PROGRAMME SPECIFICATION	

1	**Awarding Institution**	Newcastle University
2	**Teaching Institution**	Newcastle University
3	**Final Award**	BSc (Hons)
4	**Programme Title**	Computer Science **UCAS Code G400** Computer Science with Industrial Placement **UCAS Code G401** Computer Science (Mobile and Distributed Systems) **UCAS Code G420*** Computer Science with Industrial Placement (Mobile and Distributed Systems) **UCAS Code G421*** Computer Science (Game Engineering) **UCAS Code G450** Computer Science with Industrial Placement (Game Engineering) **UCAS Code G451** Computer Science (Software Engineering) **UCAS Code G600** Computer Science with Industrial Placement (Software Engineering) **UCAS Code G603** Computer Science (Bio-computing) **UCAS Code I520*** Computer Science with Industrial Placement (Bio-computing) **UCAS Code I521*** Computer Science (Security and Resilience) **UCAS Code I190** Computer Science with Industrial Placement (Security and Resilience) **UCAS Code I191** Computer Science (Human-Computer Interaction) **Code I140*** Computer Science with Industrial Placement (Human-Computer Interaction) **Code I141*** *These programmes are withdrawn from entry effective September 2019

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5	**UCAS/Programme Code**	G400, G401, G420*, G421*, G450, G451, G600, G603, I140*, I141*, I190, I191, I520*, I521* * These programmes are withdrawn from entry effective September 2019
6	**Programme Accreditation**	British Computer Society
7	**QAA Subject Benchmark(s)**	Computing
8	**FHEQ Level**	6
9	**Date written/revised**	April 2023

10 Programme Aims

1. To produce graduates with the in-depth knowledge and skills necessary to exploit computing systems throughout their professional life. Graduates will have a clear understanding of the practical, theoretical and professional foundations of Computing Science. They will have knowledge and experience of the fundamental techniques used in modern software engineering. They will also have an understanding of the architectural concepts underpinning computer and networking hardware platforms. They will be able to apply relevant theory to the solution of practical problems and to the analysis of existing algorithms and techniques, and to recommend techniques and algorithms appropriate to specific circumstances in the areas of fundamental systems and major applications. They will also be able to appreciate, develop and evaluate new algorithms, techniques and other developments within the computing field.
2. To provide a flexible structure that allows students to follow a general programme in Computer Science, or to specialise in their final year in one of six areas:
    a. Students may choose to specialise in Mobile and Distributed Systems. These students will be able to design, build and integrate advanced networked computing systems in a range of application areas, such as mobile and wireless communications, computationally intensive financial and health applications, and business-critical enterprise applications involving multiple businesses and outsourcing. We envisage students growing into architect and chief architect roles for software product groups in start-ups or other enterprises, and being able to initiate and lead consulting efforts for field implementations of networked computing solutions.
    b. Students may choose to specialise in Game Engineering. These students will be able to design, develop and implement computer graphics software and applications on a variety of architectures including games consoles, graphics workstations and advanced 3D virtual reality environments, and to exploit such software and hardware in entertainment, engineering design and scientific visualisation. We envisage graduates pursuing these activities in both the entertainment and the industrial sectors; some may also seek to develop market-niche software in small or start-up companies.
    c. Students may choose to specialise in Software Engineering. These students will have particular knowledge and skills related to the development of large-scale fundamental and application software systems. They will be equipped to develop as professionals to assume lead technical and team management roles in such developments. We envisage graduates going on to employment in technical positions in software houses and with companies designing and deploying software in specific industry sectors; some may also seek to develop market-niche software in small or start-up companies.
    d. Students may choose to specialise in Bio-Computing. These students will have particular knowledge and skills related to the development of Bio-computing, computational biology, neuroinformatics applications for data analysis, modelling and simulation. They will be equipped to develop as

professionals to assume lead technical and team management roles in such developments. We envisage graduates going on to employment in technical and management positions in software houses and companies developing Bio-computing, neuroinformatics and computational biology software, and pharmaceutical and biotechnology companies; some may also seek to develop market-niche software in small or start-up companies.

e. Students may choose to specialise in Security and Resilience. These students will have particular knowledge and skills related to the development of dependable software systems. We envisage graduates going on to employment in technical positions in software houses and with companies designing and deploying dependable software in safety-critical industry sectors.

f. Students may choose to specialise in Human-Computer Interaction. These students will have particular knowledge and skills related to the design, development and evaluation of interactive digital technologies and systems. We envisage graduates going on to employment in technical positions in software houses and with companies who are engaged in the development of interactive technologies across a variety of industry sectors, including the creative industries. We also anticipate students finding employment amongst the usability, user experience, digital strategy and management consulting industries.

3. To provide a programme that equips students with subject-specific and transferable skills that will enable them to pursue a variety of careers within, and outside, the IT industry, including research.
4. To provide a programme which meets the accreditation requirements of appropriate professional bodies, thus providing the basis for further professional development and lifelong learning.
5. To provide a programme which meets the FHEQ at Honours level and which takes appropriate account of the subject benchmark statements in Computing.
6. For those students taking a programme with industrial placement, to provide students with the opportunity to develop their skills within an industrial setting.
7. Provide students with the experience of seeking and securing a position with an employer.
8. Facilitate independent self-management and proactive interaction in a non-university setting.
9. Provide a period of practical work experience that will benefit current academic study and longer term career plans.
10. Enable students to ethically apply their knowledge and skills in the work place, reflect upon their development and effectively evidence and articulate their learning in relevant future settings.

11 Learning Outcomes

The programme provides opportunities for students to develop and demonstrate knowledge and understanding, qualities, skills and other attributes in the following areas. The programme outcomes have references to the benchmark statements for Computing.

The strategy of the degree programmes is to give a broad coverage of the subject of Computer Science in Stages 1 and 2, and when taken, the industrial placement between stages 2 and 3, and then to offer specialisation at Stage 3 in the form of a wide range of optional modules.

Those students who specialise in the area of Mobile and Distributed Systems are eligible for the award of the degree of Computer Science (Mobile and Distributed Systems) or Computer Science with Industrial Placement (Mobile and Distributed Systems).

Those students who specialise in the area of Game Engineering are eligible for the award of the degree of Computer Science (Game Engineering) or Computer Science with Industrial Placement (Game Engineering).

Those students who specialise in the area of Software Engineering are eligible for the award of the degree of Computer Science (Software Engineering) or Computer Science with Industrial Placement (Software Engineering).

Those students who specialise in the area of Bio-computing are eligible for the award of the degree of Computer Science (Bio-computing) or Computer Science with Industrial Placement (Bio-computing).

Those students who specialise in the area of Security and Resilience are eligible for the award of the degree of Computer Science (Security and Resilience) or Computer Science with Industrial Placement (Security and Resilience).

Those students who specialise in the area of Human-Computer Interaction are eligible for the award of the degree of Computer Science (Human-Computer Interaction) or Computer Science with Industrial Placement (Human-Computer Interaction).

The following identifies the generic Intended Learning Outcomes for all programmes and specific outcomes for a particular specialisation. There will be variation depending on the options taken at Stage 3 and the nature of any industrial placement.

Knowledge and Understanding

On completing any of the programmes students should have gained and be able to demonstrate knowledge and understanding of:

A1. a diverse range of programming paradigms and languages supported by programming language principles
A2. the principles of software engineering
A3. the theoretical and mathematical foundations of Computer Science
A4. techniques for the development of data representations and algorithms
A5. computer and network organisation and hardware architectures
A6. professional issues, including legal and ethical aspects of professional practice, professional development, social roles and effects of computing systems
A7. research techniques
A8. software project management techniques
A9. legal issues affecting software projects

Additionally, a student will have gained and be able to demonstrate knowledge and understanding of a range of topics depending on their compulsory or optional modules.

A student taking modules from the Mobile and Distributed Systems specialism will additionally have gained and be able to demonstrate knowledge and understanding of:

A10. technological foundations of networked systems, in depth and breadth
A11. mobile systems development
A12. fundamental networked and internet protocols and algorithms
A13. techniques for networked and Internet programming
A14. solutions for secure and reliable networked and internet computing

A student taking modules from the Game Engineering specialism will additionally have gained and be able to demonstrate knowledge and understanding of:

A15. the technological foundations of computer games systems and virtual reality platforms
A16. the mathematical principles and algorithmic basis of computer graphics
A17. design issues and development techniques for computer graphics and Game Engineering
A18. human requirements and technical capabilities of modern games, graphics platforms, and virtual environments

A19. fundamental problems and approaches in artificial intelligence, as applied to computer games, visualisation and virtual environments

A student taking modules from the Software Engineering specialism will additionally have gained and be able to demonstrate knowledge and understanding of:

A20. modern software engineering processes
A21. software architectures and their theoretical foundations
A22. design techniques for large-scale and complex software systems
A23. basic principles of advanced software CASE tools
A24. validation and verification techniques

A student taking modules from the Bio-Computing specialism will additionally have gained and be able to demonstrate knowledge and understanding of:

A25. current bioinformatics, computational biology and neuroinformatics software
A26. theoretical foundations of bioinformatics, computational biology and neuroinformatics
A27. aspects of biological systems that are relevant for bioinformatics, computational biology and neuroinformatics
A28. biologically inspired computing methods and techniques
A29. software techniques used to develop bioinformatics, computational biology and neuroinformatics applications
A30. ethical and legal issues affecting the development of bioinformatics, computational biology and neuroinformatics software

A student taking modules from the Security and Resilience specialism will additionally have gained and be able to demonstrate knowledge and understanding of:

A31. theoretical foundations of reliable systems design including fault-tolerance and fault-avoidance

A32. cryptographic techniques

A student taking modules from the Human-Computer Interaction specialism will additionally have gained and be able to demonstrate knowledge and understanding of:

A33. User interface techniques and technologies

A34. Interaction design

Intended learning outcomes A8-A34 may have been achieved by students of other degrees depending on the options taken at Stage 3.

A35. Apply personal and professional development strategies to prioritise, plan and manage their own skills, development and learning.
A36. Research, select and apply relevant knowledge aimed at enhancing their own skills and effectiveness in specific duties at their placement.
A37. Demonstrate and understanding of a work environment, how it function and their contribution to it.
A38. Relate their work based learning to other areas of personal development, including academic performance.

Teaching and Learning Methods

Lectures are the main way of imparting knowledge and understanding (A1-A34), but tutorials are also used. Practical classes feature prominently, especially to support the Stage 1 programming modules (A1, A2). Visiting speakers provide seminars on aspects of being an IT professional (A6). Students are expected to contribute to their own learning experience by independent reading. They are provided with references to books which are categorised as *essential*, *recommended*, or *background* reading, as well as scientific papers and other learning materials including appropriate web URLs. In addition, when

taken, an industrial placement will involve the development of knowledge within an industrial setting (A35-A38).

Assessment Strategy

Knowledge and understanding are assessed by means of closed and open book written examinations, and coursework, including team and individual project reports and log books (A1-A34).

Intellectual Skills

On completing any of the programmes students should have skills in the areas of:

B1. carrying out the process of software development, including: the analysis of system requirements; the production of system specifications using appropriate models and techniques; software validation and verification
B2. using a variety of advanced (especially object-orientated) programming languages and paradigms
B3. using a variety of computer-based (including operating) systems
B4. applying theoretical concepts of Computer Science in the design and analysis of systems and algorithms
B5. identifying and implementing appropriate algorithms and data structure
B6. using and providing network information services
B7. project management, including estimation and planning

A student will have additional skills depending on their compulsory or optional modules.

A student taking modules from the Mobile and Distributed Systems specialism will additionally have skills in the areas of:

B8. designing and building realistic networked systems and Internet application
B9. identifying and analysing issues such as security and reliability in networked systems and Internet applications
B10. integrating a wide variety of protocols and platforms, including trust and dependability computing
B11. articulating the key contributions of emerging and future networked and internet computing technologies

A student taking modules from the Game Engineering specialism will additionally have skills in the areas of:

B12. developing and/or implementing graphics algorithms and applications in standard software environments
B13. modelling, rendering and interaction in 3D graphical environments
B14. mathematical techniques for the manipulation of 3D geometry
B15.implementing artificial intelligence algorithms in a declarative programming language

A successful student for the degree of Computer Science (Software Engineering) or Computer Science with Industrial Placement (Software Engineering) will have additional skills in the areas of:

B16. validation and verification techniques for designs and software
B17. using software Architecture Description Languages
B18. making informed choices among software tools and techniques

A student taking modules from the Bio-computing specialism will additionally have skills in the areas of:

B19. software development using software languages and development environments specific to Bio-computing, computation biology and neuroinformatics (e.g. Python, Matlab and similar software)
B20. using large scale online Bio-Computing and neuroinformatics databases
B21. making informed choices among software tools and techniques relevant for Bio-computing, computational biology and neuroinformatics application
B22. Implementing biologically inspired computation algorithms

A student taking modules from the Security and Resilience specialism will additionally have skills in the areas of:

B23. software development for dependable systems
B24. Implementing cryptographic algorithms

Teaching and Learning Methods

B1-B6 feature prominently in all modules. In particular a team project at Stage 2 gives students experience of working with others (see D7 below) to engineer a complex piece of software (B2, B4, B5). When taken, the industrial placement will require students to produce solutions to a customer's requirements (B1-B6). In many cases the industrial placement when taken, and an individual project at Stage 3 will require students to develop a large piece of software to a customer's requirements (B1, B2, B4, B5). In all other modules, coursework is used to develop these skills (B1-B26).

Assessment Strategy

Subject-specific and professional skills are assessed by coursework (B1-B26).

Practical Skills

On completing any of the programmes students should have the ability to:
C1. conduct investigations using the technical and professional literature
C2. use and evaluate appropriate tools and techniques
C3. undertake empirical evaluation of alternative solutions
C4. solve problems by identifying suitable approaches using computer-based systems
C5. reason abstractly about the structure and behaviour of computer systems

Teaching and Learning Methods

All modules involve coursework, much of which involves problem solving skills (C4). This is especially so in the team and individual projects, and, when taken, the industrial placement, where students need to select, evaluate and apply appropriate tools and techniques (C2). Here and elsewhere students will need to investigate possible alternatives in the technical and professional literature (C1, C3), and to reason about computer systems (C5).

Assessment Strategy

Practical skills are assessed by a range of coursework (reports, design documents, etc.) (C1-C5).

Transferable/Key Skills

On completing any of the programmes students should be able to use the following skills:
D1. written communication, particularly technical writing
D2. problem solving
D3. interpersonal communication
D4. initiative
D5. oral presentation
D6. adaptability
D7. teamwork
D8. numeracy
D9. planning and organisation
D10. computer literacy
D11. Reflect on and manage own learning and development within the workplace
D12. Use existing and new knowledge to enhance personal performance in a workplace environment, evaluate the impact and communicate this process

D13. Use graduate skills in a professional manner in a workplace environment, evaluate the impact and communicate the personal development that has taken place

Teaching and Learning Methods

Key skills feature throughout the programme; teamwork in the Stage 2 team project and when taken, the industrial placement (D7); oral presentation, interpersonal communication, and planning and organisation in the final year research methods and individual project modules, as well as the Stage 2 team project and when taken, the industrial placement (D3, D5, D9); written communication in all modules, but especially in the team and final year projects and when taken, the industrial placement (D1); numeracy is covered by a Mathematics module at Stage 1 and exercises in the programming modules (D8); computer literacy, problem solving, initiative and adaptability are necessarily covered throughout the programme (D2, D4, D6, D10).

Assessment Strategy

Key (transferable) skills are assessed by both written and oral presentations (D1-D10). Teamwork in the Stage 2 team project is assessed both by the module leader at team oral presentations and by a team monitor (a member of teaching staff) who attends team formal meetings (D5, D7). When taken, the industrial placement is assessed by the Module Leader with input from an industrial supervisor and on a pass/fail basis. No resit opportunity is available. Students who fail the placement are able to proceed to Stage 3 of the corresponding "without Industry" programme.

12 Programme Curriculum, Structure and Features

Basic structure of the programme

This programme has 3 Stages and when an industrial placement is taken, an intercalating year between stages 2 and 3. Students are required to take 120 credits at each Stage (except during an intercalating year).

Students take six compulsory 20-credit modules in each of Stages 1 and 2. The teaching of these modules is split equally across semesters 1 and 2 so that students study 60 credits in each semester. At Stage 1 students take a module in Mathematics. Further mathematical concepts are covered as and where necessary in modules at each Stage.

Students taking one of the industrial placement degrees will take an industrial placement year between Stages 2 and 3.

A wide range of optional modules is available at Stage 3, however all students must take the 40-credit individual project module.

Key features of the programme (including what makes the programme distinctive)

Students may elect to one semester of their final year abroad at one of our ERASMUS partner institutions.

Students taking one of the industrial placement degrees will take an industrial placement year between Stages 2 and 3.

To gain BCS accreditation students are required to have studied Stages 2 and 3 at the Newcastle campus. Students must have also passed a problem-solving project at the first attempt.

Programme regulations (link to on-line version)

G400_G401: -RG400_G401
G450_G451: -RG450_G451
G600_G603: -RG600_G603
I190_I191: I190_I191

13 Support for Student Learning

Generic information regarding University provision is available at the following link.
Generic Information

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

Accreditation reports
A request for accreditation by the British Computer Society of the degrees in Computer Science (Bio-computing), Computer Science with Industrial Placement (Bio-computing), Computer Science (Security and Resilience) and Computer Science with Industrial Placement (Security and Resilience), Computer Science (Human-Computer Interaction) and Computer Science with Industrial Placement (Human-Computer Interaction) was made in 2013 and initial approval of accreditation was given, subject to a documentary submission on graduation of the first cohort. All other programmes covered by this Degree Programme Specification were accredited by the British Computer Society in 2013.

Additional mechanisms
None.

Generic information regarding University provision is available at the following link.
Generic Information

15 Regulation of assessment

Generic information regarding University provision is available at the following link.

Generic Information

In addition, information relating to the programme is provided in:

The University Prospectus: http://www.ncl.ac.uk/undergraduate/degrees/#subject
Degree Programme and University Regulations: http://www.ncl.ac.uk/regulations/docs/

Please note. This specification provides a concise summary of the main features of the programme and of the learning outcomes that a typical student might reasonably be expected to achieve if she/he takes full advantage of the learning opportunities provided.