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)**

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Exercise: Using DeMorgan's Laws

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

    = ((A')B)' **(add parentheses)**

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