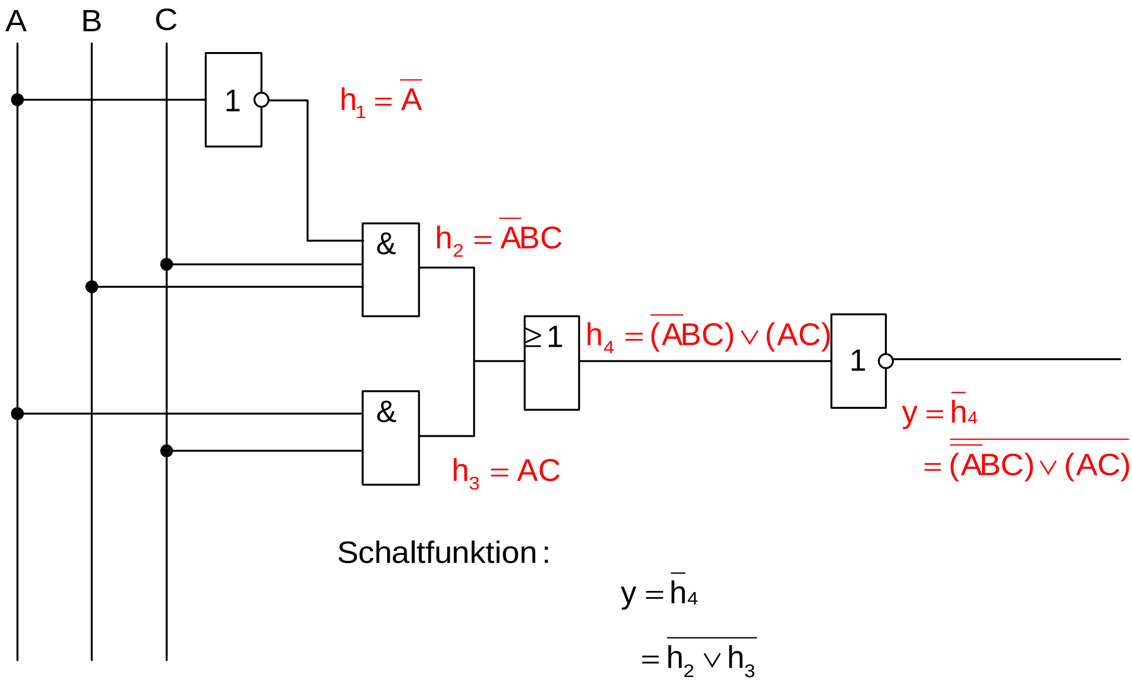
Schaltnetzanalyse



Schaltfunktion:

$$
\begin{aligned}
y &= \overline{h_4} \\
&= \overline{h_2 \vee h_3} \\
&= \overline{(h_1BC) \vee (AC)} \\
&= \overline{(\overline{A}BC) \vee (AC)}
\end{aligned}
$$

Wahrheitstabelle:

A	B	C	$h_1 = \overline{A}$	$h_2 = \overline{A}BC$	$h_3 = AC$	$h_4 = h_2 \vee h_3$	$y = \overline{h_4}$
0	0	0	1	0	0	0	1
0	0	1	1	0	0	0	1
0	1	0	1	0	0	0	1
0	1	1	1	1	0	1	0
1	0	0	0	0	0	0	1
1	0	1	0	0	1	1	0
1	1	0	0	0	0	0	1
1	1	1	0	0	1	1	0

$$A \cdot B = B \cdot A$$
$$A \vee B = B \vee A$$

Kommutativgesetze

$$A \cdot (B \cdot C) = (A \cdot B) \cdot C$$
$$A \vee (B \vee C) = (A \vee B) \vee C$$

Assoziativgesetze

$$A \cdot (B \vee C) = (A \cdot B) \vee (A \cdot C)$$
$$A \vee (B \cdot C) = (A \vee B) \cdot (A \vee C)$$

Distributivgesetze

$$A \cdot \overline{A} = 0$$
$$A \vee \overline{A} = 1$$

$$\overline{\overline{A}} = A$$

$$A \cdot A = A$$
$$A \vee A = A$$

$$A \cdot 1 = A \qquad A \cdot 0 = 0$$
$$A \vee 1 = 1 \qquad A \vee 0 = A$$

$$\overline{A \vee B \vee C \vee D} = \overline{A} \cdot \overline{B} \cdot \overline{C} \cdot \overline{D}$$
$$\overline{A \cdot B \cdot C \cdot D} = \overline{A} \vee \overline{B} \vee \overline{C} \vee \overline{D}$$

DeMorgansche Regeln

A	B	C	y	Minterme (Vollkonjunktionen)
0	0	0	1	$\overline{A}\,\overline{B}\,\overline{C}$
0	0	1	1	$\overline{A}\,\overline{B}C$
0	1	0	1	$\overline{A}B\overline{C}$
0	1	1	0	
1	0	0	1	$A\overline{B}\,\overline{C}$
1	0	1	0	
1	1	0	1	$AB\overline{C}$
1	1	1	0	ABC

Kanonische Disjunktive Normalform (KDNF):

$$y = \overline{A}\,\overline{B}\,\overline{C} \vee \overline{A}\,\overline{B}C \vee \overline{A}B\overline{C} \vee A\overline{B}\,\overline{C} \vee AB\overline{C} \vee ABC$$

KV-Diagramm hat stets so viele Plätze, wie Minterme möglich sind:

	A	$\bar{A}$
B	AB	$\bar{A}B$
$\bar{B}$	$A\bar{B}$	$\bar{A}\bar{B}$

	A	A	$\bar{A}$	$\bar{A}$
B				
$\bar{B}$				
	$\bar{C}$	C	C	$\bar{C}$

	A	A	$\bar{A}$	$\bar{A}$	
B					$\bar{D}$
B					D
$\bar{B}$					D
$\bar{B}$					$\bar{D}$
	$\bar{C}$	C	C	$\bar{C}$	

Für jeden in der KDNF vorkommenden Minterm 1 im KV-Diagramm:

	A	$\bar{A}$
B	0	0
$\bar{B}$	1	1

KDNF: $y = (A\bar{B}) \vee (\bar{A}\bar{B})$

Zuordnung der Variablen so, daß benachbarte Diagrammplätze sich nur in <u>genau einer Variablen</u> unterscheiden:

	A	$\bar{A}$
B	0	0
$\bar{B}$	1	1

	$\bar{A}$	A
B	0	0
$\bar{B}$	1	1

	$\bar{A}$	A
$\bar{B}$	1	1
B	0	0

	B	$\bar{B}$
A	0	1
$\bar{A}$	0	1

	A	A	$\bar{A}$	$\bar{A}$
B		1	1	
$\bar{B}$				
	$\bar{C}$	C	C	$\bar{C}$

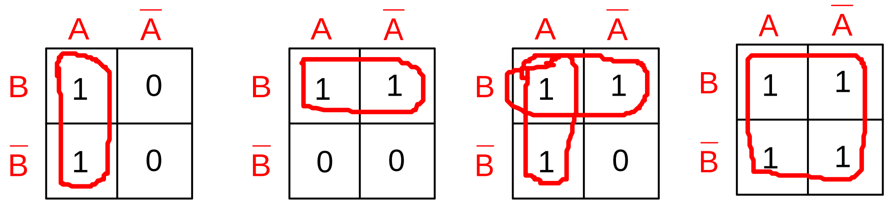
	$\bar{A}$	$\bar{A}$	A	A
B	1			1
$\bar{B}$				
	C	$\bar{C}$	$\bar{C}$	C

	$\bar{A}$	$\bar{A}$	A	A
B	1		1	
$\bar{B}$				
	C	$\bar{C}$	C	$\bar{C}$

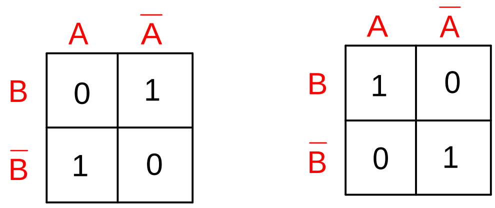
$$y = (ABC) \vee (\bar{A}BC) = (A \vee \bar{A})BC = BC$$

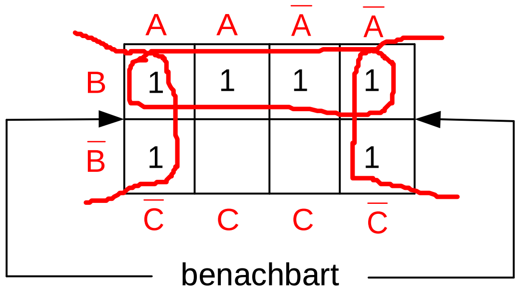
Benachbarte Minterme zu Päckchen zusammenfassen. Ein Päckchen darf nur 2er Potenzen (2, 4, 8, 16, ...) von Mintermen enthalten.

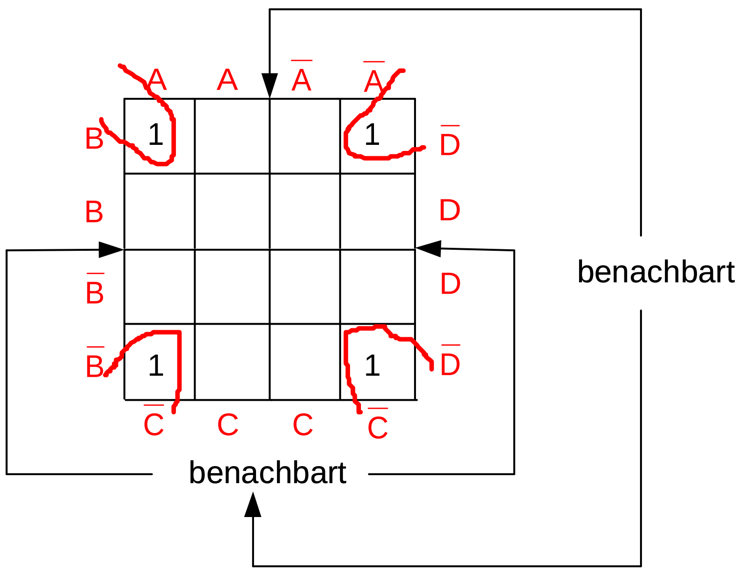
benachbart



nicht benachbart

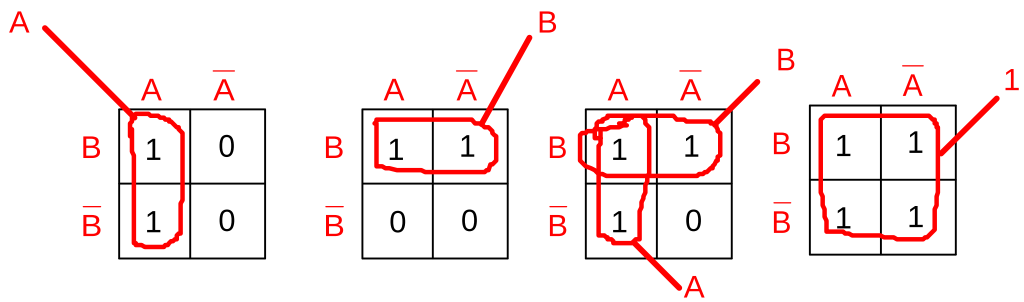




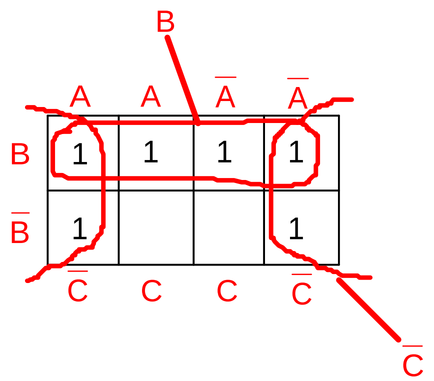


<u>Päckcheninhalt</u>: Variablen, die sowohl einfach als auch negiert vorkommen, entfallen.

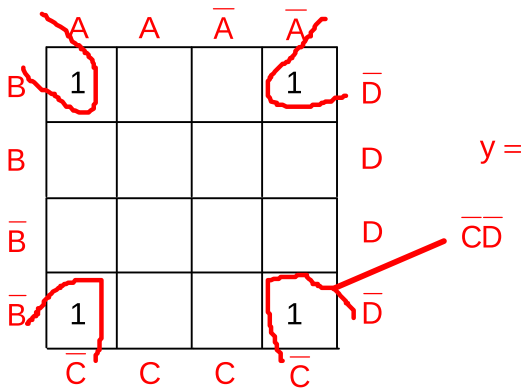
<u>Vereinfachte Schaltfunktion y:</u>
<u>V</u>ereinfachte <u>K</u>anonische <u>D</u>isjunktive <u>N</u>ormalform (<u>VKDNF</u>) :
Disjunktive (ODER) Verknüpfung der Päckcheninhalte.



$y = A$ $\quad y = B$ $\quad y = A \vee B$ $\quad y = 1$

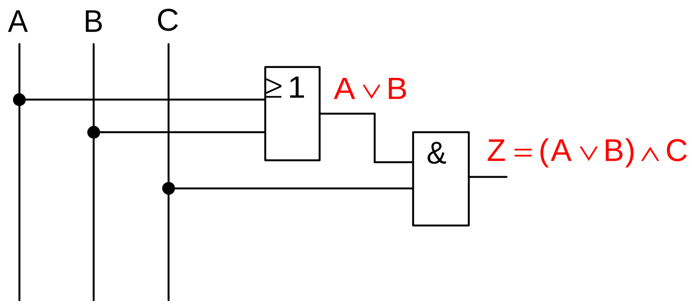


$y = B \vee \overline{C}$

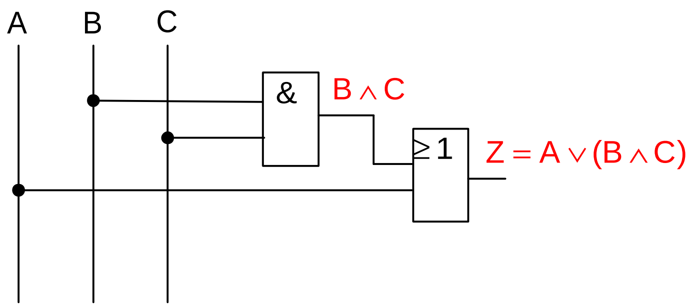


$y = \overline{C}\,\overline{D}$

$$Z = A \vee B \wedge C$$



C	B	A	Z
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	0
1	0	0	0
1	0	1	1
1	1	0	1
1	1	1	1



C	B	A	Z
0	0	0	0
0	0	1	1
0	1	0	0
0	1	1	1
1	0	0	0
1	0	1	1
1	1	0	1
1	1	1	1

Punktrechnung vor Strichrechnung:

$$Z = A \vee B \wedge C = A \vee (B \wedge C)$$