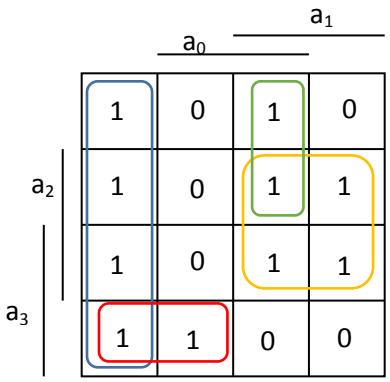
Štruktúrna syntéza KLO

Navrhnite obvod, ktorý určuje deliteľnosť binárneho čísla A(a_3, a_2, a_1, a_0) číslom 3 alebo 4 alebo 7.

Obvod zostavte z členov typu: a) NAND, b) NOR.

Za optimálny považujte obvod z minimálnym súčtom vstupov všetkých členov.



IDNF ≡ MDNF

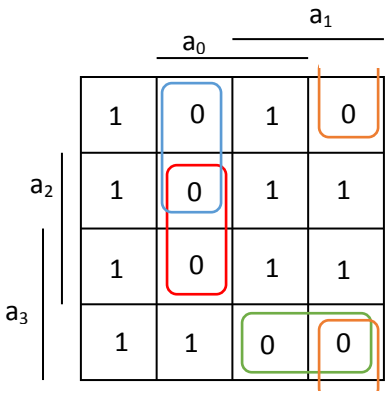
$f = \bar{a}_1 . \bar{a}_0 + a_1 . a_2 + \bar{a}_3 . a_1 . a_0 + a_3 . \bar{a}_2 . \bar{a}_1$

Počet vstupov: 2x2+2x3+1x4+4x1=18 MNF v BA

Faktorizácia:

$f = \bar{a}_1 . (\bar{a}_0 + a_3 . a_2) + a_1 . (a_2 + \bar{a}_3 . a_0)$

Počet vstupov: 7x2+3x1=17



IKNF ≡ MKNF

$f = (a_3 + a_1 + \bar{a}_0) . (\bar{a}_2 + a_1 + \bar{a}_0) . (\bar{a}_3 + a_2 + \bar{a}_1) . (a_2 + \bar{a}_1 + a_0)$

Počet vstupov: 4x3+1x4+3x1=19

Faktorizácia:

$f = (a_1 + \bar{a}_0 + a_3 . \bar{a}_2) . (a_2 + \bar{a}_1 + \bar{a}_3 . a_0)$

Počet vstupov: 2x2+2x3+1x2+3x1=15 minimálne vyjadrenie v BA

SA:

1.SNF sa získa z MDNF

$f = \overline{a_1} . \overline{a_0} + a_1 . a_2 + \overline{a_3} . a_1 . a_0 + a_3 . \overline{a_2} . \overline{a_1}$

$f = (\overline{a_1} | \overline{a_0}) | (a_1 | a_2) | (\overline{a_3} | a_1 | a_0) | (a_3 | \overline{a_2} | \overline{a_1})$

Počet vstupov: 2x2+2x3+1x4+4x1=18 MSNF

2.SNF sa získa z MKNF

$f = (a_3 + a_1 + \overline{a_0}) . (\overline{a_2} + a_1 + \overline{a_0}) . (\overline{a_3} + a_2 + \overline{a_1}) . (a_2 + \overline{a_1} + a_0)$

$f = \{ (\overline{a_3} | \overline{a_1} | a_0) | (a_2 | \overline{a_1} | a_0) | (a_3 | \overline{a_2} | a_1) | (\overline{a_2} | a_1 | \overline{a_0}) \} |$

Počet vstupov: 4x3+1x4+4x1+1x1=21

Faktorizované vyjadrenia:

z: $f = \overline{a_1} . (\overline{a_0} + a_3 . a_2) + a_1 . (a_2 + \overline{a_3} . a_0)$

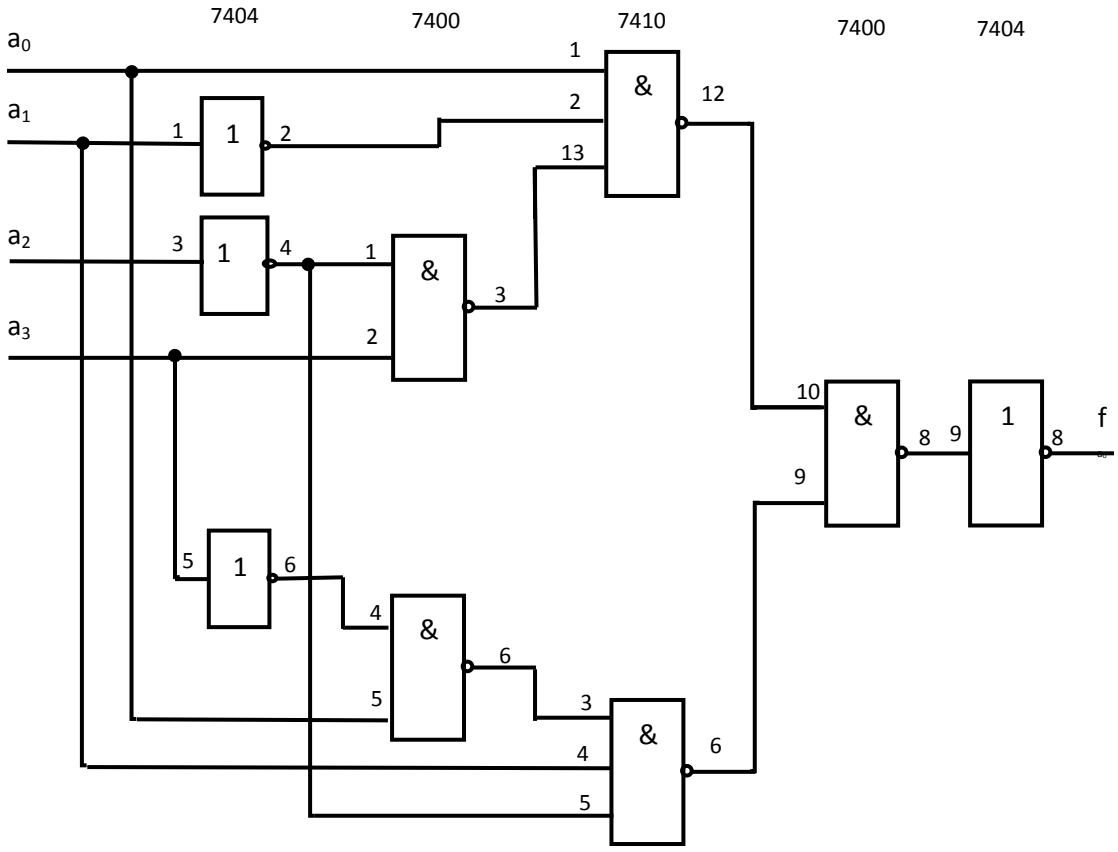
$f = \{ \overline{a_1} | [a_0 | (a_3 | a_2)] \} | \{ a_1 | [\overline{a_2} | (\overline{a_3} | a_0)] \}$

Počet vstupov: 7x2+3x1=17

z: $f = (a_1 + \overline{a_0} + a_3 . \overline{a_2}) . (a_2 + \overline{a_1} + \overline{a_3} . a_0)$

$f = [(\overline{a_1} | a_0 | (a_3 | \overline{a_2})] | [(\overline{a_2} | a_1 | (\overline{a_3} | a_0)] |$

Počet vstupov: 2x2+2x3+1x2+3x1+1x1=16 - minimálne vyjadrenie v SA



PA:

1.PNF sa získa z MKNF

$f = (a_3 + a_1 + \overline{a_0}).(\overline{a_2} + a_1 + \overline{a_0}).(\overline{a_3} + a_2 + \overline{a_1}).(a_2 + \overline{a_1} + a_0)$

$f = (a_3 \downarrow a_1 \downarrow \overline{a_0}) \downarrow (\overline{a_2} \downarrow a_1 \downarrow \overline{a_0}) \downarrow (\overline{a_3} \downarrow a_2 \downarrow \overline{a_1}) \downarrow (a_2 \downarrow \overline{a_1} \downarrow a_0)$

Počet vstupov: 4x3+1x4+4x1=20

2.PNF sa získa z MDNF

$f = \overline{a_1}.\overline{a_0} + a_1.a_2 + \overline{a_3}.a_1.a_0 + a_3.\overline{a_2}.\overline{a_1}$

$f = [(a_1 \downarrow a_0) | (\overline{a_1} \downarrow \overline{a_2}) \downarrow (a_3 \downarrow \overline{a_1} \downarrow \overline{a_0}) \downarrow (\overline{a_3} \downarrow a_2 \downarrow a_1)] \downarrow$

Počet vstupov: 2x2+2x3+1x4+4x1+1x1=19 MPNF

Faktorizované vyjadrenia:

z: $f = \overline{a_1}.(\overline{a_0} + a_3.a_2) + a_1.(a_2 + \overline{a_3}.a_0)$

$f = \{\{a_1 \downarrow [\overline{a_0} \downarrow (\overline{a_3} \downarrow \overline{a_2})]\} \downarrow \{\overline{a_1} \downarrow [a_2 \downarrow (a_3 \downarrow \overline{a_0})]\}\} \downarrow$

$f = \overline{a_1}.(\overline{a_0} + a_3.a_2) + a_1.(a_2 + \overline{a_3}.a_0)$

Počet vstupov: 7x2+3x1+1X1=18

z: $f = (a_1 + \overline{a_0} + a_3.\overline{a_2}).(a_2 + \overline{a_1} + \overline{a_3}.a_0)$

$f = [(a_1 \downarrow \overline{a_0} \downarrow (\overline{a_3} \downarrow a_2)] \downarrow [a_2 \downarrow \overline{a_1} \downarrow (a_3 \downarrow \overline{a_0})]$

Počet vstupov: 2x2+2x3+1x2+3x1=15 - minimálne vyjadrenie