

contents

PREFACE **vii**

1

INTRODUCTION TO BOOLEAN ALGEBRA **1**

1-1	The binary system	2	
1-2	Boolean operators, symbols, variables, and constants	6	
1-3	Switching circuits and electronic gates	7	
1-4	The OR operator	8	
1-5	The AND operator	11	
1-6	The negation or complementing operator	14	
1-7	Truth tables	19	
1-8	A capsule summary of the Boolean operators	25	
1-9	Other logic and Boolean symbols	25	

2

THE LANGUAGE AND LAWS OF BOOLEAN ALGEBRA **29**

2-1	The commutative laws	30	
2-2	The associative laws	30	
2-3	The distributive laws	30	
2-4	The laws of tautology	35	
2-5	The laws of complementation	36	
2-6	The laws of absorption	36	
2-7	De Morgan's theorem	38	
2-8	Application of the fundamental laws	40	

3
TRUTH TABLES AND EQUATIONS 49

- 3-1 Truth tables and equations 52
- 3-2 The four forms of a Boolean equation 54
- 3-3 The complexity index 63
- 3-4 Polyvalent and monovalent terms 64
- 3-5 The order of an equation 68
- 3-6 Synthesis of a Boolean circuit 69
- 3-7 The sign-comparator problem 70

4
PRACTICAL SIMPLIFICATION PROCEDURES 77

- 4-1 The theory of simplification 78
- 4-2 The Karnaugh map 81
- 4-3 Two common hazards 91
- 4-4 Simplification of the type-*zero* minterm equation 93
- 4-5 Don't cares 94
- 4-6 Multiple-output circuits 97
- 4-7 The Veitch diagram 99
- 4-8 Veitch diagrams for more than four variables 105

5
POSITIONAL NUMBER SYSTEMS 109

- 5-1 The structure of a positional number system 111
- 5-2 The structure of the decimal system 113
- 5-3 The decimal fraction 113
- 5-4 The zero exponent 114
- 5-5 The negative exponent 115
- 5-6 The radix point 115
- 5-7 The general positional number system 115
- 5-8 The structure of the binary system 116
- 5-9 The structure of the binary fraction 116
- 5-10 An examination of a positional number system with radix 4 117
- 5-11 Writing a given decimal number in another radix 119

6**TRANSLATION BETWEEN RADICES 125**

- 6-1 Translation from any radix into radix 10 126
- 6-2 Translation from radix 10 into any other radix 131
- 6-3 Related radices 134
- 6-4 Binary-related radices 135
- 6-5 Ternary (radix 3) and its related radix 9 137
- 6-6 The hexadecimal system (radix 16) 137
- 6-7 Two-step translations 138
- 6-8 Translation of fractions 140

7**COMPUTERS AND ARITHMETIC 147**

- 7-1 Addition 148
- 7-2 Multiplication 152
- 7-3 Subtraction through complementary addition 155
- 7-4 Division 163
- 7-5 Another method of subtraction 165
- 7-6 Coded number systems 167
- 7-7 The binary-coded decimal system 168
- 7-8 The excess-3 code 171
- 7-9 The binary-coded octal system 173
- 7-10 Subtraction of coded numbers by complementary addition 174
- 7-11 A brief summary of common computer codes 175
- 7-12 Fixed and floating radix points 180

8**APPLICATIONS OF BOOLEAN ALGEBRA
TO COMPUTER CIRCUITS 183**

- 8-1 Translation matrices 184
- 8-2 Simplification of decoding matrices 190
- 8-3 The two-stage treed matrix 191
- 8-4 The BCD adder 194
- 8-5 The nines-complement BCD circuit 209

9		
OTHER LOGIC FORMS		211
9-1	Other logic operations	212
9-2	Applications of NAND-NOR logic	216
BIBLIOGRAPHY		227
ANSWERS TO ODD-NUMBERED PROBLEMS		229
INDEX		237