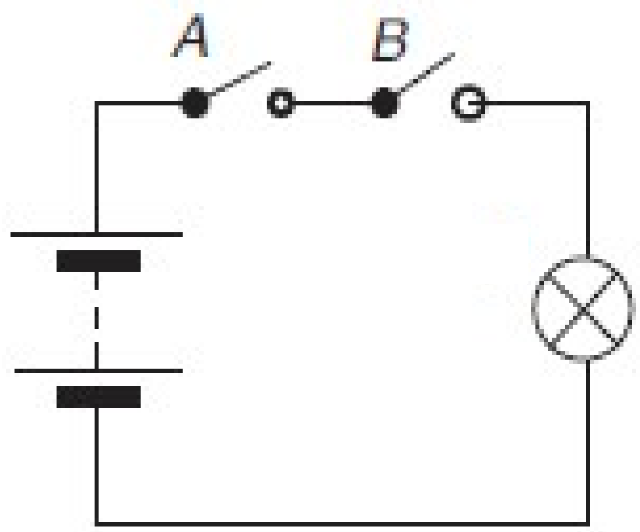
JAIN DEEMED-TO-BE UNIVERSITY | FACULTY OF ENGINEERING AND TECHNOLOGY

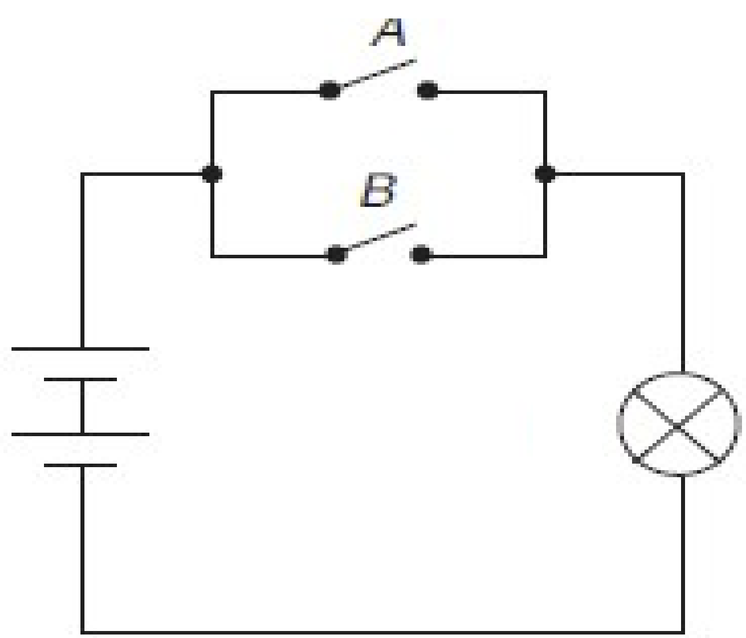
MODULE - V: DIGITAL ELECTRONICS

Tutorial

Represent the AND function by switch analogy

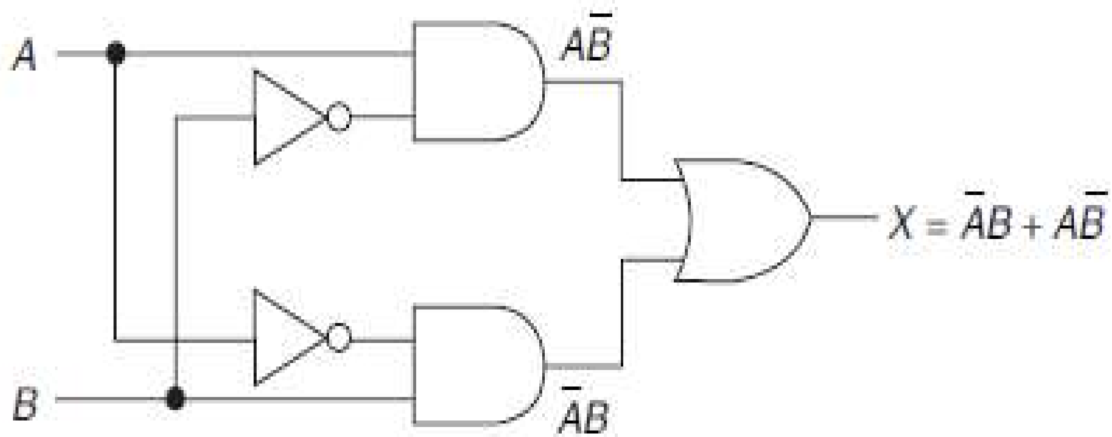


Represent the OR function by switch analogy.



Draw the combination of AND, OR, and NOT gates to provide the XOR function.

$$\bar{A}.B + A.\bar{B}$$



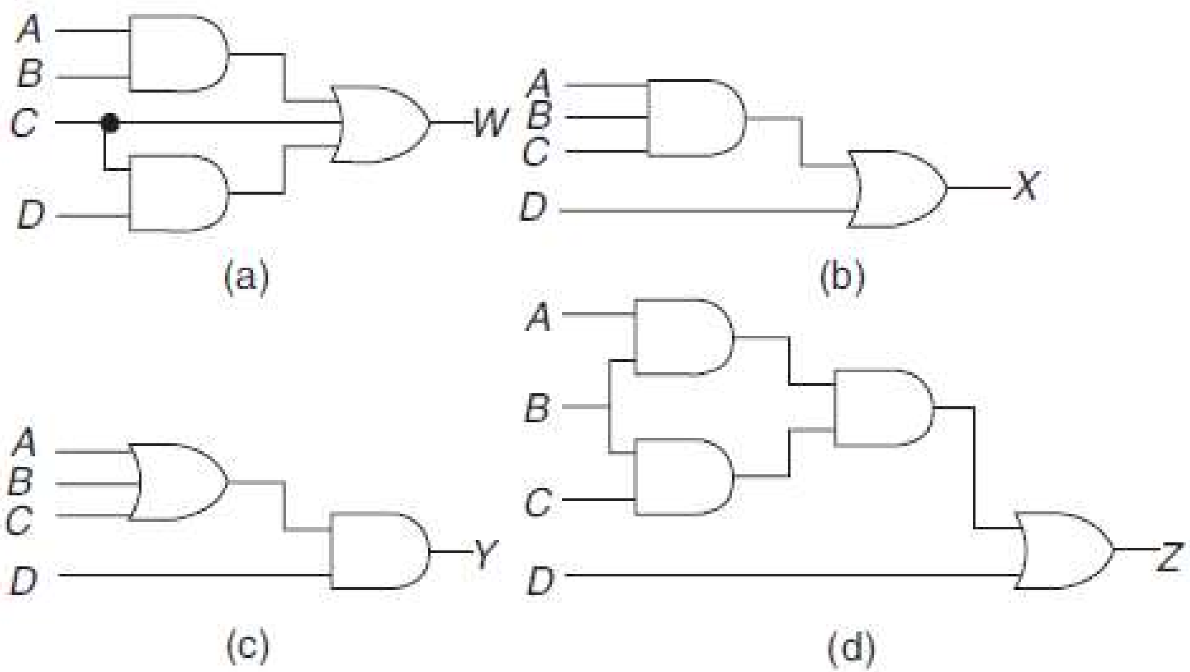
Prove that $A\,(\overline{A} + C)\,(\overline{A}B + \overline{C}) = 0$

$$
\begin{aligned}
A(\overline{A} + C)\,(\overline{A}B + \overline{C}) &= (A\overline{A} + AC)\,(\overline{A}B + \overline{C}) \\
&= (0 + AC)\,(\overline{A}B + \overline{C}) \\
&= AC\overline{A}B + AC\overline{C} \\
&= A\overline{A}BC + AC\overline{C} \\
&= 0 \cdot BC + A \cdot 0 \\
&= 0
\end{aligned}
$$

Verify DeMorgan's law for the Boolean function $A + B = \overline{\overline{A} \cdot \overline{B}}$ through truth table

A	B	$\overline{A}$	$\overline{B}$	$\overline{A} \cdot \overline{B}$	$\overline{\overline{A} \cdot \overline{B}}$	$A + B$
0	0	1	1	1	0	0
0	1	1	0	0	1	1
1	0	0	1	0	1	1
1	1	0	0	0	1	1

Write the Boolean equation for each of the logic circuits shown below



Answer

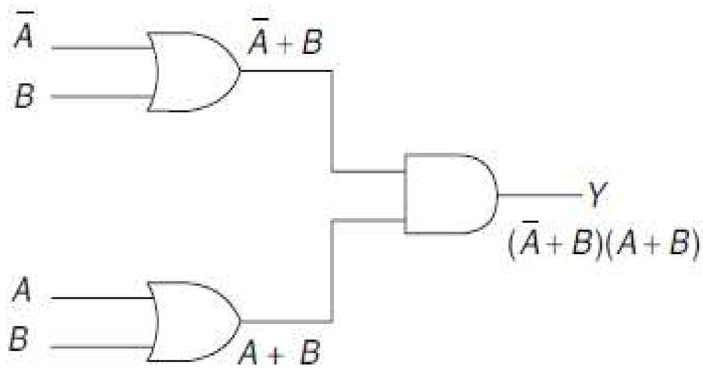
(a) $W = (AB + C) + CD$

(b) $X = ABC + D$

(c) $Y = (A + B + C)D$

(d) $Z = ((AB)(BC)) + D$

Draw the logic circuit for the Boolean equation $Y = (\overline{A} + B)(A + B)$ .Simplify the circuit as much as possible using Boolean algebra.



Simplifying yields

$$Y = \overline{A}A + \overline{A}B + BA + BB$$

$$Y = \overline{A}B + AB + B$$

$$Y = (\overline{A} + A)B + B = B + B = B$$

Since Y = B, we don’t need a logic circuit. All we need is a wire connecting the input B to the output Y.

Exercise

Add the following binary numbers

a) 11+11

b) 100+10

c) 111+11

d) 110+100

e) 10011+1111101

Subtract the following binary numbers

a) 111100-11110

b) 1100100-110010

c) 11001-1001

Find the following binary arithmetic

a) $1\,0\,1\,1\,1 \times 1\,1\,0$
b) $1\,0\,0\,0\,1 \times 101$
c) $11010 \div 101$
d) $10010011 \div 1011$