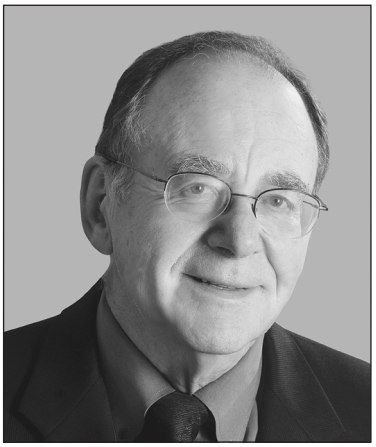
Karp Receives 2008 Kyoto Prize



Richard M. Karp

RICHARD M. KARP has received the 2008 Kyoto Prize in the category of Advanced Technology, for "fundamental contributions to the development of the theory of computational complexity". The presentation ceremony will be held at the Kyoto International Conference Center on November 10, 2008. At the ceremony, each Kyoto laureate will be awarded a diploma, a Kyoto Prize medal of 20 karat gold, and prize money of 50 million yen (about US$470,000). In the Basic Sciences category, the prize goes to molecular biologist Anthony James Pawson, and in the Arts and Philosophy category, to philosopher Charles Margrave Taylor.

The Work of Richard M. Karp

Richard M. Karp has made fundamental contributions to the development of the theory of computational complexity which began in the early 1970s by establishing the theory of NP-completeness, having a profound influence on the guiding principles for analysis and design of algorithms. He has also developed many practically relevant computer algorithms.

In particular, Karp created a technique for measuring the computational complexity of combinatorial problems by establishing complexity classes of equally hard-to-solve problems in accordance with the concept of polynomial-time reduction, and determining the class to which each problem would belong. In more concrete terms, Karp established the theory of NP-completeness by defining the complexity class P as problems for which polynomial-time algorithms of deterministic solutions exist, the complexity class NP as problems for which polynomial-time algorithms of nondeterministic solutions exist, and the NP-complete, which is a subclass of the complexity class NP to which the hardest-to-solve problems belong. With this achievement, he revealed that many familiar problems which often appear in a wide range of optimization problems in operation research, and in areas related to computer science, are equally hard-to-solve problems belonging to the NP-complete class. He also deduced and disseminated a standard methodology for this process, making a dramatic leap in the theory of computation and algorithms that underpin computer science.

Among researchers of the theory of computation, the issue of whether complexity class P and complexity class NP are the same class or not is referred to as the "P versus NP problem", which is an open problem of central interest in computer science, having also caught the interest of the mathematical community. As indicated by this fact, Karp not only added a new page to human wisdom by bringing computational complexity within the scope of scientific research, but also accelerated the development of algorithm engineering and had a significant influence on the guiding principles for the evaluation and design of algorithms for many of the problems extant in technological fields. Before his pioneering contributions, algorithms had to be designed individually for each of a plethora of technological problems. Karp freed algorithm design from this condition of manual labor and elevated it to a scientific technology.

In addition to these achievements, Karp has developed numerous individual algorithms with practical relevance, the most notable being the Edmonds-Karp algorithm. He played a central role in the development of computational complexity theory, which made notable advances in the early 1970s and after, and built a frame for the study of the theoretical computer science centered at the University of California, Berkeley, where he held a professorship and mentored many young researchers, thereby playing a leading role in the establishment of the theories of parallel algorithms and probabilistic algorithms. Over the last decade, he has stayed true to his belief that computer scientists should work on research themes that are

useful to other academic fields, particularly the life sciences, thereby making significant contributions to the study of algorithms in the bioinformatics field.

Biographical Sketch

Richard Manning Karp was born in 1935 in Boston, Massachusetts. He received his Ph.D. in applied mathematics in 1959 from Harvard University, under the direction of Anthony Oettinger. Karp was a research staff member at the IBM Thomas J. Watson Research Center from 1959 until 1968, when he became a professor at the University of California, Berkeley. He was a research scientist at the International Computer Science Institute (ICSI) from 1988 until 1995. He then spent four years at the University of Washington before returning to Berkeley, where he is now a University Professor. He is also a senior research scientist at ICSI.

His honors include the Delbert Ray Fulkerson Prize in Discrete Mathematics of the AMS and the Mathematical Programming Society (1979), the A. M. Turing Award of the Association for Computing Machinery (1985), the National Medal of Science (1996), the Harvey Prize of Technion-Israel Institute of Technology (1998), and the Benjamin Franklin Medal (2004). He is a member of the U.S. National Academy of Sciences and the U.S. National Academy of Engineering.

About the Prize

The Inamori Foundation was founded in 1984 by Kazuo Inamori (now chairman emeritus of Kyocera Corporation) and began its operations in 1985. The activities of the Inamori Foundation reflect the lifelong beliefs of its founder that people have no higher calling than to strive for the greater good of humankind and society and that the future of humanity can be assured only when there is a balance between scientific development and the enrichment of the human spirit. The foundation presents the Kyoto Prizes annually to honor those who have contributed significantly to the scientific, cultural, and spiritual betterment of mankind.

Previous Kyoto Prize winners who have made contributions to the mathematical sciences are: Rudolf E. Kalman (1985), Claude E. Shannon (1985), John McCarthy (1988), I. M. Gelfand (1989), Edward Lorenz (1991), André Weil (1994), Donald E. Knuth (1996), Kyosi Itô (1998), Mikhael Gromov (2002), Simon A. Levin (2005), and Hirotugu Akaike (2006).

—From Inamori Foundation announcements