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Book reviews

Introduction to Logic and Switching Theory, by N. N. Biswas, 1975; 354 pages. (*Gordon and Breach*, £12·80)

The material in this textbook will be familiar to electrical and computer engineers, although the style of presentation is more formally mathematical than many other books on the subject. The mathematical approach has both merits and disadvantages, but its overall effect is to clarify the presentation to a very acceptable degree. Concepts are introduced and developed using clearly stated definitions, theorems and proofs, on the whole presented at just the right pace for the intended audience (i.e. students and practising engineers). There are just one or two points where it is easy to feel that the mathematics have little practical value and are merely being presented for their own sake. One or two words of explanation could have helped to dispel this atmosphere.

The book is organised as eleven chapters which broadly cover four areas, namely, (i) basic mathematical concepts of Boolean algebra; (ii) Boolean expressions and minimisation; (iii) combinational logic; (iv) sequential logic. Each chapter is terminated with a concise list of references and several exercises. The first three chapters constitute an introduction to the terminology of Boolean algebra and switching networks. The mathematical background (sets, operations, number systems and codes) is presented in Chapter 0. Boolean algebra is discussed in detail in Chapter 1 and in Chapter 2 the reader is shown how electronic gates and electromechanical relays may be represented as such an algebra.

Chapter 3 contains detailed descriptions of Boolean expressions and various notations, including a clear explanation of canonical orfms. Minimisation techniques are covered at some length in Chapter 4. These techniques are studied in the order (i) finding common subcubes on an n-cube; (ii) using Veitch-Karnaugh maps; and (iii) using the Quine-McCluskey tabular method. The inclusion of the adjacency method (a modification to the tabular method) in the text seems unwarranted: this could have been introduced in the examples. Chapter 5, on the topic of symmetric functions is rather long and out of place. A shortened version might have been added to Chapter 3.

In Chapter 6 it is shown that all expressions may be generated by NAND or NOR circuits, and several relevant theorems are explained Hellerman's tables of three variable NAND and NOR circuits are also introduced. Chapter 7 discusses threshold logic and is perhaps too advanced for the intended audience: this topic is of specialised research interest at the present. Its presentation at this point also breaks up the book unnecessarily.

The last three chapters deal with sequential circuits. Several types of flipflops are studied in Chapter 8. The design methods presented are sound, but several of the resulting circuits would be difficult to build from readily available components. A word about practical circuits was needed here. The final chapters present too much information in too short a space. Chapter 9 deals with synchronous machines, their description and minimisation, Chapter 10 covers asynchronous machines. Space is short here, and races and hazards in particular are discussed rather briefly.

The points mentioned above are minor criticisms. On the whole I am more than happy with the clarity of presentation of ideas and with the content of the text. There are few errors and a reasonable number of worked examples and exercises are provided.

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Decomposability: Queueing and Computer System Applications, by P. J. Courtois, 1977; 201 pages. (*Academic Press for ACM*, £12·40)

In the last 20 years analytic modelling of computer systems has advanced considerably through the work of Baskett, Buzen, Chandy, Coffman, Denning, Kleinsock, Kobayashi, Muntz and others. This book adopts somewhat different methods although their work is discussed and related to the results obtained. Given a computer system with R resources and N jobs, the state of the system is determined by the length of the queue for each resource; the number of possible states, n, is the number of R partitions of N objects; it is very large even for small N and R. The equilibrium condition is given by $y = yQ$ where the elements of y represent the probabilities of the various states and Q is the stochastic transition probability matrix. From y we can compute the various performance indicators (response, throughput, average queue lengths, etc.) but the computation of y is difficult because n is large. Fortunately Q is often sparse, the non-zero elements form diagonal and non-diagonal blocks; when the elements of the latter are sufficiently small the system is said to be nearly completely decomposable and it is then possible to study separately interactions within subsystems (diagonal blocks) which determine their short term behaviour, and the interactions between subsystems which determine the long term system behaviour. The non-zero diagonal blocks are often in turn nearly completely decomposable leading to a hierarchical network and a form of aggregation. The first six chapters study in detail this theory and the next three chapters apply it to memory hierarchies, program behaviour and multiprogramming systems. A short final chapter relates this theory to the concept of a hierarchy of levels of abstraction in the design of operating and programming systems. This short book is packed with appendices and references; the reader has to follow some heavy matrix and stochastic theories; but he will find it rewarding and illuminating, e.g. the origins of the methods in Markov economic models.

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