

Sayısal Sistemler-H1CD1

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Dersin Amacı

- Bu ders öğrencilere sayısal sistemlerin mantıksal tasarımını öğretmeyi amaçlamaktadır.
- Bu kapsamda sayı sistemleri, Bool cebri ve işlem kuralları, kombinasyonel lojik devreler ve tasarımı, ardışıl devre elemanları, senkron ve asenkron ardışıl devrelerin tasarımı, hafıza devrelerinin yapıları anlatılacaktır.
- Bu dersin sonunda öğrencinin sayısal bir sistemi çözümlemesi ve ihtiyaç duyulan bir sayısal sistemi maliyeti en düşük olacak şekilde tasarlaması beklenmektedir.

Ders İçeriği

- Temel bilgiler
- Sayı Sistemleri: İkili sayılar, sayı tabanları arasında dönüşüm, farklı sayı sistemlerinde aritmetik işlemler,
- Birleşik Mantık Devreleri: ikili mantık, mantıksal kapılar,
- Bool cebri, mini-terimler ve maks-terimler, iki, üç ve dört değişkenli haritalama, çok seviyeli devre optimizasyonu.
- Birleşik fonksiyonlar ve devreler: birleşik devreler,
- Kodlayıcı tasarımları, kod çözücü tasarımları, çoklayıcı tasarımları,
- Aritmetik fonksiyonlar ve devreler: ikili toplayıcılar, yarı-tam toplayıcılar, çıkarıcılar, çoğullayıcılar, tekilleştiriciler, 1 bitlik saklayıcılar
- Flip-flop'ların çalışması, SR-RS flip flop'lar, T tipi flip-flop'lar, D tipi flip-flop'lar, JK tipi flip flop'lar,
- Sayıcılar, saklayıcılar, ALU tasarımı
- Karmaşık ardışıl lojik devre tasarım örnekleri uygulamaları

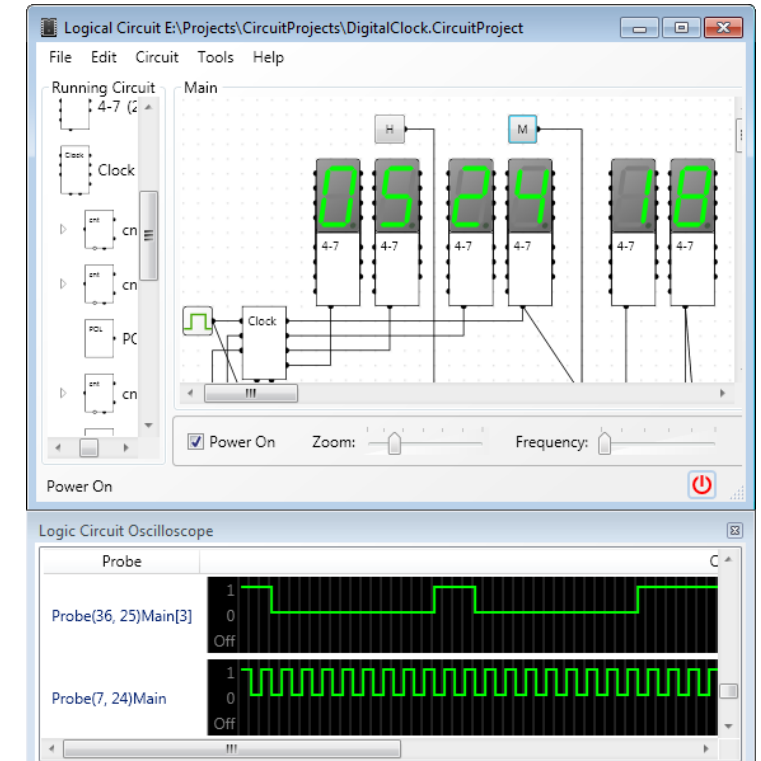
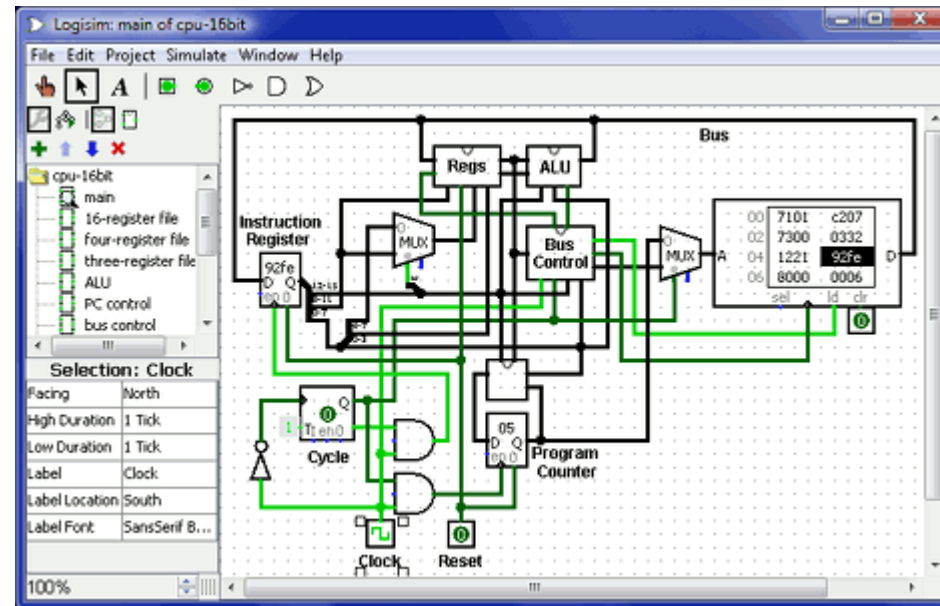
Ön Şartlar

- Temel Mantık Bilgisi
- Analiz ve Muhakeme Yeteneği
- Beyin Kas Koordinasyonu
- Programlama ve Tasarım Becerisi
 - Simulator kullanımı için



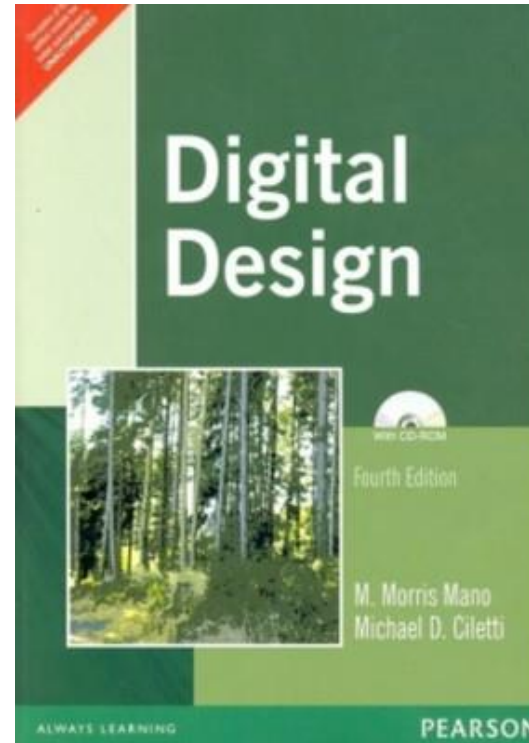
Simulator Alternatiflerini inceleyelim

- <https://circuitverse.org/simulator>
- <https://logic.ly/demo/samples>
- <http://www.cburch.com/logisim/>



Kaynaklar

- “**Digital Design**”, M. Morris Mano
- “**Sayısal Tasarım**”, M. Morris Mano (Türkçe çevirisi)



Konu Başlıkları

“Digital Design”, M. Morris Mano

Digital Systems and Binary Numbers

- 1.1 Digital Systems
- 1.2 Binary Numbers
- 1.3 Number-Base Conversions
- 1.4 Octal and Hexadecimal Numbers
- 1.5 Complements of Numbers
- 1.6 Signed Binary Numbers
- 1.7 Binary Codes
- 1.8 Binary Storage and Registers
- 1.9 Binary Logic

Boolean Algebra and Logic Gates

- 2.1 Introduction
- 2.2 Basic Definitions
- 2.3 Axiomatic Definition of Boolean Algebra
- 2.4 Basic Theorems and Properties of Boolean Algebra
- 2.5 Boolean Functions
- 2.6 Canonical and Standard Forms
- 2.7 Other Logic Operations
- 2.8 Digital Logic Gates
- 2.9 Integrated Circuits

Gate-Level Minimization

- 3.1 Introduction
- 3.2 The Map Method
- 3.3 Four-Variable K-Map
- 3.4 Product-of-Sums Simplification
- 3.5 Don't-Care Conditions
- 3.6 NAND and NOR Implementation
- 3.7 Other Two-Level Implementations
- 3.8 Exclusive-OR Function
- 3.9 Hardware Description Language

Combinational Logic

- 4.1 Introduction
- 4.2 Combinational Circuits
- 4.3 Analysis Procedure
- 4.4 Design Procedure
- 4.5 Binary Adder-Subtractor
- 4.6 Decimal Adder
- 4.7 Binary Multiplier
- 4.8 Magnitude Comparator
- 4.9 Decoders
- 4.10 Encoders
- 4.11 Multiplexers
- 4.12 HDL Models of Combinational Circuits

Konu Başlıkları

“Digital Design”, M. Morris Mano

Synchronous Sequential Logic

- 5.1 Introduction
- 5.2 Sequential Circuits
- 5.3 Storage Elements: Latches
- 5.4 Storage Elements: Flip-Flops
- 5.5 Analysis of Clocked Sequential Circuits
- 5.6 Synthesizable HDL Models of Sequential Circuits
- 5.7 State Reduction and Assignment
- 5.8 Design Procedure

Registers and Counters

- 6.1 Registers
- 6.2 Shift Registers
- 6.3 Ripple Counters
- 6.4 Synchronous Counters
- 6.5 Other Counters
- 6.6 HDL for Registers and Counters

Memory and Programmable Logic

- 7.1 Introduction
- 7.2 Random-Access Memory
- 7.3 Memory Decoding
- 7.4 Error Detection and Correction
- 7.5 Read-Only Memory
- 7.6 Programmable Logic Array
- 7.7 Programmable Array Logic
- 7.8 Sequential Programmable Devices

Design at the Register Transfer Level

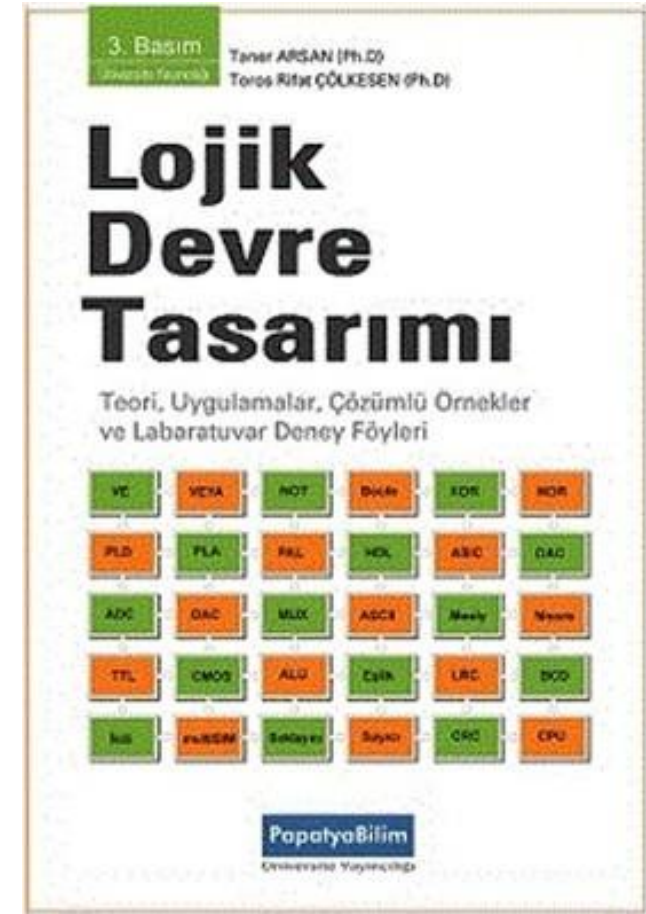
- 8.1 Introduction
- 8.2 Register Transfer Level Notation
- 8.3 Register Transfer Level in HDL
- 8.4 Algorithmic State Machines (ASMs)
- 8.5 Design Example (ASMD Chart)
- 8.6 HDL Description of Design Example
- 8.7 Sequential Binary Multiplier
- 8.8 Control Logic
- 8.9 HDL Description of Binary Multiplier
- 8.10 Design with Multiplexers
- 8.11 Race-Free Design (Software Race Conditions)
- 8.12 Latch-Free Design (Why Waste Silicon?)
- 8.13 Other Language Features

Kaynaklar

- “Lojik Devre Tasarımı”, Rifat Çölkesen, Taner Arsan

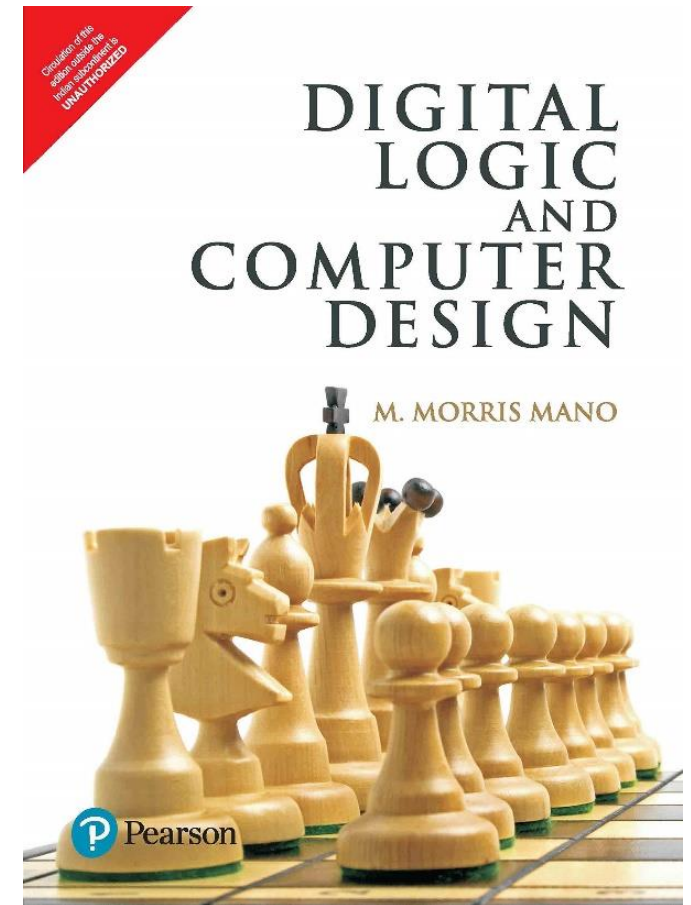
Kitap içerisinde aşağıdaki konular ele alınmış olup Lojik Devre laboratuvarı için de 10 tane deney önerisi verilmiştir:

- Lojik Devre Tasarımı Dünyası
- İşaretler ve Analog / Sayısal Dönüşüm
- Sayı Sistemleri
- Kodlama Teknikleri
- Lojik Devre Temelleri
- Boole Cebri
- Lojik Fonksiyonların İndirgenmesi
- Devre Maliyeti ve Karmaşıklık
- PLD'ler; Prom, Pal, Pla
- Ardışıl Devre Temelleri
- Saklayıcı, Sayıcı ve Bellek Elemanları
- Ardışıl Devre Tasarım Yöntemleri
- Lojik Devre Tasarımında Benzetim Ortamı
- TTL ve Cmos Tümdevre Özellikleri



Kaynaklar

- “Digital Logic and Computer Design”, M. Morris Mano



Konu Başlıkları

“Digital Logic and Computer Design”, M. Morris Mano

| | | | | | |
|----------|--|-----------|------------|---|------------|
| 1 | Binary Systems | 1 | 3.3 | Four-variable Map | 69 |
| 1.1 | Digital Computers and Digital Systems | 1 | 3.4 | Five- and Six-Variable Maps | 72 |
| 1.2 | Binary Numbers | 3 | 3.5 | Product of Sums Simplification | 75 |
| 1.3 | Number Base Conversions | 6 | 3.6 | NAND and NOR Implementation | 77 |
| 1.4 | Octal and Hexadecimal Numbers | 8 | 3.7 | Other Two-level Implementations | 83 |
| 1.5 | Complements | 9 | 3.8 | Don't-care Conditions | 87 |
| 1.6 | Binary Codes | 14 | 3.9 | The Tabulation Method | 89 |
| 1.7 | Binary Storage and Registers | 20 | 3.10 | Determination of Prime-implicants | 90 |
| 1.8 | Binary Logic | 23 | 3.11 | Selection of Prime-implicants | 94 |
| 1.9 | Integrated Circuits | 26 | 3.12 | Concluding Remarks | 96 |
| 2 | Boolean Algebra and Logic Gates | 31 | 4 | Combinational Logic | 103 |
| 2.1 | Basic Definitions | 31 | 4.1 | Introduction | 103 |
| 2.2 | Axiomatic Definition of Boolean Algebra | 32 | 4.2 | Design Procedure | 104 |
| 2.3 | Basic Theorems and Properties of Boolean Algebra | 35 | 4.3 | Adders | 105 |
| 2.4 | Boolean Functions | 39 | 4.4 | Subtractors | 109 |
| 2.5 | Canonical and Standard Forms | 43 | 4.5 | Code Conversion | 111 |
| 2.6 | Other Logic Operations | 49 | 4.6 | Analysis Procedure | 113 |
| 2.7 | Digital Logic Gates | 51 | 4.7 | Multilevel Nand Circuits | 117 |
| 2.8 | IC Digital Logic Families | 54 | 4.8 | Multilevel NOR Circuits | 124 |
| 3 | Simplification of Boolean Functions | 65 | 4.9 | Exclusive-OR and Equivalence Functions | 127 |
| 3.1 | The Map Method | 65 | 5 | Combinational Logic with MSI and LSI | 137 |
| 3.2 | Two- and Three-variable Maps | 65 | 5.1 | Introduction | 137 |
| | | | 5.2 | Binary Parallel Adder | 138 |
| | | | 5.3 | Decimal Adder | 143 |
| | | | 5.4 | Magnitude Comparator | 145 |
| | | | 5.5 | Decoders | 147 |
| | | | 5.6 | Multiplexers | 156 |
| | | | 5.7 | Read-Only Memory (ROM) | 161 |
| | | | 5.8 | Programmable Logic Array (PLA) | 167 |
| | | | 5.9 | Concluding Remarks | 173 |
| | | | 6 | Sequential Logic | 179 |
| | | | 6.1 | Introduction | 179 |
| | | | 6.2 | Flip-Flops | 180 |

Konu Başlıkları

“Digital Logic and Computer Design”, M. Morris Mano

| | | | | | | | | |
|------|--|-----|------|-----------------------------------|-----|------|---|-----|
| 6.3 | Triggering of Flip-flops | 185 | 9.6 | Design of Arithmetic Logic Unit | 335 | 13 | Digital Integrated Circuits | 492 |
| 6.4 | Analysis of Clocked Sequential Circuits | 193 | 9.7 | Status Register | 338 | 13.1 | Introduction | 492 |
| 6.5 | State Reduction and Assignment | 198 | 9.8 | Design of Shifter | 341 | 13.2 | Bipolar Transistor Characteristics | 494 |
| 6.6 | Flip-flop Excitation Tables | 204 | 9.9 | Processor Unit | 342 | 13.3 | RTL and DTL Circuits | 497 |
| 6.7 | Design Procedure | 206 | 9.10 | Design of Accumulator | 346 | 13.4 | Integrated-injection Logic (I ² L) | 500 |
| 6.8 | Design of Counters | 215 | | | | 13.5 | Transistor-Transistor Logic (TTL) | 502 |
| 6.9 | Design with State Equations | 218 | | | | 13.6 | Emitter-coupled Logic (ECL) | 511 |
| 7 | Registers, Counters, and the Memory Unit | 229 | 10 | Control Logic Design | 362 | 13.7 | Metal-Oxide Semiconductor (MOS) | 513 |
| 7.1 | Introduction | 229 | 10.1 | Introduction | 362 | 13.8 | Complementary MOS (CMOS) | 515 |
| 7.2 | Registers | 230 | 10.2 | Control Organization | 364 | | | |
| 7.3 | Shift Registers | 235 | 10.3 | Hard-wired Control — Example 1 | 369 | | | |
| 7.4 | Ripple Counters | 242 | 10.4 | Microprogram Control | 376 | | | |
| 7.5 | Synchronous-counters | 247 | 10.5 | Control of Processor Unit | 382 | | | |
| 7.6 | Timing Sequences | 253 | 10.6 | Hard-wired Control—Example 2 | 386 | | | |
| 7.7 | The Memory Unit | 258 | 10.7 | PLA Control | 393 | | | |
| 7.8 | Examples of Random-access Memories | 262 | 10.8 | Microprogram Sequencer | 396 | | | |
| 8 | Register-Transfer Logic | 271 | 11 | Computer Design | 407 | | | |
| 8.1 | Introduction | 271 | 11.1 | Introduction | 407 | | | |
| 8.3 | Arithmetic, Logic, and Shift Microoperations | 281 | 11.2 | System Configuration | 408 | | | |
| 8.4 | Conditional Control Statements | 284 | 11.3 | Computer Instructions | 411 | | | |
| 8.5 | Fixed-point Binary Data | 285 | 11.4 | Timing and Control | 417 | | | |
| 8.6 | Overflow | 289 | 11.5 | Execution of Instructions | 419 | | | |
| 8.7 | Arithmetic Shifts | 291 | 11.6 | Design of Computer Registers | 424 | | | |
| 8.8 | Decimal Data | 293 | 11.7 | Design of Control | 429 | | | |
| 8.9 | Floating-point Data | 294 | 11.8 | Computer Console | 438 | | | |
| 8.10 | Nonnumeric Data | 297 | 12 | Microcomputer System Design | 443 | | | |
| 8.11 | Instruction Codes | 300 | 12.1 | Introduction | 443 | | | |
| 8.12 | Design of a Simple Computer | 304 | 12.2 | Microcomputer Organization | 445 | | | |
| 9 | Processor Logic Design | 317 | 12.3 | Microprocessor Organization | 449 | | | |
| 9.1 | Introduction | 317 | 12.4 | Instructions and Addressing Modes | 456 | | | |
| 9.2 | Processor Organization | 318 | 12.5 | Stack, Subroutines, and Interrupt | 463 | | | |
| 9.3 | Arithmetic Logic Unit | 325 | 12.6 | Memory Organization | 471 | | | |
| 9.4 | Design of Arithmetic Circuit | 326 | 12.7 | Input-output Interface | 474 | | | |
| 9.5 | Design of Logic Circuit | 331 | 12.8 | Direct Memory Access | 484 | | | |