



**UNIVERSITY
OF LONDON**

Programme Regulations 2023–2024

Computer Science (and specialisms)

BSc

Graduate Diploma

Graduate Certificate

Important document – please read
This document contains important
information that governs your
registration, assessment and
programme of study



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7.4

The final weighted average will be based on the marks obtained from **all** modules, including those eligible for inclusion through the marginal condonement rules.

7.5

When calculating a candidate's final degree classification, a relative weighting of 1:3:5 will be applied to modules at Levels 4, 5 and 6 respectively.

7.6

If you have credit for any module through RPL, the examiners will assess your class of Honours only upon the grades received for the modules you have undertaken with us for this programme.

Graduate Diploma and Graduate Certificate

7.7

To be considered for the award of the Graduate Diploma you are required to have attempted and passed modules to the value of **120 credits**, with a minimum of 90 being at Level 6.

7.8

For the Graduate Diploma, each module is worth 15 credits except the Final Project which is worth 30 credits. To calculate the final grade for the award, the marks for **all** modules are weighted according to credit value.

7.9

To be considered for the award of the Graduate Certificate you are required to have attempted and passed modules to the value of **60 credits**, with a minimum of 45 being at Level 6.

7.10

For the Graduate Certificate, the final average will be based on the marks obtained from **all** modules.

7.11

Both the Graduate Certificate and the Graduate Diploma will be classified according to the following scale:

Final average	Classification
70% or above	Distinction
60% - 69%	Merit
50% - 59%	Pass
40% - 49%	Pass
0 - 39%	Fail

Exit qualifications

7.12

If you are registered on a BSc and are unable to pass modules to a total value of 360 credits due to exhausting the permitted number of attempts, you may be eligible for an exit qualification of either a Certificate of Higher Education in Computer Science or a Diploma of Higher Education in Computer Science.

7.13

If you are registered on a Graduate Diploma and are unable to pass modules to a total value of 120 credits due to exhausting the permitted number of attempts, you may be eligible for an exit qualification of a Graduate Certificate relating to the specialism of your Graduate Diploma.

7.14

The scale used for classification of any exit qualification is:

Final average	Classification
40% or above	Pass
0 - 39%	Fail

Diploma of Higher Education in Computer Science, Certificate of Higher Education in Computer Science, and Pass degree (unclassified)

The Diploma of Higher Education and Certificate of Higher Education are only available as an exit qualification for students studying a Bachelor of Science programme.

The Bachelor of Science (unclassified/pass degree) is only available as an exit qualification.

7.15

If you are studying a BSc and have successfully completed at least **240 credits**, with a minimum of 90 credits at Level 5, you may be considered for the **Diploma of Higher Education in Computer Science** qualification.

7.16

The final Diploma of Higher Education in Computer Science mark is determined by an average of the marks obtained from each of the 16 modules studied; it will not include any module where credit was awarded for RPL.

7.17

If you are studying a BSc and have successfully completed at least **120 credits**, with a minimum of 90 credits at Level 4, you may be considered for the **Certificate of Higher Education in Computer Science** qualification. There will be no marginal condonement for modules included in this qualification.

7.18

The final Certificate of Higher Education in Computer Science mark is determined by an average of the marks obtained from each of the eight modules studied. Prior learning will not be recognised or accredited.

7.19

If you are registered on any of the BSc programmes, where you have attempted all 22 modules and the Final Project and have successfully completed at least **300 credits**, but less than 360, including Introduction to Programming I, you may be considered for a pass (unclassified) degree in Computer Science. You will not be eligible for any of the specialist degree qualifications.

Appendix A – Structure of the programme

Refer to [Appendix B](#) for full module descriptions.

It is expected that students who are registered on a specialist degree programme will complete a final project in line with the specialist subject area.

Some modules have additional hardware and software requirements. Refer to the [Programme Specification](#) for further information.

BSc Computer Science

Level 4

One core module:

- Introduction to programming I [CM1005]

+

Seven compulsory modules:

- Introduction to programming II [CM1010]
- Computational mathematics [CM1015]
- Discrete mathematics [CM1020]
- Fundamentals of computer science [CM1025]
- How computers work [CM1030]
- Algorithms and data structures I [CM1035]
- Web development [CM1040]

Level 5

Eight compulsory modules:

- Object oriented programming [CM2005]
- Software design and development [CM2010]
- Programming with data [CM2015]
- Agile software projects [CM2020]
- Computer security [CM2025]
- Graphics programming [CM2030]
- Algorithms and data structures II [CM2035]
- Databases, networks and the web [CM2040]

Level 6

Six optional modules chosen from the list:

- Data science [CM3005]

- Databases and advanced data techniques [CM3010]
- Machine learning and neural networks [CM3015]
- Artificial intelligence [CM3020]
- Virtual reality [CM3025]
- Games development [CM3030]
- Advanced web development [CM3035]
- Physical computing and internet of things [CM3040]
- 3D graphics and animation [CM3045]
- Mobile development [CM3050]
- Interaction design [CM3055]
- Natural language processing [CM3060]
- Intelligent signal processing [CM3065]

+

One 30 credit project:

- Final project [CM3070]

BSc Computer Science (Data Science)

Level 4

One core module:

- Introduction to programming I [CM1005]

+

Seven compulsory modules:

- Introduction to programming II [CM1010]
- Computational mathematics [CM1015]
- Discrete mathematics [CM1020]
- Fundamentals of computer science [CM1025]
- How computers work [CM1030]
- Algorithms and data structures I [CM1035]
- Web development [CM1040]

Level 5

Eight compulsory modules:

- Object oriented programming [CM2005]
- Software design and development [CM2010]

- Programming with data [CM2015]
- Agile software projects [CM2020]
- Computer security [CM2025]
- Graphics programming [CM2030]
- Algorithms and data structures II [CM2035]
- Databases, networks and the web [CM2040]

Level 6

Five specialist core modules:

- Data science [CM3005]
- Databases and advanced data techniques [CM3010]
- Machine learning and neural networks [CM3015]
- Advanced web development [CM3035]
- Natural language processing [CM3060]

+

One optional module chosen from the list:

- Artificial intelligence [CM3020]
- Virtual reality [CM3025]
- Games development [CM3030]
- Physical computing and internet of things [CM3040]
- 3D graphics and animation [CM3045]
- Mobile development [CM3050]
- Interaction design [CM3055]
- Intelligent signal processing [CM3065]

+

One 30 credit project:

- Final project [CM3070]

BSc Computer Science (Machine Learning and Artificial Intelligence)

Level 4

One core module:

- Introduction to programming I [CM1005]

+

Seven compulsory modules:

- Introduction to programming II [CM1010]
- Computational mathematics [CM1015]
- Discrete mathematics [CM1020]
- Fundamentals of computer science [CM1025]
- How computers work [CM1030]
- Algorithms and data structures I [CM1035]
- Web development [CM1040]

Level 5

Eight compulsory modules:

- Object oriented programming [CM2005]
- Software design and development [CM2010]
- Programming with data [CM2015]
- Agile software projects [CM2020]
- Computer security [CM2025]
- Graphics programming [CM2030]
- Algorithms and data structures II [CM2035]
- Databases, networks and the web [CM2040]

Level 6

Five specialist core modules:

- Databases and advanced data techniques [CM3010]
- Machine learning and neural networks [CM3015]
- Natural language processing [CM3060]
- Artificial intelligence [CM3020]
- Intelligent signal processing [CM3065]

+

One optional module chosen from the list:

- Data science [CM3005]
- Virtual reality [CM3025]
- Games development [CM3030]
- Advanced web development [CM3035]
- Physical computing and internet of things [CM3040]
- 3D graphics and animation [CM3045]
- Mobile development [CM3050]
- Interaction design [CM3055]

+

One 30 credit project:

- Final project [CM3070]

BSc Computer Science (User Experience)

Level 4

One core module:

- Introduction to programming I [CM1005]

+

Seven compulsory modules:

- Introduction to programming II [CM1010]
- Computational mathematics [CM1015]
- Discrete mathematics [CM1020]
- Fundamentals of computer science [CM1025]
- How computers work [CM1030]
- Algorithms and data structures I [CM1035]
- Web development [CM1040]

Level 5

Eight compulsory modules:

- Object oriented programming [CM2005]
- Software design and development [CM2010]
- Programming with data [CM2015]
- Agile software projects [CM2020]

- Computer security [CM2025]
- Graphics programming [CM2030]
- Algorithms and data structures II [CM2035]
- Databases, networks and the web [CM2040]

Level 6

Five specialist core modules:

- Virtual reality [CM3025]
- Advanced web development [CM3035]
- Physical computing and internet of things [CM3040]
- Mobile development [CM3050]
- Interaction design [CM3055]

+

One optional module chosen from the list:

- Databases and advanced data techniques [CM3010]
- Machine learning and neural networks [CM3015]
- Artificial intelligence [CM3020]
- Data science [CM3005]
- Games development [CM3030]
- 3D graphics and animation [CM3045]
- Natural language processing [CM3060]
- Intelligent signal processing [CM3065]

+

One 30 credit project:

- Final project [CM3070]

BSc Computer Science (Web and Mobile Development)

Level 4

One core module:

- Introduction to programming I [CM1005]

+

Seven compulsory modules:

- Introduction to programming II [CM1010]
- Computational mathematics [CM1015]

- Discrete mathematics [CM1020]
- Fundamentals of computer science [CM1025]
- How computers work [CM1030]
- Algorithms and data structures I [CM1035]
- Web development [CM1040]

Level 5

Eight compulsory modules:

- Object oriented programming [CM2005]
- Software design and development [CM2010]
- Programming with data [CM2015]
- Agile Software Projects [CM2020]
- Computer security [CM2025]
- Graphics programming [CM2030]
- Algorithms and data structures II [CM2035]
- Databases, networks and the web [CM2040]

Level 6

Five specialist core modules:

- Databases and advanced data techniques [CM3010]
- Advanced web development [CM3035]
- 3D graphics and animation [CM3045]
- Mobile development [CM3050]
- Interaction design [CM3055]

+

One optional module chosen from the list:

- Data science [CM3005]
- Machine learning and neural networks [CM3015]
- Artificial intelligence [CM3020]
- Virtual reality [CM3025]
- Games development [CM3030]
- Physical computing and internet of things [CM3040]
- Natural language processing [CM3060]
- Intelligent signal processing [CM3065]

+

One 30 credit project:

- Final project [CM3070]

BSc Computer Science (Physical Computing and the Internet of Things)

Level 4

One core module:

- Introduction to programming I [CM1005]

+

Seven compulsory modules:

- Introduction to programming II [CM1010]
- Computational mathematics [CM1015]
- Discrete mathematics [CM1020]
- Fundamentals of computer science [CM1025]
- How computers work [CM1030]
- Algorithms and data structures I [CM1035]
- Web development [CM1040]

Level 5

Eight compulsory modules:

- Object oriented programming [CM2005]
- Software design and development [CM2010]
- Programming with data [CM2015]
- Agile software projects [CM2020]
- Computer security [CM2025]
- Graphics programming [CM2030]
- Algorithms and data structures II [CM2035]
- Databases, networks and the web [CM2040]

Level 6

Five specialist core modules:

- Databases and advanced data techniques [CM3010]
- Advanced web development [CM3035]
- Physical computing and internet of things [CM3040]

- Interaction design [CM3055]
- Intelligent signal processing [CM3065]

+

One optional module chosen from the list:

- Data science [CM3005]
- Machine learning and neural networks [CM3015]
- Artificial intelligence [CM3020]
- Virtual reality [CM3025]
- Games development [CM3030]
- 3D graphics and animation [CM3045]
- Mobile development [CM3050]
- Natural language processing [CM3060]

+

One 30 credit project:

- Final project [CM3070]

BSc Computer Science (Games Development)

Level 4

One core module:

- Introduction to programming I [CM1005]

+

Seven compulsory modules:

- Introduction to programming II [CM1010]
- Computational mathematics [CM1015]
- Discrete mathematics [CM1020]
- Fundamentals of computer science [CM1025]
- How computers work [CM1030]
- Algorithms and data structures I [CM1035]
- Web development [CM1040]

Level 5

Eight compulsory modules:

- Object oriented programming [CM2005]
- Software design and development [CM2010]

- Programming with data [CM2015]
- Agile software projects [CM2020]
- Computer security [CM2025]
- Graphics programming [CM2030]
- Algorithms and data structures II [CM2035]
- Databases, networks and the web [CM2040]

Level 6

Five specialist core modules:

- Artificial intelligence [CM3020]
- Virtual reality [CM3025]
- Games development [CM3030]
- 3D graphics and animation [CM3045]
- Interaction design [CM3055]

+

One optional module chosen from the list:

- Data science [CM3005]
- Databases and advanced data techniques [CM3010]
- Machine learning and neural networks [CM3015]
- Advanced web development [CM3035]
- Physical computing and internet of things [CM3040]
- Mobile development [CM3050]
- Natural language processing [CM3060]
- Intelligent signal processing [CM3065]

+

One 30 credit project:

- Final project [CM3070]

BSc Computer Science (Virtual Reality)

Level 4

One core module:

- Introduction to programming I [CM1005]

+

Seven compulsory modules:

- Introduction to programming II [CM1010]
- Computational mathematics [CM1015]
- Discrete mathematics [CM1020]
- Fundamentals of computer science [CM1025]
- How computers work [CM1030]
- Algorithms and data structures I [CM1035]
- Web development [CM1040]

Level 5

Eight compulsory modules:

- Object oriented programming [CM2005]
- Software design and development [CM2010]
- Programming with data [CM2015]
- Agile software projects [CM2020]
- Computer security [CM2025]
- Graphics programming [CM2030]
- Algorithms and data structures II [CM2035]
- Databases, networks and the web [CM2040]

Level 6

Five specialist core modules:

- Virtual reality [CM3025]
- Games development [CM3030]
- 3D graphics and animation [CM3045]
- Mobile development [CM3050]
- Interaction design [CM3055]

+

One optional module chosen from the list:

- Data science [CM3005]
- Databases and advanced data techniques [CM3010]
- Machine learning and neural networks [CM3015]
- Artificial intelligence [CM3020]
- Advanced web development [CM3035]
- Physical computing and internet of things [CM3040]
- Natural language processing [CM3060]
- Intelligent signal processing [CM3065]

+

One 30 credit project:

- Final project [CM3070]

Graduate Diploma in Data Science

Three core modules:

- Programming with Data [CM2015]
- Data Science [CM3005]
- Machine Learning and Neural Networks [CM3015]

+

Three compulsory modules:

- Databases and Advanced Data Techniques [CM3010]
- Advanced Web Development [CM3035]
- Natural Language Processing [CM3060]

+

One 30 credit project:

- Final Project [CM3070]

Graduate Diploma in Machine Learning and Artificial Intelligence

Three core modules:

- Programming with Data [CM2015]
- Machine Learning and Neural Networks [CM3015]
- Artificial Intelligence [CM3020]

+

Three compulsory modules:

- Data Bases and Advanced Data Techniques [CM3010]

- Natural Language Processing [CM3060]
- Intelligent Signal Processing [CM3065]

+

One 30 credit project:

- Final Project [CM3070]

Graduate Diploma in User Experience

Three core modules:

- Agile Software Projects [CM2020]
- Mobile Development [CM3050]
- Interaction Design [CM3055]

+

Three compulsory modules:

- Advanced Web Development [CM3035]
- Virtual Reality [CM3025]
- Physical Computing and internet of things [CM3040]

+

One 30 credit project:

- Final Project [CM3070]

Graduate Diploma in Web Development

Three core modules:

- Databases, Networks and the Web [CM2040]
- Databases and Advanced Techniques [CM3010]
- Advanced Web Development [CM3035]

+

Three compulsory modules:

- Interaction Design [CM3055]
- Agile Software Projects [CM2020]
- Mobile Development [CM3050]

+

One 30 credit project:

- Final Project [CM3070]

Graduate Diploma in Mobile Development

Three core modules:

- Object-Oriented Programming (Level 5) [CM2005]
- Databases and Advanced Data Techniques [CM3010]
- Mobile Development [CM3050]

+

Three compulsory modules:

- Advanced Web Development [CM3035]
- 3D Graphics and Animation [CM3045]
- Interaction Design [CM3055]

+

- A Final Project [CM3070]

Graduate Diploma in Physical Computing and the Internet of Things

Three core modules:

- Databases, Networks and the Web [CM2040]
- Physical Computing and internet of things [CM3040]
- Intelligent Signal Processing [CM3065]

+

Three compulsory modules:

- Advanced Web Development [CM3035]
- Databases and Advanced Data Techniques [CM3010]
- Interaction Design [CM3055]

+

One 30 credit project:

- Final Project [CM3070]

Graduate Diploma in Games Development

Three core modules:

- Object Oriented Programming [CM2005]
- Games Development [CM3030]
- 3D Graphics and Animation [CM3045]

+

Three compulsory modules:

- Artificial Intelligence [CM3020]
- Virtual Reality [CM3025]
- Interaction Design [CM3055]

+

One 30 credit project:

- Final Project [CM3070]

Graduate Diploma in Virtual Reality

Three core modules:

- Graphics Programming [CM2030]
- Virtual Reality [CM3025]
- 3D Graphics and Animation [CM3045]

+

Three compulsory modules:

- Interaction Design [CM3055]
- Games Development [CM3030]
- Mobile Development [CM3050]

+

One 30 credit project:

- Final Project [CM3070]

Graduate Certificate in Data Science

Three core modules:

- Programming with Data [CM2015]
- Data Science [CM3005]
- Machine Learning and Neural Networks [CM3015]

+

One compulsory module:

- Databases and Advanced Data Techniques [CM3010]

Graduate Certificate in Machine Learning and Artificial Intelligence

Three core modules:

- Programming with Data [CM2015]

- Machine Learning and Neural Networks [CM3015]
- Artificial Intelligence [CM3020]

+

One compulsory module:

- Data Bases and Advanced Data Techniques [CM3010]

Graduate Certificate in User Experience

Three core modules:

- Agile Software Projects [CM2020]
- Mobile Development [CM3050]
- Interaction Design [CM3055]

+

One compulsory module:

- Advanced Web Development [CM3035]

Graduate Certificate in Web Development

Three core modules:

- Databases, Networks and the Web (Level 5) [CM2040]
- Databases and Advanced Techniques [CM3010]
- Advanced Web Development [CM3035]

+

One compulsory module:

- Interaction Design [CM3055]

Graduate Certificate in Mobile Development

Three core modules:

- Object-Oriented Programming [CM2005]
- Databases and Advanced Data Techniques [CM3010]
- Mobile Development [CM3050]

+

One compulsory module:

- Advanced Web Development [CM3035]

Graduate Certificate in Physical Computing and the Internet of Things

Three core modules:

- Databases, Networks and the Web [CM2040]
- Physical Computing and internet of things [CM3040]
- Intelligent Signal Processing [CM3065]

+

One compulsory module:

- Advanced Web Development [CM3035]

Graduate Certificate in Games Development

Three core modules:

- Object Oriented Programming [CM2005]
- Games Development [CM3030]
- 3D Graphics and Animation [CM3045]

+

One compulsory module:

- Artificial Intelligence [CM3020]

Graduate Certificate in Virtual Reality

Three core modules:

- Graphics Programming [CM2030]
- Virtual Reality [CM3025]
- 3D Graphics and Animation [CM3045]

+

One compulsory module:

- Interaction Design [CM3055]

Appendix B – Module Outlines

Topics covered in each module may be revised to ensure currency and relevance. Students will be advised of any changes in advance of their study. See module descriptors under the Structure tab on the website for further information and any updates.

The BSc Computer Science suite is a new programme. In these regulations, some modules yet to be taught for the first time, do not contain a list of topics covered. As those modules are launched, future iterations of these regulations will include those topic lists.

Level 4

Introduction to programming I [CM1005]

This module is focused on basic programming techniques. By taking this module, you will learn how to use the basic elements of computer programming such as variables, conditionals, functions and loops. You will also learn how to create interactive, graphical computer programs. You will also be introduced to basic object-oriented programming techniques.

Topics covered:

- Your development environment
- Drawing in 2D
- Variables, objects and interaction
- Conditional and variable types
- For loops and arrays
- Advanced arrays and iteration
- User defined functions and scope
- Data structures and searches
- Extending objects
- Constructor functions

Assessment: Coursework only (Type II)

Introduction to programming II [CM1010]

This module is focused on adding to the basic programming skill set you developed in Introduction to Programming I and giving you experience working with existing code and third-party libraries. By taking this module, you will learn how to customise existing code, to implement basic object orientation and to work with a range of third-party libraries.

Topics covered:

- Object orientation in practice
- Introducing case study – drawing App
- Introducing case study – music Visualizer
- Introducing case study – data Visualisation

- Extending the case studies – part 1
- Extending the case studies – part 2
- Extending the case studies – part 3
- Asynchronous programming
- Testing for stability and performance
- Completing your project

Assessment: Coursework only (Type III)

Computational mathematics [CM1015]

This module helps you hone your skills in thinking abstractly. It also introduces you to many of the standard continuous models used to help understand and design computational systems. Through this module, you will develop the fundamental computational mathematical tools that will support you throughout the BSc programme. Particular attention is paid to notions of experimentation, reasoning, and generalisation. By taking this module, you will learn a wide range of the computational mathematical concepts and techniques that underpin Computer Science. In particular, you will study number systems, special functions, graphing and linear algebra.

Topics covered:

- Number bases
- Sequences and series
- Modular arithmetic
- Angles, triangles and trigonometry
- Graph sketching and kinematics
- Trigonometric functions
- Exponential and logarithmic functions
- Calculus: limits and differentiation
- Algebra: vectors, matrices and linear transformations
- Combinatorics and probability

Assessment: One two hour unseen written examination and coursework (Type I)

Discrete mathematics [CM1020]

This module helps you to hone your skills in thinking abstractly. It also introduces you to many of the standard discrete models used to help understand and design computational systems. Through this module, you will develop the fundamental discrete mathematical tools that will support you throughout the BSc programme. Particular attention is paid to notions of experimentation, reasoning, and generalisation.

Topics covered:

- Sets
- Functions

- Propositional logic
- Predicate logic
- Boolean algebra
- Induction and recursion
- Graphs
- Trees
- Relations
- Combinatorics

Assessment: One two hour unseen written examination and coursework (Type I)

Fundamentals of computer science [CM1025]

By taking this module, you will gain a broad understanding of many of the key topic areas in computer science and the fundamental concepts that underpin them. In the area of fundamental concepts, you will study binary representations and logic, complexity theory and theories of computation, finite state machines and Turing machines. Building on this, you will then study key areas of interest in computer science including databases, artificial intelligence, and machine learning. These will be presented in the light of practical examples to illustrate how they are implemented in modern computer systems.

Topics covered:

- Logic
- Proof techniques
- Basic combinatorial principles
- Automata theory
- Regular languages
- Context-free languages
- Turing machines
- Algorithms 1
- Algorithms 2
- Complexity theory

Assessment: One two hour unseen written examination and coursework (Type I)

How computers work [CM1030]

This module aims to help you understand, and to interact with, computer systems. You will learn how to use knowledge about computational processes to analyse and explain the behaviour of computer systems. The module will use the concept of a Notional Machine, an abstract representation of the functioning of a computer system, to help you to reason about computer systems and to predict their behaviour. You will also learn about typical computer system architectures, basic networking and network services such as databases.

Topics covered:

- How a computer works
- How the web works
- Data representation
- Computer architecture
- Operating systems
- Operating system processes
- Networks
- The internet
- Machine learning
- Data science

Assessment: One two hour unseen written examination and coursework (Type I)

Algorithms and data structures I [CM1035]

This module aims to help you to develop your analytical and problem-solving skills, particularly concerning thinking algorithmically. The module will encourage you to start thinking about how to use computers to solve problems. You will develop skills in thinking algorithmically and learn the central concepts of algorithms and data structures. You will learn about linear data structures such as arrays, vectors and lists, and a unifying framework for considering such data structures as collections. You will learn how algorithms can be expressed as flowcharts and pseudocode, and how to convert these expressions into running programs. You will learn specific algorithms used for sorting and searching, and how to express repetition as iteration and recursion. You will learn a simple model for execution of computation, and how to describe computational problems and their solutions. The model will allow you to compare algorithms regarding their correctness and regarding their efficiency.

Topics covered:

- Problems, algorithms and flowcharts
- Pseudocode
- Vectors, stacks and queues
- Data structures and searching
- Sorting data 1
- What makes a good algorithm?
- Searching data 2
- Recursion
- Sorting data 2
- Computational complexity

Assessment: One two hour unseen written examination and coursework (Type I)

Web development [CM1040]

This module aims to provide you with a foundational web development skill set. You will learn the critical languages of the web: HTML, CSS and JavaScript. Using HTML and CSS, you will learn how to markup, layout and style web content. You will learn about the document object model and how you can dynamically manipulate it with JavaScript to create interactive web pages. You will consider accessibility and usability issues, and how you can overcome them. You will learn about website deployment and how you can use it to make your websites accessible to other people. The module will also enable you to present your work online in the form of a website.

Topics covered:

- Introduction to the web
- Designing web sites
- Introduction to HTML
- Introduction to CSS
- Positioning in CSS
- Responsive web sites
- Introduction to JavaScript for the web
- React to the user
- JavaScript libraries
- Web hosting & professional practices

Assessment: Coursework only (Type III)

Level 5

Object oriented programming [CM2005]

This module aims to provide you with an object-oriented programming skill set. You will learn what objects and classes are and how to write your classes. You will see how objects can interact with each other, including defining and implementing interfaces to control the interaction. You will learn how to use inheritance to inherit and extend functionality from parent classes. You will learn how to write code according to style guidelines and how to write formal code documentation..

Topics covered:

- Text I/O and functions
- Using classes and variables to model data
- File I/O, exception handling and algorithms
- Writing and testing an algorithm
- Object interactions
- Libraries, toolkits, frameworks and widgets
- Event driven programming and inheritance
- Refactoring and class design

- Initialiser lists, constructors and threads
- Advanced class and user interfaces

Assessment: Coursework only (Type II)

Software design and development [CM2010]

This module aims to advance your software development skills so that you can write more robust and complicated programs. You will learn how to use a range of programming techniques that will allow you to deal with unwanted or unexpected events that might happen when your application is running. You will use defensive coding to check data before processing it, and exception handling to gracefully manage unforeseen or unwanted occurrences. You will learn how to discuss program structure concerning cohesion (how to meaningfully organise code into modules) and coupling (how to define the interactions between different parts of the program). You will learn about test-driven development, where you write tests for your code, and write the code itself, in parallel. You will also learn how to use software versioning tools to manage a software project as it develops.

Assessment: One two hour unseen written examination and coursework (Type I)

Programming with data [CM2015]

This module will show you how to work with data: getting data from a variety of sources, visualising data in compelling, informative ways, processing data to make it useful and shareable, and reasoning with data to test hypotheses and make parameterised predictions. The module will also introduce you to a new language and programming environment that is well-adapted to languages for these applications.

Assessment: One two hour unseen written examination and coursework (Type I)

Agile software projects [CM2020]

This module aims to provide insights and practice in software development using contemporary methods to produce software that meets the needs of users and supports an organisation's business function. The module will enable you to gain competence in the conceptualisation of a technology-based solution to a real-world problem, fulfilling the requirements of users and taking constraints imposed by the prevailing and foreseen market conditions and lessons learned from prototypes into account. You will then be given the opportunity to present a proposal for a technical project including a structured plan for implementing the solution using the agile development methodology and test driven development practices. During the whole process from concept to solution presentation, you will be required to work in a distributed team using online collaboration, project tracking and version control tools.

Assessment: Coursework only (Type III)

Computer security [CM2025]

This module aims to provide you with an understanding of the need for computer security and the technologies that support it. It has both a theoretical component that will teach you mathematical underpinnings of security systems and a practical element that will help you discover the pitfalls of security design and to comprehend the mathematics underlying the protocols by programming small examples.

Assessment: One two hour unseen written examination and coursework (Type I)

Graphics programming [CM2030]

This module aims to show you how to work with images in a variety of ways. You will learn how to synthesise graphics and how to process visual signals. You will learn about the mathematical ideas that underpin digital representations of graphics; how digital media files represent graphics, and how to handle and manipulate them; and the basics of working with simulated physics and 3D graphics.

Topics covered:

- 2D graphics
- Physics part 1
- Physics part 2
- Generative art part 1
- Generative art part 2
- Procedural content generation for games
- 3D graphics
- Colours and images
- Image processing
- Computer vision

Assessment: Coursework only (Type II)

Algorithms and data structures II [CM2035]

This module aims to provide you with detailed knowledge of several common algorithms and data structures. You will improve your understanding of searching and sorting and learn new algorithms to solve new problems. You will learn about a range of data structures such as trees, heaps, sets, maps, stacks, queues and graphs. You will learn how to evaluate and describe the performance of algorithms using big-O notation. You will learn: how to choose appropriate data structures for representing problems, how to define and implement algorithms for manipulating them, and how to analyse the correctness and efficiency of algorithms.

You will be expected to have mastered the material in Algorithms and Data Structures I before attempting this module.

Topics covered:

- Analysis of algorithms
- Recursive algorithms
- Comparison sorting algorithms
- Non-comparison sorting algorithms
- Hashing
- Linked lists, stacks and queues
- Linear data structures
- Trees
- Heaps

- Graphs

Assessment: One two hour unseen written examination and coursework (Type I)

Databases, networks and the web [CM2040]

In this module, you will learn theory and practical skills focused on the modern web, internet and client-server applications. You will learn about relational database systems, mainly from a development perspective, emphasising issues related to data modelling and database implementation in SQL. You will learn how to model data in a database, retrieve data from the database and provide access to data through dynamic websites. In particular, you will learn about the Relational Model, Query processing, and socket architectures to enable communication.

Topics covered:

- Three-tier web application
- Building simple web servers
- Generating web pages from data using templates
- Handling forms to input data
- Representing data in databases, relational databases
- Basic database operations, providing access to databases from middleware
- Building a dynamic web application
- Database schema, ERD
- Querying a database (advanced)
- Networking concepts

Assessment: One two hour unseen written examination and coursework (Type I)

Level 6

Data science [CM3005]

By taking this module, you will gain a data science skillset. With these skills, you will be able to write computer programs that can read, process and analyse textual and numerical data. You will be able to generate plots and interactive visualisations of data. You will understand how to apply statistical methods to the interpretation of results. You will be able to use data analysis in the decision-making process. You will also learn about a range of application domains for data science.

Assessment: One two hour unseen written examination and coursework (Type I)

Databases and advanced data techniques [CM3010]

This module aims to show you how to work with data in your computer programs. You will learn how to use SQL and NoSQL databases to store tabular data and documents. You will learn about the ethics of gathering and processing data and why it is important to consider issues around data security. You will learn about open data resources, and how you can access them from your computer programs. You will learn about audio and video data, and the challenges of working with this kind of data.

Assessment: One two hour unseen written examination and coursework (Type I)

Machine learning and neural networks [CM3015]

This module provides a broad view of machine learning and neural networks. You will learn how to solve common machine learning problems such as regression, classification, clustering, matrix completion and pattern recognition. You will learn about neural networks and how they can be trained and optimised, including an exploration of deep neural networks. You will learn about machine learning and neural network software libraries that allow you to develop machine learning systems rapidly, and you will learn how to verify and evaluate the results.

Assessment: Coursework only (Type II)

Artificial intelligence [CM3020]

This module is focused on Artificial Intelligence techniques. You will understand the historical development of Artificial Intelligence including search, vision and planning. You will become familiar with the foundations of agent-based approaches to software design, decision making and problem solving including under uncertainty. You will have an opportunity to apply Artificial Intelligence techniques to particular problems such as game playing and decision making.

Assessment: One two hour unseen written examination and coursework (Type I)

Virtual reality [CM3025]

The module will combine the theory and psychology of VR with practical development skills. You will learn the skills needed to design compelling VR environments and the skills that apply to creative practice, science and industry.

This module aims to give you the skills needed to develop VR. These skills include understanding the basic theory of presence in VR, which underlies the basic design principles. You will also learn practical development skills, using an appropriate 3D engine to create interactive virtual environments. These skills will include creating 3D environments, designing and implementing 3D interaction for VR and building social VR experiences with interactive virtual characters.

Assessment: Coursework only (Type III)

Games development [CM3030]

This module will introduce you to i) industry standard tools for game development, such as game engines, and ii) the process of game development, including prototyping and playtesting. You will undertake a short series of game development projects, each lasting a set number of weeks and with a specific brief. For each project, you will propose a game that fits the brief, and then you will implement it. You are expected to deliver the proposed game and document it thoroughly. Through this process, you will develop an awareness of intended audience and the use of media for documentation.

Contemporary video game production draws on a range of techniques from artificial intelligence (AI) to perform tasks such as controlling virtual agents and generating novel game content. This module will also introduce crucial game AI concepts. Compared to mainstream AI, the emphasis is less on optimal problem solving and more on entertaining the player with limited computational resources. This module gives students practical experience of programming game AI systems and an understanding of the relevant theory.

Assessment: Coursework only (Type III)

Advanced web development [CM3035]

Through this module, you will learn how to build dynamic, data-driven websites using databases, front-end frameworks and server-side programming. This module provides the skill set required to do full stack web development work. By studying this module, you will develop a web developer skill set that enables you to understand how to build and deploy complete, data-driven websites. You will consider several different technologies for client side-web development such as HTML, CSS, JavaScript and templates. You will explore methods for developing server-side web applications, by building web-accessible wrappers around databases. You will consider issues of scalability, and learn about web application configuration and deployment.

Assessment: Coursework only (Type II)

Physical computing and the internet of things [CM3040]

This course provides an introduction to the development and programming of hardware devices that can sense and act in the environment. The course will explain and demonstrate how the environment, which is inherently continuous, can be monitored by analogue electrical and mechanical sensors, then captured and analysed using a computer, which is a discrete system. A focus of this course is the interface between the digital and the analogue.

This study encompasses basic physics, electronics, programming and software engineering. The practical objective of this course is the development of the skills needed for designing and building interactive physical devices.

Assessment: Coursework only (Type III)

3D graphics and animation [CM3045]

This module will cover advanced methods used in current state-of-the-art graphics and animation systems. It will include the mathematical foundations, computational techniques and their use in creative practice. By taking this module, you will learn how to write programs that generate animated 3D graphics. There are several distinct study areas: 3D modelling and animation, the graphics pipeline, simulation of physics and shader programming. You will study a range of examples, and through these learn how you can program computer graphics in contemporary graphical software for different applications.

Assessment: One two hour unseen written examination and coursework (Type I)

Mobile development [CM3050]

This module aims to give you the fundamental understanding and skills needed to develop mobile applications. By studying this module, you will learn the principles of effective mobile user interface design and how to design and build user interfaces. You will learn about data-driven mobile applications, and how you can integrate a mobile application to a data source. You will learn about the mobile development ecosystem and how you can develop, run and test your applications. You will learn how to work with various sensors available on mobile devices using built-in APIs. The style of the modules will be practical, with a focus on developing functioning applications.

Assessment: Coursework only (Type III)

Interaction design [CM3055]

When taking this module, you will examine the notion of 'interaction with technology'. You will focus on the concepts behind modern user experience design and production. You will gain a solid grasp and practical experience of the process which allows the creation of interactive systems. This process involves specification, design, prototyping and evaluation. You will examine several design approaches and techniques, and consider how they enable usability engineering. You will learn how

to evaluate interactive systems against criteria such as efficiency and usability. You will examine issues of accessibility from the perspective of different populations.

Assessment: One two hour unseen written examination and coursework (Type I)

Natural language processing [CM3060]

This module will provide you with a grounding in both rule-based and statistical approaches to NLP, and it combines theoretical study with hands-on work employing widely used software packages. The module focuses on text processing, and by taking this module, you will learn about how you can work with text-based natural language in your computer programs. You will learn about grammars and how they can be used to analyse text. You will learn how statistical analysis can be used to extract information from and classify text. You will work in an appropriate programming environment for NLP, using libraries to implement NLP workflows.

Assessment: One two hour unseen written examination and coursework (Type I)

Intelligent signal processing [CM3065]

This module aims to provide you with a broad experience of digital signal processing techniques and applications. You will study how audio and video signals can be captured and processed by a computer program. You will learn about time domain and frequency domain representations and processing. You will learn how you can extract information from audio signals. You will implement movement and face detection systems that work with live camera input.

Assessment: Coursework only (Type II)

Final project [CM3070]

In this module, you will undertake a substantial independent project that will allow you to demonstrate a wide range of skills such as project planning, management, research, software implementation, and written presentation. If you are enrolled on a specialist pathway, either as part of the BSc or a graduate diploma, you will be expected to undertake a project in your specialist area. You will integrate the knowledge gained throughout the programme and use skills acquired in other modules in the implementation of your final project which will be in computer science or your specialist area. The work will consist of a combination of research and software development in various proportions. You will be expected to make use of methodologies from various components of computer science, including your specialist pathway if appropriate.

Assessment: One two hour unseen written examination and coursework

Appendix C – Assessment Criteria

Mark	Descriptor	Specific Marking Criteria
80-100%	I: First (Exceptional)	<ul style="list-style-type: none"> Represents an exceptional achievement beyond the standard requirements of a first class degree. Students' work should demonstrate considerable creative thought and be based on a critical evaluation of prior work. Work is likely to achieve some outcomes that would be expected at a higher level degree.
70-79%	I: First (Excellent)	<ul style="list-style-type: none"> Demonstration of a thorough grasp of relevant concepts, methodology and content appropriate to the subject discipline; indication of originality in application of ideas, in synthesis of material or in implementation; insight reflects depth and confidence of understanding of the material. Students should be able to design and create computer systems that demonstrate original design considerable independent thought and are based on independent learning of prior work and existing technologies. Students should be able to critically evaluate their own work.
60-69%	Ili: Upper Second (Very good)	<ul style="list-style-type: none"> Demonstration of a sound level of understanding based on a competent grasp of relevant concepts, methodology and content; display of skill in interpreting complex material; organisation of material at a high level of competence. Students should be able to demonstrate the ability to independently design, implement and evaluate a high quality and complex computer systems using knowledge from across the programme. Students should be able to effectively evaluate their work using standard methodologies.
50-59%	Ilii: Lower Second (Good)	<ul style="list-style-type: none"> Demonstration of an adequate level of understanding of relevant concepts, methodology and content; display of sufficient skill to tackle some complex problems; appropriate organisation of material. Students should demonstrate the ability to create moderately complex computer software, making use of prior knowledge and material taught within the program. Students should be able to, at least partially, test their work using standard methods.
40-49%	III: Third (Pass)	<ul style="list-style-type: none"> Represents the overall achievement of the appropriate learning outcomes to a threshold level (honours). Demonstration of a limited level of understanding of relevant concepts, methodology and content; clear if limited attempt to tackle problems; display of some skill in organisation of material. Students should demonstrate creation of a basic, complete and working computing system/ program.

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Mark	Descriptor	Specific Marking Criteria
25-39%	Fail	<ul style="list-style-type: none">• Represents an overall failure to achieve the appropriate learning outcomes.
10-24%	Bad fail	<ul style="list-style-type: none">• Represents a significant overall failure to achieve the appropriate learning outcomes.
1-9%	Very bad fail	<ul style="list-style-type: none">• A submission that does not even attempt to address the specified learning outcomes.
0%	Non submission or plagiarised	<ul style="list-style-type: none">• Work was not submitted or it was plagiarised.

Appendix D – Transfers from other University of London and Goldsmiths Programmes

Students registered to either the Computing and Information Systems or Creative Computing programmes are permitted to transfer to BSc Computer Science. If you wish to transfer, you must be within their registration period, and if your registration period has ended, the transfer will not be available to you.

Module transfers will include marks, and those marks will be listed on the BSc Computer Science transcript.

If you apply to transfer credit from the Computing and Information Systems or Creative Computing programmes, you will have the following options, depending on which stage of your studies you are in.

Level 4

Students at any stage of Level 4 can transfer onto the BSc Computer Science programme.

If you have finished all 120 credits at Level 4, you can transfer straight to Level 5.

If you have been awarded fewer than 120 credits, you are required to complete the number of credits of Level 4 on BSc Computer Science to make up to 120 credits altogether. This choice is subject to the following constraints:

- If you have done any of the modules in the first two columns of the Level 4 equivalents table below, you cannot do the modules in the right-hand column of the same row.
- You need to complete either Mathematics for computing [CO1102] (30 credits) or both of Computational mathematics [CM1015] (15 credits) and Discrete mathematics [CM1020] (15 credits).
- You need to complete either Introduction to Java and object-oriented programming [CO1109] or both of Introduction to programming I [CM1005] (15 credits) and Introduction to programming II [CM1010] (15 credits).

Level 4 Module Equivalents		
Computing and Information Systems	Creative Computing	Computer Science
Mathematics for computing [CO1102] (30 credits)	Mathematics for computing [CO1102] (30 credits)	Computational mathematics [CM1015] (15 credits) Discrete mathematics [CM1020] (15 credits)
Introduction to Java and object-oriented programming [CO1109] (30 credits)	Introduction to Java and object-oriented programming [CO1109] (30 credits)	Introduction to programming I [CM1005] (15 credits) Introduction to programming II [CM1010] (15 credits)

Level 4 Module Equivalents		
Computing and Information Systems	Creative Computing	Computer Science
Introduction to computing and the internet [CO1110] (30 credits)	Introduction to computing and the internet [CO1110] (30 credits)	How computers work [CM1030] (15 credits) Fundamentals of computer science [CM1025] (15 credits)
Information systems: foundations of e-business [CO1108] (30 credits)		
	Creative computing I: image, sound and motion [CO1112] (30 credits)	
		Algorithms and data structures I [CM1035] (15 credits)
		Web development [CM1040] (15 credits)

Level 5

Students studying Level 5 modules are permitted to transfer all of their Level 4 modules, plus, a maximum of two Level 5 modules (60 credits total).

For the remaining Level 5 Computer Science modules, if you have studied any of the modules in the first two columns of the Level 5 equivalents table below, you cannot do the modules in the right-hand column of the same row.

Level 5 Module Equivalents		
Computing and Information Systems	Creative Computing	Computer Science
Database systems [CO2209] [30 credits]	Database systems [CO2209] [30 credits]	Databases, networks and the web [CM2040] [15 credits] Computer security [CM2025] [15 credits]
Graphical object-oriented and internet programming in Java [CO2220] [30 credits]	Graphical object-oriented and internet programming in Java [CO2220] [30 credits]	Object oriented programming [CM2005] [15 credits] Software design and development [CM2010] [15 credits]

Level 5 Module Equivalents		
Computing and Information Systems	Creative Computing	Computer Science
Software engineering, algorithm design and analysis [CO2226] [30 credits]	Software engineering, algorithm design and analysis [CO2226] [30 credits]	Agile software projects [CM2020] [15 credits] Algorithms and data structures II [CM2035] [15 credits]
Data communications and enterprise networking [CO2222] [30 credits]		
	Creative computing II: interactive multimedia [CO2227] [30 credits]	
		Programming with data [CM2015] [15 credits]
		Graphics programming [CM2030] [15 credits]