Foreword

The progress of mathematics can be viewed as a movement from the infinite to the finite. At the start, the possibilities of a theory, for example, the theory of enumeration, appear to be boundless. Rules for the enumeration of sets subject to various conditions, or combinatorial objects as they are often called, appear to obey an indefinite variety of recursions, and seem to lead to a welter of generating functions. We are at first led to suspect that the class of objects with a common property that may be enumerated is indeed infinite and unclassifiable.

As cases file upon cases, however, patterns begin to emerge. Freakish instances are quietly discarded; impossible problems are recognized as such, and what is left organizes itself along a few general criteria.

We would like these criteria to eventually boil down to one, but by and large we must be content with a small finite number.

And so with the theory of enumeration, as Jackson and Goulden show in this book. There are two basic patterns, ordinary generating functions and exponential generating functions, the first counting unlabeled or linearly ordered objects, the second counting labeled objects. The various combinatorial interpretations of the Lagrange inversion formula give the deepest results in enumeration. The test case is the enumeration of permutations subject to various geometric conditions. The still largely mysterious q-analogs arise from adding an extra parameter to the enumeration of permutations.

Lastly, there is the connection between circular enumeration and exponential generating functions; this, as well as the other topics, is developed thoroughly and with a wealth of examples by Goulden and Jackson. Their book will be required reading from now on by any worker in combinatorics.

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