Programme Specification for BSc (Hons) Mathematics and Computer Science

This document applies to Academic Year 2019/20 onwards

1.	**Awarding institution/body**	University of Worcester
2.	**Teaching institution**	University of Worcester
3.	**Programme accredited by**	N/A
4.	**Final award or awards**	BSc (Hons)
5.	**Programme title**	Mathematics and Computer Science
6.	**Pathways available**	Single honours
7.	**Mode and/or site of delivery**	Standard taught programme
8.	**Mode of attendance and duration**	Full time and part time
9.	**UCAS Code**	GI11
10.	**Subject Benchmark statement and/or professional body statement**	QAA Subject Benchmark statements for Mathematics, Statistics and Operational Research (May 2015) and Computing (February 2016) ACM/IEEE Curriculum guidelines for undergraduate degree programs in Computer Science (December 2013)
11.	**Date of Programme Specification preparation/ revision**	May 2019 August 2019 AQU amendments to Section 19.

12. Educational aims of the programme

The famous mathematician Carl Friedrich Gauss (1777–1855) described Mathematics as “the Queen of the Sciences”. It has a long and distinguished history, e.g., Pythagorean triples were known to the Babylonians (around 1800BC). Computing devices and fundamental ideas in Computer Science predate the invention of digital computers, e.g., the Euclidean algorithm (around 300BC), the Antikythera mechanism (50BC), and Boolean logic (1847). Mathematics and Computer Science are deeply entwined subjects, rich in theory and applications. We are now living in the age of Big Data, where there is an explosion of data generated faster than its potential insights can be unlocked. Fundamentally, analysis of massive datasets and other applications of deep learning uses data science and machine learning approaches built on a systematic understanding of mathematics, algorithms, computer architecture, optimisation, and probability.

This course in Mathematics and Computer Science is an integrated course that aims to develop students with a solid foundation in knowledge and understanding of both subjects and deeper application of mathematics, algorithms and data science in more advanced topics such as computer graphics, scientific computing, artificial intelligence, analysis of algorithms, optimisation, and cryptography. It is a modern practice-based course that develops the logical and analytical problem-solving skills required for the practical applications. It is designed so that more general skills such as team working, communication, computational thinking, software development, and

analytical problem-solving are developed and practiced alongside understanding of the subject knowledge.

In particular, the course aims are:

1. To deliver a modern, applied, practice-oriented course of study that provides a solid foundation in core areas of Mathematics and Computer Science.
2. To provide a range of opportunities to apply and integrate knowledge across Mathematics and Computer Science in specialist areas, e.g., to model, solve and analyse problems, to design and develop systems, and to use appropriate specialist software.
3. To develop students with transferrable skills in problem-solving, logical and analytical thinking, and the communication of logical arguments and conclusions.
4. To encourage students to adopt an investigative approach to study, combining computational thinking with critical thinking.
5. To prepare students for future employment in a professional, technical, legal and ethical framework, and to work effectively as part of a team.
6. To provide a supportive and accessible teaching and learning environment that facilitates a steady progression from entering university to a depth and level appropriate to an honours degree standard, and to prepare students for a lifetime of learning.

13. Intended learning outcomes and learning, teaching and assessment methods

"Employers greatly value the intellectual ability, rigour, logical thinking and abstract reasoning that graduates acquire, their familiarity with numerical and symbolic thinking, and the analytic approach to problem solving that is their hallmark. These skills, when developed alongside more generic skills (such as communication and team-working skills) make mathematics, statistics and operational research graduates highly employable."

— QAA Benchmark Statement for Mathematics, Statistics and Operational Research

Knowledge and Understanding		
LO no.	On successful completion of the named award, students will be able to:	**Module Code/s**
1.	Demonstrate systematic knowledge and conceptual understanding of core areas and methods of pure mathematics and computer science including geometry, algebra, analysis, logic (deductive reasoning), and theoretical computer science.	MATH3403, COMP3402
2.	Demonstrate systematic knowledge and conceptual understanding of core areas and methods of applied mathematics and applied computing including mathematical modelling, data science, calculus, differential equations, numerical methods, software development, and systems analysis and design.	MATH3202, MATH3204, COMP2411
3.	Demonstrate advanced knowledge and understanding of several areas from mathematics, computer science, and data science, or their applications in other scientific fields.	All Level 6 modules

Cognitive and Intellectual skills		
4.	Use an analytical approach to determine requirements, formulate and build mathematical models, and design and implement computer-based systems, including testing, validation, identifying their limitations, and describing the assumptions on which they are based.	MATH2202, MATH3202, COMP2411
5.	Evaluate, select and apply a range of logical approaches and appropriate methods for analysing data and solving problems across a range of relevant areas of mathematics and computer science, including writing code in a high-level programming language.	All Level 5 and Level 6 modules
6.	Construct and critique logical arguments, identifying assumptions made and the conclusions drawn.	MATH2201, MATH3203
7.	Identify and apply appropriate practices within a professional, legal and ethical framework.	MATH3202, COMP2411

Skills and capabilities related to employability		
8.	Apply a rigorous, logical, computational and multidisciplinary approach to problems and projects in unfamiliar situations.	All Level 5 and Level 6 modules
9.	Select, use, adapt or develop computational tools and software to solve or analyse problems and systems.	All Level 5 and Level 6 modules
10.	Motivate and communicate complex ideas accurately, including reading and writing logical arguments, conclusions, mathematical models, algorithms, and technical documentation.	MATH3202, COMP2411

Transferable/key skills		
11.	Work effectively and constructively as part of a team, and recognise different roles within the team.	MATH2202, COMP2411
12.	Apply research skills such as planning research, and gathering and critical analysis of information from appropriate sources.	MATH3202, COMP3402
13.	Manage individual learning and development, including organisation, time management and lifelong learning.	*All modules, but especially* MATH3202

Learning, teaching and assessment

The Mathematics and Computer Science course includes a range of interesting and relevant modules, and features a variety of styles of teaching, learning and assessment, all designed to achieve the learning outcomes outlined above. The cumulative nature of these subjects means that knowledge is developed slowly in layers with progressively increasing depth of

understanding. Using a problem-based learning approach, skills in research, communication, computational thinking and team working are developed in parallel with the subject topics.

Teaching is mainly face-to-face through lectures, problem-solving workshops, and supervised computer laboratory sessions. Further support is through one-to-one and small group tutorials, learning materials posted on the university's virtual learning environment (VLE), formative problem sheets, formative tests, and suggestions for independent reading and guided research. Students learn cognitive and practical skills mainly through working in class, in groups or independently on designated problems, revision of subject content, "hands on" with a computer, and engaging with projects, all under the guidance of academic staff. A range of assessment types are used across the course, e.g., exams, practical tests, project reports, presentations, and design and development of software.

Teaching

Students are taught through a combination of interactive lectures, problem-solving workshops, group tutorials, computer labs, directed reading and formative assessments. The group tutorials and formative assessments involve practice at problem solving and application to real-world scenarios. Computer labs focus on developing practical skills in modelling, programming, data analysis, project management, and communication. In addition, meetings with a Personal Academic Tutor (PAT) will take place at least four times during the academic year for the first year and at least three times for subsequent years (see the University of Worcester Personal Academic Tutoring Policy).

The University places emphasis on enabling students to develop the independent learning capabilities to equip them for lifelong learning and future employment, as well as academic achievement. A mixture of independent study, teaching and academic support from Student Services and Library Services, and also the personal academic tutoring system enables students to reflect on progress and build up a profile of skills, achievements and experiences that will help them to flourish and be successful.

Contact time

In a typical week, students will have around 12–15 contact hours of teaching. A student studying part-time will normally have 3–4 contact hours of teaching per week for each module. The exact contact hours will depend on the optional modules selected. In the final year there is normally slightly less contact time in order to carry out more independent study. Typical class contact time is structured around lectures, workshops, group tutorials and computer labs. These are sessions where students are supported by lecturers and tutors in a lecture room or computer lab.

Independent self-study

In addition to the contact time, students are expected to undertake around 22–25 hours of independent study per week, plus assessment preparation in the assessment period at the end of each semester. A student studying part-time will normally be expected to undertake 5–6 hours of independent study per week for each module. Typically, this will involve problem solving in formative assessments, completing online activities, discussions with fellow students, reading journal articles and books, working on individual and group projects, preparing coursework assignments and presentations, and preparing for examinations. Independent learning is supported by a range of excellent learning facilities, including The Hive and library resources, the virtual learning environment, computer labs, the Peirson study and guidance centre (open 24 hours a day), and extensive electronic learning resources.

Teaching staff

Students will be taught by a teaching team whose expertise and knowledge are closely matched to the content of the modules on the course. The team includes senior academics, professional practitioners with industry experience, and visiting speakers with specialised expertise. Teaching

is informed by research and consultancy and many lecturers are Fellows of the Higher Education Academy.

Assessment

The course provides opportunities to test understanding and learning informally through the completion of practice or 'formative' assignments. Each module has one or more formal or 'summative' assessment which is graded and counts towards the overall module grade. Many of the formative assessments are designed to prepare students for a summative assessment, e.g., a practice test prior to a summative test. Assessment methods include written examinations and practical tests, and a range of coursework assessments such as reports, portfolios, presentations, design and development of software, and a final-year applied project.

The precise assessment requirements for an individual student in an academic year will vary according to the mandatory and optional modules taken, but a typical formal summative assessment pattern for each year of the course is:

- Year 1: examinations, portfolios, practical tests, reports, code, and presentations.
- Year 2: examinations, portfolios, practical tests, reports, code, mock job interview, oral examinations, system analysis and design documentation, and software demonstrations.
- Year 3: applied project, examinations, portfolios, reports, software demonstrations, presentations, and practical tests.

14. Assessment strategy

The assessment strategy is designed to demonstrate that students meet the FHEQ descriptors (QAA, 2014) for a Bachelor's Degree with honours (see Section 16) and the QAA Benchmark Statements for Mathematics, Statistics and Operational Research (QAA, 2015) and for Computing (QAA, 2016). The University of Worcester Assessment Policy provides a number of principles and processes that govern the design and management of student assessment, including the ideas of assessment as learning, assessment for learning, and assessment of learning. Assessments are aligned to the programme-level and module-level Intended Learning Outcomes (ILOs). The precise assessment requirements in an academic year will vary according to the mandatory and optional modules taken.

All modules have both formative and summative assessment elements. Formative assessment allows tutors and students to recognise strengths and weaknesses in learning and to address those issues immediately. For example, in Mathematics modules, regular formative problem sheets and small formative tests are used to check understanding, practice problem solving and writing skills, and to provide opportunities for tutors to give formative feedback. In Computer Science modules, students often work on formative tasks individually or in small groups, with tutors giving supportive feedback in the computer lab sessions. Summative assessments are graded and count towards the final module grade, and they are assessed against the specific module learning outcomes.

As a body of knowledge, Mathematics and Computer Science are structured in layers, each layer building on previous layers. The course is designed so that there is vertical alignment of knowledge (see the prerequisite structure in the module specifications) and building of skills. For example, formal mathematical writing (logical argument and proof) is developed through MATH 1201 to 2201 alongside more pure mathematics topics, while writing of reports (literature review, referencing, explanation, and forming conclusions from evidence) is developed through MATH 1202 to 2202 alongside more applied mathematics topics. Skills are also incremental in scope, e.g., at Level 4 some parts of a report may be provided and the students only write a particular part of a report, whereas a Level 5 students may write whole reports (as a group or individually).

Assessments for the individual modules have been designed to enable students to demonstrate that they have successfully met the learning outcomes. Each module outlines the nature of the assessment and the respective weighting of each assessment item, as well as a detailed assessment brief and assessment criteria. Emphasis is placed both on the development of the

underlying theory and the logical and analytical problem solving skills. The styles of each assessment takes into account a myriad of factors, including learning outcomes, content of the module and teaching and learning styles.

15. Programme structures and requirements

See the end of this document for Level 4, 5 and 6 Award Maps. If the course is studied in part-time mode, then a plan should be agreed between the student and the Course Leader as to which order to study the modules so as to satisfy any prerequisites.

There are mandatory modules at each level of the course. All modules are mandatory at Level 4, while at Levels 5 and Level 6 there are some options. All of the optional COMP and GEOG modules are related to either Data Science (Levels 5 and 6) or Applied Programming (Level 5 only). For example, Geographical Information Systems (GIS) are specialised databases that manage, analyse and visualise *spatial data*. Robotics involves design of small robots, applying mathematics to program them to perform specific tasks, and extracting useful information from sensors.

Data Science COMP 2445 Data Mining (30 credits) COMP 3407 Machine Learning (15) COMP 3471 Cyber Security (15) COMP 3491 Practical Database Applications (15) GEOG 2113/3113 Geographical Information Systems (15) GEOG 3114 Applied GIS and Remote Sensing (15)	*Applied Programming* COMP 2403 Robotics (15) COMP 2431 Object Oriented Design and Development (30) COMP 2461 Mobile Application Development (15)

16. QAA and professional academic standards and quality

The academic standards for the programme have been set and are maintained in accordance with the UK Quality Code for Higher Education (March 2018). The Quality Code sets out expectations which higher education providers are required to meet to ensure that academic standards are set and maintained.

The Frameworks for Higher Education Qualifications (FHEQ) of UK Degree-Awarding Bodies are part of the Quality Code. The Qualifications Frameworks describe the achievement represented by higher education qualifications. They apply to degrees, diplomas, certificates and other academic awards granted by a higher education provider with degree awarding powers.

The QAA Subject Benchmark statements for Mathematics, Statistics and Operational Research (QAA, 2015) and for Computing (QAA, 2016) articulate the knowledge, skills and categories of achievement to be expected of successful honours graduates in these fields. These have been used to craft the programme and module learning outcomes and content as well as learning, teaching and assessment strategies for all modules.

This award is located at Level 6 of the FHEQ.

17. Support for students

The following activities and facilities have been put in place to provide support to undergraduate students studying Mathematics and Computer Science.

Student induction
The university runs a week of induction events (“Welcome Week”) at the start of the academic year. This varies in detail from year to year but includes activities designed to provide students with an introduction to the course and an opportunity to meet their personal academic tutor as well as getting to know each other. Examples of further activities include introductions to

University of Worcester support services, key ICT and library resources, campus orienteering and study skills.

At course level, students are introduced to how the course will operate, meeting the course team, what staff are likely to expect of students, what students can expect of staff, university regulations around assessments, tour of the laboratory spaces, introduction to key software, and accessing the virtual learning environment (Blackboard). It is also for students to meet students from other cohorts (on this and similar courses), and hear their top tips for how to succeed on the course and get ideas for future careers.

Personal academic tutoring
Each student has a nominated Personal Academic Tutor (PAT) to provide academic advice and guidance, personal development planning and pastoral support as appropriate. The Personal Academic Tutor plays a significant role in enhancing the student's academic and personal experience of studying. Students will meet with their Personal Academic Tutor at least four times during the academic year for the first year and at least three times during each subsequent year (see the University of Worcester Personal Academic Tutoring Policy).

In this course, tutors will also meet with students in small group tutorials to support learning of knowledge and skills in modules. Particularly at the beginning of the first year, a key role of tutors is to support students as they make the transition to studying in higher education. Tutors will also advise individual students on the selection of optional modules, sources of information about potential careers, support with interpreting feedback on coursework, and provide an academic reference.

Students as academic partners
A strategic goal of the university is to engage students as partners in planning, managing and enhancing learning experiences. Feedback from students is always welcome and staff work together with students to continuously improve the course and how we provide support for students.

Student Services
The university has specialist teams that offer advice and support for all students, e.g., in careers and employability, counselling and mental health, and disability and dyslexia. For further information, see:

http://www.worcester.ac.uk/student-services/index.htm
https://www2.worc.ac.uk/disabilityanddyslexia/

18. Admissions

Admissions policy
The university aims to be accessible and is committed to widening participation and encouraging diversity in the student population. Hence we actively encourage and welcome people from the widest range of economic and cultural backgrounds and value the contribution of mature learners who may be able to use their work experience as evidence of prior learning. However, evidence of Mathematics attainment at least equivalent to A-Level Mathematics will be required for admission to the course.

Entry requirements
The normal minimum entry requirement for undergraduate degree courses is the possession of 4 GCSEs (Grade C/4 or above) and a minimum of 2 A Levels (or equivalent Level 3 qualifications).

Since Mathematics is a subject which builds incrementally in complexity from GCSE to A-Level (or equivalent) and beyond, it is a typical requirement for students onto the course that they have (as a minimum) an A-Level at grade C in Mathematics or an equivalent alternative qualification.

The current UCAS Tariff requirements for entry to this course are published in the prospectus and on the university website https://www.worc.ac.uk/journey/a-z-of-courses.html

See the Admissions Policy for other acceptable qualifications.

Recognition of Prior Learning
Details of acceptable Level 3 qualifications, policy in relation to mature students or applicants with few or no formal qualifications can be found in the prospectus or on the University webpages. Information on eligibility for recognition of prior learning for the purposes of entry or advanced standing is also available from the University webpages or from the Registry Admissions Office (01905 855111). Further information on Recognition of Prior Learning can be found at http://www.worcester.ac.uk/registryservices/941.htm

Admissions procedures
The university runs regular Open Days throughout the year so that prospective students can visit the university, meet some of the course team, find out more about the course, and also get advice more generally on admissions, finance, accommodation options, etc.

Please see https://www.worcester.ac.uk/study/find-a-course/how-to-apply/ for further information on how to apply for the course.

Full-time applicants apply through UCAS (using the UCAS code **GI11**).
Part-time applicants apply directly to University of Worcester (UW).

The university admissions team consider all applications and decide whether to make an offer for a place on the course. Most offers are conditional offers, subject to the attainment of acceptable entry qualifications or grades (if grades are not known at the time of application).

Admissions/selection criteria
The decision to offer a place will be based on a candidate's prior attainment in Mathematics at A-Level (or equivalent) and their demonstrated enthusiasm for the subject, commitment to study and the academic capability to succeed on the course.

19. Regulation of assessment

The course operates under the University's Taught Courses Regulatory Framework

Requirements to pass modules

- Modules are assessed using a variety of assessment activities which are detailed in the module specifications.
- The minimum pass mark is D- for each module.
- Students are required to submit all items of assessment in order to pass a module, and in some modules, a pass mark in each item of assessment may be required.
- Full details of the assessment requirements for a module, including the assessment criteria, are published in the module outline.

Submission of assessment items

- Students who submit course work late but within 7 days (one week) of the due date will have work marked, but the grade will be capped at D- unless an application for mitigating circumstances is accepted.
- Students who submit work later than 7 days (one week) will not have work marked unless they have submitted a valid claim of mitigating circumstances.
- For full details of submission regulations please see the Taught Courses Regulatory Framework.

Retrieval of failure

- Students are entitled to resit failed assessment items for any module that is awarded a fail grade.

- Reassessment items that are passed are capped at D-.
- If a student is unsuccessful in the reassessment, they have the right to retake the module (or, in some circumstances, take an alternative module); the module grade for a re-taken module is capped at D-.
- A student will be notified of the reassessment opportunities in the results notification issued via the secure student portal (SOLE). It is the student's responsibility to be aware of and comply with any reassessments.

Requirements for Progression

- A student will be permitted to progress from Level 4 to Level 5 if, by the time of the reassessment Board of Examiners, they have passed at least 90 credits at Level 4. Outstanding Level 4 credits must normally be studied in the following academic year.
- A student will be permitted to progress from Level 5 to Level 6 if, by the time of the reassessment Board of Examiners, they have passed at least 210 credits, including 90 credits at Level 5. Outstanding Level 5 credits must normally be studied in the following academic year.
- A student who, by the time of the reassessment Board of Examiners, has failed 90 credits or more during the academic year as a consequence of non-submission, will be required to withdraw from the University
- If a student has not passed 90 credits by the reassessment Board of Examiners, and is not withdrawn due to non-submission, they will be required to retake failed modules in the following academic year. Any passed modules will be carried forward.

Requirements for Awards

Award	Requirement
Certificate of Higher Education Cert HE	In order to be eligible for the exit award of Certificate in Higher Education in the named subject/area of study, a student must have passed at least 120 credits in total including the mandatory modules for Level 4 of the award as specified on the award map.
Diploma of Higher Education DipHE	In order to be eligible for the exit award of Diploma in Higher Education in the named subject/area of study, a student must have passed at least 240 credits in total including the mandatory modules for Level 4 and Level 5 of the award as specified on the award map.
Degree (non-honours)	Passed a minimum of 300 credits with at least 90 credits at Level 5 or higher and a minimum of 60 credits at Level 6, including the mandatory modules for Level 5 and Level 6 of the award (not the Independent Study/Project module) as specified on the award map.
Degree with honours	Passed a minimum of 360 credits with at least 90 credits at Level 5 or higher and a minimum of 120 credits at Level 6, as specified on the award map.

Classification

The honours classification will be determined by whichever of the following two methods results in the higher classification.

- Classification determined on the profile of the best grades from 60 credits attained at Level 5 and the best grades from 120 credits at Level 6. Level 5 and Level 6 grades count equally in the profile.
- Classification determined on the profile of the best grades from 120 credits attained at Level 6 only.

For further information on honours degree classification, see the Taught Courses Regulatory Framework.

20. Graduate destinations, employability and links with employers

Graduates of this course will have developed a range of knowledge and skills valued in careers in, e.g., mathematical modelling, data science, and software development. Increasingly, job listings in these areas emphasise the importance of technical computing skills, good communication, ability to interpret, analyse, manipulate and present significant volume of data, creativity in problem-solving, and familiarity with databases (and SQL). In particular, recent job listings for Data Scientists (see, e.g., http://www.datascientistjobs.co.uk) specify a solid background in linear algebra, predictive modelling, optimisation and machine learning, alongside an ability to communicate complex messages to various audiences.

Graduate destinations

This course opens up a wide range of career directions and possibilities for future study. In the annual Career Cast "Best Jobs" rankings (2018), Mathematician came in at #2, Statistician #5, Data Scientist #7, Information Security Analyst #8, Operational Research Analyst #9, Actuary #10, Software Developer #11, and Web Developer #20 (see https://www.careercast.com/jobs-rated/2018-jobs-rated-report). Further examples of possible future career paths include auditor, mathematical modeller, game designer, market researcher, management consultant, transport planner, cryptologist, tax advisor, systems analyst, engineer, teacher, government analyst, accountant, cartographer, and meteorologist.

Within the University, colleagues in the School of Education welcome graduates of this course to apply for the PCGE in either Mathematics (Primary or Secondary) or ICT/Computer Science (Secondary). We also have links with the Central Maths Hub involving schools, colleges and universities across the Midlands.

For further careers information, see the Institute for Mathematics and its Applications (IMA) Maths Careers website (see http://www.mathscareers.org.uk) and the Prospects careers website (see https://www.prospects.ac.uk/careers-advice/what-can-i-do-with-my-degree).

Student employability

The course aims to prepare students for employment by embedding the development of knowledge and skills valued by employers in all modules of the course. The QAA Benchmark Statements for Computing (p11, QAA, 2016) and for Mathematics, Statistics and Operational Research (p17, QAA, 2015) list a number of general skills that are to be expected of all graduates in these subjects. In particular, study skills, independent learning, information literacy, persistence with problem solving, time management, transferring knowledge from one context to another, communication, team working, modelling and programming skills are practiced alongside understanding of subject knowledge. All modules (even those in pure mathematics) have an applied flavour and many feature a problem-based approach to learning.

The University of Worcester has a Careers and Employability Service that supports students in exploring career options and preparing for employment. The course also aims to incorporate best practice from the established literature (see example publications below) in developing graduate skills and employability skills throughout the course (rather than in a separate "skills" or "research methods" module). Where possible, assessments have an employability flavour, e.g., a mock job interview (time-limited data analysis exercise), a group modelling project which involves interaction with a hypothetical client, and agile development of software prototypes. We expect

to involve visiting guest lecturers and former graduates to share their experiences, e.g., about their career development, what influenced their choice of career, or advice on what skills are desired by different employers. We will invite colleagues from the School of Education to talk to students interested in a teaching career, and put students in touch with local schools who offer summer placement or volunteering opportunities. In addition, the *Worcester Award* enables students to record additional activities completed in addition to their degree studies, e.g., hours of volunteer work.

- Jeff Waldock (editor). (2011). *Developing Graduate Skills in HE Mathematics Programmes: Case Studies of Successful Practice.* National HE STEM Programme. http://www.mathcentre.ac.uk/resources/uploaded/gradskills.pdf
- Challis, N., Robinson, M., Thomlinson, M. (2009). "Employability" skills in mathematics courses, *MSOR Connections*, 9(3), 38–41. https://www.heacademy.ac.uk/system/files/msor.9.3k.pdf

Across the course, students will gain experience using a range of specialist software and programming languages, e.g., C#, Java, Python, Matlab, SQL, and R. The TIOBE Programming Community index (see https://www.tiobe.com/tiobe-index/) gives a ranking of different programming languages and is a useful check that programming skills are up to date with what employers expect.

Links with employers

Employers attend the 'Computing Project Showcase' event each spring where third-year students present their projects to industry experts, employers, tutors and other students. Worcester Business School is supported by its Employer's Advisory Group, which meets on a regular basis. The University's Media Lab is a dedicated purposefully-equipped space to provide students with the experience of working on 'live' projects with clients from the local business community. Projects include mobile applications, games, and website and software development.

Please note: This specification provides a concise summary of the main features of the programme and the learning outcomes that a typical student might reasonably be expected to achieve and demonstrate if s/he takes full advantage of the learning opportunities that are provided. More detailed information on the learning outcomes, content and teaching, learning and assessment methods of each module can be found in associated course documentation e.g. course handbooks, module outlines and module specifications.

Award map

Course Title: Mathematics and Computer Science

Level 4					
Module Code	**Module Title**	**Credits** (Number)	**Status** (Mandatory (M) or Optional (O))	**Pre-requisites** (Code of Module required)	**Exclusions**
MATH 1201	Mathematical Foundations	30	M	None	None
MATH 1202	Data and Modelling	30	M	None	None
COMP 1421	Foundations of Computing	30	M	None	None
COMP 1447	Introduction to Object Oriented Programming	30	M	None	None

Single Honours Requirements at Level 4

Single Honours students must take 120 credits in total drawn from the table above to include all mandatory modules.

Level 5					
Module Code	**Module Title**	**Credits** (Number)	**Status** (Mandatory (M) or Optional (O))	**Pre-requisites** (Code of Module required)	**Exclusions**
MATH 2201	Vector Calculus and Linear Algebra	30	M	MATH 1201	None
MATH 2202	Explorations in Mathematical Modelling	30	M	MATH 1201 and MATH 1202	None
COMP 2411	Systems Analysis and Design	30	M	None	None
COMP 2403	Robotics	15	O	None	None
COMP 2431	Object Oriented Design and Development	30	O	None	None
COMP 2445	Data Mining	30	O	None	None
COMP 2461	Mobile Application Development	15	O	None	None
GEOG 2113	Geographical Information Systems	15	O	None	GEOG 3113

Single Honours Requirements at Level 5

Single Honours students must take 120 credits in total drawn from the table above to include all mandatory modules and 30 credits of optional modules.

Level 6					
Module Code	**Module Title**	**Credits** (Number)	**Status** (Mandatory (M) or Optional (O))	**Pre-requisites** (Code of Module required)	**Exclusions**
MATH 3202	Computer Graphics and Applied Project	30	M	MATH 2201 and MATH 2202	None
MATH 3203	Abstract Algebra and Number Theory	15	M	MATH 2201	None
MATH 3204	Optimisation	15	M	MATH 2201 and MATH 2202	None
COMP 3402	The Nature of Computing	30	M	None	None
COMP 3407	Machine Learning	15	O	None	None
COMP 3471	Cyber Security	15	O	None	None
COMP 3491	Practical Database Applications	15	O	None	None
GEOG 3113	Geographical Information Systems	15	O	None	GEOG 2113
GEOG 3114	Applied GIS and Remote Sensing	15	O	GEOG 2113	None

Single Honours Requirements at Level 6

Single Honours students must take 120 credits from the table above to include all mandatory modules and 30 credits of optional modules (including at most 15 credits from GEOG 3113 and GEOG 3114).