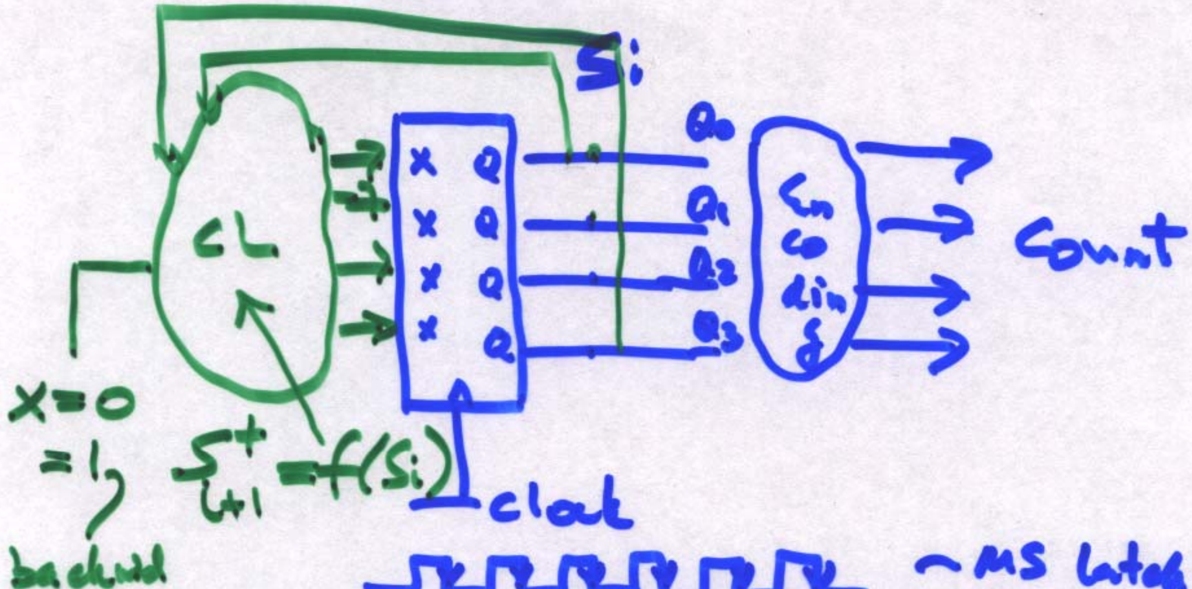
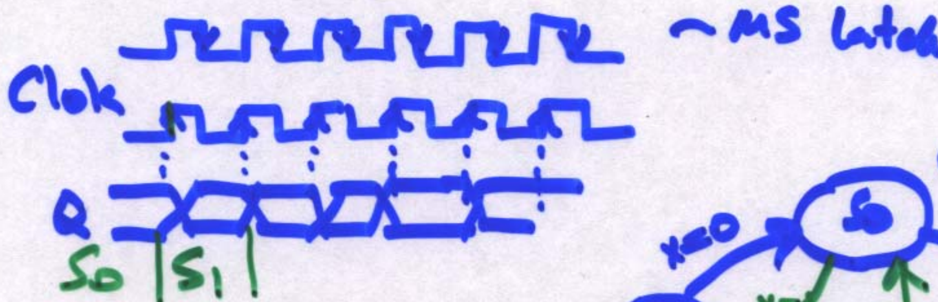
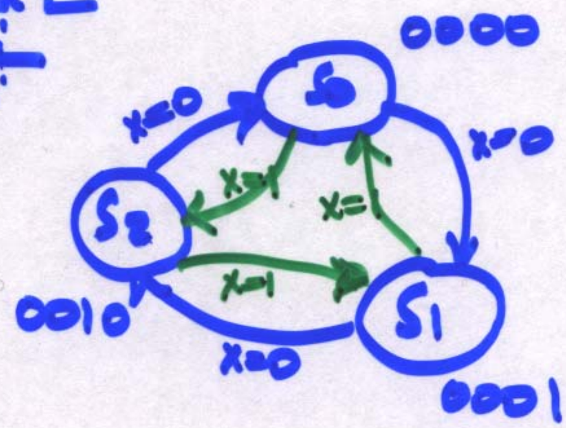
FSM





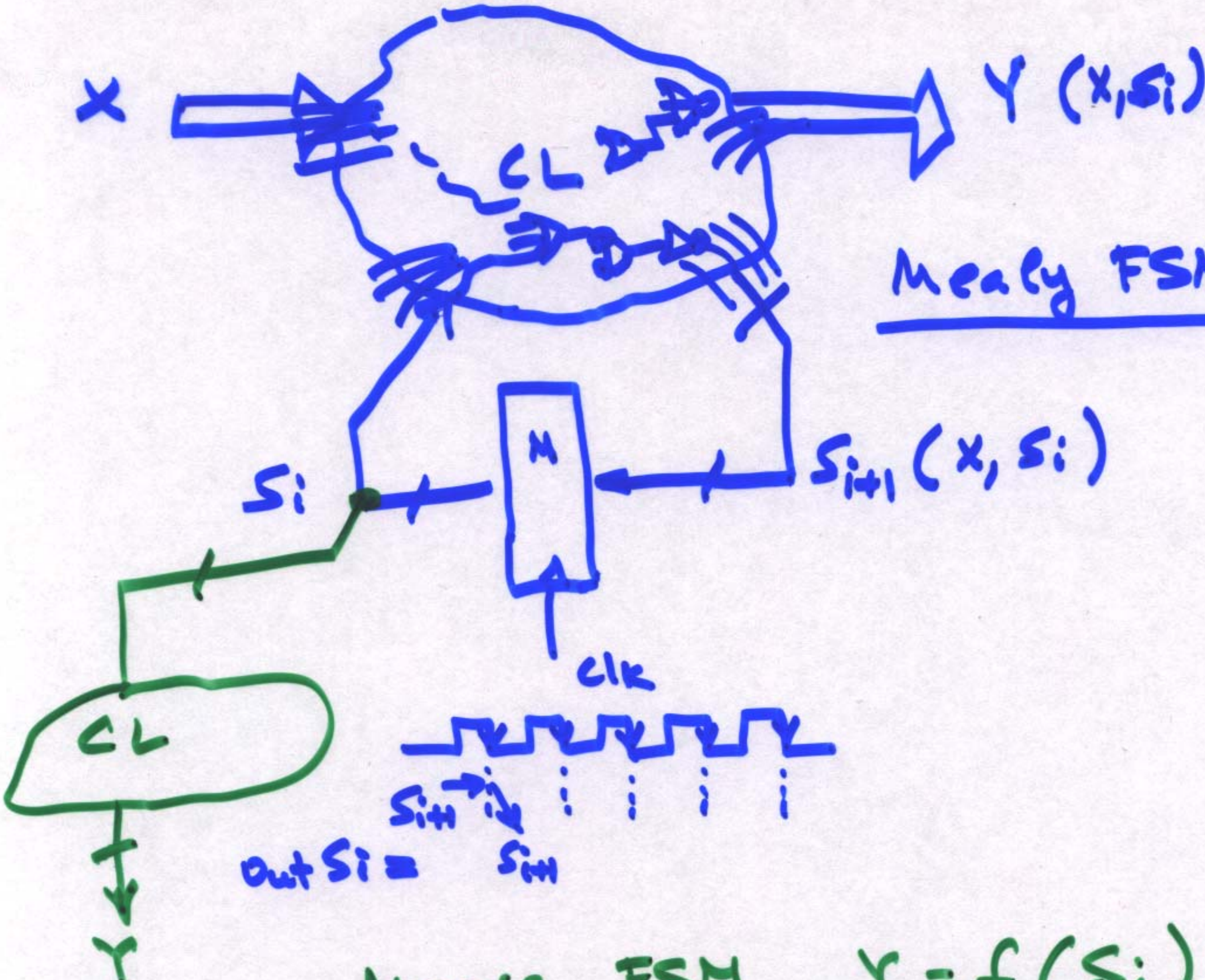
S_3



$$S_{i+1} = f(S_i, x)$$

X	S_i		S_{i+1}		S_1	R_1	S_0	R_0	$\boxed{S_i\ R_i = \psi(x, S_i)}$
0	0	0	0	0	0	—	1	0	
0	0	1	1	0	1	0	0	1	
0	1	0	0	0					
0	1	1	—	—					
1	0	0	1	0					
1	0	1	0	0					
1	1	0	0	1					
1	1	1	—	—					

FSM

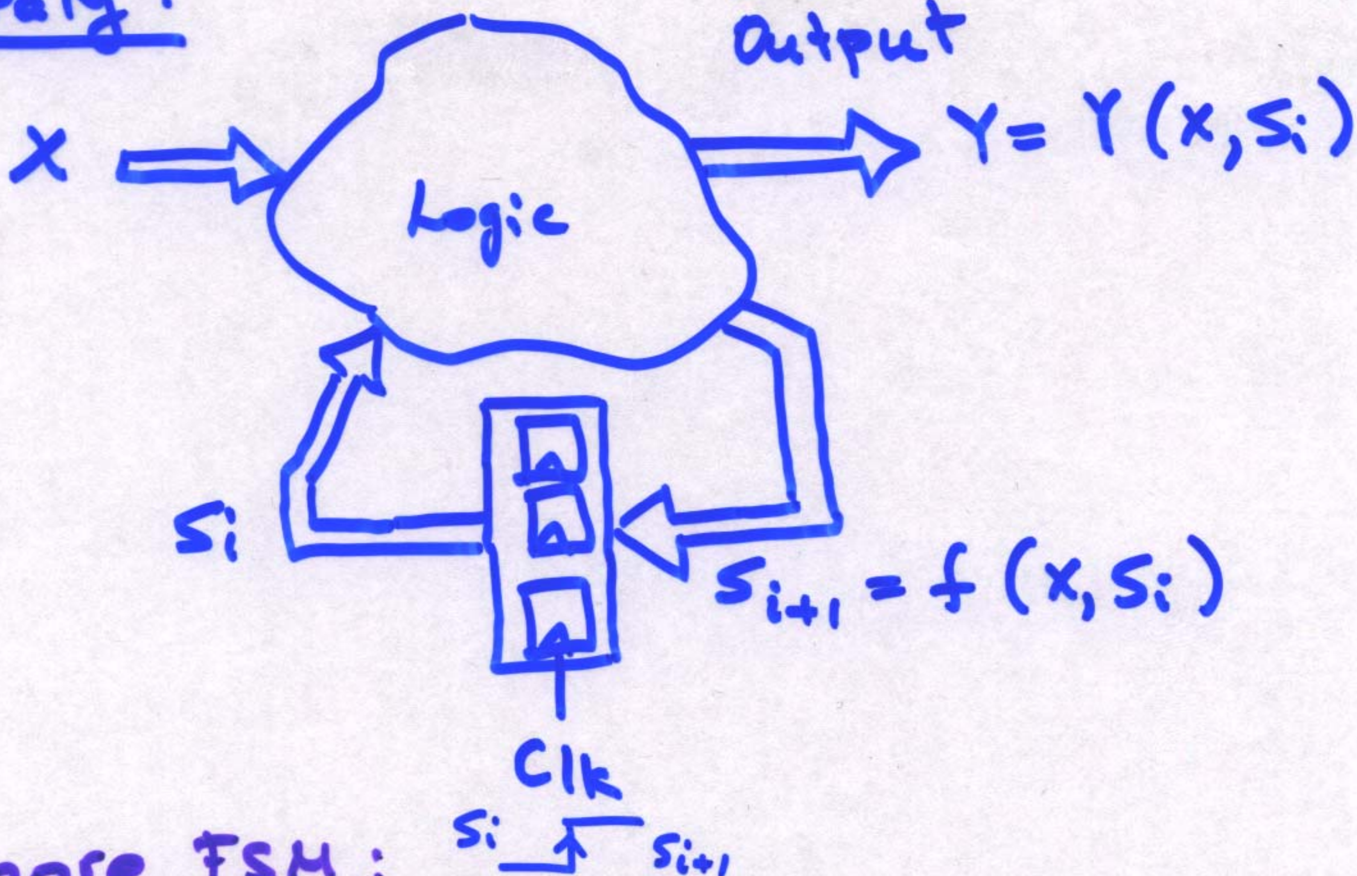


Mealy FSM

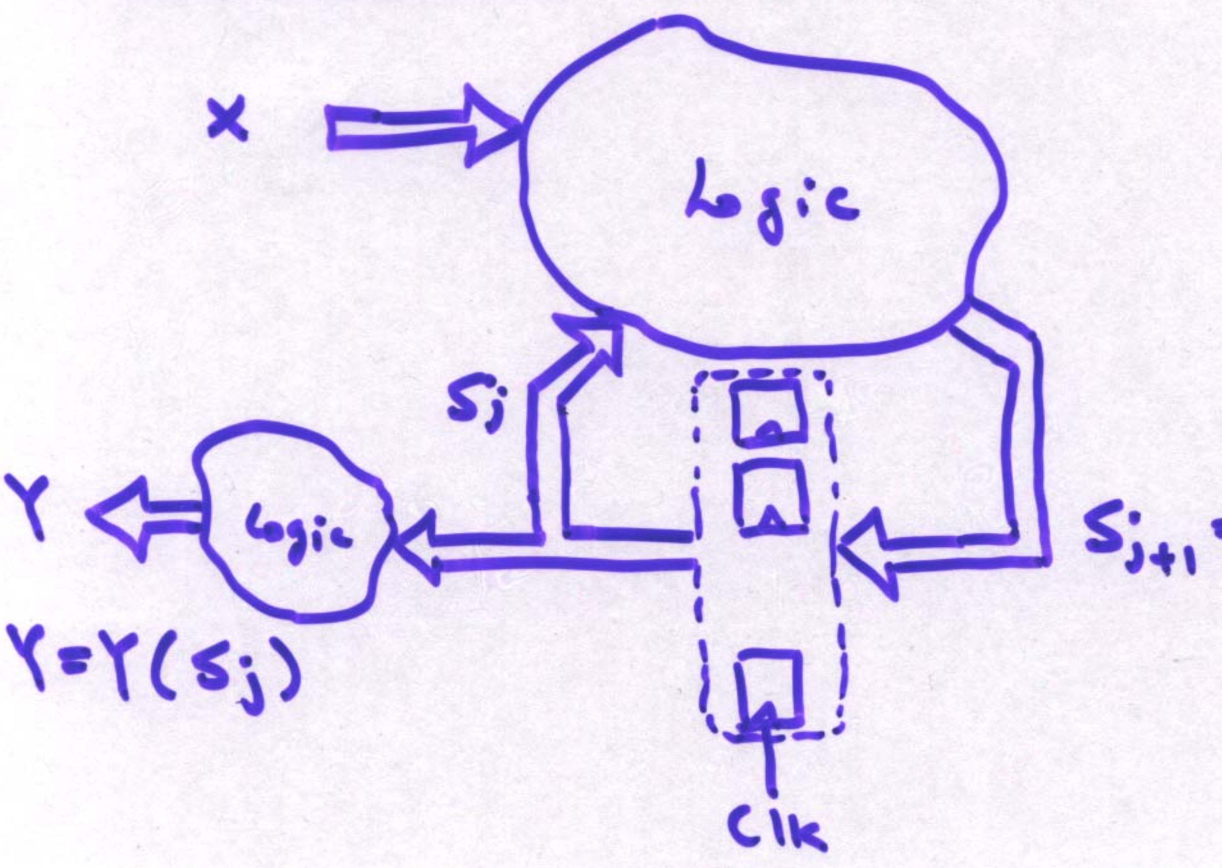
Moore FSM $Y = f(S_i)$

FSM

Mealy:



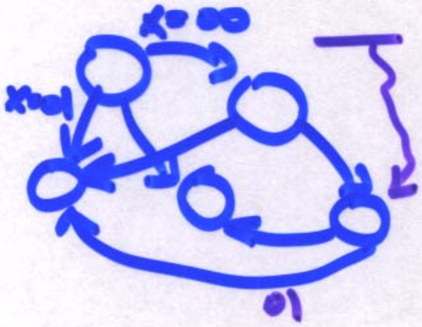
Moore FSM:



Mealy FSM:

$f(x_i, S_n)$ $\qquad$ $\psi(x_i, S_n)$

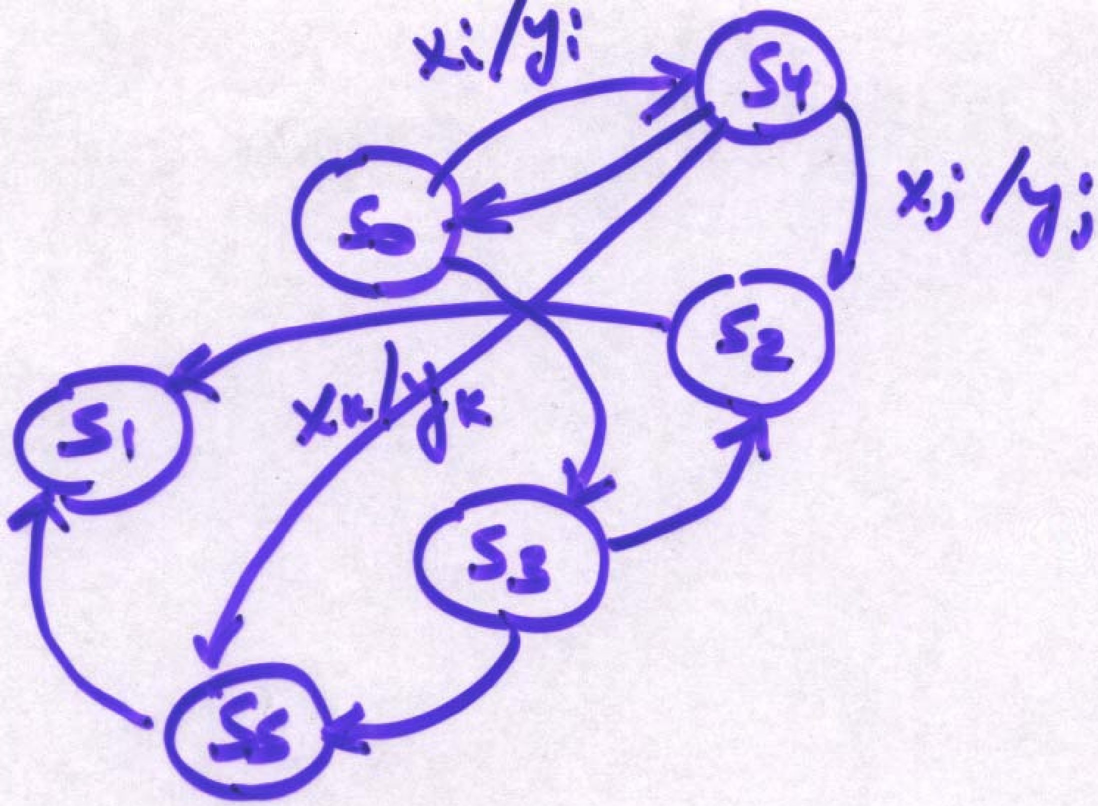
X_i	S_n	S_{n+1}	$D_0 \cdots D_k$	$Y_0 \cdots Y_m$
$x_0 \cdots x_n$	$Q_0 \cdots Q_k$	$Q_0' \cdots Q_k'$		
$\vdots$		$\vdots$		
		$Q_0' \cdots Q_k'$		



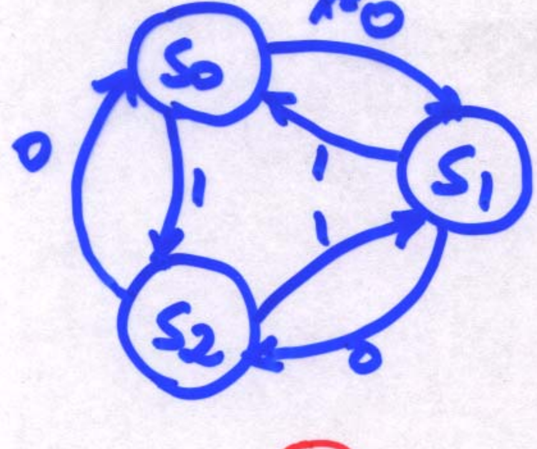
Moore FSM:

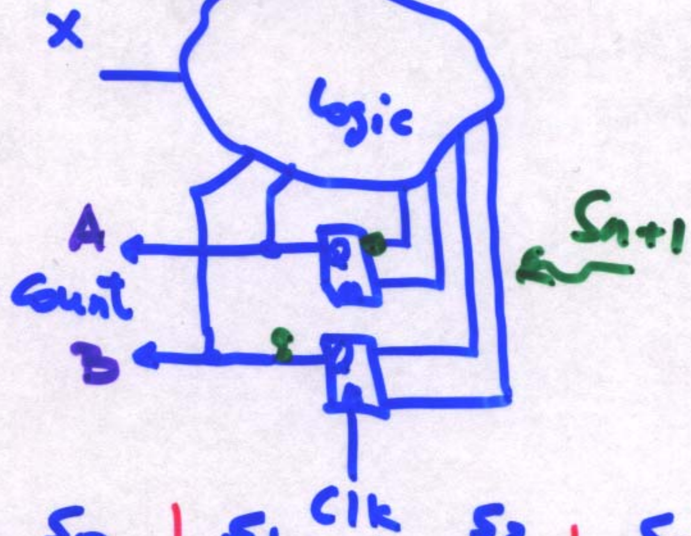
$Y = Y(S_n)$

X_i	S_n	S_{n+1}	$D_0 \cdots D_k$	$Y_0 \cdots Y_m$
$x_0 \cdots x_n$	$Q_0 \cdots Q_k$			
$\vdots$				

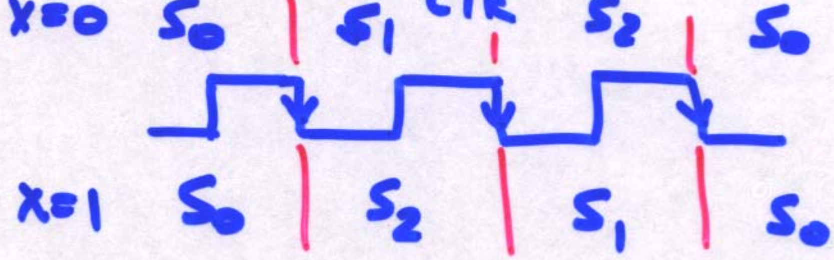

xi/yi
S4
xj/yj
S0
S2
S1
xk/yk
S3
S5

Up / Down Counter





S_3



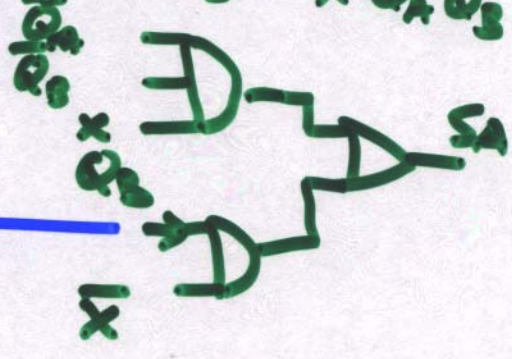
	S_n		S_{n+1}					
X	Q_A	Q_B	Q_A	Q_B	S_A	R_A	S_B	R_B
0	0	0	0	1	0	–	1	0
0	0	1	1	0	1	0	0	1
0	1	0	0	0	0	1	0	–
0	1	1	–	–	–			
1	0	0	1	0	1	0		
1	0	1	0	0	0	–		
1	1	0	0	1	0	1		
1	1	1	–	–	–	–		

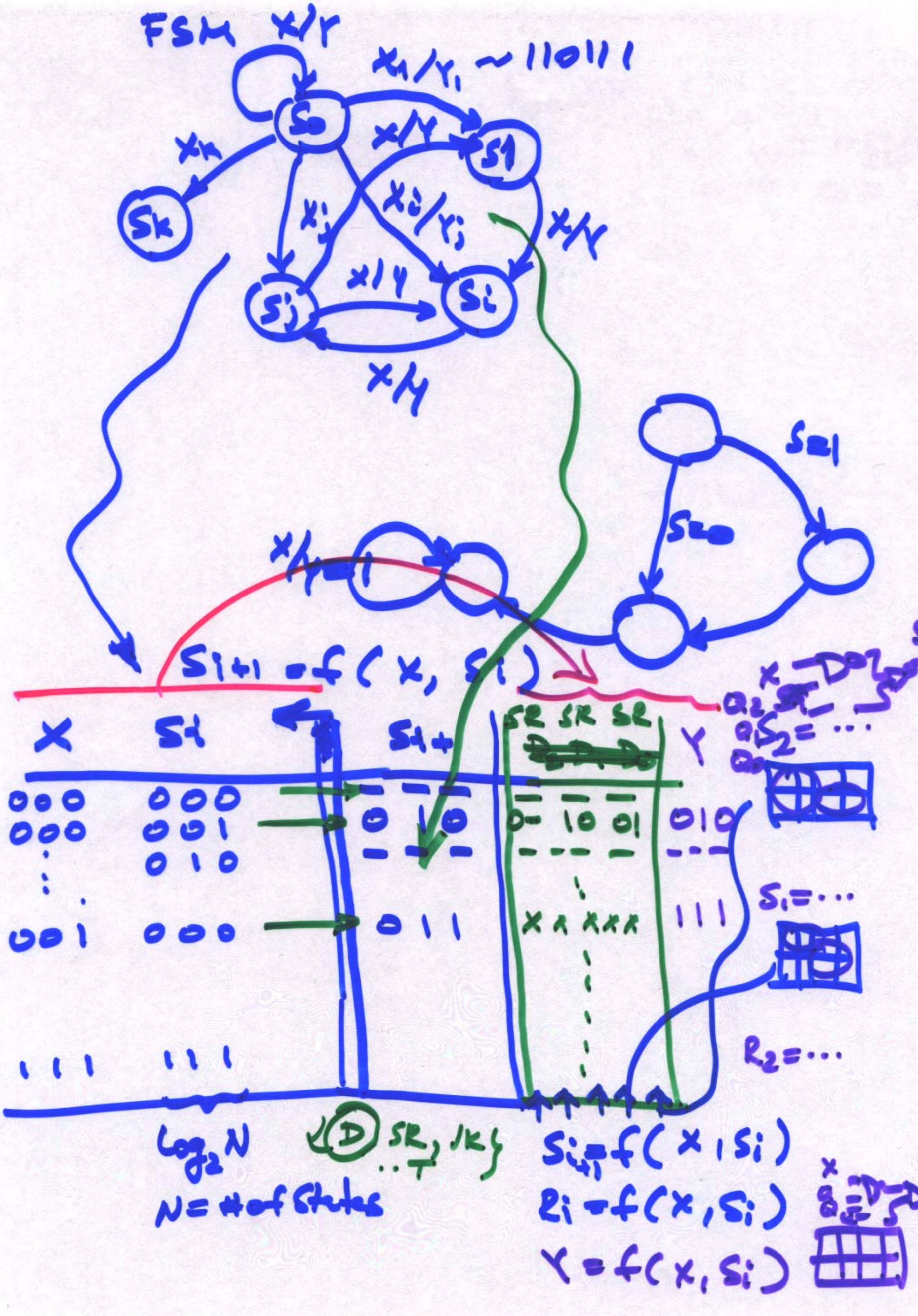
"0" bar

S_A

		Q_B		
	0	1	–	0
x	1	0	–	0
			Q_A	

$$S_A = \bar{X} Q_B + X \bar{Q}_A \bar{Q}_B$$




FSM x/Y
x1/Y1 ~ 110111
S0
S1
Sk
Sj
Si
xk
x/Y
xj
xi/Yi
S=1
S=0
x/Y=1
Si+1 = f(x, Si)
X
Si
Si+1
SR SR SR
Y
000
001
010
111
0 1 0
0 1 1
010
Log2 N
N = # of States
D SR, JK, T
Si+1 = f(x, Si)
Ri = f(x, Si)
Y = f(x, Si)
S2 = ...
S1 = ...
R2 = ...

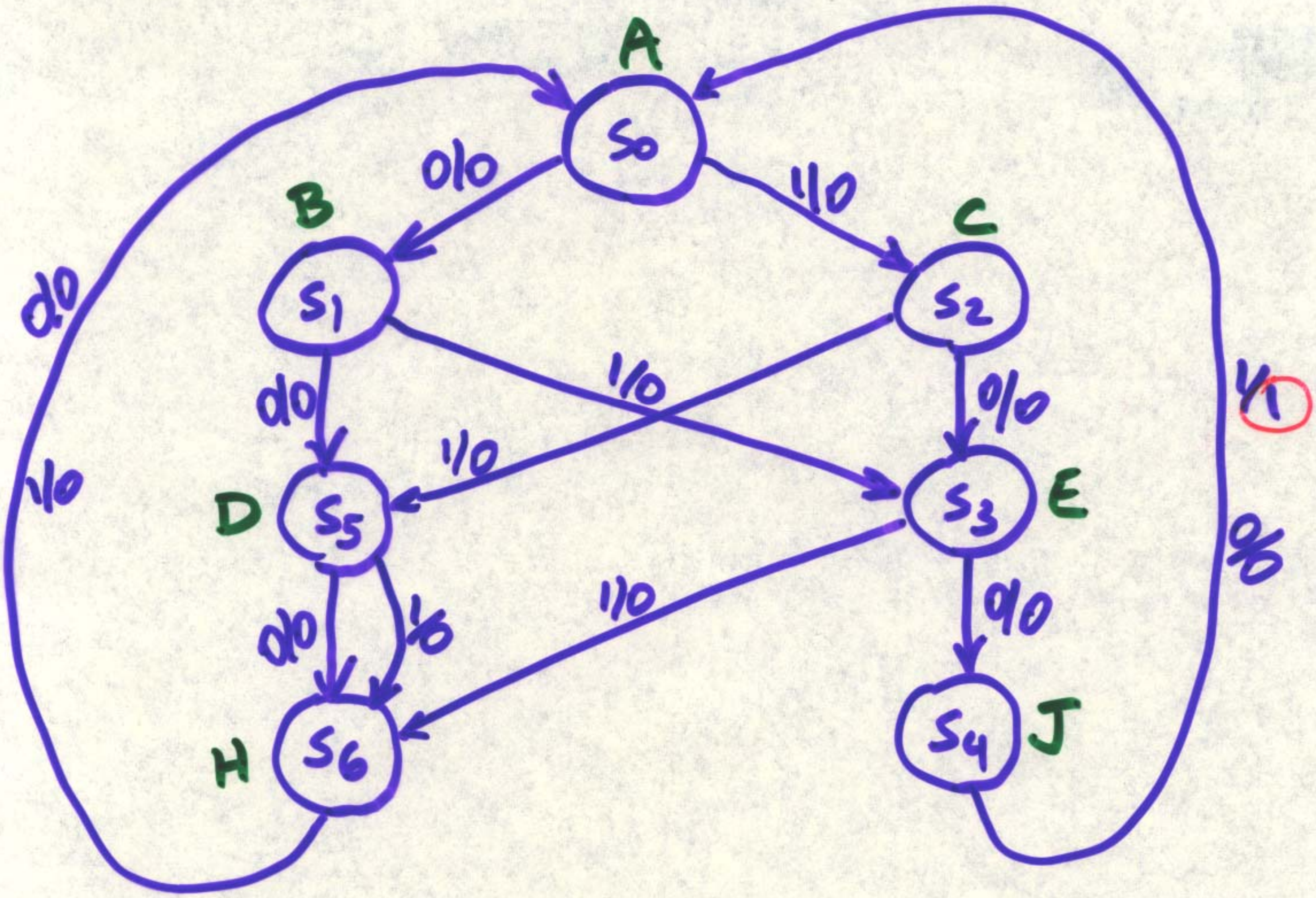
Reduction of State Tables (15.x)

If input X = 0101 or 1001, Z = 1
Network resets every fourth input

X	S_n	S_{n+1} X=0	S_{n+1} X=1	Z X=0	Z X=1
RESET	A	B	C	0	0
0	B	D	E	0	0
1	C	~~F~~ E	D ~~G~~	0	0
0 0	D	H	H ~~I~~	0	0
0 1	E	J	H ~~K~~	0	0
1 0	~~F~~	~~L~~ J	H ~~M~~	~~0~~	~~0~~
1 1	~~G~~	~~N~~ H	H ~~P~~	~~0~~	~~0~~
0 0 0	H	A	A	0	0
0 0 1	~~I~~	~~A~~	~~A~~	~~0~~	~~0~~
0 1 0	J	A	A	0	1
0 1 1	~~K~~	~~A~~	~~A~~	~~0~~	~~0~~
1 0 0	~~L~~	~~A~~	~~A~~	~~0~~	~~1~~
1 0 1	~~M~~	~~A~~	~~A~~	~~0~~	~~0~~
1 1 0	~~N~~	~~A~~	~~A~~	~~0~~	~~0~~
1 1 1	~~P~~	~~A~~	~~A~~	~~0~~	~~0~~

∅

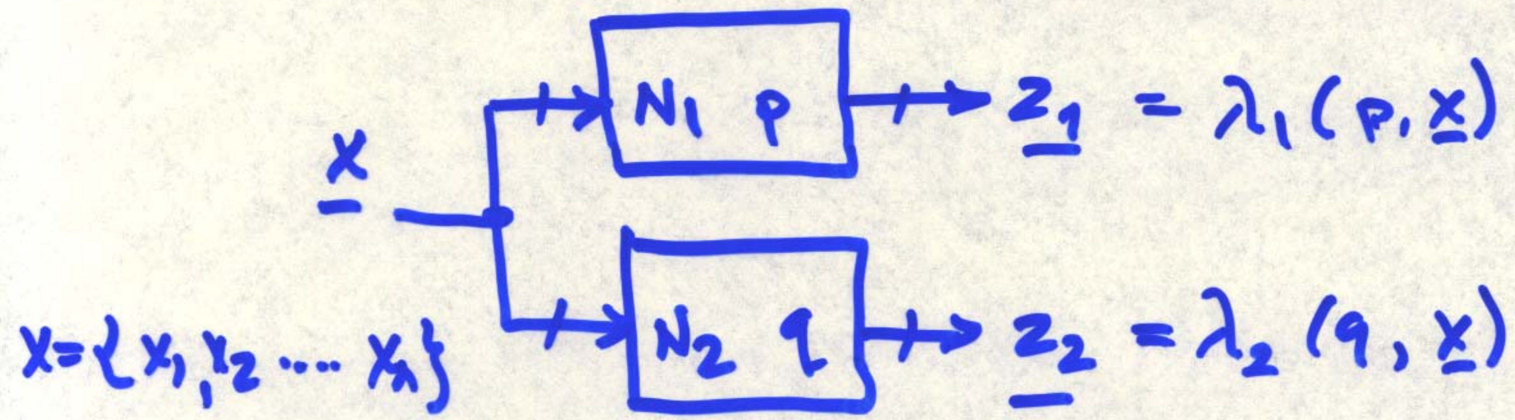
Elimination of Redundant States



	S_n	S_{n+1} $X=0$	S_{n+1} $X=1$	Z $X=0$	Z $X=1$
S_0	A	B	C	0	0
S_1	B	D	E	0	0
S_2	C	E	D	0	0
S_3	D	H	H	0	0
	E	J	H	0	0
	H	A	A	0	0
	J	A	A	0	1

Equivalent States

<u>Theorem</u>: Two states are equivalent if there is no way of telling them apart from observation of network inputs & outputs



$z_1 = z_2 \quad \forall \; X \Rightarrow$ then $\quad p \equiv q$

<u>Theorem 1a</u>: Two states p & q are equivalent if $\forall \; X$ the outputs are the same and the next states are equivalent

If $\quad \lambda_1(p, \underline{X}) = \lambda_2(q, \underline{X})$

& $\quad \delta_1(p, \underline{X}) = \delta_2(q, \underline{X})$

Then $\quad p \equiv q$

Implication Table

S_n	S_{n+1}, $X=0$	S_{n+1}, $X=1$	Z
a	~~d~~ a	c	0
b	f	h	0
c	~~e~~ c	~~d~~ a	1
~~d~~	~~a~~	~~ee~~	~~0~~
~~e~~	~~c~~	~~a~~	~~1~~
f	f	b	1
g	b	h	0
h	c	g	1

Implication Chart

	a	b	c	d	e	f	g
b	~~d-f e-h~~						
c	X	X					
d	d-a c-e	[illegible]	X				
e	X	X	c-e d-a	X			
f	X	X	[illegible]	X	~~c-f a-b~~		
g	~~a-b c-h~~	~~b-f~~	X	~~a-b e-h~~	X	X	
h	X	X	[illegible]	X	[illegible]	~~c-f b-g~~	X

$d \equiv a$

$c \equiv e$