

CS 4341: Digital Logic and Computer Architecture

Homework 1 and 2 Guides

Notes

Throughout this guide the exclamation mark (!) is a unary operator negating the argument on its right hand side, so “!A” would be read “not A” and “!(AB)” would be read “A nand B.” You may be familiar with a similar convention from popular programming languages.

Chapter 2

2.7.A

Simplification by Theorem

$Y = AC + !A!BC$	Initial Equation
$Y = C(A + !A!B)$	Distributive Property
$Y = C((A + !A) * (A + !B))$	Distributive Property
$Y = C((1) * (A + !B))$	Complements
$Y = C(A + !B)$	Identity
$Y = AC + !BC$	Distributive Property

K-Map

		B,C			
		00	01	11	10
A	0	0	1	0	0
	1	0	1	1	0

2.7.B

Simplification by Theorem

$Y = !A!B + !AB!C + !(A + !C)$	Initial Equation
$Y = !A!B + !AB!C + !AC$	DeMorgan's Theorem
$Y = !A(!B + B!C + C)$	Distributive Property
$Y = !A((!B + B) * (!B + !C) + C)$	Distributive Property
$Y = !A((1) * (!B + !C) + C)$	Complements
$Y = !A(!B + !C + C)$	Identity
$Y = !A(!B + 1)$	Complements
$Y = !A(1)$	Null Element
$Y = !A$	Identity

K-Map

		B,C			
		00	01	11	10
A	0	1	1	1	1
	1	0	0	0	0

2.7.C

Simplification by Theorem

$Y = !A!B!C!D + A!B!C + A!BC!D + ABD + !A!BC!D + B!CD + !A$	Initial Equation
$Y = A!B!C + A!BC!D + ABD + B!CD + !A$	Covering
$Y = A(!B!C + !BC!D + BD) + B!CD + !A$	Distributive Property
$Y = (A + !A) * (!A + (!B!C + !BC!D + BD)) * (!A + B!CD)$	Distributive Property
$Y = (1) * (!A + (!B!C + !BC!D + BD)) * (!A + B!CD)$	Complements
$Y = (!A + (!B!C + !BC!D + BD)) * (!A + B!CD)$	Identity
$Y = !A + !B!C + !BC!D + BD + B!CD$	Distributive Property
$Y = !A + !B!C + !BC!D + BD$	Covering
$Y = !A + ((!B + !BC!D) * (!C + !BC!D)) + BD$	Distributive Property
$Y = !A + (!B) * (!C + !BC!D) + BD$	Covering
$Y = !A + (!B) * (!C + !B) * (!C + C) * (!C + !D) + BD$	Distributive Property
$Y = !A + (!B) * (!C + !B) * (1) * (!C + !D) + BD$	Complements
$Y = !A + (!B) * (!C + !B) * (!C + !D) + BD$	Identity
$Y = !A + (!B!C + !B!B) * (!C + !D) + BD$	Distributive Property
$Y = !A + (!B) * (!C + !D) + BD$	Covering
$Y = !A + !B!C + !B!D + BD$	Distributive Property

K-Map

		C,D			
		00	01	11	10
A,B	00	1	1	1	1
	01	1	1	1	1
	11	0	1	1	0
	10	1	1	0	1

2.9.A

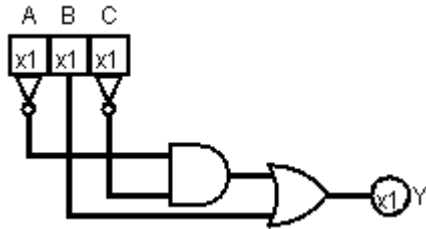
Simplification by Theorem

$Y = BC + !A!B!C + B!C$	Initial Equation
$Y = B + !A!B!C$	Combining
$Y = (!A + B) * (!B + B) * (!C + B)$	Distributive Property
$Y = (!A + B) * (1) * (!C + B)$	Complements
$Y = (!A + B) * (!C + B)$	Identity
$Y = !A!C + B$	Distributive Property

K-Map

		B,C			
		00	01	11	10
A	0	1	0	1	1
	1	0	0	1	1

Circuit Layout



2.9.B

Simplification by Theorem

$Y = !(A + !AB + !A!B) + !(A + !B)$	Initial Equation
$Y = !(A + !A) + !(A + !B)$	Combining
$Y = !(1) + !(A + !B)$	Complements
$Y = !(A + !B)$	Identity
$Y = !AB$	DeMorgan's Theorem

K-Map

		B	
		00	01
A	0	0	1
	1	0	0

Circuit Layout

