

EXERCISE: COMBINATIONAL CIRCUIT DESIGN:

This exercise will take you through the full process of logic design from truth table to K-map minimization to implementation.

The objective of this exercise is to design a combinational circuit that is used to control a seven-segment display of decimal digits as shown in Figure 1.

The block diagram of the circuit is also given (Figure 2). The circuit has four inputs a, b, c, d and seven outputs A, B, C, D, E, F, G.

The input to the circuit is a Binary Coded Decimal (BCD) number, that is, abcd = 0000 represents decimal 0, 0001 represents decimal 1, 0010 is 2, 0011 is 3, 0100 is 4, 0101 is 5, 0110 is 6, 0111 is

7, 1000 is 8 and 1001 represents 9. The seven output lines, A, B, ..., G, each connected to one of the seven displays. Based on the input, the appropriate segments should "light up" showing the corresponding decimal number. For example, when the input is 0000, the outputs A, B, C, D, E and F are 1, while the output G is 0. Thus the output displays ZERO. (Figure 3).

The above reasoning shows you how to write the truth table. The first row is given below:

a	b	c	d	A	B	C	D	E	F	G
0	0	0	0	1	1	1	1	1	1	0

Figure 1: Seven Segment Display outputs

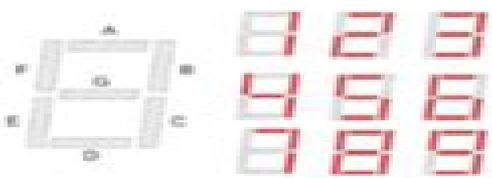


Figure 2: Block Diagram



Figure 3: Display of ZERO.

Exercise 4 Combinational Circuit Design

Nikrouz Faroughi



Exercise 4 Combinational Circuit Design:

Electronics Computer Aided Design Phil L. Jones, Anne Buckley, 1989 **Digital Systems** Raj Kamal, 2009 **How Computers Really Work** Matthew Justice, 2020-12-17 An approachable hands on guide to understanding how computers work from low level circuits to high level code How Computers Really Work is a hands on guide to the computing ecosystem everything from circuits to memory and clock signals machine code programming languages operating systems and the internet But you won't just read about these concepts you'll test your knowledge with exercises and practice what you learn with 41 optional hands on projects Build digital circuits craft a guessing game convert decimal numbers to binary examine virtual memory usage run your own web server and more Explore concepts like how to Think like a software engineer as you use data to describe a real world concept Use Ohm's and Kirchhoff's laws to analyze an electrical circuit Think like a computer as you practice binary addition and execute a program in your mind step by step The book's projects will have you translate your learning into action as you Learn how to use a multimeter to measure resistance current and voltage Build a half adder to see how logical operations in hardware can be combined to perform useful functions Write a program in assembly language then examine the resulting machine code Learn to use a debugger disassemble code and hack a program to change its behavior without changing the source code Use a port scanner to see which internet ports your computer has open Run your own server and get a solid crash course on how the web works And since a picture is worth a thousand bytes chapters are filled with detailed diagrams and illustrations to help clarify technical complexities Requirements The projects require a variety of hardware electronics projects need a breadboard power supply and various circuit components software projects are performed on a Raspberry Pi Appendix B contains a complete list Even if you skip the projects the book's major concepts are clearly presented in the main text Digital Design Techniques and Exercises Vaibhav Taraate, 2021-12-09 This book describes digital design techniques with exercises The concepts and exercises discussed are useful to design digital logic from a set of given specifications Looking at current trends of miniaturization the contents provide practical information on the issues in digital design and various design optimization and performance improvement techniques at logic level The book explains how to design using digital logic elements and how to improve design performance The book also covers data and control path design strategies architecture design strategies multiple clock domain design and exercises low power design strategies and solutions at the architecture and logic design level The book covers 60 exercises with solutions and will be useful to engineers during the architecture and logic design phase The contents of this book prove useful to hardware engineers logic design engineers students professionals and hobbyists looking to learn and use the digital design techniques during various phases of design International Journal of Electrical Engineering Education, 1990 **Digital Design** John F. Wakerly, 1990 This popular volume provides a solid foundation in the elements of basic digital electronics and switching theory that are used in most practical digital design today and builds on that theory with discussions of real world

digital components design methodologies and tools Covers a full range of topics number systems and codes digital circuits combinational logic design principles and practices combinational logic design with PLDs sequential logic design principles and practices sequential logic design with PLDs memory and additional real world topics e g computer aided engineering tools design for testability estimating digital system reliability and transmission lines reflections and termination This edition introduces PLDs as soon as possible emphasizes CMOS logic families and introduces digital circuits in a strongly technology independent fashion covers the latest Generic Array Logic GAL devices offers expanded coverage of ROM and RAM system level design and provides additional design examples For those needing a solid introduction or review of the principles and practices of modern digital design Previously announced in Oct 1992 PTR Catalogue Introduction to Computer Engineering Taylor L. Booth,1984 A one semester undergraduate course stressing the use of information transfer concepts necessary to analysis and design of modern digital systems It is organized to provide an integrated overview of the various classes of digital information processing systems and devices and the interrelationship between the hardware and software techniques that can be used to solve problems **The Art of Digital Design** Franklin P. Prosser,David E. Winkel,1987 Hardware Logic Design **Basic VLSI Design** Douglas A. Pucknell,Kamran Eshraghian,1985 **Digital Logic and Computer Design** Thomas Richard McCalla,1992 **Real-time Computing** Duncan A. Mellichamp,1983 **Digital Design With Standard MSI and LSI** Thomas R. Blakeslee,1979-03-22 Philosophy adapting the job to the bargain components The goals of digital system design Combinational logic I traditional logic design Combinational logic II MSI and LSI logic design Sequential logic design Nasty realities I race conditions and hangup states Programmed logic I microcomputers Programmed logic II computer aided programming Programmed logic III development systems Programmed logic IV microcomputer hardware design The time dimension Nasty realities II noise and reflections Input Output devices Use of statistics in digital design The social consequences of engineering **Digital System Design with FPGA: Implementation Using Verilog and VHDL** Cem Unsalan,Bora Tar,2017-07-14 Master FPGA digital system design and implementation with Verilog and VHDL This practical guide explores the development and deployment of FPGA based digital systems using the two most popular hardware description languages Verilog and VHDL Written by a pair of digital circuit design experts the book offers a solid grounding in FPGA principles practices and applications and provides an overview of more complex topics Important concepts are demonstrated through real world examples ready to run code and inexpensive start to finish projects for both the Basys and Arty boards Digital System Design with FPGA Implementation Using Verilog and VHDL covers Field programmable gate array fundamentals Basys and Arty FPGA boards The Vivado design suite Verilog and VHDL Data types and operators Combinational circuits and circuit blocks Data storage elements and sequential circuits Soft core microcontroller and digital interfacing Advanced FPGA applications The future of FPGA **Digital System Implementation** Gerrit A. Blaauw,1976 **Digital Logic Design and Computer Organization with Computer**

Architecture for Security Nikrouz Faroughi, 2014-09-08 A COMPREHENSIVE GUIDE TO THE DESIGN ORGANIZATION OF MODERN COMPUTING SYSTEMS Digital Logic Design and Computer Organization with Computer Architecture for Security provides practicing engineers and students with a clear understanding of computer hardware technologies The fundamentals of digital logic design as well as the use of the Verilog hardware description language are discussed The book covers computer organization and architecture modern design concepts and computer security through hardware Techniques for designing both small and large combinational and sequential circuits are thoroughly explained This detailed reference addresses memory technologies CPU design and techniques to increase performance microcomputer architecture including plug and play device interface and memory hierarchy A chapter on security engineering methodology as it applies to computer architecture concludes the book Sample problems design examples and detailed diagrams are provided throughout this practical resource **COVERAGE INCLUDES** Combinational circuits small designs Combinational circuits large designs Sequential circuits core modules Sequential circuits small designs Sequential circuits large designs Memory Instruction set architecture Computer architecture interconnection Memory system Computer architecture security **Digital Systems** Ronald J. Tocci, Neal S. Widmer, Gregory L. Moss, 2004 Tocci and Widmer use a block diagram approach to basic logic operations enabling readers to have a firm understanding of logic principles before they study the electrical characteristics of the logic ICs **KEY TOPICS** For each new device or circuit the authors describe the principle of the operation give thorough examples and then show its actual application An excellent reference on modern digital systems The Federal Reporter, 1921 **Applied Electronic Design** D. Joseph Stadtmiller, 2003 General in nature Applied Electronic Design covers various design projects in the areas of analog electronics digital electronics and telecommunications The text applies the theoretical information taught during the first two years of most electronics technology electrical engineering technology programs and examines the design process as it relates to many common electric circuits Topics include the design process from inception to completion creativity circuit board layout and testing This text provides very practical material that is unavailable from any other single source Applied Electronic Design will be an invaluable tool for preparing students for future employment **Programmable Logic Design Guide** National Semiconductor Corporation. Bipolar Memory, 1986 **Books in Print Supplement**, 1994

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