, 35)
Advanced Programming 2020-21													
Artificial Intelligence 2020-21													60
Internet of Things 2020-21													
Network Fundamentals 2020-21												60	
Scalable Database Systems 2020-21													
Study Period Abroad: Computer Science 2020-21													
Team Software Engineering 2020-21													
User Experience Design 2020-21													50

Level 3

	01	02	03	04	05	06	07	08	09	10	11	12
Autonomous Mobile Robotics 2021-22												
Big Data 2021-22										50		
Cloud Computing 2021-22												50
Cross-Platform Development 2021-22												
Cyber Security 2021-22												
Graphics 2021-22						50						50
Image Processing 2021-22												
Machine Learning 2021-22										50		
Parallel Programming 2021-22												

Physics Simulation 2021-22												
Project 2021-22												
Virtual and Augmented Reality 2021-22												
	13	14	15	16	17	18	19	20	21	22	23	24
Autonomous Mobile Robotics 2021-22												
Big Data 2021-22	50											
Cloud Computing 2021-22												
Cross-Platform Development 2021-22												
Cyber Security 2021-22								60				
Graphics 2021-22												
Image Processing 2021-22	100											
Machine Learning 2021-22	50											
Parallel Programming 2021-22											30	
Physics Simulation 2021-22												
Project 2021-22	20											
Virtual and Augmented Reality 2021-22	100											
	25	26	27	28	29	30	31	32	33	34	35	36
Autonomous Mobile Robotics 2021-22		50										
Big Data 2021-22												
Cloud Computing 2021-22												
Cross-Platform Development 2021-22										100		
Cyber Security 2021-22		40										
Graphics 2021-22												
Image Processing 2021-22												
Machine Learning 2021-22												
Parallel Programming 2021-22												
Physics Simulation 2021-22		40										
Project 2021-22					60		20					
Virtual and Augmented Reality 2021-22												
	37	38	39	40	41	42	43	44	45	46	47	48

Autonomous Mobile Robotics 2021-22											
Big Data 2021-22											
Cloud Computing 2021-22											
Cross-Platform Development 2021-22											
Cyber Security 2021-22											
Graphics 2021-22											
Image Processing 2021-22											
Machine Learning 2021-22											
Parallel Programming 2021-22											
Physics Simulation 2021-22											
Project 2021-22											
Virtual and Augmented Reality 2021-22											

	49	50	51	52	EP 1 (Wk 16)	EP 2 (Wks 33, 34, 35)
Autonomous Mobile Robotics 2021-22						50
Big Data 2021-22						
Cloud Computing 2021-22					50	
Cross-Platform Development 2021-22						
Cyber Security 2021-22						
Graphics 2021-22						
Image Processing 2021-22						
Machine Learning 2021-22						
Parallel Programming 2021-22						70
Physics Simulation 2021-22						60
Project 2021-22						
Virtual and Augmented Reality 2021-22						

Appendix III - Benchmark Analysis

This table maps programme learning outcomes to relevant QAA subject benchmark statements or PSRB guidelines.

Knowledge and Understanding

	Comp01	Comp02	Comp03	Comp04	Comp05	Comp06	Comp07	Comp08	Comp09
PO1	✓		✓			✓	✓		✓
PO2	✓								
PO3	✓		✓				✓		✓
PO4								✓	
PO5	✓		✓				✓		✓
PO6	✓								
PO7	✓		✓		✓		✓		✓
PO8	✓						✓		
PO9									
PO10	✓								✓
PO11	✓					✓	✓		
PO12		✓							
PO13	✓								
PO14		✓	✓					✓	✓
PO15	✓	✓				✓			
PO16	✓	✓	✓						
PO17	✓						✓		
PO18	✓		✓						
PO20	✓		✓			✓	✓		✓
PO21		✓	✓	✓					✓
PO22	✓						✓		
PO23	✓					✓	✓		
PO27	✓						✓		
PO30	✓					✓	✓		
PO33	✓	✓					✓		

PO35	✓		✓				✓		
PO36	✓	✓							
PO37	✓						✓	✓	
PO99				✓	✓				

	Comp10	Comp11	Comp12	Comp13	Comp14	Comp15
PO1			✓			
PO2						
PO3						
PO4	✓					
PO5						
PO6						
PO7		✓				
PO8						
PO9		✓				
PO10						
PO11						
PO12						
PO13	✓					
PO14						
PO15						
PO16						
PO17						
PO18						
PO20			✓			
PO21						
PO22						
PO23			✓			
PO27						
PO30						
PO33			✓			
PO35						
PO36						

PO37

PO99

Subject Specific Intellectual Skills

	Comp01	Comp02	Comp03	Comp04	Comp05	Comp06	Comp07	Comp08	Comp09
PO101			✓						✓
PO102			✓						✓
PO103		✓	✓						
PO104		✓	✓					✓	✓
PO106		✓	✓						
PO107									
PO108	✓								
PO109	✓								
PO110	✓								
PO210									
PO218									

	Comp10	Comp11	Comp12	Comp13	Comp14	Comp15
PO101						
PO102						
PO103						
PO104						
PO106						
PO107	✓	✓	✓			
PO108			✓			
PO109			✓			
PO110		✓				
PO210						
PO218						

Subject Specific Practical Skills

	Comp01	Comp02	Comp03	Comp04	Comp05	Comp06	Comp07	Comp08	Comp09
PO201	✓	✓							
PO202		✓	✓					✓	✓
PO203									
PO204				✓	✓				
PO205		✓							
PO206		✓							
PO207		✓				✓		✓	
PO208		✓				✓		✓	
PO209	✓	✓					✓		✓
PO211									
PO213	✓	✓							
PO214	✓	✓							
PO219		✓		✓				✓	✓
PO220				✓	✓				
PO221	✓						✓		
PO222	✓								

	Comp10	Comp11	Comp12	Comp13	Comp14	Comp15
PO201						
PO202						
PO203						
PO204	✓	✓				
PO205						
PO206						
PO207				✓		
PO208				✓		
PO209						
PO211						
PO213						

PO214								
PO219								
PO220				✓				✓
PO221								
PO222								

Transferable Skills and Attributes

	Comp01	Comp02	Comp03	Comp04	Comp05	Comp06	Comp07	Comp08	Comp09
PO301				✓					
PO302				✓					
PO303				✓					
PO304				✓					
PO305				✓	✓				
PO306				✓					
PO307				✓	✓				
PO310					✓				
PO320				✓	✓				

	Comp10	Comp11	Comp12	Comp13	Comp14	Comp15
PO301	✓					
PO302	✓					
PO303	✓					
PO304	✓					
PO305	✓	✓				
PO306	✓					
PO307	✓	✓				
PO310	✓		✓			
PO320	✓	✓				

Appendix IV: Benchmark Benchmark Statement(s)

Comp01 - *Demonstrate a requisite understanding of the main body of knowledge for their programme of study*

Comp02 - *Understand and apply essential concepts, principles and practice of the subject in the context of well-defined scenarios, showing judgement in the selection and application of tools and techniques.*

Comp03 - *Produce work involving problem identification, the analysis, the design or development of a system with appropriate documentation, recognising the important relationships between these...*

Comp04 - *Demonstrate transferrable skills and an ability to work under guidance and as a team member.*

Comp05 - *Identify appropriate practices within a professional, legal and ethical framework and understand the need for continuing professional development.*

Comp06 - *Discuss applications based upon the body of knowledge.*

Comp07 - *Demonstrate a sound understanding of the main areas of the body of knowledge within their programme of study, with an ability to exercise critical judgement across a range of issues.*

Comp08 - *Critically analyse and apply a range of concepts, principles and practice of the subject in an appropriate manner in the context of loosely defined scenarios, showing effective judgement in the selection and use of tools and techniques.*

Comp09 - *Produce work involving problem identification, the analysis, the design or the development of a system, with accompanying documentation, recognising the important relationships between these...*

Comp10 - *Demonstrate transferable skills with an ability to show organised work as an individual and as a team member and with minimum guidance.*

Comp11 - *Apply appropriate practices within a professional, legal and ethical framework and identify mechanisms for continuing professional development and lifelong learning.*

Comp12 - *Explain a wide range of applications based upon the body of knowledge.*

Comp13 - *Creative and innovative in their application of the principles covered in the*

Comp14 - *Able to contribute significantly to the analysis, design or the development of systems which are complex, and fit for purpose, recognising the important relationships between these.*

Comp15 - *Able to exercise critical evaluation and review of both their own work and the work of others.*