Boolean Algebra Exercises

pp 1-2 Reference

pp 3-6 Exercises

Boolean Algebra – Operations and Constants

- A AND B = A ^ B = AB
- A OR B = A v B = A+B
- NOT A = ¬A = A'
- TRUE = T = 1
- FALSE = F = 0

Boolean Algebra - Identities

- A • True = A
- A •False = False
- A •A = A
- A + True = True
- A + False = A
- A + A = A
- (A')' = A
- A + A' = True
- A •A' = False

Commutative, Associative, and Distributive Laws

- $AB = BA$ (Commutative)
- $A + B = B + A$
- $A(BC) = (AB)C$ (Associative)
- $A + (B + C) = (A + B) + C$
- $A\,(B + C) = (AB) + (AC)$ (Distributive)
- $A + (BC) = (A + B)\,(A + C)$

DeMorgan's Laws

- $(A + B)' = A'B'$
- $(AB)' = A' + B'$

Example: Proving Identities

- Using truth tables, prove:
- A + A' = True A •A' = False

A	A'	A+A'
F		
T		

A	A'	A•A'
F		
T		

(One of the) Associative Laws

- Using truth tables, prove

$$A\ (B\ C) = (A\ B)\ C$$

A	B	C	B C	A (B C)	A B	(A B) C
F	F	F				
F	F	T				
F	T	F				
F	T	T				
T	F	F				
T	F	T				
T	T	F				
T	T	T				

(One of the) Distributive Laws

- Using truth tables, prove

$$A\,(B + C) = (A\,B) + (A\,C)$$

A	B	C	B + C	A (B + C)	A B	A C	(A B) + (A C)
F	F	F					
F	F	T					
F	T	F					
F	T	T					
T	F	F					
T	F	T					
T	T	F					
T	T	T					

Proving DeMorgan's Laws (a)

- Using truth tables, prove (A + B)' = A'B'

A	B	A + B	(A + B)'
F	F		
F	T		
T	F		
T	T		

A	B	A'	B'	A'B'
F	F			
F	T			
T	F			
T	T			

Proving DeMorgan's Laws (b)

- Prove the 2nd of DeMorgan's Laws:

$$(AB)' = A' + B'$$

A	B	AB	(AB)'
F	F		
F	T		
T	F		
T	T		

A	B	A'	B'	A'+B'
F	F			
F	T			
T	F			
T	T			

Exercise: A (A + B)

A	B	A + B	A (A + B)

What have we proved in this table?

Exercise: Boolean Algebra

- Exercise - Using the Distributive Property, Identities, and your result from the previous exercise, prove:
  - **A + (AB) = A**
  - **A + (AB)**
    =

Exercise: Using DeMorgan's Laws

- Exercise – Using Boolean Algebra, including DeMorgan's Laws, prove:
  - **(A'B)' = A + B'**
  - **(A'B)'**
    = ((A')B)' **(add parentheses)**
    =