

# Advanced Data Science and Artificial Intelligence

MSc

## COURSE DETAILS

- Full-time: 12 months
- Part-time: 24 months

## KEY DATES

- Apply by: [29 August 2025](#)
  - Starts: 22 September 2025
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## Course overview

Gain hands-on experience of big data analytics, data mining and visualisation techniques using high-performance computer technology. This MSc is accredited by BCS, the Chartered Institute for IT, and enables you to develop IT solutions to big data problems in a sector with a significant skills shortage.

## INTRODUCTION

Big data is increasingly important in the contemporary business and IT world. For many public and private enterprises, analysis of large-scale data sets is critical to growth.

This MSc will prepare you for employment in an IT industry where big data professionals are in high demand.

You'll learn how to interrogate vast amounts of structured and unstructured data and make informed insights from datasets that are too large to be readily processed using standard techniques.

We'll provide an overview of the key algorithms, algorithmic approaches and software environments you'll use when solving big data problems and explore data mining techniques.

Hands-on programming experience with the latest multi-core and multi-processor platforms will ensure your expertise in big data is underpinned by knowledge of high-performance computing. Further opportunities to specialise and enhance your knowledge of algorithms, optimisation and machine learning are available through a range of optional modules.

You'll work as part of a small group on a practical project to find a solution to a big data problem. We'll also provide a thorough grounding in how to plan and conduct research in preparation for your dissertation.

## **WHAT YOU'LL LEARN**

- Theoretical and practical aspects of programming for the latest multi-core and multi-processor platforms
  - Key algorithms, approaches and software environments for developing solutions to big data problems
  - Data mining techniques and challenges using real-world datasets
  - Application of visualisation methods to data mining
  - Research skills in computer science
  - Bio-inspired algorithms for optimisation and machine learning
  - How to model continuous and discrete optimisation problems
  - The benefits and weaknesses of selected algorithmic techniques
  - Algorithmic aspects of game theory
  - Neural networks for artificial intelligence
  - How to validate systems against safety specifications
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## **ACCREDITATION**

The programme is accredited by BCS, The Chartered Institute for IT, the leading professional body for those working in IT. It is continually updated to reflect new technologies and trends.

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# Course content

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

## SEMESTER ONE

You'll study three compulsory modules and one optional module in semester one.

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### COMPULSORY MODULES

#### RESEARCH METHODS IN COMPUTER SCIENCE (COMP516)

**Credits: 15 / Semester: semester 1**

In this module the students will learn and practise all the necessary skills needed to conduct independent research in computer science, including literature search, project management, presentation techniques, peer reviewing, writing skills and critical review of texts. They will also learn about the professional, legal, social and ethical framework of the IT industry. The module covers, e.g., planning and scheduling projects and drawing Gantt charts. Students shall also conduct a research project (including research, paper, literature review, or MSc project proposal, ...) and use tools like EndNote and Zotero bibliography manager within MS Word and Latex.

#### 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.

#### 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.

## **OPTIONAL MODULES**

### **EFFICIENT ALGORITHMS (COMP526)**

**Credits: 15 / Semester: semester 1**

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

### **OPTIMISATION (COMP557)**

**Credits: 15 / Semester: semester 1**

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

*Any optional modules listed above are illustrative only and may vary from year to year. Modules may be subject to minimum student numbers being achieved and staff availability. This means that the availability of specific optional modules cannot be guaranteed.*

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## **SEMESTER TWO**

You'll study two compulsory modules and two optional modules in semester two.

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## **COMPULSORY MODULES**

### **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.

### **MSC GROUP PROJECT (COMP530)**

**Credits: 15 / Semester: semester 2**

This module is designed to allow students to consolidate work from the first semester by working as a programming team to realise a solution to a problem related to their programme of study.

## **OPTIONAL MODULES**

### **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.

### **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.

### **ALGORITHMIC GAME THEORY (COMP559)**

**Credits: 15 / Semester: semester 2**

This module focuses on algorithmic aspects of game theory. A main focus of this module is on the computational aspects in the design of mechanisms and auctions. As part of the module, the students learn about Google's sponsored search auctions, which is one of the most successful targeted advertising systems today.

### **COMPUTATIONAL INTELLIGENCE (COMP575)**

**Credits: 15 / Semester: semester 2**

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

*Any optional modules listed above are illustrative only and may vary from year to year. Modules may be subject to minimum student numbers being achieved and staff availability. This means that the availability of specific optional modules cannot be guaranteed.*

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## **FINAL PROJECT**

The dissertation project is completed over the summer.

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## **COMPULSORY MODULES**

### **MSC PROJECT (COMP702)**

**Credits: 60 / Semester: summer**

Masters Level final project (individual project with dissertation)

*Any optional modules listed above are illustrative only and may vary from year to year. Modules may be subject to minimum student numbers being achieved and staff availability. This means that the availability of specific optional modules cannot be guaranteed.*

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## **HOW YOU'LL LEARN**

Teaching on this programme comprises formal lectures, small group tutorials and practical sessions in PC and Mac laboratories. You will also take part in one or more group projects. At the end of the year, you'll complete a major individual research project under expert supervision.

## **HOW YOU'RE ASSESSED**

Modules are assessed through a combination of examinations and coursework. The examinations take place at the end of each semester and typically take the form of an in-person written assignment, usually to be completed in a couple of hours. You'll be assigned coursework across the length of each semester. This typically takes the form of class tests, programming assignments or small projects.

Your dissertation is assessed through a combination of written reports and a presentation of your achievements.

## **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.

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# Careers and employability

The programme is accredited by BCS, The Chartered Institute for IT, for the purposes of partially meeting the academic requirement for registration as a Chartered IT Professional.

Designed to address a skills gap in the employment market, this MSc will enable you to apply your skills working with big data and your knowledge of high performance computing to real-world challenges.

The MSc has been developed, and is delivered, in close collaboration with the Hartree Centre in Daresbury, near Warrington. Hartree operate the UK's largest supercomputer, capable of a thousand trillion calculations per second. They collaborate with both industry and the research community to help UK businesses and organisations explore and adopt supercomputing, data science and artificial intelligence technologies.

**Career support from day one to graduation and beyond**

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## **Career planning**

[Our Careers Studio and career coaches can provide tailored support for your future plans.](#)



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**From education to employment**

Employability in your curriculum for a successful transition

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## **Networking events**

Make meaningful connections with like-minded professionals

## **YOUR FUTURE**

Potential roles working with big data include:

- Data analyst
- Data scientist
- Mathematical modeller
- Database administrator
- Machine learning engineer
- Statistician.

The transferable skills you develop will also prepare you for a variety of other roles across the IT industry, while your expertise working with data will mean you're well suited to potential

PhD study.

In the UK, a machine learning engineer can expect a graduate entry level salary of £35,000.

With three to five years experience, this can rise to £50,000 to £80,000.

At senior level or in a specialised or lead role, this can rise to £120,000.

source: [Prospects](#), Sept 2024

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

*Graduate Outcomes, 2018-19.*

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# Fees and funding

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

## TUITION FEES

<b>UK fees (applies to Channel Islands, Isle of Man and Republic of Ireland)</b>	
Full-time place, per year	£13,300
Part-time place, per year	£6,650

<b>International fees</b>	
Full-time place, per year	£30,800
Part-time place, per year	£15,400

*Fees stated are for the 2025-26 academic year.*

Tuition fees cover the cost of your teaching and assessment, operating facilities such as libraries, IT equipment, and access to academic and personal support.

- You can [pay your tuition fees in instalments](#).
- All or part of your tuition fees can be [funded by external sponsorship](#).
- International applicants who accept an offer of a place will need to [pay a tuition fee deposit](#).

If you're a UK national, or have settled status in the UK, you may be eligible to apply for a Postgraduate Loan worth up to £12,167 to help with course fees and living costs. [Learn more about fees and funding](#).

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## 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.

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## **SCHOLARSHIPS AND BURSARIES**

We offer a range of scholarships and bursaries that could help pay your tuition and living expenses.

We've set the country or region your qualifications are from as United Kingdom. [Change it here](#)

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### **POSTGRADUATE GLOBAL ADVANCEMENT SCHOLARSHIP – ACHIEVEMENT**

◦ [International students](#)

[If you're an international student joining a master's course with us, you could be eligible to receive a tuition fee discount of £2,500, based on your prior academic achievement, choice of course, and you not having studied with us before.](#)

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### **POSTGRADUATE GLOBAL ADVANCEMENT SCHOLARSHIP – COUNTRY**

◦ [International students](#)

◦ [Antigua and Barbuda](#)

◦ [Australia](#)

◦ [Bangladesh](#)

◦ [Barbados](#)

◦ [Belize](#)

◦ [Brunei](#)

◦ [Canada](#)

◦ [China](#)

◦ [Cyprus](#)

◦ [Dominica](#)

◦ [Egypt](#)

◦ [Ghana](#)

◦ [Grenada](#)

◦ [Guyana](#)

◦ [India](#)

◦ [Jamaica](#)

◦ [Japan](#)

◦ [Kenya](#)

◦ [Malaysia](#)

◦ [Mauritius](#)

◦ [Mexico](#)

◦ [New Zealand](#)

◦ [Nigeria](#)

◦ [Pakistan](#)

◦ [Saint Kitts and Nevis](#)

◦ [Saint Lucia](#)

◦ [Saint Vincent and The Grenadines](#)

- [Singapore](#)
- [South Africa](#)
- [South Korea](#)
- [Sri Lanka](#)
- [Tanzania](#)
- [Thailand](#)
- [Trinidad and Tobago](#)
- [Turkey](#)
- [Uganda](#)
- [Vietnam](#)

[If you're an international student joining a master's course with us, you could be eligible to receive a tuition fee discount of £2,500, based on your nationality, choice of course, and you not having studied with us before.](#)

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### **GRADUATE LOYALTY ADVANCEMENT SCHOLARSHIP**

- [Home and international students](#)

[If you're a University of Liverpool graduate starting this master's degree with us, you could be eligible to receive a loyalty discount of up to £2,500 off your master's tuition fees.](#)

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### **CHILEAN NATIONAL AGENCY FOR RESEARCH AND DEVELOPMENT (ANID) SCHOLARSHIP**

- [International students](#)
- [Chile](#)

[If you're a Chilean student joining a master's degree, you could be eligible to apply for a 20% discount on your tuition fees with a Chilean National Agency for Research and Development \(ANID\) Scholarship. Scholarship.](#)

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### **BRACKEN DATA SCIENCE SCHOLARSHIP**

- [Home students](#)

[Studying a data science master's in the School of Electrical Engineering, Electronics and Computer Science? If you live in the Liverpool City Region, with household income below £25,000, you could be eligible to apply for £5,000. One award is available per academic year.](#)

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### **CHEVENING SCHOLARSHIPS**

- [International students](#)
- [Albania](#)
- [Algeria](#)
- [Anguilla](#)
- [Antigua and Barbuda](#)
- [Argentina](#)
- [Australia](#)
- [Azerbaijan](#)
- [Bangladesh](#)

- [Barbados](#)
- [Belize](#)
- [Bolivia](#)
- [Brazil](#)
- [British Virgin Islands](#)
- [Brunei](#)
- [Canada](#)
- [Cayman Islands](#)
- [Chile](#)
- [China](#)
- [Columbia](#)
- [Costa Rica](#)
- [Cuba](#)
- [Dominica](#)
- [Ecuador](#)
- [Egypt](#)
- [El Salvador](#)
- [Ghana](#)
- [Guatemala](#)
- [Guyana](#)
- [Honduras](#)
- [Hong Kong](#)
- [Iceland](#)
- [India](#)
- [Indonesia](#)
- [Iraq](#)
- [Jamaica](#)
- [Japan](#)
- [Jordan](#)
- [Kazakhstan](#)
- [Kenya](#)
- [Libya](#)
- [Malaysia](#)
- [Mauritius](#)
- [Mexico](#)
- [Moldova](#)
- [Mongolia](#)
- [Montserrat](#)
- [Morocco](#)
- [Nepal](#)
- [New Zealand](#)
- [Nicaragua](#)
- [Nigeria](#)
- [Pakistan](#)
- [Panama](#)
- [Paraguay](#)
- [Peru](#)
- [Philippines](#)

- [Russia](#)
- [Saint Kitts and Nevis](#)
- [Saint Lucia](#)
- [Saint Vincent and The Grenadines](#)
- [Serbia](#)
- [Singapore](#)
- [South Africa](#)
- [South Korea](#)
- [South Sudan](#)
- [Sri Lanka](#)
- [Sudan](#)
- [Taiwan](#)
- [Tanzania](#)
- [Thailand](#)
- [Trinidad and Tobago](#)
- [Turkey](#)
- [Turks and Caicos Islands](#)
- [Uganda](#)
- [Ukraine](#)
- [Uruguay](#)
- [Venezuela](#)
- [Vietnam](#)
- [Zimbabwe](#)

[If you're an international student from an eligible country, joining a one-year master's course, you could be eligible to apply for a Chevening Scholarship. If your application is successful, you could expect to have your master's fees paid, up to a maximum of £18,000, and receive additional help with living costs.](#)

### **CONSEJO NACIONAL DE CIENCIA Y TECNOLOGIA (CONACYT) AWARD**

- [International students](#)
- [Mexico](#)

[If you're a Mexican student joining a master's degree, you could be eligible to apply for a 30% discount on your tuition fees with a CONACyT Award.](#)

### **FUND FOR THE DEVELOPMENT OF HUMAN RESOURCES (FIDERH) AWARD**

- [International students](#)
- [Mexico](#)

[If you're a Mexican student joining a master's degree and you're in receipt of a FIDERH graduate loan, you could be eligible to benefit from a 20% discount on your tuition fees with a FIDERH Award.](#)

### **FUNED AWARD**

- [International students](#)
- [Mexico](#)



[If you're a Mexican student joining a master's degree and you're in receipt of a FUNED loan, you can apply to be considered for a 20% tuition fee discount. A total of up to 50 awards will be available to master's and PhD students per academic year.](#)

### **FUNED SCHOLARSHIP FOR WOMEN IN STEM SUBJECTS**

- [International students](#)
- [Mexico](#)

[If you're a female Mexican student joining an eligible master's course in a science, technology, engineering or maths \(STEM\) subject and you're in receipt of a FUNED loan, you can apply to be considered for a 25% tuition fee discount. Up to five awards are available in each academic year.](#)

### **HRH PRINCESS SIRINDHORN UNIVERSITY OF LIVERPOOL SCHOLARSHIP (THAILAND)**

- [International students](#)
- [Thailand](#)

[If you're a student from Thailand joining a one-year master's degree, you might be eligible to apply to have your tuition fees paid in full and receive help with living costs. One award is available and only students who are new to the University will be considered.](#)

### **HUMANITARIAN SCHOLARSHIPS FOR MASTER'S PROGRAMMES**

- [International students](#)

[Do you have recognised status as a refugee or person with humanitarian protection outside the UK? Or are you a Ukrainian who's sought temporary protection in the EU? You could be eligible to apply for the full payment of your master's fees and additional financial support.](#)

### **JOHN LENNON MEMORIAL SCHOLARSHIP**

- [Home students](#)

[If you're a UK student, either born in or with strong family connections to Merseyside, you could be eligible to apply for a fee discount of up to £4,500. You'll need to demonstrate an active interest in global, community and environmental issues to be considered.](#)

### **JUVENTUDES GTO SCHOLARSHIP**

- [International students](#)
- [Mexico](#)

[If you're a resident of the state of Guanajuato in Mexico joining a master's degree, you could be eligible for a 10% discount on your tuition fees with a JuventudEsGto Scholarship.](#)

### **KAPLAN DIGITAL PATHWAYS EXCELLENCE SCHOLARSHIP**

- [International students](#)

[Completed a Kaplan Digital Pathways Pre-Master's? We're offering a £5,000 fee discount off the first year of master's study for a maximum of two high achieving students joining one of our non-clinical master's courses from an online Kaplan Pre-Master's programme.](#)

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## **MARSHALL SCHOLARSHIP**

- [International students](#)
- [United States](#)

[If you're a USA student joining an eligible master's with us, you could be eligible to apply for a Marshall Scholarship. If your application is successful, your master's tuition fees will be paid in full. One Marshall Scholarship for master's study is available in each academic year.](#)

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## **POSTGRADUATE OPPORTUNITY BURSARY**

- [Home students](#)

[If you're a UK University of Liverpool graduate joining a master's degree with us, you could be eligible to receive £3,000 off your tuition fees. You must have graduated in the last two years and received a widening access scholarship during your undergraduate studies.](#)

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## **SCOTTISH POWER SCHOLARSHIPS**

- [Home students](#)

[Are you a UK student joining a master's course focused on sustainable energy or environmental protection? You could be eligible to apply for a Scottish Power Scholarship. This award offers full payment of your master's fees and a monthly bursary while you study.](#)

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## **SPORT LIVERPOOL PERFORMANCE PROGRAMME**

- [Home and international students](#)

[Apply to receive tailored training support to enhance your sporting performance. Our athlete support package includes a range of benefits, from bespoke strength and conditioning training to physiotherapy sessions and one-to-one nutritional advice.](#)

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## **THE AZIZ FOUNDATION SCHOLARSHIP**

- [Home students](#)

[If you're a British Muslim, active within a Muslim community and dedicated to bringing positive change to society, you could apply to potentially have the full cost of your master's tuition fees covered by an Aziz Foundation Scholarship.](#)

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## **TURKISH MINISTRY OF EDUCATION SCHOLARSHIP**

- [International students](#)
- [Turkey](#)

[If you're a Turkish student joining a master's degree, you could be eligible to apply for a 20% discount on your tuition fees with a Turkish Ministry of Education Scholarship.](#)

- **UNIVERSITY OF LIVERPOOL INTERNATIONAL COLLEGE EXCELLENCE SCHOLARSHIP**

- [International students](#)

[Completed a Pre-Master's at University of Liverpool International College \(UoLIC\)? We're offering a £5,000 fee discount off the first year of master's study to some of the highest achieving students joining one of our non-clinical master's courses from UoLIC.](#)

- **UNIVERSITY OF LIVERPOOL INTERNATIONAL COLLEGE IMPACT PROGRESSION SCHOLARSHIPS**

- [International students](#)

[If you're a University of Liverpool International College student awarded a Kaplan Impact Scholarship, we'll also consider you for an Impact Progression Scholarship. If selected, you'll receive a fee discount worth £3,000 off the first year of your master's course.](#)

- **VICE-CHANCELLOR'S INTERNATIONAL ATTAINMENT SCHOLARSHIP FOR MAINLAND CHINA**

- [International students](#)

- [China](#)

[Are you a high-achieving graduate from the People's Republic of China with a degree from a Chinese university? You could be eligible to apply for a £5,000 fee discount if you're joining an eligible master's course. Up to 15 eligible students will receive this scholarship.](#)

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# Entry requirements

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

<b>Your qualification</b>	<b>Requirements</b> <a href="#">About our typical entry requirements</a>
GCSE	4/C in English and 4/C in Mathematics
Postgraduate entry requirements	We accept a 2:2 honours degree from a UK university, or an equivalent academic qualification from a similar non-UK institution. This degree should be in computer science or a closely related subject.
International qualifications	Many countries have a different education system to that of the UK, meaning your qualifications may not meet our entry requirements. Completing your Foundation Certificate, such as that offered by the <a href="#">University of Liverpool International College</a> , means you're guaranteed a place on your chosen course.

**THE ORIGINAL**

**REDBRICK**