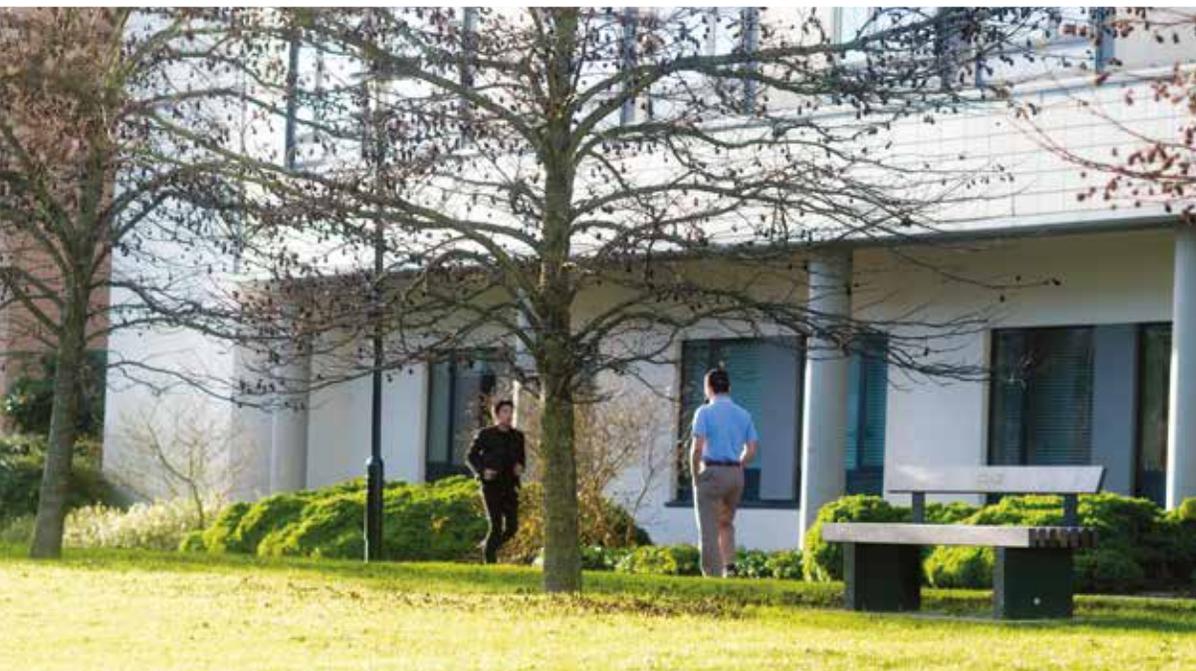




WARWICK
THE UNIVERSITY OF WARWICK

Department of
Computer Science
Discrete Mathematics

“Discrete Mathematics is used in all areas of algorithm and systems design, which means our graduates are in demand across areas such as cybersecurity, coding theory, cryptography, finance, telecommunications and search engine development.”



Discrete Mathematics (BSc / MEng)

Discrete Mathematics is a dynamic and interesting branch of Mathematics with many existing and emerging applications. It deals with mathematical structures and problems that are discrete in nature, as opposed to problems that exhibit continuous properties.

Discrete Mathematics is used in all areas of algorithm and systems design, which means our graduates are in demand across areas such as cybersecurity, coding theory, cryptography, finance, telecommunications and search engine development.

Many optimisation and planning problems give rise to questions addressed by Discrete Mathematics. For instance, the road map contained in the GPS in your car is stored as a list of crossings with mutual links describing how it is possible to drive from one crossing to another. When you enter a desired destination, a complex mathematical algorithm is invoked to compute an optimal route from your current location to the destination. It is important that the algorithm computing the route is fast enough to be useful in navigation, which is precisely why we should be concerned with the complexity of algorithms. This is just one example of how we have all come to depend on the application of Discrete Mathematics.

Discrete Mathematics was fundamental to the breaking of German codes during World War II. Bill Tutte, a key contributor to the cracking of the Enigma code, helped to set the foundations of modern Discrete Mathematics. He is not alone though, since the study of

Discrete Mathematics is also linked to the legacy of Paul Erdos, one of the most famous mathematicians of the 20th century. Driven forward by great mathematicians, such as Tutte and Erdos, Discrete Mathematics has given us the foundations of modern public-key cryptography, a technology widely used across finance services and e-commerce. In engineering, formal verification provides us with a robust framework for testing logic statements about safety-critical software systems, such as those we rely on in aviation and aerospace. On a more theoretical note, one of the greatest unsolved problems in Computer Science is the \$1m “P vs. NP” Millennium Prize Problem, relating to the existence of efficient algorithms for many intriguing Discrete Mathematics problems.

Discrete Mathematics at Warwick

Our distinctive combination of mathematics and computer science is taught by world-leading academics, providing an ideal basis for careers at the forefront of mathematical science.

Discrete Mathematics is an honours degree taught jointly by the Department of Computer Science and the Warwick Mathematics Institute. This distinctive course provides a firm grounding in modern Computer Science and Mathematics, building on the expertise of the Centre for Discrete Mathematics and its Applications (DIMAP), a leading international research centre established at the University of Warwick. Our Discrete Mathematics degree equips students with a fundamental understanding of Mathematics and a comprehensive set of skills in Computer Science, which make our graduates attractive to the world's most reputable employers.

The course involves learning about and solving interesting mathematical problems. You will be taught how to create and analyse

algorithms, as well as having the opportunity to develop software systems individually and as part of a team. Your third year project will allow you to explore a topic that you find particularly interesting, building on the expertise and skills you've developed in previous years.

Students who enjoy their study of Discrete Mathematics have the opportunity to study our MEng Discrete Mathematics degree. This 4-year course provides greater breadth and depth, making it an ideal preparation for postgraduate study in the mathematical sciences or industrial leadership.



Warwick is a world-leading university that is consistently ranked in the top 10 of all UK university league tables.

“Studying Discrete Mathematics has been perfect for me. I’m benefiting from a fully-funded PhD at Warwick, all because of the success it helped me achieve in Mathematics and Computer Science.

David Purser
Discrete Mathematics (2012-15)



Discrete Mathematics Course Structure

The 3-year BSc and the 4-year MEng Discrete Mathematics courses develop the rigorous mathematical methods and practical skills that are demanded by a variety of technical roles, including those in scientific research.

Each year of study builds on the previous year to provide excellent breadth and depth of coverage in Mathematics and Computer Science.

First year

The first year of the course focuses on the development of essential skills in Mathematics and Computer Science. Students take modules in fundamental areas of pure mathematics, such as mathematical analysis, linear algebra and probability. They experience computer programming in Java and learn how to solve fundamental problems using algorithms and data structures. A normal load consists of around 25% Computer Science modules, 40% pure mathematics modules, 20% Discrete Mathematics modules and 5% statistics modules. Around 10% of the normal load is left for optional modules, chosen in conjunction with the advice and support of a personal tutor. Many first year modules are specifically designed for Discrete Mathematics students, whilst others are studied alongside other first-year students across in Computer Science, Mathematics and Statistics.

Second year

The second year places emphasis on applying the mathematical skills developed during the first year. The core consists of modules related to discrete mathematics and advanced algorithm and data structure design, including theoretical concepts related to the formalities of computation. Optional modules offer a wide range of mathematical and statistical subjects related to optimisation and stochastic methods. More than 40% of the normal load is left for students to choose optional modules.

Third Year

The third year gives students the freedom to choose modules that suit their interests and shape their graduate profile. Students are required to take two Computer Science modules. The first of these is a module on analysing the complexity of computational problems, whilst the second is an individual project. In most cases, the projects consist of designing and implementing software to solve a student-specified research problem, though students can also choose to develop entirely mathematical projects.

Fourth Year

The fourth year propels students to the forefront of mathematics and computer science through the study of research-active material in mathematics and computer science. In particular, they develop expertise in areas such as algorithmic game theory, decision procedures and Monte Carlo methods, as well as having the opportunity to develop advanced technical skills through the study of modules such as computer security and data analytics.

UCAS Code: G190 (BSc), G4G3 (MEng)

TYPICAL OFFER

A-level: A*AA
(including an A* in Mathematics or Further Mathematics)

IB: 38
(including 6 in three Higher Level subjects including Mathematics)

Flexibility and Study Options

The Discrete Mathematics degree offers great flexibility, which only increases from the first year. Most of the modules taken are taught by the Warwick Mathematics Institute, Department of Computer Science, Department of Statistics and the Warwick Business School. However, in each year of study there is the opportunity to study unusual options that broaden the student experience, including those offered by the Department of Philosophy, Department of Economics, the Warwick Language Centre and others. Additional modules may also be taken by students opting to take a higher load.



Dr Abhir Bhalerao
Deputy Head of Department
(Teaching and Learning)

Intercalated Years, Internships and Study Abroad

We offer a variety of possibilities for students to enhance their degree with industrial experience or study overseas. Each of our degree courses has an intercalated year option, which allows students to spend a year working in industry or studying overseas. The year in industry is typically taken as the penultimate year of a degree course.

We provide support for students wanting to spend a year in industry by promoting opportunities, hosting departmental careers fairs and offering one-to-one sessions with our departmental careers advisor. Intercalated year students are supported by their personal tutor and our Industrial Liaison Team during their year in industry. Students working in the UK are visited by academic representatives to review their development during the year.

Students who take an intercalated year return with a deeper appreciation for the application of their discipline and often develop final-year project ideas based on their experiences. It is common for students to obtain an offer of a graduate role in their host company on

completion of their degree. Our students have recently spent successful internships at companies including Accenture, ARM, Bank of America, British Telecom, Cisco, Google, GSK, IBM, Intel, Microsoft, Reuters and Unilever.

Regardless of whether a student decides to take an intercalated year, there are ample opportunities to gain real-world experience through internships. These programmes usually take place during the summer vacation, allowing you to apply your knowledge and skills in an industrial setting.

An alternative to a year spent in industry is a year spent at a partner institution overseas. We have an established exchange programme with the Hong Kong University of Science and Technology, which provides opportunities for our students to experience teaching and learning at another world leading institution. In addition to benefiting from a rich cultural experience, students returning from studying overseas exhibit an international profile that is attractive to potential employers.

Discrete Mathematics Research at Warwick

Discrete Mathematics attracts high calibre students who want to work in an exciting and demanding field. Students benefit from the expertise and leadership of our world class academic staff. Modules are delivered by research leaders, exposing students to the latest developments in mathematics, ensuring they leave Warwick with the expertise and skills to contribute to any organisation.

The Centre for Discrete Mathematics and its Applications (DIMAP) is an internationally recognised research centre established in 2007 at the University of Warwick. Funded by a £3.8M EPSRC Science and Innovation Award, DIMAP has attracted world-leading mathematicians to the Warwick Mathematics Institute, the Department of Computer Science and the Warwick Business School.

“Discrete Mathematics has been an ideal preparation for a career in science. I had a lot of opportunities after graduation but I couldn’t say no to Microsoft Research. I never thought I’d have such an exciting position.”

Benjamin Biggs
Discrete Mathematics (2013-16)



Professor Artur Czumaj
Department of Computer Science and
Director of DIMAP

Research: Game theory, graph theory, string and pattern matching, randomised algorithms.

Teaching: Algorithmic Graph Theory, Discrete Mathematics and its Applications 1.



Professor Dan Kral
Department of Computer Science and
Warwick Mathematics Institute

Research: Combinatorics, graph colouring, logic methods for algorithm design.

Teaching: Combinatorics, Discrete Mathematics and its Applications 2.

Employability



"The University of Warwick has consistently delivered Computer Scientists of the highest calibre, producing graduates with the vital knowledge and skills to become successful software engineers at world-class software companies."

Sheldon Lachambre
Director of Product Engineering, Citrix

Our graduates are highly sought after by premier graduate employers, who appreciate the rigour and industrial relevance of our degree courses.

Discrete Mathematics plays an essential role in modelling and designing efficient solutions to everyday problems in the digital economy, allowing our graduates to find jobs in a wide range of areas, including:

- ▶ Consultancy
- ▶ Finance
- ▶ Scientific Research
- ▶ Software Engineering
- ▶ Telecommunications

This means our students enjoy a great deal of freedom in deciding on career paths, with the majority having a host of exciting options open to them on graduation. Sectors popular with recent Discrete Mathematics students include consultancy, financial services, government and software engineering.

We work closely with the University's highly regarded Student Careers and Skills service to offer guidance and support on graduate employment, including application reviews, interview preparation and one-to-one advice session with our dedicated careers advisor. In addition to the University's careers fairs, our students benefit from departmental careers events, including our annual flagship "Computing Your Career", where we host multi-national organisations with whom we have long-standing partnerships.

"Staff in Mathematics and Computer Science make modules interesting and help you understand the value of what you're learning. Studying at Warwick was one of the best decisions I've made."

Rachel Durrant
Discrete Mathematics (2013-16)





Mathematical Degrees at Warwick

Since its foundation in 1965, Warwick has become one of the strongest universities for mathematical science in Europe.

The Warwick Mathematics Institute is now home to many internationally renowned researchers from all areas of pure and applied mathematics. One of its members, Professor Ian Stewart, is also a well-known author in popular science.

The Department of Computer Science was established in 1969, counting itself among the oldest UK Computer Science departments. The Department is consistently ranked among the top UK Computer Science departments and invariably noted for its friendly academic community, flexible course structure and commitment to student support.

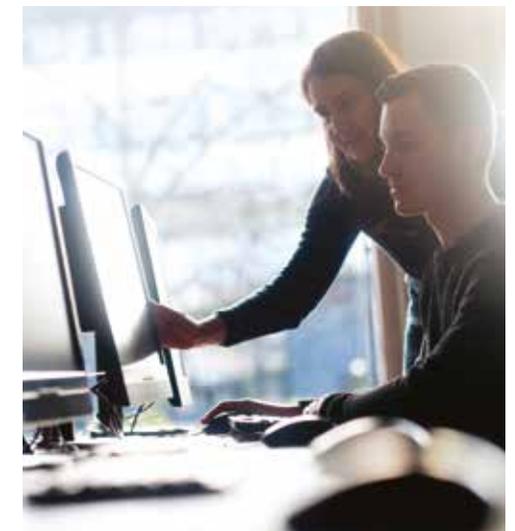
In recognition of the importance of Discrete Mathematics, the University of Warwick established the Centre for Discrete Mathematics and its Applications (DIMAP) in 2007. The centre is a joint venture of the Department of Computer Science, the Warwick Mathematics Institute and the Warwick Business School. In its first years of existence, it was supported by an EPSRC Science and Innovation Award of nearly £4M. The centre attracted many world leading experts to Warwick and turned Warwick into one of the strongest places for Discrete Mathematics in Europe.

The Discrete Mathematics degree course is administered by the Department of Computer Science, which has a strong tradition in multidisciplinary degrees. Every student is assigned a personal tutor to provide pastoral care and help deal with any academic issues.

All modules taught are delivered by specialists from relevant departments. Lecture classes in Mathematics and Computer Science are supplemented by laboratories, seminars and tutorials in each year of study. Students are encouraged to shape their degree through the selection of optional modules based on their personal interests and individual aspirations.

The University of Warwick is proud to offer several degree courses in the mathematical science, including:

- ▶ Computer Science
- ▶ Data Science
- ▶ Mathematics
- ▶ Mathematics and Statistics
- ▶ MORSE





Studying at the University of Warwick

The University of Warwick was established in 1965. Quickly gaining a reputation for excellence in research and teaching, the University has consistently been ranked among leading UK institutions. In recent years it has also been ranked among the top 20 world universities under 50, both in the QS World University Ranking and the Times Higher Education World University Ranking. The Government Teaching Quality Assessment has rated as excellent both Computer Science and Mathematics.

The Warwick Arts Centre is the largest arts centre in the UK outside London. It combines an art gallery, a concert hall, a cinema, theatres and Music Centre. The University campus also offers first class sports facilities including a Sports Centre, Games Hall, Bear Rock Climbing Centre, playing fields and running tracks.

Over 250 clubs and societies are organised by the Students Union, which is one of the biggest in the UK. This provides a vast range of activities and entertainment options for those enjoying student life at Warwick.

The main campus of the University is located in the southern part of Coventry and partly in the county of Warwickshire. Its central location means that Birmingham and its busy international airport are within easy reach. It is also one hour train ride or 90 minute motorway ride to London. The University of Warwick is a place of study for over 23,000 students with 55% being undergraduates. In January 2013, the University also opened Learning Grid in Leamington Spa to offer a supportive environment to its many students living in the nearby town.



dcs.warwick.ac.uk

A large, stylized graphic element consisting of a downward-pointing chevron shape, rendered in a bright blue color, positioned above the university name.

WARWICK
THE UNIVERSITY OF WARWICK

Department of Computer Science
The University of Warwick
Coventry
CV4 7AL
+44 (0)24 7652 3193
ugadmissions@dcs.warwick.ac.uk