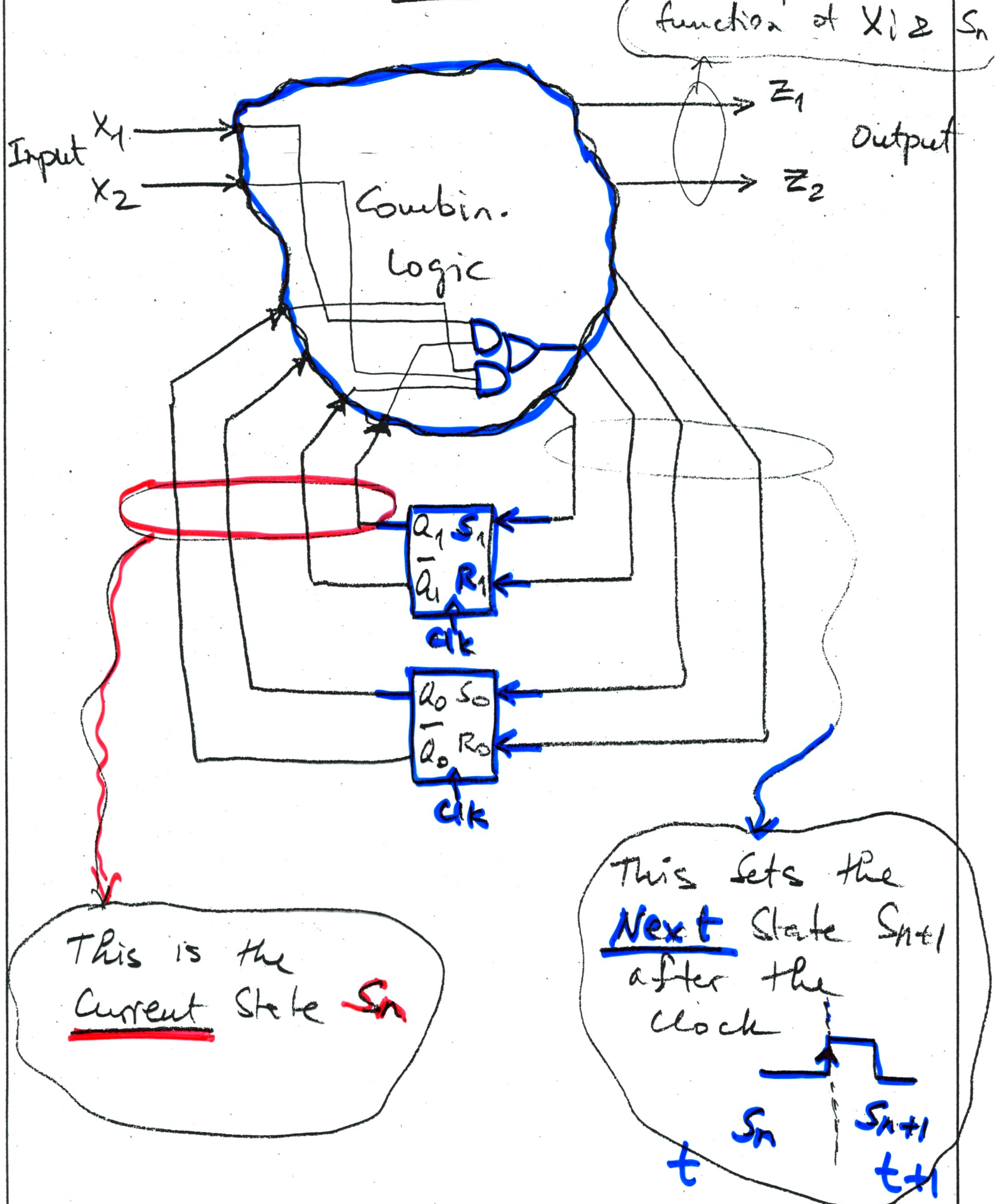
FSM:


Output is a function of Xi & Sn
Input
X1
X2
Combin. Logic
Z1
Z2
Output
Q1 S1
Q̄1 R1
Clk
Q0 S0
Q̄0 R0
Clk
This is the Current State Sn
This sets the Next State Sn+1 after the clock
Sn
Sn+1
t
t+1

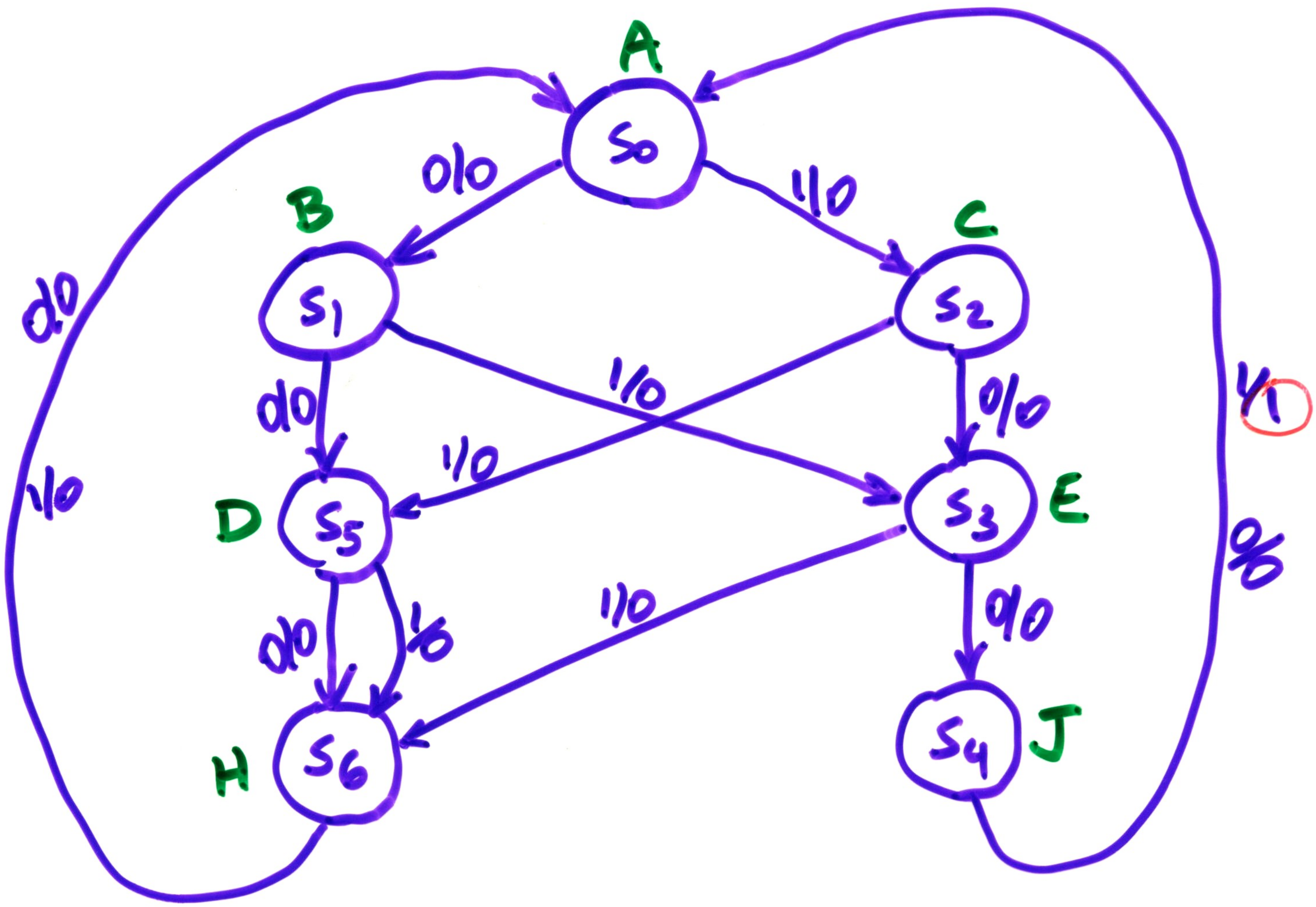
Reduction of State Tables (15.x)

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~~

∅

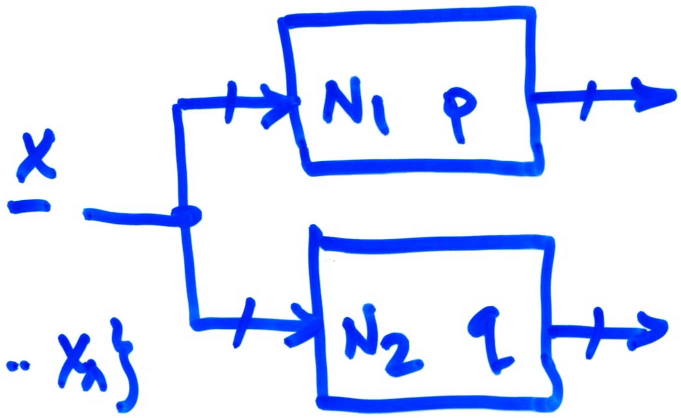
Elimination of Redundant States



	Sn	S_{n+1} X=0	X=1	Z X=0	X=1
S_0	A	B	C	0	0
S_1	B	D	E	0	0
S_2	C	E	D	0	0
S_5	D	H	H	0	0
	E	J	H	0	0
	H	A	A	0	0
	J	A	A	0	1

Equivalent States

Theorem: Two ~~states~~ FSM are equivalent if there is no way of telling them apart from observation of network inputs & outputs



$\underline{z_1} = \lambda_1(p, \underline{X})$

$\underline{z_2} = \lambda_2(q, \underline{X})$

$X = \{x_1, x_2 \dots x_n\}$

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

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

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

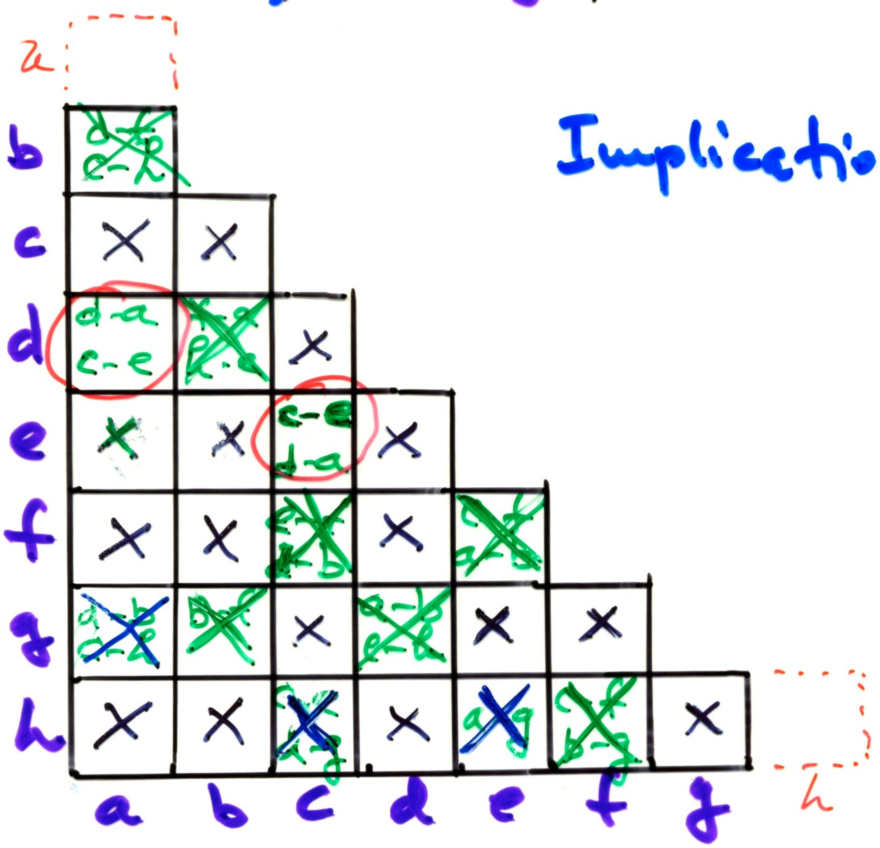
& $\delta_1(p, \underline{X}) = \delta_2(q, \underline{X})$

Then $p \equiv q$

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~~	~~c~~ ~~e~~	~~0~~
~~e~~	~~c~~	~~a~~	~~1~~
f	f	b	1
g	b	h	0
h	c	g	1

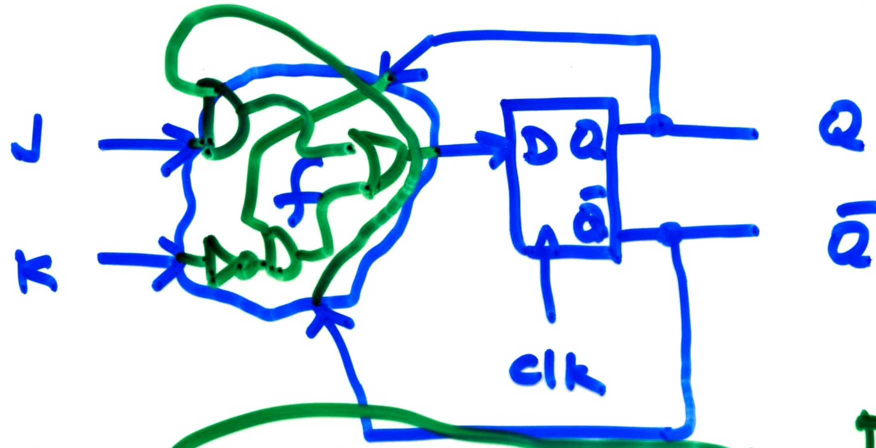
Implication Chart



d ≡ a
c ≡ e

X · form $FF_1 \rightarrow FF_2$

J-K from D (S-R)



$D = f(J, K, Q_n)$

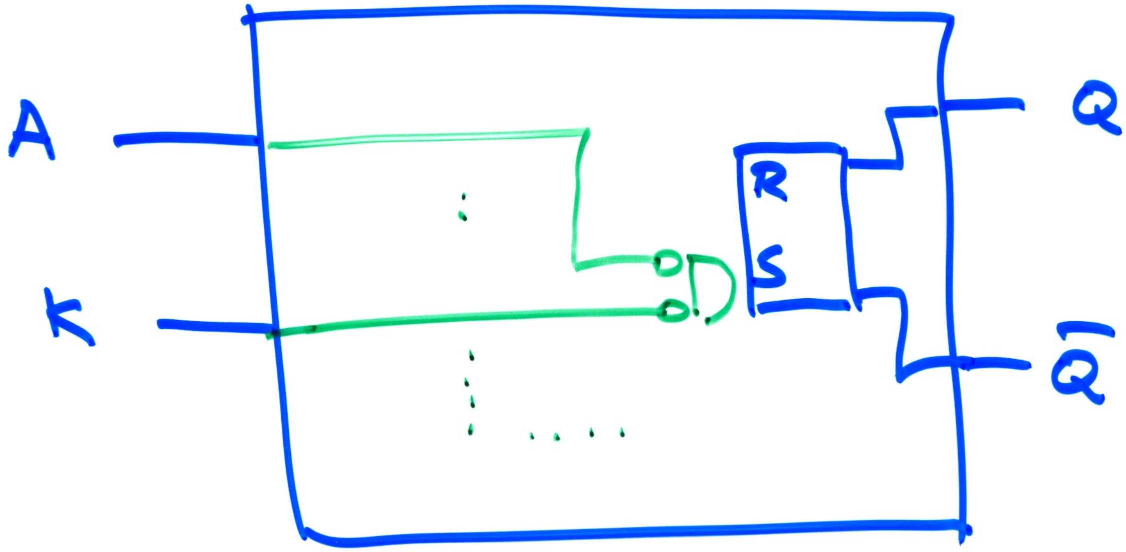
S R

J	K	Q_n	Q_{n+1}	D
0	0	0	0	0
0	0	1	1	1
0	1	0	0	0
0	1	1	0	0
1	0	0	1	1
1	0	1	1	1
1	1	0	1	1
1	1	1	0	0

$D = J \cdot \bar{Q} + \bar{K} \cdot Q$

	0	1	0	0
J	1	1	0	1

Q_n



A	K	Q_n	Q_{n+1}	S	R
0	0	0	1	1	0
0	0	1	1	–	0
0	1	0	0	0	–
0	1	1	1	–	0
1	0	0	0	0	–
1	0	1	1	–	0
1	1	0	0	0	–
1	1	1	0	0	1

$S = \bar{A}\bar{K}$

		Q_n	Q_n	
	1	–	–	0
A	0	–	0	0
			K	K