University of North Florida / School of Computing

Laws and Theorems of Boolean Algebra

Operations with 0 or 1

1: **X + 0 = X**

1D: **X * 1 = X**

2: **X + 1 = 1**

2D: **X * 0 = 0**

Idempotent Laws

3: **X + X = X**

3D: **X * X = X**

Involution Law

4: **(X')' =X**

Laws of Complementarily

5: **X + X' = 1**

5D: **X * X' = 0**

Commutative Laws

6: **X + Y = Y + X**

6D: **X * Y = Y * X**

Associative Laws

7: **(X + Y) + Z = X + (Y + Z) = X + Y + Z**

7D: **(XY)Z = X(YZ) = XYZ**

Distributive Laws

8: **X(Y + Z) = XY + XZ**

8D: **X + YZ = (X + Y)(X + Z)**

Simplification Theorems

9: **XY + XY' = X**

9D: **(X + Y)(X + Y') = X**

10: **X + XY = X**

10D: **X(X + Y) = X**

11: **(X + Y')Y = XY**

11D: **XY' + Y = X + Y**

DeMorgans's Law

12: **(X + Y + Z)' = X' Y' Z'**

12D: **(XYZ)' = X' + Y' + Z'**

Laws and Theorems of Boolean Algebra

Consensus theorem

13: **XY + YZ + X' Z = XY + X' Z**

13D: **(X + Y)(Y + Z)(X' + Z) = (X + Y)(X' + Z)**

14: **(X + Y)(X' + Z) = XZ + X' Y**

15: Exclusive-OR

X ⊕ Y = XY' + X'Y **(X ⊕ Y)' = XY + X'Y'**

X ⊕ 0 = X **X ⊕ 1 = X'**

X ⊕ X = 0 **X ⊕ X' = 1**

X ⊕ Y' = (X ⊕ Y)' **X' ⊕ Y = (X ⊕ Y)'**

A ⊕ B = B ⊕ A **(A ⊕ B) ⊕ C = A ⊕ (B ⊕ C) = A ⊕ B ⊕ C**