

# LETTERS TO THE EDITOR



## John Brillhart (1930–2022)

John David Brillhart was born in Berkeley, California, on November 13, 1930. He received his bachelor's degree in 1953, his master's degree in 1966, and his doctorate one year later in 1967, all from UC Berkeley. His dissertation on Euler and Bernoulli polynomials was supervised by D. H. Lehmer with assistance from L. Carlitz. John showed that  $E_5(x)$  is the only Euler polynomial with a multiple root and that the odd degree Bernoulli polynomials have no multiple roots. In 1967 John joined the faculty at the University of Arizona and retired from there in 2001. During his career he authored/coauthored about 50 papers and articles, along with two books. He spoke often at conferences and meetings and continued his mathematical interests long after he retired. John left this world on May 21, 2022. He was cared for by his longtime friend, Tom Struck.

When John was in the Army, his drill sergeant asked why he was scribbling numbers next to his rifle. John explained that he was factoring the serial number of his gun—branding himself as a potential trouble maker in the eyes of the surprised sergeant. This fascination with factoring stayed with John for the rest of his life. Besides integer factorization and primality testing, he had broad interests ranging over the following topics: elliptic polynomials, modular identities involving infinite products, polynomial identities and irreducibility, class numbers and algebraic number theory.

John's most influential paper was "A method of factoring and the factorization of  $F_7$ " with M. A. Morrison (*Math. Comp.* 29 (1975), 183–205), which describes how to implement the continued fraction factoring method (CFRAC), a subexponential running time algorithm first introduced by D. H. Lehmer and R. E. Powers in 1931, but thought too tedious for hand calculation at the time. In their paper, John Brillhart and Michael Morrison show how to combine the relations in this algorithm by using Gaussian elimination on vectors of exponents over the field with 2 elements, an easy task for a computer. They introduce the factor base, a fixed set of primes used for trial division of auxiliary numbers. They also describe their 1970 implementation of CFRAC to give the first factorization of the Fermat number  $F_7 = 2^{2^7} + 1$ . Their factor base and new method of combining relations led C. Pomerance to invent the quadratic sieve, some of whose ideas went back to M. Kraitchik in 1929.

\*We invite readers to submit letters to the editor at [notices-letters@ams.org](mailto:notices-letters@ams.org).

The number field sieve, the fastest known factoring method for general numbers, stemmed from the quadratic sieve.

John was one of the members of the Cunningham Project, which factors Mersenne, Fermat, and related numbers. With D. H. Lehmer, J. L. Selfridge, Bryant Tuckerman, and S. S. Wagstaff, Jr., he was a coauthor of the book *Factorizations of  $b^n \pm 1$ ,  $b = 2, 3, 5, 6, 7, 10, 11, 12$  up to high powers* (Contemporary Mathematics series, v. 22, American Mathematical Society, 1983 and 1988), which collected these factorizations in one place. John also wrote a book with J. S. Lomont, *Elliptic Polynomials*.

John was one of the founding members, as well as a financial contributor, of the Number Theory Foundation, started by J. L. Selfridge, which encourages research and collaboration by helping to sponsor conferences and working to foster a spirit of cooperation and goodwill among number theorists. John was also proud to be a participant in the first West Coast Number Theory (WCNT) meeting and attended the conference annually, health providing.

John was a great teacher, with a unique and infectious sense of humor, and boundless curiosity and enthusiasm for mathematical exploration. He enjoyed keeping an open office atmosphere for discussing mathematics with students. John had two PhD students: Richard Blecksmith and Christian Ballot. He also mentored one undergraduate at the University of San Francisco and two at the University of Arizona, helping them begin their mathematical careers: Michael Morrison, Patrick Morton, and Michael Filaseta.

John loved music, especially classical music and opera. He was a gifted amateur pianist, proud member of the UC Glee Club, and played in theater groups in the Bay Area into his mid 30's. He had strong political opinions and fought actively for what he believed was right.

—Christian Ballot, Richard Blecksmith,  
Michael Filaseta, Michael Morrison,  
Patrick Morton, and Samuel S. Wagstaff, Jr.