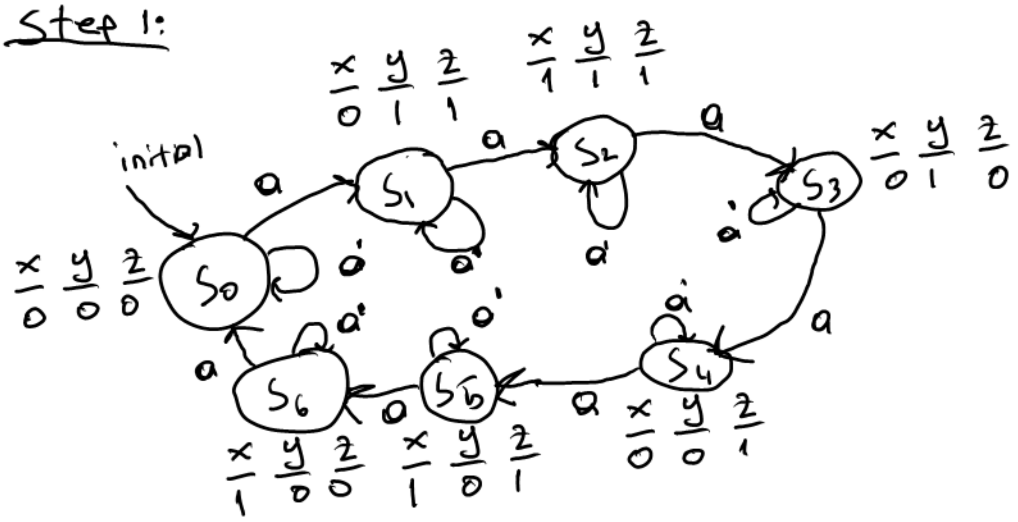
Step 1:



Step 2:

7 states: S_0 to S_6

Input: a

Output: x, y, z

output of combinational circ. input of register

vice versa

3 bit register (input: $n_2 n_1 n_0$, output: $S_2 S_1 S_0$)

Step 3: Encode states

	S_2	S_1	S_0
S_0(000) =	0	0	0
S_1(011) =	0	0	1
S_2(111) =	0	1	0
S_3(010) =	0	1	1
S_4(001) =	1	0	0
S_5(101) =	1	0	1
S_6(100) =	1	1	0

Step 4: Generate state table

	INPUT				OUTPUT					
	S_2	S_1	S_0	a	x	y	z	n_2	n_1	n_0
$State_0$	0	0	0	0	0	0	0	0	0	0
	0	0	0	1	0	0	0	0	0	1
$State_1$	0	0	1	0	0	1	1	0	0	1
	0	0	1	1	0	1	1	0	1	0
$State_2$	0	1	0	0	1	1	1	0	1	0
	0	1	0	1	1	1	1	0	1	1
$State_3$	0	1	1	0	0	1	0	0	1	1
	0	1	1	1	0	1	0	1	0	0
$State_4$	1	0	0	0	0	0	1	1	0	0
	1	0	0	1	0	0	1	1	0	1
$State_5$	1	0	1	0	1	0	1	1	0	1
	1	0	1	1	1	0	1	1	1	0
$State_6$	1	1	0	0	1	0	0	1	1	0
	1	1	0	1	1	0	0	0	0	0
Empty	1	1	1	0	x	x	x	x	x	x
	1	1	1	1	x	x	x	x	x	x

Step 5:

Karnaugh maps:

for x:

$s_2s_1 \backslash s_0a$	00	01	11	10
00				
01	1	1		
11	1	1	x	x
10			1	1

$\to s_1s_0'$

$\to s_2s_0$

$x = s_1s_0' + s_2s_0$

for y:

$s_2s_1 \backslash s_0a$	00	01	11	10
00			1	1
01	1	1	1	1
11			x	x
10				

$\to s_2's_0$

$\to s_2's_1$

$y = s_2's_1 + s_2's_0 = s_2'(s_1+s_0)$

for z:

$s_2s_1 \backslash s_0a$	00	01	11	10
00			1	1
01	1	1		
11			x	x
10	1	1	1	1

$\to s_1's_0$

$\to s_2's_1s_0'$

$\to s_2s_1'$

$z = s_2's_1s_0' + s_2s_1' + s_1's_0$

$= s_1'(s_2+s_0) + s_2's_1s_0'$

for n_2:

$s_2s_1 \backslash s_0a$	00	01	11	10
00				
01			1	
11	1		x	x
10	1	1	1	1

$\to s_1s_0a$

$\to s_2a'$

$\to s_2s_1'$

$n_2 = s_1s_0a + s_2a' + s_2s_1'$

$= s_2(s_1'+a') + s_1s_0a$

0011,0100,0101,0110,1011,1100

for n_1:

$s_2s_1 \backslash s_0a$	00	01	11	10
00			1	
01	1	1		1
11	1		x	x
10			1	

$s_1's_0a$

s_1s_0a'

$s_2's_1s_0'$

$s_1s_0'a'$

$$n_1 = s_2's_1s_0' + s_1s_0'a' + s_1s_0a' + s_1's_0a$$
$$= s_1a'\cancel{(s_0+s_0')} + s_2's_1s_0' + s_1's_0a$$
$$= s_1a' + s_2's_1s_0' + s_1's_0a$$
$$= s_1(s_2's_0'+a') + s_1's_0a$$

for n_0:

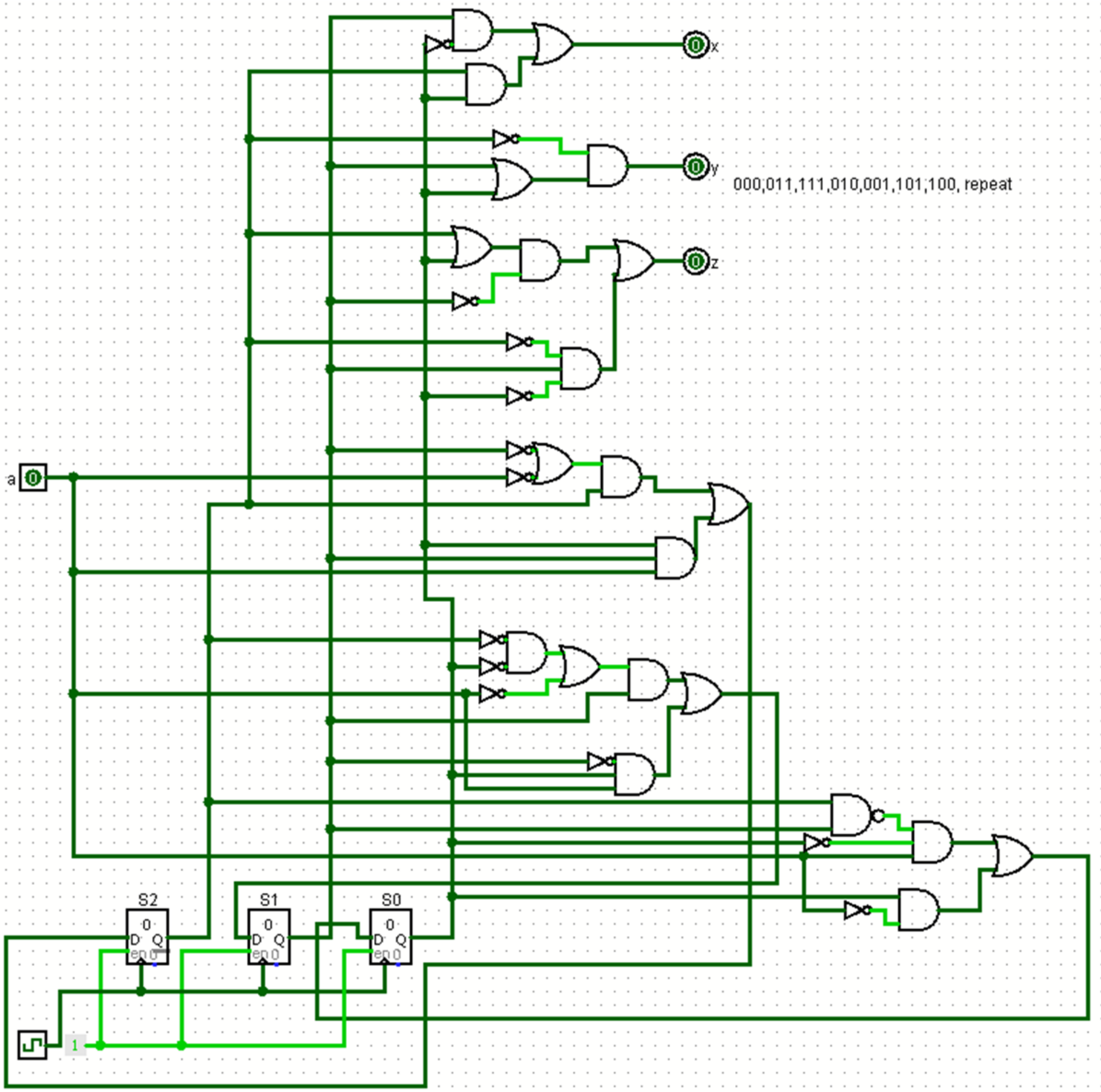
$s_2s_1 \backslash s_0a$	00	01	11	10
00		1		1
01		1		1
11			x	x
10		1		1

s_0a'

$s_2's_0'a$

$s_2s_1's_0'a$

$$n_0 = s_2s_1's_0'a + s_2's_0'a + s_0a'$$
$$= s_0'a(\underbrace{s_2s_1' + s_2'}_{s_2 \text{ nand } s_1}) + s_0a'$$
$$= s_0'a(s_2 \text{ nand } s_1) + s_0a'$$


x
y
z
000,011,111,010,001,101,100, repeat
a
S2
S1
S0