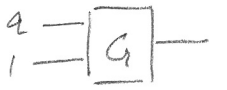
Uppgift 1

a b	a+b	y
0 0	0	0
0 1	1	1
1 0	1	0
1 1	1	0

$$y = G(a,b) = a \oplus (a+b) = a'b$$

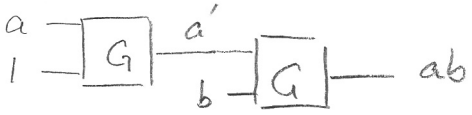
NOT

$$y = G(a,1) = a' \cdot 1 = a'$$



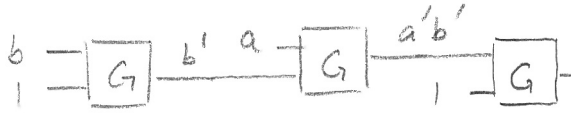
AND

$$y = ab = G(a',b) = G(G(a,1),b)$$



OR

$$y = (a+b)'' = (a'b')' = G(a'b',1) = G(G(a,b'),1) =$$
$$= G(G(a,G(b,1)),1)$$

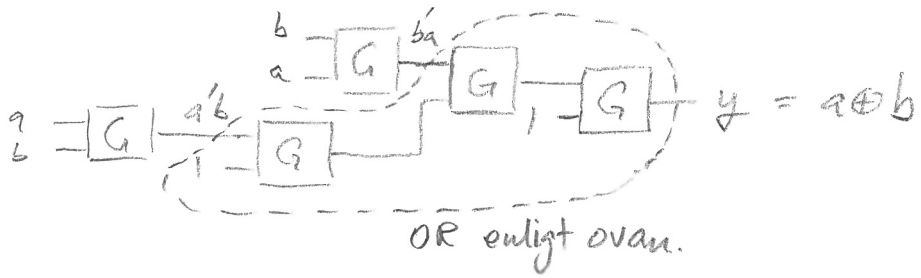


XOR

$$y = a \oplus b = ab' + a'b = G(b,a) + G(a,b) =$$

↑ OR implementeras som ovan

$$= G(G(G(b,a), G(G(a,b),1)),1)$$



Uppgift 2

	x=0	x=1
A	A/0	B/1
B	D/1	C/0
C	E/1	D/0
D	A/0	B/1
E	F/0	C/0
F	D/0	B/1

1-ekv. klasser:

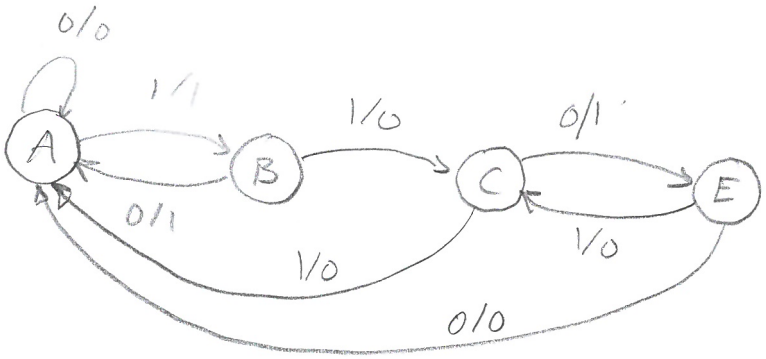
$P_1 = \{\{A, D, F\}, \{B, C\}, \{E\}\}$

2-ekv. klasser:

$P_2 = \{\{A, D, F\}, \{B\}, \{C\}, \{E\}\} = P_3$

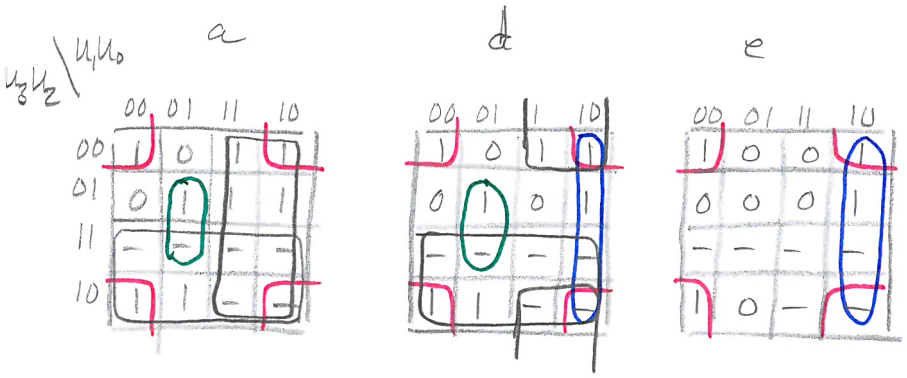
Ersätt $\{A, D, F\}$ med A

	x=0	x=1
A	A/0	B/1
B	A/1	C/0
C	E/1	A/0
E	A/0	C/0



Uppgift 3

u_3	u_2	u_1	u_0	a	d	e
0	0	0	0	1	1	1
0	0	0	1	0	0	0
0	0	1	0	1	1	1
0	0	1	1	1	1	0
0	1	0	0	0	0	0
0	1	0	1	1	1	0
0	1	1	0	1	1	1
0	1	1	1	1	0	0
1	0	0	0	1	1	1
1	0	0	1	1	1	0
t.ö.				–	–	–



$$a = (u_3 + u_1 + u_2'u_0' + u_2u_1'u_0)'' =$$

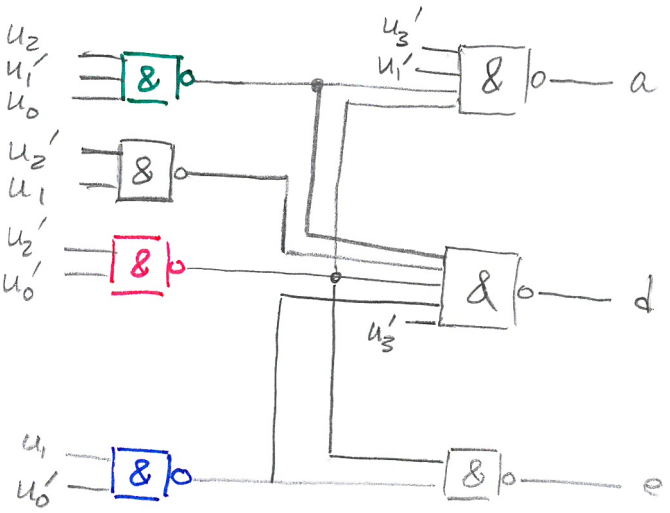
$$= (u_3'u_1'(u_2'u_0')'(u_2u_1'u_0)')'$$

$$d = (u_3 + u_2'u_0' + u_2'u_1 + u_1u_0' + u_2u_1'u_0)'' =$$

$$= (u_3'(u_2'u_0')'(u_2'u_1)'(u_1u_0')'(u_2u_1'u_0)')'$$

$$e = (u_2'u_0' + u_1u_0')'' = ((u_2'u_0')'(u_1u_0')')'$$

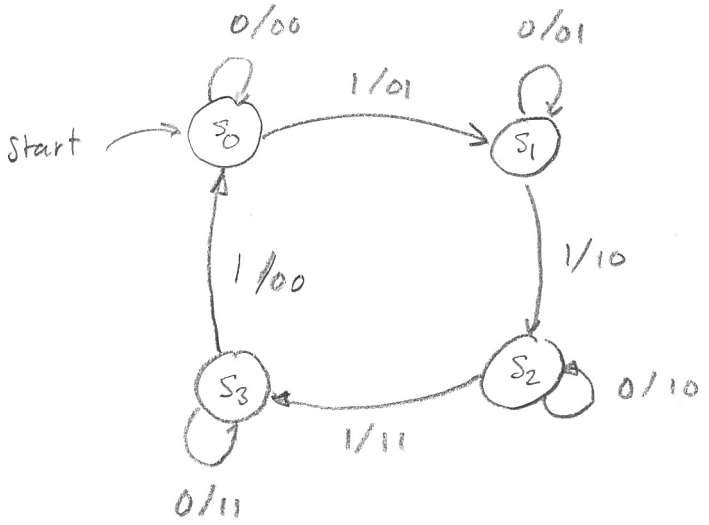
u_i — 1 o— u_i' för $i \in \{0,1,2,3\}$



Totalt krävs 7 NAND-grindar och 4 inverterare.

Uppgift 4

Diagram



Välj tillstånd så att
nästa tillstånd = utsignal

$q_1^+ = u_1$

$q_0^+ = u_0$

	$q_1 q_0$
S_0	00
S_1	01
S_2	10
S_3	11

Tabell

	$q_1^+ q_0^+$	
$q_1 q_0$	$x=0$	$x=1$
00	00	01
01	01	10
11	11	00
10	10	11

K-diagram

q_1^+ / u_1

$q_1 q_0$ \ x	0	1
00	0	0
01	0	1
11	1	0
10	1	1

q_0^+ / u_0

$q_1 q_0$ \ x	0	1
00	0	1
01	1	0
11	1	0
10	0	1

Cell 1 $q_1 q_0 = 00$

$(q_1^+ = 0)$ $q_0^+ = x$

Cell 2 $q_1 q_0 = 00$ eller 01

$q_1^+ = q_0 x$ $q_0^+ = q_0 \oplus x$

Cell 3 $q_1 q_0 =$ 00 eller 01 eller 10

$q_1^+ = q_1 + q_0 x$ $q_0^+ = q_0 \oplus x$

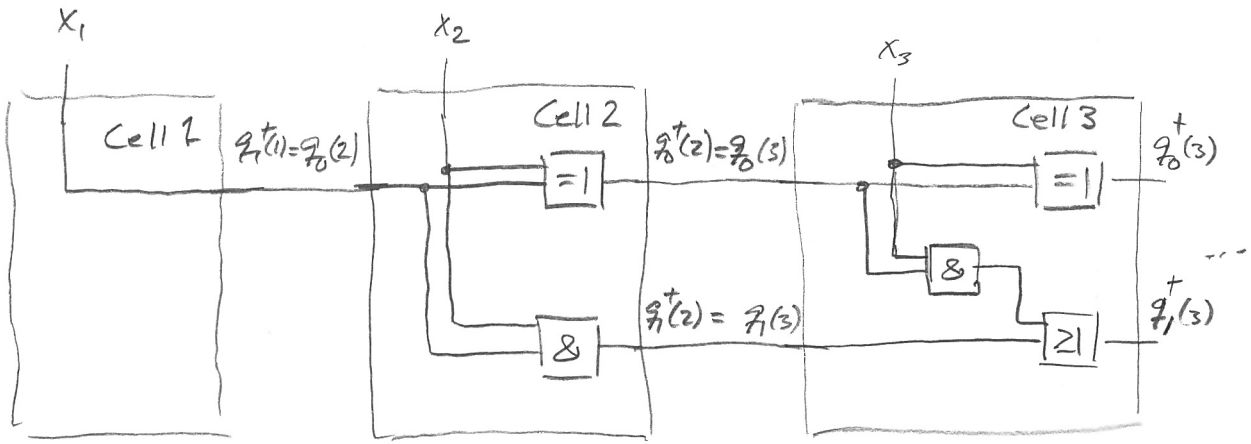
Cell 4 – (n-1)

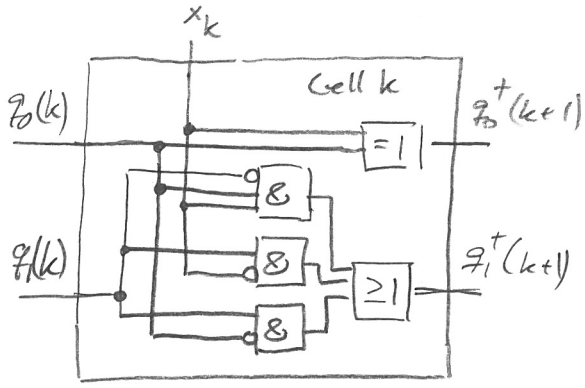
$q^+ = q' q x + q x' + q q'$ $q^+ = q \oplus x$

Cell n

$u_1 = q_1' q_0 x + q_1 x' + q_1 q_0'$

$u_0 = q_0 \oplus x$





för $k \in \{4, \ldots, n\}$ där

$z_1^+(n+1) = u_1$ och

$z_0^+(n+1) = u_0$

Uppgift 4 forts.

Uppgift 5

$x_i = \begin{cases} 1 & \text{tackat} \\ 0 & \text{annars} \end{cases}$

$u_1u_0 = \begin{cases} 01 & 1\text{-krona} \\ 10 & 5\text{-krona} \\ 11 & 10\text{-krona} \\ 00 & \text{f.ö.} \end{cases}$

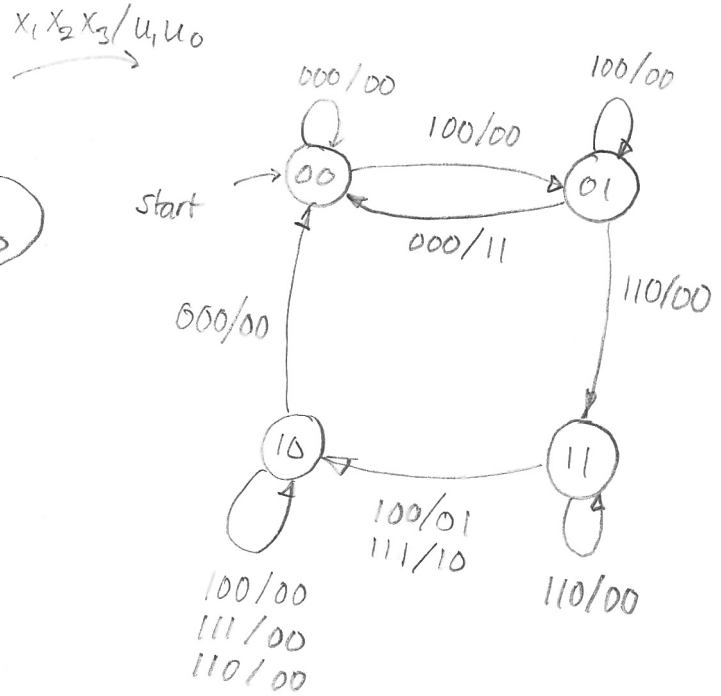
Scenario

1-krona: $x_1x_2x_3$: 000 → 100 → 110 → 100 → 000 (1 krona, $u_1u_0 = 01$)

5-krona: $x_1x_2x_3$: 000 → 100 → 110 → 111 → 110 → 100 → 000 (5 krona, $u_1u_0 = 10$)

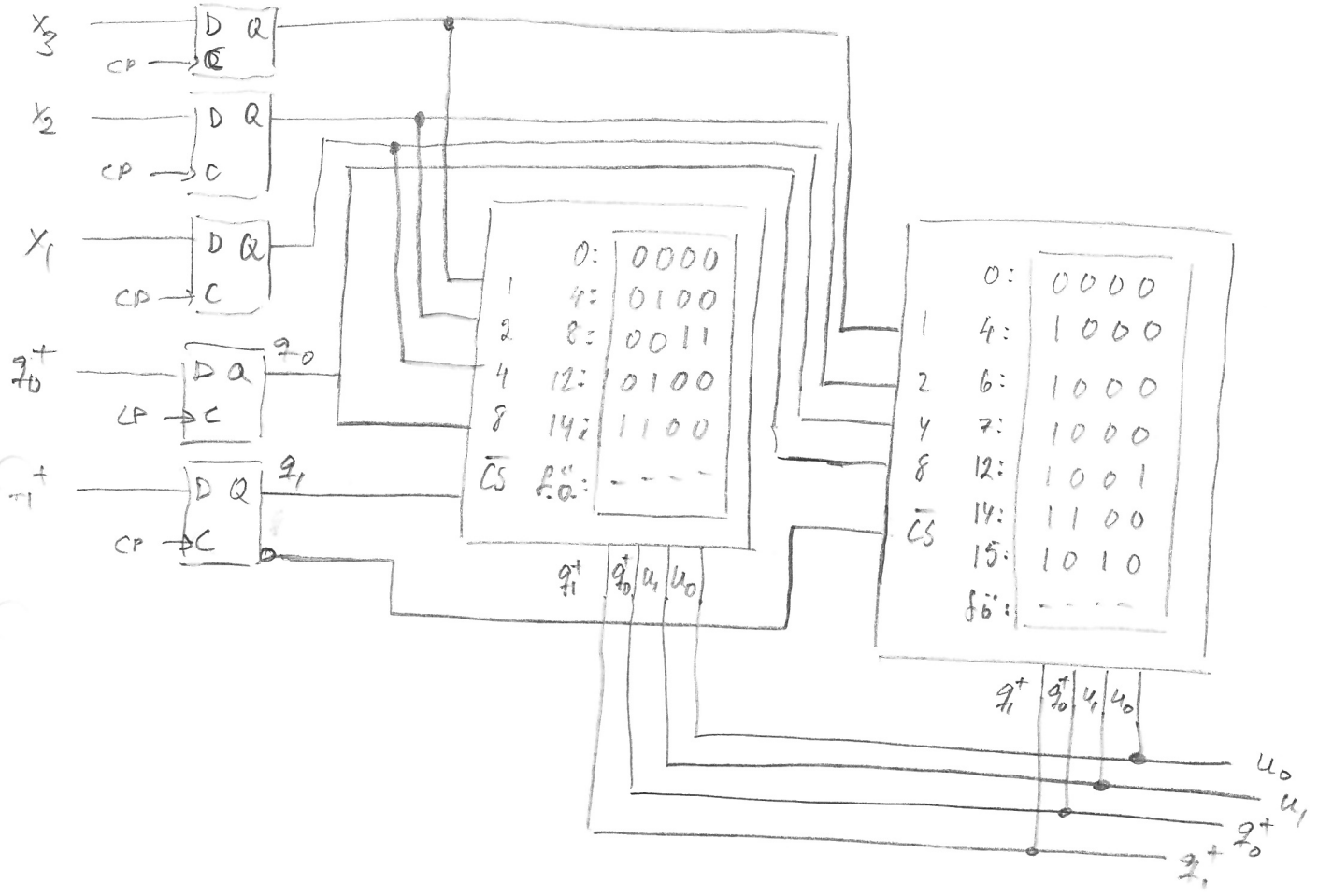
10-krona: $x_1x_2x_3$: 000 → 100 → 000 (10 krona, $u_1u_0 = 11$)

Tillståndsdiagram

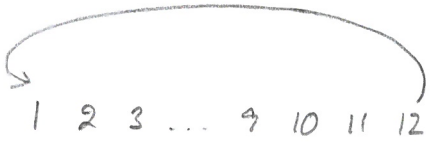


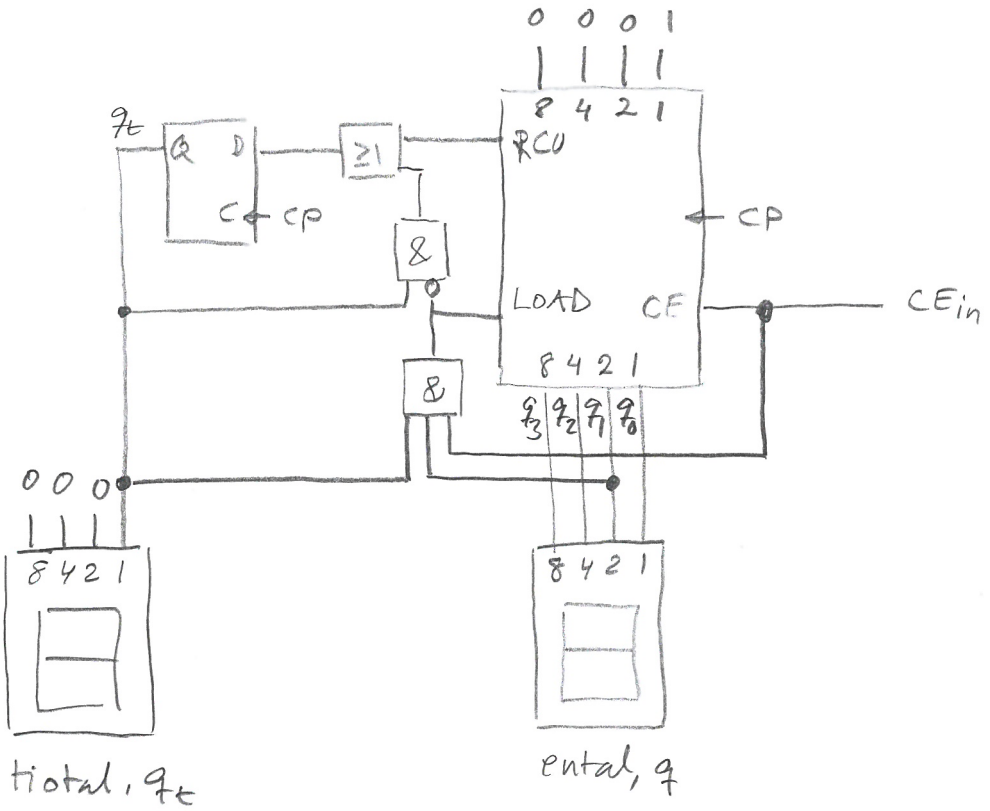
nr	q_1 q_0 $x_1x_2x_3$	q_1^+ q_0^+/u_1u_0
0	0 0 000	0 0 / 0 0
4	0 0 100	0 1 / 0 0
8	0 1 000	0 0 / 1 1
12	0 1 100	0 1 / 0 0
14	0 1 110	1 1 / 0 0
16	1 0 000	0 0 / 0 0
20	1 0 100	1 0 / 0 0
22	1 0 110	1 0 / 0 0
23	1 0 111	1 0 / 0 0
28	1 1 100	1 0 / 0 1
30	1 1 110	1 1 / 0 0
31	1 1 111	1 0 / 1 0
	f.ö.	- - / - -

Uppgift 5 forts



Uppgift 6





Scenario

Insignal CEin		0	1	0	1	0		0	1	0	0		0	1	0								
Tillstånd/ utsignal	q	1	1	2	2	3	...	9	9	0	0	...	2	2	1	...							
	q_t	0	0	0	0	0		0	0	1	1		1	1	0								
Räknare	CE	0	1	0	1	0		0	1	0	0		0	1	0								
	LOAD	0	0	0	0	0		0	0	0	0		0	1	0								
	RCO	0	0	0	0	0		0	1	0	0		0	0	0								

Entalet

Låt räknarens tillstånd $q = (q_3, q_2, q_1, q_0)$ vara entalet.

Räknarens styrsignaler

① : $CE = CE_{in}$

② : $LOAD = (q = 2)$ och $(q_t = 1)$ och $(CE_{in} = 1) =$

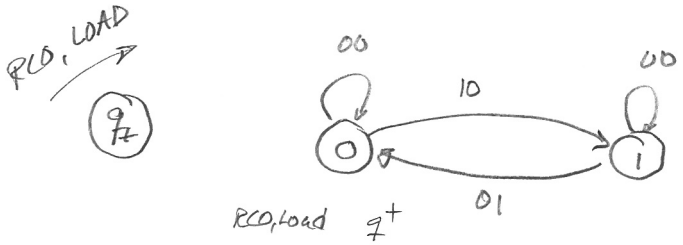
$= q_1 q_t CE_{in}$

Data in $= 1_{10} = (0001)_2$

Tiotalet q_t

③ : Sätt q_t till 1 då $RCO = 1$

④ : Sätt q_t till 0 då $LOAD = 1$



RCO, load / q^+	00	01	11	10
q_t = 0	0	–	–	1
q_t = 1	1	0	–	–

$$q_t = RCO + q_t \cdot LOAD'$$