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A biography of László Lovász

A mathematical star since he was a teenager, László Lovász has more than delivered on his early promise, becoming one of the most prominent mathematicians of the last half century. His work has established connections between discrete mathematics and computer science, helping to provide theoretical foundations, as well as design practical applications, for these two large and increasingly important areas of scientific study. He has also served his community as a prolific writer of books, noted for their clarity and accessibility, as an inspirational lecturer, and as a leader, spending a term as president of the International Mathematical Union (2007–2010).

Born in 1948 in Budapest, Lovász was part of a golden generation of young Hungarian mathematicians, nurtured by the country's unique school mathematics culture. He was in the first group of an experiment in which gifted students at a Budapest high school were given specialist maths classes. (One of his classmates was Katalin Vesztergombi, whom he later married.) Lovász excelled, winning gold medals in the 1964, 1965 and 1966 International Mathematics Olympiads, on the latter two occasions with perfect scores. He also won a primetime Hungarian TV show in which students were placed in glass cages and asked to solve maths problems.

Perhaps the most important encounter in his teenage years, however, was with his mathematical hero, Paul Erdös, the nomadic and famously sociable Hungarian mathematician. Erdös was an insatiable sharer of problems and inspired Lovász to work in 'Hungarian-style combinatorics', essentially concerned with properties of graphs. Not only did this set up an initial research direction, but it also paved the way for Lovász's style of how to do maths: openly and collaboratively.

Lovász attended Eötvös Loránd University in Budapest. He was awarded a PhD (or rather, the Hungarian equivalent, the C.Sc.) aged 22 in 1970, by which time he had already lectured at international conferences and had 15 papers

published. Due to a quirk of the Hungarian system, he only graduated in 1971, a year *after* he got his PhD.

Combinatorics is the maths of patterns and counting patterns. Graph theory is the maths of connections such as in a network. Both come under the umbrella of 'discrete' maths, since the objects of study have distinct values, rather than varying smoothly like, say, a point moving along curve. Erdös liked to study these areas for purely intellectual pleasure, with no concern for their usefulness in the real world. Lovász, on the other hand, became a leader of a new generation of mathematicians who realised that discrete maths had, in computer science, a thrilling new area of application.

In the 1970s, for example, graph theory became one of the first areas of pure mathematics able to illuminate the new field of computational complexity. Indeed, one of the major impacts of Lovász's work has been to establish ways in which discrete maths can address fundamental theoretical questions in computer science. "I was very lucky to experience one of those periods when mathematics was developing completely together with an application area," he says.

Among his contributions to the foundational underpinning of computer science are powerful algorithms with wide-ranging applications. One of these, the LLL algorithm, named after Lovász and the brothers Arjen and Hendrik Lenstra, represented a conceptual breakthrough in the understanding of lattices, a basic geometrical object, and which has had remarkable applications in areas including number theory, cryptography and mobile computing. Currently, the only known encryption systems that can withstand an attack by a quantum computer are based on lattices and use the LLL algorithm.

During the 1970s and 80s, Lovász was based in Hungary, first at Eötvös Loránd University and then at József Attila University in Szeged, where he became Chair of Geometry in 1978. He returned to Eötvös Loránd in 1982 to be Chair of Computer Science. In those early decades he solved important and far-reaching problems in many areas of discrete mathematics. One of his first major results, in 1972, was to resolve the 'perfect graph conjecture', a long-standing open problem in graph theory. In 1978 he settled Kneser's conjecture, again in graph theory, but this time surprising his colleagues by using a proof from algebraic topology, a completely different area. In 1979 he solved a classical problem in information theory, determining the 'Shannon capacity' of the pentagon graph.

A major theme of Lovász's work in both combinatorics and algorithm design is the investigation of probabilistic methods. The discovery in this area for which he is best known is the Lovász Local Lemma, an important and frequently used tool in probabilistic combinatorics used to establish the existence of rare objects, as opposed to the more standard tools used when objects are more abundant. Lovász also contributed to an early, influential paper on probabilistically checkable proofs (PCP), which grew into one of the most important areas of computational complexity.

In 1993 Lovász was appointed William K Lanman Professor of Computer Science and Mathematics at Yale University. In 1999 he left academia to take up a position as a Senior Researcher at Microsoft, before returning in 2006 to Eötvös Loránd University, where he is currently a professor.

Lovász has travelled widely. He has held visiting positions at the universities of Vanderbilt in Nashville (1972/3), Waterloo (1978/9), Bonn (1984/5), Chicago (1985), Cornell (1985), and Princeton (1989–93) as well as spending a year at the Institute for Advanced Study in Princeton (2011/12). Called 'Laci' by friends and colleagues, he is known for his modesty, generosity and openness. These qualities have led to positions on the executive committee of the International Mathematical Union (including as president), and at the Hungarian Academy of Sciences (where he was president from 2014–2020.)

Lovász has won many awards including the 1999 Wolf Prize, the 1999 Knuth Prize, the 2001 Gödel Prize and the 2010 Kyoto Prize.

He has four children with Katalin Vesztergombi, a mathematician who is also one of his frequent collaborators, and seven grandchildren.

Source for quote: Simons Foundation, interview with László Lovász, 2013.