interval (as an approximation of a real number) contains the unknown true value with certainty and nothing is known about the precise location of the true value inside the interval. Fuzzy numbers are similar to random numbers as well, but they should not be confused: A random number is associated with the error in the measurement of a theoretically precise value, whereas a fuzzy number is a way to describe the uncertainty of human thought; it is a "subjective valuation assigned by one or more human operators."

A large number of generalizations of the concept of a fuzzy number are considered. Fuzzy numbers of higher dimensions can be introduced. Fuzzy complex numbers, fuzzy relative integers modulo n, fuzzy reals modulo one, and other concepts are considered. Fuzzy numbers of type two can be defined as fuzzy numbers where the intervals of confidence are not precisely known, being fuzzy numbers themselves. Numerous notions of statistics can be adapted to, or combined with the theory of fuzzy numbers; this, for example, leads to the novel concept of a hybrid number.

All of the concepts and operations are illustrated by a large number of examples which are in most cases given in the form of easy-to-understand figures. Many of these examples make use of triangular fuzzy numbers which are the easiest to compute with. In addition to these illustrative examples, the book contains some applications, including an optimization problem and an application of fuzzy numbers in catastrophe theory. The reviewer would like to make two recommendations about future research in the field of fuzzy numbers: First, fuzzy numbers are described by a function which tends to get more and more complicated after every operation; for example, the sum of triangular fuzzy numbers is a triangular fuzzy number again, but the product is not; is there a class of fuzzy numbers which can be easily represented in a computer and which is, in addition, closed, under all operations under consideration? Second, more applications should be investigated where fuzzy arithmetic is essential to obtain clear, reliable, detailed results that interval arithmetic, for example, could not deliver.

In summary, the present book is an excellent introduction for anybody who wants to get acquainted with the theory of fuzzy numbers. The numerous illustrative examples make it ideal for self-instruction as well as for courses on the subject. For the more advanced reader it contains a large number of novel ideas and incentives for application and research.

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48[68-02, 68P05, 68Q25, 68U05].—FRANCO P. PREPARATA & MICHAEL IAN SHAMOS, *Computational Geometry—An Introduction*, Texts and Monographs in Computer Science, Springer-Verlag, New York, 1985, xii + 390 pp., 24 cm. Price $45.00.

A book like this was badly needed by the scientific community, especially in view of the rapid growth and increasing popularity of the area of computational geometry, and its importance from both a theoretical and practical point of view. The book is very well written and is impressive in the breadth and depth of its coverage of the field. A major strength of the book is that it typically gives an excellent intuitive explanation of an algorithm or data structure before providing implementation details. The lower-bound proofs are given in the unified framework of Ben-Or's theorem; including this theorem was a particularly good decison by the authors. As a reference, the book is a must for the researcher in algorithm design and data structures, and for any programmer writing software that deals with geometric objects. As a textbook, the book is ideal for a graduate-level course taken by students who have already taken an algorithms course, or as a supplementary textbook for a senior or graduate-level course on algorithm design and analysis; in either case, the book's list of suggested exercises will be most valuable to the instructor.

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49[11T06].—HAROLD FREDRICKSEN & ROBERT WARD, *A Table of Irreducible Binary Pentanomials of Degrees* 4 *Through* 100, 4 pp. of introductory text, 1 fig., and 273 pp. of tables, deposited in the UMT file.

An irreducible binary pentanomial of degree n takes the form $f(x) = x^n + c_{n-1}x^{n-1} + c_{n-2}x^{n-2} + \cdots + c_1x + 1$. The c_i are 0's and 1's with exactly three c_i nonzero. $f(x)$ is irreducible means there are no polynomials $g(x)$ and $h(x)$, both of degrees less than n over the field of 2 numbers, for which $f(x) = g(x)h(x)$.

In the tables, all irreducible pentanomials over the field of 2 elements are given for each degree from $n = 4$ through $n = 100$. Each polynomial which appears is listed as a, b, c, where these are the exponents of x for which the coefficients of f are nonzero. If $x^n + x^c + x^b + x^a + 1$ is irreducible with $a < b < c$, then its reverse polynomial $x^n + x^{n-a} + x^{n-b} + x^{n-c} + 1$ is also irreducible. We do not list both of these polynomials in the interest of economy. For each degree we also list the total number of irreducible pentanomials of that degree. Here, of course, we count both a polynomial and its reverse polynomial.

There have not been extensive tables of irreducible binary pentanomials published. However, there have been a number of tables of irreducible binary trinomials published [1]–[2]. When one examines these tables of trinomials, it is clear that there are several degrees for which there are no irreducible trinomials of these degrees. In fact, for degree $8t$ there are no irreducible trinomials for any t and for degrees $8t \pm 3$ there are very few irreducible trinomials of those degrees. It has been conjectured that there is no degree above $n = 4$ which does not possess an irreducible pentanomial of that degree. Our table lends evidence to support that conjecture.

The number N_n, of pentanomials of degree n, is also plotted with our tables. At (n, N_n) we have plotted the value of n (mod 8). One of the main suggestions of our work is clear from this figure, that is, there is a distinct modulo 8 character to the number of irreducible pentanomials. This compares to the similar modulo 8 character of irreducible trinomials indicated in Swan [3] and Fredricksen et al. [4].