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# Book Reviews

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VIGGO STOLTENBERG-HANSEN, INGRID LINDSTRÖM AND EDWARD R. GRIFFOR  
*Mathematical Theory of Domains*. Cambridge University Press. 1994. ISBN 0-521-38344-7 £27.50. 349 pp. hardbound.

'What is the set of values of a given datatype?' Innocent though this question may look, it turns out to be a misleading one if you want to give a mathematical account of datatypes and, subsequently, of the meaning of programs. For a proper mathematical treatment you must know not only what the values are, but how they relate to each other: which are finite, which are infinite, which are just partial approximations and what to. The mathematical structures embodying this extra information are called 'domains', so the opening question is then rephrased as, 'What is the *domain* of values of a given datatype?'

The deep nature of domains is somewhat murky, both technically (there are a number of rather different sorts with different properties) and foundationally (for instance, domains can be described either as partially ordered sets or as topological spaces). Nonetheless, there is a more or less stable mathematical account which can already be found in various books such as Winskell's *Formal Semantics of Programming Languages* or Gunter's *Semantics of Programming Languages* (or, indeed, in Plotkin's classic lecture notes, which are now readily available in electronic form).

The new book, *Mathematical Theory of Domains*, is unlikely to supplant the older ones as an introduction to the basic theory. On the whole it limits itself to Scott domains. Continuous domains (essential for domains involving real numbers) are not described at all and the SFP domains that are vital for some purposes are given only a short account towards the end. This means that the view of domains that is presented is a slightly narrow one. Moreover, though a whole chapter is devoted to giving an introduction to topology, the topological aspect of domains is presented rather shallowly (for instance, the elegant topological account of power-domains is not mentioned at all).

However, the true strength of the book lies in mathematical logic. Virtually a third of the book is devoted to issues of computability and effectiveness, including a whole chapter on basic recursion theory and a full treatment of effective domains and computable elements (including the Myhill-Sheperdson and Rice-Shapiro Theorems, deep results that are not commonly included in books).

In conclusion, then, the book is more specialist than might appear from the title: computer scientists who wish to learn something of the mathematical theory of domains would be better off using one of the texts

oriented towards semantics. However, it can be thoroughly recommended for anyone interested in computability.

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DOV M. GABBAY, C. J. HOGGER AND J. A. ROBINSON (eds)  
*Handbook of Logic in Artificial Intelligence and Logic Programming*. Oxford University Press. 1993. Hardbound. Vol. 1, ISBN 0-19-853745-X, £60.00, 518 pp. Vol. 2, ISBN 0-19-853746-8, £55.00, 511 pp. Vol. 3, ISBN 0-19-853747-6, £60.00, 529 pp.

The first three volumes of the *Handbook of Logic in Artificial Intelligence and Logic Programming* represent a detailed and comprehensive exposition of the theoretical and computational features of a wide variety of classical and non-classical logics. The sequence covers considerable ground, beginning with introductory chapters which explain some of the fundamental properties of first-order systems and concluding with a series of highly technical, learned and, indeed, inspiring chapters on nonmonotonic and uncertain reasoning. The intended audience is stated to be graduate students and researchers, but much of the material presented is more specialist than this target implies. Given the intended audience the sequence seems to contain a rather odd mixture of material, some foundational and well within the grasp of the average graduate student, and some highly specialist, requiring considerable proficiency in philosophical and mathematical aspects of logic. The foundational chapters do not supply the necessary background for the specialist ones, so the specialist chapters seem bound to be beyond the reach of most graduate students and researchers with other specialisms. Whilst this, to some extent, undermines the description of the sequence as a *handbook*, which one expects to be accessible to the majority of AI practitioners who see a role for logic in their work, it does not prevent one from enjoying, and benefitting from, the effort involved in studying the volumes.

The objective of the first volume is to provide a foundation in classical logics and their automation. It begins by motivating the use of logic in AI and introducing first-order logic, then goes on to discuss computational aspects of deduction. In-depth surveys of the automation of various deduction systems are followed by an excellent introduction to, and analysis of, modal logics in their many different forms and interpretations. Despite a gentle introduction to the role of logic in AI, containing some quite basic material about the construction and analysis of arguments, the