Module Descriptor

Title	Algorithms & Collections		
Session	2025/26	**Status**	Published
Code	COMP09044	**SCQF Level**	9
Credit Points	20	**ECTS (European Credit Transfer Scheme)**	10
School	**Computing, Engineering and Physical Sciences**		
Module Co-ordinator	Joanna Olszewska		

Summary of Module

The module builds on the foundation laid in the level 8 module, Structures and Algorithms, to further develop object-oriented programming and design concepts of algorithms and collections and their implementation using trees, heaps, hash-tables, and graphs. There is a major focus on the analysis of the algorithms and the trade-offs involved in choosing how a collection should be represented. The treatment of recursion is also further developed, including backtracking as a strategy for goal-seeking.

This module is delivered long and thin over two terms and provides students with knowledge in analysing and applying algorithms and collections in context of real-world applications, in analytically evaluating design and performance trade-offs, and in critically thinking about more general design considerations relevant to algorithms and collections when implemented in modern object-oriented languages such as Java and C++. Hence, undertaking this module will develop a range of graduate attributes such as analytical thinking and problem solving. Furthermore, students will get practice in socially responsible, creative design and ethically-minded, autonomous development of a software embedding appropriate algorithms and collections. Students will also get the opportunity to apply Artificial Intelligence based Software Engineering principles and related ISO/IEC/IEEE standards as well as a range of scientific communication skills through a wide range of assessments such as essays, videos, etc.

Module Delivery Method	**On-Campus**[1]	**Hybrid**[2]	**Online**[3]	**Work -Based Learning**[4]
	☒	☐	☒	☐

[1] Where contact hours are synchronous/ live and take place fully on campus. Campus-based learning is focused on providing an interactive learning experience supported by a range of digitally-enabled asynchronous learning opportunities including learning materials, resources, and opportunities provided via the virtual learning environment. On-campus contact hours will be clearly articulated to students.

[2] The module includes a combination of synchronous/ live on-campus and online learning events. These will be supported by a range of digitally-enabled asynchronous learning opportunities including learning materials, resources, and opportunities provided via the virtual learning environment. On-campus and online contact hours will be clearly articulated to students.

[3] Where all learning is solely delivered by web-based or internet-based technologies and the participants can engage in all learning activities through these means. All required contact hours will be clearly articulated to students.

[4] Learning activities where the main location for the learning experience is in the workplace. All required contact hours, whether online or on campus, will be clearly articulated to students

Campuses for Module Delivery	☐ Ayr ☐ Dumfries		☐ Lanarkshire ☐ London ☒ Paisley		☒ Online / Distance Learning ☐ Other (specify)	
Terms for Module Delivery	Term 1	☒	Term 2	☒	Term 3	☐
Long-thin Delivery over more than one Term	Term 1 – Term 2	☐	Term 2 – Term 3	☐	Term 3 – Term 1	☐

Learning Outcomes	
L1	Evaluate requirements relating to collections of data in a given scenario and select an appropriate concrete implementation for the collection, taking in to account space and time performance trade-offs.
L2	Design and develop implementations of collection classes, applying the principles of object-oriented programming and conforming to the relevant conventions, standards and accepted best practice in the programming language used.
L3	Identify and implement algorithms, using recursion where appropriate, for a variety of technically demanding tasks including explorations of graphs and search spaces to find and/or arrive at a destination or goal state.
L4	Recognise the implications for type safety and the guaranteeing of object invariants that arise when trying to meet requirements for persistence, and in designing classes for serialization and de-serialization take full account of these.
L5	N/A

Employability Skills and Personal Development Planning (PDP) Skills	
SCQF Headings	**During completion of this module, there will be an opportunity to achieve core skills in:**
Knowledge and Understanding (K and U)	**SCQF 9** Demonstrate a broad and integrated knowledge and understanding of the technologies available for the design and implementation of data collections. Demonstrate a detailed understanding of existing collections frameworks and the performance of a variety of implementations of the collections in the frameworks.
Practice: Applied Knowledge and Understanding	**SCQF 9** Design and develop implementations of collection classes, making use of advanced programming language features, and where appropriate to obtain good performance using data structures that are algorithmically complex to manipulate. Use algorithmic analysis and development practices at an advanced level in designing solutions involving collections of data.
Generic Cognitive skills	**SCQF 9**

	Critically evaluate the requirements for a collection, taking account of a range of considerations including reusability, performance, security and other aspects of the problem scenario.
Communication, ICT and Numeracy Skills	**SCQF 9** Communicating effectively and appropriately in speech and writing. Interpreting complex primary materials. Making effective use of information retrieval systems and use information technology applications to present documents in an appropriate form.
Autonomy, Accountability and Working with Others	**SCQF 9** Exercise autonomy and initiative at a professional level in the design and development of applications involving collections

Prerequisites	**Module Code** COMP08034	**Module Title** Structures & Algorithms
	Other	
Co-requisites	**Module Code**	**Module Title**

Learning and Teaching	
In line with current learning and teaching principles, a 20-credit module includes 200 learning hours, normally including a minimum of 36 contact hours and maximum of 48 contact hours. Theory is presented in lectures and applied in tutorial exercises and laboratories. Online laboratory classes and animations are used to illustrate the behaviour of a variety of algorithms and structures. Additional reading materials and other resources, including some research publications, are provided on each topic. Opportunities are taken to link the materials to problems arising in the students area of study in tutorial and laboratory sessions.	
Learning Activities During completion of this module, the learning activities undertaken to achieve the module learning outcomes are stated below:	**Student Learning Hours** (Note: Learning hours include both contact hours and hours spent on other learning activities)
Lecture / Core Content Delivery	24
Laboratory / Practical Demonstration / Workshop	24
Independent Study	152
Please select	
Please select	
Please select	
TOTAL	200

Indicative Resources

The following materials form essential underpinning for the module content and ultimately for the learning outcomes:

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Lecture and Laboratory materials (published on Aula)

C++ and Java development environments (Microsoft Visual Studio and Eclipse, for example).

The following texts represent useful supplementary reading material:

Core Books

Mak, R. (2024) Object-Oriented Software Design in C++. Manning.

Myers, D. S. (2024) Data Structures and Algorithms in Java: A Project-Based Approach. Cambridge University Press.

Stroustrup, B. (2024) Programming: Principles and Practice Using C++. 3rd Ed. Pearson.

Recommended Readings

Black, R., Davenport, J, Olszewska, J. I., Rössler, J, Smith, A. L., and Wright, J. (2022) Artificial Intelligence and Software Testing: Building Systems You Can Trust. BCS Press.

Chauhan, N. (2016) Software Testing: Principles and Practice. 2nd Ed. Oxford University Press.

Preece, J., Sharp, H., and Rogers, Y. (2023) Interaction Design: Beyond Human-Computer Interaction. 6th Ed. Wiley.

Sommerville, I. (2015) Software Engineering. 10th Ed. Pearson.

(N.B. Although reading lists should include current publications, students are advised (particularly for material marked with an asterisk*) to wait until the start of session for confirmation of the most up-to-date material)

Attendance and Engagement Requirements

In line with the Student Attendance and Engagement Procedure, Students are academically engaged if they are regularly attending and participating in timetabled on-campus and online teaching sessions, asynchronous online learning activities, course-related learning resources, and complete assessments and submit these on time.

For the purposes of this module, academic engagement equates to the following:

The School of Computing, Engineering and Physical Sciences considers attendance and engagement to mean a commitment to attending, and engaging in, timetabled sessions. You will scan your attendance via the scanners each time you are on-campus and you will login to the VLE several times per week. Where you are unable to attend a timetabled learning session due to illness or other circumstance, you should notify the Programme Leader that you cannot attend. Across the School an 80% attendance threshold is set. If you fall below this, you will be referred to the Student Success Team to see how we can best support your studies.

Equality and Diversity

The University's Equality, Diversity and Human Rights Procedure can be accessed at the following link: UWS Equality, Diversity and Human Rights Code. Aligned with the University's commitment to equality and diversity, this module supports equality of opportunity for students from all backgrounds and learning needs. Using the VLE, material will be presented electronically in formats that allow flexible access and manipulation of content. This module complies with University regulations and guidance on inclusive learning and teaching practice. This module has lab-based teaching and as such you are advised to speak to the Module Co-ordinator to ensure that specialist assistive equipment, support provision and adjustment to assessment practice can be put in place, in accordance with the University's policies and regulations.
(N.B. Every effort will be made by the University to accommodate any equality and diversity issues brought to the attention of the School)

Supplemental Information

Divisional Programme Board	**Computing**
Overall Assessment Results	☐ **Pass / Fail** ☒ **Graded**
Module Eligible for Compensation	☐ **Yes** ☒ **No** **If this module is eligible for compensation, there may be cases where compensation is not permitted due to programme accreditation requirements. Please check the associated programme specification for details.**
School Assessment Board	Business & Applied Computing
Moderator	J Riordan
External Examiner	A Jindal
Accreditation Details	This module forms part of a number of programmes accredited by the BCS and by Skillset.
Module Appears in CPD catalogue	☐ **Yes** ☒ **No**
Changes / Version Number	2.13

Assessment (also refer to Assessment Outcomes Grids below)
Assessment 1
Two class tests, worth 40% of the final mark (20% for each test) allow the student to demonstrate knowledge and understanding of non-linear data structures used in implementing collections and the ability to evaluate the impact of design and representation choices on the performance of a collection's operations. Preparation for these tests will include two formative (practice) tests, whose solutions are then discussed with the class.
Assessment 2
A development project with supporting documentation and an evaluative report of the work are worth the remaining 60% of the final mark. The project provides an opportunity for students to demonstrate an ability to apply the principles learned in the module in the development and testing of a collection and to experimentally assess the performance obtained. The project will be issued in two parts, following ISO/IEC/IEEE standards, with detailed written feedback on the first part given to the students before they undertake the second part.
Assessment 3

(N.B. (i) Assessment Outcomes Grids for the module (one for each component) can be found below which clearly demonstrate how the learning outcomes of the module will be assessed.

(ii) An indicative schedule listing approximate times within the academic calendar when assessment is likely to feature will be provided within the Student Module Handbook.)

Component 1							
Assessment Type	**LO1**	**LO2**	**LO3**	**LO4**	**LO5**	**Weighting of Assessment Element (%)**	**Timetabled Contact Hours**
Class test (written)	☒	☒	☒	☒	☐	40	4

Component 2							
Assessment Type	**LO1**	**LO2**	**LO3**	**LO4**	**LO5**	**Weighting of Assessment Element (%)**	**Timetabled Contact Hours**
Portfolio of written work	☒	☒	☒	☒	☐	60	

Component 3							
Assessment Type	**LO1**	**LO2**	**LO3**	**LO4**	**LO5**	**Weighting of Assessment Element (%)**	**Timetabled Contact Hours**
	☐	☐	☐	☐	☐		
Combined total for all components						100%	hours

Change Control

What	**When**	**Who**
Attendance and EDI regulations	20/01/2025	L Cunningham