CSC258 Lab6 Pre-Lab Report

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Part I

1. ① The Reset signal is asynchronous

② It is active high signal.

③ The output after the Reset should be our first state.

After the Reset, z should equal to 1 as we input sequence 1111 or 1101.

2.

① assign flip-flop values to each state.

state	flip-flop value		
A/0	0	0	0
B/0	0	0	1
C/0	0	1	1
D/0	0	1	0
E/0	1	0	0
F/1	1	1	0
G/1	1	0	1

② create a state table.

	Present state					Next state			
	F_2	F_1	F_0	W	Z	F_2	F_1	F_0	
A	0	0	0	0	0	0	0	0	A
A	0	0	0	1	0	0	0	1	B
B	0	0	1	0	0	0	0	0	A
B	0	0	1	1	0	0	1	1	C
C	0	1	1	0	0	1	0	0	E
C	0	1	1	1	0	0	1	0	D
D	0	1	0	0	0	1	0	0	E
D	0	1	0	1	0	1	1	0	F
E	1	0	0	0	0	0	0	0	A
E	1	0	0	1	0	1	0	1	G
F	1	1	0	0	1	1	0	0	E
F	1	1	0	1	1	1	1	0	F
G	1	0	1	0	1	0	0	0	A
G	1	0	1	1	1	0	1	1	C

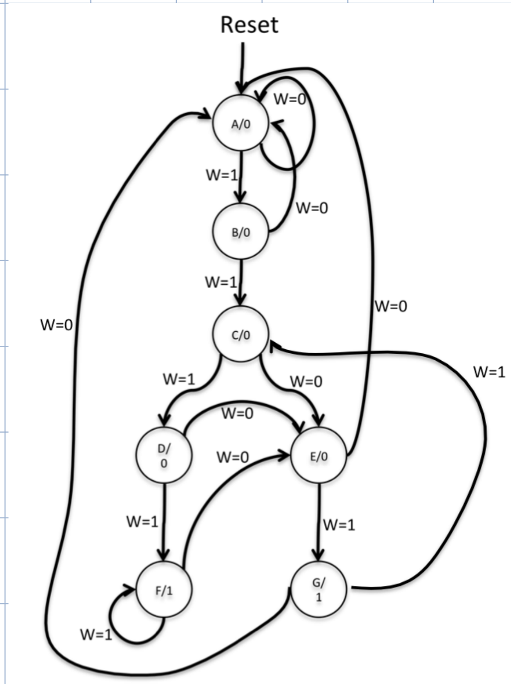


Figure 2: A state diagram for the FSM.

3 Karnaugh map for F_2

	$\overline{F_0}\cdot\overline{w}$	$\overline{F_0}\cdot w$	$F_0\cdot w$	$F_0\cdot\overline{w}$
$\overline{F_2}\cdot\overline{F_1}$	0	0	0	0
$\overline{F_2}\cdot F_1$	1	1	0	1
$F_2\cdot F_1$	1	1	×	×
$F_2\cdot\overline{F_1}$	0	1	0	0

$$F_2 = F_1\cdot\overline{F_0} + F_1\cdot\overline{w} + F_2\cdot\overline{F_0}\cdot w$$

Karnaugh map for F_1

	$\overline{F_0}\cdot\overline{w}$	$\overline{F_0}\cdot w$	$F_0\cdot w$	$F_0\cdot\overline{w}$
$\overline{F_2}\cdot\overline{F_1}$	0	0	1	0
$\overline{F_2}\cdot F_1$	0	1	1	0
$F_2\cdot F_1$	0	1	×	×
$F_2\cdot\overline{F_1}$	0	0	1	0

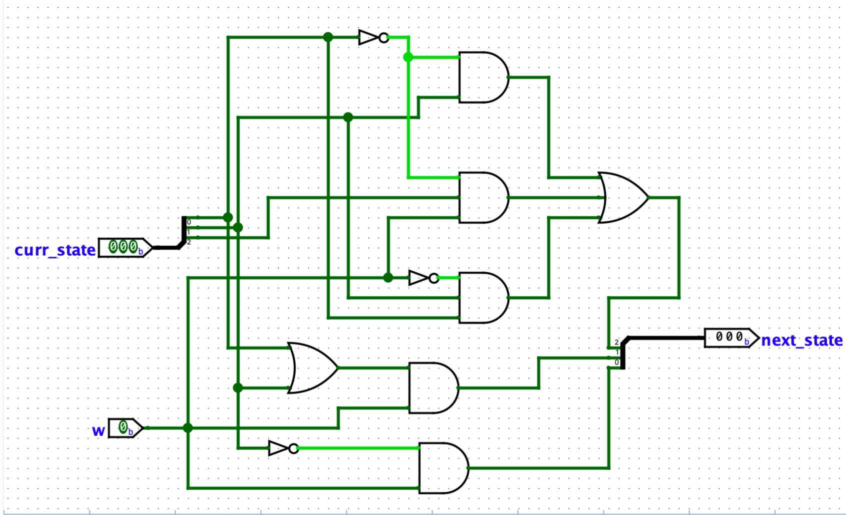
$$F_1 = F_0\cdot w + F_1\cdot w$$

Karnaugh map for F_0

	$\overline{F_0}\cdot\overline{w}$	$\overline{F_0}\cdot w$	$F_0\cdot w$	$F_0\cdot\overline{w}$
$\overline{F_2}\cdot\overline{F_1}$	0	1	1	0
$\overline{F_2}\cdot F_1$	0	0	0	0
$F_2\cdot F_1$	0	0	×	×
$F_2\cdot\overline{F_1}$	0	1	1	0

$$F_0 = \overline{F_1}\cdot w$$

3. part1_state_table implement and test vector results.



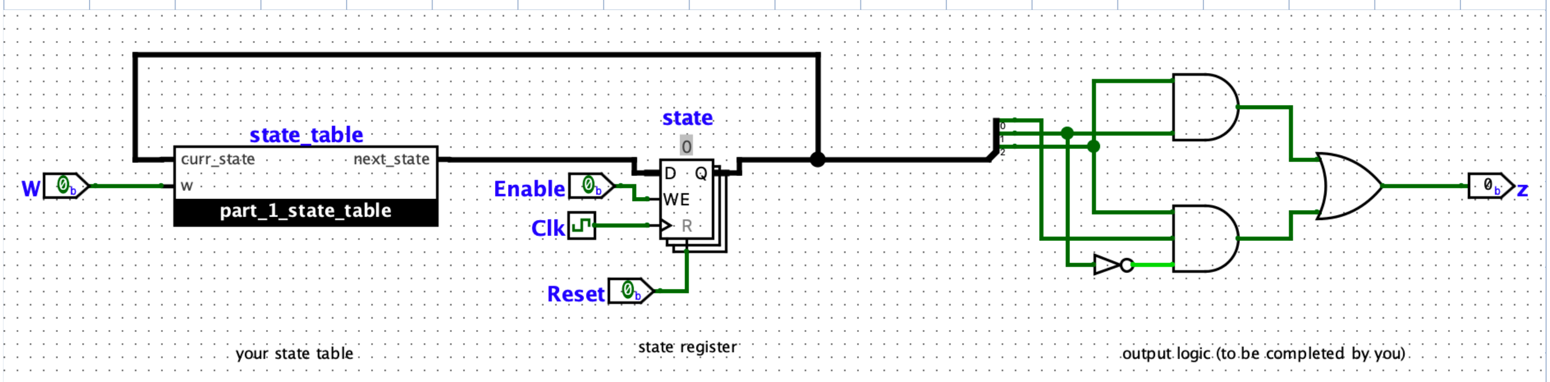
Test Vector part_1_state_table of lab6_starter

Passed: 14 Failed: 0

Status	curr_state	w	next_state
pass	000	0	000
pass	000	1	001
pass	001	0	000
pass	001	1	011
pass	011	0	100
pass	011	1	010
pass	010	0	100
pass	010	1	110
pass	100	0	000
pass	100	1	101
pass	110	0	100
pass	110	1	110
pass	101	0	000
pass	101	1	011

Load Vector | Run | Stop | Reset | Close Window

4. part1_FSM implement.



5. Test route like this:

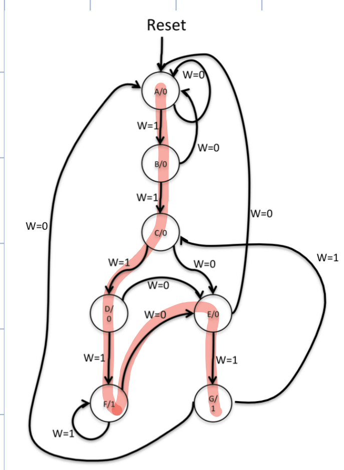
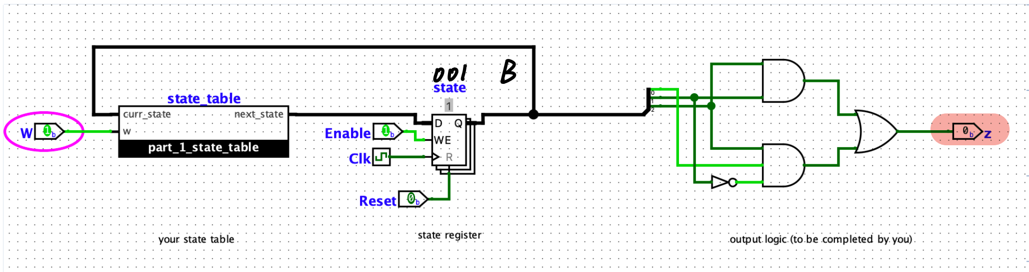
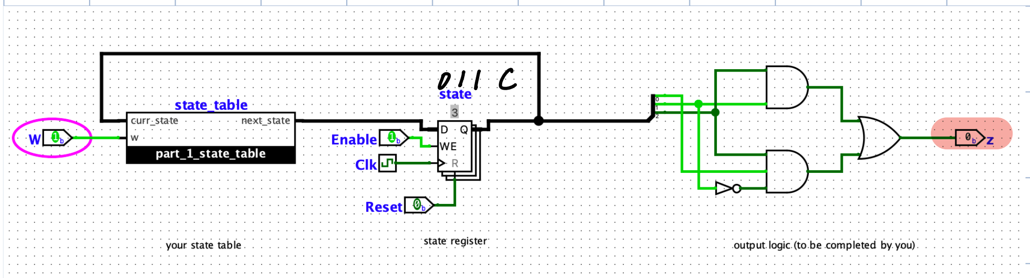


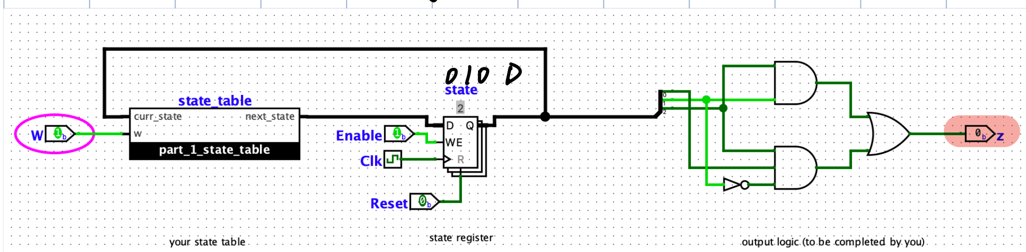
Figure 2: A state diagram for the FSM.



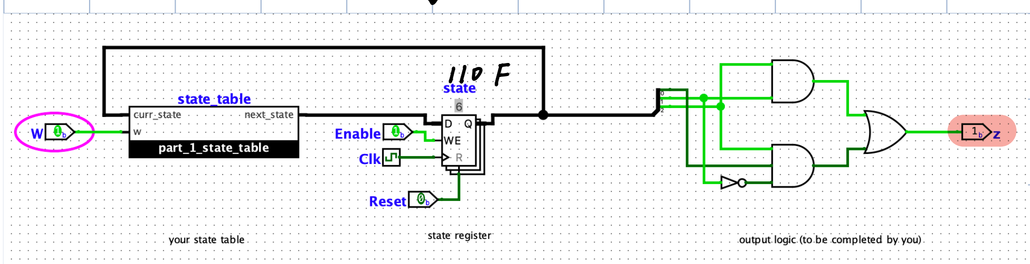
↓ $w=1$



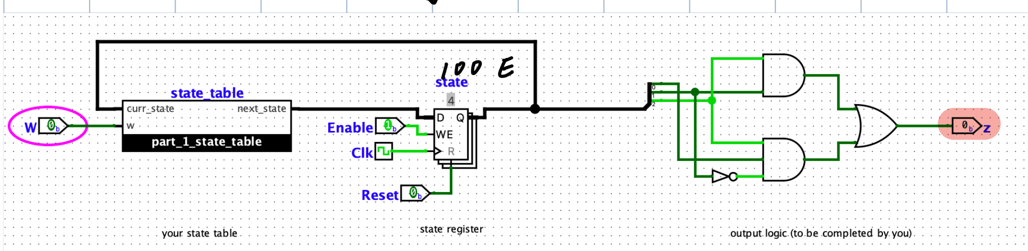
↓ $w=1$



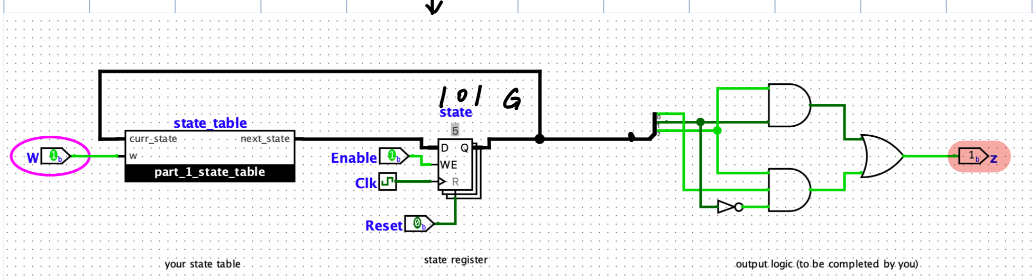
↓ $w=1$



↓ $w=0$



↓ $w=1$



A/0

↓ $w=1$

B/0 ✓

↓ $w=1$

C/0 ✓

↓ $w=1$

D/0 ✓

↓ $w=1$

F/1 ✓

↓ $w=0$

E/0 ✓

↓ $w=1$

G/1 ✓

Part II

2. $Cx^2 + Bx + A$

	alu_op	alu_select_a	alu_select_b	ld_alu_out
① $R_B \times R_x$ and store in R_B Bx ld_b = 1	1	11	01	1
② $R_B + R_A$ and store in R_A $Bx + A$ ld_a = 1	0	00	01	1
③ $R_x \times R_x$ and store in R_B x^2 ld_b = 1	1	11	11	1
④ $R_C \times R_B$ and store in R_B Cx^2 ld_b = 1	1	10	01	1
⑤ $R_B + R_A$ and get the output $Cx^2 + Bx + A$ ld_r = 1	0	00	01	1

3. Draw a state diagram for the controller.

Reset

↓

0000 load A

↓

0001 load B

↓

0010 load C

↓

0011 load x

↓

0100 Compute $R_B \times R_x$; store in R_B

Bx

↓

0101 Compute $R_B + R_A$; store in R_A

$Bx + A$

↓

0110 Compute $R_x \times R_x$; store in R_B

x^2

↓

0111 Compute $R_C \times R_B$; store in R_B

Cx^2

↓

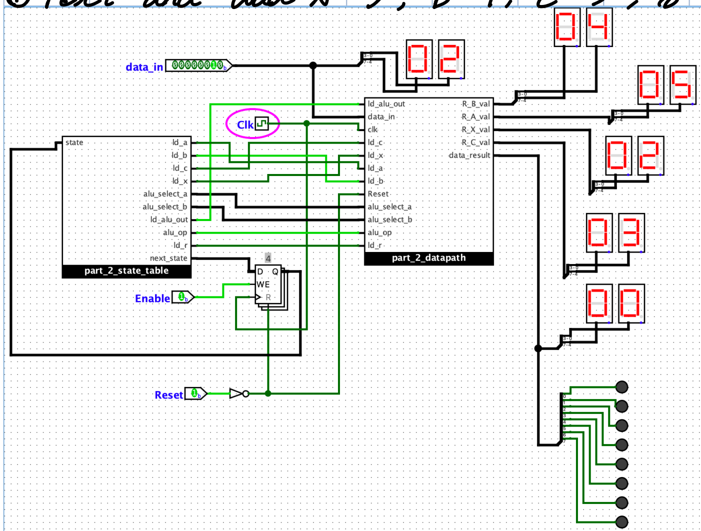
1000 Compute $R_B + R_A$; output

$Cx^2 + Bx + A$

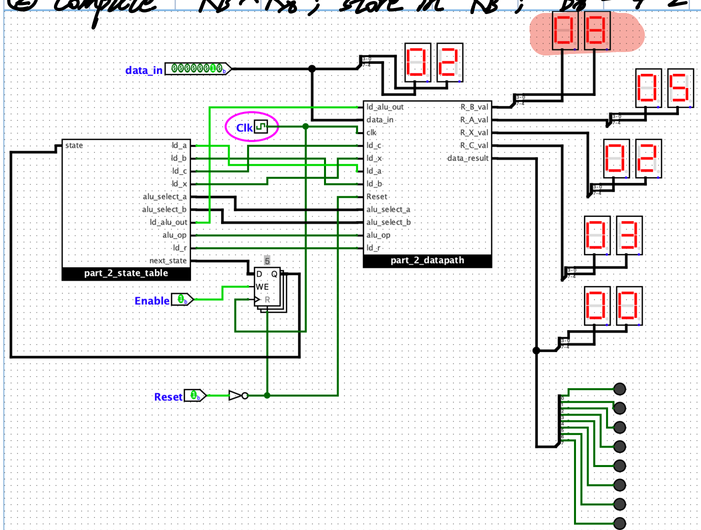
5. Test Case: $A = 5$, $B = 4$, $C = 3$, $x = 2$

Result should be: $Cx^2 + Bx + A = 3\cdot 2^2 + 4\cdot 2 + 5 = 25 = (11001)_2$

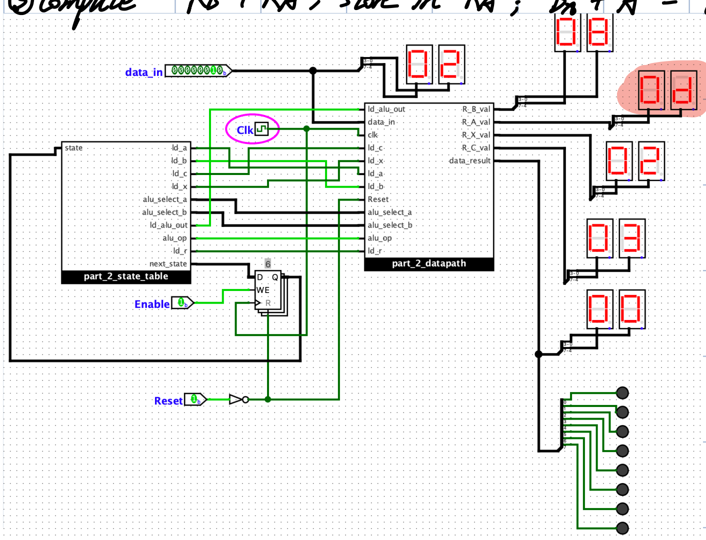
① Reset and load $A = 5$, $B = 4$, $C = 3$, $x = 2$ successively



② Compute $R_B \times R_x$; store in R_B; $Bx = 4\cdot 2 = 8$



③ Compute $R_B + R_A$; store in R_A; $Bx + A = 8 + 5 = 13$

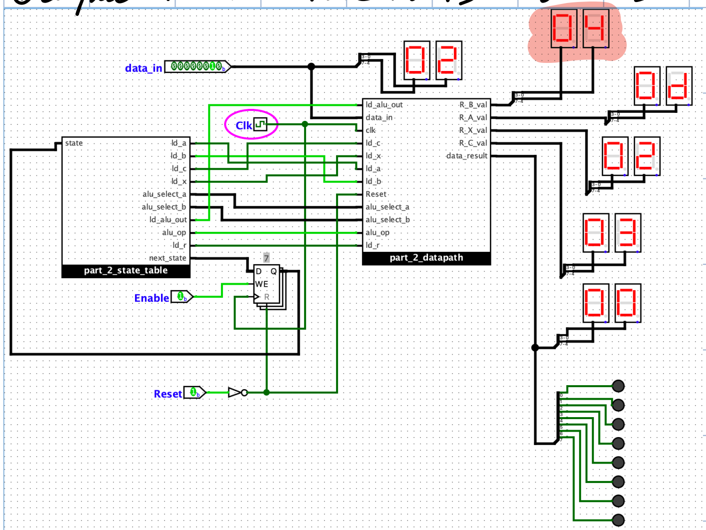


$= 13$

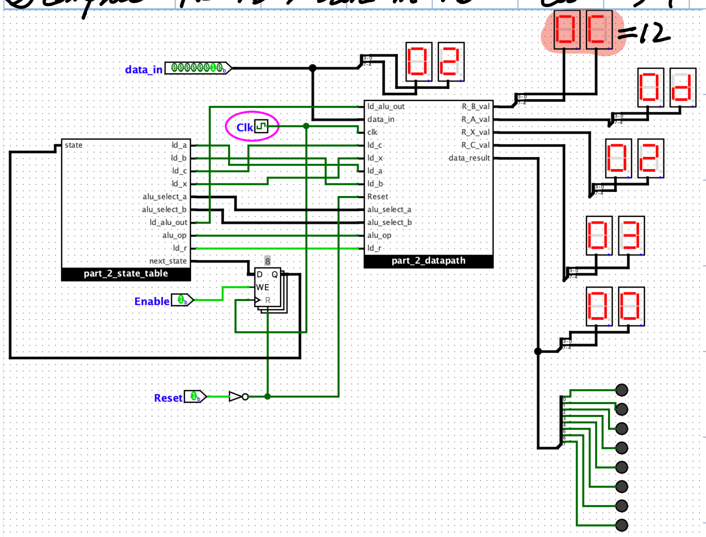
$c_3c_2c_1c_0$	Character
0000	0
0001	1
0010	2
0011	3
0100	4
0101	5
0110	6
0111	7
1000	8
1001	9
1010	A 10
1011	b 11
1100	C 12
1101	d 13
1110	E 14
1111	F 15

Table 2: Desired behaviour of HEX decoder

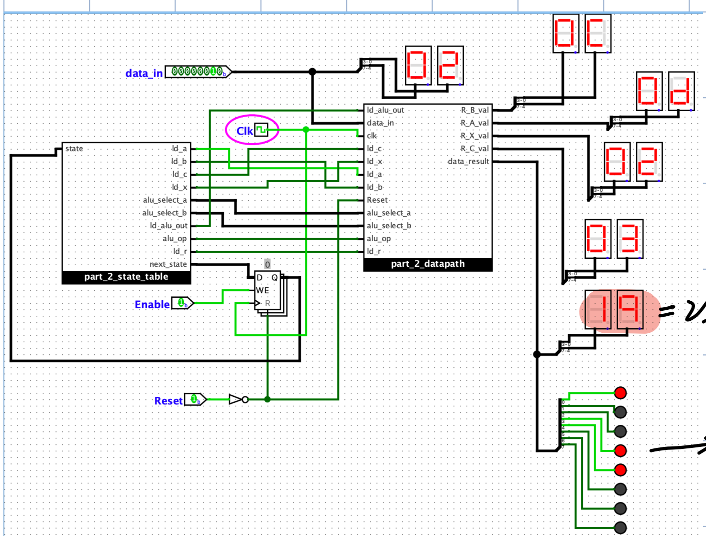
④ Compute $R_X \times R_X$; store in R_B $\quad x^2 = 2^2 = 4$



⑤ Compute $R_C \times R_B$; store in R_B $\quad Cx^2 = 3 \cdot 4 = 12$



⑥ Compute $R_B + R_A$; $\quad$ output $\quad Cx^2 + Bx + A = 12 + 13 = 25$



$= 25$

$\rightarrow (11001)_2 = 25$