4.6.5 Boolean Algebra

Boolean Laws

Identities	
$A \,.\, 0 = 0$	$A + 0 = A$
$A \,.\, 1 = A$	$A + 1 = 1$
$A \,.\, A = A$	$A + A = A$
$A \,.\, \bar{A} = 0$	$A + \bar{A} = 1$
$\bar{\bar{A}} = A$	

Absorption law – absorb the brackets	
$A + (A \cdot B) = A$	$A.(A + B) = A$

Commutative rules	
$A + B = B + A$	$A.B = B.A$

Distributive rules	
$A.\ (B + C) = A.B + A.C$	$A + B.C = (A + B).(A + C)$

De Morgan’s Laws – break the bar, change the sign	
$\overline{A.B} = \bar{A} + \bar{B}$	$\overline{A + B} = \bar{A}.\bar{B}$

TIPS: Simplifying Boolean Expressions

When simplifying Boolean expressions, look for identities in the following order:

1) Look for 0s and 1s	$A \,.\, 0 = 0$ $A + 0 = A$ $A \,.\, 1 = A$ $A + 1 = 1$
2) Look for these identities	$A \,.\, A = A$ $A + A = A$ $A \,.\, \overline{A} = 0$ $A + \overline{A} = 1$
3) Look for absorption law	$A + (A \cdot B) = A$ $A \,.\, (A + B) = A$
4) Multiply out brackets or factorise	$A \,.\, (B + C) = A \,.\, B + A \,.\, C$ $A + B \,.\, C = (A + B) \,.\, (A + C)$
5) De Morgan's law	$\overline{A \,.\, B} = \bar{A} + \bar{B}$ $\overline{A + B} = \overline{A} \,.\, \overline{B}$

Following this will tend to make the expression reduce to smaller, more manageable expressions sooner.