
Preface

In the spring of 1994 at the College of William & Mary, we started work on a project that would end up being a long-lasting source of research. We explored the idea of combining a computer algebra system (Maple V at the time) and probability results to see if the computer could be useful in performing operations on random variables and finding new distributions. Over the next 4 years, a series of procedures written in Maple started to form its own programming language, soon to be called A Probability Programming Language (APPL). Furthermore, the language and the results that the language helped produce were starting to contribute to a field of research we called computational probability. The program APPL, unlike statistical software that works on data values, is designed to work on random variables and the various functions that describe their distribution. APPL helps derive distributions of functions of random variables, probabilistic models, and other transformations. Soon after, Diane Evans joined the team and wrote procedures for discrete distributions. The two sets of procedures were put together, and in a 2001 article in *The American Statistician* [60], the launch of this open-source software began.

In 2008, John Drew, along with Evans, Glen, and Leemis, put together a monograph explaining the creation of APPL and some of the important results from the research. This book, *Computational Probability: Algorithms and Applications in the Mathematical Sciences* [46], established the state of APPL at the time, primarily how it evolved and its major algorithms. Camille Price contacted us recently and requested that we update the original monograph and write a second monograph that summarizes some more recent work. The purpose of this, the second monograph, is twofold. First, we want to combine in this one document some of the recent results that have come about with the language. Second, we want to inspire future users, professors, students, and researchers to bring APPL into their work, their classroom, and their mindset. Just as Word, Excel, L^AT_EX, and PowerPoint are vital yet ubiquitous elements to many researchers, we hope that APPL will become such a

research tool that enables a probabilist or statistician the ability to explore new ideas, methods, and models.

Much of what is contained in the chapters that follow was published in journals over the last 20 years. Some of the works in the monograph are original efforts, yet to be published. These works highlight interesting examples, often done by undergraduate students and graduate students, that can serve as templates for future work. Each chapter is a stand-alone publication, with the authors recognized, and a short description of the importance that APPL had in the research. Furthermore, as an open-source language, it sets the foundation for future algorithms to augment the original code. Some papers heavily rely on APPL procedures; others enjoy the ease of use of data structures. Still others have added procedures to the base language.

The editors would like to thank the many people who have contributed, supported, and encouraged this effort. Each chapter author clearly has been instrumental in furthering this cause, and they are recognized at the start of each chapter. Many friends and colleagues have also been immensely supportive over the years. We would especially like to recognize the lifelong support of our wives, Jill Leemis and Lisa Glen, who have put up with our wild ideas, even though it often meant more work for them in other areas. Our children Lindsey, Mark, Logan, Andrea, Rebecca, Mary, Grace, Gabriel, Anna, Michael, and Claire have all been supportive and patient “listeners” to their fathers. Our many colleagues over the years deserve our heartfelt thanks: Richard Bell, Roger Berger, Barry Bodt, Fr. Gabriel Costa, Kevin Cumminskey, Sam Ellis, James Fritz, Ben Garlick, Grant Hartman, Steven Horton, Ted Hromadka, Michael Huber, Steven Janke, Rex Kincaid, Chris Marks, Joe Myers, Bill Pulleyblank, Tess Powers, Matthew Robinson, Mick Smith, Alex Stodala, Rod Sturdivant, Fred Tinsley, Dave Webb, Chris Weld, Joanne Whitner, and Wei Yin-Loh.

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