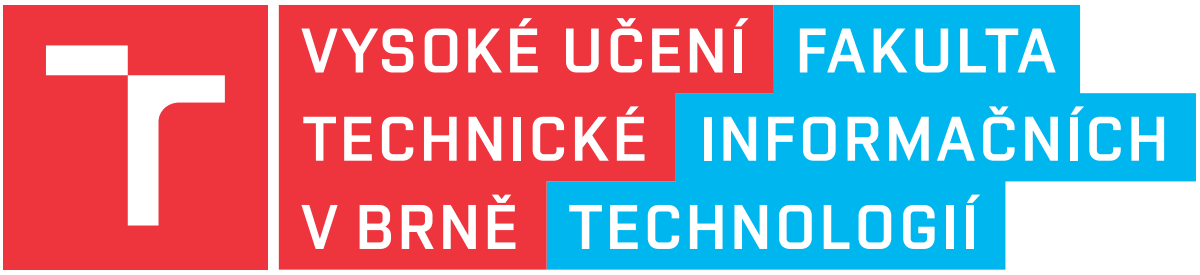


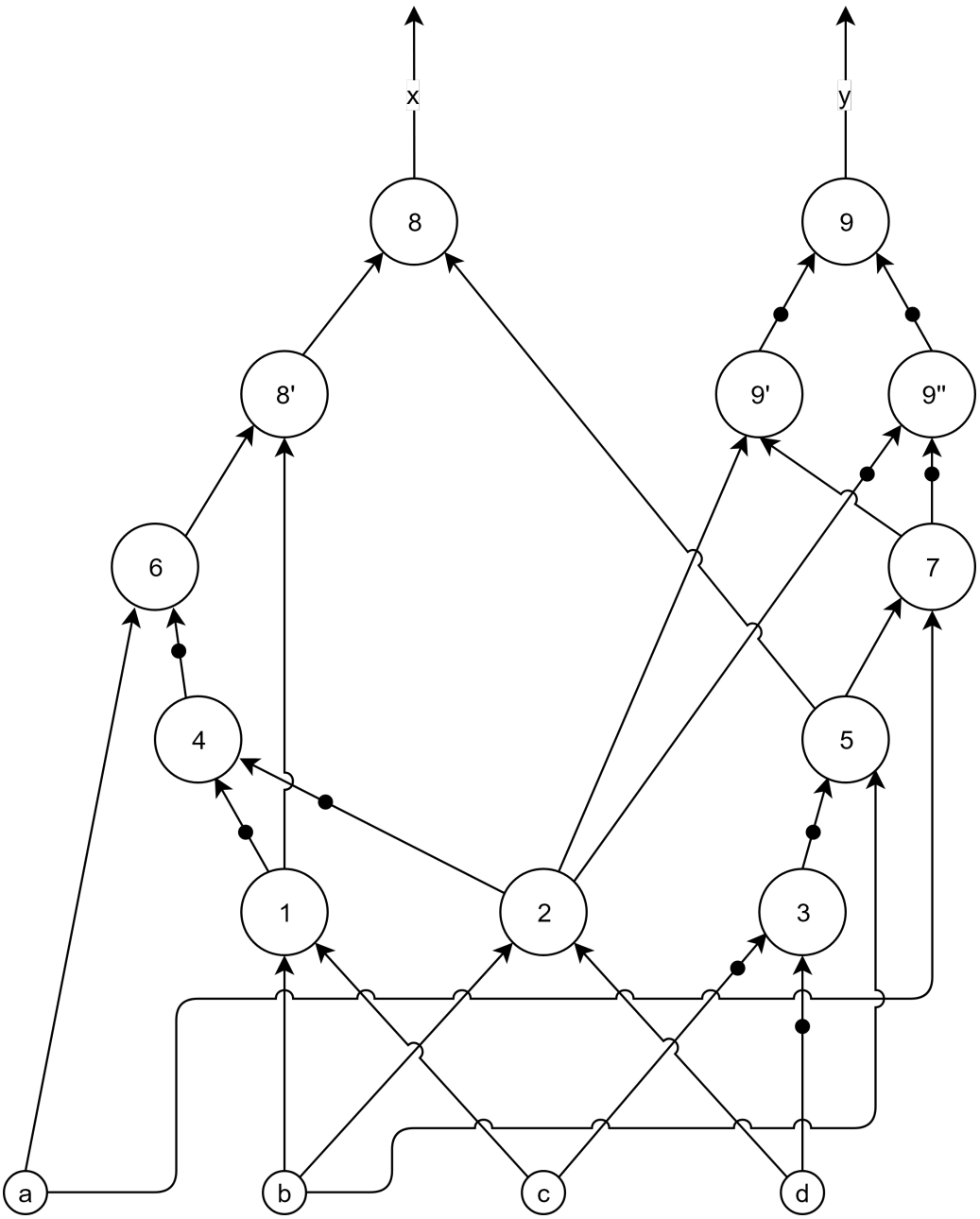
Pokročilé číslicové systémy (PCS)

1. projekt

v Brně
1. prosince 2019

Václav Martinka
xmarti76

1. úkol



Obrázek 1: AIG graf

2. úkol

Uzel 6

$MFFC(6) = \{4\}$

$Leaves_0 = \{6\}, Visited_0 = \{6\}$
$Leaves_1 = \{a, 4\}, Visited_0 = \{a, 4, 6\}$
$Leaves_2 = \{a, 1, 2\}, Visited_0 = \{a, 1, 2, 4, 6\}$
$Leaves_3 = \{a, b, c, 2\}, Visited_0 = \{a, b, c, 1, 2, 4, 6\}$

$C(6) = \{a, b, c, 2\}$
$D(6) = \{a, b, c, 1, 2, 3, 6, 7, 9', 9''\}$

$f_a = a$
$f_b = b$
$f_c = c$
$f_1 = b \wedge c$
$f_2 = b \wedge d$
$f_3 = c' \wedge d'$
$f_6 = a \wedge b \wedge (c \vee d)$
$f_7 = a \wedge b \wedge (c \vee d)$
$f_{9'} = a \wedge b \wedge d$
$f_{9''} = (b' \vee d') \wedge (a' \vee b' \vee (c' \wedge d'))$

Uzel 7

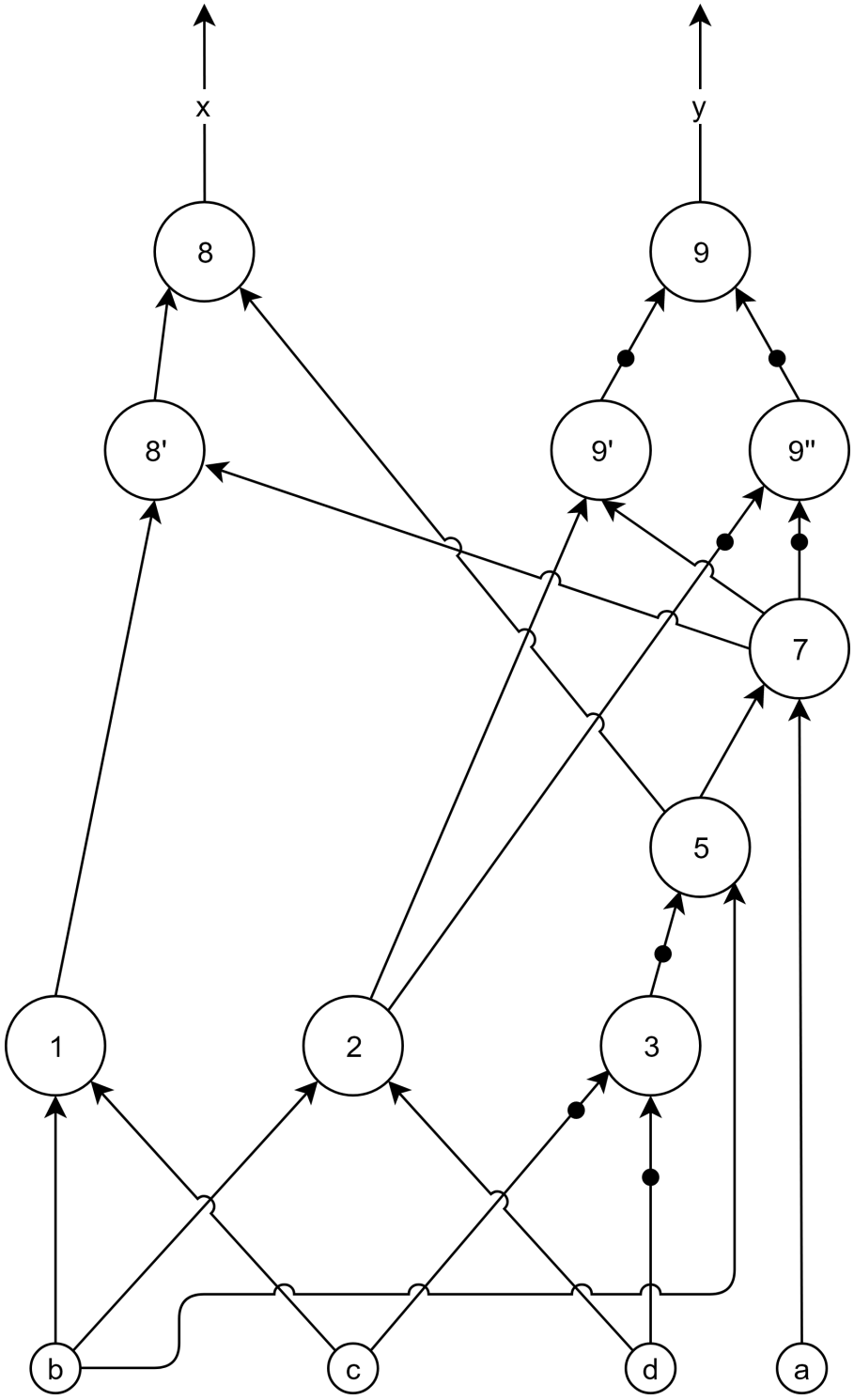
$MFFC(7) = \emptyset$

$Leaves_0 = \{7\}, Visited_0 = \{7\}$
$Leaves_1 = \{a, 5\}, Visited_0 = \{a, 5, 7\}$
$Leaves_2 = \{a, b, 3\}, Visited_0 = \{a, b, 3, 5, 7\}$
$Leaves_3 = \{a, b, c, d\}, Visited_0 = \{a, b, c, d, 3, 5, 7\}$

$C(7) = \{a, b, c, d\}$
$D(7) = \{a, b, c, d, 1, 2, 3, 5, 6, 7\}$

$f_a = a$
$f_b = b$
$f_c = c$
$f_d = d$
$f_1 = b \wedge c$
$f_2 = b \wedge d$
$f_3 = c' \wedge d'$
$f_5 = b \wedge (c \vee d)$
$f_6 = a \wedge b \wedge (c \vee d)$
$f_7 = a \wedge b \wedge (c \vee d)$

Je patrné, že uzly 6 a 7 popisují stejnou logickou funkci, tedy $f_6 = f_7$. Sestrojíme proto nový optimalizovaný AIG graf:



Obrázek 2: Optimalizovaný AIG graf

3. úkol

Pokud by se zaměnilo pořadí uzlů, tedy nahrazení uzlu `7` uzlem `6` bylo by nutné stále zachovat i uzel `4` na kterém je uzel `6` závislý.

4. úkol

$K = 4$

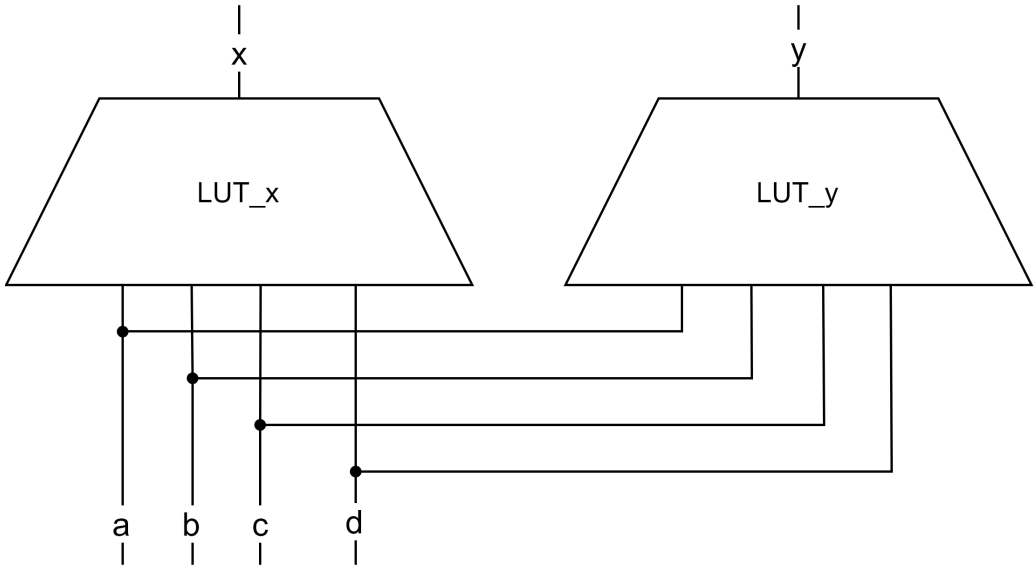
$C(a) = \{\{a\}\}$
$C(b) = \{\{b\}\}$
$C(c) = \{\{c\}\}$
$C(d) = \{\{d\}\}$
$C(1) = \{\{1\}, \{b, c\}\}$
$C(2) = \{\{2\}, \{b, d\}\}$
$C(3) = \{\{3\}, \{c, d\}\}$
$C(5) = \{\{5\}, \{b, 3\}, \{b, c, d\}\}$
$C(7) = \{\{7\}, \{a, 5\}, \{a, b, 3\}, \{a, b, c, d\}\}$
$C(8') = \{\{8'\}, \{1, 7\}, \{b, c, 7\}, \{a, 1, 5\}, \{a, b, c, 5\}, \{a, b, 1, 3\}, \{a, b, c, 3\}, \{a, b, c, d\}\}$
$C(8) = \{\{8\}, \{5, 8'\}, \{1, 5, 7\}, \{b, c, 5, 7\}, \{a, 1, 5\}, \{a, b, c, 5\}, \{b, 3, 8'\}, \{b, 1, 3, 7\}, \{b, c, 3, 7\}, \{a, b, 1, 3\}, \{a, b, c, 3\}, \{b, c, d, 8'\}, \{b, c, d, 7\}, \{a, b, c, d\}\}$
$C(9') = \{\{9'\}, \{2, 7\}, \{a, 2, 5\}, \{a, b, 2, 3\}, \{b, d, 7\}, \{a, b, d, 5\}, \{a, b, d, 3\}, \{a, b, c, d\}\}$
$C(9'') = \{\{9''\}, \{2, 7\}, \{a, 2, 5\}, \{a, b, 2, 3\}, \{b, d, 7\}, \{a, b, d, 5\}, \{a, b, d, 3\}, \{a, b, c, d\}\}$
$C(9) = \{\{9\}, \{9', 9''\}, \{2, 7\}, \{a, 2, 5\}, \{a, b, 2, 3\}, \{b, d, 7\}, \{a, b, d, 5\}, \{a, b, d, 3\}, \{a, b, c, d\}\}$

$M_0 = \emptyset, F_0 = \{8, 9\}$
$M_1 = \{8\}, F_1 = \{9\}$
$M_2 = \{8, 9\}, F_2 = \emptyset$

5. úkol

$a(a) = 0,\ r(a) = 2$
$a(b) = 0,\ r(b) = 2$
$a(c) = 0,\ r(c) = 2$
$a(d) = 0,\ r(d) = 2$
$a(1) = 1,\ r(1) = \infty$
$a(2) = 1,\ r(2) = \infty$
$a(3) = 1,\ r(3) = \infty$
$a(5) = 1,\ r(5) = \infty$
$a(7) = 1,\ r(7) = \infty$
$a(8') = 2,\ r(8') = \infty$
$a(8) = 2,\ r(8) = 3$
$a(9') = 2,\ r(9') = \infty$
$a(9'') = 2,\ r(9'') = \infty$
$a(9) = 3,\ r(9) = 3$

6. úkol



Obrázek 3: Schéma realizace

S	**a**	**b**	**c**	**d**	$F_x(a,b,c,d)$	$F_y(a,b,c,d)$
1	1	1	1	1	1	0
2	1	1	1	0	1	1
3	1	1	0	1	0	0
4	1	1	0	0	0	0
5	1	0	1	1	0	0
6	1	0	1	0	0	0
7	1	0	0	1	0	0
8	1	0	0	0	0	0
9	0	1	1	1	0	1
10	0	1	1	0	0	0
11	0	1	0	1	0	1
12	0	1	0	0	0	0
13	0	0	1	1	0	0
14	0	0	1	0	0	0
15	0	0	0	1	0	0
16	0	0	0	0	0	0

Tabulka 1: Funkce x a y realizované pomocí LUT_x a LUT_y

$$f_x = a \wedge b \wedge c$$

$$f_y = b \wedge ((a' \wedge d) \vee (a \wedge c \wedge d'))$$