

Introduction to Quantum Computing

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An Introduction To Quantum Computing

RD Boyd



An Introduction To Quantum Computing:

An Introduction to Quantum Computing Algorithms Arthur O. Pittenger, 2012-12-06 In 1994 Peter Shor 65 published a factoring algorithm for a quantum computer that finds the prime factors of a composite integer N more efficiently than is possible with the known algorithms for a classical computer Since the difficulty of the factoring problem is crucial for the security of a public key encryption system interest and funding in quantum computing and quantum computation suddenly blossomed Quantum computing had arrived The study of the role of quantum mechanics in the theory of computation seems to have begun in the early 1980s with the publications of Paul Benioff 67 who considered a quantum mechanical model of computers and the computation process A related question was discussed shortly thereafter by Richard Feynman 35 who began from a different perspective by asking what kind of computer should be used to simulate physics His analysis led him to the belief that with a suitable class of quantum machines one could imitate any quantum system

An Introduction to Quantum Computing Phillip Kaye, Raymond Laflamme, Michele Mosca, 2006-11-17 This concise accessible text provides a thorough introduction to quantum computing an exciting emergent field at the interface of the computer engineering mathematical and physical sciences Aimed at advanced undergraduate and beginning graduate students in these disciplines the text is technically detailed and is clearly illustrated throughout with diagrams and exercises Some prior knowledge of linear algebra is assumed including vector spaces and inner products However prior familiarity with topics such as quantum mechanics and computational complexity is not required

Introduction to Quantum Computing Ray LaPierre, 2021-09-27 This book provides a self contained undergraduate course on quantum computing based on classroom tested lecture notes It reviews the fundamentals of quantum mechanics from the double slit experiment to entanglement before progressing to the basics of qubits quantum gates quantum circuits quantum key distribution and some of the famous quantum algorithms As well as covering quantum gates in depth it also describes promising platforms for their physical implementation along with error correction and topological quantum computing With quantum computing expanding rapidly in the private sector understanding quantum computing has never been so important for graduates entering the workplace or PhD programs Assuming minimal background knowledge this book is highly accessible with rigorous step by step explanations of the principles behind quantum computation further reading and end of chapter exercises ensuring that undergraduate students in physics and engineering emerge well prepared for the future

Introduction to Quantum Computing Hiu Yung Wong, 2022-05-24 This textbook introduces quantum computing to readers who do not have much background in linear algebra The author targets undergraduate and master students as well as non CS and non EE students who are willing to spend about 60 90 hours seriously learning quantum computing Readers will be able to write their program to simulate quantum computing algorithms and run on real quantum computers on IBM Q Moreover unlike the books that only give superficial hand waving explanations this book uses exact formalism so readers can continue to pursue more advanced topics

based on what they learn from this book Encourages students to embrace uncertainty over the daily classical experience when encountering quantum phenomena Uses narrative to start each section with analogies that help students to grasp the critical concept quickly Uses numerical substitutions accompanied by Python programming and IBM Q quantum computer programming as examples in teaching all critical concepts Quantum Computer Science N. David Mermin, 2007-08-30 In the 1990 s it was realized that quantum physics has some spectacular applications in computer science This book is a concise introduction to quantum computation developing the basic elements of this new branch of computational theory without assuming any background in physics It begins with an introduction to the quantum theory from a computer science perspective It illustrates the quantum computational approach with several elementary examples of quantum speed up before moving to the major applications Shor s factoring algorithm Grover s search algorithm and quantum error correction The book is intended primarily for computer scientists who know nothing about quantum theory but will also be of interest to physicists who want to learn the theory of quantum computation and philosophers of science interested in quantum foundational issues It evolved during six years of teaching the subject to undergraduates and graduate students in computer science mathematics engineering and physics at Cornell University Introduction to Quantum Computation and Information Hoi-Kwong Lo, Tim Spiller, Sandu Popescu, 1998 The book fills a gap between the turgid prose of the burgeoning research literature and the superficial accounts in the popular press Nature 1999 The concepts introduced in this book and the forecast of future directions provided should continue to provide a good primer for the exciting breakthrough anticipated in this field Mathematics Abstracts 2001 Despite its age this book remains an excellent way to learn the basics of quantum information Quantum Information and Computation 2002 **Quantum Computing** Eleanor G. Rieffel, Wolfgang H. Polak, 2011-03-04 A thorough exposition of quantum computing and the underlying concepts of quantum physics with explanations of the relevant mathematics and numerous examples The combination of two of the twentieth century s most influential and revolutionary scientific theories information theory and quantum mechanics gave rise to a radically new view of computing and information Quantum information processing explores the implications of using quantum mechanics instead of classical mechanics to model information and its processing Quantum computing is not about changing the physical substrate on which computation is done from classical to quantum but about changing the notion of computation itself at the most basic level The fundamental unit of computation is no longer the bit but the quantum bit or qubit This comprehensive introduction to the field offers a thorough exposition of quantum computing and the underlying concepts of quantum physics explaining all the relevant mathematics and offering numerous examples With its careful development of concepts and thorough explanations the book makes quantum computing accessible to students and professionals in mathematics computer science and engineering A reader with no prior knowledge of quantum physics but with sufficient knowledge of linear algebra will be able to gain a fluent understanding by working through the book **An Introduction to**

Quantum Computing for Computer Engineers Marcus Stephen Edwards, 2025-10-13 This book focuses on topics within quantum computing that will give a student or practitioner of computer engineering a solid but not exhaustive understanding of the ideas that are foundational to how a quantum computer works and the practical aspects of what goes into building a quantum computer from an engineering perspective The reader should know enough by the end of the book to begin to work effectively and knowledgeably with quantum computers in a lab or industry setting at any layer in the technology stack Provides readers with a working knowledge of quantum mechanics without the need to read comprehensive textbooks Includes prerequisite knowledge needed to begin working on any part of the quantum computing stack Teaches useful skills throughout the book such as nanofabrication programming PCB design and RF circuit design Quantum Computing in the Arts and Humanities Eduardo Reck Miranda, 2022-05-05 Computers are essential for the functioning of our society Despite the incredible power of existing computers computing technology is progressing beyond today's conventional models Quantum Computing QC is surfacing as a promising disruptive technology QC is built on the principles of quantum mechanics QC can run algorithms that are not trivial to run on digital computers QC systems are being developed for the discovery of new materials and drugs and improved methods for encoding information for secure communication over the Internet Unprecedented new uses for this technology are bound to emerge from ongoing research The development of conventional digital computing technology for the arts and humanities has been progressing in tandem with the evolution of computers since the 1950s Today computers are absolutely essential for the arts and humanities Therefore future developments in QC are most likely to impact on the way in which artists will create and perform and how research in the humanities will be conducted This book presents a comprehensive collection of chapters by pioneers of emerging interdisciplinary research at the crossroads of quantum computing and the arts and humanities from philosophy and social sciences to visual arts and music Prof Eduardo Reck Miranda is a composer and a professor in Computer Music at Plymouth University UK where he is a director of the Interdisciplinary Centre for Computer Music Research ICCMR His previous publications include the Springer titles Handbook of Artificial Intelligence for Music Guide to Unconventional Computing for Music Guide to Brain Computer Music Interfacing and Guide to Computing for Expressive Music Performance *An Introduction to Quantum Computing* Anya Bindra, Quantum computing is an emerging technology with the power to bring new breakthroughs in the fields of science and can complement and make existing technologies such as machine learning more powerful Today there are certain challenges that classical computing is not able to solve such as the factoring integers problem which is considered an NP problem but can easily be cracked using Shor's algorithm In this textbook we will explore how quantum computers use the principles of superposition and entanglement as their foundations and harness the power of Bloch Spheres to represent states of a qubit An introduction to quantum computing with Qiskit begins with developing the linear algebra and quantum mechanics that are key to understanding quantum computing Then the basics of coding quantum

circuits and quantum logic gates will be introduced and several exciting algorithms such as quantum cryptography algorithms will be implemented on Qiskit Quantum Information Science Kit

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