Exercises on the topics of class 9

Exercises with solutions

Ex. 1. Build the truth table for the following BE:

$$(x \oplus (y \text{ NOR } \bar{z})) \text{ NAND } (x+yz)$$

SOLUTION:

x	y	z	$\bar{z}$	$y \text{ NOR } \bar{z}$	$x\oplus(y \text{ NOR } \bar{z})$	yz	$x+yz$	$x\oplus(y \text{ NOR } z) \text{ NAND } (x+yz)$
0	0	0	1	0	0	0	0	1
0	0	1	0	1	1	0	0	1
0	1	0	1	0	0	0	0	1
0	1	1	0	0	0	1	1	1
1	0	0	1	0	1	0	1	0
1	0	1	0	1	0	0	1	1
1	1	0	1	0	1	0	1	0
1	1	1	0	0	1	1	1	0

Ex. 2. Check the following equality, by using the truth tables:

$$\bar{x} + z\,(\bar{x} + y) = \bar{x} + z\,y$$

Then, write the dual and the complementary versions of the given equality.

SOLUTION:

The truth table of the two expressions is:

x	y	z	$\bar{x}$	zy	$\bar{x} + zy$	$\bar{x}$	$\bar{x}+y$	$z(\bar{x}+y)$	$\bar{x}+z(\bar{x}+y)$
0	0	0	1	0	1	1	1	0	1
0	0	1	1	0	1	1	1	1	1
0	1	0	1	0	1	1	1	0	1
0	1	1	1	1	1	1	1	1	1
1	0	0	0	0	0	0	0	0	0
1	0	1	0	0	0	0	0	0	0
1	1	0	0	0	0	0	1	0	0
1	1	1	0	1	1	0	1	1	1

The dual equality is $\bar{x}\,(z + \bar{x}\,y) = \bar{x}\,(z + y)$

The complementary equality is $x\,(\bar{z} + x\,\bar{y}) = x\,(\bar{z} + \bar{y})$

Ex. 3. Let $y = x1\ x0 + \underline{x1}\ \underline{x0}$. Express y in ALL-NAND form.

SOLUTION:

By using De Morgan and the definition of negation with NAND, we have

$$
\begin{aligned}
x1\ x0 + \underline{x1}\ \underline{x0} &= x1\ x0 + \underline{(x1 + x0)} \\
&= \underline{(x1\ x0)}\ \text{NAND}\ (x1 + x0) \\
&= (x1\ \text{NAND}\ x0)\ \text{NAND}\ (\underline{x1}\ \text{NAND}\ \underline{x0}) \\
&= (x1\ \text{NAND}\ x0)\ \text{NAND}\ ((x1\ \text{NAND}\ x1)\ \text{NAND}\ (x0\ \text{NAND}\ x0))
\end{aligned}
$$

Exercises without solutions

Ex. 1. Consider the following BE: $x + \bar{z}(x + \bar{y}(x + z))$.
Build up its truth table, its dual and its complemetary expressions.

Ex. 2. Consider the following BEs, where ⊕ denotes the XOR. Rewrite them first in form all-NAND and then in form all-NOR:

$$X \oplus (Y \oplus Z)$$

$$XY + XZ + YZ$$