particular, it does not examine how streams of Boolean values with strengths at one level turn into Boolean values at the level above (if a grosser quantum of time is introduced), and it does not consider adequately how constraints must be formalised so that non-determinism at one level does not spread to the level above. Thirdly, the book does not exploit all the lessons of structured VLSI design; these suggest that the three levels of abstraction sharply delineated in the book should perhaps be replaced by two (roughly, a block level, providing blocks larger than registers, and a gate/switch level), and that layout should proceed in parallel with the design of behaviour, at least to a certain point. The book is therefore not a complete account of the theory, but it is a more comprehensive introduction than most.

Robert MILNE
STC Technology Ltd.
Harlow, United Kingdom

Computability. By Klaus Weihrauch. EATCS Monographs on Theoretical Computer Science 9, Springer, Berlin, 1987, Price DM 98.00 (hard cover), ISBN 3 540 13721 1.

This book gives a well written treatment of those parts of recursion theory that are important from the point of view of computer science. The book is divided into three parts and includes standard recursion theory (Parts I and II) and recursion theory on non-denumerable sets (Part III).

Part I describes the mechanisms leading to recursively enumerable sets and partial recursive functions: Register machines, μ-recursive functions, WHILE-programs, Turing machines, stack machines. A standard numbering of the unary partial recursive functions of the natural numbers is introduced via a recursive language. The universal Turing machine theorem (utm-theorem), the translation lemma (smn-theorem) and some basic unsolvable problems (general halting problem, word problem for Semi-Thue systems) are given.

In Part II recursion theory on natural numbers is developed. The author departs from the standard numbering defined in Part I and introduces an axiom system for recursion theory to be a total numbering of the unary partial recursive functions for which the utm- and smn-theorem holds together with a Blum complexity measure.

Reducibility theory is extensively treated: m-reducibility, 1-reducibility, Turing reducibility and truth-table reducibility. Myhill's theorem is proved and the Kleene Hierarchy is considered.

Further topics of Part II are Blum's complexity theory (compression theorem, gap theorem, speed up theorem), oracle machines, computable ordinals and applications to logic.

In Part III, recursion theory on sets that have the cardinality of the continuum is developed: the so-called "Type 2 theory of Constructivity and Computability".

(Usual recursion theory is "Type 1".) Here some knowledge of topology is helpful for the reader.

The sets considered are:

(i) the set of all finite and infinite 0-1-sequences,

(ii) the set of all finite and infinite sequences of natural numbers,

(iii) the power set of the set of natural numbers.

It turns out, that the computability theories on these sets are essentially the same.

The main topics of Part III are:

(i) The theory of constructive solution of domain equations. (This theory is used for the investigation of new notations of denotational semantics.)

(ii) Constructive analysis (in the sense of recursion theory). The author establishes an interesting hierarchy of constructivity over classical analysis:

(iii) (1) classical analysis,
(2) Type 2 theory of constructivity,
(3) Type 2 theory of computability,
(4) Type 2 theory of computational complexity,
(5) numerical analysis.

In Part III, two topics are not discussed in their full importance: 1. Some of the results concerning the recursion theory of the continuum have a more general content and could be developed for more general cardinalities by the same methods. (Maybe one could use a more axiomatic way.) 2. There is no discussion of the other not recursion theoretic notions of constructivity.

The book is written in a very exact and formal style and should not be used as a first introduction to recursion theory. But for readers with some background in computability theory it will be a very interesting presentation of the topics dealt with. Furthermore it seems to be the first book to give an introduction into "Type 2 theories".

W. KUICH
Institut für Algebra
und Diskrete Mathematik
TU Wien, Austria

Algorithmic Information Theory. By G. J. Chaitin. Cambridge University Press, Cambridge, 1987, Price £20.00, ISBN 0 521 34306 2.

This is a very welcome comprehensive treatment of the algorithmic information theory which the author developed in a series of papers over the last twenty years. It deals with that aspect of complexity theory where the complexity of a function is measured not by the time or space required for its computation but by the size of the smallest program which computes it.