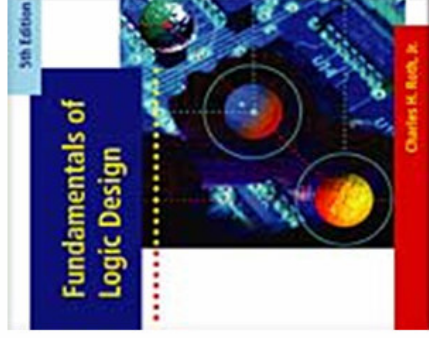


FIGURES FOR CHAPTER 19

STATE MACHINE DESIGN WITH SM CHARTS



This chapter in the book includes:

- Objectives
- Study Guide
- 19.1 State Machine Charts
- 19.2 Derivation of SM Charts
- 19.3 Realization of SM Charts
- Problems

Click the mouse to move to the next page.
Use the ESC key to exit this chapter.

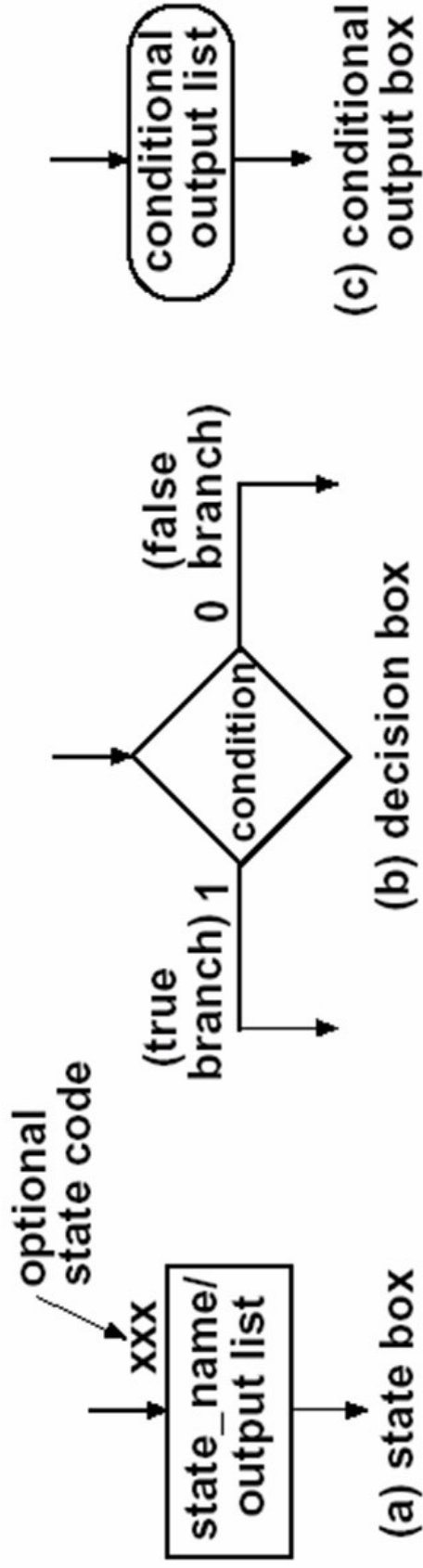


Figure 19-1 Components of an SM Chart

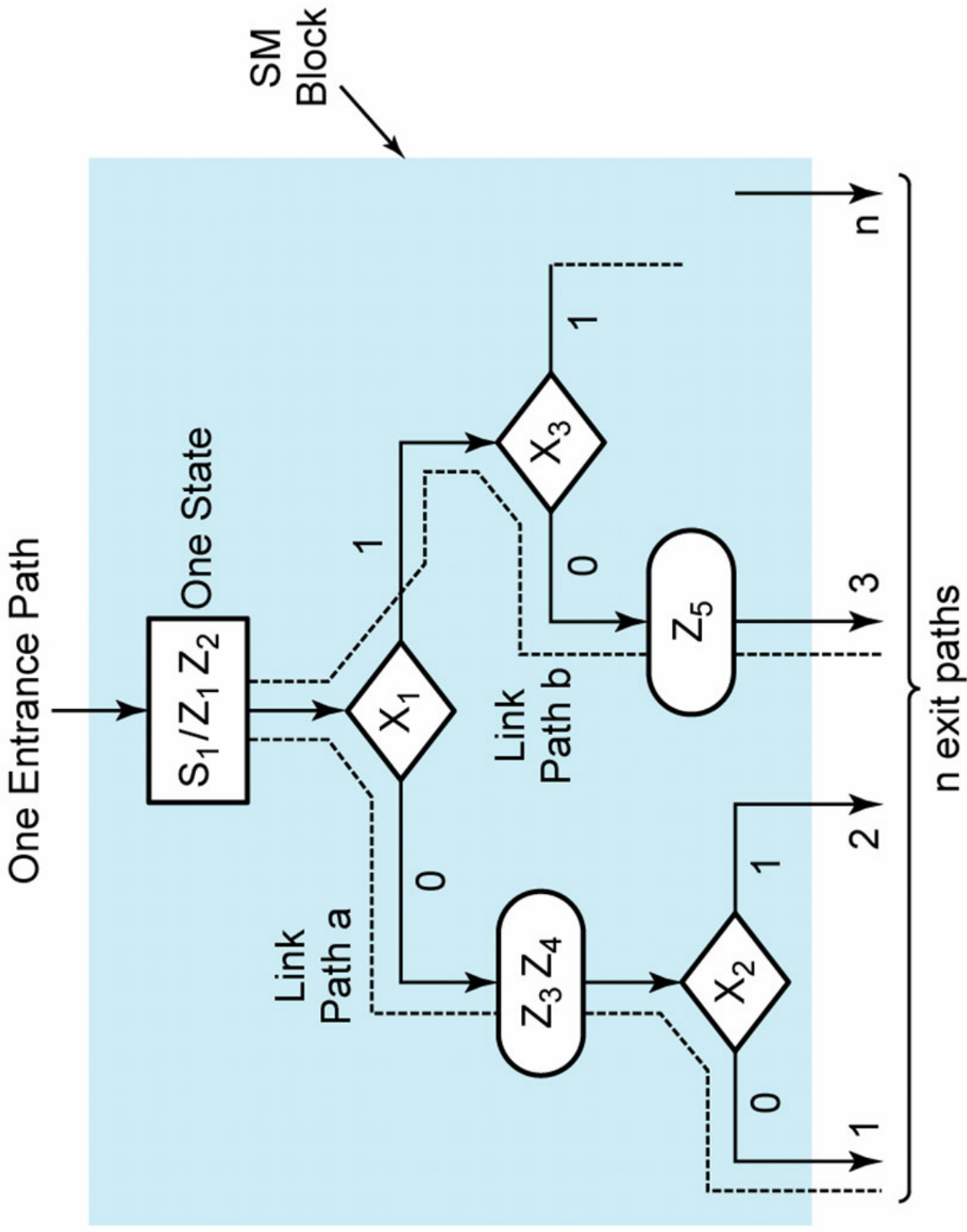
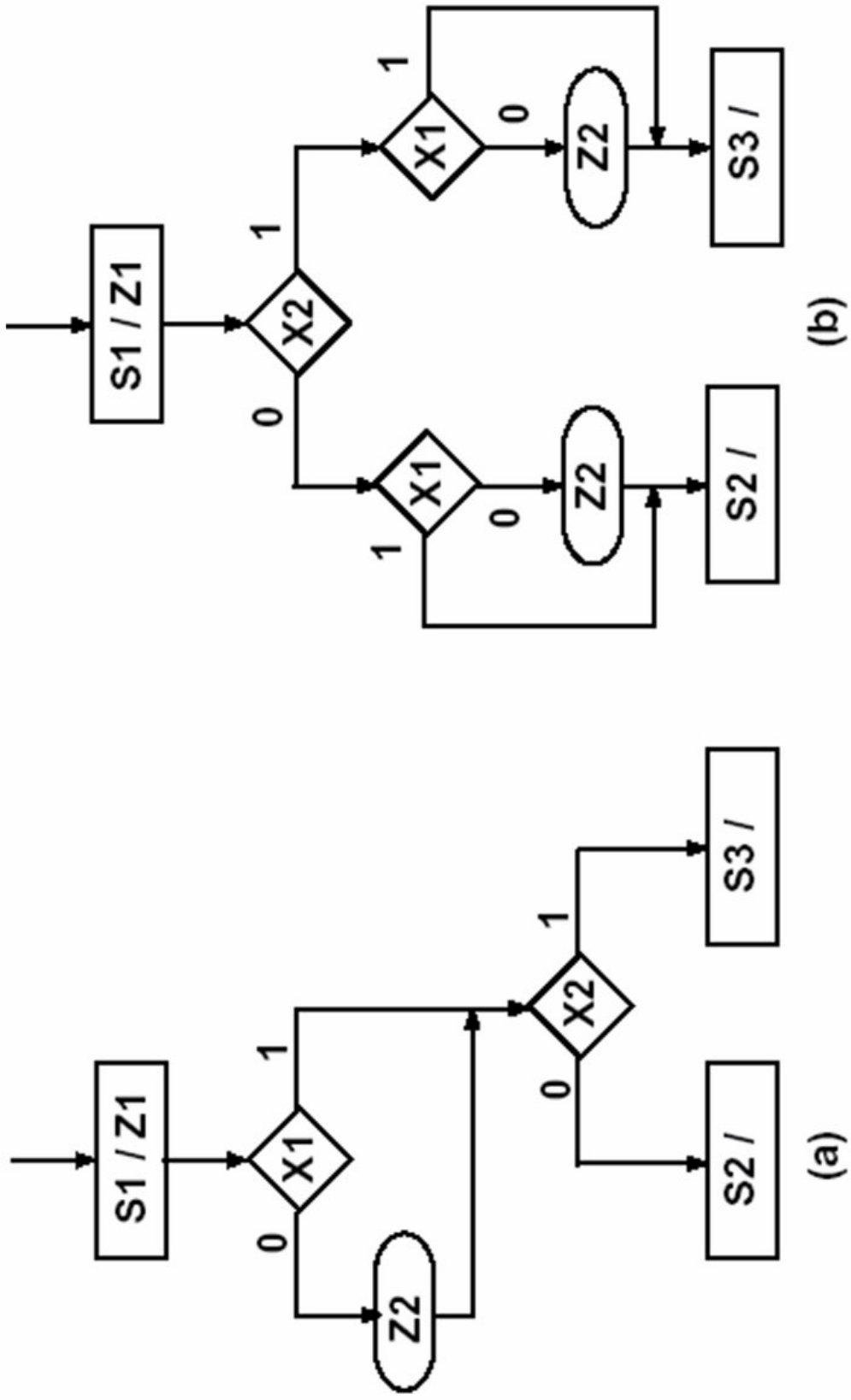


Figure 19-2 Example of an SM Block





(b)

(a)

Figure 19-3: Equivalent SM Blocks



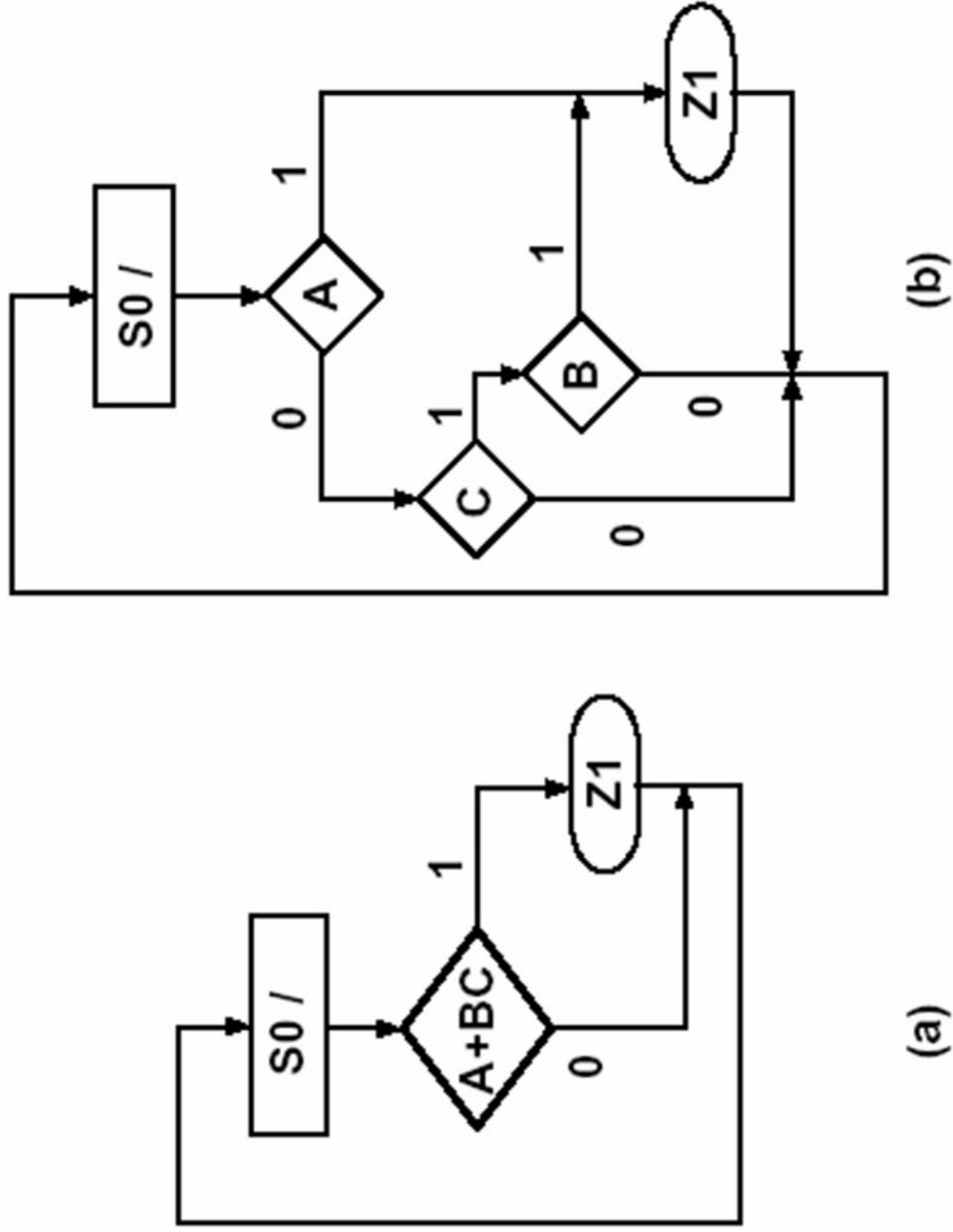
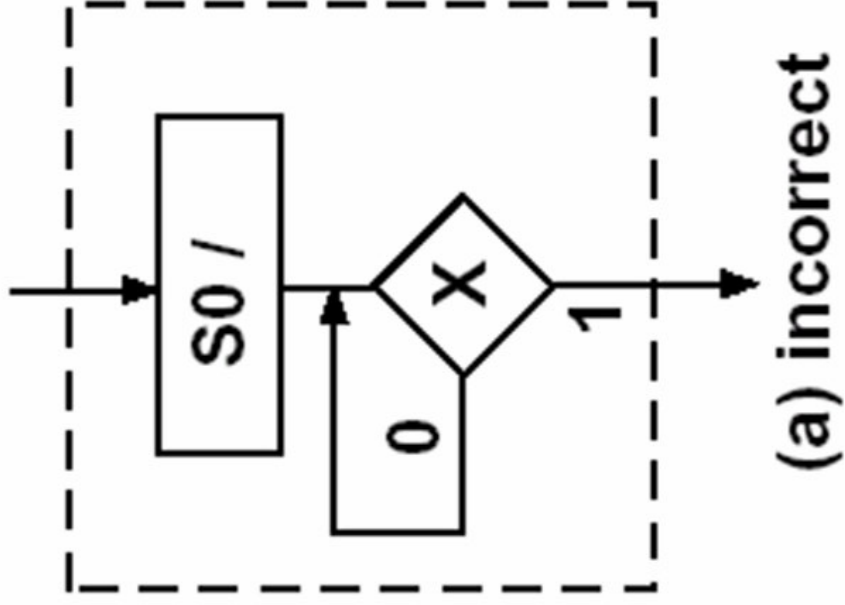
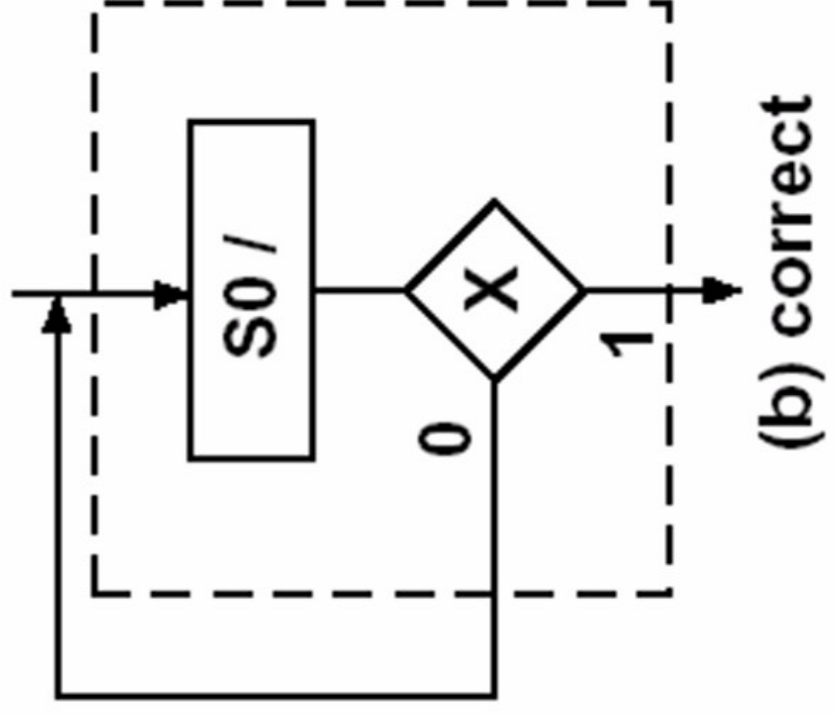


Figure 19-4: Equivalent SM Charts for a Combinational Circuit

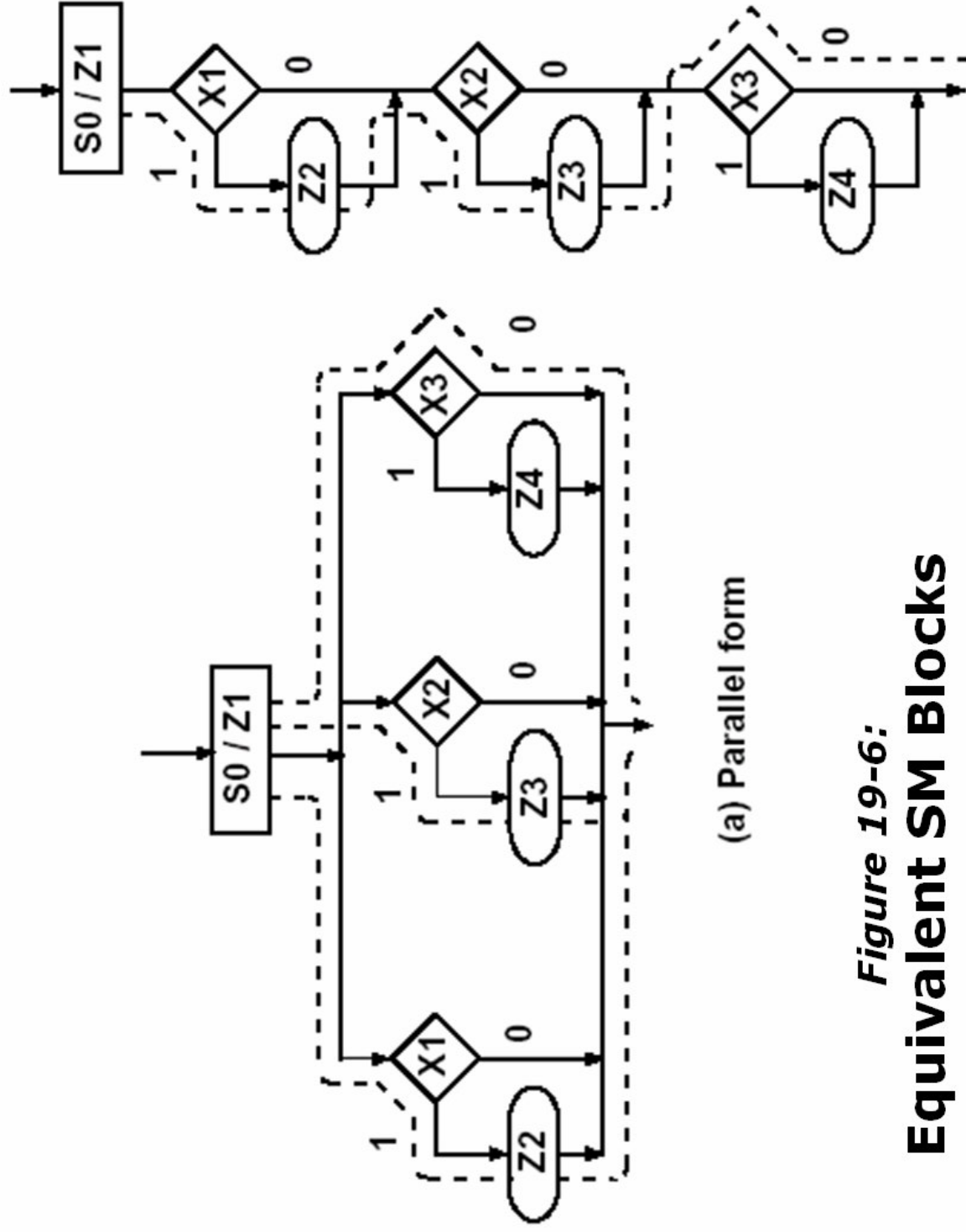


(a) incorrect



(b) correct

Figure 19-5: SM Block with Feedback



(a) Parallel form

(b) Serial form

Figure 19-6:
Equivalent SM Blocks

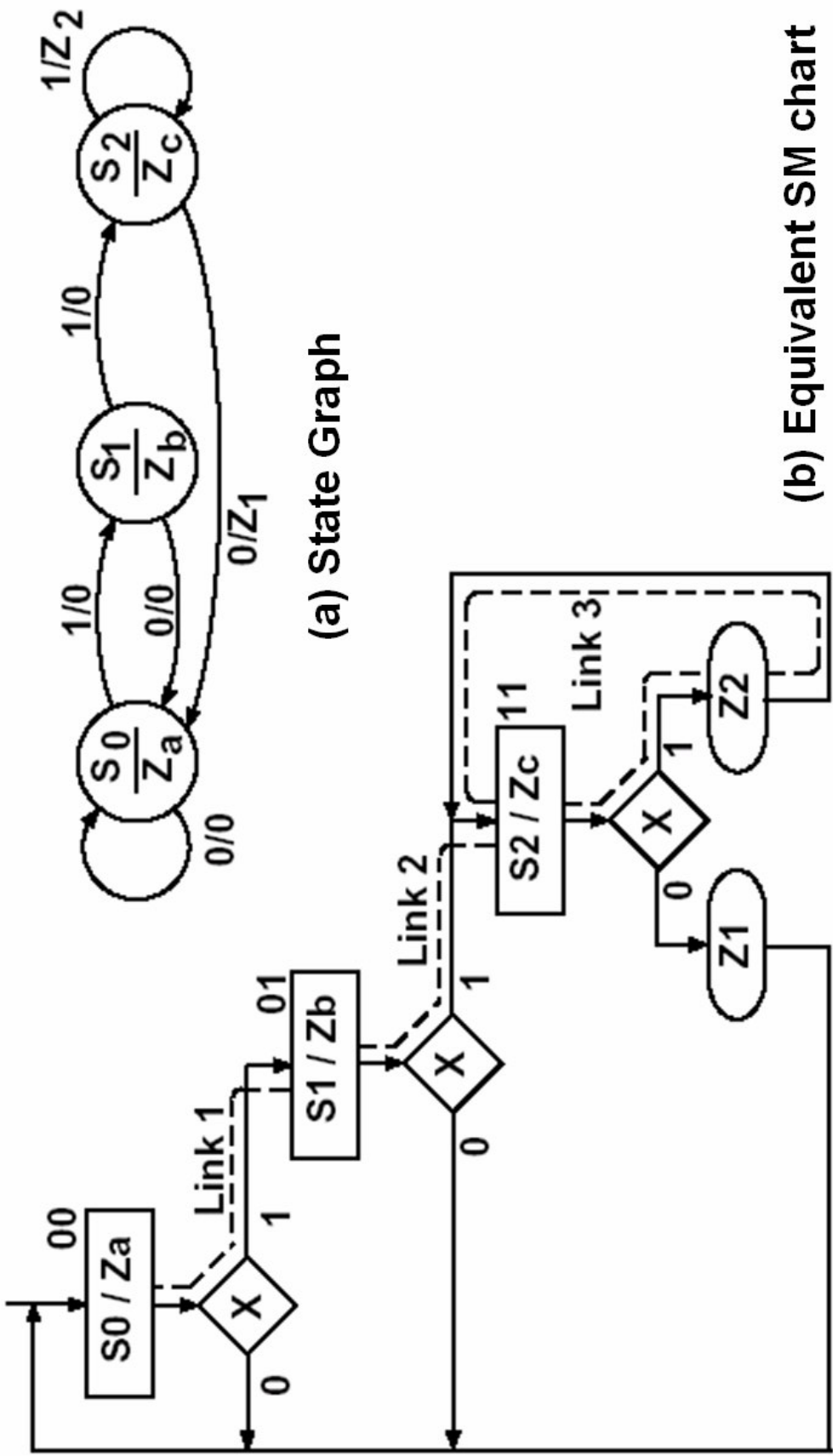


Figure 19-7:

Conversion of a State Graph to an SM Chart

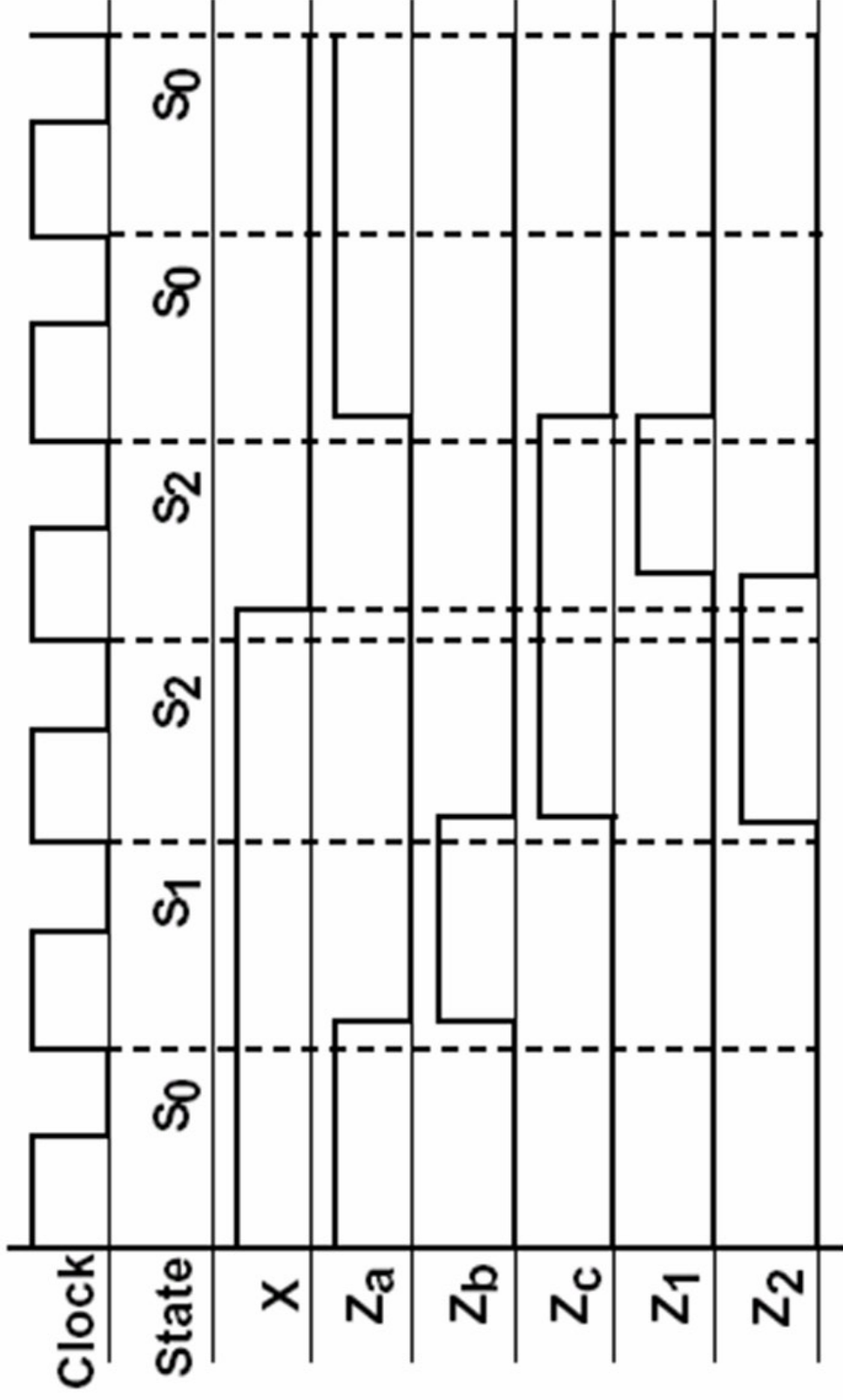


Figure 19-8: Timing Chart for Figure 19-7



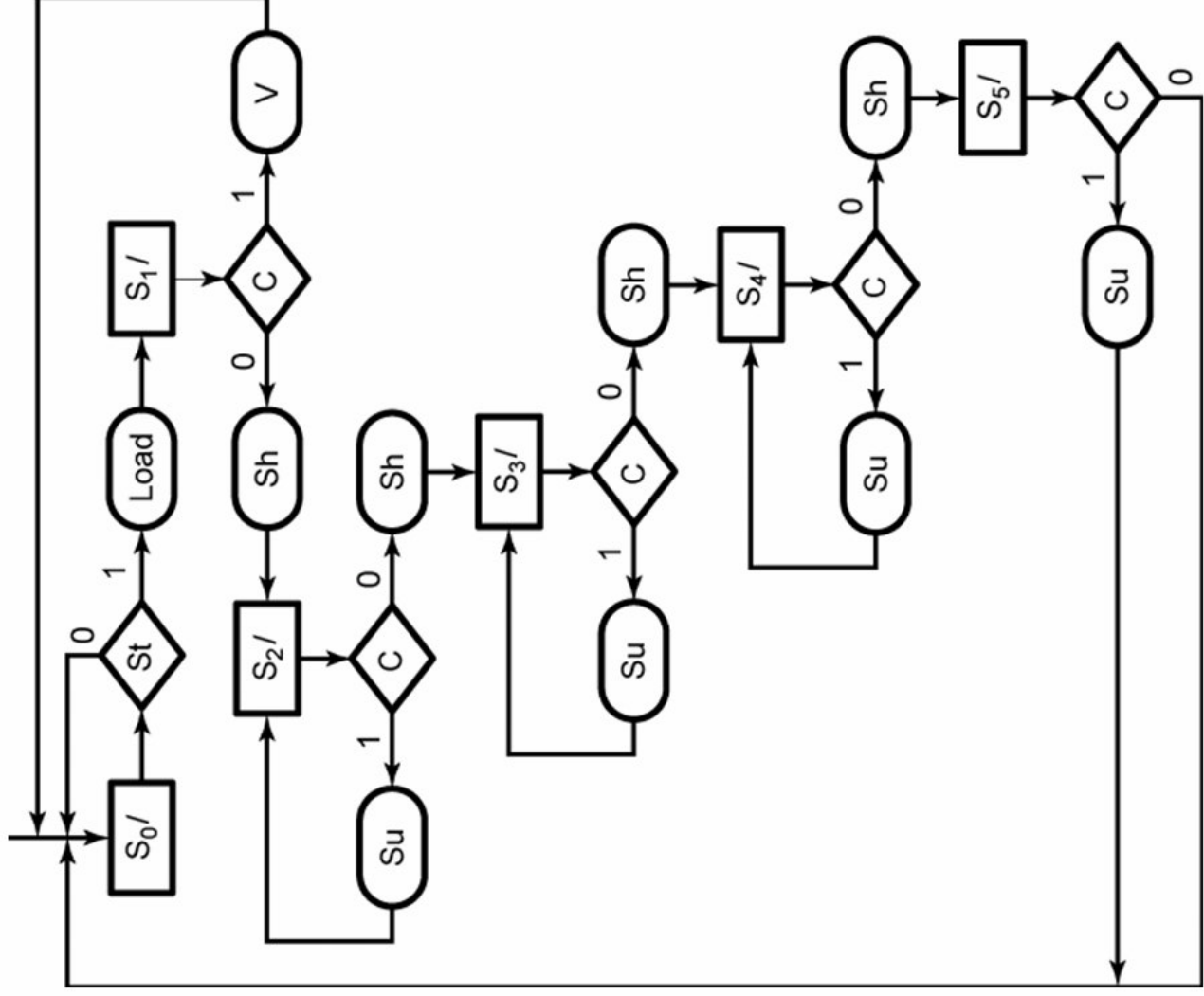


Figure 19-9:
SM Chart for
Binary Divider

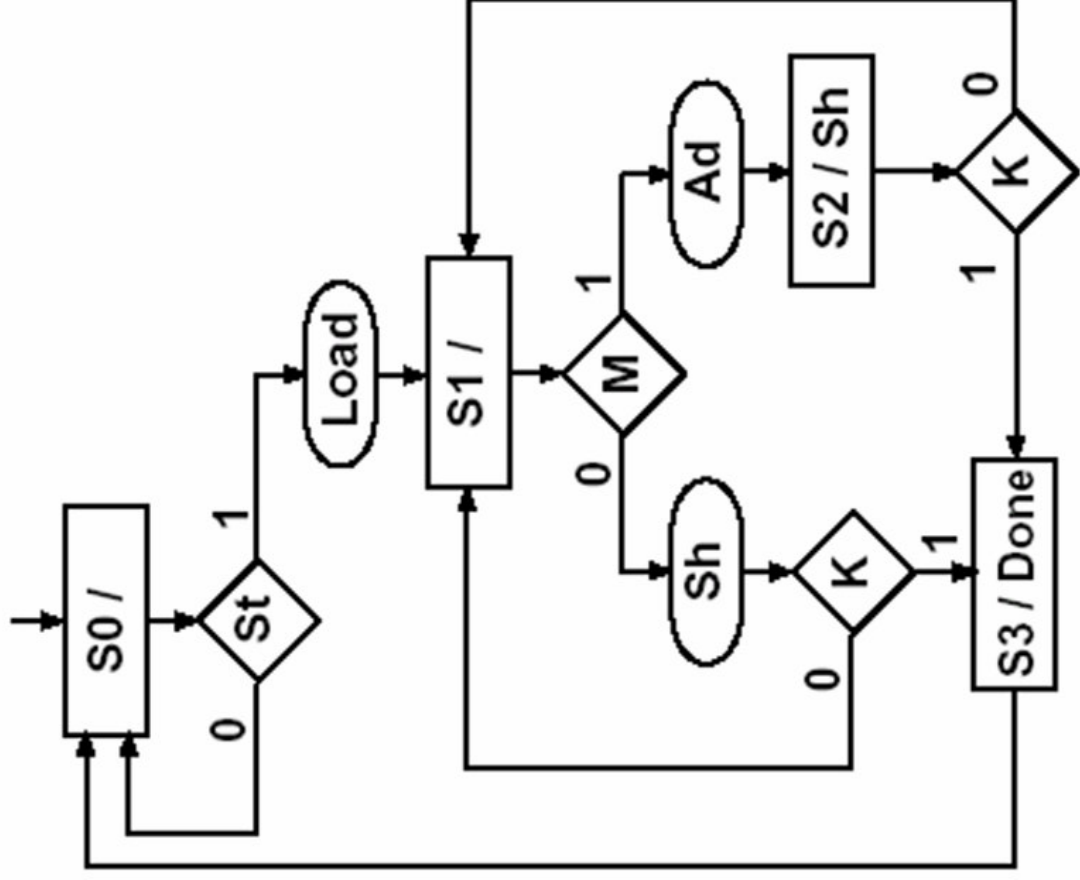


Figure 19-10:
SM Chart for Binary Multiplier



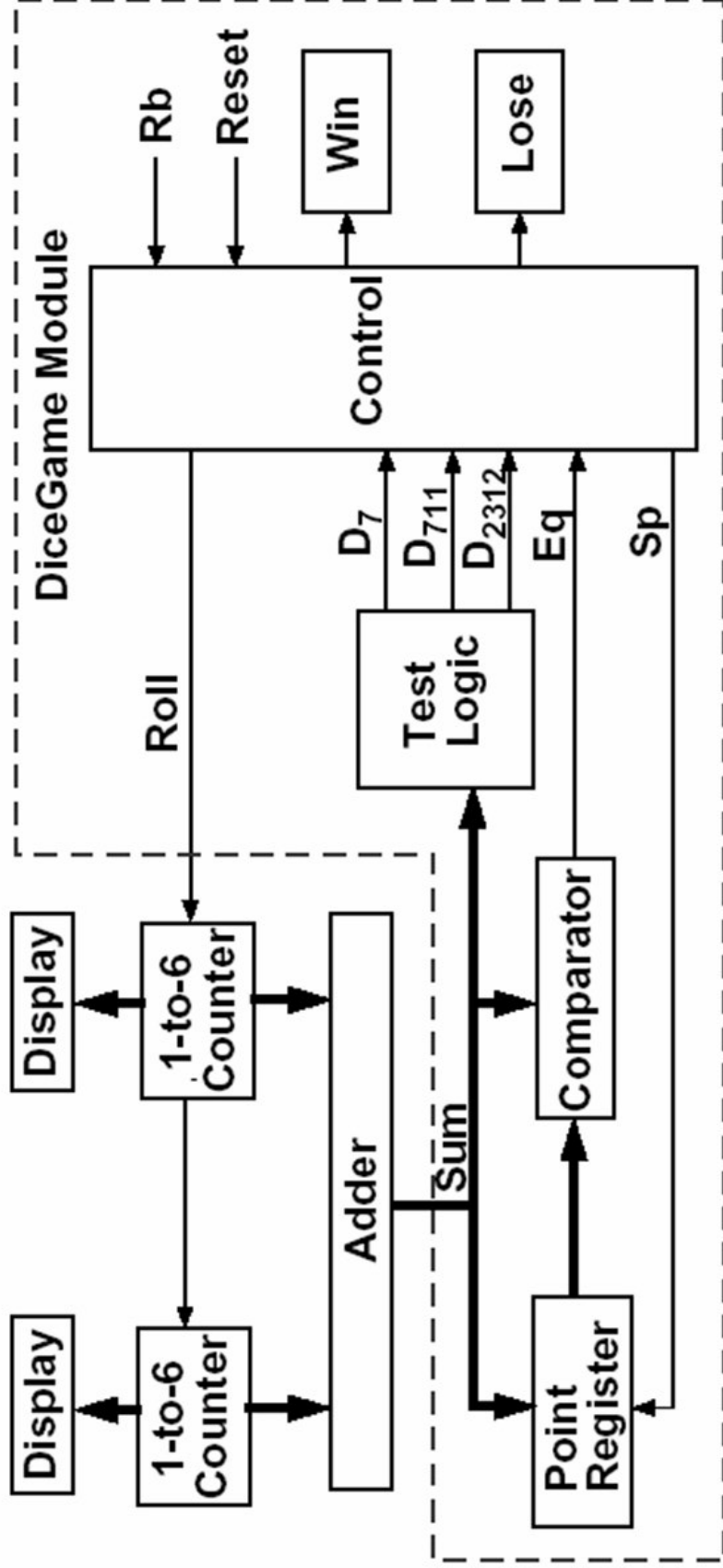


Figure 19-11: Block Diagram for Dice Game

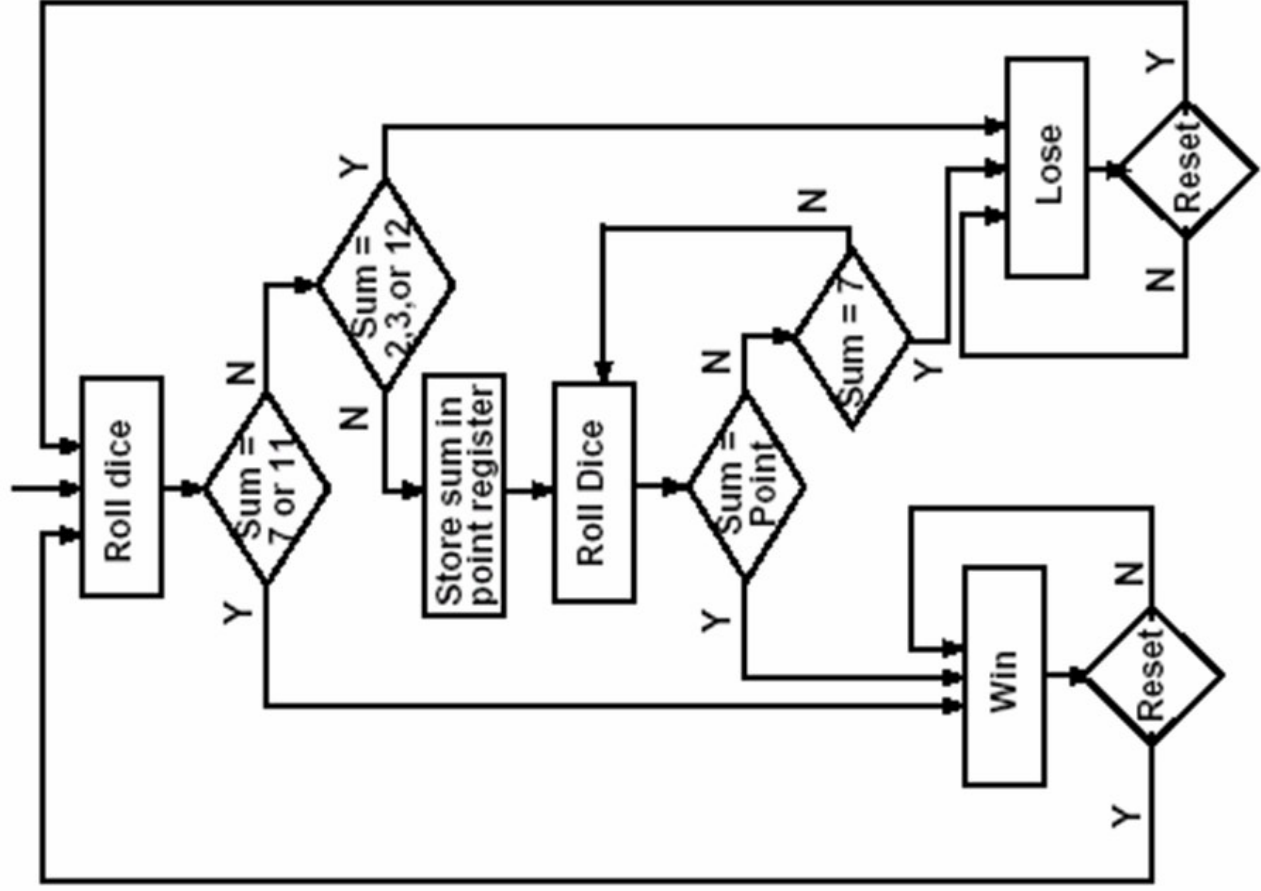


Figure 19-12:
Flowchart for
Dice Game

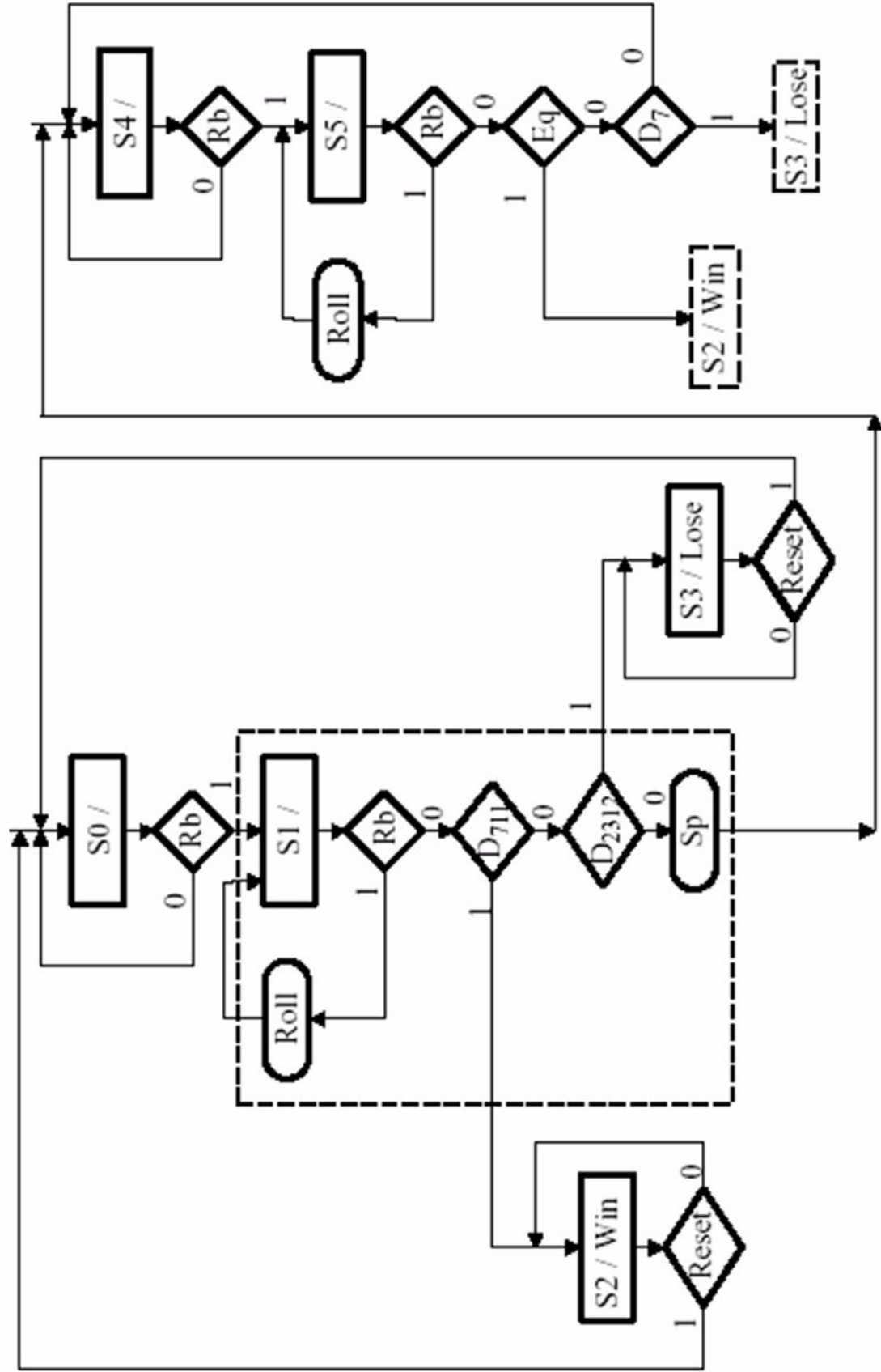


Figure 19-13:
SM Chart for Dice Game



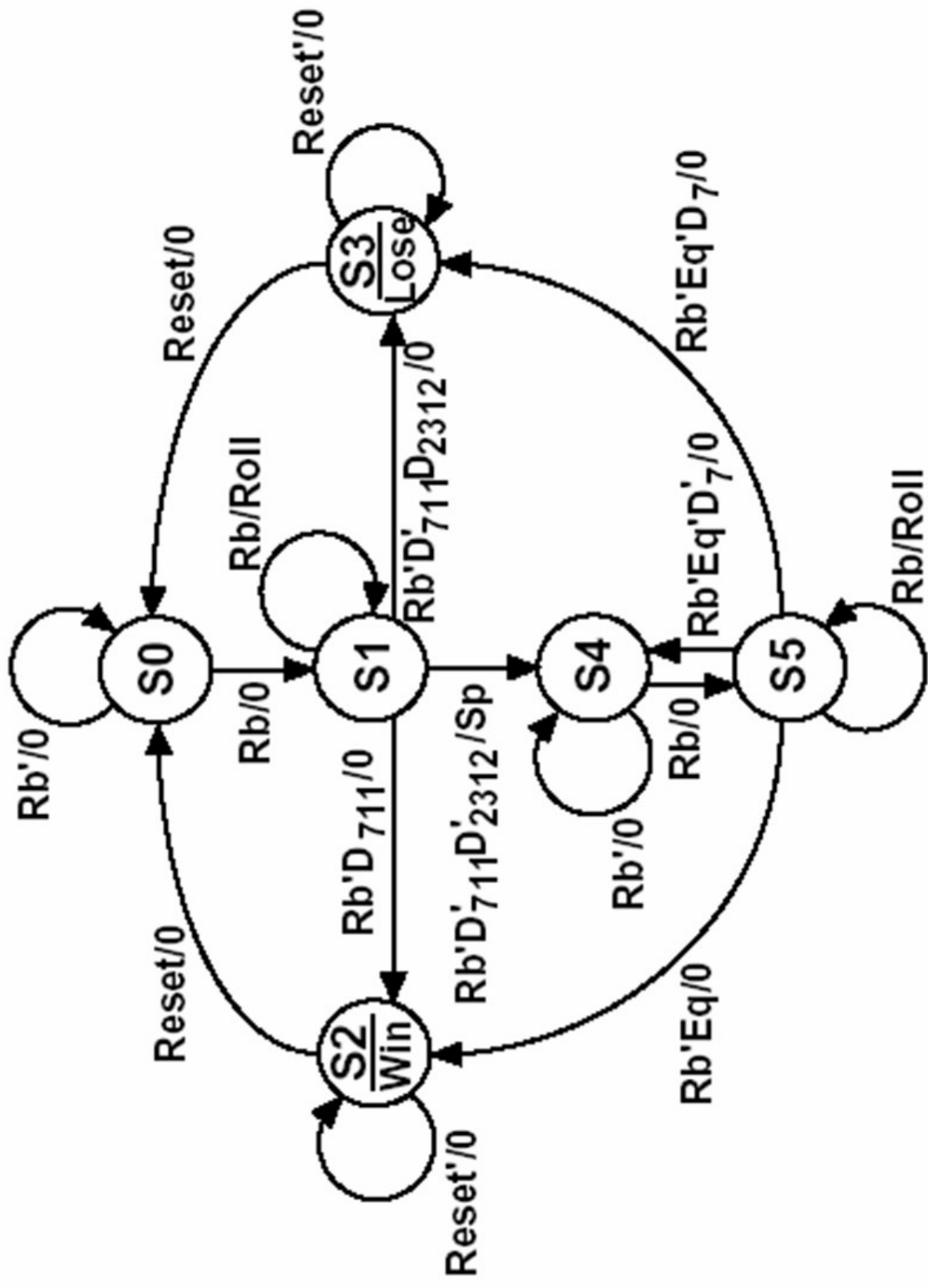


Figure 19-14: State Graph for Dice Game Controller

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Figure 19-15:
Realization of
Figure 19-10
Using a PLA
and Flip-Flops

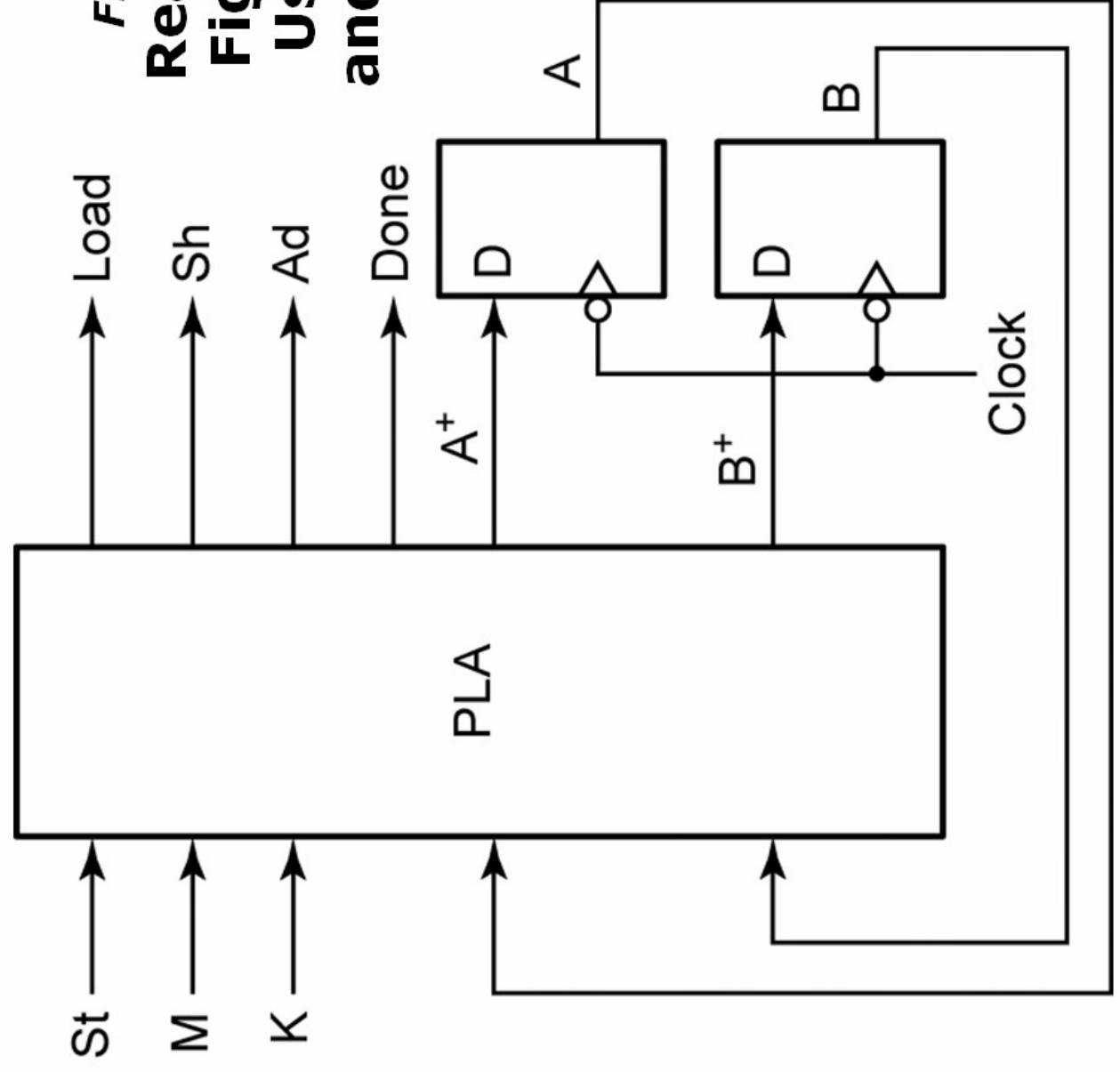
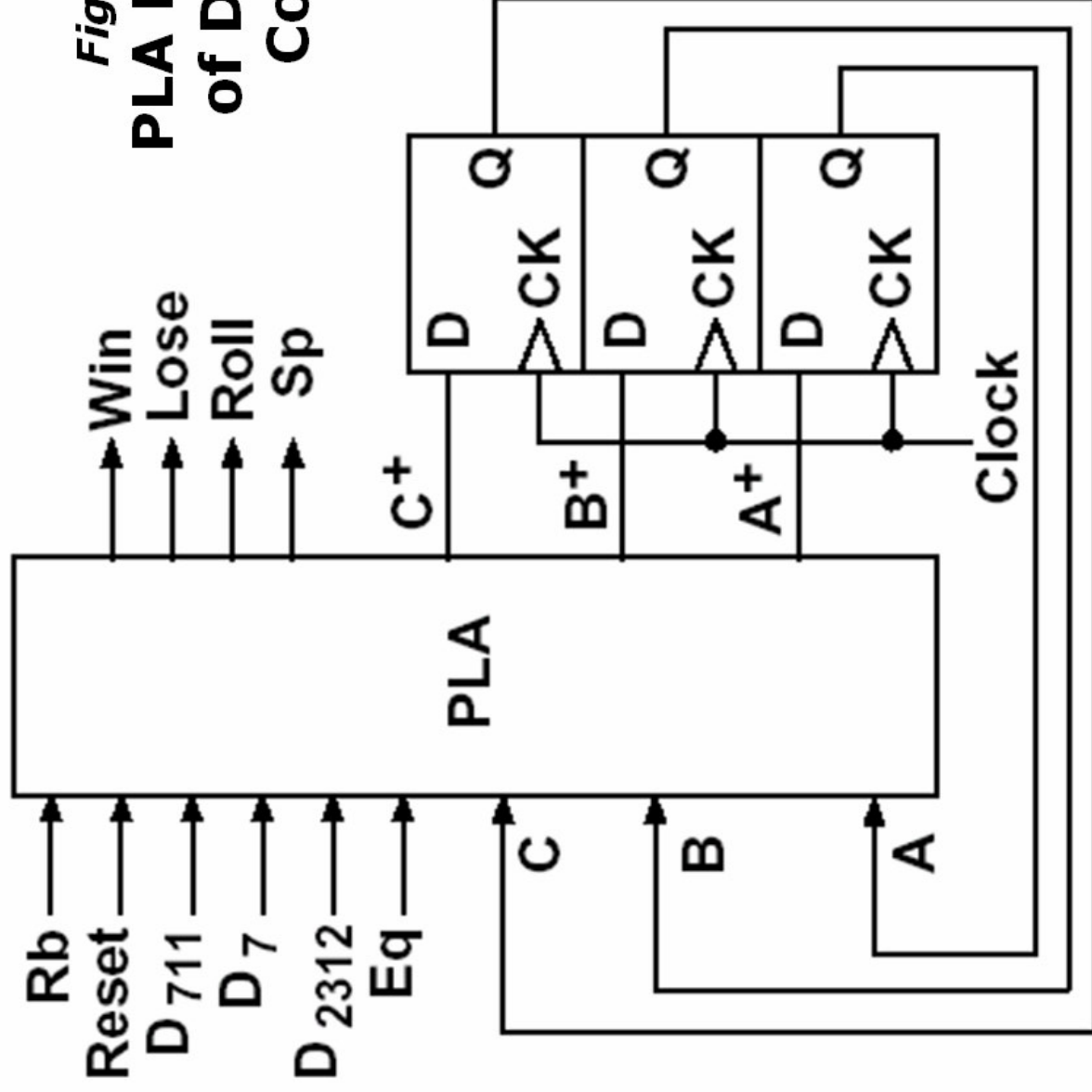


Table 19-1. PLA Table for Multiplier Control

Present State	PLA Inputs					PLA Outputs					
	A	B	St	M	K	A ⁺	B ⁺	Load	Sh	Ad	Done
S ₀	0	0	0	-	-	0	0	0	0	0	0
	0	0	1	-	-	0	1	1	0	0	0
S ₁	0	1	-	0	0	0	1	0	1	0	0
	0	1	-	0	1	1	1	0	1	0	0
	0	1	-	1	-	1	0	0	0	1	0
S ₂	1	0	-	-	0	0	1	0	1	0	0
	1	0	-	-	1	1	1	0	1	0	0
S ₃	1	1	-	-	-	0	0	0	0	0	1



Figure 19-16:
PLA Realization
of Dice Game
Controller



AB \ CRb	00	01	11	10
00			X 1	
01			X 1	
11			X 1	
10				X E ₂

A⁺

$$E_1 = D'_{711} D'_{2312}$$

$$E_2 = D'_7 E_q'$$

AB \ CRb	00	01	11	10
00		R'	X	
01		R'	X	
11		R'	X	
10	E ₃	R'	X	E ₄

B⁺

R = Reset

$$E_3 = D_{711} + D'_{711} D'_{2312} = D_{711} + D'_{2312}$$

$$E_4 = E_q + D_7 E_q' = E_q + D_7$$

AB \ CRb	00	01	11	10
00		1	X	
01		1	X	
11			X	
10				X

Win

Figure 19-17: Maps Derived from Table 19-2