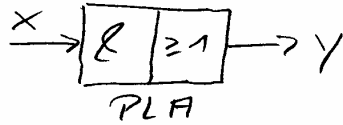
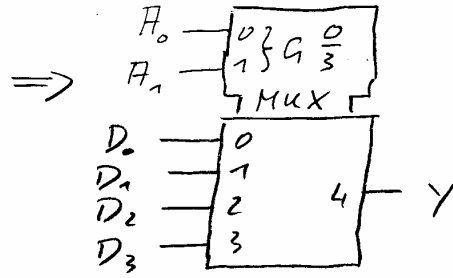


①

a)



$X = (D_3 D_2 D_1 D_0)$



X

b)

i	A <sub>1</sub> A <sub>0</sub>	Y	P <sub>i</sub>
0	0 0	D <sub>0</sub>	$\bar{A}_1 \bar{A}_0 D_0 = P_0$
1	0 1	D <sub>1</sub>	$\bar{A}_1 A_0 D_1 = P_1$
2	1 0	D <sub>2</sub>	$A_1 \bar{A}_0 D_2 = P_2$
3	1 1	D <sub>3</sub>	$A_1 A_0 D_3 = P_3$

Dual-Code

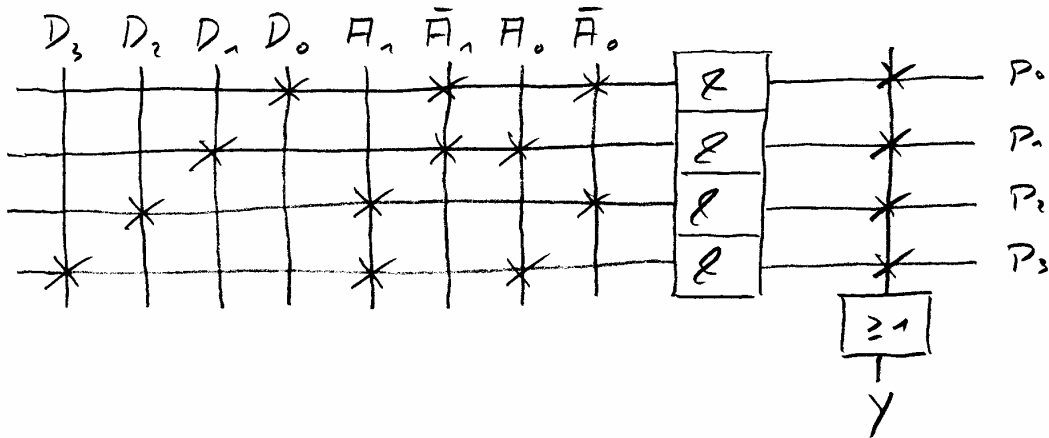
XX

c)

$Y = P_0 + P_1 + P_2 + P_3$

X

d)

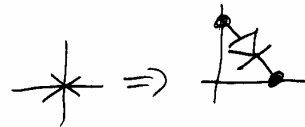


XXX

e)



UND-Dioden-  
verknüpfung

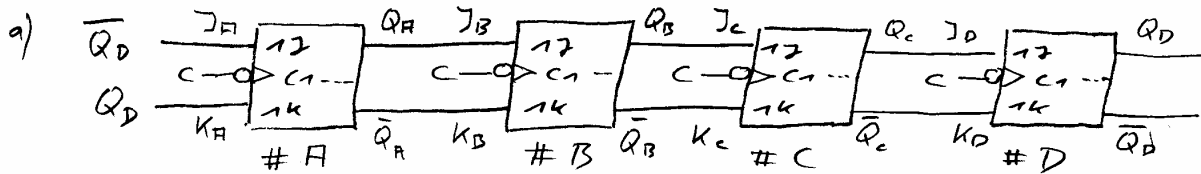


ODER-Dioden-  
Verknüpfung

X

8

(2)



b)

$$J_A = \bar{Q}_D \quad J_B = Q_A \quad J_C = Q_B \quad J_D = Q_C$$

$$K_A = Q_D \quad K_B = \bar{Q}_A \quad K_C = \bar{Q}_B \quad K_D = \bar{Q}_C \quad \text{XX}$$

c)

J	K	$Q^{(k+1)}$	
0	0	$Q^{(k)}$	hold
1	0	1	set
0	1	0	reset
1	1	$\bar{Q}^{(k)}$	toggle

$$Q^{(k+1)} = \bar{K}Q + J\bar{Q}$$

X (3)

X

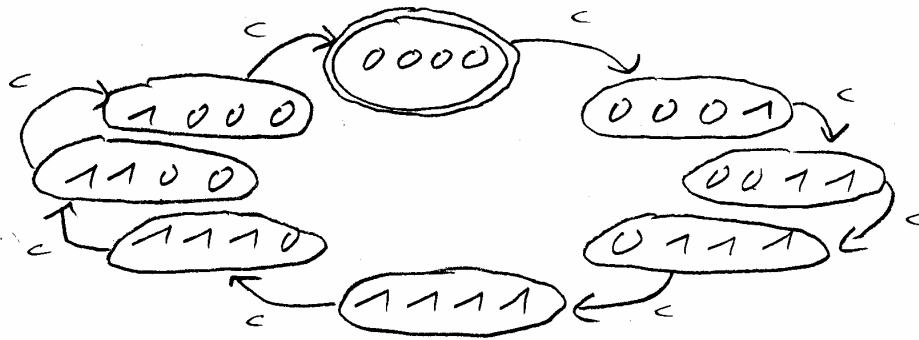
d)

k	$Q^{(k)}$				$J_D K_D$		$J_C K_C$		$J_B K_B$		$J_A K_A$		$Q_D^{(k+1)}$	$Q_C^{(k+1)}$	$Q_B^{(k+1)}$	$Q_A^{(k+1)}$	
	$Q_D$	$Q_C$	$Q_B$	$Q_A$	reset	set	reset	set	reset	set	reset	set					
init	0	0	0	0	0	1	0	1	0	1	1	0	0	0	0	1	0
1	0	0	0	1	0	1	0	1	1	0	1	0	0	0	1	1	X
2	0	0	1	1	0	1	1	0	1	0	1	0	0	1	1	1	X
3	0	1	1	1	1	0	1	0	1	0	1	0	1	1	1	1	X
4	1	1	1	1	1	0	1	0	1	0	0	1	1	1	1	0	X
5	1	1	1	0	1	0	1	0	0	1	0	1	1	1	0	0	X
6	1	1	0	0	1	0	0	1	0	1	0	1	1	0	0	0	X
7	1	0	0	0	0	1	0	1	0	1	0	1	0	0	0	0	X
8	0	0	0	0	0	1	0	1	0	1	1	0	0	0	0	1	

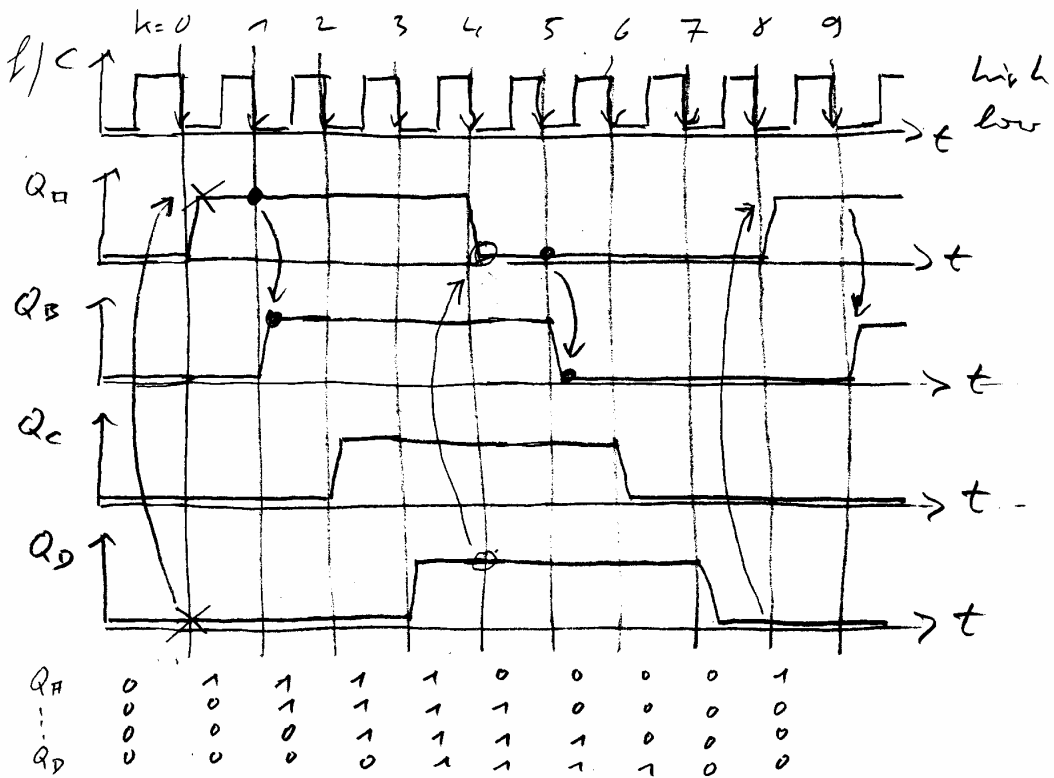
$Q_C \bar{Q}_C \quad Q_B \bar{Q}_B \quad Q_A \bar{Q}_A \quad \bar{Q}_D \bar{Q}_D$

(10)

e)  $Z = (Q_D Q_C Q_B Q_A)$  ; [decimal: 0 → 1 → 3 → 7 → 15 →  
→ 14 → 12 → 8 → 0 →]



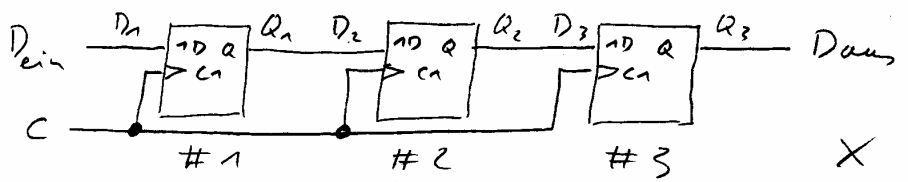
XX  
(2)



X  
X  
X  
X  
X  
(5)

⇒ Ringzähler in 8 Schritten zu 4 Bit

③ b)  $D_1 = D_{\text{ein}}$  a)  
 $D_2 = Q_1$   
 $D_3 = Q_2$   
 $D_{\text{aus}} = Q_3$



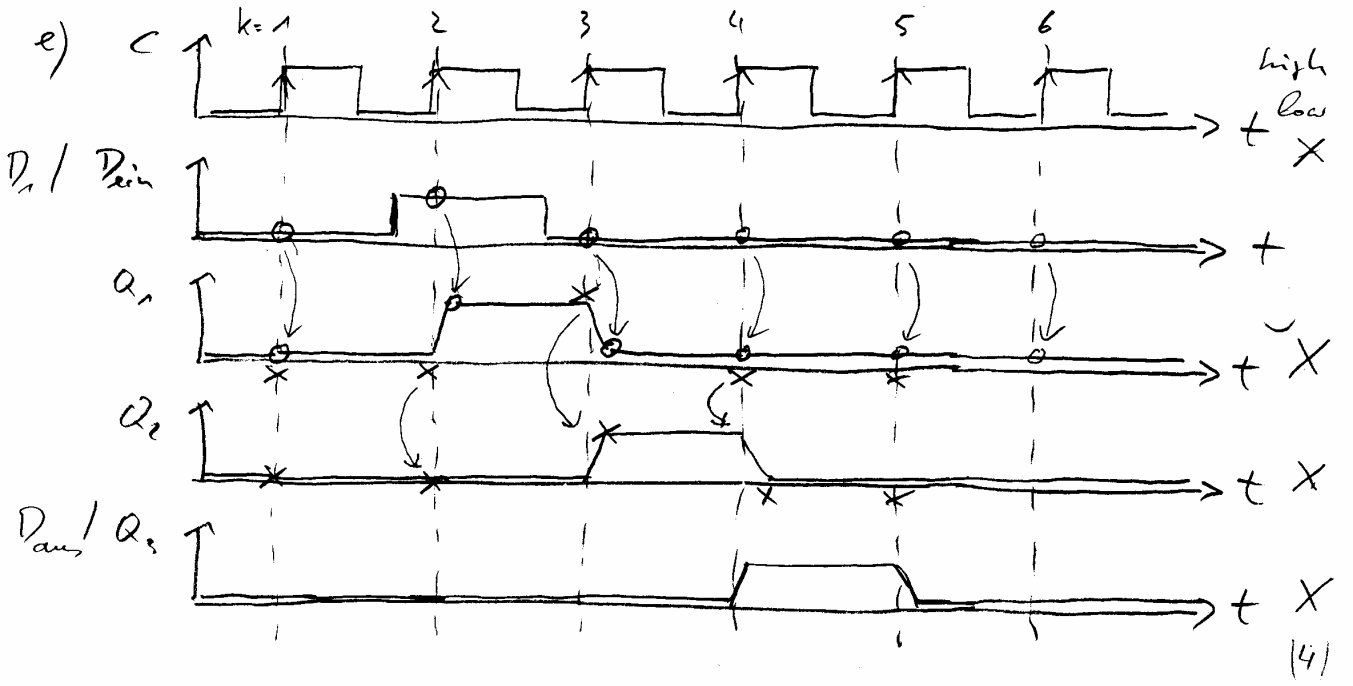
c)  $Q^{(k+1)} = D^{(k)}$   
 $D_n^{(k)}: D_1^{(1)} = 0, D_1^{(2)} = 1, D_1^{(3)} = 0, D_1^{(4)} = 0$

D	$Q^{(k+1)}$	reset
0	0	ut
1	1	ut

d)

K	$Q_1$	$Q_2$	$Q_3$	$D_1$	$D_2$	$D_3$	$Q_1^{(k+1)}$	$Q_2^{(k+1)}$	$Q_3^{(k+1)}$
1	0	0	0	0	0	0	0	0	0
2	0	0	0	1	0	0	1	0	0
3	1	0	0	0	1	0	0	1	0
4	0	1	0	0	0	1	0	0	1
5	0	0	1	0			0	0	0

$D_{\text{ein}} \quad Q_1 \quad Q_2$   $D_{\text{aus}} \quad (6)$



⇒ 3-Bit-Schieberegister (von links nach rechts)