



# Digitalna vezja UL, FRI



Vaja 3

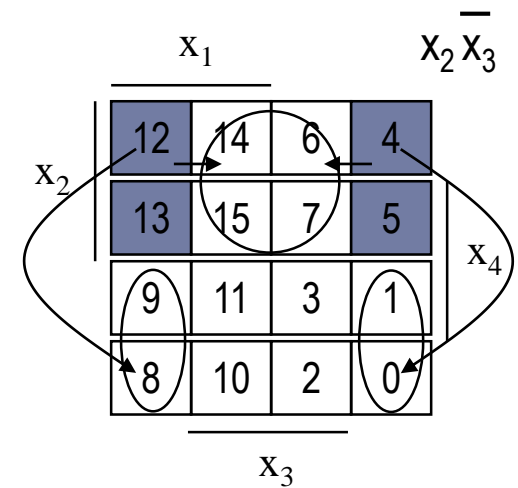
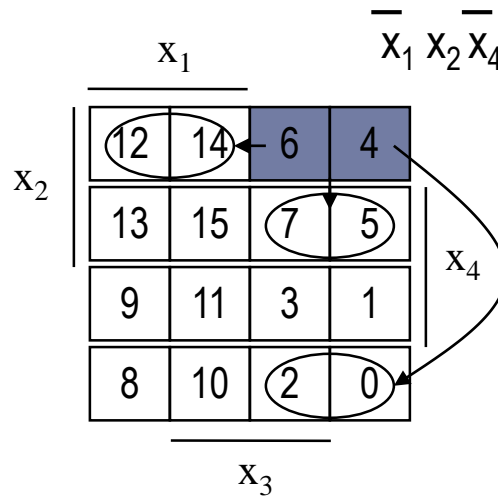
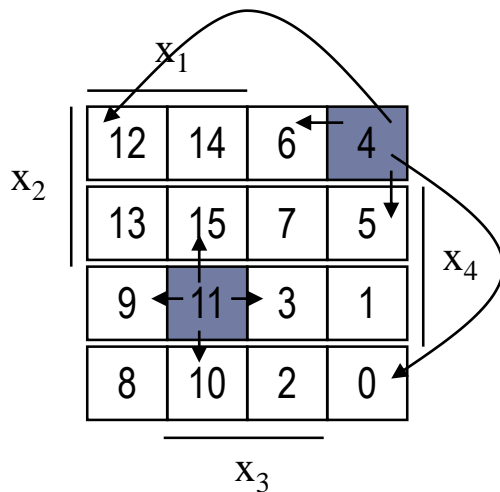
# Veitchev diagram (n=3,4,5)

$$\begin{array}{c}
 \overline{x_1} \\
 \begin{array}{|c|c|c|c|}
 \hline
 6 & 7 & 3 & 2 \\
 \hline
 4 & 5 & 1 & 0 \\
 \hline
 \end{array} \\
 \overline{x_3}
 \end{array}
 \begin{array}{c}
 x_2 \\
 \left| \right.
 \end{array}$$

$$\begin{array}{c}
 \overline{x_1} \\
 \begin{array}{|c|c|c|c|}
 \hline
 12 & 14 & 6 & 4 \\
 \hline
 13 & 15 & 7 & 5 \\
 \hline
 9 & 11 & 3 & 1 \\
 \hline
 8 & 10 & 2 & 0 \\
 \hline
 \end{array} \\
 \overline{x_3}
 \end{array}
 \begin{array}{c}
 x_2 \\
 \left| \right.
 \end{array}
 \begin{array}{c}
 x_4 \\
 \left| \right.
 \end{array}$$

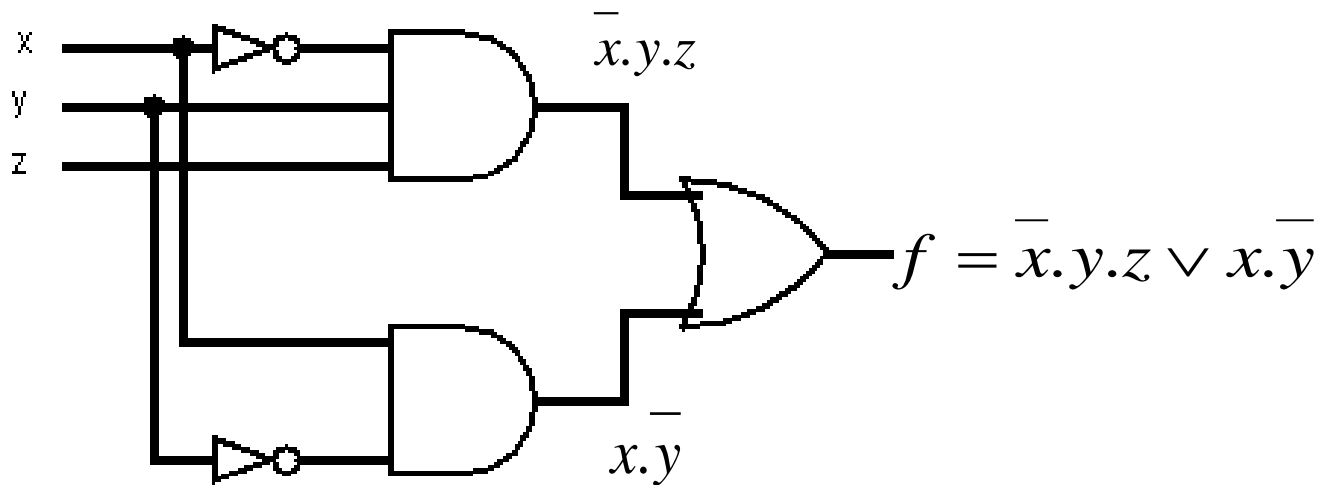
$$\begin{array}{c}
 \overline{x_5} \\
 \begin{array}{c}
 \overline{x_1} \qquad \qquad \overline{x_1} \\
 \begin{array}{|c|c|c|c|c|c|c|c|}
 \hline
 25 & 29 & 13 & 9 & 24 & 28 & 12 & 8 \\
 \hline
 27 & 31 & 15 & 11 & 26 & 30 & 14 & 10 \\
 \hline
 19 & 23 & 7 & 3 & 18 & 22 & 6 & 2 \\
 \hline
 17 & 21 & 5 & 1 & 16 & 20 & 4 & 0 \\
 \hline
 \end{array}
 \end{array}
 \begin{array}{c}
 x_2 \\
 \left| \right.
 \end{array}
 \begin{array}{c}
 x_4 \\
 \left| \right.
 \end{array}$$

Sosednost



# Logična shema

- ▶ Funkcija  $f$  je realizirana z logičnimi vrati:
  - ▶ NE
  - ▶ IN
  - ▶ ALI



# Naloga 1

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- ▶ Podani sta logični funkciji
  - ▶  $f_A$
  - ▶  $f_B$ .
- ▶ Zapišite oznake za  $i$  in  $j$  v tabeli
- ▶ Zapišite:
  - a) MDNO
  - b) MKNO
  - c) MNO

i	j	x	y	z	$f_A$	$f_B$
		0	0	0	1	1
		0	0	1	0	0
		0	1	0	1	1
		0	1	1	1	0
		1	0	0	1	1
		1	0	1	1	1
		1	1	0	1	1
		1	1	1	0	0



# Naloga 2: Dvojiški komplement (n=4)

V tabeli zapišite pretvorbo dvojiške kode v predznačena števila v dvojiškem komplementu ( $2^4K$ ) tako, da je bit  $k_3$  predznak:

- Vhodi:  $b_3, b_2, b_1, b_0$
- Izhodi:  $k_3, k_2, k_1, k_0$

Določite:

- Zapis funkcij v Veitchev diagram
- Minimizacija
- Zapis MDNO in MKNO
- MNO (št. logičnih vrat in št. povezav).

i	j	$b_3$	$b_2$	$b_1$	$b_0$	$k_3$	$k_2$	$k_1$	$k_0$
0	15	0	0	0	0	0	0	0	0
1	14	0	0	0	1	1	1	1	1
2	13	0	0	1	0	1	1	1	0
3	12	0	0	1	1	1	1	0	1
4	11	0	1	0	0	1	1	0	0
5	10	0	1	0	1	1	0	1	1
6	9	0	1	1	0	1	0	1	0
7	8	0	1	1	1	1	0	0	1
8	7	1	0	0	0	1	0	0	0
9	6	1	0	0	1	0	1	1	1
10	5	1	0	1	0	0	1	1	0
11	4	1	0	1	1	0	1	0	1
12	3	1	1	0	0	0	1	0	0
13	2	1	1	0	1	0	0	1	1
14	1	1	1	1	0	0	0	1	0
15	0	1	1	1	1	0	0	0	1

# Naloga 3: Primerjalnik

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V pravilnostno tabelo zapišite funkciji za izhoda  $p_1, p_0$  za dvo-bitni primerjalnik števil  $X=(x_1, x_0)$  in  $Y=(y_1, y_0)$ :

- $p_1 = p_0 = 0$ , če je  $X = Y$
- $p_1 = 0, p_0 = 1$ , če je  $X < Y$
- $p_1 = 1, p_0 = 0$ , če je  $X > Y$

Za izhoda  $p_1$  in  $p_0$  določite:

- a) Zapis funkcij v Veitchev diagram
- b) Minimizacija v Veitchevem diagramu
- c) Zapis MDNO in MKNO
- d) Zapis MNO (št. logičnih vrat in št. povezav za  $p_1$  in  $p_0$ ).
- e) Realizacijo MDNO, MKNO (logisim)



i	j	x <sub>1</sub>	x <sub>0</sub>	y <sub>1</sub>	y <sub>0</sub>	P <sub>1</sub>	P <sub>0</sub>
0	15	0	0	0	0	0	0
1	14	0	0	0	1	0	1
2	13	0	0	1	0	0	1
3	12	0	0	1	1	0	1
4	11	0	1	0	0	1	0
5	10	0	1	0	1	0	0
6	9	0	1	1	0	0	1
7	8	0	1	1	1	0	1
8	7	1	0	0	0	1	0
9	6	1	0	0	1	1	0
10	5	1	0	1	0	0	0
11	4	1	0	1	1	0	1
12	3	1	1	0	0	1	0
13	2	1	1	0	1	1	0
14	1	1	1	1	0	1	0
15	0	1	1	1	1	0	0

PDNO

$$p_1 = \bar{x}_1 \cdot x_0 \cdot \bar{y}_1 \cdot \bar{y}_0 \vee x_1 \cdot \bar{x}_0 \cdot \bar{y}_1 \cdot \bar{y}_0 \vee x_1 \cdot \bar{x}_0 \cdot \bar{y}_1 \cdot y_0 \vee x_1 \cdot x_0 \cdot \bar{y}_1 \cdot \bar{y}_0 \vee x_1 \cdot x_0 \cdot \bar{y}_1 \cdot y_0 \vee x_1 \cdot x_0 \cdot y_1 \cdot \bar{y}_0$$

$$p_0 = \bar{x}_1 \cdot \bar{x}_0 \cdot \bar{y}_1 \cdot y_0 \vee \bar{x}_1 \cdot \bar{x}_0 \cdot y_1 \cdot \bar{y}_0 \vee \bar{x}_1 \cdot \bar{x}_0 \cdot y_1 \cdot y_0 \vee \bar{x}_1 \cdot x_0 \cdot y_1 \cdot \bar{y}_0 \vee \bar{x}_1 \cdot x_0 \cdot y_1 \cdot y_0 \vee x_1 \cdot \bar{x}_0 \cdot y_1 \cdot y_0$$

PKNO

$$p_1 = (x_1 \vee x_0 \vee y_1 \vee y_0)(x_1 \vee x_0 \vee y_1 \vee \bar{y}_0)(x_1 \vee x_0 \vee \bar{y}_1 \vee y_0)(x_1 \vee x_0 \vee \bar{y}_1 \vee \bar{y}_0)(x_1 \vee \bar{x}_0 \vee y_1 \vee \bar{y}_0)(x_1 \vee \bar{x}_0 \vee \bar{y}_1 \vee y_0)(x_1 \vee \bar{x}_0 \vee \bar{y}_1 \vee \bar{y}_0)(\bar{x}_1 \vee x_0 \vee \bar{y}_1 \vee y_0)(\bar{x}_1 \vee x_0 \vee \bar{y}_1 \vee \bar{y}_0)(\bar{x}_1 \vee \bar{x}_0 \vee y_1 \vee y_0)(\bar{x}_1 \vee \bar{x}_0 \vee y_1 \vee \bar{y}_0)(\bar{x}_1 \vee \bar{x}_0 \vee y_1 \vee \bar{y}_0)(\bar{x}_1 \vee \bar{x}_0 \vee \bar{y}_1 \vee y_0)(\bar{x}_1 \vee \bar{x}_0 \vee \bar{y}_1 \vee \bar{y}_0)$$

$$p_0 = (x_1 \vee x_0 \vee y_1 \vee y_0)(x_1 \vee \bar{x}_0 \vee y_1 \vee y_0)(x_1 \vee \bar{x}_0 \vee y_1 \vee \bar{y}_0)(\bar{x}_1 \vee x_0 \vee y_1 \vee y_0)(\bar{x}_1 \vee x_0 \vee y_1 \vee \bar{y}_0)(\bar{x}_1 \vee x_0 \vee \bar{y}_1 \vee y_0)(\bar{x}_1 \vee x_0 \vee \bar{y}_1 \vee \bar{y}_0)(\bar{x}_1 \vee \bar{x}_0 \vee y_1 \vee y_0)(\bar{x}_1 \vee \bar{x}_0 \vee y_1 \vee \bar{y}_0)(\bar{x}_1 \vee \bar{x}_0 \vee \bar{y}_1 \vee y_0)(\bar{x}_1 \vee \bar{x}_0 \vee \bar{y}_1 \vee \bar{y}_0)$$