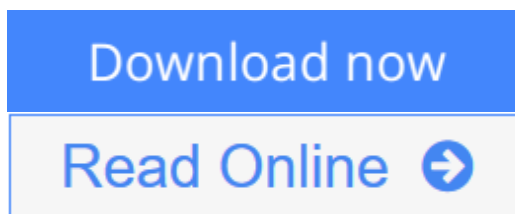# Introducing Monte Carlo Methods with R (Use R!)

By Christian Robert, George Casella

Introducing Monte Carlo Methods with R (Use R!) By Christian Robert, George Casella

Computational techniques based on simulation have now become an essential part of the statistician's toolbox. It is thus crucial to provide statisticians with a practical understanding of those methods, and there is no better way to develop intuition and skills for simulation than to use simulation to solve statistical problems. *Introducing Monte Carlo Methods with R* covers the main tools used in statistical simulation from a programmer's point of view, explaining the R implementation of each simulation technique and providing the output for better understanding and comparison. While this book constitutes a comprehensive treatment of simulation methods, the theoretical justification of those methods has been considerably reduced, compared with Robert and Casella (2004). Similarly, the more exploratory and less stable solutions are not covered here.

This book does not require a preliminary exposure to the R programming language or to Monte Carlo methods, nor an advanced mathematical background. While many examples are set within a Bayesian framework, advanced expertise in Bayesian statistics is not required. The book covers basic random generation algorithms, Monte Carlo techniques for integration and optimization, convergence diagnoses, Markov chain Monte Carlo methods, including Metropolis {Hastings and Gibbs algorithms, and adaptive algorithms. All chapters include exercises and all R programs are available as an R package called mcsm. The book appeals to anyone with a practical interest in simulation methods but no previous exposure. It is meant to be useful for students and practitioners in areas such as statistics, signal processing, communications engineering, control theory, econometrics, finance and more. The programming parts are introduced progressively to be accessible to any reader.

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Editorial Review

Review

From the reviews:

"Robert and Casella's new book uses the programming language R, a favorite amongst (Bayesian) statisticians to introduce in eight chapters both basic and advanced Monte Carlo techniques … . The book could be used as the basic textbook for a semester long course on computational statistics with emphasis on Monte Carlo tools … . useful for (and should be next to the computer of) a large body of hands on graduate students, researchers, instructors and practitioners … ." (Hedibert Freitas Lopes, Journal of the American Statistical Association, Vol. 106 (493), March, 2011)

"Chapters focuses on MCMC methods the Metropolis–Hastings algorithm, Gibbs sampling, and monitoring and adaptation for MCMC algorithms. … There are exercises within and at the end of all chapters … . Overall, the level of the book makes it suitable for graduate students and researchers. Others who wish to implement Monte Carlo methods, particularly MCMC methods for Bayesian analysis will also find it useful." (David Scott, International Statistical Review, Vol. 78 (3), 2010)

"The primary audience is graduate students in statistics, biostatistics, engineering, etc. who need to know how to utilize Monte Carlo simulation methods to analyze their experiments and/or datasets. … this text does an effective job of including a selection of Monte Carlo methods and their application to a broad array of simulation problems. … Anyone who is an avid R user and has need to integrate and/or optimize complex functions will find this text to be a necessary addition to his or her personal library." (Dean V. Neubauer, Technometrics, Vol. 53 (2), May, 2011)

From the Back Cover

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communications engineering, control theory, econometrics, finance and more. The programming parts are introduced progressively to be accessible to any reader.

Christian P. Robert is Professor of Statistics at Université Paris Dauphine, and Head of the Statistics Laboratory of CREST, both in Paris, France. He has authored more than 150 papers in applied probability, Bayesian statistics and simulation methods. He is a fellow of the Institute of Mathematical Statistics and the recipient of an IMS Medallion. He has authored eight other books, including *The Bayesian Choice* which received the ISBA DeGroot Prize in 2004, Monte Carlo Statistical Methods with George Casella, and *Bayesian Core* with Jean-Michel Marin. He has served as Joint Editor of the *Journal of the Royal Statistical Society Series B*, as well as an associate editor for most major statistical journals, and was the 2008 ISBA President.

George Casella is Distinguished Professor in the Department of Statistics at the University of Florida. He is active in both theoretical and applied statistics, is a fellow of the Institute of Mathematical Statistics and the American Statistical Association, and a Foreign Member of the Spanish Royal Academy of Sciences. He has served as Theory and Methods Editor of the *Journal of the American Statistical Association*, as Executive Editor of *Statistical Science*, and as Joint Editor of the *Journal of the Royal Statistical Society Series B*. In addition to books with Christian Robert, he has written *Variance Components*, 1992, with S.R. Searle and C.E. McCulloch; *Statistical Inference*, Second Edition, 2001, with Roger Berger; and *Theory of Point Estimation*, Second Edition, 1998, with Erich Lehmann. His latest book is *Statistical Design* 2008.

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