CIESIELSKI, K. *Set theory for the working mathematician* (London Mathematical Society Student Texts Vol. 39, Cambridge University Press, 1997), xi + 236 pp.; 0 521 59465 0 (paperback), £13.95 (US$19.95); 0 521 59441 3 (hardback), £37.50 (US$59.95).

I imagine that I am not alone among mathematicians who are not specialists in set theory but who have had to consult literature on abstract set theory from time to time and have found this to be almost impenetrable – even the notation is not familiar! Ciesielski's book goes a long way towards removing some of the mystery and should prove to be of considerable value to non-specialists.

The main text is divided into four parts. Part I (Chapters 1–3) deals with the basics of set theory: the axioms of ZFC set theory, operations on sets, relations, the axiom of choice, functions, Cartesian product, natural numbers, integers and real numbers. To some extent this is a review of prerequisites and some results are presented without proof. The real work begins in Part II (Chapters 4 and 5), which is concerned with well orderings, transfinite induction, ordinal numbers, Zorn's lemma, cardinal numbers and cofinality. Properties of ordinal and cardinal numbers are carefully developed, including a little of the arithmetic of ordinal numbers. Some standard applications of Zorn's lemma are presented, presumably to whet the appetites of algebraists, analysts and topologists, viz. the existence of a basis in every non-zero vector space, the Hahn-Banach theorem and Tychonoff's product theorem. Part III (Chapters 6 and 7) demonstrates the power of recursive definitions. Some subsets of $\mathbb{R}^n$ with properties that are perhaps counter to our intuition are constructed; e.g. Mazurkiewicz's result that there is a subset of $\mathbb{R}^2$ which intersects every straight line in exactly two points is proved. Perfect sets, Borel sets, Lebesgue-measurable sets and the Baire property are all discussed. Various classes of functions are also investigated: measurable and non-measurable, Darboux, additive, symmetrically discontinuous. Part IV (Chapters 8 and 9) has the intriguing heading "When induction is too short". The continuum hypothesis (CH) and its negation have had mention in earlier chapters, but now they are centre-stage. Chapter 8 begins with the Rasiowa-Sikorski lemma on $\mathcal{D}$-generic filters. It was a pleasure to find next some material on the relation $<^*$ on ω^ω and scales, which have recently found application in certain problems on barrelled spaces. This is followed by a good introduction to Martin's axiom (MA) and its consequences as well as the Suslin hypothesis and the diamond principle ($\diamond$). Up to this point I have essentially unreserved praise for the book. I gained new perspectives on some familiar material and encountered many new ideas which were presented in a careful and thought-provoking manner.

The final chapter is concerned with forcing and questions of consistency; models for $\neg$CH, CH and $\diamond$, MA + $\neg$CH are considered. While the author has certainly conveyed some idea of the problems and techniques involved, I have doubts about whether the reader who does not already have a good background in logic and model theory will end up with any deep understanding of the material of this chapter. The presentation has changed from the essentially self-contained, full-detail treatment of Chapters 4–8 to one where we are asked to accept some theorems without proof and to complete many of the proofs for ourselves. We are presented with the fundamental "forcing principle":

> In order to prove that the consistency of ZFC implies the consistency of ZFC + "ψ" it is enough to show (in ZFC) that
>
> (F) every countable transitive model M of ZFC can be extended to a countable transitive model N of ZFC + "ψ".

But are we ever really told what a *countable transitive model* is? Perhaps I have just missed the point, but I do not think we have.

Each chapter contains exercises and there are useful appendices on "Axioms of set theory", "Comments on the forcing method" and "Notation".

In spite of my reservations concerning Chapter 9 I believe that the author has produced a very valuable resource for the working mathematician. Postgraduates and established researchers in many (perhaps all) areas of mathematics will benefit from reading it.

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