

UNIVERSITY OF VICTORIA

CENG 241

DIGITAL DESIGN I

Lab 6

Finite state machines: Mealy and Moore circuits

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1 Introduction

2 Discussion

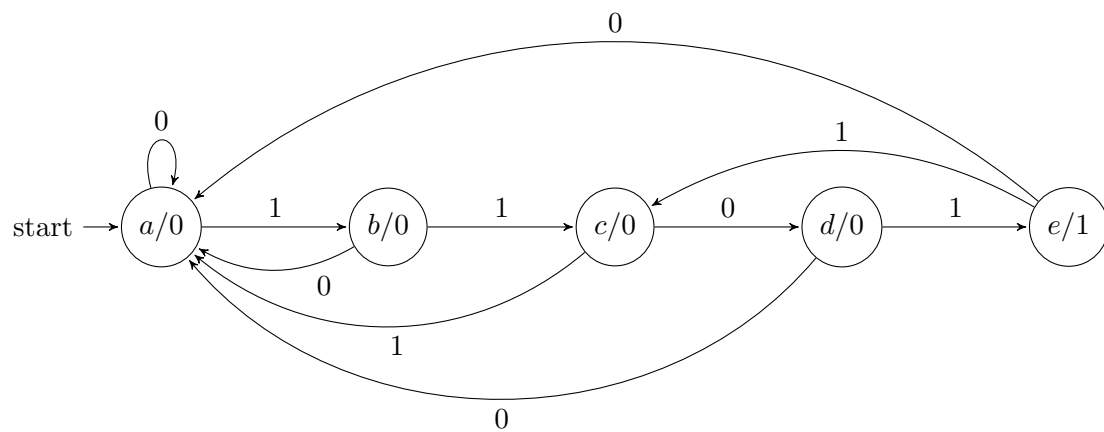
A brief description about what the circuit will do.

Difference between Moore and Mealy?

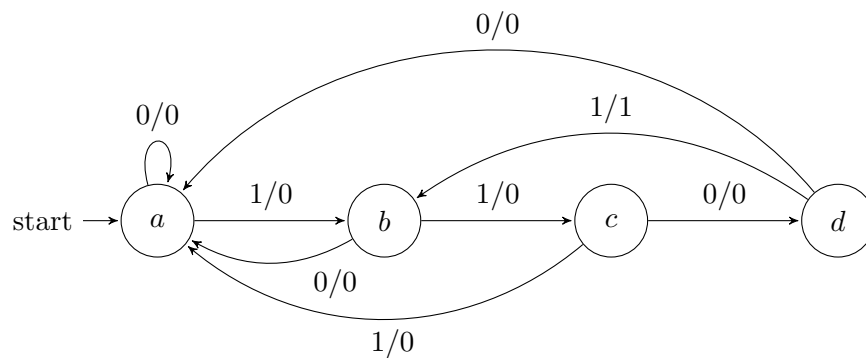
Method for generating circuits? State machine \rightarrow Truth table \rightarrow Kmap \rightarrow Boolean \rightarrow circuits

Input	1001	1011	0100	1101
Output	0000	0010	0100	0001

2.1 State diagrams



(a) Moore machine



(b) Mealy machine

Figure 1: State machines to detect sequence “1101” with overlap

				S_2	S_1	S_0	X	S_2^+	S_1^+	S_0^+				
				0	0	0	0	0	0	0				
				0	0	0	1	0	0	1				
				0	0	1	0	0	0	0				
State	S_2	S_1	S_0	0	0	1	1	0	1	0	S_2	S_1	S_0	Z
a	0	0	0	0	1	0	0	0	1	1	0	0	0	0
b	0	0	1	0	1	0	1	0	0	0	0	0	1	0
c	0	1	0	0	1	1	0	0	0	0	0	1	0	0
d	0	1	1	0	1	1	1	1	0	0	0	1	1	0
e	1	0	0	1	0	0	0	0	0	0	1	0	0	1
-	1	0	1	1	0	0	1	0	1	0	1	0	1	-
-	1	1	0	1	0	1	0	-	-	-	1	1	0	-
-	1	1	1	1	0	1	1	-	-	-	1	1	1	-
(a) State enumeration				1	1	0	0	-	-	-	(c) Output			
				1	1	0	1	-	-	-				
				1	1	1	0	-	-	-				
				1	1	1	1	-	-	-				
				(b) Next state										

Figure 2: Transition tables for the Moore machine

			S_1	S_0	X	S_1^+	S_0^+	S_1	S_0	X	Z
			0	0	0	0	0	0	0	0	0
			0	0	1	0	1	0	0	1	0
State	S_0	S_1	0	1	0	0	0	0	1	0	0
a	0	0	0	1	1	1	0	0	1	1	0
b	0	1	1	0	0	1	1	1	0	0	0
c	1	0	1	0	1	0	0	1	0	1	0
d	1	1	1	1	0	0	0	1	1	0	0
(a) State enumeration			1	1	0	0	0	1	1	0	0
			1	1	1	0	1	1	1	1	1
			(b) Next state				(c) Output				

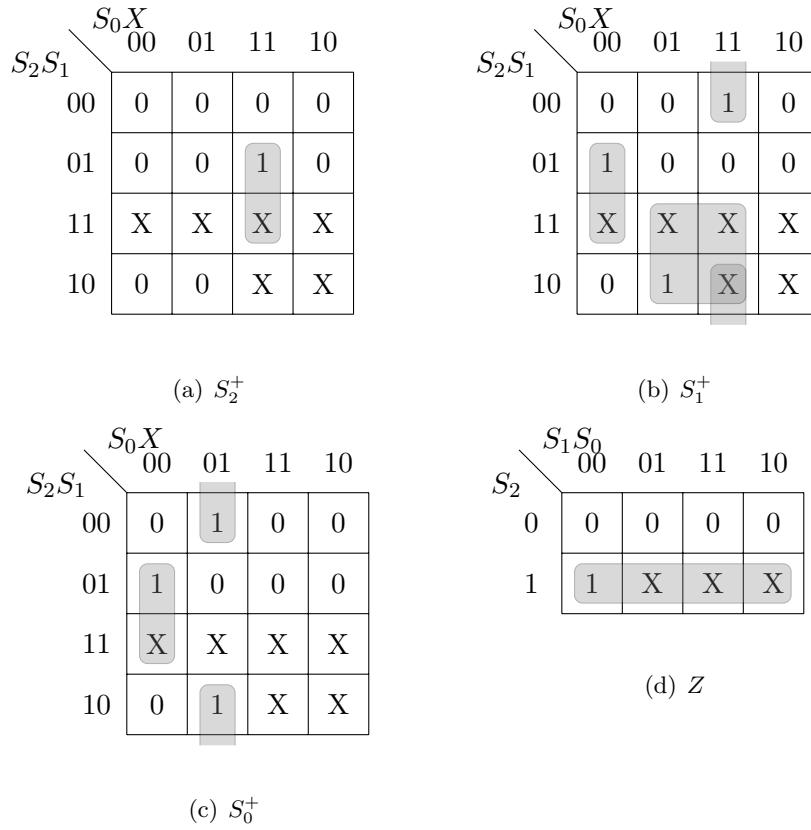


Figure 4: Karnaugh maps for the Moore machine

2.2 Transition tables

2.3 Karnaugh maps

The optimal boolean functions for the Moore machine are

$$\begin{aligned}
 S_2^+ &= S_1S_0X \\
 S_1^+ &= S_1S_0'X' + S_1'S_0X + S_2X \\
 S_0^+ &= S_1S_0'X' + S_1'S_0X \\
 Z &= S_2
 \end{aligned}$$

The optimal boolean functions for the Mealy machine are

$$\begin{aligned}
 S_1^+ &= S_1S_0'X' + S_1'S_0X \\
 S_0^+ &= S_1S_0'X' + S_1'S_0X + S_1S_0X \\
 Z &= S_1S_0X
 \end{aligned}$$

3 Xilinx simulation

Include schematic for Mealy machine and functional output

		S_0X			
		00	01	11	10
S_1	0	0	0	1	0
	1	1	0	0	0

(a) S_1^+

		S_0X			
		00	01	11	10
S_1	0	0	1	0	0
	1	1	0	1	0

(b) S_0^+

		S_0X			
		00	01	11	10
S_1	0	0	0	0	0
	1	0	0	1	0

(c) Z

Figure 5: Karnaugh maps for the Mealy machine

4 Conclusion