Introduction to Scientific Programming and Simulation Using R (Chapman & Hall/CRC The R Series)

Owen Jones, Robert Maillardet, Andrew Robinson

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Known for its versatility, the free programming language R is widely used for statistical computing and graphics, but is also a fully functional programming language well suited to scientific programming.

An Introduction to Scientific Programming and Simulation Using R teaches the skills needed to perform scientific programming while also introducing stochastic modelling. Stochastic modelling in particular, and mathematical modelling in general, are intimately linked to scientific programming because the numerical techniques of scientific programming enable the practical application of mathematical models to real-world problems.

Following a natural progression that assumes no prior knowledge of programming or probability, the book is organised into four main sections:

- **Programming In R** starts with how to obtain and install R (for Windows, MacOS, and Unix platforms), then tackles basic calculations and program flow, before progressing to function based programming, data structures, graphics, and object-oriented code
- **A Primer on Numerical Mathematics** introduces concepts of numerical accuracy and program efficiency in the context of root-finding, integration, and optimization
- **A Self-contained Introduction to Probability Theory** takes readers as far as the Weak Law of Large Numbers and the Central Limit Theorem, equipping them for point and interval estimation
- **Simulation** teaches how to generate univariate random variables, do Monte-Carlo integration, and variance reduction techniques

In the last section, stochastic modelling is introduced using extensive case studies on epidemics, inventory management, and plant dispersal. A tried and tested pedagogic approach is employed throughout, with numerous examples, exercises, and a suite of practice projects. Unlike most guides to R, this volume is not about the application of statistical techniques, but rather shows how to turn algorithms into code. It is for those who want to make tools, not just use them.

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