UNIVERSITY OF LIVERPOOL

Computer Science with a Year in Industry MEng

COURSE DETAILS

- A level requirements: A*AA
- UCAS code: G404
- Study mode: Full-time
- Length: 5 years

KEY DATES

- Apply by: 31 January 2024
- Starts: 23 September 2024

Course overview

From the underlying principles to the very edge of modern technology, this programme will cover all aspects of Computer Science and ensure that when you graduate you will know exactly what is and isn't possible with computers.

INTRODUCTION

Study Computer Science at Liverpool and develop a deep understanding of the technology that underpins much of modern life and society. Computer Science is a great choice for those with a keen interest in computers, software and technology. You'll create functional applications as well as how to consistently iterate and improve your work.

After learning core theory you can choose to maintain a balanced mixture of modules throughout your degree or opt to follow a specialist pathway in artificial intelligence, algorithms and optimisation or data science.

This integrated master's programme offers the same specialism pathways as Computer Science BSc (Hons). You will not only develop a good 'all-round' understanding of the academic discipline of computer science, you will also go on to develop a much deeper and systematic specialisation in topics at the forefront of current research.

In the first two years you will cover programming, computer systems, databases, software engineering, algorithmic foundations, complexity of algorithms & decision and computation & language. You will then spend a year on industrial placement acquiring experience and awareness of practical business and industrial environments.

After you've covered the core elements, we give you the flexibility to tailor your own learning to your own interests, offering specialisms in in artificial intelligence, algorithms and

optimisation, data science, and software development.

WHAT YOU'LL LEARN

- Programming in Java
- Understanding different computer systems
- Building and structuring databases
- Fundamentals of software engineering
- Algorithmic foundations
- Complexity of algorithms and decision
- Computation and language
- Uses and possibilities of biocomputation
- Introduction of Computation Game Theory
- Complex social networks
- Experience and awareness of professional environments

ACCREDITATION

Accredited by BCS, so opens up a wide variety of career opportunities with excellent employment prospects.

Course content

Discover what you'll learn, what you'll study, and how you'll be taught and assessed.

YEAR ONE

In year one you will learn the fundamentals of Computer Science. Starting with an introduction to procedural programming using commonly found language platforms, you'll move on to learn about the importance of hardware and software components within the operation of computer systems, formal analytic techniques and the development of artificial intelligence.

In year one students will typically undertake either COMP101 (Introduction to Programming) or COMP105 (Programming Language Paradigms) based on prior exposure to programming (eg Computer Science A level). Students without a background in computer science will normally study COMP101, however in some instances may be permitted to enrol on COMP105 instead.

All other year one modules are required.

COMPULSORY MODULES

ANALYTIC TECHNIQUES FOR COMPUTER SCIENCE (COMP116)

Credits: 15 / Semester: semester 2

Many areas of Computer Science rely on formal analytic techniques and this module presents a basic grounding in a number of these topics focusing on their role and application to computational issues. Among the topics reviewed are Linear Algebra (with particular attention to Matrix Theory); Statistical aspects; Introductory calculus including the concepts of limits, continuity, basic differentiation and integration formulae; properties of Complex Numbers. If time allows a very brief overview of the principles of Information Theory will be included. The overriding aim of this module is to present the methods discussed in the context of practical Computer Science, and as such the emphasis will be on instilling confidence in applying techniques and not on providing rigorous supporting justifications of their validity.

COMPUTER SYSTEMS (COMP124)

Credits: 15 / Semester: semester 2

This module provides a basic introduction to the important hardware and software components supporting the operation of computer systems. The module presents coverage of how low-level hardware components are organised so as to provide a platform on which complex software systems can be built. Coverage includes the important components of modern operating systems, including abstractions such as processes and concurrency. There is an opportunity to gain some practical awareness of low-level programming and a modern command-line environment.

DATA STRUCTURES AND ALGORITHMS (COMP108)

Credits: 15 / Semester: semester 2

This module introduces students to some basic algorithms and data structures. It gives some fundamental concepts of design and analysis of algorithms, and implementation of algorithms by choosing appropriate data structures.

DESIGNING SYSTEMS FOR THE DIGITAL SOCIETY (COMP107)

Credits: 15 / Semester: semester 1

This module will provide students with an all rounded appraisal of what is expected from a computing professional in the current digital society. Students will be introduced to social, legal and ethical aspects on computing and will develop employability skills. As a way to blend both theory and practice, students will be equipped with concepts and techniques for designing digital systems tailored to the needs of the user.

FOUNDATIONS OF COMPUTER SCIENCE (COMP109)

Credits: 15 / Semester: semester 1

This module provides students with the mathematical foundation, mathematical tools and basic proof techniques necessary for the study of Computer Science and develops the study skills necessary to learn new concepts in this area.

INTRODUCTION TO ARTIFICIAL INTELLIGENCE (COMP111)

Credits: 15 / Semester: semester 1

Artificial intelligence (AI) is the theory and development of machines able to perform tasks normally requiring human intelligence, such as visual perception, speech recognition, decision-making, and translation between languages. In the 21st century, AI techniques became an essential part of the technology industry. High-profile examples include autonomous vehicles, medical diagnosis, creating art, proving mathematical theorems, playing games, search engines, and online assistants. This module provides an application driven introduction to AI through studying the basic problems most AI systems have to deal with: search problems, reasoning under uncertainty, knowledge representation, planning, and learning in intelligent systems. The module will also provide a basic introduction to the history and philosophy of AI as well as recent issues in ethics of AI.

OBJECT-ORIENTED PROGRAMMING (COMP122)

Credits: 15 / Semester: semester 2

The intention of COMP122 is to introduce students to the concepts and methodology of object-oriented programming using the Java programming language. Topics covered include hierarchical structures, polymorphism, collections and iterators, exception handling, and graphical user interface design. Basic concepts of software design methodology, testing, and version control are also included in the module. It is normally expected that students have prior programming experience.

OPTIONAL MODULES

INTRODUCTION TO PROGRAMMING (COMP101)

Credits: 15 / Semester: semester 1

The module provides an introduction to procedural programming using current language platforms. The module incorporates program design, problem solving, the importance of maintainable, robust software and testing as well as introducing procedural language main programming constructs. Students gain practical experience with program design, programming and testing during weekly laboratory sessions.

PROGRAMMING LANGUAGE PARADIGMS (COMP105)

Credits: 15 / Semester: semester 1

This module is for students that already have some programming skills. Students will learn about the two main programming paradigms: imperative programming and functional programming. Since most introductory programming courses teach imperative programming, this module will focus on the functional paradigm. Students will learn how to program in Haskell, a popular functional programming language. They will learn how to formulate programs in a functional way, and the common techniques and idioms that are used to solve problems in functional programming.

Programme details and modules listed are illustrative only and subject to change.

YEAR TWO

In year two you will expand your knowledge of key concepts and skills related to software development and database development. You will also begin to choose which wider elements of computer science you want to engage with such as cyber security, computer-based trading in financial markets and principles of computer game design.

You will take the compulsory modules listed, in addition to selected optional modules. Depending on your choice of optional modules you will be able to graduate with one of the following degrees:

- Computer Science MEng
- Computer Science with Artificial Intelligence MEng
- Computer Science with Algorithms and Optimisation MEng
- Computer Science with Data Sciences MEng

COMPULSORY MODULES

COMPLEXITY OF ALGORITHMS (COMP202)

Credits: 15 / Semester: semester 2

This module studies techniques, such as dynamic programming and recursion, used for the design and analysis of algorithms and data structures. Some fundamental algorithmic problems are studied, such as searching, sorting and network flows and efficient algorithms for such problems. The emphasis of this module is on problem solving using efficient algorithms together with their formal analysis and implementation, thus enhancing the students' toolbox for efficient programming.

DATABASE DEVELOPMENT (COMP207)

Credits: 15 / Semester: semester 1

This module introduces students to the problems arising from databases, including concurrency in databases, information security considerations and how they are solved; the integration of heterogeneous sources of information and the use of semi-structured data; non-relational databases and the economic factors involved in their selection and to techniques for analysing large amounts of data, the security issues and commercial factors involved with them.

GROUP SOFTWARE PROJECT (COMP208)

Credits: 15 / Semester: semester 2

Software development skills form a fundamental part of the professional expertise of a Computer Scientist. Often the development is a team activity. The module provides the students with the unique opportunity to complete a sizeable software development project working as part of team.

SOFTWARE ENGINEERING I (COMP201)

Credits: 15 / Semester: semester 1

This module deals with the issues associated with the analysis, design, implementation and testing of significant computing systems (that is, systems that are too large to be designed and developed by a single person).

PLANNING YOUR CAREER (COMP221)

Credits: 7.5 / Semester: semester 1

This module aims to provide a more in depth experience of crucial employability skills needed to secure either a placement or a graduate job.

OPTIONAL MODULES

ADVANCED ARTIFICIAL INTELLIGENCE (COMP219)

Credits: 15 / Semester: semester 1

This module will provide students with an introduction to the machine learning. It will contain traditional machine learning algorithms, deep learning algorithms, and probabilistic graphical models. Both theoretical knowledge and practical skills will be offered.

COMPUTER NETWORKS (COMP211)

Credits: 15 / Semester: semester 1

This module provides an introduction to current computer networks and communications technologies. We will use the architecture and protocols of the Internet as a primary vehicle for studying fundamental computer networking concepts. This will include an in-depth study of the key protocols that enable communications accross the Internet. You will become familiar with the various network devices and network addressing schemes. We will identify critical network security issues and study approaches towards addressing these issues.

INTRODUCTION TO THEORY OF COMPUTATION (COMP218)

Credits: 15 / Semester: semester 1

This module aims to introduce formal concepts of automata, grammars and languages; to introduce ideas of computability and decidability, and to illustrate the importance of automata, formal language theory and general models of computation in Computer Science and Artificial Intelligence.

INTRODUCTION TO DATA SCIENCE (COMP229)

Credits: 15 / Semester: semester 1

This module provides a thorough introduction to the new subject of Data Science starting from the fundamental mathematical methods and developing real-life applications in several areas including Pattern Recognition, Materials Science, Computer Vision, Climate Analysis. The basic concepts from Linear Algebra and Metric Geometry will be gradually introduced without assuming any prior knowledge. The methods and algorithms from Graph Theory and Computational Geometry will be illustrated by worked examples and short programs/scripts.

APP DEVELOPMENT (COMP228)

Credits: 15 / Semester: semester 1

App Development is an exploration of the design and programming of application programs on mobile devices. It covers topics such as how to design for small displays and non-traditional input devices; what the expectations of mobile users are; how to use publicallly accessible data sources to develop innovative solutions.

DISTRIBUTED SYSTEMS (COMP212)

Credits: 15 / Semester: semester 2

This module covers the concepts of distributed systems and the underlying principles of distributed computing and discusses the issues and various solutions proposed in the distributed computing community. Specifically, communication and broadcast, election algorithms, synchronization and concurrency, fault-tolerance and security related issues will be discussed in the lectures. Where applicable practical implementations of the concepts will be introduced.

SOFTWARE DEVELOPMENT TOOLS (COMP220)

Credits: 15 / Semester: semester 2

This module covers the skills and knowledge required for the effective use of tools in the software development lifecycle.

PRINCIPLES OF COMPUTER GAMES DESIGN AND IMPLEMENTATION (COMP222)

Credits: 15 / Semester: semester 2

This module introduces topics commonly present in the modern computer games from software architecture principles to advanced artificial intelligence techniques to the creation of 3D content. As part of the continuous assessment, students create a simple 3D video game using an existing game engine and an AI control procedure for a multiuser framework.

COMPUTER-BASED TRADING IN FINANCIAL MARKETS (COMP226)

Credits: 15 / Semester: semester 2

The last few decades has seen a huge transformation in finance, where human traders have been increasingly replaced by algorithms. The aims of COMP226 are to:

– Provide an understanding of financial markets at the level of individual trades;
– Provide an overview of computer-based trading applications;
– Introduce key issues with the use of market data;
– Develop a practical understanding of the development of algorithmic trading strategies.

CYBER SECURITY (COMP232)

Credits: 15 / Semester: semester 2

The module provides a thorough introduction to the area of Cyber Security, including cryptographic algorithms and protocols, systems vulnerabilities and attacks, computer networks and web security. The main basic concepts and theoretical foundations are presented in the lectures, while extensive practical sessions support the development of skills in practical cybersecurity.

PRINCIPLES OF C AND MEMORY MANAGEMENT (COMP281)

Credits: 7.5 / Semester: semester 2

When dealing with computationally intensive tasks, such as in scientific computing, it is important to make the most out of the available computational resources. In order to accomplish this, one can use low-level programming languages, such as assembly, but the downside is that these are difficult to write, port and maintain. Alternatively, one can pick a high-level language with a small computational overhead. This module will teach how to program in one such a language: the C programming language.

THE C++ PROGRAMMING LANGUAGE (COMP282)

Credits: 7.5 / Semester: semester 2

This module looks at the ways in which the C programming language can be extended to incorporate object oriented principles, by looking at C++. The module also examines the ways in which object orientation offers a natural means of developing graphical, event-driven applications within a powerful IDE.

SCRIPTING LANGUAGES (COMP284)

Credits: 7.5 / Semester: semester 2

COMP284 `Scripting Languages' is one of several technical skills/employability skills modules offered in the second semester of the second year of study. It addresses both the demand by employers and the desire of students that students should encounter a range of programming languages during their studies and should be able to use these programming languages productively. Scripting languages have gained enormously in their popularity with the expansion and development of the world wide wide and world wide web technologies as they are now the predominant languages used in the development of web applications. The module will cover two scripting languages, namely, JavaScript and PHP. At the end of the module students should be able to develop applications, both web-based and computer-based, in them.

COMPUTER AIDED SOFTWARE DEVELOPMENT (COMP285)

Credits: 7.5 / Semester: semester 2

This module covers the theory and practice of the application of tools to the software development lifecyle

Programme details and modules listed are illustrative only and subject to change.

YEAR IN INDUSTRY (YEAR THREE)

Year three of the programme is taken up with a placement in a professional software industry environment.

COMPULSORY MODULES

INDUSTRIAL PLACEMENT Y3 (COMP299)

Credits: 120 / Semester: whole session

The aim of this module is to provide students with working experience within a commercial or industrial environment and to gain an understanding of the various operational aspects of a company, of its products and working practices.

Programme details and modules listed are illustrative only and subject to change.

YEAR FOUR

Year four is where you will start to build on what you've learnt to far with your own research and exploration by undertaking an individual project. Whilst guided, you will work independently to explore a substantial computer science problem in depth, making use of the principles, techniques and methodologies acquired elsewhere in the programme.

You will take the compulsory modules listed, in addition to selected optional modules. Depending on your choice of optional modules you will be able to graduate with one of the following degrees:

- Computer Science MEng
- Computer Science with Artificial Intelligence MEng
- Computer Science with Algorithms and Optimisation MEng
- Computer Science with Data Sciences MEng

COMPULSORY MODULES

HONOURS YEAR COMPUTER SCIENCE PROJECT (COMP390)

Credits: 30 / Semester: whole session

The honours year project gives students the opportunity to study independently on an extended piece of work under the guidance of an academic supervisor. Many diverse projects are available for selection, inspired by the research of the department. Each student is encouraged to propose a project in an area that meets their own personal needs, whether it's related to their career aspirations or simply an interesting academic pursuit. The project consolidates learning from the taught part of the course, with authentic assessment that is designed to encourage communication of complex ideas via a range of media. On completion of the module, students will have the confidence to pursue their career, having developed proficiency in their chosen topic and an ability to communicate clearly and effectively.

OPTIONAL MODULES

BIOCOMPUTATION (COMP305)

Credits: 15 / Semester: semester 1

Biology inspired adaptive algorithms such as Artificial Neural Networks (ANNs) and Genetic Algorithms (GAs) play an important role in modern computing, information processing, and machine learning. The latest increase in computer power ensured broad use of the algorithms to solve problems in science and engineering previously considered impossible to tackle. ANNs are now broadly used in pattern recognition, including speech recognition and classification problems, statistics, functional analysis, modelling financial series with considerable stochasticity, etc. GAs are search procedures based on the mechanics of natural selection and natural genetics. They provide effective solutions to a variety of optimisation problems in economics, linguistics, engineering, and computer science. Both ANNs and GAs can exploit massively parallel architectures to speed up problem solving and provide further understanding of intelligence and adaptation.The main goals of the module are to introduce students to some of the established work in the field of Artificial Neural Networks and Genetic Algorithms and their applications, particularly in relation to multidisciplinary research. To equip students with a broad overview of the field, placing it in a historical and scientific context. The module provides students with the knowledge and skills necessary to keep up-to-date in actively developing areas of science and technology and be able to make reasoned decisions.

COMMUNICATING COMPUTER SCIENCE (COMP335)

Credits: 15 / Semester: whole session

This module spans both semesters in the final year, with a small number of teacher training lectures in the first semester, followed by delivery of a lesson in the second semester as part of the department's outreach activities. Students will consider the issues associated with teaching STEM subjects in schools, and learn how to create a lesson plan that delivers a computer science topic within the context of the National Curriculum in Computing. They will then deliver this lesson several times in a real classroom setting, and reflect on its effectiveness in a written report. There is a significant amount of private study, with the majority of the time spent in the first semester, so students must manage their time effectively.

COMPLEX INFORMATION NETWORKS (COMP324)

Credits: 15 / Semester: semester 2

Complex network structures are ubiquitous: the world-wide web, the internet, mobile phone networks, social communities, network structures in
biology are just a few popular examples. The module shows how simple combinatorial and algorithmic techniques can be exploited to obtain useful information
about these (often) massive structures. The content is delivered through a mixture of lectures on core topics and more informal presentations on
various application areas. A series of interactive tutorials and on-line tools in VITAL complete the support offered by this module.

COMPUTATIONAL GAME THEORY AND MECHANISM DESIGN (COMP326)

Credits: 15 / Semester: semester 2

In this module we introduce and study games that have some underlying network structure or that appear in auctions. A focus will be on scheduling and routing, as well as on the computational aspects in the design of mechanisms and auctions.

EFFICIENT SEQUENTIAL ALGORITHMS (COMP309)

Credits: 15 / Semester: semester 1

This module aims to teach students some advanced topics in the design and analysis of efficient sequential algorithms, and a few key results related to the study of their complexity.

FORMAL METHODS (COMP313)

Credits: 15 / Semester: semester 2

As more complex computational systems are used within critical applications, it is becoming essential that these systems are formally specified. Such specifications are used to give a precise and unambiguous description of the required system. In addition, as computational systems become more complex in general, formal specification can allow us to define the key characteristics of systems in a clear way and so help the development process. Formal specifications provide the basis for verification of properties of systems. While there are a number of ways in which this can be achieved, the model-checking approach is a practical and popular way to verify the temporal properties of finite-state systems. Indeed, such temporal verification is widely used within the design of critical parts of integrated circuits, has recently been used to verify parts of the control mechanism for one of NASA's space probes, and is now beginning to be used to verify general Java programs.

This module will introduce: the principles of standard formal methods, such as Z; the basic notions of temporal logic and its use in relation to reactive systems; the use of model checking techniques in the verification of reactive systems.

IMAGE PROCESSING (ELEC319)

Credits: 7.5 / Semester: semester 1

This module covers the fundamentals of how images are generated, represented, compressed and processed to extract features of interest.

INTRODUCTION TO COMPUTATIONAL GAME THEORY (COMP323)

Credits: 15 / Semester: semester 1

This module is an introduction to the area of algorithmic game theory, which is a novel area in the intersection of economics and computer science. It provides tools for dealing with and analysing problems related to applications motivated by the Internet. Examples involve various Internet auctions and e-commerce systems, like, Google's sponsored search, Ebay auctions, recommendation systems, etc.

KNOWLEDGE REPRESENTATION AND REASONING (COMP304)

Credits: 15 / Semester: semester 1

This module presents formal ways to reason about knowledge and uncertain or partial information.

MULTI-AGENT SYSTEMS (COMP310)

Credits: 15 / Semester: semester 2

Multi-agent systems have emerged as one of the most important areas of research and development in information technology in the 1990s. A multi-agent system is one composed of multiple interacting software components known as agents, which are typically capable of co-operating to solve problems that are beyond the abilities of any individual member. Multi-agent systems are important primarily because they have been found to have very wide applicability, in areas as diverse as industrial process control and electronic commerce. This module will begin by introducing the student to the notion of an agent, and will lead them to an understanding of what an agent is, how they can be constructed, and how agents can be made to co-operate effectively with one another to solve problems.

NEURAL NETWORKS (ELEC320)

Credits: 7.5 / Semester: semester 2

Introduction to neural network theory, applications and artificial intelligence.

ONTOLOGIES AND SEMANTIC WEB (COMP318)

Credits: 15 / Semester: semester 2

This modules provides a basic introduction to the main principles behind representing and retrieving knowledge effectively on the Web. The module covers the evolution from the standard Web to the Semantic Web, and gives student the opportunity to gain an awareness of the main methods and techniques, including practical awareness, of the main issues arising in annotating web pages with semantic information, in interlinking pages with similar semantic content and in effectively querying these pages.

OPTIMISATION (COMP331)

Credits: 15 / Semester: semester 1

This module is an indepth tour over optimisation methods applied for various optimisation models. These methods are extensively used in both academic and industrial practices.

AUTONOMOUS MOBILE ROBOTICS (COMP329)

Credits: 15 / Semester: semester 1

The aims of this module are to develop an understanding of the principals of Robotics and Autonomous Systems, as well as the pragmatic skills of developing such systems on top of a Robotics Platform.

SOFTWARE ENGINEERING II (COMP319)

Credits: 15 / Semester: semester 1

The overall aim of this module is to introduce students to a range of advanced, near-research level topics in contemporary software engineering. The actual choice of topics will depend upon the interests of the lecturer and the topics current in the software engineering research literature at that time. The course will introduce issues from a problem (user-driven) perspective and a technology-driven perspective where users have new categories of software problems that they need to be solved, and where technology producers create technologies that present new opportunities for software products. It will be expected that students will read articles in the software engineering research literature, and will discuss these articles in a seminar-style forum.

COMPUTER FORENSICS (COMP343)

Credits: 15 / Semester: semester 2

Forensic Computing involves the examining and analysing of data retrieved from various computer storage mediums, to be used as evidence in a court of law. Students will develop the skills and knowledge to undertake a forensic computing investigation in a systematic manner utilising existing methods, tools and techniques.

BIG DATA ANALYTICS (COMP336)

Credits: 15 / Semester: semester 1

This module provides an initial overview of key algorithms and algorithmic approaches and corresponding software environments used when developing solutions to Big Data problems and explains how to use these to analyse data. A significant portion of statistics, some advanced AI approaches as well as key deterministic and hybrid algorithms are included to support the development of future data analytics and to understand how to develop stochastic, machine learning and hybrid algorithms that can exploit Big Data and can be applied to solve real life problems.

COMPUTER VISION (COMP338)

Credits: 15 / Semester: semester 1

This module provides an introduction to the topic of Computer Vision and helps students develop the practical skills necessary to build computer vision applications. It presents fundamental problems in both 2D and 3D vision with a variety of classical and emerging approaches to overcome them.

DATA MINING AND VISUALISATION (COMP337)

Credits: 15 / Semester: semester 2

To provide an in-depth, systematic and critical understanding of some of the current research issues at the forefront of the academic research domain of data mining. Google search framework and IBM Watson QA system and various other industrial level data mining applications are discussed.

HIGH PERFORMANCE COMPUTING (COMP328)

Credits: 15 / Semester: semester 2

In this module, we study the use of High-Performance Computing systems, from accessing them to programming for them. We study some theory including Computer Architecture at the hardware level to some fundamentals of parallelism. We then go into practical parallelism using C on multicore systems using OpenMP and multiprocessor/distributed systems using MPI. We will also briefly study GPU programming using CUDA, as well as some emerging hardware architectures.

ADVANCED TOPICS IN COMPUTER GAME DEVELOPMENT (COMP342)

Credits: 15 / Semester: semester 2

This modules aims to cover advanced concepts underpinning computer games development; including game AI, content generation, graphics, physics and sound. As part of the continuous assessment, students apply those concepts to computer games development.

ROBOT PERCEPTION AND MANIPULATION (COMP341)

Credits: 15 / Semester: semester 2

In this module, we focus on how robots perceive the world and accomplish manipulation tasks, which is widely used in many applications such as warehouse robots and assistive robots in a domestic environment. We will study how sensory data, e.g., visual images and tactile data, is transformed into representations like features of object shapes, poses and textures. Such representations facilitate the grasping and manipulation of objects.

Programme details and modules listed are illustrative only and subject to change.

YEAR FIVE

In year five you will join with the MSc programme for students with a computer science first degree. You will undertake a research-oriented group project in the first semester and a research-oriented individual project in the second.

Alongside your compulsory modules, you will also select from a range of optional modules.

COMPULSORY MODULES

MENG GROUP PROJECT (COMP591)

Credits: 30 / Semester: semester 1

The MEng Group project is to give students the opportunity to work in a group, in a guided but independent fashion, on a substantial problem that allows to show innovation and creativity, to make practical use of principles, techniques and methodologies acquired elsewhere in the programme. The MEng Group Project will provide students with experience of carrying out a large piece of group work involving the synthesis of advanced information, ideas and practices to achieve a quality solution together, with a critical evaluation of the process and the solution.The Group Project will enhance students' communication skills, both oral and written, in particular through collaboratively producing a report that documents the conduct of the project, the solution produced and giving a critical evalution of process and solution.

MENG INDIVIDUAL PROJECT (COMP592)

Credits: 30 / Semester: semester 2

To give students the opportunity to work individually, in a guided but independent fashion, on a substantial problem that allows to show innovation and/or creativity and allows to make practical use of principles, techniques and methodologies acquired elsewhere in the programme.
To give experience of carrying out a large piece of individual work involving the synthesis of advance information, ideas and practices in order to provide a quality solution together with an critical evaluation of the process and the solution.
To enhance communication skills, both oral and written, in particular through producing a dissertation that documents the conduct of the project, the solution produced and giving a critical evalution of process and solution.

OPTIONAL MODULES

ADVANCED ALGORITHMIC TECHNIQUES (COMP523)

Credits: 15 / Semester: semester 2

This module aims to teach basic algorithmic methods for design and analysis of algorithms.

EFFICIENT ALGORITHMS (COMP526)

Credits: 15 / Semester: semester 1

Masters module on practical algorithms and data structures for large datasets.

BIG DATA ANALYTICS (COMP529)

Credits: 15 / Semester: semester 1

This module provides an initial overview of key algorithms and algorithmic approaches and corresponding software environments used when developing solutions to Big Data problems and explains how to use these to analyse data. A significant portion of statistics, some advanced AI approaches as well as key deterministic and hybrid algorithms are included to support the development of future data analytics and to understand how to develop stochastic, machine learning and hybrid algorithms that can exploit Big Data and can be applied to solve real life problems.

COMPUTATIONAL INTELLIGENCE (COMP575)

Credits: 15 / Semester: semester 2

Biologically inspired optimisation and introduction to neural networks for artificial intelligence.

DATA MINING AND VISUALISATION (COMP527)

Credits: 15 / Semester: semester 2

The module covers a range of topics and techniques for analyzing data. Students will learn about different types of data mining problems, including classification, clustering, association pattern mining, and social network analysis, as well as algorithms to solve them.

Students will program selected data mining algorithms from scratch using Python. This hands-on approach will allow them to gain a deeper understanding of how the algorithms work and how they can be applied to real-world datasets. They will experiment with different datasets to see how the algorithms perform and learn how to interpret the results.

KNOWLEDGE REPRESENTATION (COMP521)

Credits: 15 / Semester: semester 1

The module introduces formalisms to reason about knowledge and information. One such formalism is epistemic logic, where one can explicitly represent of what an agent (robot, human, system) knows about the world or about others, as in "I have sent a message, how do I know that it has been received, and that the receiver knows I know this?"

MACHINE LEARNING AND BIOINSPIRED OPTIMISATION (COMP532)

Credits: 15 / Semester: semester 2

This module teaches you about bio-inspired algorithms for optimisation and machine learning. The algorithms are based on reinforcement learning, DNA computing, brain or neural network models, immune systems, the evolutionary version of game theory, and social insect swarm behaviour such as ant colonies and bee colonies. These techniques are extremely useful for searching very large solution spaces (optimisation) and they can be used to design agents or robots that have to interact and operate in dynamic unknown environments (e.g. a Mars rover, a swarm of robots or network of satellites). The idea of learning optimal behaviour, rather than designing, algorithms and controllers is especially appealing in AI.

MULTI-CORE AND MULTI-PROCESSOR PROGRAMMING (COMP528)

Credits: 15 / Semester: semester 1

This is a module to cover theoretical and practical aspects of parallel programming for multi-core architectures with the main focus on hand-on programming experience with latest multi-core and multi-processor platforms.

PRIVACY AND SECURITY (COMP522)

Credits: 15 / Semester: semester 1

The module "Privacy and Security" covers topics such as: identification and authentication, monitoring protocols, attacks and defences, legal and ethical issues and future directions.

SAFETY AND DEPENDABILITY (COMP524)

Credits: 15 / Semester: semester 2

Safety and Dependability will cover techniques for the validation of systems against formal specifications. In a first part, safety specifications (something bad never happens) using the Hoare calculus and safe abstraction are covered. A second part refers to termination (something good eventually happens), exploiting well foundedness. In a third part, Markov chains and decision processes are studied, extending the qualitative safety and termination problems from the first part to qualitative/probabilistic properties, and extending them to a simple probabilistic specification language, PCTL. As part of the module, the ability of formulating (probabilistic) models as Markov chains and decision processes are taught, as well as the use of of-the-shelf tools like PRISM or IscasMC for their analysis.

Programme details and modules listed are illustrative only and subject to change.

HOW YOU'LL LEARN

Teaching is a mix of formal lectures, small group tutorials and supervised laboratory-based practical sessions. Students also undertake individual and group projects. Key problem

solving skills and employability skills, like presentation and teamwork skills, are developed throughout the programme.

HOW YOU'RE ASSESSED

The main modes of assessment are through a combination of coursework and examination, but depending on the modules taken you may encounter project work, presentations (individual or group), and specific tests/tasks focused on solidifying learning outcomes.

LIVERPOOL HALLMARKS

We have a distinctive approach to education, the Liverpool Curriculum Framework, which focuses on research-connected teaching, active learning, and authentic assessment to ensure our students graduate as digitally fluent and confident global citizens.

Careers and employability

Liverpool's computer science graduates go onto well-paid graduate jobs and careers such as: computer programmer; software developer; systems analyst; software engineer; technical consultant; web designer.

Computer science graduates will enter a high-in-demand pool in the field with possible roles in:

- computer programmers, web developers, or software engineers
- data scientists
- artificial intelligence researchers
- systems analysts
- technical consultants.

Recent employers include:

- BAE Systems
- BT
- Guardian Media Group
- Royal Bank of Scotland
- Siemens
- Unilever

87% **OF COMPUTER SCIENCE STUDENTS FIND THEIR MAIN ACTIVITY AFTER GRADUATION MEANINGFUL.**

Graduate Outcomes, 2018-19.

Fees and funding

Your tuition fees, funding your studies, and other costs to consider.

TUITION FEES

UK fees (applies to Channel Islands, Isle of Man and Republic of Ireland)	
Full-time place, per year	£9,250

International fees	
Full-time place, per year	£28,000

Fees are correct for the academic year 2024/25
Tuition fees cover the cost of your teaching and assessment, operating facilities such as libraries, IT equipment, and access to academic and personal support. Learn more about tuition fees, funding and student finance.

ADDITIONAL COSTS

We understand that budgeting for your time at university is important, and we want to make sure you understand any course-related costs that are not covered by your tuition fee. This could include buying a laptop, books, or stationery.

Find out more about the additional study costs that may apply to this course.

SCHOLARSHIPS AND BURSARIES

We offer a range of scholarships and bursaries to provide tuition fee discounts and help with living expenses while at university.

Check out our Undergraduate Global Advancement Scholarship. This offers a tuition fee discount of up to £5,000 for eligible students starting an undergraduate degree from September 2024. There's also the Liverpool Bursary which is worth £2,000 per year for eligible students.

Discover our full range of undergraduate scholarships and bursaries

Entry requirements

The qualifications and exam results you'll need to apply for this course.

A*AA with grade A in A-level Maths or Computer Science. BTEC not accepted.

Your qualification	**Requirements** About our typical entry requirements
A levels	A*AA with grade A in A level Maths Applicants with the Extended Project Qualification (EPQ) are eligible for a reduction in grade requirements. For this course, the offer is **AAA** with an **A** in the EPQ. You may automatically qualify for reduced entry requirements through our contextual offers scheme.
GCSE	GCSE: 4/C in English and 4/C in Mathematics
Subject requirements	A level Mathematics or Computer Science. For applicants from England: For science A levels that include the separately graded practical endorsement, a "Pass" is required. Applicants with the Extended Project Qualification (EPQ) are eligible for a reduction in grade requirements. For this course, the offer is AAA with an A in the EPQ.
BTEC Level 3 Subsidiary Diploma	Acceptable at grade D* (any subject) alongside A*A at A level. A Levels must include Mathematics
BTEC Level 3 Diploma	D*D* in BTEC considered alongside A Level grade A in Mathematics.
BTEC Level 3 National Extended Diploma	Not accepted

Your qualification	**Requirements** About our typical entry requirements
International Baccalaureate	36 overall including 5 in Higher Level Mathematics
Irish Leaving Certificate	Irish Leaving Certificate: H1,H1,H1,H2,H2,H2, including H1 in Higher Maths. We also require a minimum of H6 in Higher English or O3 in Ordinary English
Scottish Higher/Advanced Higher	AAA including Maths – Advanced Higher only
Welsh Baccalaureate Advanced	Welsh Bacc: Acceptable at grade A or above alongside A*A at A level including A Level Mathematics.
Cambridge Pre-U Diploma	Principal subjects acceptable in lieu of A levels. D3 in Cambridge Pre U Principal Subject is accepted as equivalent to A-Level grade A M2 in Cambridge Pre U Principal Subject is accepted as equivalent to A-Level grade B Global Perspectives and Short Courses are not accepted.
Access	Not accepted
International qualifications	Many countries have a different education system to that of the UK, meaning your qualifications may not meet our direct entry requirements. Although there is no direct Foundation Certificate route to this course, completing a Foundation Certificate, such as that offered by the University of Liverpool International College, can guarantee you a place on a number of similar courses which may interest you.

ALTERNATIVE ENTRY REQUIREMENTS

- If your qualification isn't listed here, or you're taking a combination of qualifications, contact us for advice
- Applications from mature students are welcome.

THE ORIGINAL REDBRICK