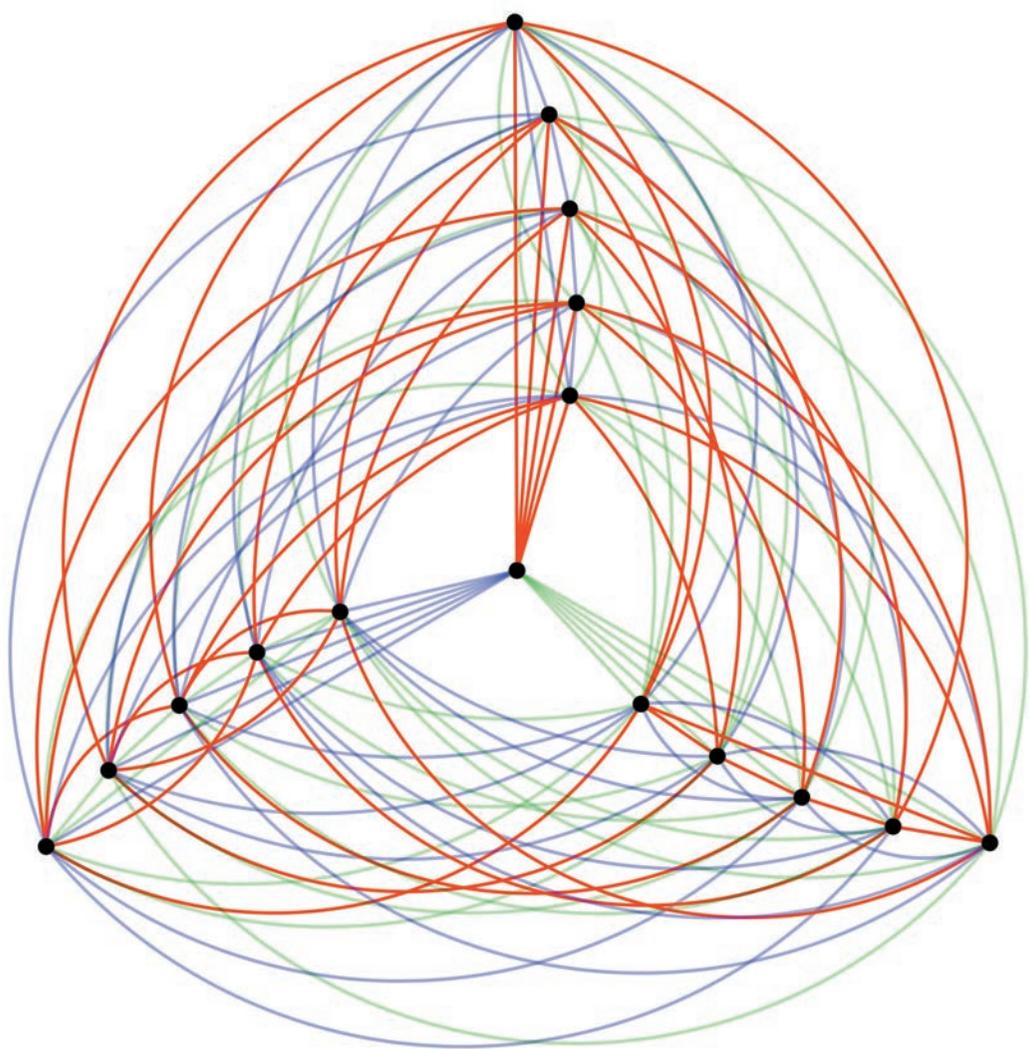
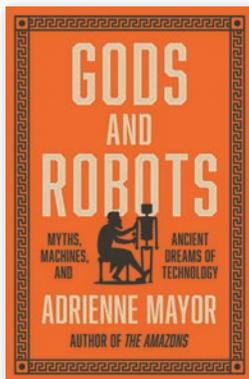


# Computer Science & Information Science 2019



## LETTER FROM THE ADVISERS

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The fields of computer science and information science have had unquestioned impact over the several decades of their existence. As academic disciplines, they have evolved to take a central role in science, mathematics, and engineering at universities and research institutions around the world. They have a rich history that connects to David Hilbert, Alan Turing, John von Neumann, Alonzo Church, Claude Shannon, and many other leading mathematicians and scientists of the twentieth century.

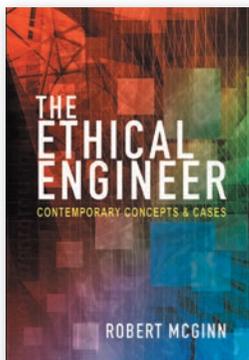
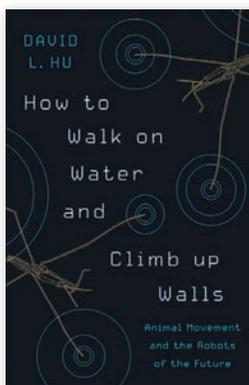
Computer science and information science now encompass core areas such as algorithms and data structures, programming methodology and languages, theoretical computer science, computer architecture, artificial intelligence, networking and wireless communications, social and energy networks, database systems, parallel and distributed computation, cryptography, information theory, privacy and security, machine learning, computer-human interaction, computer graphics, data analytics, probabilistic methods, signal processing, and operating systems. These fields are all expanding and have direct impact on the development of the computational and communication infrastructure that surrounds us today.

Research in computer science and information science now provides a foundation for research in many other fields, including computational biology, chemistry to physics, neuroscience, and all subareas of engineering. Indeed, computation and information now play an essential role in science, as scientists are confronted with massive amounts of data, computational models, and large-scale simulations of natural phenomena. More broadly, academics in all fields are recognizing the essential role of computer science and information science in the production and dissemination of knowledge in their disciplines.

As demonstrated by the titles in this catalog, Princeton University Press has a history of publishing in these areas and has begun developing a new book list dedicated to computer science and information science. It will include a select list of advanced field-shaping textbooks, outstanding research monographs, and excellent trade books of broad interest covering the areas mentioned above. We see this expansion as a logical extension of what Princeton University Press has published across the disciplines in recent years.

As advisers to this publishing venture, we hope that you will offer your suggestions or even consider contributing to a list that includes books by many leaders who have made computer science and information science what they are today.

**SANJEEV KULKARNI & ROBERT SEDGEWICK**



catalog cover: Ramsey's theorem; A partition of the complete graphs on 16 vertices, into three components, each being a Clebsch graph. "Twisted" version. Maproom.

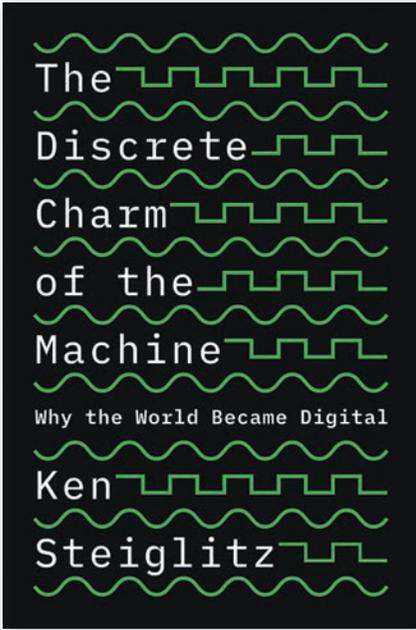
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**Susannah Shoemaker**, Associate Editor  
Susannah\_Shoemaker@press.princeton.edu



*“The Discrete Charm of the Machine is an inspirational must-read and delightful guide for anyone interested in traveling from the computational past through to the present. Reading this book will make you rethink what computation really is.”*  
—Andrew Adamatzky, University of the West of England

## The Discrete Charm of the Machine

**The genesis of the digital idea and why it transformed civilization**

A few short decades ago, we were informed by the smooth signals of analog television and radio; we communicated using our analog telephones; and we even computed with analog computers. Today our world is digital, built with zeros and ones. Why did this revolution occur? *The Discrete Charm of the Machine* explains, in an engaging and accessible manner, the varied physical and logical reasons behind this radical transformation.

The spark of individual genius shines through this story of innovation: the stored program of Jacquard’s loom, Charles Babbage’s logical branching, Alan Turing’s brilliant abstraction of the discrete machine, Harry Nyquist’s foundation for digital signal processing, Claude Shannon’s breakthrough insights into the meaning of information and bandwidth, and Richard Feynman’s prescient proposals for nanotechnology and quantum computing. Ken Steiglitz follows the progression of these ideas in the building of our digital world, from the internet and artificial intelligence to the edge of the unknown. Are questions like the famous traveling salesman problem truly beyond the reach of ordinary digital computers? Can quantum computers transcend these barriers? Does a mysterious magical power reside in the analog mechanisms of the brain? Steiglitz concludes by confronting the moral and aesthetic questions raised by the development of artificial intelligence and autonomous robots.

*The Discrete Charm of the Machine* examines why our information technology, the lifeblood of our civilization, became digital, and challenges us to think about where its future trajectory may lead.

**KEN STEIGLITZ** is professor emeritus of computer science and senior scholar at Princeton University. His books include *Combinatorial Optimization*, *A Digital Signal Processing Primer*, and *Snipers, Shills, and Sharks* (Princeton). He lives in Princeton, New Jersey.

February 2019. 256 pages. 40 b/w illus.  
Hardback 9780691179438 \$27.95 | £22.00  
E-book 9780691184173

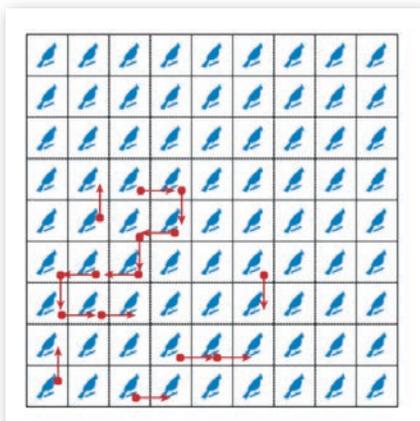


Figure 1.4 Each pigeonhole in a  $9 \times 9$  array has one pigeon. All simultaneously move to another pigeonhole that is immediately above, below, to the left, or to the right of its current hole. Must some pigeonhole wind up with two pigeons?

March 2019. 408 pages, 116 color + 77 b/w illus, 19 tables.  
 Hardback 9780691179292 \$75.00 | £58.00  
 E-book 9780691190617

“This excellent book is an outstanding combination of clarity, rigor, and elegance. . . . [W]ill be invaluable for any student of computer science.”

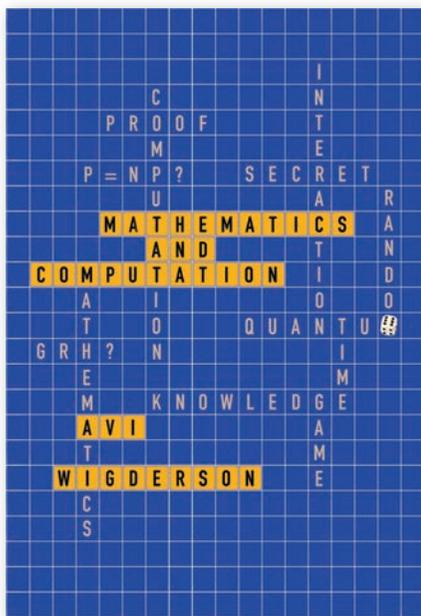
—John MacCormick, Dickinson College

## Essential Discrete Mathematics for Computer Scientists

Discrete mathematics is the basis of much of computer science, from algorithms and automata theory to combinatorics and graph theory. This textbook covers the discrete mathematics that every computer science student needs to learn. Proven in the classroom, the book teaches students not just the “content” of discrete mathematics but how to think rigorously about computational problems.

A welcome alternative to costly, encyclopedic volumes on the subject, this accessible book is versatile enough to adapt to any instructor’s curriculum and teaching style.

**HARRY LEWIS** is Gordon McKay Professor of Computer Science and former dean of Harvard College at Harvard University. **RACHEL ZAX** is a software engineer at Google.



May 2019. 488 pages, 25 b/w illus.  
 Hardback 9780691189130 \$49.95 | £40.00  
 E-book 9780691192543

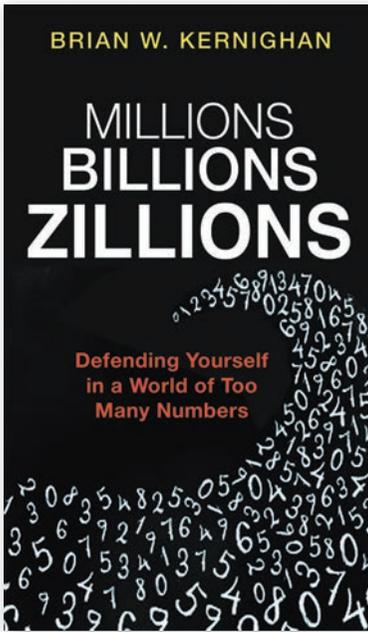
“A beautiful, broad view of theoretical computer science, by a giant in the field. A must-read.”

—Ryan O’Donnell, Carnegie Mellon University

## Mathematics and Computation

This book provides a broad, conceptual overview of computational complexity theory—the mathematical study of efficient computation. With important practical applications to computer science and industry, computational complexity theory has evolved into a highly interdisciplinary field, with strong links to most mathematical areas and to a growing number of scientific endeavors. Useful for undergraduates in mathematics and computer science as well as researchers and teachers in the field, *Mathematics and Computation* brings conceptual clarity to this central and dynamic scientific discipline.

**AVI WIGDERSON** is the Herbert H. Maass Professor in the School of Mathematics at the Institute for Advanced Study in Princeton, New Jersey.



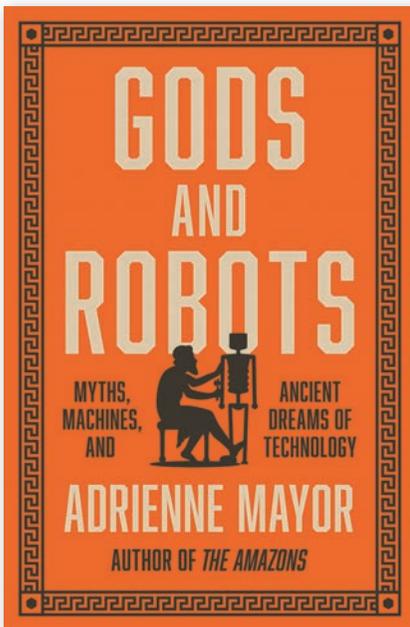
2018. 176 pages. 30 b/w illus.  
 Hardback 9780691182773 \$22.95 | £17.99  
 E-book 9780691190136

“This sophisticated, rich, and accessible book walks us through something we all need but are almost never taught: number sense. The reader is left with real skills and confidence about understanding and interpreting numbers, probabilities, graphics, and much more.”  
 —Zeynep Tufekci, contributing opinion writer for the *New York Times*

## Millions, Billions, Zillions

Numbers are often intimidating, confusing, and even deliberately deceptive—especially when they are really big. The media loves to report on millions, billions, and trillions, but frequently makes basic mistakes or presents such numbers in misleading ways. And misunderstanding numbers can have serious consequences. Giving you the simple tools you need to avoid being fooled by dubious numbers, *Millions, Billions, Zillions* is an essential survival guide for a world drowning in big—and often bad—data.

**BRIAN W. KERNIGHAN** is professor of computer science at Princeton University. His many books include *Understanding the Digital World* (Princeton).



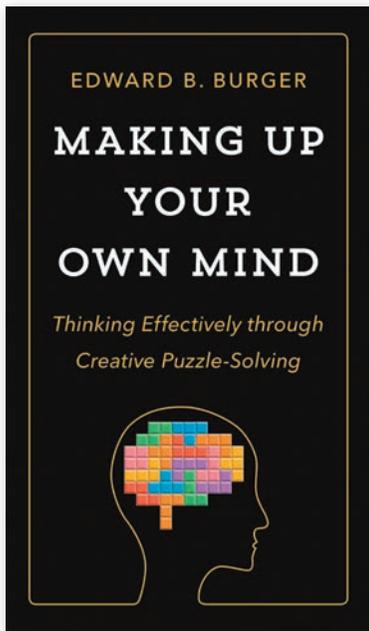
2018. 304 pages. 11 color + 75 b/w illus.  
 Hardback 9780691183510 \$29.95 | £24.00  
 E-book 9780691185446 Audiobook 9780691193021

“Evocative . . . reveals many resonances between ancient thinking and current debates around robotics and AI.”  
 —E. R. Truitt, author of *Medieval Robots*

## Gods and Robots

More than 2,500 years ago, Greek mythology was exploring ideas about creating artificial life—and grappling with still-unresolved ethical concerns about it. This is the fascinating story of how ancient Greek, Roman, Indian, and Chinese myths envisioned automata, self-moving devices, and human enhancements—and how these visions relate to and reflect the ancient invention of real animated machines. A groundbreaking account of the earliest expressions of the timeless impulse to create artificial life, *Gods and Robots* reveals how science has always been driven by imagination. This is mythology for the age of AI.

**ADRIENNE MAYOR** is the author, most recently, of *The Amazons: Lives and Legends of Warrior Women across the Ancient World* and *The Poison King: The Life and Legend of Mithradates, Rome’s Deadliest Enemy*, which was a finalist for the National Book Award (both Princeton). She is a research scholar in classics and the history of science at Stanford University.



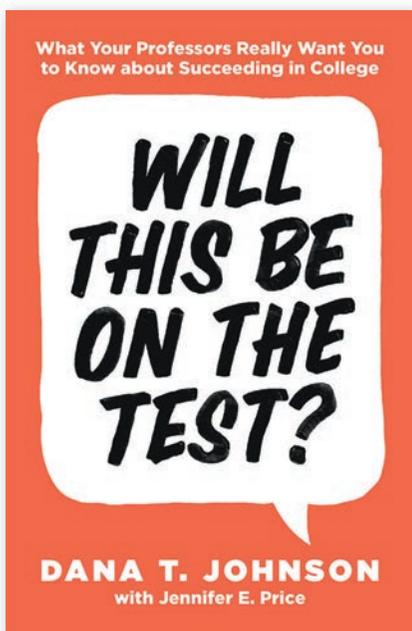
2018. 136 pages. 35 b/w illus.  
 Hardback 9780691182780 \$19.95 | £14.99  
 E-book 9780691188881 Audiobook 9780691193014

“We often claim that education should not just teach facts; it should help us learn how to think clearly. [This] is a book that takes that goal seriously. It is brilliantly constructed, clearly written, and fun.”  
 —William C. Powers Jr., former president of the University of Texas, Austin

## Making Up Your Own Mind

We solve countless problems—big and small—every day. With so much practice, why do we often have trouble making simple decisions—much less arriving at optimal solutions to important questions? Is there a practical way to learn to think more effectively and creatively? Edward Burger shows how we can become far better at solving real-world problems by learning creative puzzle-solving skills using simple, effective thinking techniques.

**EDWARD B. BURGER** is the president of Southwestern University, a mathematics professor, and a leading teacher on thinking, innovation, and creativity. He has written more than seventy research articles, video series, and books, including *The 5 Elements of Effective Thinking* (with Michael Starbird) (Princeton).



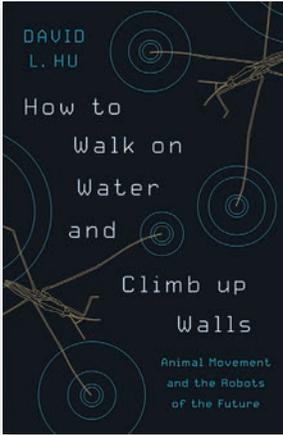
May 2019. 192 pages. 33 b/w illus.  
 Hardback 9780691179537 \$19.95 | £14.99  
 E-book 9780691189451 Audiobook 9780691193526

“Much of today’s college talk revolves around getting in—but this book meaningfully shifts the focus to how to be successful once getting to college. Johnson provides expert advice to make this book an important and eye-opening read.”  
 —Sarah Graham, director of college counseling, Princeton Day School

## Will This Be on the Test?

*Will This Be on the Test?* is the essential survival guide for high-school students making the transition to college academics. In this entertaining and informative book, Dana Johnson shares wisdom and wit gleaned from her decades of experience as an award-winning teacher in the freshman classroom—lessons that will continue to serve you long after college graduation.

**DANA T. JOHNSON** taught for many years at the College of William and Mary, where she twice won the Simon Prize for Excellence in the Teaching of Mathematics. **JENNIFER E. PRICE** is a biologist who has much experience teaching online as well as traditional college courses.



"I recommend this book to all interested in biology and nature-inspired engineering. They will learn much and be marvelously entertained."—Bert Hölldobler, coauthor of *The Ants*

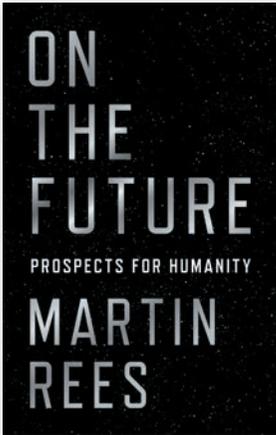
## How to Walk on Water and Climb up Walls

Animals move with astounding grace, speed, and versatility: how do they do it, and what can we learn from them? Integrating biology, engineering, physics, and robotics, David Hu shows how animals have adapted and evolved to traverse their environments, and how discoveries about animal mechanics are inspiring scientists to invent robots and devices that move with similar elegance and efficiency.

**DAVID L. HU** is associate professor of mechanical engineering and biology and adjunct professor of physics at Georgia Institute of Technology.

2018. 240 pages. 12 color + 33 b/w illus.  
Hardback 9780691169866 \$24.95 | £20.00

E-book 9780691184081



"An impassioned call to action from one of the world's foremost scientists. A book to be read by anyone on Earth who cares about its future."—*Kirkus*, starred review

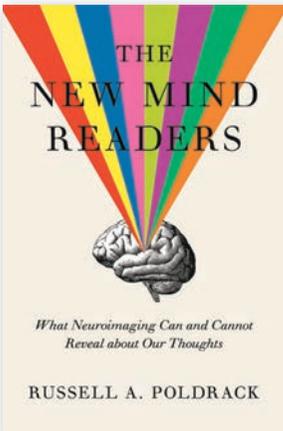
## On the Future

Humanity has reached a critical moment. Our world is unsettled, and we face existential risks over the next century. In this short, exhilarating book, Martin Rees argues that the future of humanity is bound to the future of science and hinges on how successfully we harness technological advances to address our challenges.

**MARTIN REES** is Astronomer Royal, and has been Master of Trinity College and Director of the Institute of Astronomy at Cambridge University.

2018. 272 pages.  
Hardback 9780691180441 \$18.95 | £14.99  
E-book 9780691184401

Audiobook 9780691192994



"A page-turner about the sense and nonsense of modern brain imaging research."—Michael S. Gazzaniga, author of *The Consciousness Instinct*

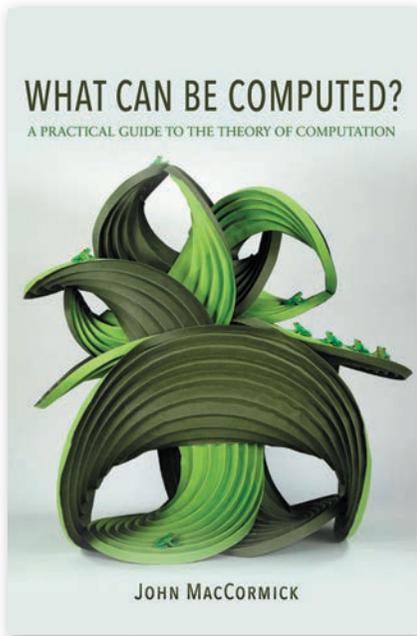
## The New Mind Readers

Mind reading has long been a fascination of science fiction, but new brain-imaging methods are bringing it closer to scientific reality. Russell Poldrack looks at the origins, development, and future of these tools, revealing how they are increasingly being used to decode our thoughts and experiences—and the questions this raises about their application in domains such as marketing, politics, and the law.

**RUSSELL A. POLDRACK** is the Albert Ray Lang Professor of Psychology at Stanford University.

2018. 232 pages. 12 color + 25 b/w illus.  
Hardback 9780691178615 \$27.95 | £22.00

E-book 9780691184128



2018. 408 pages. 69 b/w illus. 13 tables.  
Hardback 9780691170664 \$85.00 | £66.00  
E-book 9781400889846

“This wonderful book explores the theory of computing from a practical viewpoint. John MacCormick covers the basic concepts of computability and complexity, what we can and cannot compute—keeping the material grounded by connecting it with Python—the popular programming language.”

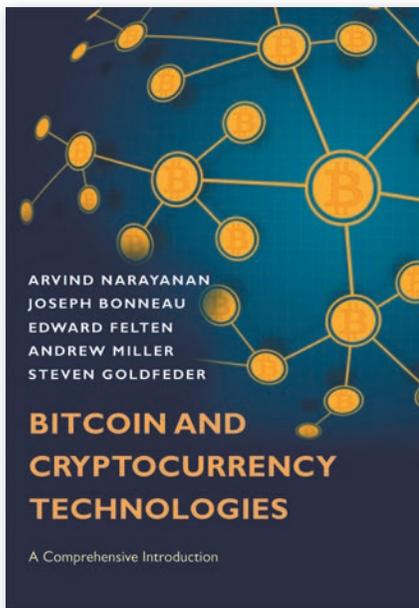
—Lance Fortnow, author of *The Golden Ticket*

## What Can Be Computed?

This is a uniquely accessible yet rigorous introduction to the most profound ideas at the heart of computer science. Crafted specifically for undergraduates studying the subject for the first time, the book focuses on the essential fundamentals of computer science theory and features a practical approach that encourages active experimentation. Throughout, the book recasts traditional computer science concepts by considering how computer programs are used to solve real problems.

**JOHN MACCORMICK** is associate professor of computer science at Dickinson College.

**ERIK DEMAINE & MARTIN DEMAINE** created the curved crease sculpture featured on the cover of *What Can Be Computed?* Cover photo courtesy of the artists.



2016. 336 pages. 97 b/w illus. 7 tables.  
Hardback 9780691171692 \$49.50 | £40.00  
E-book 9781400884155

Honorable Mention for the 2017 PROSE Award in Computing and Information Sciences, Association of American Publishers

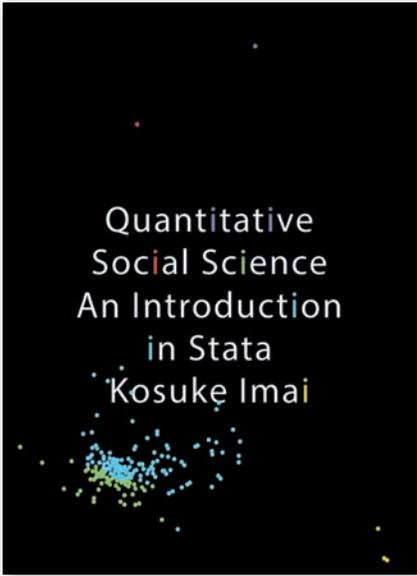
“Block chain technology is set to disrupt many different industries. If you want to get up to speed on this fast-moving technology, this book should be your first stop.”—Campbell R. Harvey, Duke University

## Bitcoin and Cryptocurrency Technologies

This book provides a comprehensive introduction to the revolutionary yet often misunderstood new technologies of digital currency. Whether you are a student, software developer, tech entrepreneur, or researcher in computer science, this authoritative and self-contained book tells you everything you need to know about the new global money for the Internet age.

The book begins by tracing the history and development of Bitcoin and cryptocurrencies, and then gives the conceptual and practical foundations you need to engineer secure software that interacts with the Bitcoin network as well as to integrate ideas from Bitcoin into your own projects.

**ARVIND NARAYANAN, JOSEPH BONNEAU, EDWARD FELTEN, ANDREW MILLER & STEVEN GOLDFEDER**



August 2019. 432 pages. 14 color + 86 b/w illus.  
Paperback 9780691191096 \$49.95 | £40.00  
Hardback 9780691191089 \$95.00 | £74.00  
E-book 9780691191294

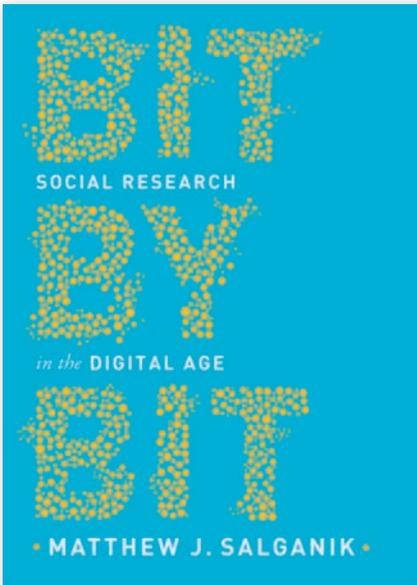
Praise for the previous edition:

“Imai’s new textbook has the potential to totally transform how undergraduate statistics is taught. . . . Students will engage this book rather than dread it.”  
—Christopher Winship, Harvard University

## Quantitative Social Science

Quantitative analysis is an increasingly essential skill for social science research, yet students in the social sciences and related areas typically receive little training in it—or end up in statistics classes that offer few insights into their field. This textbook is a practical introduction to data analysis and statistics written especially for undergraduates and beginning graduate students in the social sciences and allied fields, such as business, economics, education, political science, psychology, sociology, public policy, and data science.

**KOSUKE IMAI** is Professor of Government and of Statistics at Harvard University.



2017. 448 pages. 79 b/w illus. 28 tables. 2 maps.  
Hardback 9780691158648 \$35.00 | £27.00  
E-book 9781400888184

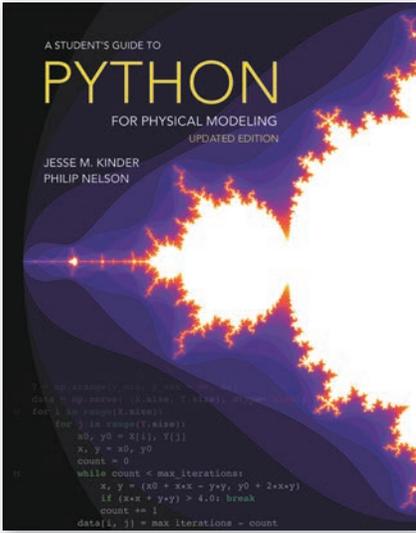
“Written by one of the world’s most respected computational social scientists, *Bit by Bit* addresses the benefits as well as the pitfalls of leveraging digital data for scientific insight. The result is a highly readable yet intellectually rigorous introduction to the brave new world of computational social science.”

—Duncan Watts, Microsoft Research

## Bit by Bit

This is the essential guide to mastering the key principles of doing social research in this fast-evolving digital age. Matthew Salganik explains how the digital revolution is transforming how social scientists observe behavior, ask questions, run experiments, and engage in mass collaborations. *Bit by Bit* is an invaluable resource for social scientists who want to harness the research potential of big data and a must-read for data scientists interested in applying the lessons of social science to tomorrow’s technologies.

**MATTHEW J. SALGANIK** is professor of sociology at Princeton University, where he is also affiliated with the Center for Information Technology Policy and the Center for Statistics and Machine Learning.



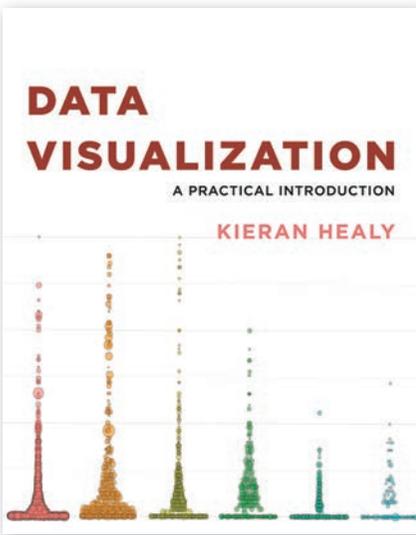
2018. 168 pages. 5 color illus.  
 Paperback 9780691180571 \$24.95 | £20.00  
 Hardback 9780691180564 \$75.00 | £58.00  
 E-book 9781400889426

Praise for the previous edition:  
 “Friendly and succinct, yet surprisingly comprehensive.”  
 —Vinothan N. Manoharan, Harvard University

## A Student’s Guide to Python for Physical Modeling

Python is a computer programming language that is rapidly gaining popularity throughout the sciences. This fully updated edition of *A Student’s Guide to Python for Physical Modeling* aims to help you, the student, teach yourself enough of the Python programming language to get started with physical modeling. You will learn how to install an open-source Python programming environment and use it to accomplish many common scientific computing tasks: importing, exporting, and visualizing data; numerical analysis; and simulation. No prior programming experience is assumed.

**JESSE M. KINDER** is assistant professor of physics at the Oregon Institute of Technology. **PHILIP NELSON** is professor of physics at the University of Pennsylvania.



2018. 296 pages. 185 color illus.  
 Paperback 9780691181622 \$40.00 | £30.00  
 Hardback 9780691181615 \$99.95 | £77.00  
 E-book 9780691185064

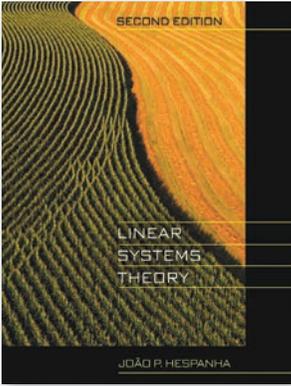
“A brilliant book that not only teaches the reader how to visualize data but also carefully considers why data visualization is essential for good social science. . . . [E]asily accessible for students at any level.”  
 —Becky Pettit, University of Texas at Austin

## Data Visualization

This book provides students and researchers a hands-on introduction to the principles and practice of data visualization. It explains what makes some graphs succeed while others fail, how to make high-quality figures from data using powerful and reproducible methods, and how to think about data visualization in an honest and effective way.

Effective graphics are essential to communicating ideas and a great way to better understand data. This book provides the practical skills students and practitioners need to visualize quantitative data and get the most out of their research findings.

**KIERAN HEALY** is associate professor of sociology at Duke University. He is the author of *Last Best Gifts: Altruism and the Market for Human Blood and Organs*.



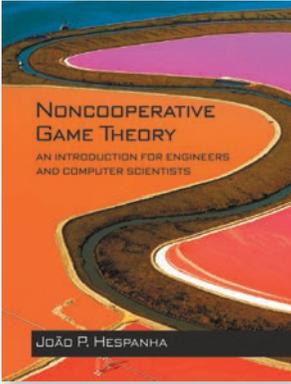
Praise for the previous edition:  
“A sound basis for an excellent course on linear systems theory.”  
—Geir E. Dullerud, University of Illinois, Urbana-Champaign

## Linear Systems Theory

Linear systems theory is the cornerstone of control theory and a well-established discipline that focuses on linear differential equations from the perspective of control and estimation. This updated second edition covers the subject’s key topics in a unique lecture-style format, making the book easy to use for instructors and students.

**JOÃO P. HESPANHA** is professor of electrical engineering in the Center for Control, Dynamical Systems and Computation at the University of California, Santa Barbara.

2018. 352 pages. 52 b/w illus.  
Hardback 9780691179575 \$85.00 | £66.00 E-book 9781400890088



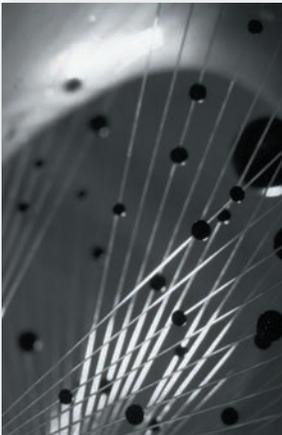
“Hespanha’s standing in the field is stellar and students will appreciate his textbook in courses. This well-written book is clear and focused, and organized around suitable modules and lectures. It contains compelling theoretical and computational exercises.”—Magnus Egerstedt, coauthor of *Graph Theoretic Methods in Multiagent Networks*

## Noncooperative Game Theory

This book is aimed at students interested in using game theory as a design methodology to solve problems in engineering and computer science. It shows that such design challenges can be analyzed through game theoretical perspectives that help pinpoint each problem’s essence.

**JOÃO P. HESPANHA** is a professor in the Department of Electrical and Computer Engineering at the University of California, Santa Barbara.

2017. 248 pages.  
Hardback 9780691175218 \$65.00 | £50.00 E-book 9781400885442



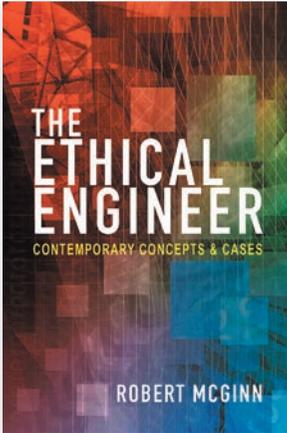
“Innovative, mathematically exact, and very well written. Garoche is a rare resource.”—Eric Feron, Georgia Institute of Technology

## Formal Verification of Control Systems Software

The verification of control systems software is critical to a host of technologies and industries, from aeronautics and medical technology to the cars we drive—the failure of controller software can cost people their lives. This authoritative and accessible book provides an indispensable introduction to the formal techniques for analyzing and verifying this important class of software.

**PIERRE-LOÏC GAROCHÉ** is senior research scientist at ONERA, France’s national aerospace research center.

May 2019. 232 pages. 79 b/w illus.  
Hardback 9780691181301 \$55.00 | £43.00 E-book 9780691189581  
Princeton Series in Applied Mathematics



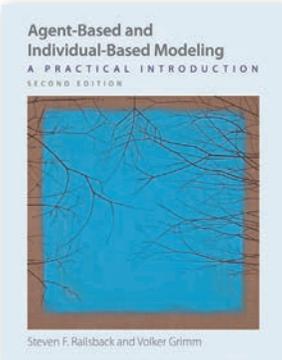
“A crucial and timely book on ethics in engineering and science by one of the world’s foremost ethicists of technology and society.”  
—Stephen R. Barley, University of California, Santa Barbara

## The Ethical Engineer

This book explores ethical issues that arise in engineering practice, from technology transfer to privacy protection to whistle-blowing. Presenting key concepts and real-life examples, McGinn illuminates the ethical dimension of engineering practice and helps students and professionals determine engineers’ context-specific ethical responsibilities.

**ROBERT MCGINN** is professor of management science and engineering and of science, technology, and society at Stanford University.

2018. 352 pages. 25 b/w illus.  
Paperback 9780691177700 \$55.00 | £43.00  
Hardback 9780691177694 \$95.00 | £74.00  
E-book 9781400889105

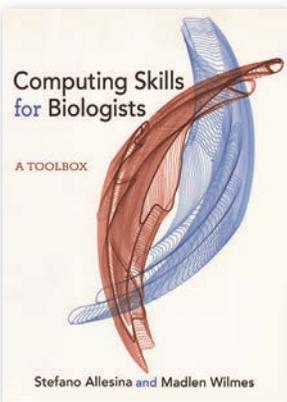


## Agent-Based and Individual-Based Modeling

This has become the standard textbook on the subject for classroom use and self-instruction. Now fully updated with new examples and exercises, the latest version of NetLogo, and an enhanced text for easier comprehension, this is the essential resource for anyone seeking to understand how the dynamics of biological, social, and other complex systems arise from the characteristics of the agents that make up these systems.

**STEVEN F. RAILSBACK** is adjunct professor of mathematics at Humboldt State University and a consulting environmental scientist. **VOLKER GRIMM** is senior scientist in the Department of Ecological Modeling at the Helmholtz Centre for Environmental Research – UFZ in Leipzig and professor of theoretical ecology at the University of Potsdam.

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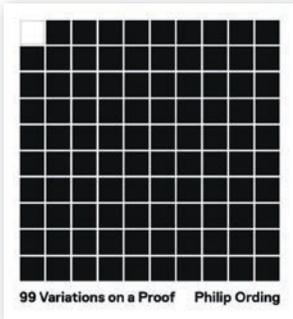
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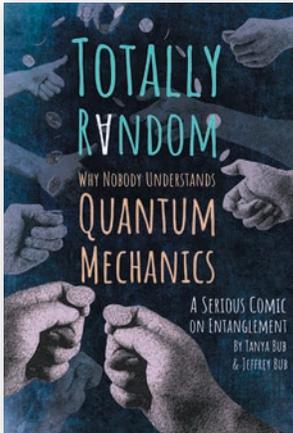
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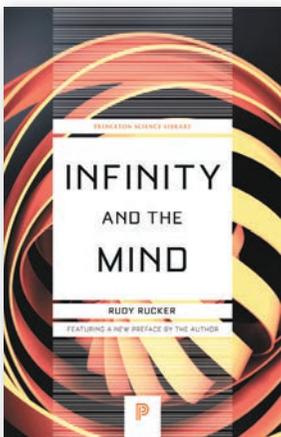
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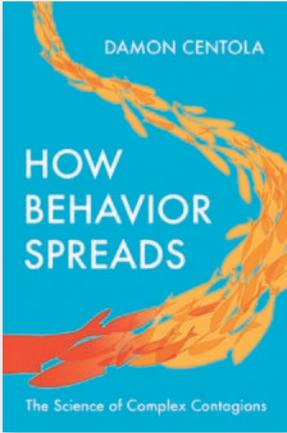
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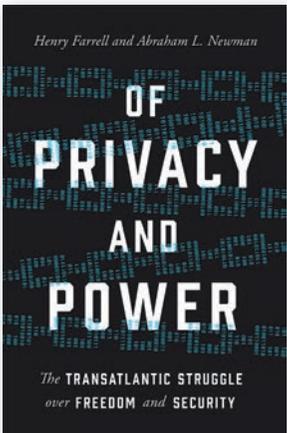
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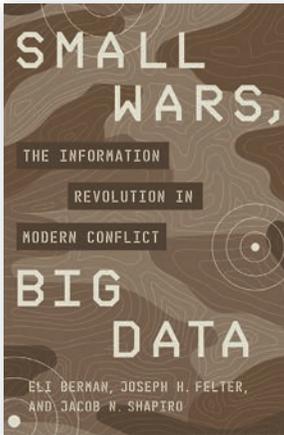
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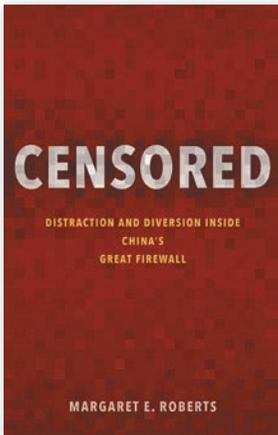
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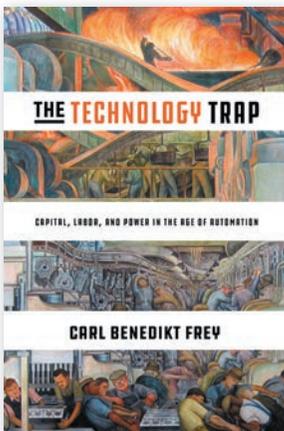
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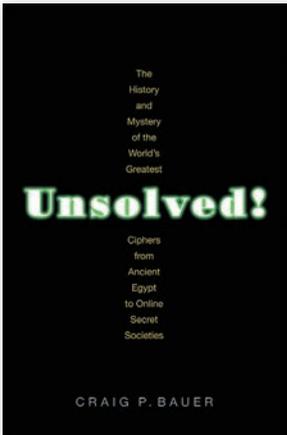
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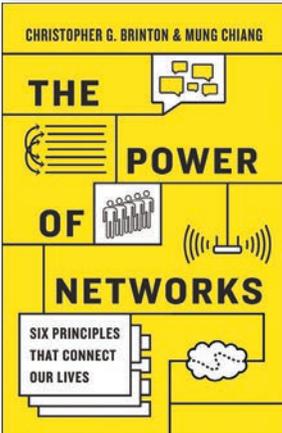
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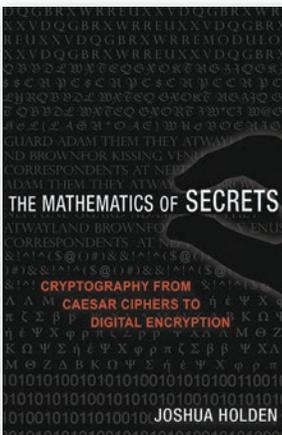
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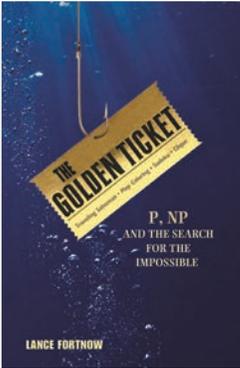
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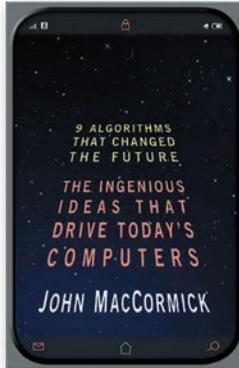
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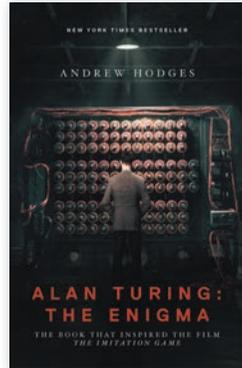
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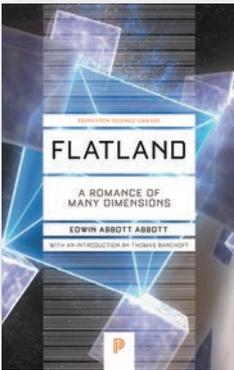
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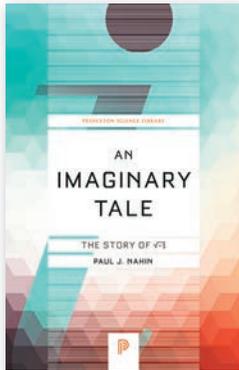
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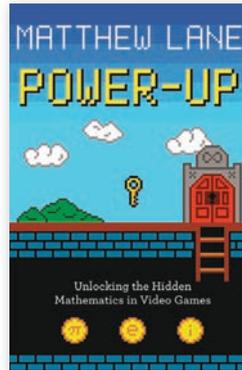
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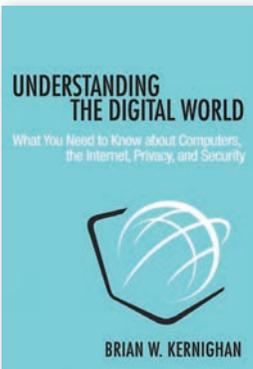
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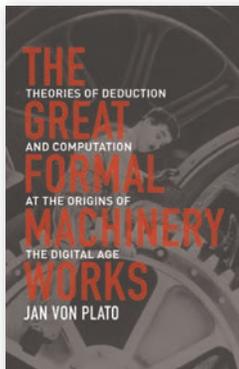
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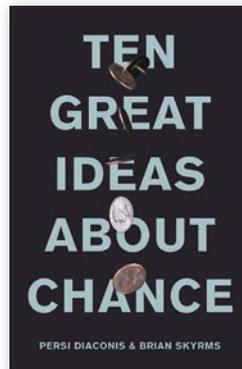
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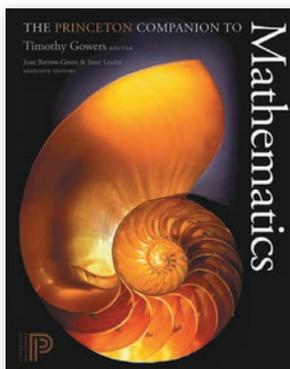


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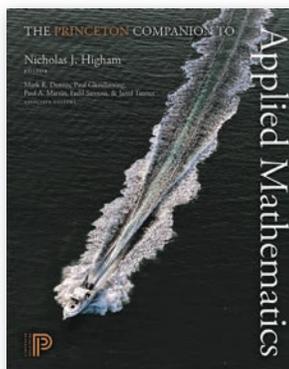


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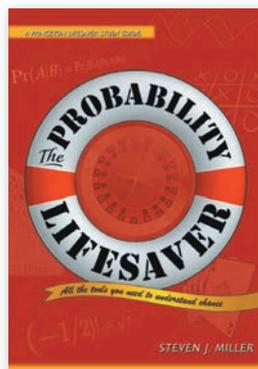
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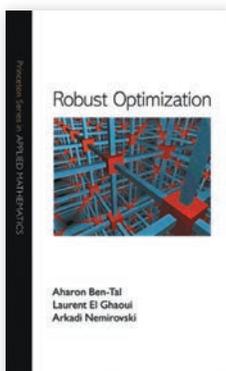
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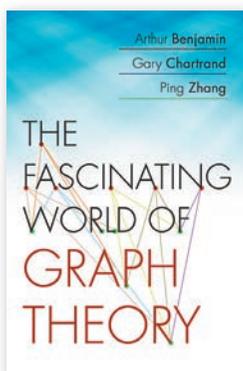
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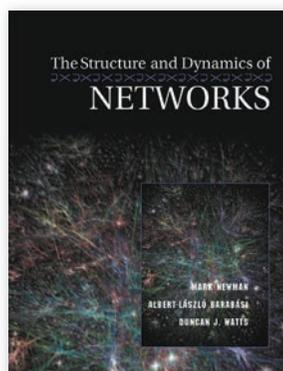
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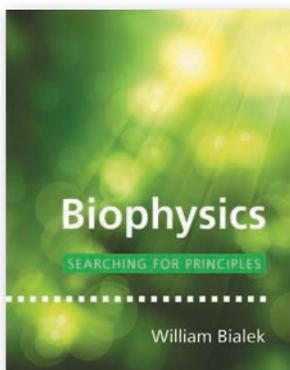
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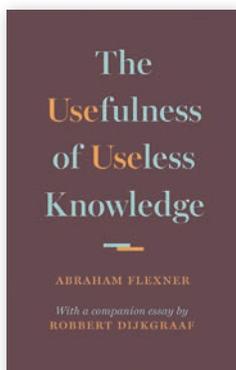
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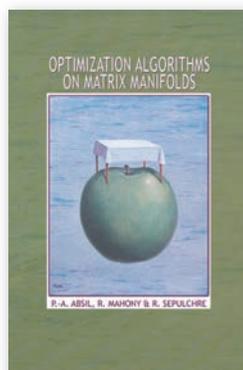
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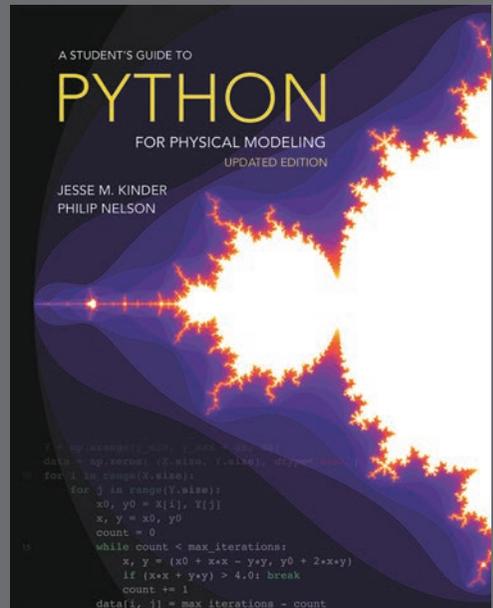
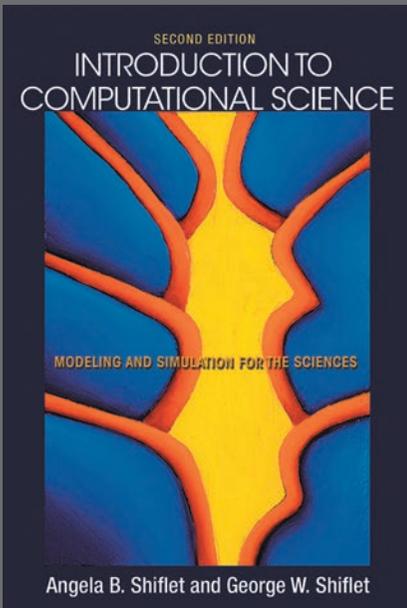
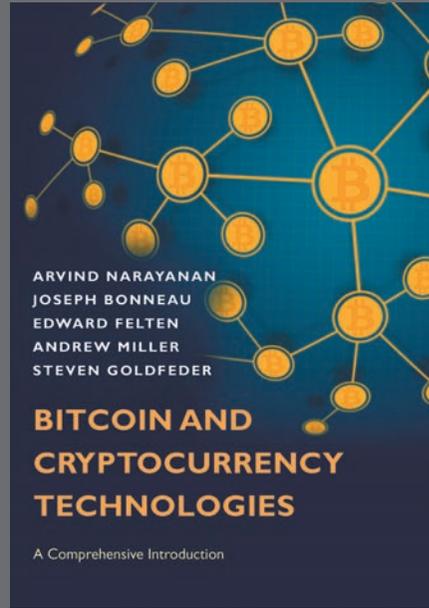
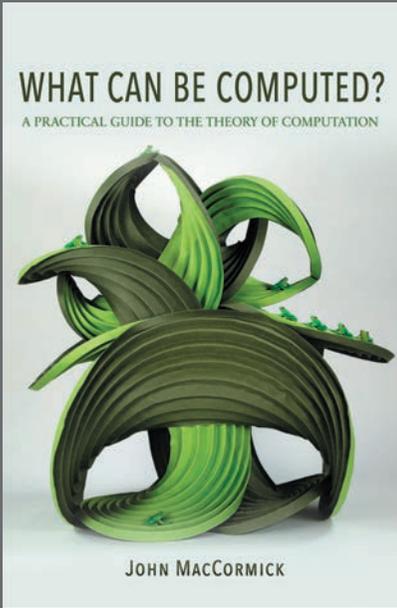
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