Preface

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> *Learn from yesterday, live for today, hope for tomorrow.*
> *The important thing is not to stop questioning.*
> – Albert Einstein (1879–1955)

It has become clear to the modern working mathematician that no single researcher, regardless of his knowledge, experience, and talent, is capable anymore of overviewing the major open problems and trends of mathematics in its entirety. The breadth and diversity of mathematics during the last century has witnessed an unprecedented expansion.

In 1900, when David Hilbert began his celebrated lecture delivered before the International Congress of Mathematicians in Paris, he stoically said:

> Who of us would not be glad to lift the veil behind which the future lies hidden; to cast a glance at the next advances of our science and at the secrets of its development during future centuries? What particular goals will there be toward which the leading mathematical spirits of coming generations will strive? What new methods and new facts in the wide and rich field of mathematical thought will the new centuries disclose?

Perhaps Hilbert was among the last great mathematicians who could talk about mathematics as a whole, presenting problems which covered most of its range at the time. One can claim this, not because there will be no other mathematicians of Hilbert's caliber, but because life is probably too short for one to have the opportunity to expose himself to the allness of the realm of modern mathematics. Melancholic as this thought may sound, it simultaneously creates the necessity and aspiration for intense collaboration between researchers of different disciplines. Thus, overviewing open problems in mathematics has nowadays become a task which can only be accomplished by collective efforts.

The scope of this volume is to publish invited survey papers presenting the status of some essential open problems in pure and applied mathematics, including old and new results as well as methods and techniques used toward their solution. One expository paper is devoted to each problem or constellation of related problems. The present anthology of open problems, notwithstanding the fact that it ranges over a variety of mathematical areas, does not claim by any means to be complete,

as such a goal would be impossible to achieve. It is, rather, a collection of
beautiful mathematical questions which were chosen for a variety of reasons. Some
were chosen for their undoubtable importance and applicability, others because
they constitute intriguing curiosities which remain unexplained mysteries on the
basis of current knowledge and techniques, and some for more emotional reasons.
Additionally, the attribute of a problem having a somewhat *vintage flavor* was also
influential in our decision process.

The book chapters have been contributed by leading experts in the corresponding
fields. We would like to express our deepest thanks to all of them for participating
in this effort.

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