#### UNIVERSITY OF NEWCASTLE UPON TYNE

#### FACULTY OF SCIENCE, AGRICULTURE & ENGINEERING



# DEGREE PROGRAMME SPECIFICATION

| 1. | Awarding Institution        | University of Newcastle upon Tyne           |
|----|-----------------------------|---|
| 2. | <b>Teaching Institution</b> | University of Newcastle upon Tyne           |
| 3. | Final Award                 | BSc (Hons)                                  |
| 4. | Programme Title             | Computing Science                           |
|    |                             | or Computing Science (Software Engineering) |
| 5. | Programme Accredited by:    | British Computer Society                    |
| 6. | UCAS Code                   | G402 (or G602)                              |
| 7. | QAA Benchmarking Group(s)   | Computing                                   |
| 8. | Date of production/revision | 29/9/04                                     |

#### 9. Programme Aims:

- To produce graduates who 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 requirements analysis, specification, design, development, validation, documentation, maintenance and evaluation of software systems in accordance with modern principles of Software Engineering. They will also have an understanding of the architectural concepts underlying the hardware systems on which such software is run. 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 develop and evaluate new algorithms and techniques in these areas. Students who graduate with a degree in Computing Science (Software Engineering) will be particularly well suited to the implementation of large-scale fundamental software and major applications. We envisage graduates going on to employment in technical positions in software houses and with large-scale scientific and engineering users; some students may also seek to develop market-niche software in small companies; some graduates may also seek to pursue research careers.
- To provide a programme which meets the FHEQ at Honours level and which takes appropriate account of the subject benchmark statements in Computing.

# 10. Intended Learning Outcomes; Teaching and Learning Strategies and Methods; Assessment Strategies and Methods

## A Knowledge and understanding

A successful student will have gained and be able to demonstrate knowledge and understanding of:

- A1. A range of programming paradigms and languages
- A2. A number of applications within Computing Science
- A3. The principles of software engineering
- A4. The theoretical and mathematical foundations of Computing Science
- A5. Techniques for the development of algorithms for a range of applications
- A6. Computer organisation and architectures
- A7. Professional issues to cover: social, ethical and legal aspects

#### Teaching & Learning Strategy

Lectures are the main way of imparting knowledge and understanding (A1-A7), but tutorials are also used. Practical classes feature prominently, especially to support the Stage 1 programming modules (A1, A3). Visiting speakers provide seminars on aspects of being an IT professional (A7). 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.

#### Assessment strategy

Knowledge and understanding are assessed by means of closed and open book written examinations, and coursework, including group and individual project reports (A1-A7).

# **B** Subject –specific/professional skills

A successful student will have skills in the areas of:

- B1. The process of software development
- B2. The use of hardware and software systems

B3. The application of theoretical concepts of computing science in the design and analysis of systems and algorithms

- B4. The identification and implementation of appropriate algorithms and data structures
- B5. The use and provision of network information services
- B6. The use of a variety of programming languages and paradigms
- B7. Analysis of system requirements and the production of system specifications

## Teaching & Learning Strategy

B1-B7 feature prominently in all modules. In particular a group project at Stage 2 gives students experience of working within teams to engineer a complex piece of software. An individual project at Stage 3 requires students to develop a large piece of software to a customer's requirements. In all other modules, coursework is used to develop these skills.

Assessment strategy

Subject-specific and professional skills are assessed by coursework (B1-B7).

## C Cognitive skills

A successful student will have :

- C1. The ability to conduct investigations using the technical and professional literature
- C2. The ability to use and evaluate appropriate tools and techniques

C3. The ability to undertake empirical evaluation of alternative solutions

C4. The ability to formulate problems and identify suitable approaches to solving them C5. The ability to reason abstractly about the structure and behaviour of computer systems

# Teaching & Learning Strategy

All modules involve coursework, much of which involves problem solving skills (C4). This is especially so in the group and individual projects 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 Cognitive skills are assessed by a range of coursework (reports, design documents, etc.) (C1-C5).

# D Key (transferable) skills

A successful student will be able to use the following skills:

- D1. Written communication
- 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 & Learning Strategy

Key skills feature throughout the programme; teamwork in the Stage 2 group project (D7); oral presentation, interpersonal communication, and planning and organisation in the final year Project module, as well as the Stage 2 group project (D3, D5, D9); written communication in all modules, but especially in the final year project (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).

The strategy of the degree programme is to give a broad coverage of the subject of Computing Science in Stages 1 and 2, and then to provide specialisation at Stage 3 in the form of a wide range of optional modules. Those students who specialise in the area of Software Engineering are eligible for the award of the degree of Computing Science (Software Engineering).

Assessment strategy

Key (transferable) skills are assessed by both written and oral presentations (D1-D10). Teamwork in the Stage 2 group project is assessed both by the module leader at team oral presentations and by a group monitor (a member of teaching staff) who attends group formal meetings (D5, D7).

# 11 Programme Features, Structure and Curriculum

# A & B Programme Features & Structure

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 who have taken A-level Mathematics (or equivalent) take CSC163 Mathematics for Computing Science. Those without this qualification take CSC167 Foundation Mathematics for Computing Science. For both sets of students further mathematical concepts are covered as and where necessary in modules at each Stage. However, certain modules at Stage 3, as indicated in the Degree Programme Handbook, may not be available to those students who have taken CSC167.

A wide range of optional modules is available at Stage 3, however all students must take the 30-credit individual project. Students who take CSC307, CSC308 and a Software Engineering-related CSC399 CS Project and Dissertation are eligible for the award of a degree in Computing Science (Software Engineering).

# C Programme Curriculum

Degree of Bachelor of Science with Honours in Computing Science *or* Computing Science (Software Engineering)

**UCAS Codes:** 

**Computing Science: G402** 

# Computing Science (Software Engineering): G602

1. Stage 1

(a) Candidates for the programmes in Computing Science and in Computing Science (Software Engineering) shall take the following core modules:

Code Credits Descriptive title

CSC161 (20) Problem Solving, Program Design and Implementation

CSC162 (20) Object-Oriented Program Design and Development

(b) Candidates for the programmes in Computing Science and in Computing Science (Software Engineering) shall take the following compulsory modules:

Code Credits Descriptive title

CSC163 (20) Mathematics for Computing Science

or

- CSC167 (20) Foundation Mathematics for Computing Science
- CSC164 (20) Computer Architecture and Communications
- CSC165 (20) The IT Professional in Today's Society
- CSC166 (20) Computer Environments

(c) Candidates may take other modules (eg from other schools) to a value of 20 credits, subject to the approval of the Degree Programme Director by deferring an equivalent number of credits from the list at 1(b).

# 2. Stage 2

(a) Subject to regulation 1(c) above candidates for the programmes in Computing Science and in Computing Science (Software Engineering) must take any deferred compulsory modules from Stage 1.

(b) Candidates for the programmes in Computing Science and in Computing Science (Software Engineering) shall take the following compulsory modules:

Code Credits Descriptive title

- CSC261 (20) Advanced Programming
- CSC262 (20) Requirements Analysis and Database Design
- CSC263 (20) Computer Systems and Networks
- CSC264 (20) Modelling and Computation
- CSC265 (20) Software Engineering Group Project
- CSC266 (20) Algorithm Design and Analysis

(c) Any module specified under (b) which is not taken at Stage 2 shall be taken at Stage 3.

# 3. Stage 3

(a) Subject to regulation 2(c) above candidates for the programmes in Computing Science and in Computing Science (Software Engineering) must take any deferred compulsory modules from Stage 2.

(b) Candidates for the programmes in Computing Science and in Computing Science (Software Engineering) shall take the following compulsory module:

CodeCredits Descriptive titleCSC399 (30)Project and Dissertation

(c) After considering compulsory modules, candidates must select optional modules from the table below, to make the total credits for the year total 120. The choice of modules determines the title of the degree.

(i) Candidates who take CSC307 and CSC308 are eligible for the award of the degree in Computing Science (Software Engineering).

(ii) Candidates who take any other combinations of modules are eligible for the award of the degree in Computing Science.

(iii) Candidates who are eligible for the award of the degree in Computing Science (Software Engineering) may elect to be awarded the degree in Computing Science instead.

| Code   | Credits | Descriptive title                       |
|--------|---------|---|
| CSC301 | (10)    | Operating Systems                       |
| CSC304 | (10)    | Applications of Artificial Intelligence |
| CSC305 | (10)    | Parallel Computation                    |
| CSC306 | (10)    | Graphics                                |
| CSC307 | (10)    | Human-Computer Interaction              |
| CSC308 | (10)    | Software Project Management             |

| CSC309 (10) | Distributed Systems                           |
|-------------|---|
| CSC310 (10) | Real-time Systems                             |
| CSC311 (10) | Reliability and Fault Tolerance               |
| CSC331 (10) | System and Network Security                   |
| CSC332 (10) | Internet Technologies and Electronic Commerce |
| CSC334 (10) | Understanding Programming Languages           |
| CSC335 (10) | Performance Evaluation                        |
| CSC337 (10) | Computer Games Development                    |
| CSC338 (10) | Evolution of Complex Systems                  |

Note: not all options listed may be offered in any one year; additional modules may be available.

(d) Candidates may take other modules (eg from other schools) to a value of 20 credits, subject to the approval of the Degree Programme Director.

**Development of specific Intended Learning Outcomes** occurs through the following modules (compulsory modules in bold text, optional modules in normal, italic text.) Notes:

1. CSC163 and CSC167 are alternative compulsory modules.

2. Modules CSC307 and CSC308 are compulsory for students wishing to have the title "Computing Science (Software Engineering)" <u>only</u> and are therefore indicated by a \*.

| A1. | A range of programming paradigms and languages                           | CSC161, CSC162, CSC164,<br>CSC166, CSC261, CSC262,<br>CSC263, CSC264, CSC265,<br>CSC305, CSC309, CSC332, CSC334,<br>CSC335, CSC337.                      |
|-----|--|--|
| A2. | A number of applications within Computing Science                        | CSC164, CSC166, CSC167,<br>CSC262, CSC264, CSC265,<br>CSC266, CSC305, CSC335,<br>CSC337, CSC338.   |
| A3. | The principles of software engineering                                   | CSC161, CSC162, CSC261,<br>CSC262, CSC263, CSC264,<br>CSC265, CSC266, CSC301,<br>CSC306, CSC307*, CSC308*,<br>CSC310, CSC311, CSC335, CSC337,<br>CSC399. |
| A4. | The theoretical and mathematical foundations of<br>Computing Science     | CSC163, CSC164, CSC166,<br>CSC167, CSC262, CSC264,<br>CSC265, CSC266, CSC305,<br>CSC306, CSC309, CSC310, CSC334,<br>CSC335.                              |
| A5. | Techniques for the development of algorithms for a range of applications | CSC161, CSC162, CSC167,<br>CSC261, CSC262, CSC265,<br>CSC266, CSC305, CSC306,<br>CSC309, CSC311, CSC335, CSC338.   |
| A6. | Computer organisation and architectures                                  | CSC161, CSC164, CSC166,<br>CSC263, CSC301, CSC305,<br>CSC307*, CSC310, CSC311,   |

| A7.       Professional issues to cover: social, ethical and legal aspects       CSC163, CSC167, CSC265, CSC307, CSC309, CSC337, CSC338,         B1.       The process of software development       CSC161, CSC162, CSC164, CSC264, CSC265, CSC301, CSC335, CSC337, CSC338, CSC311, CSC332, CSC334, CSC331, CSC335, CSC337, CSC338, CSC311, CSC362, CSC264, CSC262, CSC264, CSC262, CSC263, CSC306, CSC308, CSC307, CSC337, CSC339, CSC311, CSC332, CSC337, CSC339, CSC311, CSC332, CSC337, CSC399, CSC30, CSC301, CSC305, CSC301, CSC305, CSC300, CSC301, CSC305, CSC301, CSC305, CSC301, CSC305, CSC300, CSC307, CSC305, CSC300, CSC307, CSC305, CSC307, CSC305, CSC306, CSC307, CSC305, CSC306, CSC307, CSC305, CSC306, CSC307, CSC305, CSC307, CSC305, CSC307, CSC305, CSC305  |     |   | <i>CSC335</i> .                                 |
|--|-----|---|---|
| aspects       CSC307*,CSC308*,CSC309,<br>CSC337,CSC338,         B1.       The process of software development       CSC161, CSC162, CSC166,<br>CSC261, CSC262, CSC264,<br>CSC265, CSC301, CSC335,<br>CSC306, CSC308*, CSC311,<br>CSC332, CSC334, CSC335,<br>CSC306, CSC308*, CSC311,<br>CSC332, CSC334, CSC335,<br>CSC306, CSC308*, CSC307,<br>CSC300, CSC305,<br>CSC265, CSC301, CSC305,<br>CSC264, CSC265, CSC204,<br>CSC264, CSC264, CSC264,<br>CSC264, CSC265, CSC204,<br>CSC306, CSC161, CSC262,<br>CSC264, CSC265, CSC206,<br>CSC306, CSC307*,<br>CSC306, CSC307*,<br>CSC306, CSC307,<br>CSC306, CSC307,<br>CSC307, CSC332,<br>CSC337,<br>B5.         B4.       The identification and implementation of appropriate<br>algorithms and data structures       CSC161, CSC164,<br>CSC264, CSC265,<br>CSC306, CSC307,<br>CSC307, CSC337,<br>B5.         B5.       The use and provision of network information services       CSC161, CSC164, CSC165,<br>CSC307, CSC337,<br>CSC337, CSC337,<br>B5.         B6.       The use of a variety of programming languages and<br>paradigms       CSC166, CSC261, CSC265,<br>CSC337, CSC337,<br>CSC337, CSC337,<br>CSC337, CSC337,<br>CSC337, CSC337,<br>CSC337, CSC337,<br>CSC337, CSC337, CSC337,<br>CSC337, CSC337,<br>CSC337, CSC337   | A7. | Professional issues to cover: social, ethical and legal   | CSC163, CSC167, CSC265,                         |
| B1.       The process of software development       CSC137, CSC138.         B1.       The process of software development       CSC161, CSC162, CSC264, CSC264, CSC265, CSC301, CSC305, CSC306, CSC306, CSC308, CSC311, CSC332, CSC337, CSC337, CSC336, CSC301, CSC305, CSC300, CSC301, CSC305, CSC300, CSC301, CSC305, CSC300, C  |     | aspects   | CSC307*,CSC308* CSC309,                         |
| B1.       The process of software development       CSC161, CSC162, CSC166,<br>CSC261, CSC262, CSC204,<br>CSC265, CSC301, CSC305,<br>CSC306, CSC308*, CSC311,<br>CSC332, CSC334, CSC335, CSC337,         B2.       The use of hardware and software systems       CSC161, CSC164, CSC166,<br>CSC261, CSC262, CSC263,<br>CSC301, CSC301, CSC305,<br>CSC300, CSC311, CSC332, CSC337,<br>CSC399.         B3.       The application of theoretical concepts of computing<br>science in the design and analysis of systems and<br>algorithms       CSC164, CSC163, CSC164,<br>CSC264, CSC265, CSC266,<br>CSC305, CSC306, CSC307*,<br>CSC300, CSC311, CSC332,<br>CSC305, CSC306, CSC307*,<br>CSC305, CSC306, CSC307,<br>CSC305, CSC306, CSC307,<br>CSC305, CSC306, CSC307,<br>CSC300, CSC334, CSC335,         B4.       The identification and implementation of appropriate<br>algorithms and data structures       CSC161, CSC164, CSC164,<br>CSC264, CSC265,<br>CSC300, CSC301, CSC331,<br>CSC300, CSC311, CSC332,<br>CSC305, CSC300, CSC311, CSC332,<br>CSC305, CSC307, CSC309,<br>CSC335, CSC337,         B5.       The use and provision of network information services       CSC161, CSC164, CSC165,<br>CSC305, CSC307, CSC309,<br>CSC332, CSC337,<br>CSC335, CSC337,<br>CSC335, CSC337,<br>CSC335, CSC337,<br>CSC335, CSC337, CSC399,<br>CSC335, CSC337, CSC399,         C1.       The ability to conduct investigations using the technical<br>and professional literature       CSC162, CSC164, CSC265,<br>CSC307, CSC304, CSC335,<br>CSC337, CSC399,<br>CSC335, CSC337, CSC337,   |     |   | <i>CSC337, CSC338</i> .                         |
| <ul> <li>CSC261, CSC262, CSC264,<br/>CSC206, CSC301, CSC305,<br/>CSC300, CSC308*, CSC311,<br/>CSC332, CSC334, CSC335, CSC337,<br/>CSC332, CSC344, CSC355, CSC337,<br/>CSC361, CSC262, CSC263,<br/>CSC261, CSC262, CSC263,<br/>CSC261, CSC262, CSC263,<br/>CSC301, CSC305,<br/>CSC301, CSC311, CSC305,<br/>CSC301, CSC311, CSC305,<br/>CSC301, CSC311, CSC305,<br/>CSC301, CSC311, CSC305,<br/>CSC301, CSC305, CSC307*,<br/>CSC300, CSC306, CSC307*,<br/>CSC310, CSC304, CSC265,<br/>CSC306, CSC307*,<br/>CSC310, CSC314, CSC353,<br/>CSC306, CSC307,<br/>CSC310, CSC314, CSC353,<br/>CSC306, CSC307,<br/>CSC310, CSC314, CSC353,<br/>CSC306, CSC307,<br/>CSC310, CSC314, CSC353,<br/>CSC306, CSC307, CSC305,<br/>CSC306, CSC307, CSC305,<br/>CSC306, CSC307, CSC307,<br/>CSC306, CSC307, CSC307,<br/>CSC337,<br/>CSC337, CSC307,<br/>CSC337, CSC309,<br/>CSC337, CSC307,<br/>CSC337, CSC309,<br/>CSC337, CSC309,<br/>CSC337, CSC307, CSC309,<br/>CSC335, CSC337, CSC307,<br/>CSC335, CSC337, CSC309,<br/>CSC335, CSC337, CSC307,<br/>CSC335, CSC337, CSC337,<br/>CSC335, CSC337,<br/>CSC335, CSC337,<br/>CSC335, CSC337,<br/>CSC335, CSC337,<br/>CSC335, CSC337,<br/>CSC335, CSC337,<br/>CSC335, CSC337,<br/>CSC335, CSC337,<br/>CSC335, CSC33</li></ul> | B1. | The process of software development                       | CSC161, CSC162, CSC166,                         |
| CSC265, CSC301, CSC305,<br>CSC306, CSC304, CSC311,<br>CSC332, CSC334, CSC311,<br>CSC332, CSC334, CSC335, CSC337,B2.The use of hardware and software systemsCSC161, CSC164, CSC166,<br>CSC261, CSC262, CSC263,<br>CSC301, CSC311, CSC332, CSC337,<br>CSC309,B3.The application of theoretical concepts of computing<br>science in the design and analysis of systems and<br>algorithmsCSC161, CSC164, CSC164,<br>CSC166, CSC167, CSC262,<br>CSC306, CSC306, CSC306,<br>CSC334, CSC335, CSC337,<br>CSC334, CSC335, CSC337,<br>CSC306, CSC306, CSC307*,<br>CSC301, CSC311, CSC332, CSC337,<br>CSC306, CSC306, CSC307, CSC306,<br>CSC307, CSC306, CSC307*,<br>CSC301, CSC311, CSC332,<br>CSC306, CSC301, CSC311, CSC332,<br>CSC337, CSC337,B4.The identification and implementation of appropriate<br>algorithms and data structuresCSC161, CSC162, CSC164,<br>CSC264, CSC262, CSC264, CSC263,<br>CSC306, CSC307, CSC307,<br>CSC307, CSC309,<br>CSC337, CSC337,B5.The use and provision of network information servicesCSC164, CSC164, CSC165,<br>CSC166, CSC202, CSC263,<br>CSC337, CSC337,<br>CSC337, CSC339,B6.The use of a variety of programming languages and<br>paradigmsCSC166, CSC261, CSC265,<br>CSC307*, CSC309,<br>CSC337, CSC337, CSC399,C1.The ability to conduct investigations using the technical<br>and professional literatureCSC165, CSC166, CSC262,<br>CSC307*, CSC307*, CSC307*,<br>CSC337, CSC399,C2.The ability to use and evaluate appropriate tools and<br>techniquesCSC164, CSC164, CSC164,<br>CSC265, CSC306,<br>CSC307*, CSC311,<br>CSC337, CSC337, CSC337,<br>CSC337, CSC337,   |     |   | CSC261, CSC262, CSC264,                         |
| B2.The use of hardware and software systemsCSC306, CSC308*, CSC331,<br>CSC332, CSC335, CSC337,<br>CSC332, CSC335, CSC337,<br>CSC261, CSC262, CSC263,<br>CSC261, CSC262, CSC263,<br>CSC2399.B3.The application of theoretical concepts of computing<br>science in the design and analysis of systems and<br>algorithmsCSC162, CSC163, CSC164,<br>CSC162, CSC163, CSC164,<br>CSC164, CSC265, CSC307, CSC306,<br>CSC306, CSC307, CSC306, CSC307*,<br>CSC310, CSC334, CSC335,<br>CSC306, CSC307, CSC306, CSC307,<br>CSC310, CSC334, CSC335,B4.The identification and implementation of appropriate<br>algorithms and data structuresCSC161, CSC164, CSC164,<br>CSC264, CSC265, CSC306, CSC307,<br>CSC307, CSC306, CSC307, CSC330,<br>CSC335, CSC337,B5.The use and provision of network information servicesCSC161, CSC164, CSC165,<br>CSC307, CSC309,<br>CSC337, CSC337, CSC337,B6.The use of a variety of programming languages and<br>paradigmsCSC166, CSC261, CSC261, CSC262,<br>CSC337, CSC337, CSC337,<br>CSC337, CSC337, CSC337,B7.Analysis of system requirements and the production of<br>system specificationsCSC166, CSC261, CSC262,<br>CSC337, CSC337, CSC337, CSC337,<br>CSC337, CSC337, CSC337, CSC337, CSC337,<br>CSC337, CSC337, CSC337, CSC337,<br>CSC337, CSC337, CSC337, CSC337, CSC337,<br>CSC337, CSC337, CSC337, CSC337, CSC337,<br>CSC337, CSC337, CSC337, CSC337, CSC337, CSC337, CSC337, CSC337, CSC33  |     |   | <b>CSC265</b> , <i>CSC301</i> , <i>CSC305</i> , |
| B2.The use of hardware and software systemsCSC332, CSC334, CSC335, CSC337,B2.The use of hardware and software systemsCSC161, CSC164, CSC166,CSC261, CSC262, CSC263,CSC265, CSC301, CSC305,CSC370, CSC311, CSC332, CSC337,CSC370, CSC311, CSC332, CSC337,B3.The application of theoretical concepts of computing<br>science in the design and analysis of systems and<br>algorithmsCSC162, CSC163, CSC164,B4.The identification and implementation of appropriate<br>algorithms and data structuresCSC161, CSC164, CSC335,B5.The use and provision of network information servicesCSC161, CSC164, CSC164,<br>CSC306, CSC307,<br>CSC307, CSC310, CSC311, CSC332,<br>CSC305,<br>CSC306, CSC307,<br>CSC337, CSC337,B6.The use of a variety of programming languages and<br>paradigmsCSC162, CSC164, CSC265,<br>CSC337, CSC337, CSC339,<br>CSC337, CSC339,B7.Analysis of system requirements and the production of<br>system specificationsCSC162, CSC164, CSC262,<br>CSC337, CSC337, CSC339,<br>CSC337, CSC339,C1.The ability to conduct investigations using the technical<br>and professional literatureCSC162, CSC164, CSC262,<br>CSC337, CSC337, CSC339,C2.The ability to use and evaluate appropriate tools and<br>techniquesCSC162, CSC163, CSC164,<br>CSC162, CSC163, CSC337, CSC337,<br>CSC338, CSC339,  |     |   | CSC306, CSC308*, CSC311,                        |
| B2.       The use of hardware and software systems       CSC161, CSC164, CSC166, CSC263, CSC263, CSC263, CSC265, CSC301, CSC305, CSC310, CSC311, CSC332, CSC337, CSC399.         B3.       The application of theoretical concepts of computing science in the design and analysis of systems and algorithms       CSC162, CSC163, CSC164, CSC164, CSC166, CSC167, CSC262, CSC307, CSC306, CSC307, CSC305, CSC306, CSC301, CSC305, CSC306, CSC307, CSC306, CSC307, CSC309, CSC306, CSC307, CSC309, CSC306, CSC307, CSC309, CSC306, CSC307, CSC309, CSC335, CSC337, CSC335, CSC337, CSC335, CSC337, CSC309, CSC305, CSC307, CSC309, CSC306, CSC301, CSC309, CSC306, CSC301, CSC302, CSC305, CSC307, CSC309, CSC305, CSC307, CSC309, CSC305, CSC307, CSC309, CSC307, CSC309, CSC307, CSC307, CSC309, CSC307, CSC307, CSC307, CSC307, CSC309, CSC307, CSC307, CSC309, CSC307, CSC307, CSC309, CSC307, CSC307, CSC309, CSC307, CSC309, CSC307, CSC307  |     |   | <i>CSC332, CSC334, CSC335, CSC337.</i>          |
| <ul> <li>CSC261, CSC262, CSC301, CSC305, CSC301, CSC303, CSC305, CSC301, CSC301, CSC302, CSC3037, CSC309, CSC301, CSC302, CSC302,</li></ul>  | B2. | The use of hardware and software systems                  | CSC161, CSC164, CSC166,                         |
| B3.The application of theoretical concepts of computing<br>science in the design and analysis of systems and<br>algorithmsCSC162, CSC163, CSC164,<br>CSC265, CSC307, CSC307,<br>CSC309,B4.The identification and implementation of appropriate<br>algorithms and data structuresCSC161, CSC162, CSC164,<br>CSC264, CSC265, CSC307,<br>CSC310, CSC333, CSC305,<br>CSC306, CSC307, CSC306, CSC307,<br>CSC307, CSC307, CSC307,<br>CSC307, CSC337, CSC307, CSC337,B5.The use and provision of network information servicesCSC161, CSC164, CSC164, CSC164,<br>CSC161, CSC164, CSC164, CSC263,<br>CSC337, CSC337, CSC337,B6.The use of a variety of programming languages and<br>paradigmsCSC166, CSC261, CSC262,<br>CSC337, CSC337, CSC337,B7.Analysis of system requirements and the production of<br>system specificationsCSC166, CSC261, CSC262,<br>CSC337, CSC337, CSC337, CSC337,<br>CSC337, CSC337, CSC337,<br>CSC337, CSC337, CS   |     |   | CSC261, CSC262, CSC263,                         |
| B3.The application of theoretical concepts of computing<br>science in the design and analysis of systems and<br>algorithmsCSC161, CSC163, CSC164,<br>CSC166, CSC167, CSC262,<br>CSC306, CSC307*,<br>CSC306, CSC307, CSC306,<br>CSC306, CSC307, CSC307,<br>CSC306, CSC307, CSC307,<br>CSC306, CSC307, CSC307,<br>CSC306, CSC307, CSC307,<br>CSC306, CSC307, CSC307,<br>CSC307, CSC307, CSC307,<br>CSC307, CSC307, CSC307,<br>CSC307, CSC307, CSC307,<br>CSC307, CSC307, CSC309,<br>CSC307, CSC307, CSC309,<br>CSC307, CSC307, CSC309,<br>CSC307, CSC307, CSC309,<br>CSC307, CSC307, CSC309,<br>CSC332, CSC337, CSC337, CSC337,<br>CSC307, CSC307, CSC309,<br>CSC332, CSC337, CSC337, CSC339,B5.The use and provision of network information servicesCSC166, CSC261, CSC164, CSC263,<br>CSC307, CSC307, CSC309,<br>CSC332, CSC337, CSC339,B6.The use of a variety of programming languages and<br>paradigmsCSC166, CSC261, CSC262,<br>CSC307, CSC339, CSC337, CSC399,C1.The ability to conduct investigations using the technical<br>and professional literatureCSC166, CSC262,<br>CSC337, CSC399,C2.The ability to use and evaluate appropriate tools and<br>techniquesCSC161, CSC163, CSC164,<br>CSC264, CSC265, CSC307,<br>CSC332, CSC337, CSC339,  |     |   | <b>CSC265,</b> <i>CSC301, CSC305,</i>           |
| B3.The application of theoretical concepts of computing<br>science in the design and analysis of systems and<br>algorithmsCSC162, CSC163, CSC164,<br>CSC166, CSC167, CSC262,<br>CSC264, CSC265, CSC266,<br>CSC306, CSC307*,<br>CSC310, CSC334, CSC335.B4.The identification and implementation of appropriate<br>algorithms and data structuresCSC161, CSC162, CSC164,<br>CSC266, CSC307, CSC306, CSC305,<br>CSC266, CSC301, CSC305,<br>CSC266, CSC301, CSC305,<br>CSC306, CSC310, CSC305,<br>CSC306, CSC310, CSC305,<br>CSC306, CSC310, CSC307,<br>CSC332, CSC337.B5.The use and provision of network information servicesCSC161, CSC164, CSC265,<br>CSC266, CSC301, CSC306,<br>CSC337, CSC309,<br>CSC332, CSC337.B6.The use of a variety of programming languages and<br>paradigmsCSC166, CSC261, CSC262,<br>CSC305, CSC307*, CSC309,<br>CSC332, CSC337, CSC337,<br>CSC337, CSC339,B7.Analysis of system requirements and the production of<br>system specificationsCSC166, CSC262, CSC307*,<br>CSC337, CSC307*,<br>CSC337, CSC307*,<br>CSC337, CSC337, CSC337,<br>CSC337, CSC337, CSC337, CSC337,<br>CSC337, C  |     |   | <i>CSC310, CSC311, CSC332, CSC337,</i>          |
| B3.       The application of theoretical concepts of computing science in the design and analysis of systems and algorithms       CSC162, CSC163, CSC164, CSC262, CSC266, CSC266, CSC266, CSC266, CSC266, CSC267, CSC266, CSC267, CSC266, CSC307*, CSC307, CSC309, CSC332, CSC337, CSC332, CSC337, CSC337, CSC309, CSC332, CSC337, CSC307, CSC309, CSC332, CSC337, CSC307, CSC309, CSC332, CSC337, CSC309, CSC337, CSC307*, CSC307, CSC337, C  |     |   | CSC399.   |
| science in the design and analysis of systems and<br>algorithmsCSC166, CSC167, CSC262,<br>CSC264, CSC265, CSC266,<br>CSC305, CSC306, CSC307*,<br>CSC310, CSC335, CSC336, CSC335,B4.The identification and implementation of appropriate<br>algorithms and data structuresCSC161, CSC162, CSC164,<br>CSC306, CSC310, CSC335,<br>CSC306, CSC310, CSC305,<br>CSC306, CSC310, CSC305,<br>CSC306, CSC310, CSC307,<br>CSC337,B5.The use and provision of network information servicesCSC166, CSC261, CSC263,<br>CSC366, CSC310, CSC307,<br>CSC337,B6.The use of a variety of programming languages and<br>paradigmsCSC166, CSC261, CSC263,<br>CSC337, CSC337,B7.Analysis of system requirements and the production of<br>system specificationsCSC166, CSC261, CSC262,<br>CSC337, CSC337, CSC399,<br>CSC337, CSC399,C1.The ability to conduct investigations using the technical<br>and professional literatureCSC165, CSC166, CSC262,<br>CSC331, CSC337, CSC399,<br>CSC331, CSC332, CSC337, CSC399,C2.The ability to use and evaluate appropriate tools and<br>techniquesCSC162, CSC163, CSC164,<br>CSC264, CSC265, CSC307*,<br>CSC338, CSC399,C2.The ability to use and evaluate appropriate tools and<br>techniquesCSC162, CSC163, CSC164,<br>CSC264, CSC265, CSC337,<br>CSC338, CSC399,   | B3. | The application of theoretical concepts of computing      | CSC162, CSC163, CSC164,                         |
| algorithmsCSC 264, CSC265, CSC266,<br>CSC305, CSC306, CSC307*,<br>CSC310, CSC334, CSC335.B4.The identification and implementation of appropriate<br>algorithms and data structuresCSC161, CSC162, CSC164,<br>CSC261, CSC266, CSC301, CSC335,<br>CSC310, CSC311, CSC332,<br>CSC335, CSC337.B5.The use and provision of network information servicesCSC161, CSC164, CSC263,<br>CSC266, CSC301, CSC311, CSC332,<br>CSC337, CSC337.B6.The use of a variety of programming languages and<br>paradigmsCSC166, CSC261, CSC261, CSC265,<br>CSC265, CSC307*, CSC309,<br>CSC332, CSC337.B7.Analysis of system requirements and the production of<br>system specificationsCSC166, CSC261, CSC262,<br>CSC335, CSC337, CSC339.C1.The ability to conduct investigations using the technical<br>and professional literatureCSC166, CSC264, CSC264, CSC265,<br>CSC307*, CSC306,<br>CSC331, CSC332, CSC337,<br>CSC338, CSC237, CSC337,<br>CSC338, CSC237, CSC337, CSC337,<br>CSC338, CSC337, CSC337, CSC337,<br>CSC338, CSC264, CSC265, CSC307*,<br>CSC331, CSC332, CSC337, CSC337,<br>CSC338, CSC264, CSC265,<br>CSC306, CSC307*, CSC310, CSC311,<br>CSC311, CSC332, CSC337, CSC337,<br>CSC338, CSC264, CSC265,<br>CSC307, CSC310, CSC311,<br>CSC311, CSC332, CSC337, CSC337,<br>CSC338, CSC337, CSC337, CSC337,<br>CSC338, CSC264, CSC265,<br>CSC307*, CSC310, CSC311,<br>CSC331, CSC332, CSC337,<br>CSC338, CSC337, CSC337, CSC337,<br>CSC338, CSC337, CSC337, CSC337,<br>CSC338, CSC337, CSC337, CSC337,<br>CSC338, CSC337,   |     | science in the design and analysis of systems and         | CSC166, CSC167, CSC262,                         |
| B4.The identification and implementation of appropriate<br>algorithms and data structuresCSC305, CSC306, CSC307*,<br>CSC310, CSC334, CSC335.B4.The identification and implementation of appropriate<br>algorithms and data structuresCSC161, CSC162, CSC164,<br>CSC261, CSC201, CSC205,<br>CSC206, CSC301, CSC305,<br>CSC306, CSC310, CSC301, CSC332,<br>CSC335, CSC337.B5.The use and provision of network information servicesCSC161, CSC164, CSC165,<br>CSC206, CSC307*, CSC309,<br>CSC337, CSC309,<br>CSC337, CSC309,<br>CSC337, CSC337,B6.The use of a variety of programming languages and<br>paradigmsCSC166, CSC261, CSC265,<br>CSC307*, CSC307, CSC332, CSC337,B7.Analysis of system requirements and the production of<br>system specificationsCSC166, CSC261, CSC262,<br>CSC335, CSC307*, CSC309,<br>CSC335, CSC337, CSC399,C1.The ability to conduct investigations using the technical<br>and professional literatureCSC166, CSC264, CSC262,<br>CSC335, CSC337, CSC337,<br>CSC338, CSC337, CSC337, CSC337, CSC338, CSC337, CSC337, CSC337, CSC337, CSC337, CSC337, CSC337, CSC33  |     | algorithms  | CSC264, CSC265, CSC266,                         |
| CSC310, CSC334, CSC335.B4.The identification and implementation of appropriate<br>algorithms and data structuresCSC161, CSC162, CSC164,<br>CSC261, CSC264, CSC265,<br>CSC306, CSC301, CSC305,<br>CSC335, CSC337.B5.The use and provision of network information servicesCSC166, CSC262, CSC263,<br>CSC166, CSC262, CSC263,<br>CSC265, CSC307*, CSC309,<br>CSC332, CSC337.B6.The use of a variety of programming languages and<br>paradigmsCSC166, CSC261, CSC265,<br>CSC305, CSC337, CSC337,B7.Analysis of system requirements and the production of<br>system specificationsCSC166, CSC261, CSC262,<br>CSC335, CSC337, CSC337, CSC332, CSC335.C1.The ability to conduct investigations using the technical<br>and professional literatureCSC165, CSC166, CSC262,<br>CSC307, CSC306, CSC337, CSC337, CSC337,<br>CSC331, CSC332, CSC337, CSC337,<br>CSC331, CSC332, CSC337,<br>CSC331, CSC332, CSC335, CSC337,<br>CSC331, CSC332, CSC335, CSC337,<br>CSC331, CSC332, CSC335, CSC337,<br>CSC338, CSC399.C2.The ability to use and evaluate appropriate tools and<br>techniquesCSC164, CSC164, CSC164,<br>CSC165, CSC166, CSC167,<br>CSC165, CSC166, CSC167,<br>CSC165, CSC166, CSC167,<br>CSC261, CSC262, CSC263,<br>CSC264, CSC265, CSC266,   |     | 6   | CSC305, CSC306, CSC307*,                        |
| B4.       The identification and implementation of appropriate algorithms and data structures       CSC161, CSC162, CSC164, CSC265, CSC201, CSC205, CSC201, CSC305, CSC306, CSC310, CSC311, CSC332, CSC335, CSC337.         B5.       The use and provision of network information services       CSC166, CSC262, CSC263, CSC209, CSC309, CSC309, CSC332, CSC337.         B5.       The use of a variety of programming languages and paradigms       CSC166, CSC261, CSC265, CSC307*, CSC309, CSC332, CSC337.         B6.       The use of a variety of programming languages and paradigms       CSC166, CSC261, CSC265, CSC307*, CSC309, CSC332, CSC337.         B7.       Analysis of system requirements and the production of system specifications       CSC166, CSC261, CSC262, CSC307*, CSC309, CSC337, CSC330, CSC337, CSC338, CSC399.         C1.       The ability to use and evaluate appropriate tools and techniques       CSC165, CSC166, CSC262, CSC37*, CSC337, CSC338, CSC399.         C2.       The ability to use and evaluate appropriate tools and techniques       CSC165, CSC166, CSC167, CSC262, CSC263, CSC264, CSC265, CSC266, CSC266, CSC266, CSC266, CSC266, CSC264, CSC266, CSC264, CSC266, CSC264, CSC266, CSC264, CSC266, CSC264, CSC266, CSC266, CSC264, CSC266, CSC264, CSC266, CSC264, CS  |     |   | CSC310, CSC334, CSC335.                         |
| algorithms and data structuresCSC261, CSC264, CSC265,<br>CSC300, CSC301, CSC305,<br>CSC306, CSC310, CSC311, CSC332,<br>CSC335, CSC337.B5.The use and provision of network information servicesCSC161, CSC164, CSC165,<br>CSC307, CSC307, CSC309,<br>CSC337.B6.The use of a variety of programming languages and<br>paradigmsCSC166, CSC261, CSC265,<br>CSC307, CSC307, CSC309,<br>CSC337.B7.Analysis of system requirements and the production of<br>system specificationsCSC166, CSC261, CSC265,<br>CSC307, CSC337.C1.The ability to conduct investigations using the technical<br>and professional literatureCSC165, CSC307, CSC307,<br>CSC337, CSC399.C2.The ability to use and evaluate appropriate tools and<br>techniquesCSC162, CSC163, CSC164, CSC264,<br>CSC265, CSC307, CSC337, CSC337,<br>CSC338, CSC399.C2.The ability to use and evaluate appropriate tools and<br>techniquesCSC162, CSC163, CSC164,<br>CSC165, CSC166, CSC167,<br>CSC264, CSC262, CSC263,<br>CSC264, CSC265, CSC266,   | B4. | The identification and implementation of appropriate      | CSC161. CSC162. CSC164.                         |
| CSCSC266, CSC301, CSC305,<br>CSC306, CSC310, CSC311, CSC332,<br>CSC335, CSC337.B5.The use and provision of network information servicesCSC161, CSC164, CSC165,<br>CSC166, CSC262, CSC263,<br>CSC332, CSC337.B6.The use of a variety of programming languages and<br>paradigmsCSC166, CSC261, CSC265,<br>CSC305, CSC337.B7.Analysis of system requirements and the production of<br>system specificationsCSC166, CSC261, CSC262,<br>CSC332, CSC337, CSC339,<br>CSC332, CSC337, CSC399.C1.The ability to conduct investigations using the technical<br>and professional literatureCSC165, CSC166, CSC262,<br>CSC307, CSC306,<br>CSC331, CSC335, CSC337, CSC399.C2.The ability to use and evaluate appropriate tools and<br>techniquesCSC162, CSC163, CSC164,<br>CSC262, CSC263, CSC307,<br>CSC336, CSC264, CSC265, CSC337,<br>CSC337, CSC399.  |     | algorithms and data structures                            | CSC261, CSC264, CSC265,                         |
| CSC 306, CSC 310, CSC 311, CSC 332,<br>CSC 335, CSC 337.B5.The use and provision of network information servicesCSC 161, CSC 164, CSC 165,<br>CSC 166, CSC 262, CSC 263,<br>CSC 332, CSC 337.B6.The use of a variety of programming languages and<br>paradigmsCSC 166, CSC 261, CSC 265,<br>CSC 307*, CSC 309,<br>CSC 332, CSC 337.B7.Analysis of system requirements and the production of<br>system specificationsCSC 166, CSC 261, CSC 262,<br>CSC 305, CSC 331, CSC 332, CSC 335.B7.The ability to conduct investigations using the technical<br>and professional literatureCSC 166, CSC 262, CSC 307*,<br>CSC 335, CSC 337, CSC 399.C1.The ability to conduct investigations using the technical<br>and professional literatureCSC 165, CSC 166, CSC 262,<br>CSC 301, CSC 305, CSC 307,<br>CSC 331, CSC 332, CSC 337,<br>CSC 333, CSC 339.C2.The ability to use and evaluate appropriate tools and<br>techniquesCSC 162, CSC 163, CSC 164,<br>CSC 165, CSC 166, CSC 167,<br>CSC 261, CSC 262, CSC 263,<br>CSC 264, CSC 265, CSC 264,<br>CSC 264, CSC 265, CSC 237,<br>CSC 238, CSC 239.   |     |   | <b>CSC266.</b> <i>CSC301</i> . <i>CSC305</i> .  |
| CSC 335, CSC 337.B5.The use and provision of network information servicesCSC161, CSC164, CSC165,<br>CSC166, CSC262, CSC263,<br>CSC332, CSC337.B6.The use of a variety of programming languages and<br>paradigmsCSC166, CSC261, CSC265,<br>CSC305, CSC331, CSC332, CSC335.B7.Analysis of system requirements and the production of<br>system specificationsCSC162, CSC166, CSC262,<br>CSC335, CSC337, CSC339,<br>CSC335, CSC337, CSC399.C1.The ability to conduct investigations using the technical<br>and professional literatureCSC165, CSC166, CSC262,<br>CSC307, CSC306,<br>CSC331, CSC332, CSC337,<br>CSC331, CSC332, CSC337,<br>CSC333, CSC399.C2.The ability to use and evaluate appropriate tools and<br>techniquesCSC162, CSC163, CSC164,<br>CSC165, CSC166, CSC167,<br>CSC261, CSC262, CSC263,<br>CSC264, CSC265, CSC307,<br>CSC264, CSC265, CSC337,<br>CSC338, CSC399.  |     |   | <i>CSC306. CSC310. CSC311. CSC332.</i>          |
| B5.The use and provision of network information servicesCSC161, CSC164, CSC165,<br>CSC166, CSC262, CSC263,<br>CSC307*, CSC309,<br>CSC332, CSC337.B6.The use of a variety of programming languages and<br>paradigmsCSC166, CSC261, CSC265,<br>CSC332, CSC337.B7.Analysis of system requirements and the production of<br>system specificationsCSC162, CSC166, CSC262,<br>CSC332, CSC337, CSC332, CSC335.B7.Analysis of system requirements and the production of<br>system specificationsCSC162, CSC166, CSC262,<br>CSC335, CSC337, CSC399.C1.The ability to conduct investigations using the technical<br>and professional literatureCSC165, CSC166, CSC262,<br>CSC305, CSC306,<br>CSC331, CSC332, CSC335, CSC337,<br>CSC331, CSC332, CSC335, CSC337,<br>CSC331, CSC332, CSC335, CSC337,<br>CSC331, CSC332, CSC335, CSC337,<br>CSC338, CSC399.C2.The ability to use and evaluate appropriate tools and<br>techniquesCSC162, CSC163, CSC164,<br>CSC165, CSC166, CSC167,<br>CSC261, CSC262, CSC263,<br>CSC264, CSC265, CSC264, CSC265,<br>CSC264, CSC265, CSC264, CSC265,<br>CSC264, CSC265, CSC264, CSC265,<br>CSC264, CSC265, CSC266,  |     |   | CSC335. CSC337.                                 |
| DefinitionCSC 166, CSC 262, CSC 263,<br>CSC 332, CSC 337.B6.The use of a variety of programming languages and<br>paradigmsCSC 166, CSC 261, CSC 265,<br>CSC 332, CSC 337.B7.Analysis of system requirements and the production of<br>system specificationsCSC 166, CSC 261, CSC 262,<br>CSC 305, CSC 331, CSC 332, CSC 335.B7.The ability to conduct investigations using the technical<br>and professional literatureCSC 166, CSC 264, CSC 262,<br>CSC 264, CSC 265, CSC 307*,<br>CSC 335, CSC 337, CSC 339.C1.The ability to conduct investigations using the technical<br>and professional literatureCSC 165, CSC 166, CSC 262,<br>CSC 264, CSC 265, CSC 307*,<br>CSC 305, CSC 306,<br>CSC 307*, CSC 310, CSC 311,<br>CSC 331, CSC 332, CSC 335, CSC 337,<br>CSC 338, CSC 399.C2.The ability to use and evaluate appropriate tools and<br>techniquesCSC 162, CSC 163, CSC 164,<br>CSC 165, CSC 166, CSC 167,<br>CSC 261, CSC 262, CSC 263,<br>CSC 264, CSC 265, CSC 266,  | B5. | The use and provision of network information services     | CSC161. CSC164. CSC165.                         |
| CSC265, CSC307*, CSC309,<br>CSC332, CSC337.B6.The use of a variety of programming languages and<br>paradigmsCSC166, CSC261, CSC265,<br>CSC305, CSC331, CSC332, CSC335.B7.Analysis of system requirements and the production of<br>system specificationsCSC162, CSC166, CSC262,<br>CSC305, CSC337, CSC307*,<br>CSC335, CSC337, CSC399.C1.The ability to conduct investigations using the technical<br>and professional literatureCSC165, CSC166, CSC262,<br>CSC305, CSC307*, CSC307,<br>CSC305, CSC307, CSC306,<br>CSC301, CSC305, CSC306,<br>CSC331, CSC332, CSC337,<br>CSC338, CSC399.C2.The ability to use and evaluate appropriate tools and<br>techniquesCSC162, CSC163, CSC164,<br>CSC165, CSC166, CSC167,<br>CSC261, CSC262, CSC263,<br>CSC264, CSC265, CSC264, CSC263,<br>CSC264, CSC265, CSC266,   |     | F   | CSC166, CSC262, CSC263,                         |
| CSC 332, CSC 337.B6.The use of a variety of programming languages and<br>paradigmsCSC166, CSC261, CSC265,<br>CSC305, CSC331, CSC332, CSC335.B7.Analysis of system requirements and the production of<br>system specificationsCSC162, CSC166, CSC262,<br>CSC335, CSC337, CSC399.C1.The ability to conduct investigations using the technical<br>and professional literatureCSC165, CSC166, CSC262,<br>CSC335, CSC337, CSC399.C2.The ability to use and evaluate appropriate tools and<br>techniquesCSC162, CSC163, CSC164,<br>CSC338, CSC399.C2.The ability to use and evaluate appropriate tools and<br>techniquesCSC162, CSC166, CSC262,<br>CSC264, CSC262, CSC263,<br>CSC338, CSC399.  |     |   | <b>CSC265.</b> <i>CSC307*. CSC309.</i>          |
| B6.The use of a variety of programming languages and<br>paradigmsCSC166, CSC261, CSC265,<br>CSC305, CSC331, CSC332, CSC335.B7.Analysis of system requirements and the production of<br>system specificationsCSC166, CSC264, CSC262,<br>CSC335, CSC337, CSC399.C1.The ability to conduct investigations using the technical<br>and professional literatureCSC165, CSC166, CSC262,<br>CSC335, CSC337, CSC399.C2.The ability to use and evaluate appropriate tools and<br>techniquesCSC162, CSC163, CSC164,<br>CSC331, CSC332, CSC335, CSC337,<br>CSC338, CSC199.C2.The ability to use and evaluate appropriate tools and<br>techniquesCSC165, CSC166, CSC164,<br>CSC261, CSC262, CSC263,<br>CSC264, CSC265, CSC263,<br>CSC264, CSC265, CSC266,   |     |   | <i>CSC332, CSC337.</i>                          |
| paradigmsCSC 305, CSC 331, CSC 332, CSC 335.B7.Analysis of system requirements and the production of<br>system specificationsCSC 162, CSC 166, CSC 262,<br>CSC 264, CSC 265, CSC 307*,<br>CSC 335, CSC 337, CSC 399.C1.The ability to conduct investigations using the technical<br>and professional literatureCSC 165, CSC 166, CSC 262,<br>CSC 307*, CSC 307, CSC 399.C2.The ability to use and evaluate appropriate tools and<br>techniquesCSC 162, CSC 163, CSC 164,<br>CSC 337, CSC 337, CSC 337,<br>CSC 338, CSC 339.C2.The ability to use and evaluate appropriate tools and<br>CSC 165, CSC 166, CSC 164,<br>CSC 264, CSC 265, CSC 263,<br>CSC 264, CSC 265, CSC 266,  | B6. | The use of a variety of programming languages and         | CSC166, CSC261, CSC265,                         |
| B7.Analysis of system requirements and the production of<br>system specificationsCSC162, CSC166, CSC262,<br>CSC335, CSC307*,<br>CSC335, CSC337, CSC399.C1.The ability to conduct investigations using the technical<br>and professional literatureCSC165, CSC166, CSC262,<br>CSC335, CSC337, CSC399.C2.The ability to use and evaluate appropriate tools and<br>techniquesCSC162, CSC163, CSC164, CSC263,<br>CSC337, CSC306,<br>CSC331, CSC332, CSC335, CSC337,<br>CSC338, CSC399.C2.The ability to use and evaluate appropriate tools and<br>techniquesCSC162, CSC163, CSC164,<br>CSC262, CSC263,<br>CSC264, CSC265, CSC266,  |     | paradigms   | <i>CSC305, CSC331, CSC332, CSC335.</i>          |
| system specificationsCSC264, CSC265, CSC307*,<br>CSC335, CSC337, CSC399.C1.The ability to conduct investigations using the technical<br>and professional literatureCSC165, CSC166, CSC262,<br>CSC263, CSC264, CSC265,<br>CSC307*, CSC306,<br>CSC307*, CSC310, CSC311,<br>CSC331, CSC332, CSC335, CSC337,<br>CSC338, CSC399.C2.The ability to use and evaluate appropriate tools and<br>techniquesCSC162, CSC163, CSC164,<br>CSC165, CSC166, CSC167,<br>CSC261, CSC262, CSC263,<br>CSC264, CSC265, CSC266,  | B7. | Analysis of system requirements and the production of     | CSC162, CSC166, CSC262,                         |
| C1.CSC335, CSC337, CSC399.C1.The ability to conduct investigations using the technical<br>and professional literatureCSC165, CSC166, CSC262,<br>CSC263, CSC264, CSC265,<br>CSC301, CSC305, CSC306,<br>CSC307*, CSC310, CSC311,<br>CSC331, CSC332, CSC335, CSC337,<br>CSC338, CSC399.C2.The ability to use and evaluate appropriate tools and<br>techniquesCSC162, CSC163, CSC164,<br>CSC165, CSC166, CSC167,<br>CSC261, CSC262, CSC263,<br>CSC264, CSC265, CSC266,   |     | system specifications                                     | CSC264, CSC265, CSC307*,                        |
| C1.The ability to conduct investigations using the technical<br>and professional literatureCSC165, CSC166, CSC262,<br>CSC263, CSC264, CSC265,<br>CSC301, CSC305, CSC306,<br>CSC307*, CSC310, CSC311,<br>CSC331, CSC332, CSC335, CSC337,<br>CSC338, CSC399.C2.The ability to use and evaluate appropriate tools and<br>techniquesCSC162, CSC163, CSC164,<br>CSC165, CSC166, CSC167,<br>CSC261, CSC262, CSC263,<br>CSC264, CSC265, CSC266,   |     |   | CSC335, CSC337, CSC399.                         |
| and professional literatureCSC263, CSC264, CSC265,<br>CSC301, CSC305, CSC306,<br>CSC307*, CSC310, CSC311,<br>CSC331, CSC332, CSC335, CSC337,<br>CSC338, CSC399.C2.The ability to use and evaluate appropriate tools and<br>techniquesCSC162, CSC163, CSC164,<br>CSC165, CSC166, CSC167,<br>CSC261, CSC262, CSC263,<br>CSC264, CSC265, CSC266,  | C1. | The ability to conduct investigations using the technical | CSC165, CSC166, CSC262,                         |
| CSC301, CSC305, CSC306,         CSC307*, CSC310, CSC311,         CSC331, CSC332, CSC335, CSC337,         CSC338, CSC399.         C2.       The ability to use and evaluate appropriate tools and         techniques       CSC162, CSC163, CSC164,         CSC261, CSC262, CSC263,         CSC261, CSC262, CSC263,         CSC264, CSC265, CSC266,  |     | and professional literature                               | CSC263, CSC264, CSC265,                         |
| C2.CSC 307*, CSC 310, CSC 311,<br>CSC 331, CSC 332, CSC 335, CSC 337,<br>CSC 338, CSC 399.C2.The ability to use and evaluate appropriate tools and<br>techniquesCSC 162, CSC 163, CSC 164,<br>CSC 165, CSC 166, CSC 167,<br>CSC 261, CSC 262, CSC 263,<br>CSC 264, CSC 265, CSC 266,   |     | 1   | CSC301, CSC305, CSC306,                         |
| CSC331, CSC332, CSC335, CSC337,<br>CSC338, CSC399.C2.The ability to use and evaluate appropriate tools and<br>techniquesCSC162, CSC163, CSC164,<br>CSC165, CSC166, CSC167,<br>CSC261, CSC262, CSC263,<br>CSC264, CSC265, CSC266,   |     |   | CSC307*. CSC310. CSC311.                        |
| C2.CSC338, CSC399.C2.The ability to use and evaluate appropriate tools and<br>techniquesCSC162, CSC163, CSC164,<br>CSC165, CSC166, CSC167,<br>CSC261, CSC262, CSC263,<br>CSC264, CSC265, CSC266,   |     |   | <i>CSC331, CSC332, CSC335, CSC337,</i>          |
| C2. The ability to use and evaluate appropriate tools and techniques CSC162, CSC163, CSC164, CSC165, CSC166, CSC167, CSC261, CSC262, CSC263, CSC264, CSC265, CSC266, C   |     |   | <i>CSC338</i> , <b>CSC399</b> .                 |
| techniques CSC165, CSC166, CSC167,<br>CSC261, CSC262, CSC263,<br>CSC264, CSC265, CSC266,   | C2. | The ability to use and evaluate appropriate tools and     | CSC162, CSC163, CSC164,                         |
| CSC261, CSC262, CSC263,<br>CSC264, CSC265, CSC266,   |     | techniques  | CSC165, CSC166, CSC167,                         |
| CSC264, CSC265, CSC266,  |     | 1   | CSC261, CSC262, CSC263,                         |
|  |     |   | CSC264, CSC265, CSC266,                         |
| <i>CSC301, CSC305, CSC306,</i>   |     |   | CSC301, CSC305, CSC306,                         |
| <i>CSC307*, CSC309, CSC331.</i>  |     |   | CSC307*, CSC309, CSC331,                        |
| <i>CSC332, CSC334, CSC335, CSC337,</i>   |     |   | CSC332, CSC334, CSC335, CSC337.                 |
| <i>CSC338</i> , <b>CSC399</b> .  |     |   | <i>CSC338</i> , <b>CSC399</b> .                 |
| C3. The ability to undertake empirical evaluation of <b>CSC161. CSC162. CSC165.</b>  | C3. | The ability to undertake empirical evaluation of          | CSC161, CSC162, CSC165.                         |
| alternative solutions CSC166. CSC261. CSC262.  |     | alternative solutions                                     | CSC166, CSC261, CSC262.                         |
| CSC264. CSC265. CSC266.  |     |   | CSC264, CSC265, CSC266.                         |
| CSC305. CSC306. CSC307*.   |     |   | CSC305, CSC306, CSC307*.                        |
| CSC331. CSC332. CSC335. CSC337.  |     |   | <i>CSC331, CSC332, CSC335, CSC337.</i>          |

|      |  | <i>CSC338</i> , <b>CSC399</b> .  |
|------|--|--|
| C4.  | The ability to formulate problems and identify suitable  | CSC161, CSC162, CSC163,  |
|      | approaches to solving them                               | CSC164, CSC166, CSC167,  |
|      |  | CSC261, CSC262, CSC264,  |
|      |  | CSC265, CSC266, CSC305,  |
|      |  | CSC306, CSC307*, CSC309,   |
|      |  | <i>CSC311</i> , <i>CSC331</i> , <i>CSC332</i> , <i>CSC335</i> ,  |
|      |  | CSC337, CSC338, CSC399.  |
| C5.  | The ability to reason abstractly about the structure and | CSC164, CSC167, CSC261,  |
|      | behaviour of computer systems                            | CSC262, CSC263, CSC264,  |
|      | 1 5  | CSC265, CSC266, CSC301.  |
|      |  | CSC311. CSC332. CSC334. CSC335.  |
|      |  | <i>CSC337, CSC338.</i>   |
| D1.  | Written communication                                    | CSC161, CSC162, CSC164,  |
| -    |  | CSC165, CSC166, CSC262,  |
|      |  | CSC263, CSC264, CSC265,  |
|      |  | CSC305. CSC306. CSC307*.   |
|      |  | CSC308*. CSC310. CSC311.   |
|      |  | <i>CSC335. CSC337. CSC338.</i>   |
|      |  | CSC399.  |
| D2.  | Problem solving  | CSC161, CSC162, CSC163,  |
|      |  | CSC164, CSC165, CSC166,  |
|      |  | CSC167, CSC261, CSC262,  |
|      |  | CSC263, CSC264, CSC265,  |
|      |  | <b>CSC266.</b> CSC301. CSC305.   |
|      |  | CSC306, CSC307*, CSC309  |
|      |  | CSC310 $CSC311$ $CSC331$ $CSC332$  |
|      |  | CSC334 $CSC335$ $CSC337$ $CSC338$  |
|      |  | CSC399.  |
| D3.  | Interpersonal communication                              | CSC165, CSC264, CSC265,  |
| 20.  |  | CSC307* $CSC308*$ $CSC334$   |
|      |  | CSC338 <b>CSC399</b> .   |
| D4   | Initiative   | CSC162, CSC163, CSC165,  |
| 21.  | Initiative   | CSC166, CSC167, CSC262,  |
|      |  | CSC264 $CSC265$ $CSC305$   |
|      |  | CSC306 $CSC307*$ $CSC311$  |
|      |  | CSC331 $CSC334$ $CSC335$ $CSC337$  |
|      |  | CSC338 <b>CSC399</b> .   |
| D5   | Oral presentation  | <b>CSC165 CSC265</b> CSC307*   |
| D.J. | oral presentation  | $CSC_{338}$ <b>CSC_{399</b>  |
| D6   | Adaptability   | CSC162 CSC163 CSC165   |
| D0.  | Mapaointy  | CSC166 CSC167 CSC265   |
|      |  | <b>CSC266</b> CSC305 CSC307*   |
|      |  | $CSC_{200}, CSC_{305}, CSC_{307}, CSC_{338}$   |
|      |  | CSC331, CSC335, CSC337, CSC338,  |
| D7   | Teamwork   | CSC377.<br>CSC165 CSC265 CSC207*   |
| D7.  | ITAIIIWUIK   | CSC103, CSC203, CSC30/*,   |
| D0   | Numeroay   | CSC163 CSC167 CSC364   |
| D8.  | numeracy   | CSC103, CSC107, CSC204, CSC265, CSC265, CSC265, CSC265, CSC265, CSC205, CSC2 |
|      |  | CSC205, CSC200, CSC303, CSC206, CSC207*, CSC221  |
|      |  | $CSC300, CSC307^{*}, CSC331,$  |
| Do   | Dianaing and augonization                                | CSC153, CSC357.  |
| D9.  | Planning and organisation                                | USC101, USC102, USC164,  |

|                        | CSC165, CSC166, CSC262,                |
|------------------------|--|
|                        | CSC264, CSC265, CSC305,                |
|                        | CSC306, CSC307*, CSC308*,              |
|                        | <i>CSC310, CSC335, CSC337, CSC338,</i> |
|                        | CSC399.                                |
| D10. Computer literacy | CSC161, CSC162, CSC163,                |
|                        | CSC165, CSC166, CSC167,                |
|                        | CSC261, CSC262, CSC264,                |
|                        | <b>CSC265, CSC266,</b> <i>CSC301,</i>  |
|                        | CSC305, CSC306, CSC307*,               |
|                        | <i>CSC311, CSC332, CSC335, CSC337,</i> |
|                        | CSC399.                                |
|                        | 000000                                 |

#### 12 Criteria for Admission:

Minimum Grade B GCSE Mathematics

A-Level Subjects and Grades

Typical ABC at A2. We do not require any particular A level subjects to have been taken. Those without A level Mathematics will take CSC167 in Stage 1.

Alternative entry qualifications

We accept a wide range of alternative qualifications, such as IB 32 points, Distinction at GNVQ, BTEC to include 6 merits, Scottish Highers BBBB.

In addition, we accept students who have successfully completed the Newcastle University International Arts & Social Sciences Bridging Course, or the Computing Science International Bridging Course, or the SAgE Foundation Year.

Arrangements exist for appropriate Diploma holders from the Singapore Polytechnics with a Grade B average to enter at Stage 2, and for Taylor's College Kuala Lumpur students to enter at Stage 2 or 3 depending on the period of study in Malaysia.

Admissions policy

Suitable applicants are usually made an offer without interview as soon as possible after their application forms have been received and considered. In some cases, however, e.g. where an applicant has non-standard qualifications, an interview may be necessary before a decision is made. Applicants are invited to visit the School to see the University and to meet staff and 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.

Arrangements for non-standard entrants

Potential students are interviewed either in person or over the phone to assess their suitability for the programme.

Any Additional Requirements None.

## **13** Support for Students and their Learning:

#### Induction

The first week of the first term/semester is an Induction Week with no formal teaching. During this period all students attend an induction programme in which they will be given detailed programme information relating to their Stage and the timetable of lectures/practicals/labs/ tutorials/etc. In particular all new students will be given general information about the School and their course, as described in the Degree Programme Handbook. The International Office offers an additional induction programme for overseas students (see <a href="http://www.ncl.ac.uk/international/coming\_to\_newcastle/orientation.phtml">http://www.ncl.ac.uk/international/coming\_to\_newcastle/orientation.phtml</a>).

#### Study skills support

Students will learn a range of Personal Transferable Skills, including Study Skills, as outlined in the 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 group and individual projects.

#### 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 programme 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. Details of the personal tutor system can be found at <a href="http://www.ncl.ac.uk/undergraduate/support/tutor.phtml">http://www.ncl.ac.uk/undergraduate/support/tutor.phtml</a>. In addition the University offers a range of support services, including the Student Advice Centre, the Student Counselling Service, the Mature Student Support Service, and a Childcare Support Officer, see <a href="http://www.ncl.ac.uk/undergraduate/support/welfare.phtml">http://www.ncl.ac.uk/undergraduate/support/tutor.phtml</a>. In addition the University offers a range of support services, including the Student Advice Centre, the Student Counselling Service, the Mature Student Support Service, and a Childcare Support Officer, see <a href="http://www.ncl.ac.uk/undergraduate/support/welfare.phtml">http://www.ncl.ac.uk/undergraduate/support/welfare.phtml</a>.

#### Support for Special Needs

Support for students with special needs is provided as required and the University's Disability Support Service can be consulted where appropriate. For further details see <u>http://www.ncl.ac.uk/undergraduate/support/disability.phtml</u>.

#### Learning resources

The University's main learning resources are provided by the Robinson and Walton Libraries (for books, journals, online resources), and Information Systems and Services, which supports campus-wide computing facilities, see <a href="http://www.ncl.ac.uk/undergraduate/support/acfacilities.phtml">http://www.ncl.ac.uk/undergraduate/support/acfacilities.phtml</a>.

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 exchanges. See

#### http://www.ncl.ac.uk/undergraduate/support/langcen.phtml.

The School of Computing Science has well equipped computer laboratories consisting of networked PCs with dedicated labs for each stage of the programme. Key software used in the support and delivery of the programme is available to students free of charge. The School has its own library which is mainly used for the support of advanced topics in the later stages of the programme. The University's Robinson Library has available multiple copies of all recommended undergraduate texts.

# 14 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 School Teaching and Learning Committee and at the Board of Studies. 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 and Learning Committee.

#### Programme reviews

The Board of Studies conducts an Annual Monitoring and Review of the degree programme and reports to Faculty Teaching and Learning Committee.

#### External examiner reports

External Examiner reports are considered by the Board of Studies under Reserved Business, in the absence of the student representatives. The Board responds to these reports through Faculty Teaching and Learning Committee.

#### Accreditation reports

Accreditation was sought from the BCS at its visit in November 2003 and the programmes were provisionally approved. Graduates are entitled to Full Exemption.

#### 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.

#### Feedback mechanisms

Feedback to students is effected 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 programme, see <a href="http://www.ncl.ac.uk/internal/academic-quality/qualityhome.htm#2">http://www.ncl.ac.uk/internal/academic-quality/qualityhome.htm#2</a>.

#### **15** Regulation of Assessment:

#### Pass Marks

The pass mark, as defined in the University's Undergraduate Examination Conventions (<u>http://www.ncl.ac.uk/calendar/university.regs/ugexamconv.pdf</u>), is 40.

#### Course Requirements

Progression is subject to the University's Undergraduate Progress Regulations (<u>http://www.ncl.ac.uk/calendar/university.regs/ugcont.pdf</u>) and Undergraduate Examination Conventions (<u>http://www.ncl.ac.uk/calendar/university.regs/ugexamconv.pdf</u>). In summary, students must pass 120 credits at each Stage. Limited compensation down to 35 is possible at each Stage and there are resit opportunities, with certain restrictions.

#### Weighting of Stages

Modules taken at Stages 2 and 3 are Honours modules and the two stages contribute to the award

of the final degree in the ratio 50:50.

Common Marking Scheme

The University employs a common marking scheme, which is specified in the Undergraduate Examination Conventions (<u>http://www.ncl.ac.uk/calendar/university.regs/ugcont.pdf</u>), namely

|       | Honours                       | Non-honours |
|-------|-------------------------------|-------------|
| <40   | Fail                          | Failing     |
| 40-49 | Third Class                   | Basic       |
| 50-59 | Second Class, Second Division | Good        |
| 60-69 | Second Class, First Division  | Very Good   |
| 70+   | First Class                   | Excellent   |

#### Role of the External Examiner

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

See and approve examination papers Moderate examination and coursework marking Attend the June Board of Examiners Report to the University on the standards of the programme

#### 16 Indicators of Quality and Standards:

**Professional Accreditation Reports** 

Accreditation was sought from the BCS at its visit in November 2003 and the programmes were provisionally approved.

#### Internal Review Reports

These programmes were covered by the Internal Subject Review of the School of Computing Science held on 28/29th April 2003 and was subsequently approved by Faculty Teaching and Learning Committee and University Teaching and Learning Committee.

The overall judgement was that "The team was impressed by the very positive relationships between the staff and students in the School - it was abundantly clear that the subject group is very student-focused and this was to their significant credit, with students commenting favourably about the approachable nature of the staff as a whole. The overall provision was felt to be excellent, with a significant number of commendations relating to good practice in the School, which others may wish to consider and incorporate into their own procedures."

Previous QAA Reports Computing Science was adjudged *Satisfactory* in 1994.

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. The accuracy of the information contained is reviewed by the University and may be checked by the Quality Assurance Agency for Higher Education.

# **17** Other Sources of Information:

The University Prospectus (see <a href="http://www.ncl.ac.uk/undergraduate/">http://www.ncl.ac.uk/undergraduate/</a> )

The School Prospectus (see http://www.ncl.ac.uk/undergraduate/subjects/computing)

The University and Degree Programme Regulations (see <u>http://www.ncl.ac.uk/calendar/pdf/uniregs.pdf</u> and <u>http://www.ncl.ac.uk/calendar/sae/</u>)

The Degree Programme Handbook

(For G402 see <u>http://www.cs.ncl.ac.uk/teaching/undergraduate/handbook.php?id=1&year=2004</u>, for G602 see <u>http://www.cs.ncl.ac.uk/teaching/undergraduate/handbook.php?id=3&year=2004</u>)

QAA Subject Review Report