

ESE170 LAWS AND THEOREMS OF BOOLEAN ALGEBRA

DUAL Expression

Existence 0 and 1: 1. $X + 0 = X$ 2. $X + 1 = 1$	1D. $X1 = X$ 2D. $X0 = 0$
Idempotent theorem: 3. $X + X = X$	3D. $XX = X$
Involution theorem: 4. $(X')' = X$	
Theorem of complementarity (or existence complement): 5. $X + X' = 1$	5D. $XX' = 0$
Cummutative law: 6. $X + Y = Y + X$	6D. $XY = YX$
Associative law: 7. $(X + Y) + Z = X + (Y + Z)$ $\quad = X + Y + Z$	7D. $(XY)Z = X(YZ)$ $\quad = XYZ$
Distributive law: 8. $X(Y + Z) = XY + XZ$	8D. $X + (YZ) = (X + Y)(X + Z)$
Simplification theorems: 9. $XY + XY' = X$ (minimizing or uniting) 10. $X + XY = X$ (absorption) 11. $(X + Y')Y = XY$ (simplification or adsorption)	9D. $(X + Y)(X + Y') = X$ 10D. $X(X + Y) = X$ 11D. $(XY') + Y = X + Y$
DeMorgan's theorem: 12. $(X + Y + Z + \dots)' = X'Y'Z' \dots$ 13. $\{f(X_1, X_2, \dots, X_n, 0, 1, +, \dots)\}$ $\quad = \{f(X_1', X_2', \dots, X_n', 1, 0, \dots, +)\}$	12D. $(XYZ \dots)' = X' + Y' + Z' + \dots$
Duality: 14. $(X + Y + Z + \dots)^D = XYZ \dots$ 15. $\{f(X_1, X_2, \dots, X_n, 0, 1, +, \dots)\}^D$ $\quad = f(X_1, X_2, \dots, X_n, 1, 0, \dots, +)$	14D. $(XYZ \dots)^D = X + Y + Z + \dots$
Theorem for multiplying and factoring: 16. $(X + Y)(X' + Z)$ $\quad = XZ + X'Y$	16D. $XY + X'Z = (X + Z)(X' + Y)$
Consensus theorem: 17. $XY + YZ + X'Z = XY + X'Z$	17D. $(X + Y)(Y + Z)(X' + Z)$ $\quad = (X + Y)(X' + Z)$