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Lab Solutions Manual

for

Lab Manual: A Design Approach

to accompany

DIGITAL SYSTEMS:

PRINCIPLES AND APPLICATIONS

Eleventh Edition

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Prentice Hall

Boston Columbus Indianapolis New York San Francisco Upper Saddle River
Amsterdam Cape Town Dubai London Madrid Milan Munich Paris Montreal Toronto
Delhi Mexico City Sao Paulo Sydney Hong Kong Seoul Singapore Taipei Tokyo



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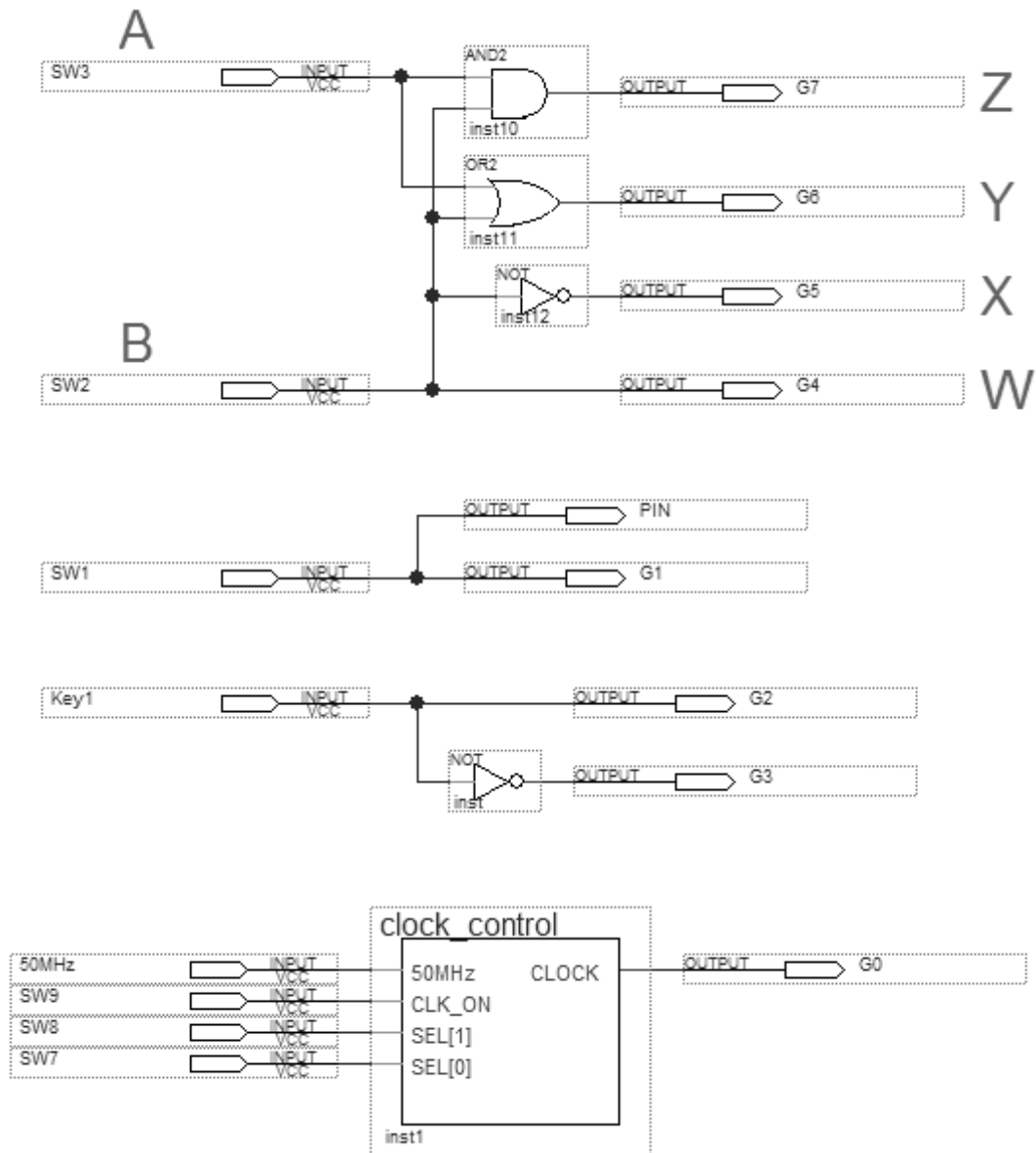
ISBN-13: 978-0-13-512382-9
ISBN-10: 0-13-512382-8

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Unit 1 Introduction to the DE0, DE1, or DE2 Development & Education Board

Project: Intro2DE0, Intro2DE1, or Intro2DE2



1.3 Logic Switches

Board	DE0	DE1	DE2
# switches	10	10	18

Logic Switch SW1	LEDG1 (on/off)	Logic level (high/low)	Voltage at connector pin
Down	Off	Low	~0 V
Up	On	High	~3.3 V

1.4 LEDs

LED label	Color	DE0	DE1	DE2
LEDR	Red	0	10	18
LEDG	Green	10	8	9

1.5 Pushbuttons → Normally High

Board	DE0	DE1	DE2
Pushbutton	3	4	4

Pushbutton #1	LEDG2 (on/off)	LEDG3 (on/off)
Normal	On	Off
Pressed	Off	On

1.6 Clock

CLK_ON (SW9)	1	1	1	1	0
SEL[1..0] (SW8, SW7)	00	01	10	11	XX
freq _{G0}	0.5 Hz	5 Hz	25 Hz	50 Hz	0 Hz

1.7 Simple logic circuits

A (SW3)	B (SW2)	W (LEDG4)	X (LEDG5)	Y (LEDG6)	Z (LEDG7)
0	0	0	1	0	0
0	1	1	0	1	0
1	0	0	1	1	0
1	1	1	0	1	1

$$W = B$$

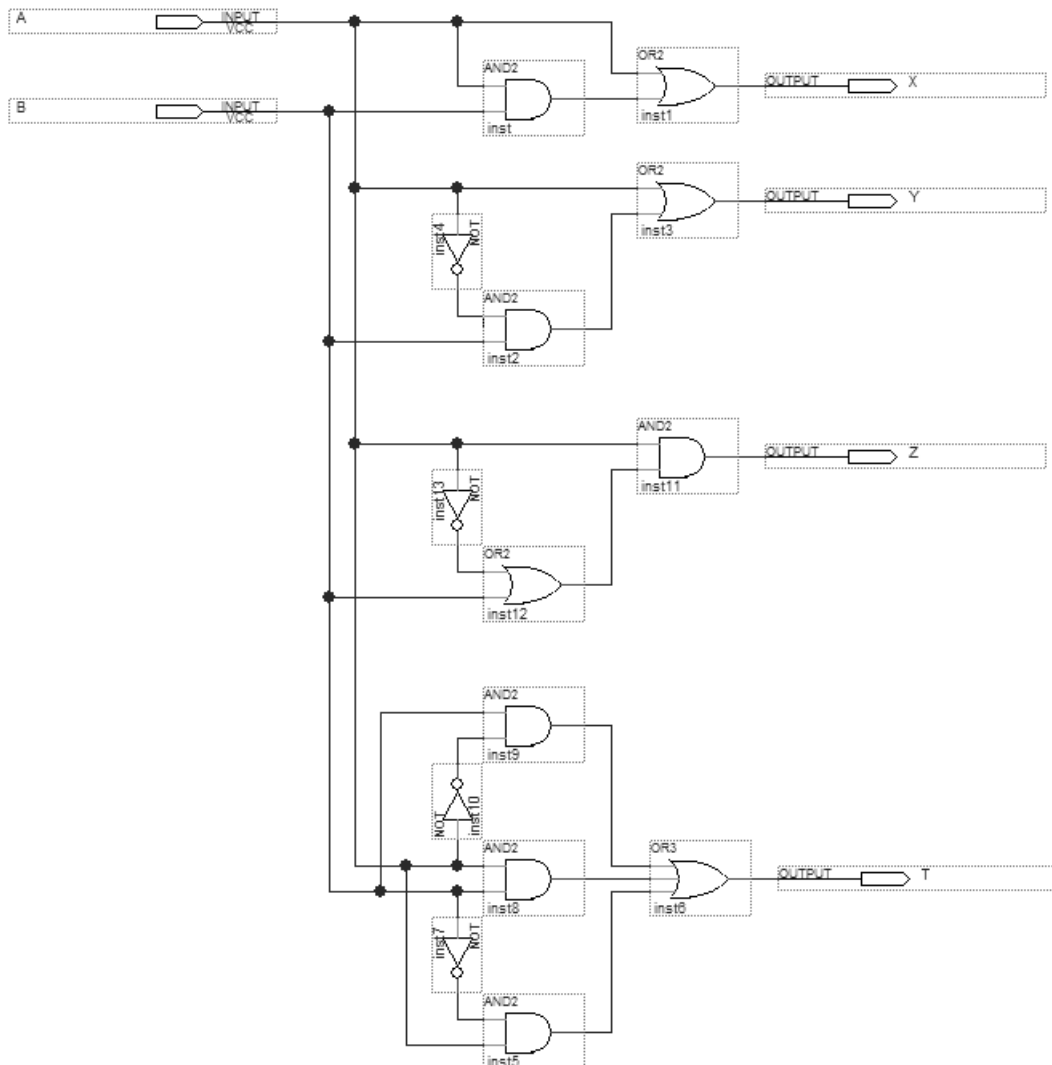
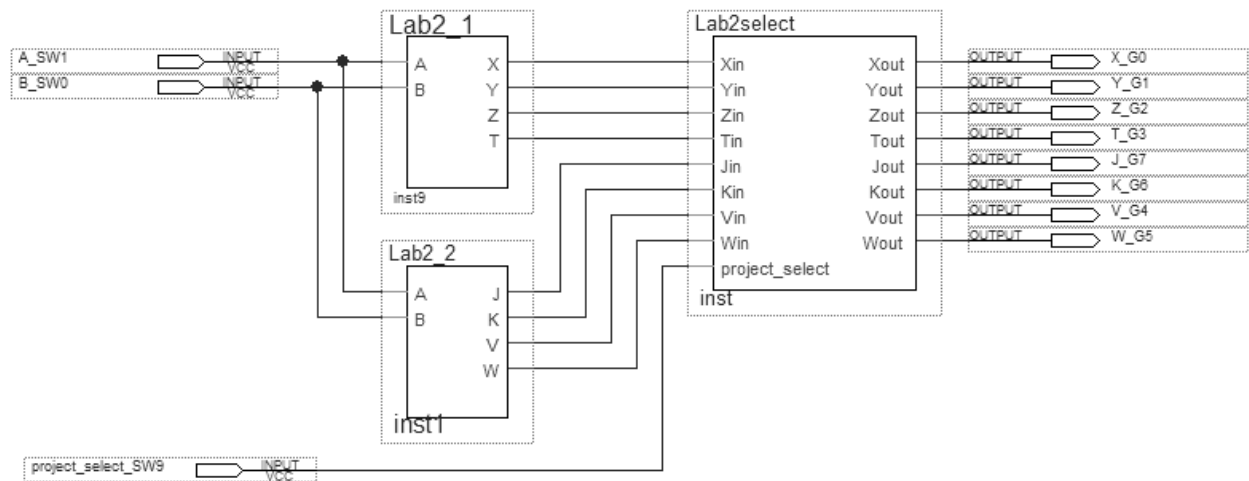
$$X = \overline{B}$$

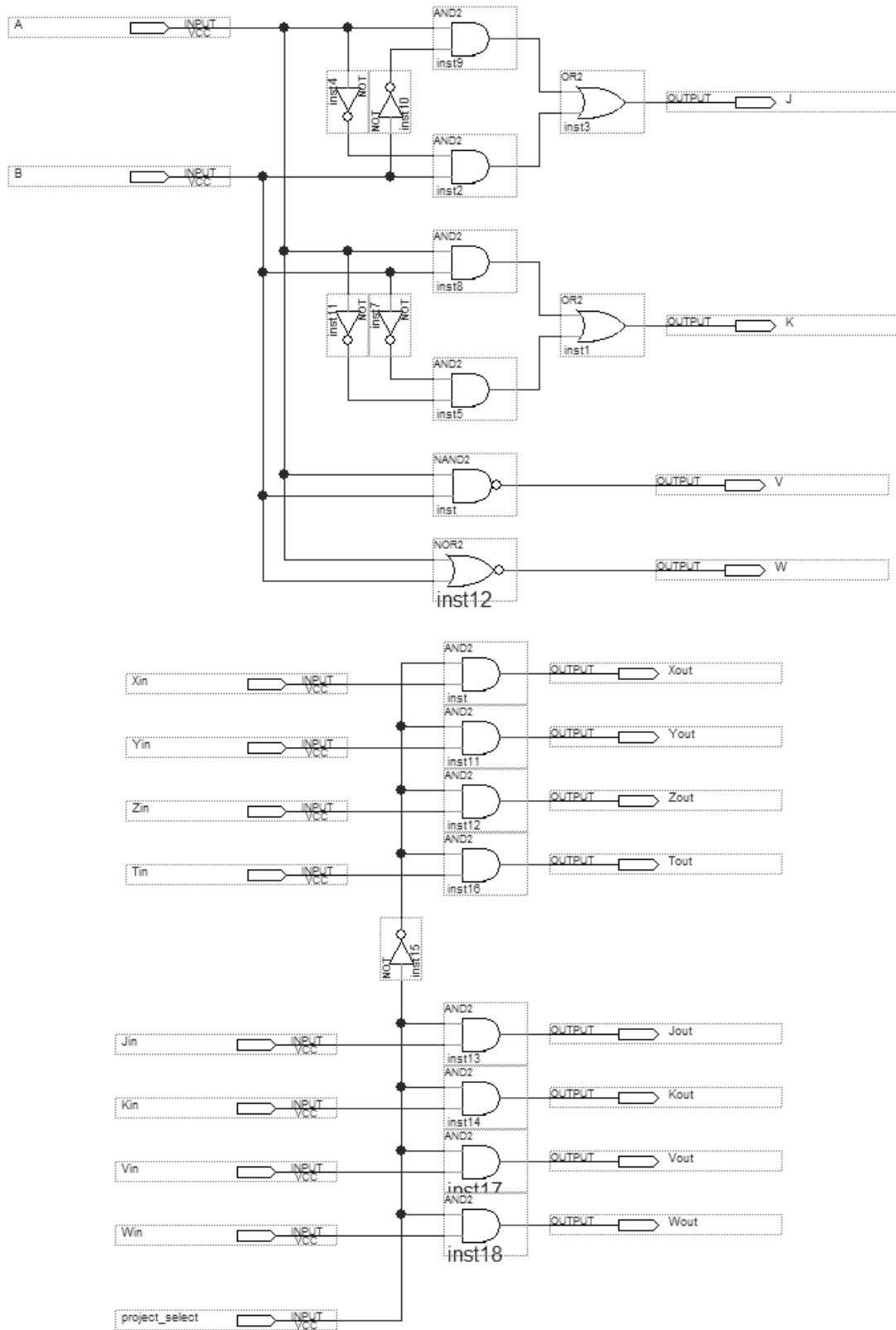
$$Y = A + B$$

$$Z = A \cdot B$$

Unit 2 Testing Combinational Logic Circuits Using DE0, DE1, or DE2 Boards

Project: Lab2DE0, Lab2DE1, or Lab2DE2





2.1 Simple circuits

$$X = A + A B = A$$

$$Y = A + \bar{A} B = A + B$$

$$Z = A (\bar{A} + B) = A B$$

$$T = \bar{A} B + A B + A \bar{B} = A + B$$

A	B	T	Z	Y	X	J	K	W	V
0	0	0	0	0	0	0	1	1	1
0	1	1	0	1	0	1	0	0	1
1	0	1	0	1	1	1	0	0	1
1	1	1	1	1	1	0	1	0	0

2.2 More circuit functions

$$V = \overline{A B}$$

$$W = \overline{A + B}$$

$$J = A \bar{B} + \bar{A} B = A \oplus B$$

$$K = A B + \bar{A} \bar{B} = \overline{A \oplus B}$$