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Combinatorial enumeration, by Ian P. Goulden and David M. Jackson, John Wiley & Sons, Inc., Somerset, New Jersey, 1983, xxiv + 569 pp., $47.50. ISBN 0-4718-6654-7

The most important idea in enumerative combinatorics is that of a generating function. According to the classical viewpoint, if the function $f(x)$ has a power series expansion $\sum_{n=0}^{\infty} a_n x^n$, then $f(x)$ is called the generating function for the sequence a_n. Sometimes the coefficients b_n, defined by

$$f(x) = \sum_{n=0}^{\infty} b_n \frac{x^n}{n!},$$

are more useful; here $f(x)$ is called the exponential (or factorial) generating function for the sequence b_n. Generating functions are often easier to work with than explicit formulas for their coefficients, and they are useful in deriving recurrences, congruences, and asymptotics.

Although generating functions have been used in enumeration since Euler, only in the past twenty years have theoretical explanations been developed for their use. Some of these, such as those of Foata and Schützenberger [**6, 7**] and Bender and Goldman [**2**] use decompositions of objects to explain generating function relations. Other approaches, such as those of Rota [**13**], Doubilet, Rota, and Stanley [**4**], and Stanley [**14**], use partially ordered sets. Goulden and Jackson's book is a comprehensive account of the decomposition-based approach to enumeration.

In the classical approach to generating functions, one has a set A of configurations (for example, finite sequences of 0's and 1's) satisfying certain conditions. Each configuration has a nonnegative integer "length". The problem is to find the number a_i of configurations of length i. One first finds a recurrence for the a_i by combinatorial reasoning; the recurrence then leads to