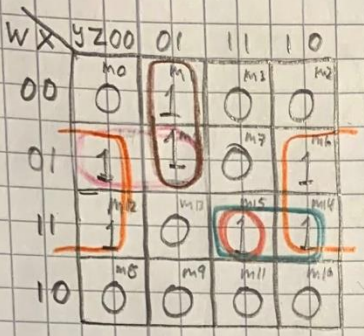
Greining og hönnun stafrænna rása

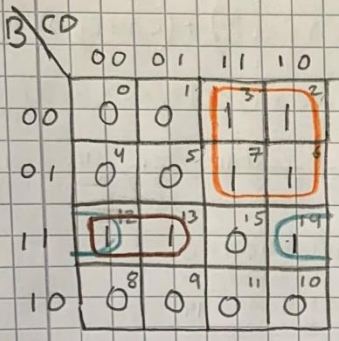
3.5 Simplify the following Boolean functions using four-variable maps:

a) $F(w,x,y,z) = \Sigma(1,4,5,6,12,14,15)$



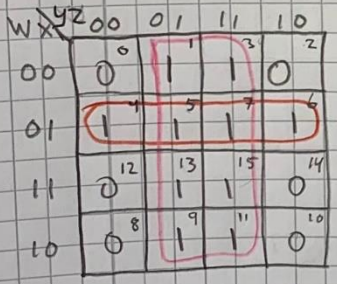
$F = x\bar{z} + \bar{w}\bar{y}z + wxy$

b) $F(A,B,C,D) = \Sigma(2,3,6,7,12,13,14)$



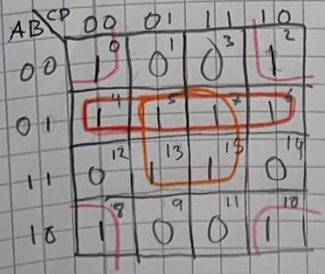
$F = \bar{A}C + AB\bar{D} + AB\bar{C}$

c) $F(w,x,y,z) = \Sigma(1,3,4,5,6,7,9,11,13,15)$



$F = z + \bar{w}x$

d) $F(A,B,C,D) = \Sigma(0,2,4,5,6,7,8,10,13,15)$

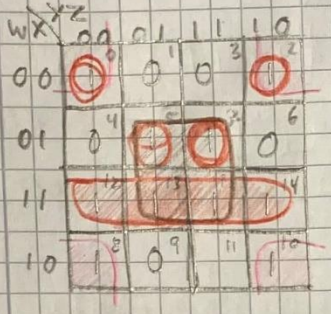


$F = \bar{B}\bar{D} + \bar{A}B + BD$

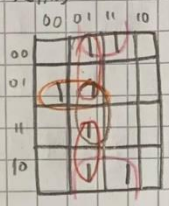
3.10 Simplify the following Boolean functions by first finding the EPI:

a) $F(w,x,y,z) = \Sigma(0,2,5,7,8,10,12,13,14,15)$

NB: EPI: verður að vera á sínu einfaldasta formi.



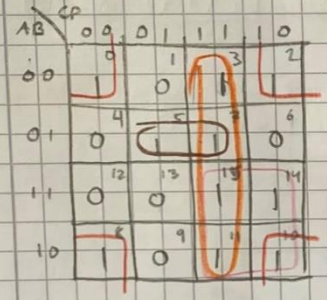
Aftur:



= PI: $\bar{x}\bar{z}, \bar{x}z$

$F = \bar{x}\bar{z} + xz + wx$

b) $F(A,B,C,D) = \Sigma(0,2,3,5,7,8,10,11,14,15)$



$F = B\bar{D} + AC + \bar{A}BD + CD$

3.16 Simplify the following functions, and implement them with two-level NAND gate circuits:

a) $F(A,B,C,D) = A\bar{C}\bar{D} + \bar{A}C + ABC + A\bar{B}C + \bar{A}\bar{C}\bar{D}$

$C\bar{D}(A+\bar{A}) + \quad AC(B+\bar{B}) \quad + \bar{A}C$

$\bar{C}\bar{D} + AC + \bar{A}C$

$\bar{C}\bar{D} + \quad C(A+\bar{A})$

$\bar{C}\bar{D} + C$

AND-OR uppsetning

NAND-Invert-OR uppsetning

NAND-NAND UPPSETNING

BRUNNEN

b) $F(A,B,C,D) = \overline{\bar{A}\bar{B}\bar{C}D + CD + A\bar{C}\bar{D}}$

$(A+B+C+\bar{D})(C+\bar{D})(\bar{A}+C+\bar{D})$

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

$C\bar{C} \to 0$, $\bar{D}\bar{D} \to \bar{D}$

$(A\bar{C} + A\bar{D} + B\bar{C} + B\bar{D} + C\bar{D} + \bar{D}\bar{C} + \bar{D})(\bar{A} + C + \bar{D})$

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

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

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

$1 + X = 1$

$0 \cdot X = 0$

$X \cdot X = X$

$X \cdot 1 = X$

$X \cdot \bar{X} = 0$

$= A\bar{C}\bar{D} + AC\bar{D} + A\bar{D} + \bar{A}B\bar{C} + B\bar{C}\bar{D} + \bar{A}B\bar{D} + BC\bar{D} + B\bar{D} + \bar{A}C\bar{D} + C\bar{D} + C\bar{D}$

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

$\bar{C}\bar{D}(A+\bar{A})$ $C\bar{D}(A+\bar{A})$ $\bar{C}\bar{D}(1+B)$ $\bar{D}(A+\bar{A})$ $\bar{D}(1+C)$

$C\bar{D}$

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

$\bar{C}\bar{D} + C\bar{D} + \bar{D} + B\bar{D}(1+\bar{A}) + \bar{A}B\bar{C} + B\bar{D}(1+C)$

$\bar{D}(C+\bar{C}) + \bar{D} + B\bar{D} + \bar{A}B\bar{C} + B\bar{D}$

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

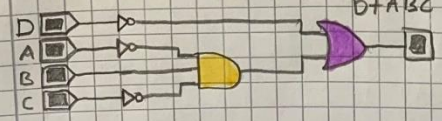
$\bar{D} + B\bar{D} + \bar{A}B\bar{C}$

$\bar{D}(1+B) + \bar{A}B\bar{C}$

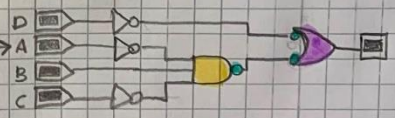
$\bar{D} + \bar{A}B\bar{C}$

AND-OR Uppsetning

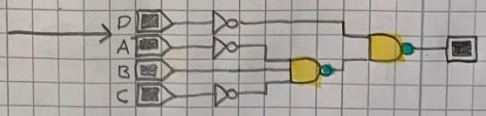
$\bar{D} + \bar{A}B\bar{C}$



NAND-Invert-OR



NAND-NAND



d)

$F(A,B,C,D) = \bar{A} + B + \bar{D} + \bar{B}C$

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

$\bar{A} \cdot \bar{B} \cdot \bar{D} \cdot (\bar{B} + \bar{C})$

$(A\bar{B}D)(B + \bar{C})$

$\bar{B} \cdot B = 0$

$X \cdot 0 = 0$

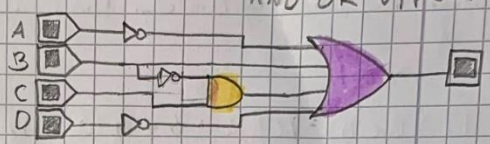
$A\bar{B}BD + A\bar{B}\bar{C}D$

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

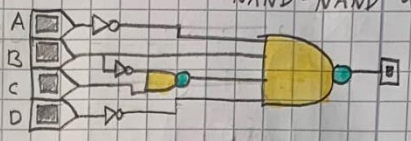
$\bar{A} + \bar{\bar{B}} + \bar{\bar{C}} + \bar{D}$

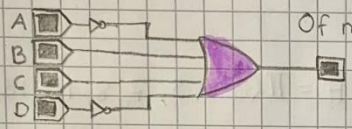
$\bar{A} + B + C + \bar{D}$

AND-OR Uppsetning



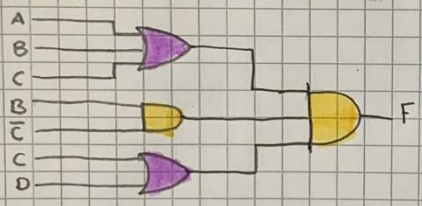
NAND-NAND uppsetning



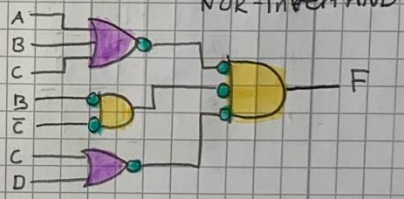


Of mikil einföldun fyrir tveggja NAND uppsetningu.

3.A 0 Convert the following logic to an equivalent NOR-NOR circuit

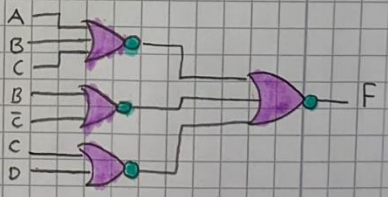


NOR-InvertAND



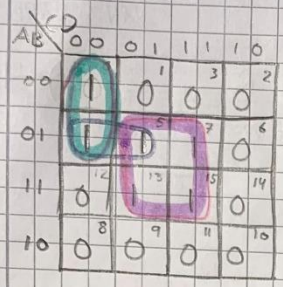
NB = Invert-AND ≡ NOR

NB = Invert-OR ≡ NAND



3. A 1 Convert the following Boolean functions from a sum-of product form to a simplified product of sums form.

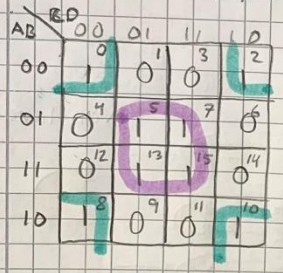
i) $F(A,B,C,D) = \Sigma(1,2,3,6,8,9,10,11,12,14) \longrightarrow = \Pi(0,4,5,7,13,15)$



POS

$\overline{F} = \overline{A}B\overline{C} + \overline{A}\,\overline{C}\,\overline{D}$

ii) $F(A,B,C,D) = \Sigma(1,3,4,6,9,11,12,14) \longrightarrow \overline{F} = \Pi(0,2,5,7,8,10,13,15)$



$\overline{F} = BD + \overline{B}\,\overline{D}$