EE2020 Tutorial 3 - Solutions

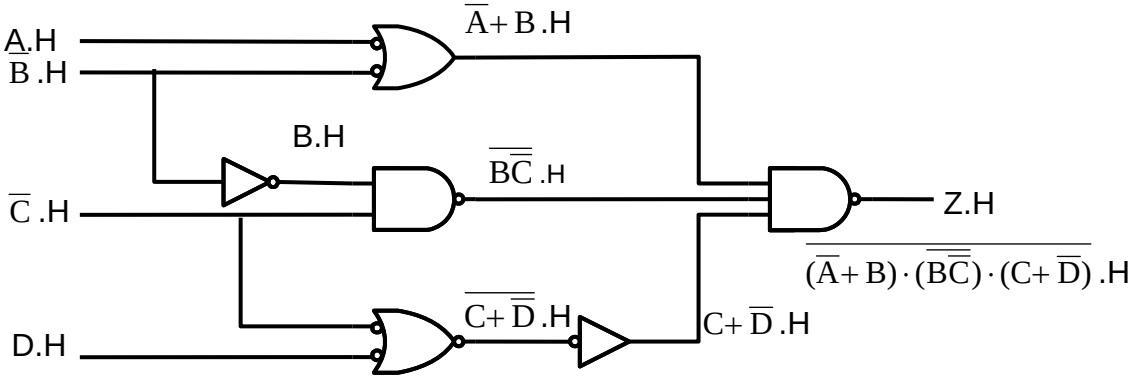
Logic gates

1.

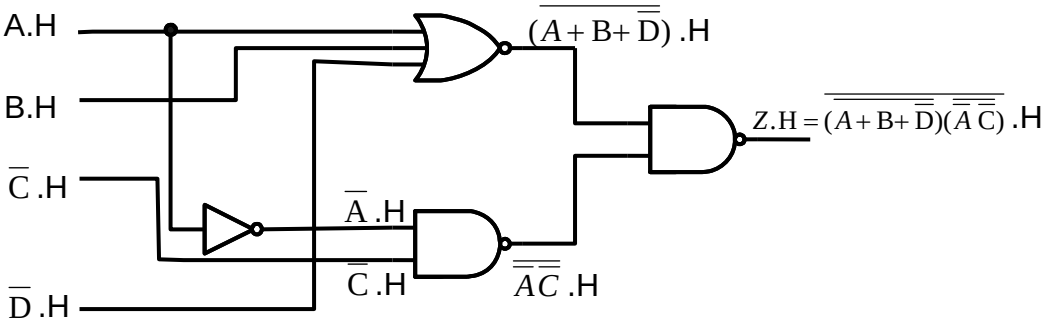
$$
\begin{aligned}
& x_1x_3+x_1\bar{x}_2+\bar{x}_1x_2x_3+\bar{x}_1\bar{x}_2\bar{x}_3 \\
&= x_3(x_1+\bar{x}_1x_2)+\bar{x}_2(x_1+\bar{x}_1\bar{x}_3) \\
&= x_3(x_1+x_2)+\bar{x}_2(x_1+\bar{x}_3) \quad \{\text{using } A+\bar{A}B=A+B\} \\
&= x_1x_3+x_2x_3+x_1\bar{x}_2+\bar{x}_2\bar{x}_3 \\
&= x_1x_3+x_2x_3+\bar{x}_2\bar{x}_3 \quad \{\text{using } AB+\bar{A}C+BC=AB+\bar{A}C;\ A\to x_3,\ B\to x_1,\ C\to \bar{x}_2\} \\
&\text{or } x_1\bar{x}_2+x_2x_3+\bar{x}_2\bar{x}_3 \quad \{\text{using } AB+\bar{A}C+BC=AB+\bar{A}C;\ A\to \bar{x}_2,\ B\to x_1,\ C\to x_3\}
\end{aligned}
$$

2.

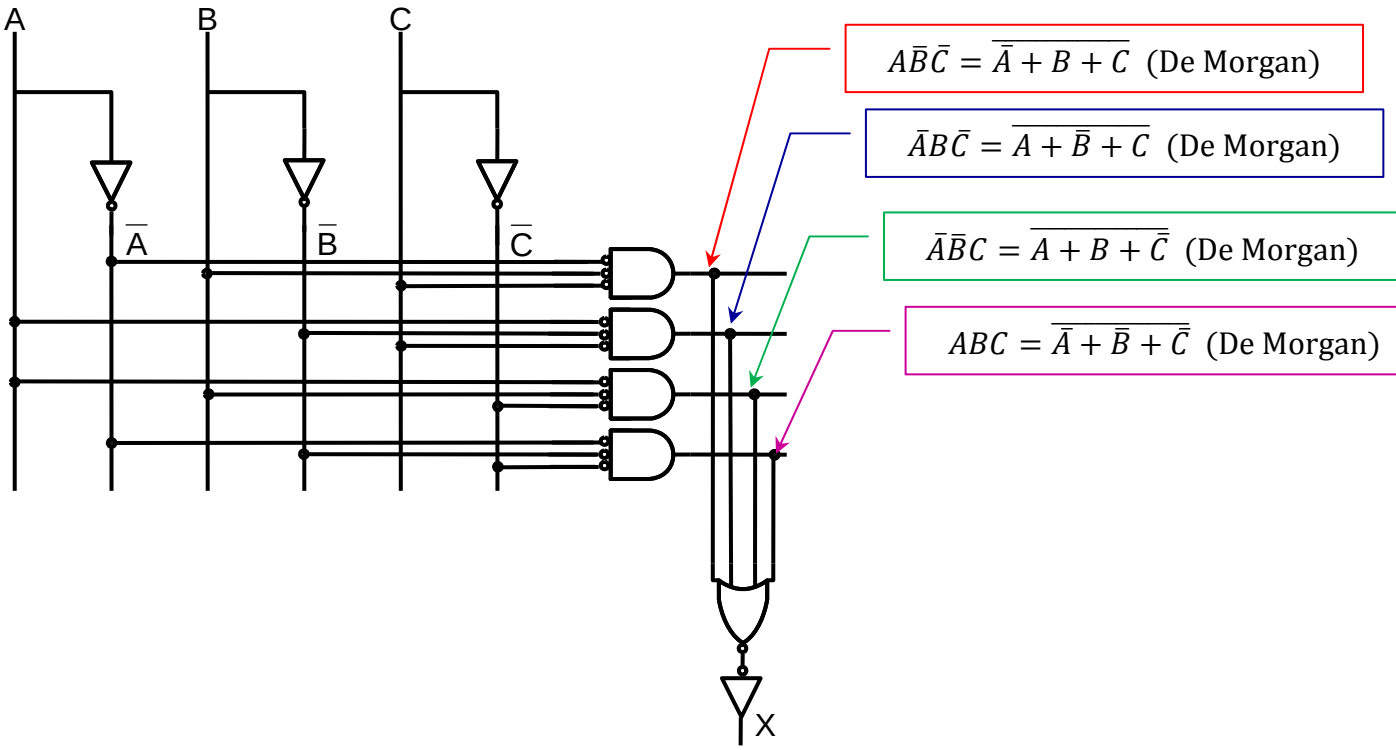
Circuit 1



Circuit 2



3. $X = A \oplus B \oplus C = (A\bar{B} + \bar{A}B)\cdot\bar{C} + \overline{A\bar{B} + \bar{A}B}\cdot C = A\bar{B}\bar{C} + \bar{A}B\bar{C} + \bar{A}\bar{B}C + ABC$

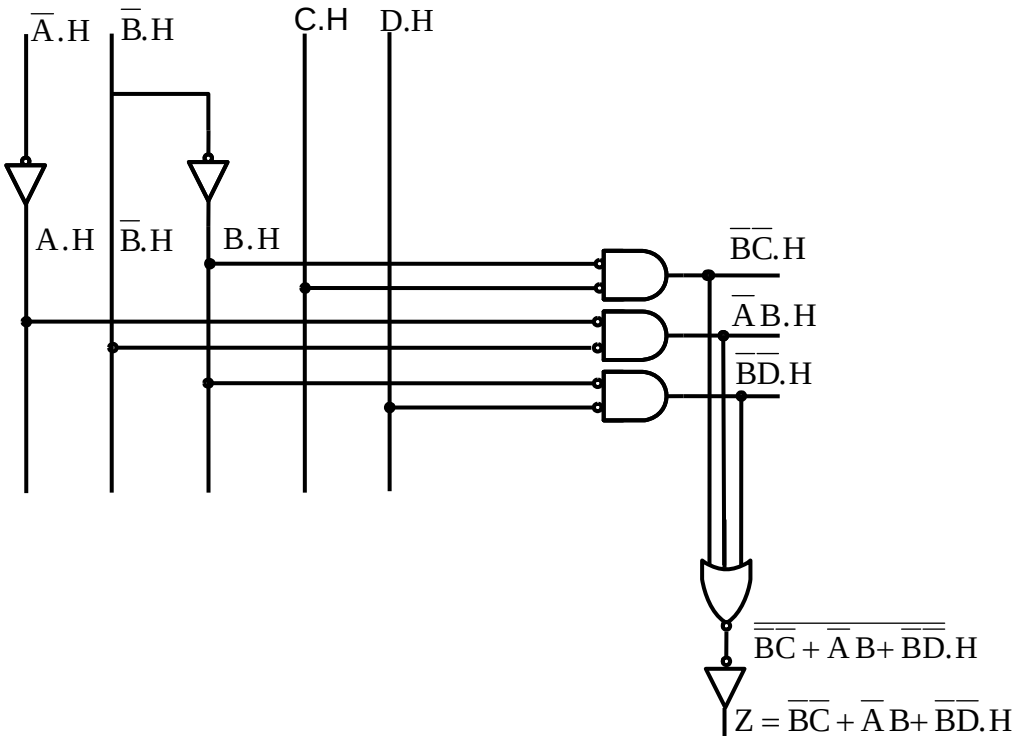


4. $Z = \bar{A}B + \bar{B}\bar{C}D + \bar{B}\bar{D} = \bar{B}\bar{C} + \bar{A}B + \bar{B}\bar{D}$

Logic circuit

$Z = \bar{B}\bar{C} + \bar{A}B + \bar{B}\bar{D}$

CD \ AB	00	01	11	10
00	1	1	0	1
01	1	1	0	1
11	0	1	0	0
10	1	1	0	1



Use POS:

$Z = (\bar{A} + \bar{B})(B + \bar{C} + \bar{D})$