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

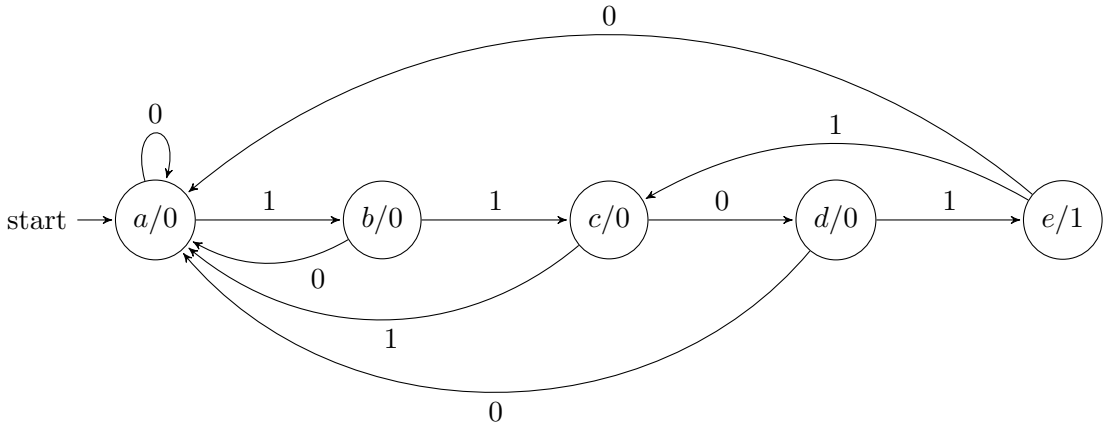
A brief description about what the circuit will do.

Difference between Moore and Mealy?

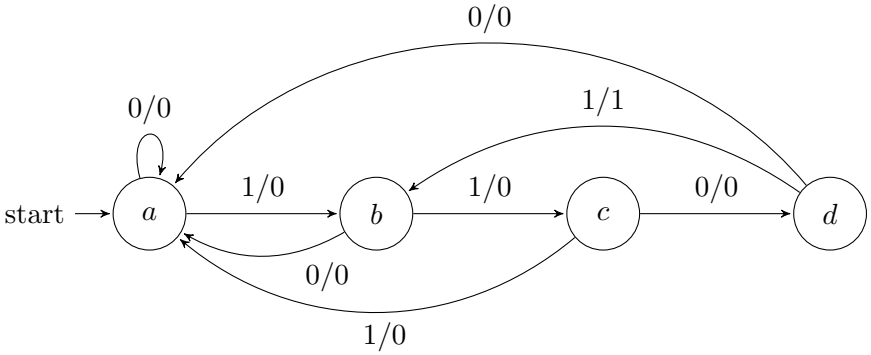
Method for generating circuits? State machine → Truth table → Kmap → Boolean → circuits

Input	1001101101001101
Output	0000001001000001

2.1 State diagrams



(a) Moore machine



(b) Mealy machine

Figure 1: State machines to detect sequence "1101" with overlap

State	S_2	S_1	S_0
a	0	0	0
b	0	0	1
c	0	1	0
d	0	1	1
e	1	0	0
-	1	0	1
-	1	1	0
-	1	1	1

(a) State enumeration

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
0	0	1	1	0	1	0
0	1	0	0	0	1	1
0	1	0	1	0	0	0
0	1	1	0	0	0	0
0	1	1	1	1	0	0
1	0	0	0	0	0	0
1	0	0	1	0	1	0
1	0	1	0	-	-	-
1	0	1	1	-	-	-
1	1	0	0	-	-	-
1	1	0	1	-	-	-
1	1	1	0	-	-	-
1	1	1	1	-	-	-

(b) Next state

S_2	S_1	S_0	Z
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	0
1	0	0	1
1	0	1	-
1	1	0	-
1	1	1	-

(c) Output

Figure 2: Transition tables for the Moore machine

State	S_0	S_1
a	0	0
b	0	1
c	1	0
d	1	1

(a) State enumeration

S_1	S_0	X	S_1^+	S_0^+
0	0	0	0	0
0	0	1	0	1
0	1	0	0	0
0	1	1	1	0
1	0	0	1	1
1	0	1	0	0
1	1	0	0	0
1	1	1	0	1

(b) Next state

S_1	S_0	X	Z
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	0
1	0	0	0
1	0	1	0
1	1	0	0
1	1	1	1

(c) Output

Figure 3: Transition tables for the Mealy machine

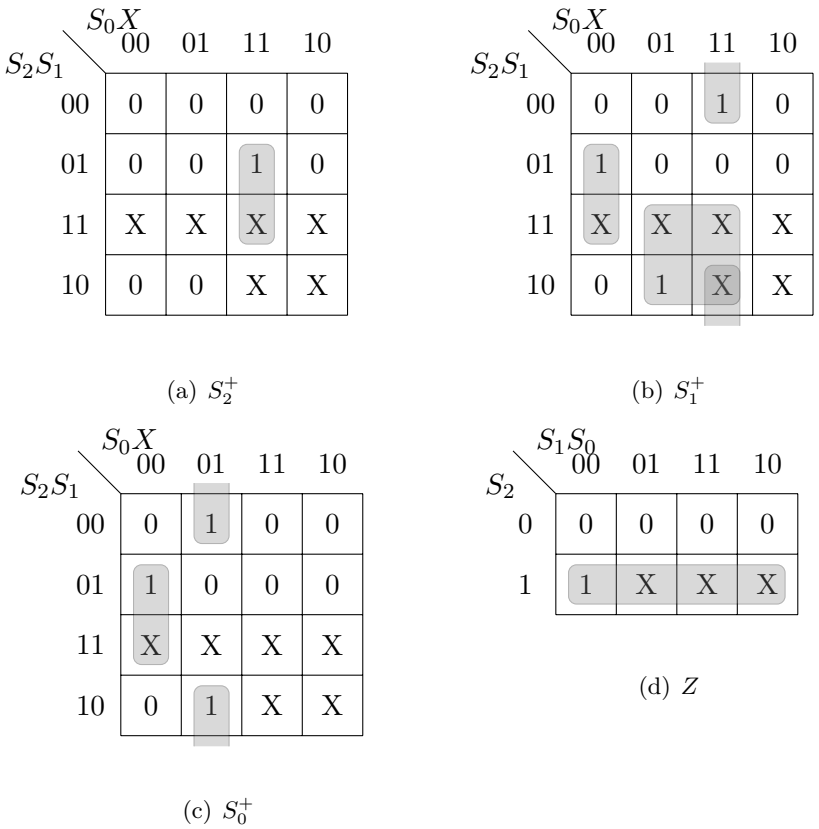


Figure 4: Karnaugh maps for the Moore machine

2.2 Transition tables

2.3 Karnaugh maps

The optimal boolean functions for the Moore machine are

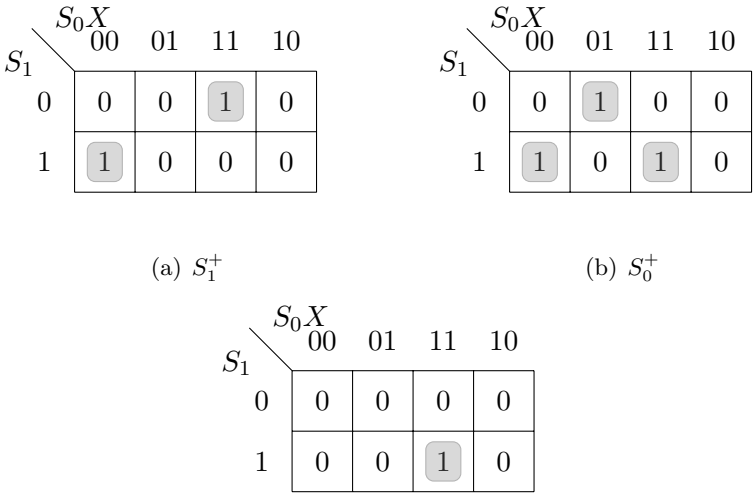
$$\begin{aligned} S_2^+ &= S_1 S_0 X \\ S_1^+ &= S_1 S_0' X' + S_1' S_0 X + S_2 X \\ S_0^+ &= S_1 S_0' X' + S_1' S_0' X \\ Z &= S_2 \end{aligned}$$

The optimal boolean functions for the Mealy machine are

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

3 Xilinx simulation

Include schematic for Mealy machine and functional output



(a) S_1^+

(b) S_0^+

(c) Z

Figure 5: Karnaugh maps for the Mealy machine

4 Conclusion