Contents

Editor's Foreword Preface Safety	xi xiii xv	 4-6 The Microprocessor's Registers 4-7 The Microprocessor's Instructions 4-8 Memory Addressing Architecture 4-9 The Microprocessor's Support Circuits 	62 63 64
Chapter 1 What Is the Microprocessor?	1	4710 Microprocessor Development and Maintenance Systems	65
1-1 A Brief History 1-2 What Is a Microprocessor? 1-3 What Is a Microcomputer? 1-4 What Is the Power of a Microprocessor?	1 4 6	Chapter 5 Inside the Microprocessor 5-1 The Microprocessor Block Diagram and Programming Model 5-2 The ALU	71 71 72
Chapter 2 The Decimal and Binary Number Systems	<u> 16</u>	5-3 The Microprocessor's Registers5-4 The Accumulator5-5 The Program Counter	74 76 78
 2-1 The Decimal Number System 2-2 The Binary Number System 2-3 Binary-to-Decimal Conversion 2-4 Decimal-to-Binary Conversion 	16 18 19 20	 5-6 The Status Register 5-7 The Stack Pointer 5-8 The Microprocessor's General- Purpose Registers 	80 83 85
2-5 The Hexadecimal Number System 2-6 Decimal and Hexadecimal Conversions	22	 5-9 The Memory Address Register and Logic 5-10 The Instruction Register 5-11 The Temporary Data Registers 	87 88 89
Chapter 3 Processor Arithmetic	_28	5-12 The Microprocessor's Control Logic 5-13 The Microprocessor's Internal	90 92
 3-1 Binary Addition 3-2 Binary Subtraction 3-3 Two's Complement Numbers 3-4 Binary Multiplication 3-5 Binary Division 3-6 Multiple-Precision Arithmetic 		Data Bus Chapter 6 An Introduction to Microprocessor Instructions	
3-7 Floating-Point Arithmetic Chapter 4	42	 6-1 What Is an Instruction Set? 6-2 Mnemonics 6-3 The Microprocessor's Basic 	102 105 106
Basic Microprocessor Architectural Concepts	49	Instruction Types 6-4 More Basic Instruction Types 6-5 The Microprocessor's Addressing	109
 4-1 What Is the Microprocessor's Architecture? 4-2 Word Lengths 4-3 Addressable Memory 	49 50 54 58	Modes 6-6 Inherent Addressing 6-7 Immediate Addressing 6-8 Direct Addressing 6-9 Register Indirect Addressing	113 114 114 117
4-4 The Microprocessor's Speed 4-5 Other Microprocessor Architectural Characteristics	58 59	6-10 Indexed Addressing 6-11 Relative Addressing	118

Chapter 7 Communicating with the Microprocessor 1 7-1 The Need for Microprocessor I/O 7-2 Connecting the I/O Port to the Microprocessor 7-3 Polling and Interrupts Chapter 8 Two 8-Bit Microprocessors:	27 127 130 131	 10-4 The X86 Addressing Modes 10-5 The X86 Instruction Set 10-6 The X86 Hardware 10-7 An Introduction to the Motorola 68XXX Family of Advanced Microprocessors 10-8 A Programming Model for the 68XXX Family of Advanced Microprocessors 10-9 The 68XXX Addressing Modes 10-10 The 68XXX Instruction Set 10-11 The 68XXX Hardware 	235 243 256 267 269 273 282 291
The Z80 and 6802 1	40		
An Introduction to 8-Bit Microprocessors 8-2 A Programming Model for the Z80 8-3 The Z80 8-Bit Registers	140 141 142	Chapter 11 Memory 11-1 Random-Access Read-Write	<u>309</u>
8-4 The Assigned Registers	144	Memories	309
8-5 The Z80 Block Diagram	148	11-2 Static and Dynamic Memories	312
8-6 The Z80 Instruction Set 8-7 Z80 Hardware	149 152	11-3 Two Memory Systems 11-4 ROMS, EPROMS, and EAROMS	318 323
8-8 A Programming Model for the	102	11-5 Direct Memory Access	323
6802	158	11-6 Paging and Other Memory	
8-9 The 6802 Instruction Set	161	Extension Techniques	329
8-10 The 6802 Hardware	162		
Charten O		Chapter 12	
Chapter 9 The Microcontroller: A		Mass Storage	337
	189		337
Single-Cirp Microprocessor	100	12-1 An Introduction to Mass Storage 12-2 Basic Magnetic Storage	331
9-1 An Introduction to	100	Techniques	339
Microcontrollers	189	12-3 Tapes and Disks	343
9-2 The 8051 Architecture and Programming Model	192	12-4 Mass Storage Support Electronics	
9-3 The 8051 Internal RAM and	172	12-5 The Floppy Disk	346
Registers	195	12-6 The Winchester-Disk Drive	353
9-4 The 8051 I/O Ports	199	12-7 Magnetic-Tape Storage12-8 Optical Storage Devices	355 357
9-5 The 8051 Interrupt System	206	12-6 Optical Storage Devices	557
9-6 The 8051 Instruction Set	209		
9-7 Other Microcontrollers in the 8051 Family	217	Chapter 13	
ranny	217	Microprocessor I/O	366
Chapter 10		13-1 An Introduction to Data	
Two Advanced		Communications	366
•	226	13-2 Parallel I/O	369
Microprocessors	220	13-3 Serial Communications	373
10-1 An Introduction to the Advanced		13-4 The Serial Interface and the	257.4
Microprocessors	226	UART	374 379
10-2 An Introduction to the Intel X86 Family of Advanced		13-5 Serial Communication Lines 13-6 Modems	383
Microprocessors	230	13-7 Input/Output Devices	386
10-3 A Programming Model for the		13-8 Digital-to-Analog and Analog-to-	
X86 Family of Advanced		Digital Interfaces	390
Microprocessors	232	13-9 Special I/O Devices	395

viii

Chapter 14 An Introduction to Programming	<u>108</u>	 16-5 Troubleshooting the CPU 16-6 Troubleshooting Memory 16-7 Troubleshooting Mass Storage and I/O 	473
14-1 What Is Programming?14-2 The Programming Process14-3 The Program's Specification	408 412 413	16-8 Other Troubleshooting Hints16-9 Using Test Equipment	475 476
14-4 The Program's Design14-5 Implementing the Program Design14-6 The Elements of a Program (Algorithms and Data)	415 417 419	Chapter 17 Developing Microprocessor- Based Products	487
14-7 Fundamental Programming Constructs 14-8 Documentation	420 423	17-1 An Introduction to the Design Process 17-2 Preparing the Specification 17-3 Developing a Design	487 491 494
Chapter 15 Operating Systems and System Software	<u>437</u>	 17-3 Developing a Design 17-4 Implementing and Testing the Design 17-5 Regulatory Compliance Testing 17-6 Design Tools for Microprocessor 	498 501
15-1 What Is System Software? 15-2 Operating Systems 15-3 Two Microcomputer Disk	437 439	Development	503
Operating Systems 15-4 Programming Tools 15-5 Programming Languages	445 450 455	Chapter 18 New Developments in Microprocessor Technology	516
Chapter 16 Servicing Microprocessor- Based Products	<u>464</u>	 18-1 Flash Memory 18-2 PCMCIA 18-3 RISC Processors and the PowerPC 18-4 Wireless Communications 	516 521 524 527
16-1 Reviewing Service Procedures 16-2 Finding the Problem	464 466 468	Glossary	537
16-3 Troubleshooting Specific Modules16-4 Troubleshooting the Power Supply		Index	547