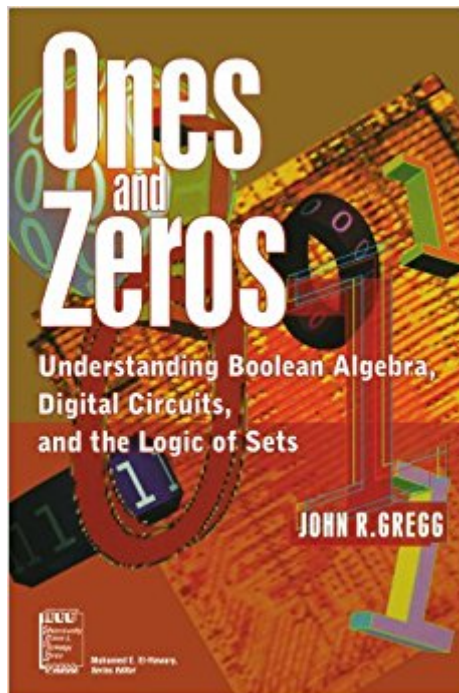




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# Ones And Zeros: Understanding Boolean Algebra, Digital Circuits, And The Logic Of Sets



## Synopsis

This book explains, in lay terms, the surprisingly simple system of mathematical logic used in digital computer circuitry. Anecdotal in its style and often funny, it follows the development of this logic system from its origins in Victorian England to its rediscovery in this century as the foundation of all modern computing machinery. **ONES AND ZEROS** will be enjoyed by anyone who has a general interest in science and technology.

## Book Information

Paperback: 296 pages

Publisher: Wiley-IEEE Press; 1 edition (March 30, 1998)

Language: English

ISBN-10: 0780334264

ISBN-13: 978-0780334267

Product Dimensions: 6 x 0.6 x 9.1 inches

Shipping Weight: 1.1 pounds (View shipping rates and policies)

Average Customer Review: 4.3 out of 5 stars 9 customer reviews

Best Sellers Rank: #791,592 in Books (See Top 100 in Books) #43 in [Books > Engineering & Transportation > Engineering > Electrical & Electronics > Circuits > Logic](#) #247 in [Books > Engineering & Transportation > Engineering > Electrical & Electronics > Circuits > Design](#) #284 in [Books > Engineering & Transportation > Engineering > Electrical & Electronics > Digital Design](#)

## Customer Reviews

**Mathematics Ones and Zeros** Understanding Boolean Algebra, Digital Circuits, and the Logic of Sets **Ones and Zeros** explains, in lay terms, Boolean algebra, the surprisingly simple system of mathematical logic used in digital computer circuitry. Anecdotal in style and often funny, **Ones and Zeros** follows the development of this logic system from its origins in Victorian England to its rediscovery in this century as the foundation of all modern computing machinery. Readers will learn about the interesting history of the development of symbolic logic in particular, and the often misunderstood process of mathematical invention and scientific discovery, in general. **Ones and Zeros** also features practical exercises with answers, real-world examples of digital circuit design, and a reading list. This fascinating look at the crucial technology of the twentieth century will be enjoyed by anyone who has a general interest in science, technology, and mathematics. **Ones and Zeros** will be of particular interest to software engineers who want to gain a comprehensive

understanding of computer hardware. Outstanding features include: A history of mathematical logic  
An explanation of the logic of digital circuits Hands-on exercises and examples About the IEEE  
Press Understanding Science & Technology Series The IEEE Press Understanding Science &  
Technology Series treats important topics in science and technology in a simple and easy to  
understand manner. Designed expressly for the nonspecialist engineer, scientist, or technician, as  
well as the technologically curious, each volume stresses practical information over mathematical  
theorems and complicated derivations.

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\_\_\_\_ REVIEW OF 'ONES AND ZEROS' INTRODUCTION I received this book on Wed 24 Aug 11  
for \$56.14 price and read nearly all of it between Sat 9 Mar 13 and Mon 8 Apr 13. This is probably the  
best modern treatment of a wide range of Boolean subjects. Actually the present review is the  
second one from this reader. Earlier when actually reading this book, I deleted my review. Shouldn't  
have done that. So it is time on Tue-Thu 11-13 Jun 13 to resynthesize an accurate 2nd review. A  
much more difficult Boolean book used for reference while reading this book is a Dover reprint  
of  $\hat{A}$  Boolean Reasoning: The Logic of Boolean Equations (Dover Books on Mathematics), much  
of which I read in early 2011, with a touch of rereading near the end of reading 'Ones and Zeros'. In  
Jan 2014 I did reread 'Boolean Reasoning' from its beginning to well into chapter 6. SIMPLE TABLE  
OF CONTENTS All titles in the TOC in the book are in ALL CAPS, which I will not follow. Before We  
Begin-xiii / 0 Number Systems and Counting-1 / 1 The Basic Functions of Boolean Algebra: AND,  
OR and NOT-22 / 2 Combinational Logic-37 / 3 The Algebra of Sets and Venn Diagrams-59 / 4  
Other Boolean Functions-77 / 5 Realizing Any Boolean Function with AND, OR and NOT-101 / 6  
More Digital Circuits-126 / 7 Laws of Boolean Algebra-150 / 8 Boolean Logic-173 / Appendix A:  
Counting in Base 2-203 / Appendix B: Powers of 2-204 / Appendix C: Summary of Boolean  
Functions-205 / Further Reading-213 / Answers to Exercises-219 / Index-277 / About the  
Author-281 / Please note the large 219-276 segment of full answers to all exercises. Great for  
people working the exercises. For this reader, who completely ignores exercises, those are wasted  
pages that could have been 2 more subject chapters. READING THIS BOOK CHAPTER 0 This short  
chapter gives a lot of basic and handy info about various number systems, especially base 2 and  
base 10, but also base 7. Conversions between different number bases and other calculations are  
given. Finished Sun 10 Mar 13. CHAPTER 1 Simply gets us into Boolean algebra with truth tables and  
circuit diagrams for AND, OR and NOT. Those circuit diagrams get quite a bit more involved later in  
this book. Finished Tue 12 Mar 13. CHAPTER 2 This chapter gets more deeply into somewhat

complicated Boolean logic expressions and realization of them with more detailed circuit diagrams.

A great technical chapter. Read Tue-Thu 12-14Mar13.**CHAPTER 3** Mostly a downright remedial and extremely basic, as in middle school, treatment of Venn diagrams. Finally in sections 3.10-3.12 pp. 68-76, a normal and interesting level of Boolean technicality is reached, which redeems this chapter. Read Thu-Fri 14-15Mar13.**CORRELATION** On Thu 14Mar13 afternoon at my favorite coffee place in Dubuque, I spent about 2 hours with tables of contents and indexes of 'Ones and Zeros' and 'Boolean Reasoning', recording in detail what subjects are in both books on a sheet of graph paper. A lot of overlap as expected, with just items in chapters 5, 7, and 8 of '1s and 0s' corresponding to items in chapters 1-7 and the appendix of 'BR', which is more detailed in most items than '1s and 0s' is. 'BR' contains 10 regular chapters, while '1s and 0s' contains 8 regulars. The two books are of nearly the same number of pages close to 300. However, with '1s and 0s' having 58 pages of answers to exercises not in the 'BR' book, the presently reviewed book is only 238 pages of corresponding textbook.

**CHAPTER 4** A fully technical and mighty interesting chapter. In fact, my favorite chapter. Here we branch off of just AND, OR and NOT into other Boolean functions. We work with NAND/NOT AND, NOR/NOT OR, XOR/exclusive OR, and COIN/Coincidence, plus IMP/implication. COIN ends up being just NOT XOR, so the more well known XOR usually takes over COIN's role. There are special circuit symbols for both XOR and COIN though. By section 4.7 (p.96), we are discussing 'Complete Systems'. Highlight of this section is that NAND by itself can be used to define all 3 of AND, OR and NOT. M. Ben-Ari in chapter 2 of *Mathematical Logic for Computer Science* found that both NAND and NOR have this same 'defining property'. Fascinating chapter read Fri-Sat 15-16Mar13.

**CHAPTER 5** This chapter starts overlapping 'Boolean Reasoning' but in a much more clear way. Minterms are introduced in a straightforward way, and later maxterms are also introduced, which is not even a subject in 'BR'. A minterm has only one '1' in output of its truth table, with all other outputs being '0'. A maxterm is the opposite, with only one '0' in the table output with the rest being '1'. Great examples of decoder circuits are stressed in several ways, and there is a terrific long discussion of how 7-segment displays, as in a digital watch work. Sum-of-Products (SOP) and Product-of-Sums (POS) expressions are also covered. An excellent chapter. Read Sat-Mon 16-18Mar13.

**CHAPTER 6** Chap 6 covers a variety of more abstract and advanced circuits such as several kinds of multiplexers and decoders in detail. Also adders and arithmetic logic units (ALU). Not one of my favorite chapters, as it seems more appropriate for electrical engineers, of which I am not one. Tue-Wed 2-3Apr13.

**CHAPTER 7** This chapter covers in some detail how Boolean logic really works. Special properties of 0 and 1 are discussed, plus commutative and distributive laws. A huge stumbling block

in 'Boolean Reasoning', i.e., 'absorption' is laid out quite clearly in chapter 7. Excellent! Near the end, circuit element versions of some of the expressions are shown. Great chapter read Thu-Sat 4-6Apr13. CHAPTER 8 Final chapter touches heavily on the heart of 'Boolean Reasoning', but again more clearly and less detailed than in that more advanced book. Chapters 4 and 6 of 'BR' roughly correspond. This chapter, restarted and continued in mid Jun13, is the most theoretical one. It starts with Opposition and Consensus clearly described, followed by a discussion of the complicated Blake Canonical Form (BCF) algorithm and Prime Implicants. Especially in this chapter, the author often gives one 'instance' of a complicated procedure instead of generally describing it. Then a short treatment of refiguring implication rolls into several pages on Syllogistic Reasoning. Three 'cases' of Clausal Form are next. My one skip in this chapter is long section 8.10, which is a video game example. After two short descriptive sections, the chapter and the main book ends on p.201 with section 8.13 on Karnaugh maps, which are rather bizarre with their 'gray codes'. Except for that unread extended example 8.10, this has been a very interesting final chapter, finished Thu 13Jun13 evening. Chapters 2, 4, 5, and 7 were my favorites in this book, with chapter 4 being my favorite favorite.

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\_\_\_\_\_ BOOLEAN HISTORY From the three thin and 53-55 year old Boolean books that Dover sells, it looks like the early 1960s may have been a 'golden age' for the development of modern Boolean algebra. At that time, computer science was just starting up as a separate subject and the giant machines still had discrete transistor circuits in them as integrated circuit chips hadn't been developed yet. Circuit theory in electrical engineering might yet have been in play and so thin books about Boolean algebra were coming out:  $\hat{\wedge}$  Boolean Algebra and Its Applications (Dover Books on Computer Science)-1961/192pg /  $\hat{\wedge}$  Boolean Algebra (Dover Books on Mathematics)-1963/145pg /  $\hat{\wedge}$  Logic and Boolean Algebra (Dover Books on Mathematics)-1962/152pg. Searching for Boolean algebra books in reveals several more thin out of print books from 1958-1967, so there was a flood of small Boolean books in the 1960s, rather confirming my 'golden age' comment above. I own all three old Dovers, and have read most of the one from 1962. Another now out of print book that I received a copy of is 128pg  $\hat{\wedge}$  Boolean Algebra for Computer Logic  $\hat{\wedge}$  which, from 1978 is between those early 1960s Dovers and 1990 'Boolean Reasoning', plus it is 20 years before our 1998 'Ones and Zeros'. The 1978 book contains lots of the modern circuit diagrams used in '1s and 0s' and many more Karnaugh maps than are covered in any of the other books. I did communicate with Dover Publications about possibly reprinting the 'Boolean Algebra for Computer Logic' book and they showed some interest in the project. Dover also sells two books by the 19th century mathematician George Boole himself:  $\hat{\wedge}$  An Investigation of

the Laws of Thought / Studies in Logic and Probability (Dover Books on Mathematics). I own the first of these two books. Interesting to see some of the original Boolean algebra by Boole himself! A good mathematical history book covering Boole, Cantor, Turing and others is The Universal Computer: The Road from Leibniz to Turing. That book is by the legendary Martin Davis, mathematician and one of the first computer scientists.

Great book, explains things well. But why not proof read for errors? I spent today doubting myself, asking colleagues whether they thought the answers to exercises in chapter two were correct...and they weren't. Very frustrating. However, the book itself flows so much better than other terse mathematical texts

This is an extremely clear introduction to Boolean Algebra. It is very well written and edited. Plenty of exercises with answers to cement the concepts in your brain. The book covers number systems, logic gates, and some elementary set theory. They are all covered well. There is no coverage of flip-flops which I would have liked to have seen. I should note this is not an electronics book. There are no real circuits but there are plenty of logic diagrams. Read this book to understand the concepts then go on to an electronic book if you actually wanted to build any of this stuff.

Very well explained, easy to understand and amazing book, for beginners wanting to learn the digital circuit fundamentals. Highly recommended!!

I'm a Computer Engineering student and have read many books on the subject. Until I read this book, I was constantly struggling with complex Boolean equations. Fortunately, this book has helped me master the subject -with a lot of hard work. I highly recommend this book for any student in the Computer Engineering field.

I purchased the book to get a full understanding of boolean algebra, and this fit the bill to a T. If you are dealing even lightly with x-bit integers or x-base numbering systems (i.e. 32-bit integers, Hex numbers, etc.) this is the book to get. A great primer for anyone who wants to \*understand\* numbers, rather than just coexist with them. One caveat though...the exercises don't always match the answers in the back of the book, which proves frustrating.

If you are looking for a complete understanding of boolean algebra, this book will definitely satisfy

your needs. It provides several interesting examples with each chapter to keep your mind working. Great way to start out learning about boolean logic.

This is an excellent book for anyone interested in digital circuits and boolean algebra. It is very easy to understand, but does go into enough detail for the advanced to learn from it also. We can all improve our skills after reading this book. Also the price is right!

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Ones and Zeros: Understanding Boolean Algebra, Digital Circuits, and the Logic of Sets Logic and Boolean Algebra (Dover Books on Mathematics) Boolean Algebra as the Basis of Mathematical Logic Understanding Coding Using Boolean Logic (Spotlight on Kids Can Code) Set Theory: Boolean-Valued Models and Independence Proofs (Oxford Logic Guides) CMOS Digital Integrated Circuits: A First Course (Materials, Circuits and Devices) Introduction to Logic Circuits & Logic Design with VHDL Introduction to Logic Circuits & Logic Design with Verilog Small Stage Sets on Tour: A Practical Guide to Portable Stage Sets The Bond Book, Third Edition: Everything Investors Need to Know About Treasuries, Municipals, GNMA's, Corporates, Zeros, Bond Funds, Money Market Funds, and More (Professional Finance & Investment) Problems and Theorems in Analysis II: Theory of Functions. Zeros. Polynomials. Determinants. Number Theory. Geometry (Classics in Mathematics) A World of Three Zeros: The New Economics of Zero Poverty, Zero Unemployment, and Zero Net Carbon Emissions The Forsaken Ones: The Chosen Ones Selected Topics in RF, Analog and Mixed Signal Circuits and Systems (Tutorials in Circuits and Systems) Fuzzy Sets and Fuzzy Logic: Theory and Applications Bebop to the Boolean Boogie, Third Edition: An Unconventional Guide to Electronics CMOS and Beyond: Logic Switches for Terascale Integrated Circuits Logic Circuits and Microcomputer Systems (McGraw-Hill series in electrical engineering) Electronic Logic Circuits The Essence of Logic Circuits

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