Foreword

In my view, mathematics of the 21st century can be characterized by the attempt at *automating* mathematical reasoning. By Gödel, we know that this will never be completely possible: The higher we go in the sophistication of automation the more remote is the horizon of where we would like to go next. However, it is possible and exciting to conquer higher and higher levels of automation.

The 20th century was the century of *formalizing* mathematical reasoning, which is the first step towards *automating* mathematical reasoning. As a side-product of mathematical formalization, the notion of "universal computer" – which in essence is a mathematical and not an engineering concept – was invented. The enormous impact of this notion on all aspects of science, technology, economy, and society as a whole, by now, is understood by everybody. The impact of *automating* mathematical reasoning (mathematical invention and mathematical verification) will generate bigger and bigger waves of understanding the world and of societal transformation. The waves will include such theoretical areas like, for example, the build-up of web-accessible global and comprehensive mathematical knowledge bases and such practical effects like, for example, deriving hidden knowledge from social media messages.

The level of formalization is not equally high in all areas of mathematics. In this book, Dirk Draheim lays the ground for the formalization of an important part of mathematics that also has high relevance to modern data science: probabilistic reasoning. He clarifies the frequentist semantics of the fundamental notion of partial conditional probability and reveals the subtle differences and the relation between this frequentist and the established Bayesian view. This is the first time that the many results that are due to earlier publications in this area are brought into a coherent form. The concepts can be made operational in today's standard programming paradigms. Thus, the foundational results are immediately available also for practical probabilistic modeling, which is of course of high relevance in current data science and artificial intelligence.

I wish this book wide distribution both in the research community and in the business world.

Research Institute for Symbolic Computation
Johannes Kepler University
Linz/Hagenberg, October 2017 *Bruno Buchberger*