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FOUNDATION of SWITCHING THEORY and LOGIC DESIGN



A.K. SINGH



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Dedicated to
My Parents

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PREFACE

The objective of this book is to develop in the reader the ability to analyze and design the digital circuits. The increased uses of digital technology in objects used for day-to-day life necessitate an in-depth knowledge of the subject for the professionals and engineers.

There are lots of references available on Switching Theory and Basic Digital Circuits, which discuss various topics separately. But through this text our notion was to discover the topics rather than to cover them. This comprehensive text fulfills the course requirement on the subject of Switching Theory and Logic Design for B. Tech degree course in Electronics Engineering of different technical Universities. This text is also bound to serve as a useful reference book for various competitive examinations.

There is no special pre-requisite before starting this book. Each chapter of the book starts with simple facts and concepts, and traverse through the examples & figures it uncovers the advanced topics. The book has 11 well-organized chapters.

Chapter 1 deals with number systems and their arithmetic. It includes an exhaustive set of solved examples and exercise to clarify the concepts. Chapter 2 introduces the basic building blocks of digital electronics. It starts with basic postulates, Boolean algebra and then introduces logic gates. It also deals with several types of implementation using logic gates. For beginners we strongly recommend to work out this chapter twice before proceeding further.

Chapter 3 deals with the Boolean function minimization techniques using Postulates and Boolean Algebra, K-Map and Quine-McCluskey methods. Chapter 4 presents various combinational logic design using the discrete logic gates and LSI & MSI circuits. This chapter also deals with hazards and fault detection. Chapter 5 introduces the Programmable Logic Devices. It also deals with basics of ROM, and then moves towards PLAs, PALs, CPLDs and FPGA.

Chapter 6 introduces the clocked (synchronous) sequential circuits. It starts with discussions on various flip-flops their triggering and flip-flop timings. It then deals with analysis and design of synchronous circuits and concludes with sequence detector circuits. Chapter 7 deals with shift registers and counters. It introduces the basic idea of shift registers and then discusses various modes and application of shift registers. It then introduces the various types and modes of counters and concludes with applications. Chapter 8 describes introductory concept of finite state machines and Chapter 9 deals with asynchronous sequential

circuits. It elaborates the analysis and design procedures with different considerations. Chapter 10 introduces the Threshold logic and its capabilities to realize switching functions. Chapter 11 describes the Algorithmic State Machine. It starts with basic concepts, design tools and concludes with design using multiplexers and PLA.

All the topics are illustrated with clear diagram and simple language is used throughout the text to facilitate easy understanding of the concepts. The author welcomes constructive suggestion and comments from the readers for the improvement of this book at singh_a_k@rediffmail.com

AUTHOR

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This book is the result of the dedication and encouragement of many individuals. I would like to thank my family members especially wife Menka and daughter Omanshi for their patience and continuing support and parents for their blessings.

I am indebted to my friends and colleague especially Manish Tiwari and Arun Prakash for their invaluable contribution in the project.

I thankfully acknowledge the contributions of various authors, data manuals, journals, reference manuals etc. from where materials have been collected to enrich the contents of the book.

Finally, I would like to thank the people at New Age International (P) Limited, especially Mr. L.N. Mishra, who continues support and encourages writing and who made the book a reality. Thanks are also due to Mr. Saumya Gupta, M.D. New Age International (P) Limited for his involvement in the project.

In last but not the least by the blessing of almighty and good fortune I get such a supporting and cooperative people around me who in one way or other help me to complete this project in time.

ARUN KUMAR SINGH

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