PROGRAMME SPECIFICATION	

1	**Awarding Institution**	Newcastle University
2	**Teaching Institution**	Newcastle University
3	**Final Award**	MComp (Hons)
4	**Programme Title**	Computer Science Computer Science with Study Abroad Computer Science with Industrial Placement Computer Science (Mobile and Distributed Systems) Computer Science with Study Abroad (Mobile and Distributed Systems) Computer Science with Industrial Placement (Mobile and Distributed Systems) Computer Science (Game Engineering) Computer Science with Study Abroad (Game Engineering) Computer Science with Industrial Placement (Game Engineering) Computing Science (Bio-Computing) Computing Science with Study Abroad (Bio-Computing) Computing Science with Industrial Placement (Bio-Computing) Computing Science (Security and Resilience) Computing Science with Study Abroad (Security and Resilience) Computing Science with Industrial Placement (Security and Resilience)
5	**UCAS/Programme Code**	G405 G406 I100 I120 I121 I122 I610 I611 I612 I522 I523 I524 I192 I193 I194
6	**Programme Accreditation**	British Computer Society
7	**QAA Subject Benchmark(s)**	Computing
8	**FHEQ Level**	7
9	**Last updated**	3 September 2013

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 Computing Science for two years then specialise in their 3rd and 4th years. Students studying for the G405, G406 and 1M55 programmes 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. Students studying for the I120, I121, 1K32, I610, I611, 1D24, I522, I523, 1F66, I192, I193, 1U22 programmes specialise in their last two (3rd and 4th) years in one of four 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 Bio-Computing. These students will have particular knowledge and skills related to the development of computing applications relevant to biological sciences, for example applications in bioinformatics, neuroinformatics, computational systems biology, or biological modelling. 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 focusing on the development of software systems for medical and biological applications; some may also seek to develop market-niche software in small or start-up companies.
    d. Students may choose to specialise in Security and Resilience. These students will be able to design and develop software applications for secure and safety-critical systems. They will be able to work in multi-disciplinary teams in defence, security and aerospace industries. Graduates may also act as security specialists in consulting companies.

3. To provide programmes that equip students with subject-specific and transferable skills that will enable them to pursue a variety of careers within, and outside, the IT industry.
4. To provide programmes which meet the accreditation requirements of appropriate professional bodies (including Further Learning), thus providing the basis for further professional development and lifelong learning.
5. To provide a qualification enhancing employment prospects in the wide range of IT based careers.
6. To provide opportunities for students with a background in computer science to acquire further knowledge, both in breadth and depth, in a range of relevant advanced computer science topics.
7. To equip students with a range of advanced practical computing skills.
8. To provide students with the opportunities to acquire research skills.
9. To provide a foundation for students wishing to embark on a research career in academia or industry.
10. To provide programmes which meet the FHEQ at Masters Levels and which takes appropriate account of the subject benchmark statements in Computing.
11. For those students taking a programme with study abroad, to provide students with the opportunity to develop their skills within an international setting.
12. For those students taking a programme with industrial placement, to provide students with the opportunity to develop their skills within an industrial setting.

11 Learning Outcomes

The programmes provide opportunities for students to develop and demonstrate knowledge and understanding, qualities, skills and other attributes in areas of computing science. The programme outcomes cover the benchmark statements for Computing.

The strategy of the degree programmes is to give a broad coverage of the subject of Computing 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 and Stage 4 in the form of a wide range of optional modules.

The following identifies the generic Intended Learning Outcomes for the programmes. There will be variation depending on the nature of the study abroad (if that is part of the programme), and the options taken at Stage 3 and Stage 4.

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

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:

A8. technological foundations of networked systems, in depth and breadth
A9. mobile systems development
A10. fundamental networked and internet protocols and algorithms
A11. techniques for networked and Internet programming, including advanced topics
A12. solutions for secure, reliable and trusted networked and internet computing, including trust and dependability enhancements

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

A13. the technological foundations of computer games systems and virtual reality platforms
A14. the mathematical principles and algorithmic basis of computer graphics
A15. design issues and advanced development techniques for computer graphics and Game Engineering
A16. human requirements and technical capabilities of modern games, graphics platforms, and virtual environments
A17. fundamental and advanced problems and approaches in artificial intelligence, as applied to computer games, visualisation and virtual environments

A18-A24 reserved.

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

Intended learning outcomes A8-A32 may have been achieved by students of other degrees depending on the options taken at Stage 3 and stage 4.

A33-A34 reserved.

Teaching and Learning Methods

Lectures are the main way of imparting knowledge and understanding (A1-A32), 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*, and *background* reading, as well as scientific papers and other learning materials including appropriate web URLs. In addition, when taken, the study abroad will involve the development of knowledge within an international setting. In addition, when taken, an industrial placement will involve the development of knowledge within an industrial setting.

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-A32).

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-oriented) programming languages and paradigms
B3. using a variety of computer-based (including operating) systems
B4. applying theoretical concepts of computing science in the design and analysis of systems and algorithms
B5. identifying and implementing appropriate algorithms and data structures
B6. using and providing network information services

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:

B7. designing and building realistic networked systems and Internet applications
B8. identifying and analysing issues such as security and reliability in networked systems and Internet applications
B9. integrating a wide variety of protocols and platforms, including trust and dependability computing
B10. 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:

B11. developing and/or implementing graphics algorithms and applications in standard software environments
B12. modelling, rendering and interaction in 3D graphical environments
B13 mathematical techniques for the manipulation of 3D geometry
B14. implementing artificial intelligence algorithms in a declarative programming language

B15-B18 reserved.

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, computational biology and neuroinfromatics (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 neuroinfromatics applications
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.imlpementing cryptographic algorithms

Intended learning outcomes B7-B24 may have been achieved by students of other degrees depending on the options taken at Stage 3 and stage 4.

B25-B26 reserved.

Teaching and Learning Methods

B1-B6 feature prominently in all modules. In particular a team project at Stage 2 and Stage 4 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). Individual projects at Stage 3 and Stage 4 will require students to develop large pieces of software to a customer's requirements (B1, B2, B4, B5). In all other modules, coursework is used to develop these skills (B1-B24).

Assessment Strategy

Subject-specific and professional skills are assessed by coursework (B1-B24).

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

Teaching and Learning Methods

Key skills feature throughout all programmes; teamwork in the Stage 2 and when taken, the industrial placement and Stage 4 team projects (D7); oral presentation, interpersonal communication, and planning and organisation in the Stage 3 and Stage 4 research methods and individual project modules, as well as the Stage 2 and Stage 4 team projects (D3, D5, D9); written communication in all modules, but especially in the Stage 2 and Stage 4 team projects, and the Stage 3 and Stage 4 individual projects (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 all programmes (D2, D4, D6, D10).

Assessment Strategy

Key (transferable) skills are assessed by both written and oral presentations (D1-D10). Teamwork in the Stage 2 and Stage 4 team projects 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

All programmes have 4 Stages and when an industrial placement is taken, an intercalating year between stages 2 and 3 and when a study abroad is taken (if it is part of the programme), the whole of Stage 3 shall be taken at a partner institution that offers an equivalent programme (curriculum, structure, features) for this stage. Students are required to take 120 credits at each Stage. In the case of students who take the study abroad option (G406, I121, I611, I523 and I193) the calculation of credits will be done according to the credit conversion rules included in the partnership agreement with the partner institution.

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 CSC1025 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 to all students at Stage 3. However, all must take the 40-credit individual project module CSC3095 and in the case of student on one of the specialisms, 40 credits of specialist modules. An equivalent project module will be compulsory for study abroad students.

Students study a group of compulsory modules and where available, a range of optional modules covering advanced computer science topics at Stage 4. However, all students must take the 5 credit research skills module CSC8205 (CSC8390 for Bio-Computing) and the 30-credit individual project module CSC8498.

Relevant sections of the School's Placements Handbook which conforms to the University's Policies and Procedures for Assuring the Standards of Work-Based and Placement Learning will apply in the case of students taking a programme with study abroad or industrial placement.

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

Students on G406, I121, I611, I523 and I191 will study Stage 3 abroad at one of our ERASMUS or other overseas partner institutions.

To gain BCS accreditation students are required to have studied Stage 2 and at least one of Stage 3 and Stage 4 at the Newcastle campus. Students must have also passed a problem-solving project at the first attempt.

Programme regulations (link to on-line version)

http://www.ncl.ac.uk/regulations/programme/2013-2014/comp.php

13 Criteria for admission

Entry qualifications

A Levels

AAB (excluding General Studies and Critical Thinking). GCSE Mathematics grade B required.

Scottish Qualifications

AAABB at Higher Grade. Mathematics required at grade 2 Standard Grade (or Intermediate 2

equivalent) if not offered at Higher Grade. Combinations of Highers and Advanced Highers accepted.

International Baccalaureate

35 points. Standard Level Mathematics or Mathematical Studies required at grade 5 if not offered at Higher Level.

Irish Leaving Certificate

A1A1A1B1B

Access Qualifications

A unit in Mathematical Studies essential. At least 15 level 3 credits in a science subject at Distinction. In addition, at least 30 level 3 credits at a minimum of Merit.

BTEC Level 5 HND

Applicants will be considered on an individual basis.

BTEC Level 3 Extended Diploma (formerly BTEC National Diploma)

Applicants will be considered on an individual basis.

Cambridge Pre-U

D3,D3,M2 in Principal Subjects. GCSE Mathematics grade B required.

Admissions policy/selection tools

Applicants are invited to visit the School for interview and to see the University and to meet staff current undergraduates on the programme. Attendance is strongly encouraged but not compulsory and applicants who are not based in the UK are not expected to attend.

Additional Requirements

None.

Level of English Language capability
For applicants whose first language is not English we ask for IELTS 6.5 or equivalent.

14 Support for Student Learning

The Student Services portal provides links to key services and other information and is available at: https://my.ncl.ac.uk/students/

Induction
During the first week of the first semester students attend an induction programme. New students will be given a general introduction to University life and the University's principle support services and general information about the School and their programme, as

described in the Student Handbook and Degree Programme Handbook. New and continuing students will be given detailed programme information and the timetable of lectures/practicals/labs/ tutorials/etc. The International Office offers an additional induction programme for overseas students.

Study skills support
Students will learn a range of Personal Transferable Skills, including Study Skills, as outlined in this Programme Specification. Some of this material, e.g. time management is covered in the appropriate Induction Programme. Students are explicitly tutored on their approach to both team and individual projects. Specific help is available to improve writing skills:

http://www.ncl.ac.uk/students/wdc/learning/

Numeracy support is available through Maths Aid and help with academic writing is available from the Writing Centre (further information is available from the Robinson Library).

Academic support
The initial point of contact for a student is with a lecturer or module leader, or their tutor (see below) for more generic issues. Thereafter the Degree Programme Director or Head of School may be consulted. Issues relating to the programmes may be raised at the Staff-Student Committee, and/or at the Board of Studies.

Pastoral support
All students are assigned a personal tutor whose responsibility is to monitor the academic performance and overall well-being of their tutees. In addition the University offers a range of support services, including one-to-one counselling and guidance or group sessions / workshops on a range of topics, such as emotional issues e.g. Stress and anxiety, student finance and budgeting, disability matters etc. There is specialist support available for students with dyslexia and mental health issues. Furthermore, the Union Society operates a Student Advice Centre, which can provide advocacy and support to students on a range of topics including housing, debt, legal issues etc. For details of all student support services see:

http://www.ncl.ac.uk/undergraduate/life/support/

Support for students with disabilities
The University's Disability Support Service provides help and advice for disabled students at the University - and those thinking of coming to Newcastle. It provides individuals with: advice about the University's facilities, services and the accessibility of campus; details about the technical support available; guidance in study skills and advice on financial support arrangements; a resources room with equipment and software to assist students in their studies. For further details see:

http://www.ncl.ac.uk/students/wellbeing/disability-support/

Learning resources
The University's main learning resources are provided by the Robinson and Walton Libraries (for books, journals, online resources), (http://www.ncl.ac.uk/library/) and Information Systems and Services, which supports campus-wide computing facilities:

http://www.ncl.ac.uk/itservice/

All new students whose first language is not English are required to take an English Language test in the Language Centre. Where appropriate, in-sessional language training can be provided. The Language Centre houses a range of resources for learning other languages which may be particularly appropriate for those interested in an Erasmus exchange :

http://www.ncl.ac.uk/langcen/

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

Module reviews
All modules are subject to review by questionnaires which are considered by the Board of Studies. Changes to, or the introduction of new, modules are considered at the Board of Studies and/or the School Teaching and Learning Committee. Student opinion is sought at the Staff-Student Committee and/or the Board of Studies. New modules and major changes to existing modules are subject to approval by the Faculty Teaching, Learning and Student Experience Committee.

Programme reviews
The Board of Studies conducts an Annual Monitoring and Review of the degree programmes and reports to Faculty Teaching, Learning and Student Experience Committee. The FTLSEC takes an overview of all programmes within the Faculty and reports any Faculty or institutional issues to the University Teaching, Learning and Student Experience Committee.

External Examiner reports
External Examiner reports are considered by the Board of Studies. The Board responds to these reports through Faculty Teaching and Learning Committee. External Examiner reports are shared with institutional student representatives, through the Staff-Student Committee.

Student evaluations
All modules, and the degree programme, are subject to review by student questionnaires. Informal student evaluation is also obtained at the Staff Student Committee and the Board of Studies. The National Student Survey is sent out every year to final-year undergraduate students and consists of a set of questions seeking the students' views on the quality of the learning and teaching in their HEIs. Further information is at www.thestudentsurvey.com/. With reference to the outcomes of the NSS and institutional student satisfaction surveys actions are taken at all appropriate levels by the institution.

Mechanisms for gaining student feedback
Feedback is channelled via the Staff-Student Committee and the Board of Studies.

Faculty and University Review Mechanisms
The programme is subject to the University's Internal Subject Review process:

http://www.ncl.ac.uk/quilt/assets/documents/qsh-isr-policy.pdf

Accreditation reports
The Stage 1, Stage 2 and Stage 3 parts of the programmes covered by this Degree Programme Specification were accredited by the British Computer Society in October 2008. A request for accreditation by the British Computer Society of all MComp programmes will be made in 2013.

Additional mechanisms
None.

16 Regulation of assessment

Pass mark
The pass mark for Level 7 modules is 50, and for Level 4, 5 and 6 modules is 40.

Course requirements
Progression is subject to the University's Undergraduate Progress Regulations and Integrated Masters Examination Conventions (http://www.ncl.ac.uk/regulations/docs/). In order to progress a student must meet the internal progression thresholds at the end of Stages 2 and 3 as specified in the relevant degree programme regulations. Students not meeting the threshold at the end of Stage 2 will be transferred on to the appropriate Bachelor's Degree programme. Students not meeting the threshold at the end of Stage 3 will not be permitted to progress to Stage 4 and will be considered for the appropriate Stage 3 exit award. Compensation rules do apply to this programme at Stages 1, 2 and 3 along with reassessment opportunities and these are fully outlined in the Examination Conventions.

Weighting of Stages
Marks from all modules studied at Stages 2, 3 and 4, may contribute to degree classification as specified in the relevant degree programme regulations.

Common Marking Scheme
The University employs a common marking scheme, which is specified in Integrated Masters Examination Conventions, namely:

Summary description applicable to Honours level Degree Classification Modules (levels 4-6)		**Summary description applicable to level 7 Degree Classification Modules**	
<39	Fail	<39	Fail
40-49	Third Class	40-49	Fail
50-59	Second Class, Second Division	50-59	Second Class, Second Division
60-69	Second Class, First Division	60-69	Second Class, First Division
70 or above	First Class	70 or above	First Class

Role of the External Examiner
An External Examiner, a distinguished member of the subject community, is appointed by Faculty Teaching and Learning Committee, following recommendation from the Board of Studies. The External Examiner is expected to:

i. See and approve assessment papers
ii. Moderate examination and coursework marking
iii. Attend the Board of Examiners
iv. Report to the University on the standards of the programme

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

The University Prospectus (see http://www.ncl.ac.uk/undergraduate/)

The School Brochure http://www.ncl.ac.uk/computing/

The University Regulations (see http://www.ncl.ac.uk/regulations/docs/)

The Degree Programme Handbook
(see http://www.ncl.ac.uk/computing/current/studenthandbook/)

Please note. This specification provides a concise summary of the main features of the programmes 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. The accuracy of the information contained is reviewed by the University and may be checked by the Quality Assurance Agency for Higher Education.

Annex

Mapping of Intended Learning Outcomes onto Stage 1, 2 and 3 Modules

Notes:

1. Modules in bold text are compulsory for all students.

2. Modules qualified by (MD) are compulsory for students wishing to have the degree title Computer Science (Mobile and Distributed Systems) or Computer Science with Industrial Placement (Mobile and Distributed Systems) and are optional for all other programmes.

3. Modules qualified by (GE) are compulsory for students wishing to have the degree title Computer Science (Game Engineering) or Computer Science with Industrial Placement (Game Engineering) and are optional for all other programmes.

4. Modules qualified by (BI) are compulsory for students wishing to have the degree title Computer Science (Bio-computing) or Computer Science with Industrial Placement (Bio-computing) and are optional for all other programmes.

5. Modules qualified by (SR) are compulsory for students wishing to have the degree title Computer Science (Security and Resilience) or Computer Science with Industrial Placement (Security and Resilience) and are optional for all other programmes.

–	**CSC1021**	**CSC1022**	**CSC1023**	**CSC1024**	**CSC1025**	**CSC1026**	**CSC2011**	**CSC2012**	**CSC2013**	**CSC2014**	**CSC2015**	**CSC2016**	**CSC3095**	CSC3622 SR	CSC3721	CSC3321 SE	CSC3322 SE	CSC3421 BI	CSC3121 MD	CSC3124 MD,SR	CSC3123 MD	CSC3122 MD	CSC3223 GE	CSC3224 GE	CSC3222 GE	CSC3221 GE	CSC3303 SE	CSC3323 SE,SR	CSC3423 BI	CSC3424 BI	CSC3722	CSC3723	CSC3422 BI	CSC3621 SR
A1	X	X		X		X	X	X	X	X	X		X			X	X		X		X	X		X					X	X			X	
A2	X	X				X	X	X	X	X	X	X	X	X	X		X					X	X	X			X	X		X				
A3				X	X			X		X	X	X				X			X				X						X		X	X		
A4	X	X					X	X			X	X		X			X	X	X				X						X	X	X	X		
A5				X					X					X	X		X																	
A6	X		X								X			X	X			X	X					X			X		X	X				
A7													X																					
A8																			X															
A9																						X												
A10																			X															
A11																					X													
A12																			X	X														
A13																							X	X		X					X	X		
A14																							X	X		X					X	X		
A15																								X	X	X					X	X		
A16																							X	X		X					X	X		
A17																									X	X					X	X		
A25																														X				
A26																		X												X				
A27																		X												X				
A28																													X					
A29																													X	X				
A30																													X	X				
A31														X																				
A32																																		X

C5	C4	C3	C2	C1	
	X	X	X		**CSC1021**
	X	X	X		**CSC1022**
		X	X	X	**CSC1023**
X	X	X	X	X	**CSC1024**
	X		X		**CSC1025**
	X	X	X		**CSC1026**
X	X	X	X		**CSC2011**
X	X	X	X	X	**CSC2012**
X			X	X	**CSC2013**
X	X	X	X	X	**CSC2014**
X	X	X	X	X	**CSC2015**
X	X	X	X		**CSC2016**
	X	X	X	X	**CSC3095**
X	X			X	CSC3622 SR
	X	X	X	X	CSC3721
X			X		CSC3321 SE
	X		X		CSC3322 SE
X	X	X	X	X	CSC3421 BI
	X		X		CSC3121 MD
	X	X	X	X	CSC3124 MD,SR
X	X	X	X	X	CSC3123 MD
	X			X	CSC3122 MD
	X	X	X	X	CSC3223 GE
X	X	X	X	X	CSC3224 GE
					CSC3222 GE
					CSC3221 GE
					CSC3303 SE
					CSC3323 SE,SR
X	X	X	X	X	CSC3423 BI
X	X	X	X	X	CSC3424 BI
X	X	X			CSC3722
X	X	X			CSC3723
	X			X	CSC3422 BI
					CSC3621 SR

B24	B23	B22	B21	B20	B19	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	
														X	X		X	X	X	**CSC1021**
														X	X	X	X	X	X	**CSC1022**
														X						**CSC1023**
														X	X	X	X	X	X	**CSC1024**
																X				**CSC1025**
														X	X	X	X	X	X	**CSC1026**
															X		X	X	X	**CSC2011**
														X		X	X		X	**CSC2012**
														X			X			**CSC2013**
															X	X			X	**CSC2014**
														X	X	X	X	X	X	**CSC2015**
															X	X				**CSC2016**
																	X	X	X	**CSC3095**
X	X														X		X		X	CSC3622 SR
														X					X	CSC3721
																X			X	CSC3321 SE
														X	X	X	X	X	X	CSC3322 SE
																				CSC3421 BI
												X	X	X						CSC3121 MD
										X		X						X		CSC3124 MD,SR
										X	X		X	X	X		X	X	X	CSC3123 MD
											X		X				X	X	X	CSC3122 MD
							X	X	X						X	X			X	CSC3223 GE
							X	X	X					X	X		X		X	CSC3224 GE
						X														CSC3222 GE
							X	X	X											CSC3221 GE
																			X	CSC3303 SE
																				CSC3323 SE,SR
		X	X		X										X	X				CSC3423 BI
			X	X	X										X	X	X			CSC3424 BI
									X						X					CSC3722
									X						X					CSC3723
																	X	X		CSC3422 BI
X																				CSC3621 SR

	CSC1021	**CSC1022**	**CSC1023**	**CSC1024**	**CSC1025**	**CSC1026**	**CSC2011**	**CSC2012**	**CSC2013**	**CSC2014**	**CSC2015**	**CSC2016**	**CSC3095**	CSC3622 SR	CSC3721	CSC3321 SE	CSC3322 SE	CSC3421 BI	CSC3121 MD	CSC3124 MD,SR	CSC3123 MD	CSC3122 MD	CSC3223 GE	CSC3224 GE	CSC3222 GE	CSC3221 GE	CSC3303 SE	CSC3323 SE,SR	CSC3423 BI	CSC3424 BI	CSC3722	CSC3723	CSC3422 BI	CSC3621 SR
D1	X	X	X	X		X		X	X	X	X		X	X	X			X				X	X	X			X				X	X	X	
D2	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X					X	X	X	X	X	
D3			X							X	X		X					X									X							
D4	X	X	X	X	X	X		X		X	X		X	X	X	X	X	X		X		X	X	X					X	X				
D5			X								X		X					X																
D6	X	X	X	X	X	X					X	X	X					X		X				X										
D7			X								X					X		X									X							
D8					X					X	X	X					X			X			X	X						X	X			
D9	X	X	X	X		X		X		X	X		X		X			X					X	X			X		X	X				
D10	X	X	X	X		X	X	X		X	X	X	X	X	X		X				X	X	X	X					X	X			X	

Mapping of Intended Learning Outcomes onto Stage 4 Modules

Notes:

1. Modules in bold text are compulsory for all students.

2. Modules qualified by (**MD**) are compulsory and modules qualified by (MD) are optional for students wishing to have the degree title Computer Science (Mobile and Distributed Systems) or Computer Science with Industrial Placement (Mobile and Distributed Systems).

3. Modules qualified by (**GE**) are compulsory and modules qualified by (GE) are optional for students wishing to have the degree title Computer Science (Game Engineering) or Computer Science with Industrial Placement (Game Engineering).

4. Modules qualified by (**BI**) are compulsory and modules qualified by (BI) are optional for students wishing to have the degree title Computer Science (Bio-computing) or Computer Science with Industrial Placement (Bio-computing).

5. Modules qualified by (**SR**) are compulsory and modules qualified by (SR) are optional for students wishing to have the degree title Computer Science (Security and Resilience) or Computer Science with Industrial Placement (Security and Resilience).

	CSC8101 **MD**, GE	CSC8103 **MD**	CSC8104 **MD**	CSC8106 **MD**	CSC8110 **MD**	CSC8109 **MD**	CSC8201 **SR**	CSC8202 **MD**, **SR**	CSC8205 **MD**, **SR**, **GE**	**CSC8498**	CSC8102 **SR**	CSC8105 **SR**	CSC8203 **SR**, GE	CSC8204 **SR**	CSC8206 **SR**	CSC8404 **MD**, SR	CSC8406 SR	CSC8501 **GE**	CSC8502 **GE**	CSC8503 **GE**	CSC8506 **GE**	CSC8308 **BI**	CSC8313 **BI**	CSC8314 **BI**	CSC8390 **BI**	BIO8009 **BI**	MAS8401 **BI**	CSC8305 BI	CSC8311 BI
A1			X	X	X	X	X							X		X	X	X	X	X									X
A2	X			X		X		X			X	X	X			X	X	X											X
A3						X						X								X							X	X	
A4	X	X				X						X				X	X		X	X								X	
A5			X								X																		
A6						X	X	X					X		X						X								
A7										X																			
A8			X				X							X															
A9				X	X		X																						
A10		X						X				X																	
A11	X		X	X	X						X		X	X															
A12							X	X			X	X		X															
A13																			X										
A14																			X	X									
A15																		X			X								
A16					X								X						X	X	X								
A17																				X									
A25																						X	X						
A26																						X	X						X
A27																							X						
A28																								X		X			
A29																							X	X	X			X	
A30																								X			X		
A31							X							X	X														
A32								X																					

C5	C4	C3	C2	C1	
			X		CSC8101 **MD**, GE
		X			CSC8103 **MD**
		X	X		CSC8104 **MD**
X	X				CSC8106 **MD**
	X	X	X		CSC8110 **MD**
X	X	X	X	X	CSC8109 **MD**
X				X	CSC8201 **SR**
X				X	CSC8202 **MD**, **SR**
X	X	X	X	X	CSC8205 **MD**, **SR**, **GE**
X	X	X	X	X	**CSC8498**
					CSC8102 **SR**
X			X		CSC8105 **SR**
X		X	X	X	CSC8203 **SR**, GE
	X	X	X		CSC8204 **SR**
		X	X	X	CSC8206 **SR**
	X	X	X		CSC8404 **MD**, SR
	X	X	X		CSC8406 SR
	X		X		CSC8501 **GE**
	X	X	X		CSC8502 **GE**
	X	X	X	X	CSC8503 **GE**
X	X	X	X	X	CSC8506 **GE**
	X	X	X	X	CSC8308 **BI**
	X	X	X	X	CSC8313 **BI**
	X	X	X		CSC8314 **BI**
				X	CSC8390 **BI**
				X	BIO8009 **BI**
					MAS8401 **BI**
	X		X		CSC8305 BI
X					CSC8311 BI

B24	B23	B22	B21	B20	B19	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	
													X		X					CSC8101 **MD**, GE
											X					X				CSC8103 **MD**
											X			X	X			X	X	CSC8104 **MD**
											X						X		X	CSC8106 **MD**
										X	X		X	X	X			X	X	CSC8110 **MD**
														X	X	X	X	X	X	CSC8109 **MD**
	X									X		X					X			CSC8201 **SR**
X												X			X	X				CSC8202 **MD**, **SR**
																				CSC8205 **MD**, **SR**, **GE**
																				CSC8498
											X	X				X	X			CSC8102 **SR**
											X						X			CSC8105 **SR**
									X	X			X				X			CSC8203 **SR**, GE
	X									X		X						X	X	CSC8204 **SR**
	X													X	X	X	X	X	X	CSC8206 **SR**
															X		X	X		CSC8404 **MD**, SR
															X		X	X		CSC8406 SR
						X	X	X										X	X	CSC8501 **GE**
								X	X						X	X		X	X	CSC8502 **GE**
						X	X		X						X	X	X	X	X	CSC8503 **GE**
														X	X	X	X	X	X	CSC8506 **GE**
			X	X										X					X	CSC8308 **BI**
		X	X	X											X	X	X	X	X	CSC8313 **BI**
			X	X	X									X	X	X				CSC8314 **BI**
																				CSC8390 **BI**
																				BIO8009 **BI**
		X			X															MAS8401 **BI**
		X			X										X	X				CSC8305 BI
			X	X																CSC8311 BI

	CSC8101 **MD**, GE	CSC8103 **MD**	CSC8104 **MD**	CSC8106 **MD**	CSC8110 **MD**	CSC8109 **MD**	CSC8201 **SR**	CSC8202 **MD**, **SR**	CSC8205 **MD**, **SR**, **GE**	**CSC8498**	CSC8102 **SR**	CSC8105 **SR**	CSC8203 **SR**, GE	CSC8204 **SR**	CSC8206 **SR**	CSC8404 **MD**, SR	CSC8406 SR	CSC8501 **GE**	CSC8502 **GE**	CSC8503 **GE**	CSC8506 **GE**	CSC8308 **BI**	CSC8313 **BI**	CSC8314 **BI**	CSC8390 **BI**	BIO8009 **BI**	MAS8401 **BI**	CSC8305 BI	CSC8311 BI
D1							X	X	X	X			X		X						X		X		X			X	
D2		X		X						X		X			X				X	X	X		X				X	X	
D3							X	X	X	X			X		X						X		X		X			X	
D4							X	X	X	X			X		X						X		X		X			X	
D5									X	X					X						X				X				
D6									X	X					X						X				X				
D7															X						X								
D8												X							X	X							X	X	
D9	X								X	X			X		X						X				X				
D10					X			X	X	X			X	X	X				X	X	X		X		X				X