Date

Intro to Computer Science : Sheet # 08

Problem 8.1: Quine-mcclusky algorithm

$$F(x_4, x_3, x_2, x_1, x_0) = m_1' + m_5' + m_7' + m_8' + m_9 + m_{10}' + m_{11}' + m_{13}' + m_{16}' + m_{18}' + m_{24}' + m_{29}'$$

a) minterm pattern

m_1	00001
m_8	01000
m_{16}	10000
m_5	00101
m_9	01001
m_{10}	01010
m_{18}	10010
m_{24}	11000
m_7	00111
m_{11}	01011
m_{13}	01101
m_{29}	11101

minterms patterns

$m_{1,5}$	00-01
$m_{1,9}$	0-001
$m_{8,9}$	0100-
$m_{8,10}$	010-0
$m_{8,24}$	-1000
$m_{16,18}$	100-0
$m_{16,24}$	1-000
$m_{5,7}$	001-1
$m_{5,13}$	0-101
$m_{9,11}$	010-1
$m_{9,13}$	01-01
$m_{10,11}$	0101-
$m_{13,29}$	-1101

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2nd Iterations

minterms pattern

- $m_{1,5}$ 00-01
- $m_{1,9}$ 0-001
- $m_{8,9}$ 0100-
- $m_{8,10}$ 010-0
- $m_{8,24}$ -1000
- $m_{16,18}$ 100-0
- $m_{16,24}$ 1-000
- $m_{5,7}$ 001-1
- $m_{5,13}$ 0-101
- $m_{9,11}$ 010-1
- $m_{9,13}$ 01-01
- $m_{10,11}$ 0101-
- $m_{13,29}$ -1101

minterms pattern

- P $m_{1,9,5,13}$ 0--01
- P $m_{8,9,10,11}$ 010--

	m_1	m_5	m_7	m_8	m_9	m_{10}	m_{11}	m_{13}	m_{16}	m_{18}	m_{24}	m_{29}
$m_{8,24}$				✓							✓	
$m_{16,18}$									✓	✓	✓	✓
$m_{16,24}$									✓		✓	
$m_{5,7}$		✓	✓									
$m_{13,29}$								✓				✓
$m_{1,9,5,13}$	✓	✓			✓			✓				
$m_{8,9,10,11}$				✓	✓	✓	✓					

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Essential Prime

$m_{5,7}$

$m_{13,29}$

$m_{1,9,5,13}$

$m_{16,18}$

$m_{8,9,10,11}$

$m_{8,24}$

$m_{16,24}$

Choosing $m_{8,24}$:

$$F(x_4, x_3, x_2, x_1, x_0) = (\neg x_4 \wedge \neg x_3 \wedge x_2 \wedge x_0) \vee (x_3 \wedge x_2 \wedge \neg x_1 \wedge x_0) \vee (\neg x_4 \wedge \neg x_1 \wedge x_0) \vee (x_4 \wedge \neg x_3 \wedge \neg x_2 \wedge \neg x_0) \vee (\neg x_4 \wedge x_3 \wedge \neg x_2) \vee (x_3 \wedge \neg x_2 \wedge \neg x_1 \wedge \neg x_0)$$

$\rightarrow$ cost = 21

Choosing $m_{16,24}$:

$$F(x_4, x_3, x_2, x_1, x_0) = (\neg x_4 \wedge \neg x_3 \wedge x_2 \wedge x_0) \vee (x_3 \wedge x_2 \wedge \neg x_1 \wedge x_0) \vee (\neg x_4 \wedge \neg x_1 \wedge x_0) \vee (x_4 \wedge \neg x_3 \wedge \neg x_2 \wedge \neg x_0) \vee (\neg x_4 \wedge x_3 \wedge \neg x_2) \vee (x_4 \wedge \neg x_2 \wedge \neg x_1 \wedge \neg x_0)$$

$\rightarrow$ cost = 21