

CMPE 240 Experiment 1 Preliminary Work

Student Names: Ergün ERDOĞMUŞ, Mustafa Enes ÇAKIR

Student IDs: 2014400006, 2013400105

Group ID: 2

Truth Table

#	x_2	x_1	x_0	y
0	0	0	0	0
1	0	0	1	1
2	0	1	0	1
3	0	1	1	1
4	1	0	0	0
5	1	0	1	1
6	1	1	0	0
7	1	1	1	1

Sum of Products (SOP)

$$y = (x'_2x'_1x_0) + (x'_2x_1x'_0) + (x'_2x_1x_0) + (x_2x'_1x_0) + (x_2x_1x_0)$$

Minimized SOP

$$\begin{aligned} y &= x'_2(x'_1x_0 + x_1x'_0 + x_1x_0) + x_2x_0(x'_1 + x_1) && [Distributive] \\ &= x'_2(x'_1x_0 + x_1x'_0 + x_1x_0) + x_2x_0(1) && [Complement] \\ &= x'_2(x'_1x_0 + x_1x'_0 + x_1x_0) + x_2x_0 && [Identity] \\ &= x'_2(x_0(x'_1 + x_1) + x_1x'_0) + x_2x_0 && [Distributive] \\ &= x'_2(x_0(1) + x_1x'_0) + x_2x_0 && [Complement] \\ &= x'_2(x_0 + x_1x'_0) + x_2x_0 && [Identity] \\ &= x'_2((x_0 + x_1)(x_0 + x'_0)) + x_2x_0 && [Distributive] \\ &= x'_2((x_0 + x_1)(1)) + x_2x_0 && [Complement] \\ &= x'_2(x_0 + x_1) + x_2x_0 && [Identity] \\ &= x'_2x_0 + x'_2x_1 + x_2x_0 && [Distributive] \\ &= x_0(x'_2 + x_2) + x'_2x_1 && [Distributive] \\ &= x_0(1) + x'_2x_1 && [Complement] \\ &= x_0 + x'_2x_1 && [Identity] \end{aligned}$$

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Product of Sums (POS)

$$y = (x_2 + x_1 + x_0).(x'_2 + x_1 + x_0).(x'_2 + x'_1 + x_0)$$

Minimized POS

$$\begin{aligned}
y &= (x_2 + x_1 + x_0).(x'_2 + x_1 + x_0).(x'_2 + x'_1 + x_0) \\
&= (x_2x'_2 + x_1 + x_0)(x'_2 + x'_1 + x_0) && [Distributive] \\
&= (0 + x_1 + x_0)(x'_2 + x'_1 + x_0) && [Complement] \\
&= (x_1 + x_0)(x'_2 + x'_1 + x_0) && [Identity] \\
&= x_1x'_2 + x_1x'_1 + x_1x_0 + x_0x'_2 + x_0x'_1 + x_0x_0 && [Distributive] \\
&= x_1x'_2 + 0 + x_1x_0 + x_0x'_2 + x_0x'_1 + x_0x_0 && [Complement] \\
&= x_1x'_2 + x_1x_0 + x_0x'_2 + x_0x'_1 + x_0x_0 && [Identity] \\
&= x_1x'_2 + x_1x_0 + x_0x'_2 + x_0x'_1 + x_0 && [Idempotent] \\
&= x_1x'_2 + x_0x'_2 + x_0(x_1 + x'_1) + x_0 && [Distributive] \\
&= x_1x'_2 + x_0x'_2 + x_01 + x_0 && [Complement] \\
&= x_1x'_2 + x_0x'_2 + x_0 + x_0 && [Identity] \\
&= x_1x'_2 + x_0x'_2 + x_0 && [Idempotent] \\
&= x'_2(x_1 + x_0) + x_0 && [Distributive] \\
&= (x'_2 + x_0)(x_0 + x_1 + x_0) && [Distributive] \\
&= (x'_2 + x_0)(x_1 + x_0) && [Idempotent]
\end{aligned}$$

Circuit

