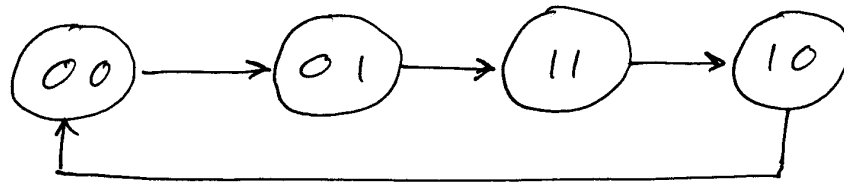


MORE SEQUENTIAL SYNTHESIS

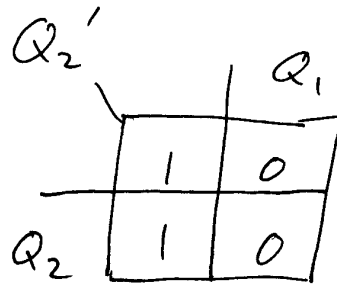
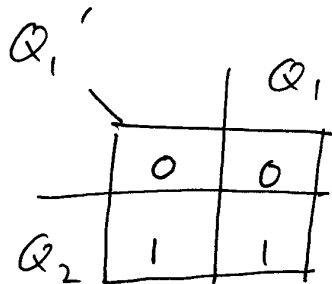
GRAY CODE COUNTER



STATE-
TRANSITION
DIAGRAM

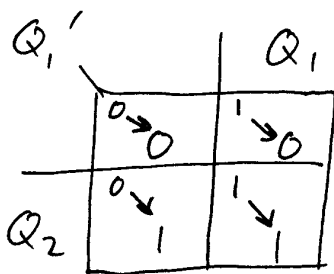
Q_1	Q_2	Q_1'	Q_2'
0	0	0	1
0	1	1	1
1	0	0	0
1	1	1	0

STATE - TRANSITION
TABLE

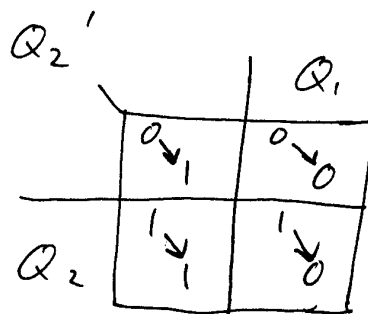


S-T
MAPS

NEED "COME-FROM" AS WELL AS
"GO TO"



COME FROM IS Q_1'



COME FROM
IS Q_2

J-K EXCITATION TABLE

Q	Q'	J	K
0	0	0	D
0	1	1	D
1	0	D	1
1	1	D	0

MEM OR RESET
 SET OR TOGGLE
 CLEAR OR TOGGLE
 SET OR MEM

COME FROM \uparrow
 Go TO \uparrow

J-K DESIGN

Q ₁ '	Q ₁
0	1
0	0
1	1
1	1

J ₁	Q ₁
0	D
1	D

K ₁	Q ₁
D	1
D	0

$$J_1 = Q_2 \quad K_1 = \overline{Q_2}$$

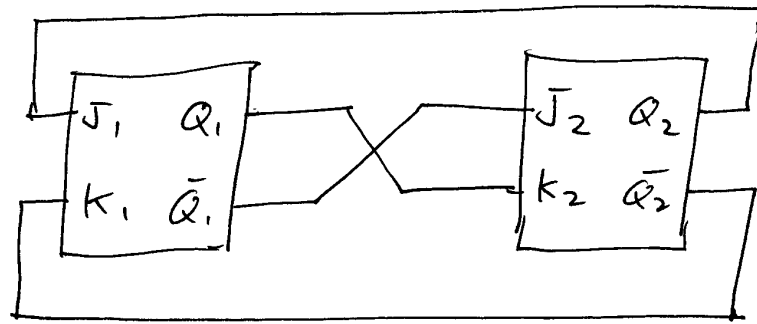
Q ₂ '	Q ₁
0	0
1	0
1	1
0	0

J ₂	Q ₁
1	0
D	D

K ₂	Q ₁
D	D
0	1

$$J_2 = \overline{Q_1} \quad K_2 = Q_1$$

ANALYSIS VERIFY DESIGN

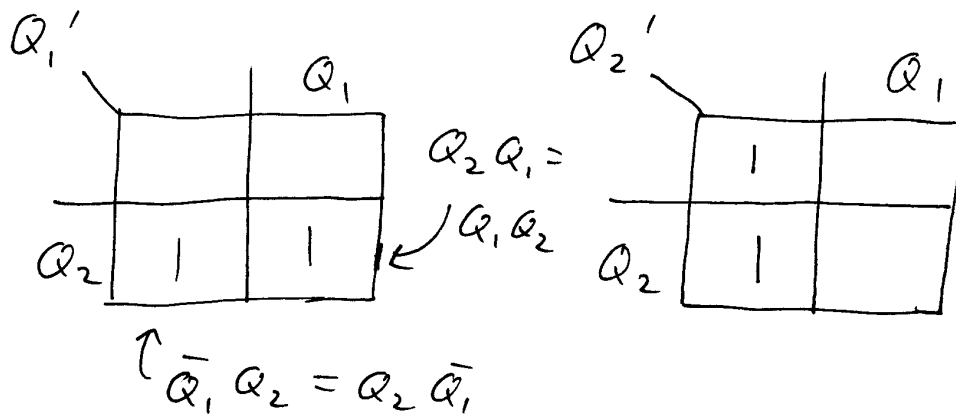


← DON'T
NEED
INVERTER -
JUST USE
 \bar{Q}_2 PIN

$$J_1 = Q_2 \quad K_1 = \bar{Q}_2 \quad J_2 = \bar{Q}_1 \quad K_2 = Q_1$$

$$Q_1' = J_1 \bar{Q}_1 + \bar{K}_1 Q_1 = Q_2 \bar{Q}_1 + Q_2 Q_1$$

$$Q_2' = J_2 \bar{Q}_2 + \bar{K}_2 Q_2 = \bar{Q}_1 \bar{Q}_2 + \bar{Q}_1 Q_2$$



Q_1	Q_2	Q_1'	Q_2'	
0	0	0	1	✓
0	1	1	1	✓
1	0	0	0	✓
1	1	1	0	✓

S-R EXCITATION TABLE

Q	Q'	S	R	
0	0	0	D	MEM OR RESET
0	1	1	0	SET (ONLY)
1	0	0	1	RESET (ONLY)
1	1	D	0	MEM OR SET

THIS TABLE TAKES CARE OF
NOT PERMITTING $S=1$ $R=1$

S-R DESIGN

Q ₁ '	Q ₁
0	1
0	0
Q ₂	Q ₂ '
1	1
1	0

Q ₂ '	Q ₁
0	1
0	0
Q ₂	Q ₁ '
1	1
1	0

$$S_1 = Q_2$$

$$S_2 = \bar{Q}_1$$

S ₁	Q ₁
0	0
0	1
Q ₂	S ₂
1	1
1	0

S ₂	Q ₁
1	0
0	1
Q ₂	S ₁
1	1
1	0

$$R_1 = \bar{Q}_2$$

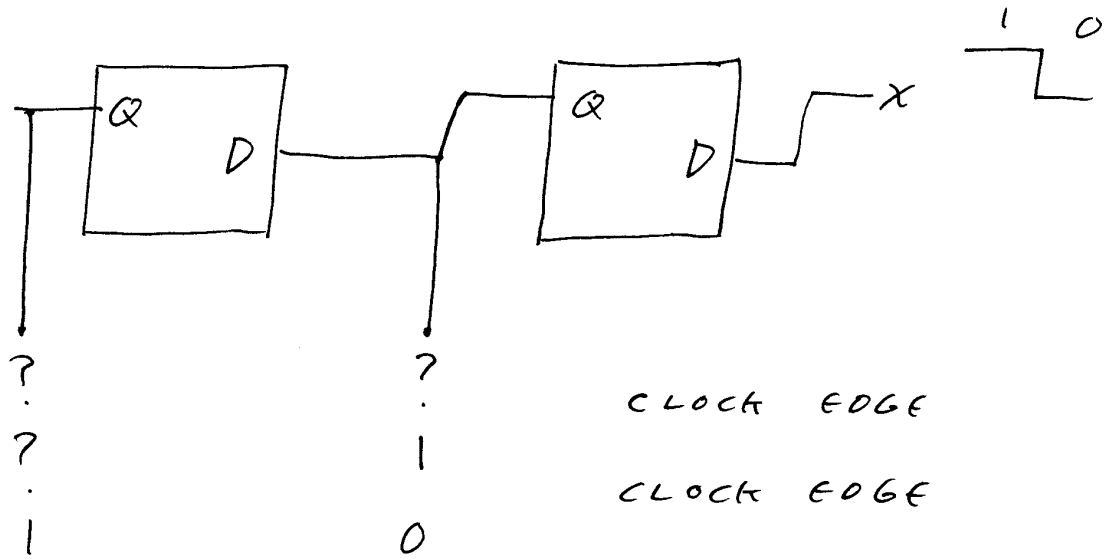
$$R_2 = Q_1$$

R ₁	Q ₁
1	1
0	0
Q ₂	R ₂
1	1
1	0

R ₂	Q ₁
0	1
1	0
Q ₂	R ₁
1	1
1	0

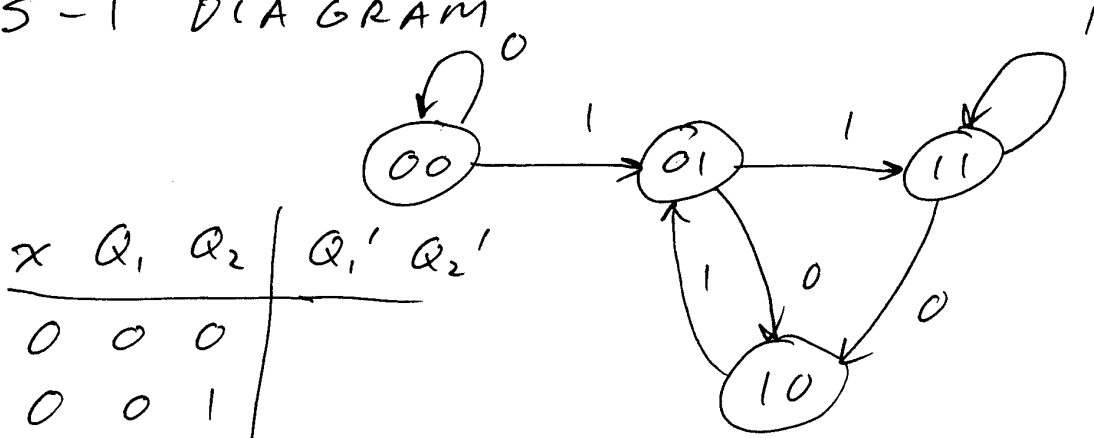
* 0 INSTEAD OF D

2-BIT SHIFT REGISTER



SERIAL → PARALLEL
(MODEM)

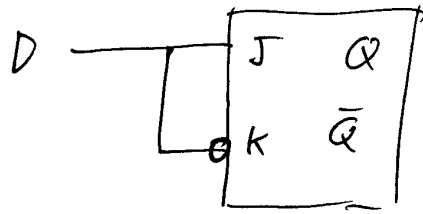
S-T DIAGRAM



x	Q ₁	Q ₂	Q ₁ '	Q ₂ '
0	0	0		
0	0	1		
0	1	0		
0	1	1		
1	0	0		
1	0	1		
1	1	0		
1	1	1		

← FILL IN

J-K REALIZATION



$$\begin{aligned}
 Q' &= J\bar{Q} + KQ \\
 &= D\bar{Q} + DQ \\
 &= D
 \end{aligned}$$

FULL DESIGN

Q_1'

			x
Q_2'	0	0	0
	1	1	1
	Q_1		

Q_2'

			x
Q_1'	0	0	1
	1	0	1
	Q_1		

J_1

			x
Q_2	0	D	0
	1	D	1
	Q_1		

J_2

			x
Q_1	0	0	1
	D	D	D
	Q_1		

K_1

			x
Q_2	D	1	D
	D	0	D
	Q_1		

K_2

			x
Q_1	D	D	D
	1	1	0
	Q_1		