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978-1-009-71985-8 — A Science of Concurrent Programs
Leslie Lamport
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A SCIENCE OF CONCURRENT PROGRAMS

Turing Award-winner Leslie Lamport shares the key lessons he has learned about concurrent and distributed computing over decades of writing and reasoning about their algorithms.

Algorithms are not programs, and they shouldn't be written in a programming language. Instead, this book explores how to write them and reason about them by using mathematics. It explains the principles underlying abstract programs and understanding those principles helps avoid concurrency errors. Designing an abstract program before writing any code can lead to better, more reliable programs.

The book has very few mathematical prerequisites, with an appendix summarizing the necessary knowledge. Many of the examples are available online, written in the formal language TLA$^+$, and can be checked with the TLA$^+$ tools.

This is a fascinating read for any graduate students and researchers in theoretical computer science, concurrency, and distributed systems.

LESLIE LAMPORT was Distinguished Scientist at Microsoft Research until his retirement. Dr. Lamport won the 2013 Turing Award for "fundamental contributions to the theory and practice of distributed and concurrent systems." He is a member of the National Academies of Science and Engineering and the American Association of Arts and Sciences.

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Shaftesbury Road, Cambridge CB2 8EA, United Kingdom

One Liberty Plaza, 20th Floor, New York, NY 10006, USA

477 Williamstown Road, Port Melbourne, VIC 3207, Australia

314-321, 3rd Floor, Plot 3, Splendor Forum, Jasola District Centre, New Delhi - 110025, India

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a department of the University of Cambridge.

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www.cambridge.org
Information on this title: www.cambridge.org/9781009719858
DOI: 10.1017/9781009719841

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When citing this work, please include a reference to the DOI 10.1017/9781009719841

First published 2026

Cover image: Filo/DigitalVision Vectors/Getty Images

A catalogue record for this publication is available from the British Library

A Cataloging-in-Publication data record for this book is available from the Library of Congress

ISBN 978-1-009-71985-8 Hardback

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To Ellen

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About this Book

The first chapter, which is a little over ten pages, explains what this book is about. I believe it will tell you whether you should read the book. If you decide to read it, here are some things you should know.

The book's science is embodied in a language called TLA$^+$. Many of its examples have been written in TLA$^+$ and checked with the TLA$^+$ tools. However, TLA$^+$ is not used here because the requirements of handling industrial applications require it to be a little more complicated than is necessary for the book. The TLA$^+$ versions of the examples and an explanation of how to translate from the book's notation to TLA$^+$ will be available at `https://www.cambridge.org/9781009719858`.

The book has no formal exercises, but the text proposes a number of problems for you to solve that can help you learn the material. To learn how the science can be put into practice, you should try writing your own examples in TLA$^+$, checking what you do with the TLA$^+$ tools.

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Acknowledgments

This book presents things that I have learned over decades. During that time, I have discussed them with many wonderful colleagues. I learned many things from them, and I cannot possibly remember who taught me what. Here is a list containing only my coauthors of published papers who I can remember contributing to the content of this book. Omitted are a number of colleagues who taught me a lot that does not appear in the book, and a few who taught me things contained here but with whom I never wrote a published paper.

> Martín Abadi, Krzysztof Apt, Brannon Batson, Manfred Broy, K. Mani Chandy, Ernie Cohen, Edsger Dijkstra, Damien Doligez, Urban Engberg, Georges Gonthier, Jim Gray, Peter Grønning, Markus Kuppe, Robert Kurshan, Peter Ladkin, David Langworthy, Nancy Lynch, Michael Melliar-Smith, Stephan Merz, Susan Owicki, Richard Palais, Fred Schneider, Carel Scholten, Robert Shostak, Mark Tuttle, Friedrich H. Vogt, and Yuan Yu.

The following people not in the list above read preliminary versions of the book and reported errors or sent me comments that led to significant changes.

> Petros Angelatos, Paul Banks, Sergey Bronnikov, Siegfried Bublitz, Hugo Sanz González, Bruno Grenet, Matthias Grundmann, Rob Hagemans, Pedro de las Heras Quirós, Lorin Hochstein, Dave Hughes, Johannes Laire, Tom Moertel, Ron Pressler, Chris Newcombe, Divyanshu Ranjan, Michael Roeleveld, Mark Rogers, Scarlet Schwiderski-Grosche, Peter Sovietov, Alexander Vasilev, and Ugur Y. Yavuz.

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