Boolean Algebra

Steps to Solution (SOP)

1. From the problem statement a truth table is formed. The problem may be expressed in words, waveforms, tables, Boolean expressions, or as a circuit. The problem statement must specify (a) the number of inputs, and (b) the desired output for all input conditions. With this information in hand the problem is synthesized into a set of input and corresponding output conditions in tabular form (a truth table).
2. A column is added to the truth table and named product terms. For each row whose output is 1, a product term is formed from the input columns.
3. A sum-of-products (SOP) expression is built from these product terms.
4. The algebraic expression is simplified
5. The answer is checked.
6. A logical circuit is designed.

Boolean Operators

INPUT		**OUTPUT**			
		NOT	**OR**	**AND**	*Logical Operators*
x	y	$\bar{x}$ or x'	$x+y$	xy	*Traditional Representation*
		$\sim x$	$x\|y$	$x\&y$	*Bitwise HDL Verilog*
0	0	1	0	0	
0	1		1	0	
1	0	0	1	0	
1	1		1	1	

Basic Laws and Theorems of Boolean Algebra

Law		**Dual (D)**	
1	$\bar{\bar{x}} = x$		Involution
	OR Laws	**AND Laws**	
2	$x + 0 = x$	$x \cdot 1 = x$	Identity element under addition is 0 and under multiplication it is 1
3	$x + 1 = 1$	$x \cdot 0 = 0$	Dominance
4	$x + x = x$	$x \cdot x = x$	Idempotent
5	$x + \bar{x} = 1$	$x \cdot \bar{x} = 0$	Complements
	Commutative		
6	$x + y = y + x$	$x \cdot y = y \cdot x$	
	Associative		
7	$x + (y + z) = (x + y) + z$	$x(yz) = (xy)z$	
	Distributive		
8	$x(y + z) = xy + xz$	$x + yz = (x + y)(x + z)$	
Theorem	**Simplification**		
9	$x + xy = x$	$x(x + y) = x$	Absorption
10	$x + \bar{x}y = x + y$	$x(\bar{x} + y) = xy$	Degenerate-Reflect Law
	De Morgan's		
11	$\overline{x + y} = \bar{x} \cdot \bar{y}$	$\overline{x \cdot y} = \bar{x} + \bar{y}$	

ASCII Code

	$b_6b_5b_4$							
$b_3b_2b_1b_0$	000	001	010	011	100	101	110	111
0000	NUL	DLE	SP	0	@	P	‘	p
0001	SOH	DC1	!	1	A	Q	a	q
0010	STX	DC2	″	2	B	R	b	r
0011	EXT	DC3	#	3	C	S	c	s
0100	EOT	DC4	$	4	D	T	d	t
0101	ENQ	NAK	%	5	E	U	e	u
0110	ACK	SYN	&	6	F	V	f	v
0111	BEL	ETB	’	7	G	W	g	w
1000	BS	CAN	(	8	H	X	h	x
1001	HT	EM	)	9	I	Y	i	y
1010	LF	SUB	*	:	J	Z	j	z
1011	VT	ESC	+	;	K	[	k	{
1100	FF	FS	,	<	L	\	l	¦
1101	CR	GS	–	=	M	]	m	}
1110	SO	RS	.	>	N	^	n	~
1111	SI	US	/	?	O	−	o	DEL