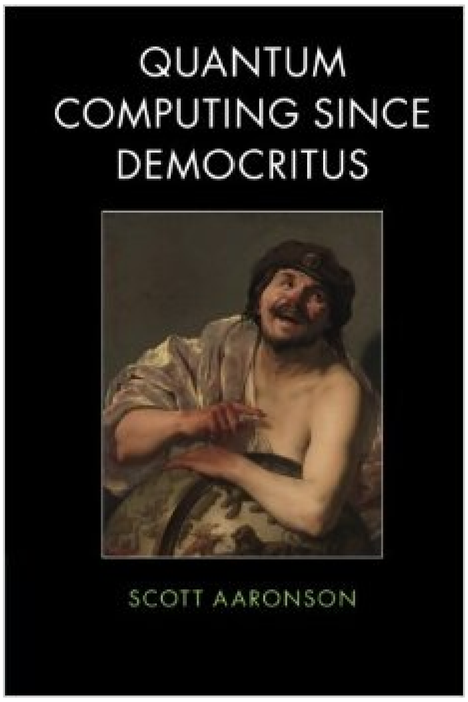
Quantum Computing Since Democritus



Synopsis

Written by noted quantum computing theorist Scott Aaronson, this book takes readers on a tour through some of the deepest ideas of maths, computer science and physics. Full of insights, arguments and philosophical perspectives, the book covers an amazing array of topics. Beginning in antiquity with Democritus, it progresses through logic and set theory, computability and complexity theory, quantum computing, cryptography, the information content of quantum states and the interpretation of quantum mechanics. There are also extended discussions about time travel, Newcomb's Paradox, the anthropic principle and the views of Roger Penrose. Aaronson's informal style makes this fascinating book accessible to readers with scientific backgrounds, as well as students and researchers working in physics, computer science, mathematics and philosophy.

Book Information

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Customer Reviews

If you're a computational complexity theorist, then everything looks like .. well, a problem in computational complexity. Scott Aaronson is astonishingly bright, on top of his subject and genuinely droll: this book gives you a fly-on-the-wall view of how he engaged with his students at the University of Waterloo.We start with a tour of prerequisites. Chapter 2 covers axiomatic set theory (ZF); chapter 3 GÃ¶del's Completeness and Incompleteness Theorems, and Turing Machines. In chapter 4 we apply some of these ideas to artificial intelligence, discuss Turing's Imitation Game and the state of the art in chatbots, and also Searle's Chinese Room puzzle. Aaronson invariably provides a fresh perspective on these familiar topics although already we see the `lecture note' character of this book, where details are hand-waved over (because the students already know this stuff, or they can go away and look it up).Chapters 5 and 6 introduce us to the elementary computation complexity classes and explain the famous P not = NP conjecture. This is not a first introduction - you are assumed to already understand formal logic and concepts such as clauses, validity and unsatisfiability. Chapters 7 and 8 introduce, by way of a discussion on randomness and probabilistic computation, a slew of new complexity classes and the hypothesised relations between them, applying some of these ideas to cryptanalysis.Chapter 9 brings us to quantum theory. Six pages in we're talking about qubits, norms and unitary matrices so a first course on quantum mechanics under your belt would help here. The author's computer science take on all this does bring in some refreshing new insights. We're now equipped, in chapter 10, to talk about quantum computing.

I found this book disappointing because it could have been a truly great book. What it's got going for it: Aaronson is very smart and reasonably eloquent. The table of contents is fantastic. He understands the material backwards and forwards.What it's got against it: Scott makes two terrible mistakes. First, he tries overhard to be conversational. Some of this is just offputting, like the many appearances of profanity in the book. (What possible purpose could this serve?) But in many cases, he simply fails to take advantage of print as a medium. You can explain things multiple times in multiple ways. More formal and less formal. Basic idea and then development. This is never done. Everything is said basically once, at some almost completely unpredictable level of detail and formality.The second problem is that Aaronson makes no distinction -- and I mean *no* distinction -- between what he actually knows and what he only thinks about. In some cases, he's speculating on things that other people know well, but he just goes on as if his opinion were gospel. A case in point is where he supports the view -- still not mainstream, I don't think -- that something "weird" happens when you cross the event horizon of a black hole not for any physical reason, but because he simply felt that "it should be that way." I'm sorry. If I want to adopt someone's vague intuition on this as physically accurate, I'll ask a physicist.In other cases, he's speculating on things that no one knows about. But he still presents his speculations as if they were fact.It's really a pity. I would have been pretty happy reading those speculations if they had only been clearly identified as such.

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