

Theoretical Computer Science 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

Explore the world of computational game theory, where computer science and economics collide, and receive a grounding in algorithmic techniques and optimisation methods and models on this MSc. You'll develop a toolkit of analytical skills and have opportunities to specialise in areas such as microeconomics, e-commerce and data mining.

INTRODUCTION

This MSc immerses you in theoretical computer science, with a particular focus on computational game theory, where computer science and economics intersect. This is an area of rapid growth where skilled professionals are in high demand.

You'll receive a comprehensive introduction to computational game theory and focus on algorithmic aspects of game theory in depth. Exploring the computational aspects of the design of mechanisms and auctions, you'll also examine optimisation methods and their application to various optimisation models.

Optional modules include opportunities to work with large datasets, specialise in the design and analysis of algorithms, discover the essentials of microeconomic theory, or investigate e-commerce technologies.

We'll prepare you for an independent research project, where you'll plan and conduct research and analyse your findings, by equipping you with all the skills you'll need to conduct research in computer science.

Based in the Department of Computer Science, you'll learn from leading academic experts and find a culture of research excellence with close links to industry. We'll augment and enrich your knowledge with specialist analytical tools and develop your ability to identify and execute creative solutions to practical problems.

WHO IS THIS COURSE FOR?

This programme is aimed principally at graduates who either plan to become high-profile professionals working in the IT industry or those who plan to continue to a research degree in this cutting-edge research area. This programme may also be appropriate for those professionals who are already in IT-related employment and wish to broaden and deepen their knowledge.

WHAT YOU'LL LEARN

- An understanding of the notion of a game, its solutions, concepts and applications
- Algorithmic aspects of game theory
- How computational game theory, computer science and economics intersect
- Contemporary application of algorithmic paradigms
- How to model continuous and discrete optimisation problems
- Key research methods in computer science
- How to design and analyse advanced discrete algorithms
- Essentials of microeconomic theory
- An understanding of all aspects of software safety and dependability
- Research issues in data mining
- Privacy, security, encryption and other technologies behind e-commerce

ACCREDITATION

Please note that this course is pending accreditation by BCS, The Chartered Institute for IT.

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.

You'll choose an additional optional module in place of COMP323 Introduction to Computational Game Theory if you previously studied this module on your undergraduate degree.

COMPULSORY MODULES

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.

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.

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.

OPTIONAL MODULES

EFFICIENT ALGORITHMS (COMP526)

Credits: 15 / Semester: semester 1

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

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?"

MICROECONOMIC ANALYSIS (ECON915)

Credits: 15 / Semester: semester 1

This module aims to provide an understanding of the essentials of microeconomic theory. This includes understanding what is meant by rational choice and how it can be used to predict what choices agents will make in different contexts. Students will also understand how markets work and what causes markets to fail.

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.

SEMESTER TWO

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

It's only possible to select a maximum of one of modules COMP310 Multi-Agent Systems and COMP315 Technologies for E-Commerce unless you selected an alternative to COMP323 Introduction to Computational Game Theory in semester one. You will not be able to select these optional semester two modules if you previously studied them on your undergraduate degree.

COMPULSORY MODULES

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 Googles sponsored serarch auctions, which is one of the most successful targeted advertising systems today.

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.

ADVANCES IN THEORETICAL COMPUTER SCIENCE (COMP555)

Credits: 15 / Semester: semester 2

This module equips students to work at the cutting edge of research in a selected topic in theoretical computer science. Students work with primary research literature to summarize and contextualize results in an area of their choice. They will further practice to present and explain research-level results in theoretical computer science to computer scientists outside of the specific subfield.

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.

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.

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.

CLOUD COMPUTING FOR E-COMMERCE (COMP315)

Credits: 15 / Semester: semester 2

This module will provide an introduction to cloud computing. It will cover physical cloud infrastructure (data-centres, networks and servers), and the software stacks that run on it (containers, micro-services, orchestration and web frameworks).

During the course, students will assemble their own cloud-based application, which will be a webpage with a scalable micro-service-based backend.

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.

FINAL PROJECT

The dissertation project is completed over the summer.

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.

HOW YOU'LL LEARN

Teaching on this programme comprises formal lectures, small group tutorials and practical sessions in computer 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.

Careers and employability

This MSc equips you with an in-depth understanding of theoretical computer science. There is particular focus on computational game theory, a subject at the intersection of computer science and economics, which has seen a rapid growth in recent years. There is a significant skills shortage in this area and high demand for skilled professionals.

Whether you're a recent graduate seeking a career in the IT industry, plan to continue your studies and pursue a research degree, or you're already an IT professional in related employment, this programme will enhance your knowledge and immerse you in current developments.

We'll prepare you for senior technical and managerial positions in the profession, as well as providing a strong foundation for potential PhD research.

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

Previous graduates have progressed into a variety of roles which include:

- IT consultant
- Enterprise risk consultant
- Network optimisation engineer
- Data analyst
- Information analyst
- Business analyst
- IT implementation and support analyst
- Customer service adviser

- Software developer
- Software engineer
- Sales and marketing
- Search engine optimisation (SEO) specialist.

Many of our graduates also choose to continue their studies and embark on PhD research.

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	£13,300
Part-time place, per year	£6,650

International fees	
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](#).

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 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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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.](#)

HONG KONG GRADUATE ASSOCIATION & TUNG FOUNDATION POSTGRADUATE SCHOLARSHIPS

- [International students](#)
- [China](#)
- [Hong Kong](#)

[If you're a master's student from Hong Kong or the People's Republic of China who can demonstrate academic excellence, you may be eligible to apply for a scholarship worth up to £10,000 in partnership with the Tung Foundation.](#)

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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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.](#)

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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.](#)

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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.](#)

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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.](#)

Entry requirements

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

Your qualification	Requirements About our typical entry requirements
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 a subject area closely related to computer science.
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 University of Liverpool International College , means you're guaranteed a place on your chosen course.

THE ORIGINAL

REDBRICK