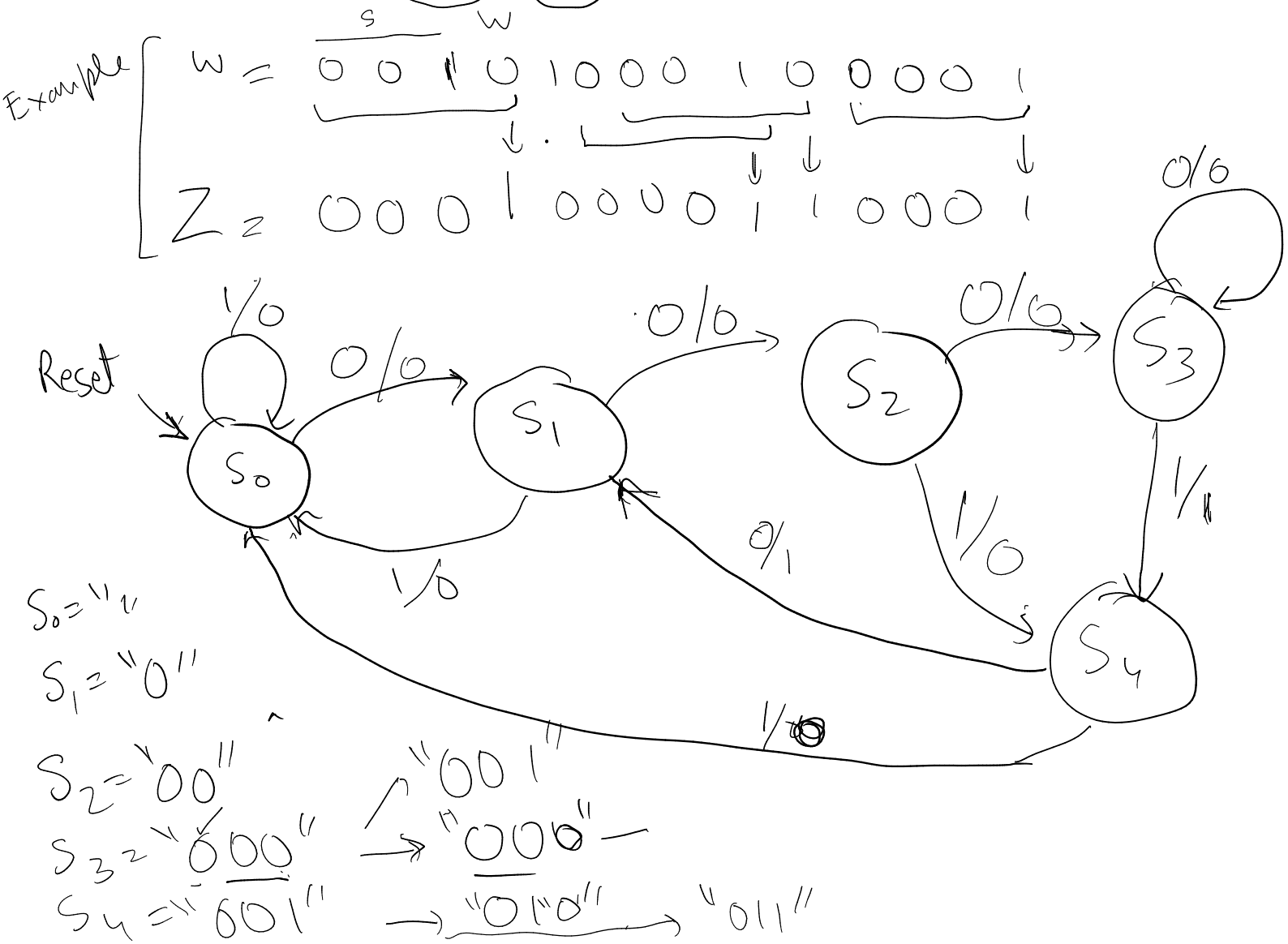
Mealy

W | State 3

Detect sequences of 0010 or 0001. Overlapping patterns are allowed.



$S_0 = "1"$

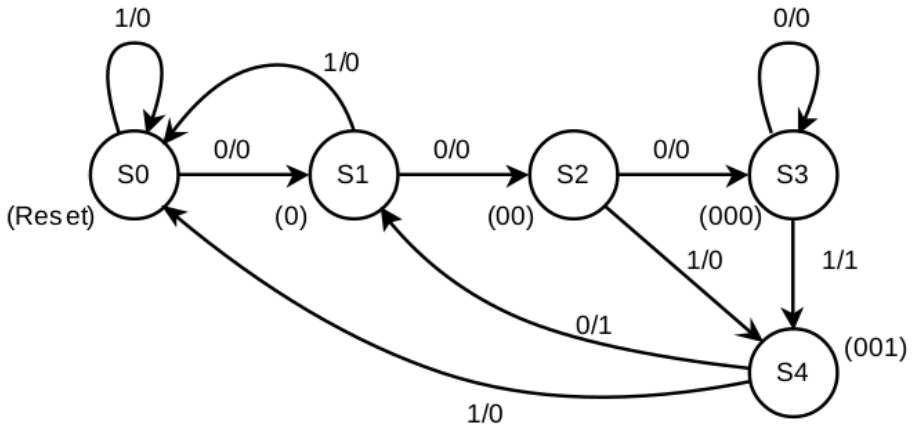
$S_1 = "0"$

$S_2 = "00"$

$S_3 = "000"$ → "0001" → "0010"

$S_4 = "001"$ → "0010" → "0011"

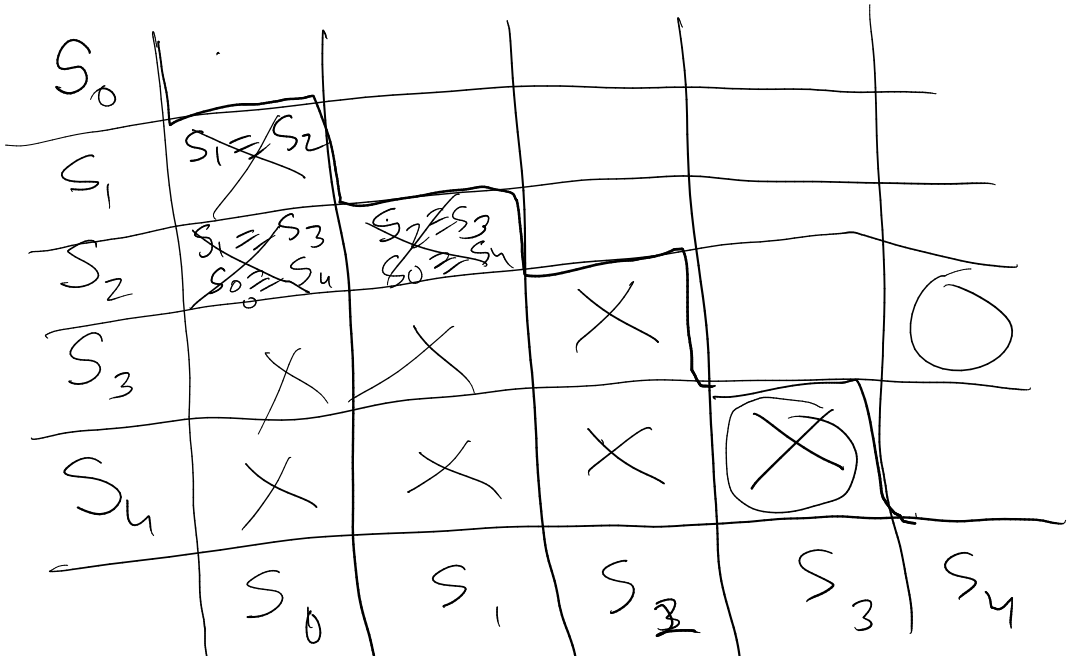
Mealy state diagram



Seq	PS	NS		Output (Z)	
		w=0	w=1	w=0	w=1
"1"	S_0	S_1	S_0	0	0
"0"	S_1	S_2	S_0	0	0
"00"	S_2	S_3	S_4	0	0
"000"	S_3	S_3	S_4	0	1
"001"	S_4	S_1	S_0	1	0

Seq	PS	NS		Output	
		W=0	W=1	W=0	W=1
()	S0	S1	S0	0	0
"0"	S1	S2	S0	0	0
"00"	S2	S3	S4	0	0
"000"	S3	S3	S4	0	1
"001"	S4	S1	S0	1	0

State reduction



Seq	PS	NS		Output	
		W=0	W=1	W=0	W=1
()	S0	S1	S0	0	0
"0"	S1	S2	S0	0	0
"00"	S2	S3	S4	0	0
"000"	S3	S3	S4	0	1
"001"	S4	S1	S0	1	0

State assignment

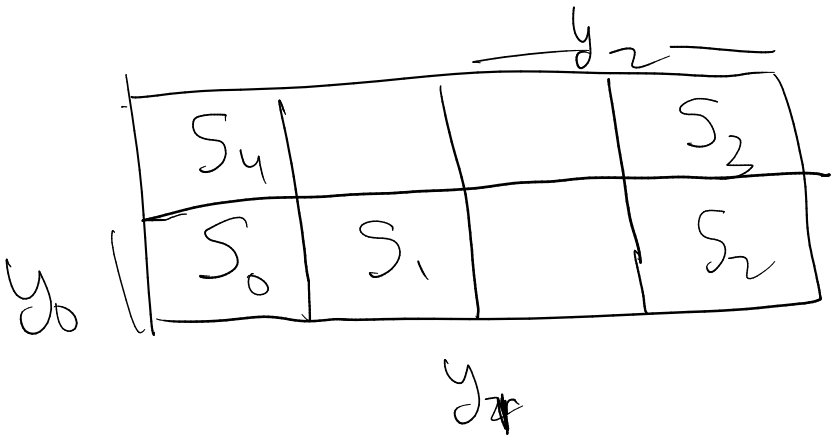
G1: In-neighbors: $(S0, S1, S4), (S0, S4)\ (S2, S3)^{x2}$

common next state

G2: Out-neighbors: $(S1, S0)^{x2}, (S2, S0), (S3, S4)^{x2}$

common prev state

State assignment $4 < \#\text{states} = 5 \leq 8$ 3 ff



	$y_2 y_1 y_0$
S_0	0 0 1
S_1	0 1 1
S_2	1 0 1
S_3	1 0 0
S_4	0 0 0

Seq	PS	NS		Output	
		W=0	W=1	W=0	W=1
0	S0	S1	S0	0	0
"0"	S1	S2	S0	0	0
"00"	S2	S3	S4	0	0
"000"	S3	S3	S4	0	1
"001"	S4	S1	S0	1	0

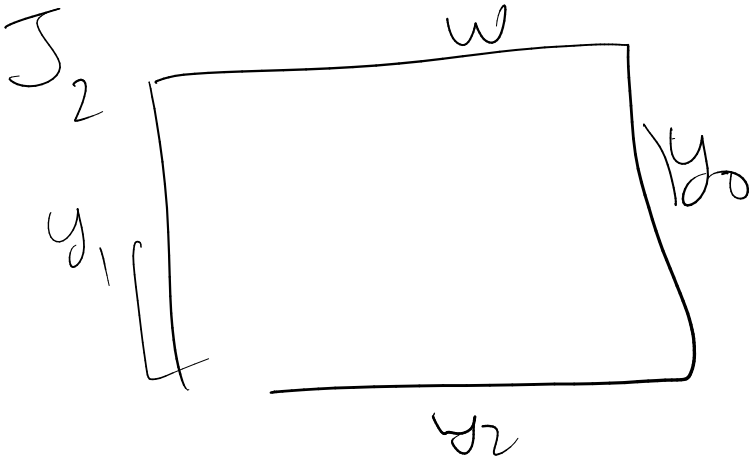
PS	NS $Y_2^+ Y_1^+ Y_0^+$		JK-Input
	w=0	w=1	w=0
$y_2 y_1 y_0$	$Y_2 Y_1 Y_0$	$Y_2 Y_1 Y_0$	$J_2 K_2 \; J_1 K_1 \; J_0 K_0$
0 0 1	0 1 1	0 0 1	0 d 1 d d 0
0 1 1	1 0 1	0 0 1	
1 0 1	1 0 0	0 0 0	
1 0 0	1 0 0	0 0 0	
1 0 0 0	0 1 1	0 0 1	

Excitation table

$Q \to Q^+$	J K
0 0	0 d
0 1	1 d
1 0	d 1
1 1	d 0

excitation table
hold 00
reset 01

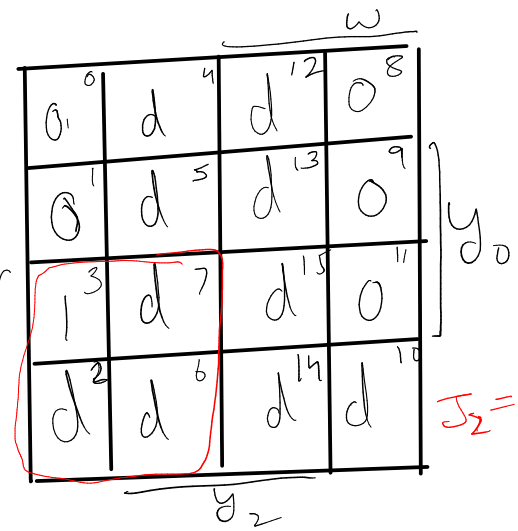
JK-ff



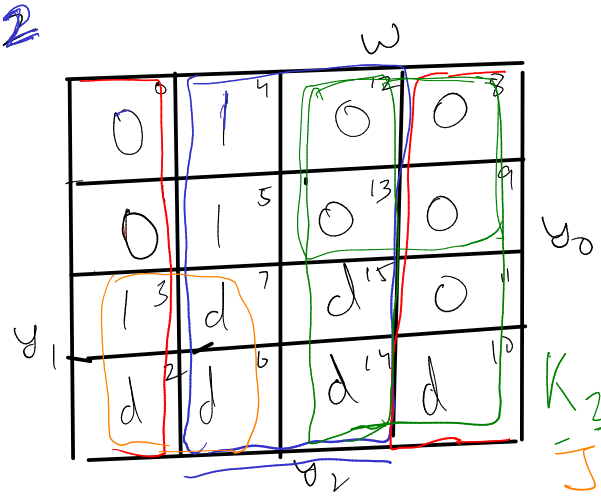
	PS	NS $Y_2^+ Y_1^+ Y_0^+$		JK-Inputs					
		w=0	w=1	w=0			w=1		
	$y_2 y_1 y_0$	$Y_2 Y_1 Y_0$	$Y_2 Y_1 Y_0$	$J_2 K_2$	$J_1 K_1$	$J_0 K_0$	$J_2 K_2$	$J_1 K_1$	$J_0 K_0$
0	0 0 1	0 1 1	0 0 1	0 d	1 d	d 0	0 d	0 d	d 0
3	0 1 1	1 0 1	0 0 1	1 d	d 1	d 0	0 d	d 1	d 0
5	1 0 1	1 0 0	0 0 0	d 0	0 d	d 1	d 1	0 d	d 1
4	1 0 0	1 0 0	0 0 0	d 0	0 d	0 d	d 1	0 d	0 d
0	0 0 0	0 1 1	0 0 1	0 d	1 d	1 d	0 d	0 d	1 d

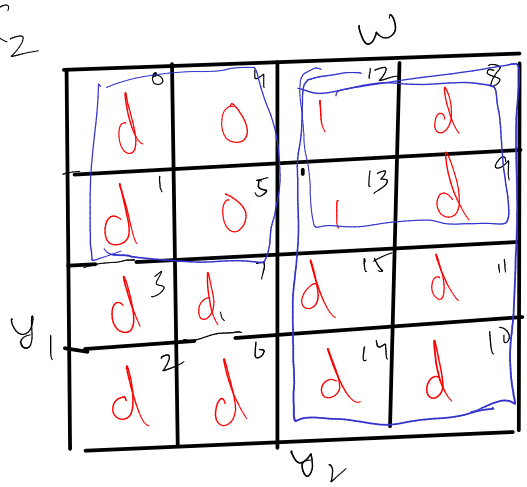
$Q \to Q^+$	J	K
0 0	0	d
0 1	1	d
1 0	d	1
1 1	d	0

J_2



K_2





$y_2 \to Y_2$	J_2	K_2
1 → 1	d	0
1 → 0	d	1
0 → 1	1	d
0 → 0	0	d

	PS	NS								
					$w=0$			$w=1$		
	y_2	y_1	y_0	Y_2	Y_1	Y_0	Y_2	Y_1	Y_0	y_2 y_1 y_0
1+8	0	0	1	0	1	1	0	0	1	
3+8	0	1	1	1	0	1	0	0	1	
5+8	1	0	1	1	0	0	0	0	0	
4+8	1	0	0	1	0	0	0	0	0	
0+8	1	0	0	0	1	1	0	0	1	

Y_1

		w		
	1 ^{0}	0 ^{4}	0 ^{12}	0 ^{8}
	1 ^{1}	0 ^{5}	0 ^{13}	0 ^{9}
y_1	0 ^{3}	d ^{7}	d ^{15}	0 ^{11}
	d ^{2}	d ^{6}	d ^{14}	d ^{10}
		y_2		

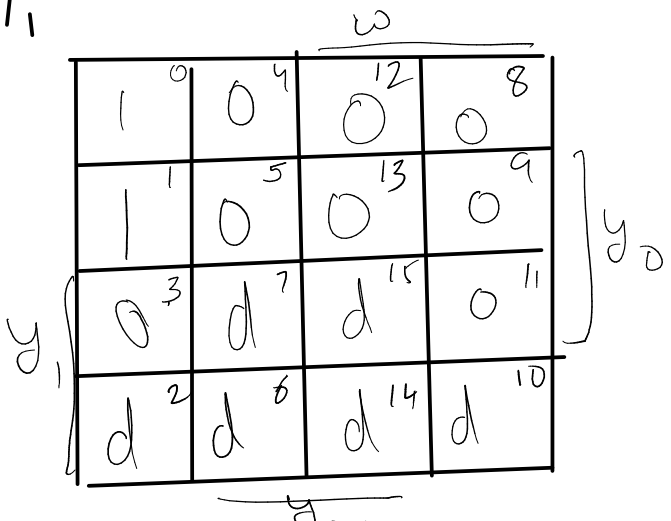
y_0

Y_2

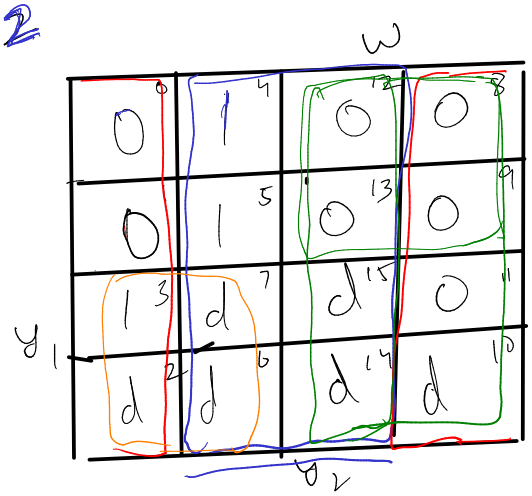
		w		
	0 ^{0}	1 ^{4}	0 ^{12}	0 ^{8}
	0	1 ^{5}	0 ^{13}	0 ^{9}
y_1	1 ^{3}	d ^{7}	d ^{15}	0 ^{11}
	d ^{2}	d ^{6}	d ^{14}	d ^{10}
		y_2		

y_0

$K_2 = w$



$J_2 = \bar{w} y_1$



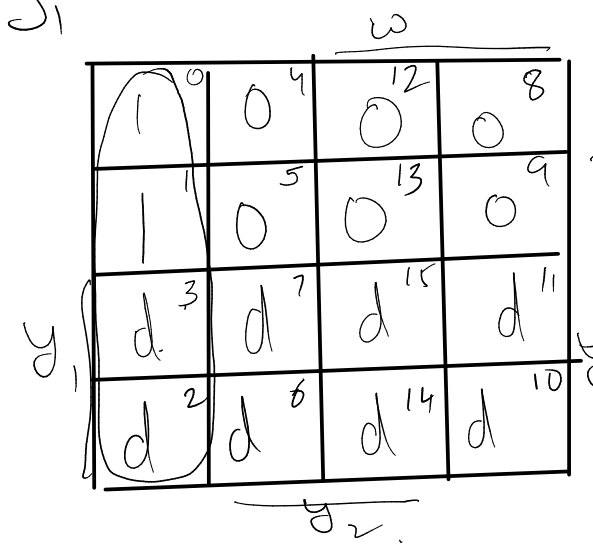
J_1

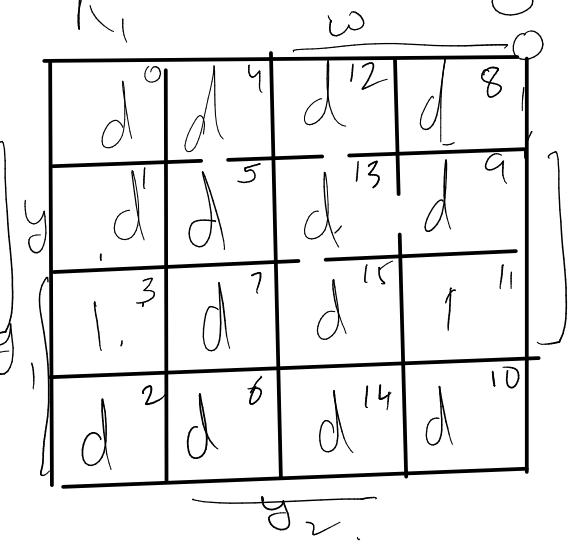
		w		
	1 ^{0}	0 ^{4}	0 ^{12}	0 ^{8}
	1 ^{1}	0 ^{5}	0 ^{13}	0 ^{9}
y_1	d ^{3}	d ^{7}	d ^{15}	d ^{11}
	d ^{2}	d ^{6}	d ^{14}	d ^{10}
		y_2		

y

K_1

		w		
	d ^{0}	d ^{4}	d ^{12}	d ^{8}
	d ^{1}	d ^{5}	d ^{13}	d ^{9}
y_1	1 ^{3}	d ^{7}	d ^{15}	1 ^{11}
	d ^{2}	d ^{6}	d ^{14}	d ^{10}
		y_2		





y

Q	Q^+	J	K
0	0	0	d
0	1	1	d
1	0	d	1
1	1	d	0

$K_1 = 1$

$J_1 = \bar{w}\,\bar{y}_2$

	PS	NS						
		$w=0$			$w=1$			
	$y_2\ y_1\ y_0$	Y_2	Y_1	Y_0	Y_2	Y_1	Y_0	y_0
1+8	0 0 1	0	1	1	0	0	1	
3+8	0 1 1	1	0	1	0	0	1	
5+8	1 0 1	1	0	0	0	0	0	
4+8	1 0 0	1	0	0	0	0	0	
0+8	1 0 0 0	0	1	1	0	0	1	

Y_0

	0	4	12	8
	1	0	0	1
	1	0	0	1
	1	d	d	1
	d	d	d	d

y_1, y_2, y_0

J_0

	0	4	12	8
	1	0	0	1
	d	d	d	d
	d	d	d	d
	d	d	d	d

y_1, y_2, y_0

K_0

	0	4	12	8
	d	d	d	d
	0	1	1	0
	0	d	d	0
	d	d	d	d

y_1, y_2, y_0

y_0	Y_0	J_0	K_0
0	0	0	d
0	1	1	d
1	0	d	1
1	1	d	0

$J_0 = \bar{y}_2$

$K_0 = y_2$

$J_2 = \bar{w} \cdot y_1$

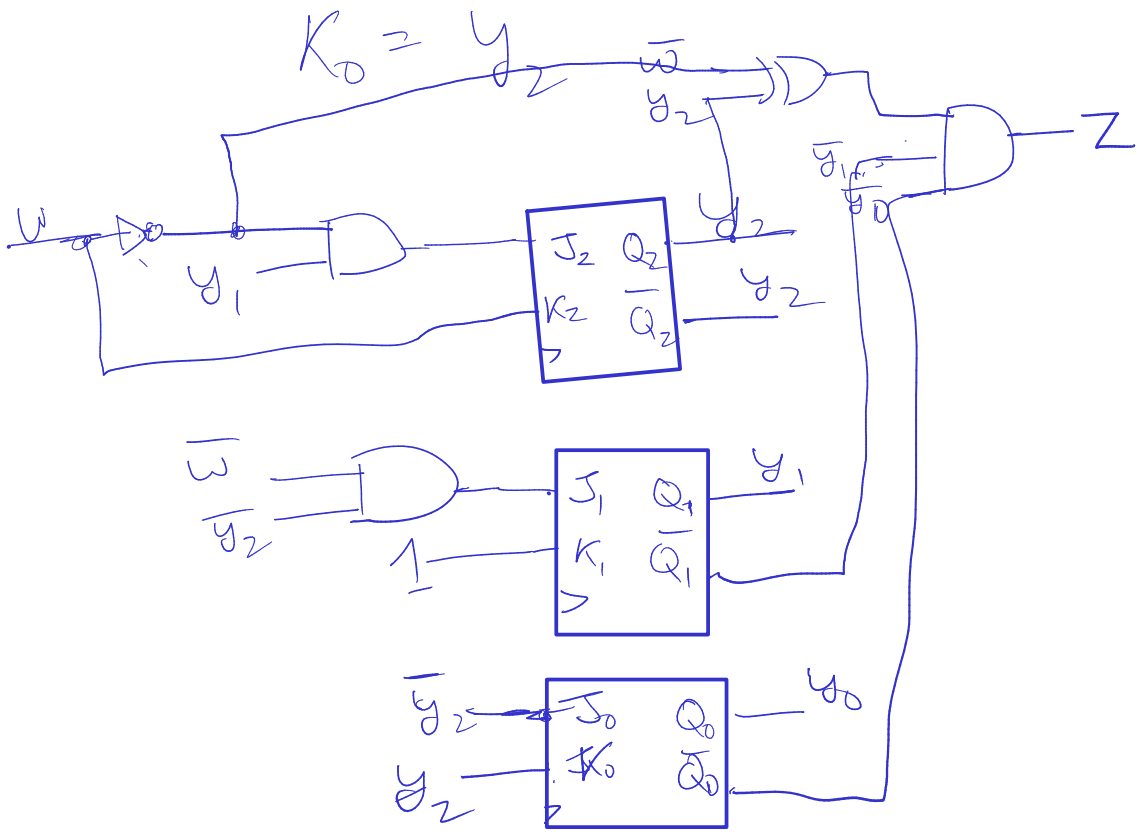
$K_2 = w$

$J_1 = \bar{w}\,\bar{y}_2$

$K_1 = 1$

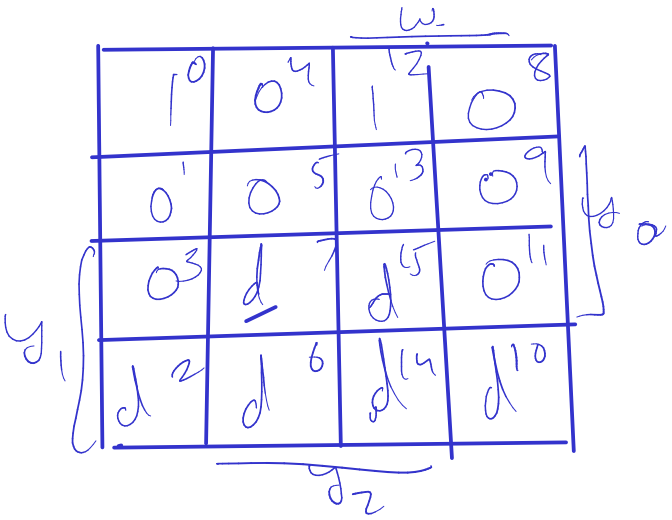
$J_0 = \bar{y}_2$

$K_0 = y_2$



	PS	NS $Y_2^+ Y_1^+ Y_0^+$		Outputs (z)	
		$w=0$	$w=1$	$w=0$	$w=0$
	$y_2 y_1 y_0$	$Y_2 Y_1 Y_0$	$Y_2 Y_1 Y_0$		
1 9	0 0 1	0 1 1	0 0 1	0	0
3 11	0 1 1	1 0 1	0 0 1	0	0
5 13	1 0 1	1 0 0	0 0 0	0	0
4 12	1 0 0	1 0 0	0 0 0	0	1
0 8	0 0 0	0 1 1	0 0 1	1	0

z



$$z = \bar{w}\,\bar{y}_2\,\bar{y}_1\,\bar{y}_0 + w\,y_2\,\bar{y}_1\,\bar{y}_0$$

$$= (\bar{w}\,y_2 + w\,y_2)\,\bar{y}_1\,\bar{y}_0$$

$$= (\bar{w} \oplus y_2)\,\bar{y}_1\,\bar{y}_0$$

G1: in-neighbors: (S0, S1, S4), (S0, S4), (S2, S3), (S2, S3)

G2: out-neighbors: (S1, S0), (S2, S0), (S3, S4), (S1, S0)