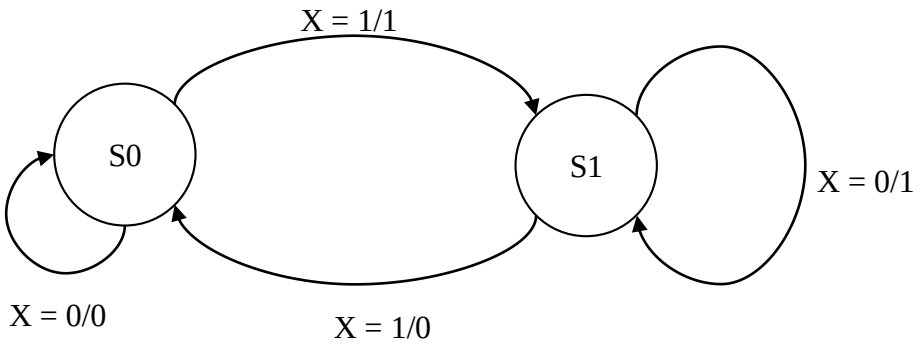
Another Sequence Detector Example

Mealy Machine Model

The Mealy Machine

- The Mealy machine was named after George Mealy
- It has the characteristic of associating its outputs with the arcs
  - The outputs are represented within the arcs or in close proximity to the arc

Mealy Machine State Graph and State Table



Present State	Next State		Z	
	X = 0	X = 1	X = 0	X = 1
S0	S0	S1	0	1
S1	S1	S0	1	0

FSM Design Concepts

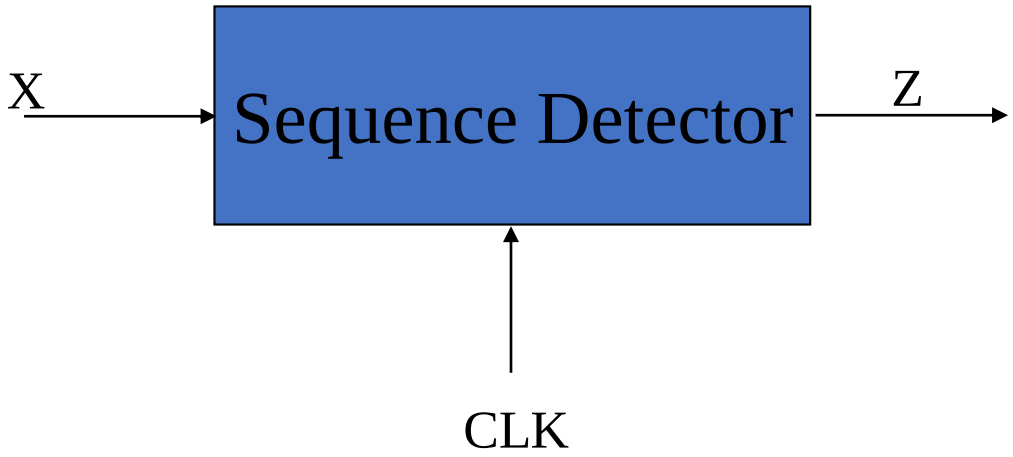
A Sequence Detector

The Mealy Machine Example

What’s a Sequence Detector, Yul?

- A sequence detector is a FSM that produces a logic 1 when a specific binary sequence has been observed
- When the FSM does not observe the sequence in the observed binary sequence, it emits a logic 0
- Let’s get started!

Macro View of the Sequence Detector



This sequence detector will be designed to recognize the pattern "**110**". The behavior of the machine calls for the Z output to equal 1 whenever the programmed pattern is observed in the input bit stream X.

Example:

X = 0011011001010100

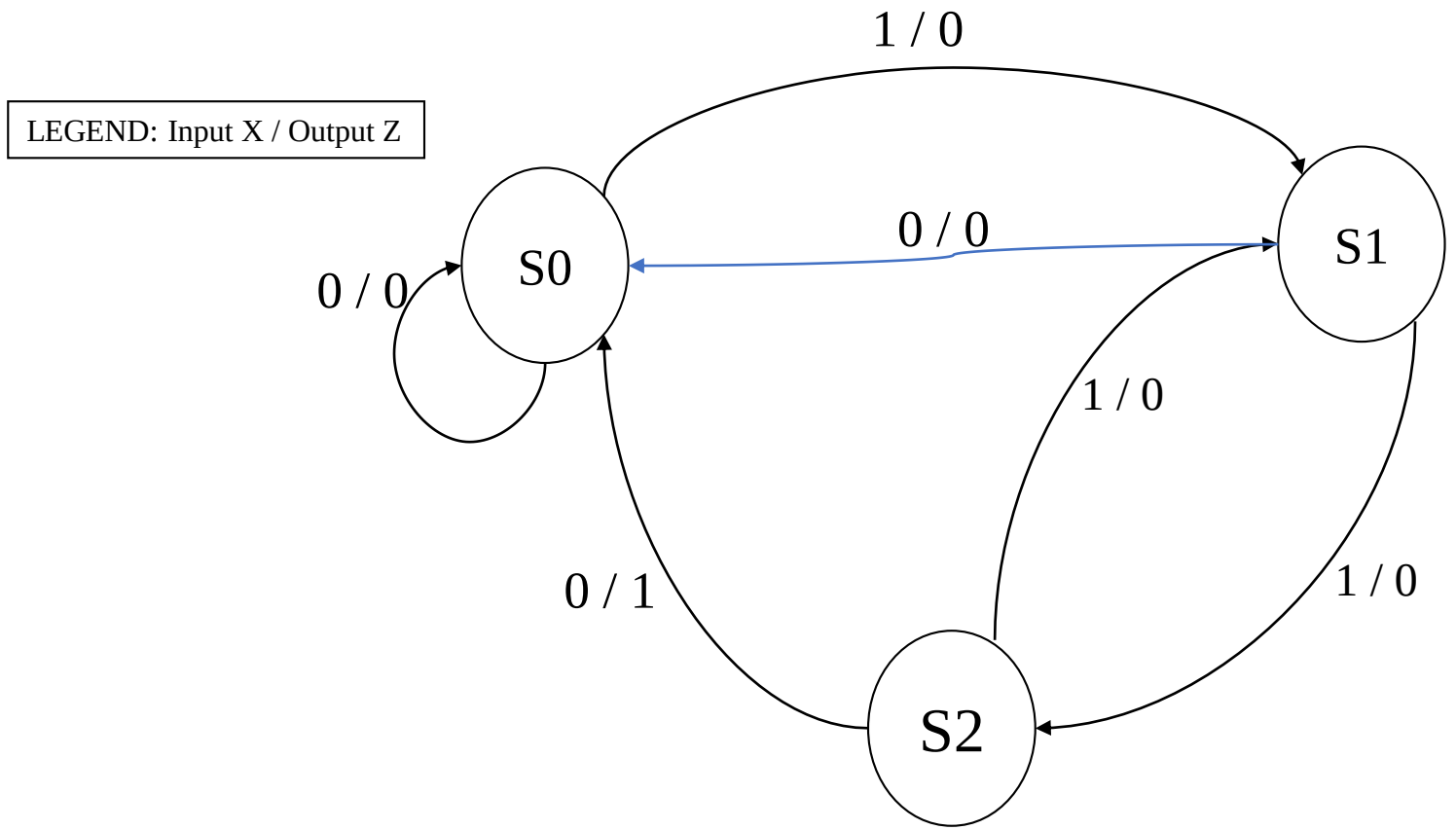
Z = 0000010000010100

Source: Fundamentals of Logic Design by Charles H. Roth

Design Strategy

- For the design of the sequence detector, we will select the Mealy machine model
- For this design, we will use the following process:
    1. Generate the state graph
    2. Create the state table
    3. Create the state transition table
    4. Generate the input expressions for the JKFF
    5. Realize the final logic design

Generate the State Graph



Create the state table

Present State	Next State		Z	
	X = 0	X = 1	X = 0	X = 1
S0	S0	S1	0	0
S1	S0	S2	0	0
S2	S0	S1	1	0

Create the State Transition Table

State Table

Present State	Next State		Z	
	X = 0	X = 1	X = 0	X = 1
S0	S0	S1	0	0
S1	S0	S2	0	0
S2	S0	S1	1	0

Let S0 = 00

S1 = 01

S2 = 10

State Transition Table

Present State	Next State		Z	
	X = 0	X = 1		
AB	A+B+	A+B+	X = 0	X = 1
00	00	01	0	0
01	00	10	0	0
10	00	01	1	0

Generate the Input Expressions for the JKFF

Present State	Next State		Z	
	X = 0	X = 1		
AB	A+B+	A+B+	X = 0	X = 1
00	00	01	0	0
01	00	10	0	0
10	00	01	1	0

J_A-Map

AB \ X	0	1
00	0	0
01	0	1
11	X	X
10	1	1

JA = A+XB

K_A-Map

AB \ X	0	1
00	1	1
01	1	0
11	X	X
10	1	1

KA = X'+B'

J_B-Map

AB \ X	0	1
00	0	1
01	1	1
11	X	X
10	0	1

JB = B+X

K_B-Map

AB \ X	0	1
00	1	1
01	1	1
11	X	X
10	1	0

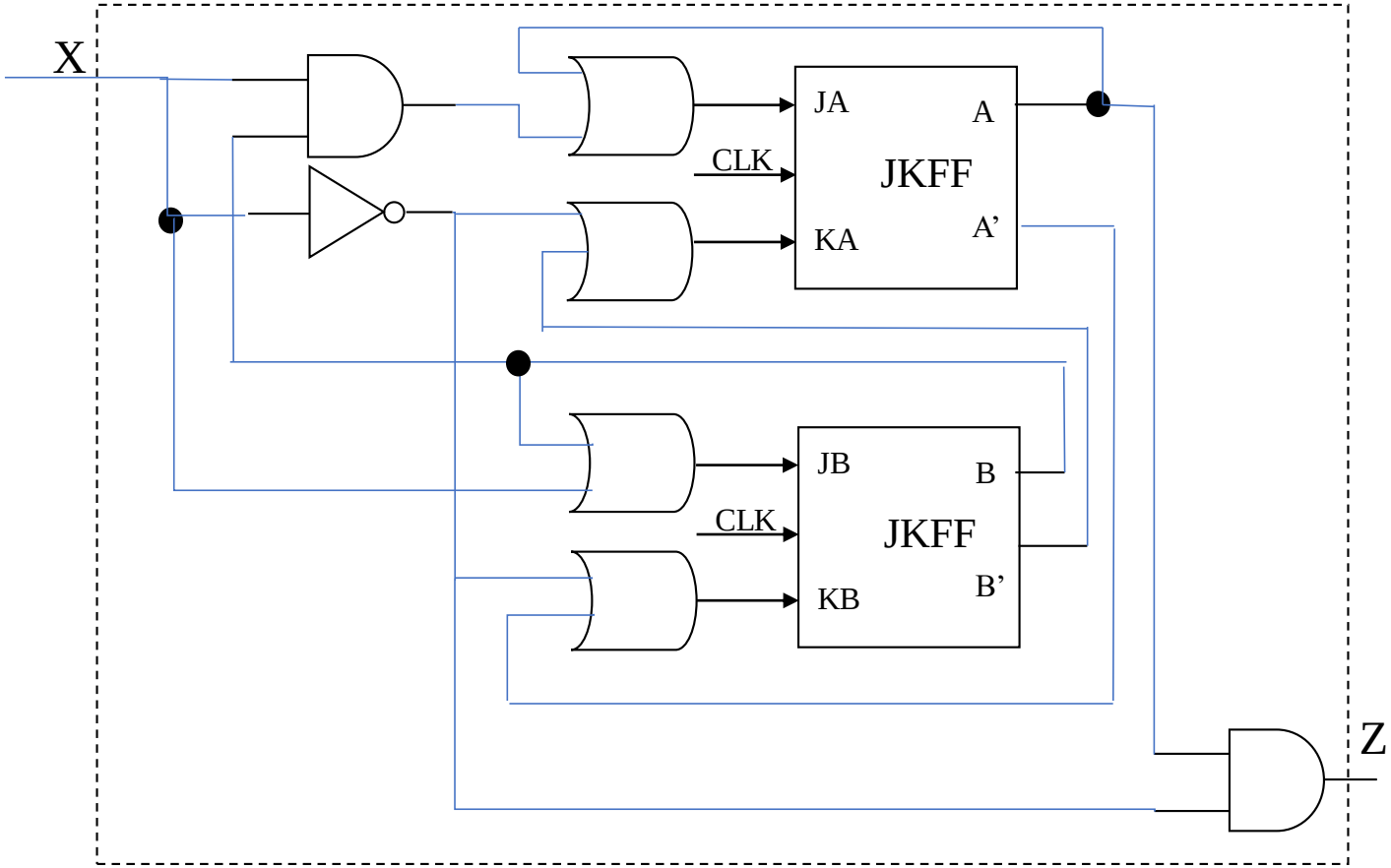
KB = A'+X'

Z-Map

AB \ X	0	1
00	0	0
01	0	0
11	X	X
10	1	0

Z = X'A

Realize the final logic design



Sequence Detector based on the Mealy Machine model