

# FACULTY PROFILES

**R**onald Graham has gained a reputation as one of the world's most esteemed mathematicians. His extensive list of published works includes number theory, graph theory, discrete and computational geometry, theoretical computer science and combinatorics.

To Graham, mathematics poses alluring challenges waiting to be dissected and solved virtually everywhere: in the complex mix of ball equations in juggling (Graham is an avid juggler and former circus performer); while discussing mathematics with his wife, Fan Chung Graham; or in practical problems, such as how the world's emerging telecommunications companies can optimize their information distribution patterns.

The casual observer may not see how mathematical concepts apply in today's world, but Graham readily provides examples. Graham has conducted research on algorithms, a key concept in computer science. His work in optimization can help pinpoint the best distribution scenario for a network or the best performance layout for an integrated circuit board. New areas, such as quantum computing, could hold implications for computer transmission issues such as security and bank verification.

"Fifty years ago, number theory was felt to be pure and not really connected to the real world," said Graham. "Now it's one of the most applied areas. If you want to transmit numbers, or encrypt or store them, you're really using number theory."

**F**an Chung Graham believes mathematics is currently moving through a critical period. The successful implementation of new and amazing technologies, she says, increasingly depends on building the technology upon the principles of mathematics.

Engineers are constantly looking for new ways to make digital technologies, the Internet and multimedia applications move information faster, cleaner, better.

"The hardware is moving so fast that the software is really holding the key to taking advantage of all the advances," says Chung Graham. "Math, computer science and communications are the foundation of the digital age. The kind of mathematics I work with deals with many complex problems of the information age."

Her research interest is primarily in combinatorics, an area that bridges mathematics and computer science. While she has achieved a remarkable record of published papers on theoretical matters, Chung Graham has put theory to practice again and again. In 1988, for example, while working as a division manager at Bell Communications Research, she was awarded a patent for encoding and decoding Code Division Multiple Access (CDMA) communication systems.

Five years later, while working as a Bellcore Fellow, she was awarded a second patent for routing network traffic.

Graham also notes the applicability of mathematics in biology, economics and a number of new "computational" disciplines that require analysis of large sets of data. Graham thrives on the combination of the established, age-tested strength of mathematics with the fresh problems posed by the young computer science field.

"It's a very positive symbiosis, in a sense, these two disciplines are interacting and strengthening each other."

Graham decided to give up his position as Chief Scientist at AT&T Bell Laboratories for the opportunity to join a growing university and to interact with students.

"It's always good to stand in front of students," Graham said. "They are the ones who look at you and say, 'Why do you do it this way?,' and 'Couldn't you do it another way?' I think to myself: hmmm, good questions." ➤

## Ronald Graham

became the Irwin and Joan Jacobs Chair in Information and Computer Science in 1998. Previously, Graham was Chief Scientist at AT&T Bell Laboratories, where he spent 35 years as a researcher and then as Director of Information Sciences. Among his many accomplishments and contributions, Graham is Treasurer of the National Academy of Sciences.



## Fan Chung Graham

recently joined UC San Diego as a professor of mathematics and computer science. Most recently she was a professor of mathematics at the University of Pennsylvania. She previously worked at Bell Laboratories and then Bell Communications Research where she was a Division manager and Bellcore Fellow.

Chung Graham was awarded the Allendoerfer Award of the Mathematical Association of America in 1990.



She believes that mathematics provides important tools for numerous practical problems, such as how to efficiently use data sets and systems that are steadily becoming larger and more complex.

Chung Graham plans to continue working in fundamental mathematical areas, but she also sees her new surroundings within the Jacobs School and UC San Diego as an opportunity to explore a variety of interdisciplinary efforts. She and her husband, Ron Graham have already begun exploring collaborative opportunities with the San Diego Supercomputer Center.

"Coming here gives us a unique opportunity to contribute to UC San Diego's explosive growth," said Chung Graham. "This is a very key time in the development of the university and we're happy to be able to be here to participate." ➤