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Frontmatter

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**Textbook****Quantum Computation and Quantum Information**

Series: [Cambridge Series on Information and the Natural Sciences](#)

Michael A. Nielsen  
*University of Queensland*

Isaac L. Chuang  
*Massachusetts Institute of Technology*

**Paperback** (ISBN-13:  
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There was also a [Hardback](#) of this title but it is no longer available

Published October 2000

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**£47.00****Textbook**

Lecturers can [request inspection copies](#) of this title.

This text is the first comprehensive introduction to the main ideas and techniques of the field of quantum computation and quantum information. Michael Nielsen and Isaac Chuang ask the question: what are the ultimate physical limits to computation and communication? They describe in detail such remarkable effects as fast quantum algorithms, quantum teleportation, quantum cryptography and quantum error-correction. A wealth of accompanying figures and exercises illustrate and develop the material in more depth. The authors describe what a quantum computer is, how it can be used to solve problems faster than familiar 'classical' computers, and the real-world implementation of quantum computers. The book concludes with an in-depth treatment of quantum information, explaining how quantum states can be used to perform remarkable feats of communication, together with a

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discussion of how it is possible to protect quantum states against the effects of noise.

- The first-ever comprehensive introduction to this key new area in physics, computer science, mathematics and electrical engineering
- The authors are among the top researchers in the field
- The book is comprehensive, completely self-contained, with extensive exercises

## Contents

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Preface; Acknowledgement; Nomenclature and notation; Part I. Fundamental Concepts: 1. Introduction and overview; 2. Introduction to quantum mechanics; 3. Introduction to computer science; Part II. Quantum Computation: 4. Quantum circuits; 5. The quantum Fourier transform and its applications; 6. Quantum search algorithms; 7. Quantum computers: physical realisation; Part III. Quantum Information: 8. Quantum noise, open quantum systems, and quantum operations; 9. Distance measurement for quantum information; 10. Quantum error-correction; 11. Entropy and information; 12. Quantum information theory; Appendix A. Notes on basic probability theory; Appendix B. Group theory; Appendix C. Approximating quantum gates: the Solvay-Kitaev theorem; Appendix D. Number theory; Appendix E. Public-key cryptography and the RSA cryptosystem; Appendix F. Proof of Lieb's theorem; References; Index.

## Reviews

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'... Although the field of quantum information and computation is evolving rapidly, this book was written just after the basic algorithmic and physical tools of the field had reached a standard form. and so the text contains essentially all of the material that might be covered in a course on quantum information. I used it as a textbook for an introductory course in quantum computation at my institute. At the end of the term, the class was polled

on various aspects of the book. The response was uniformly positive ... a must-read for the generation of budding quantum-mechanical engineers who will build the technologies of the future.' Seth Lloyd, Nature

'Nielsen and Chuang have set a high standard.' Science

'... almost colloquial ... the simple writing style is complemented by an enormous volume of information, both in the wide ranging nature of the subject matter and in the level of technical detail used to describe it.' Dave Donaghy, The Computer Bulletin

'... a highly readable, thorough, and timely survey of the field of theoretical quantum information science ... probably destined to become a standard text for researchers in this still emerging, rapidly developing field ... there are quite a few books published on quantum information science, none with either the scope or depth of the Nielson-Chuang work ... The book is very well written and a pleasure to read.' Daniel V. James, Physics Today



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