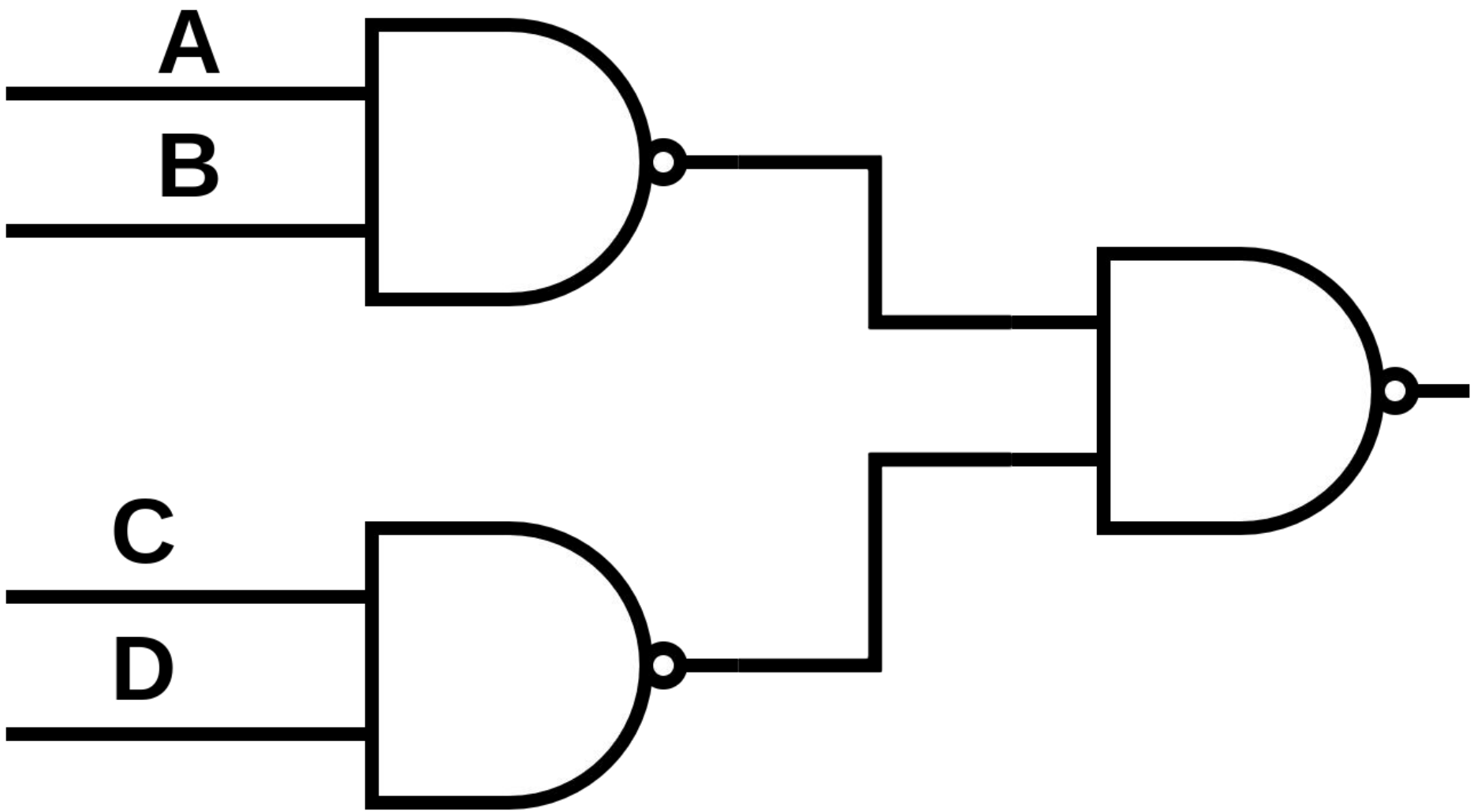
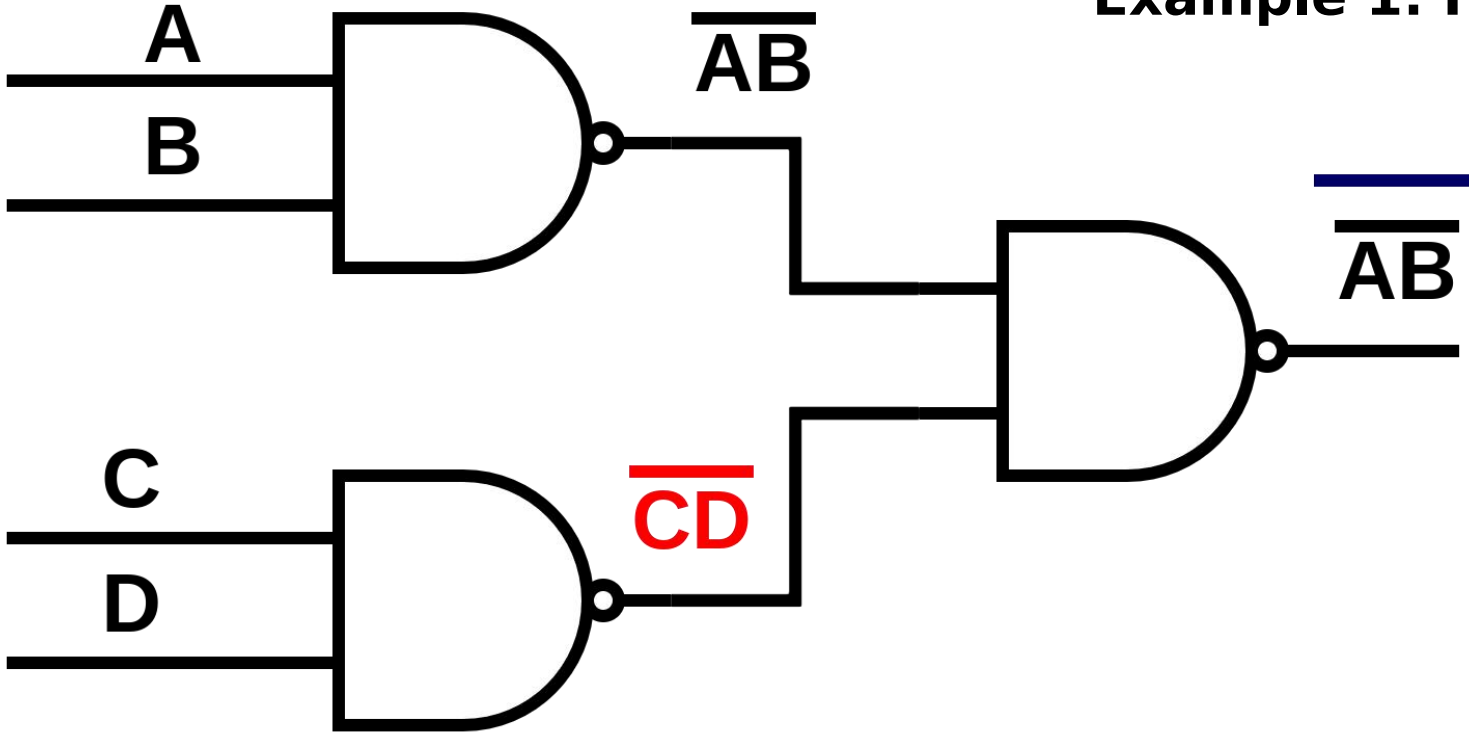
Universal Gates
And
Complement Arithmetic

Example 1: Find out the output

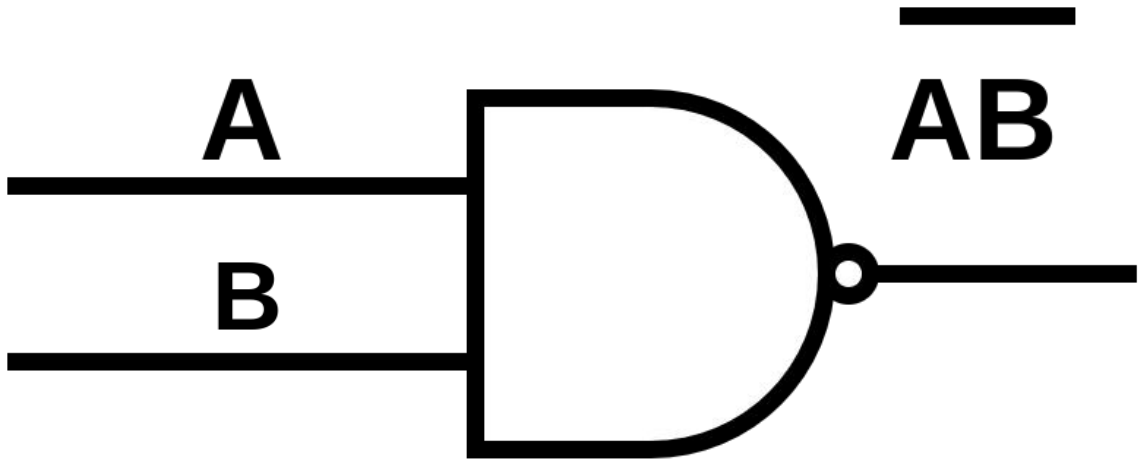


Example 1: Find out the output

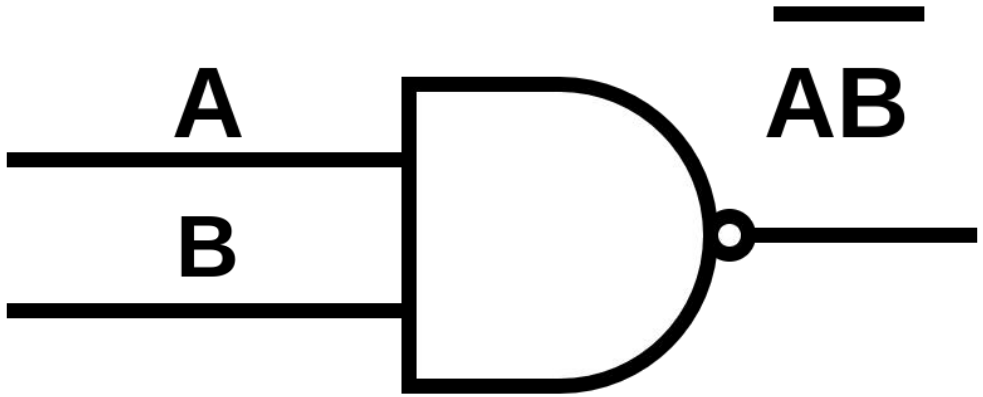


$$\overline{\overline{AB}\ .\overline{CD}} = \overline{\overline{AB}} + \overline{\overline{CD}}$$

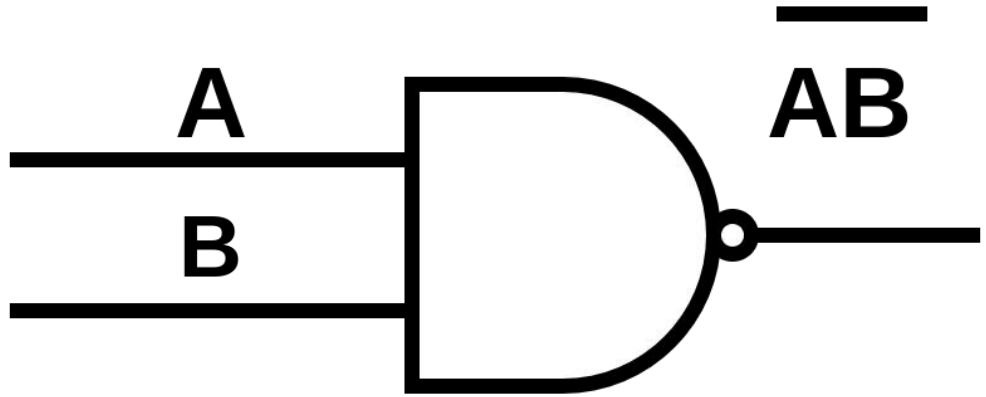
$$= AB + CD$$



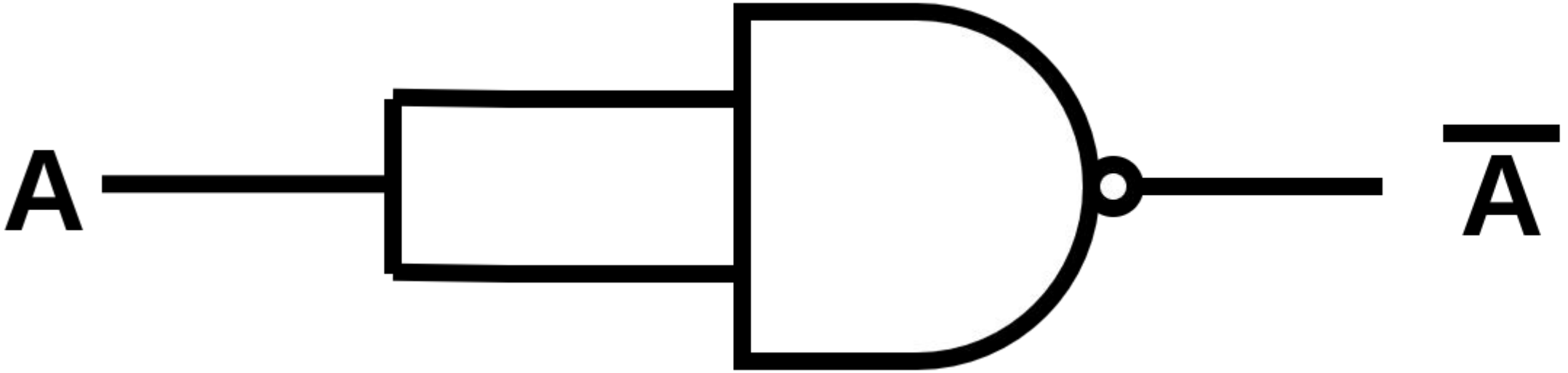
So, This is a Simple **NAND** Gate with inputs **A and B**

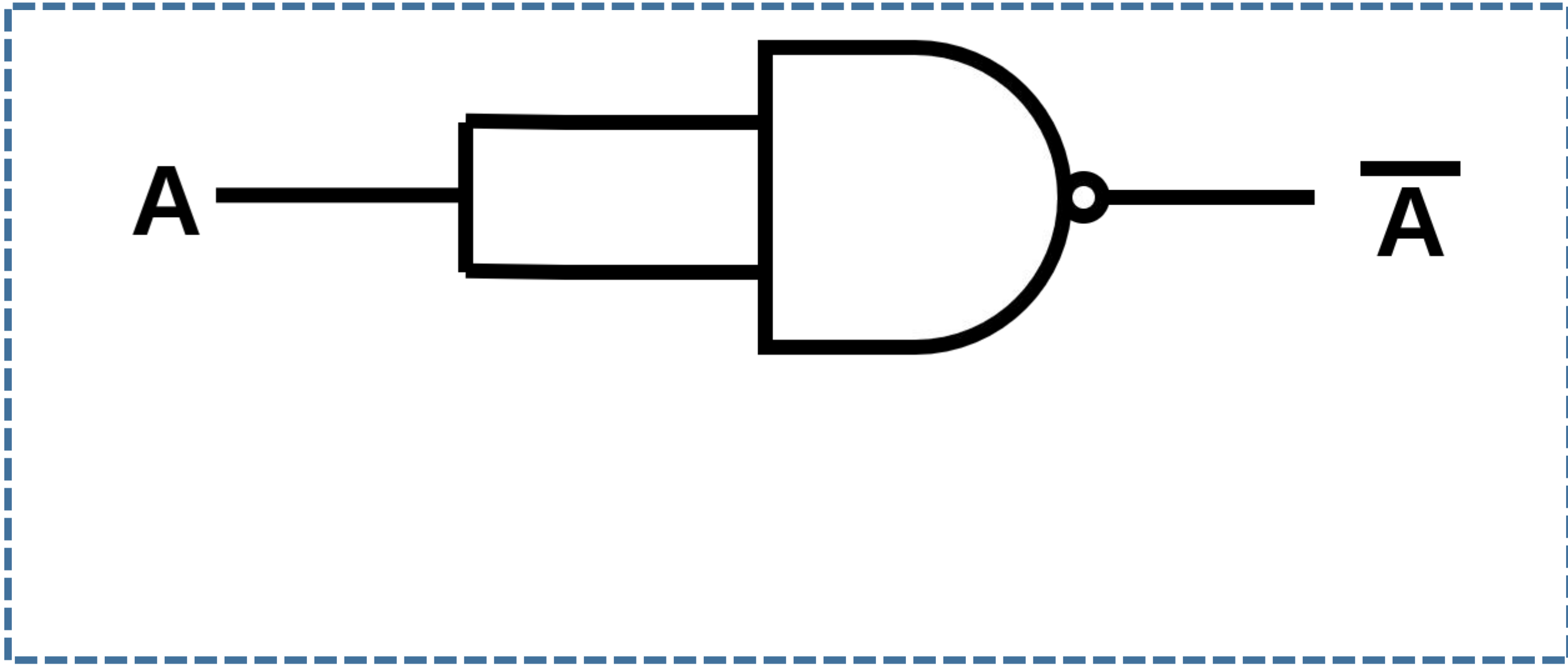


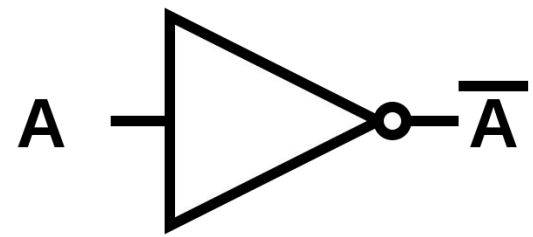
IF A=B , then

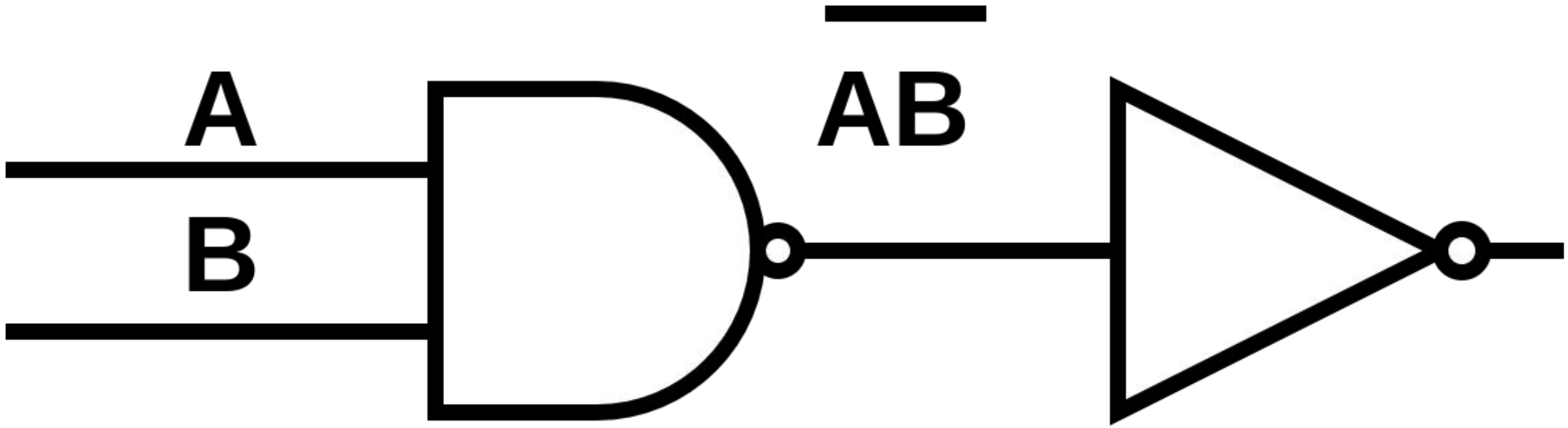


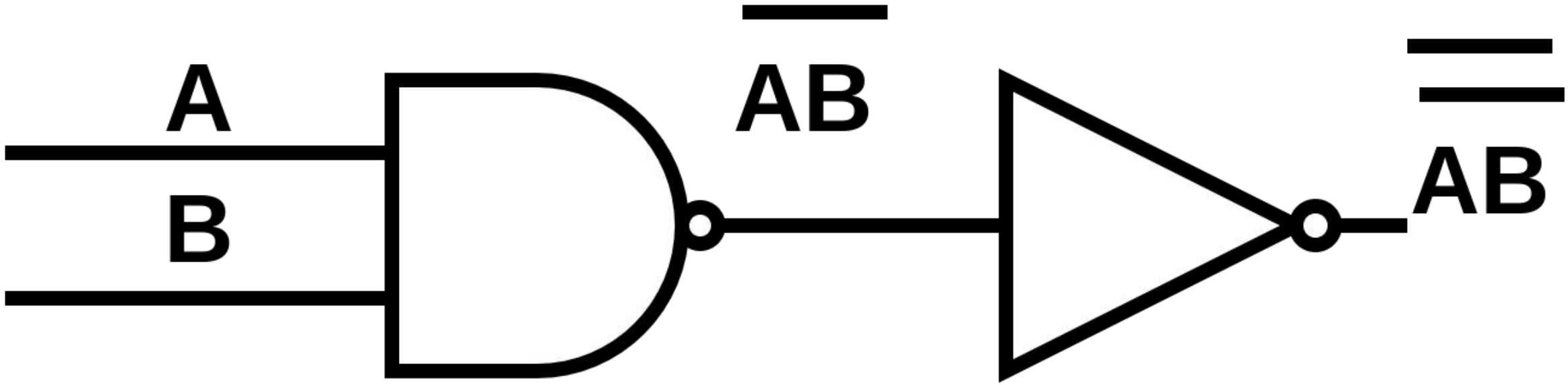
IF A=B , then

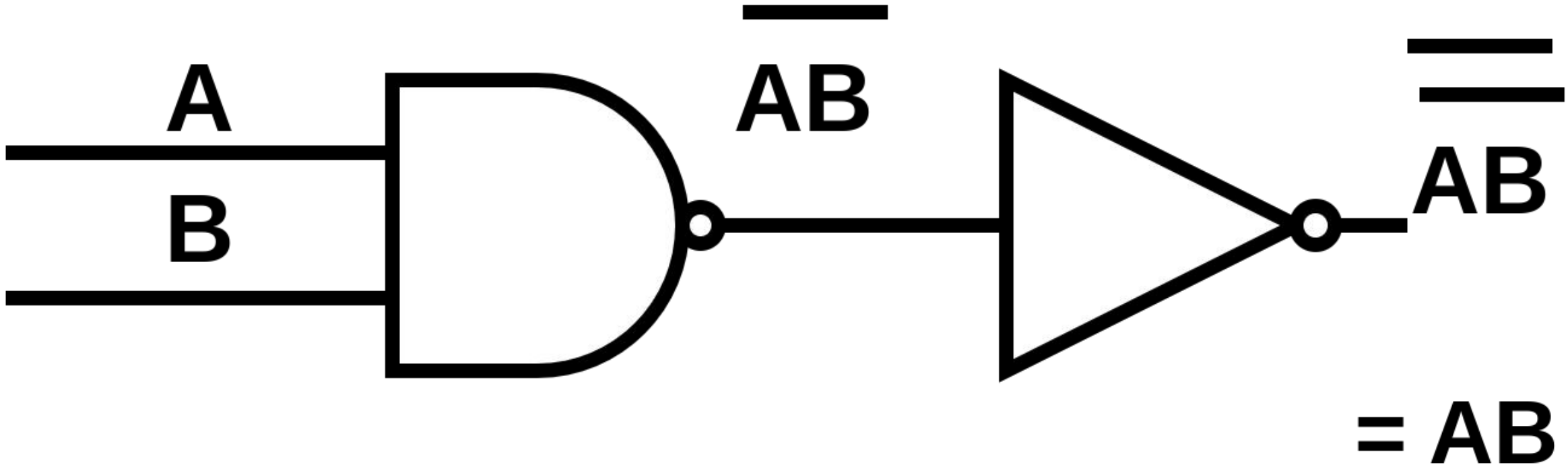


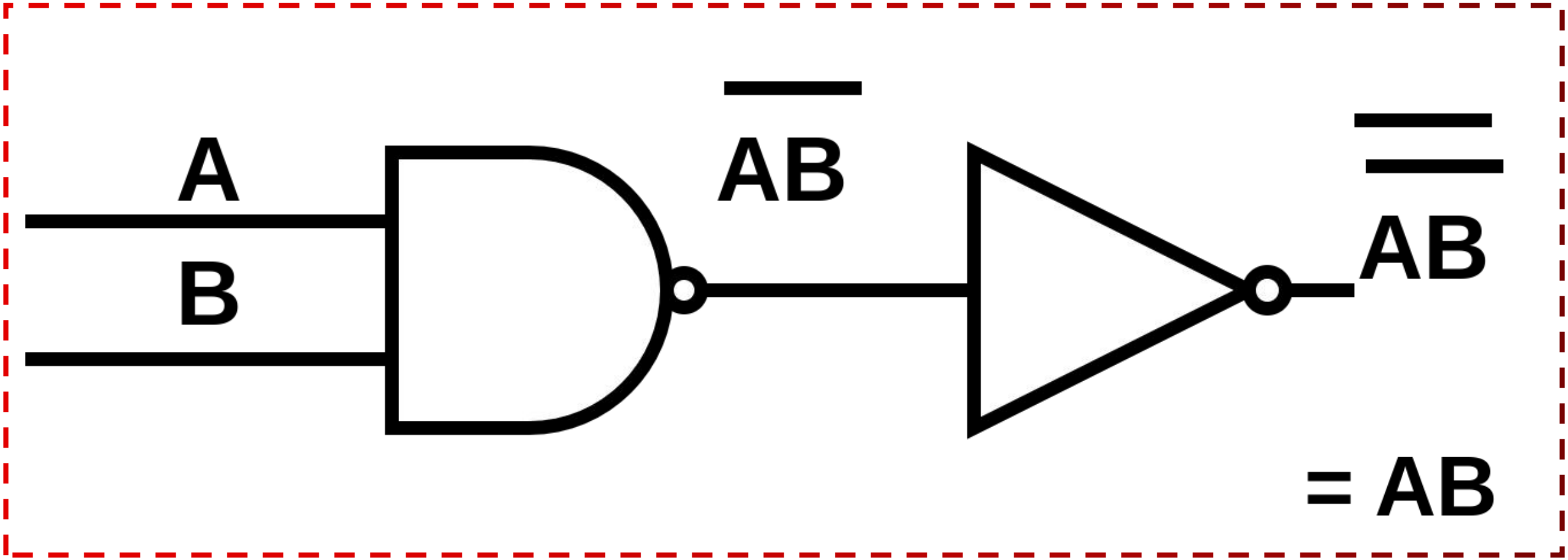

A
$\overline{A}$

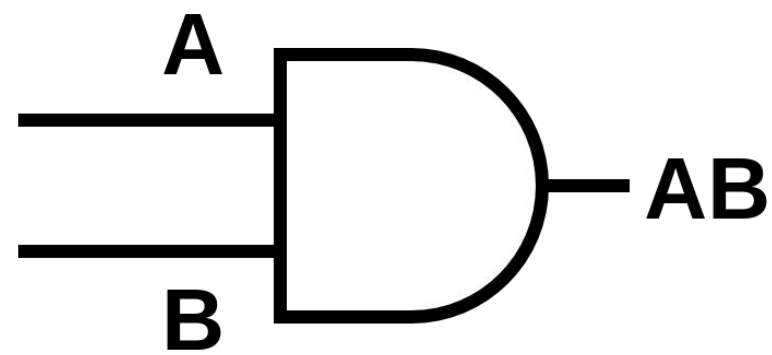

A
$\overline{A}$

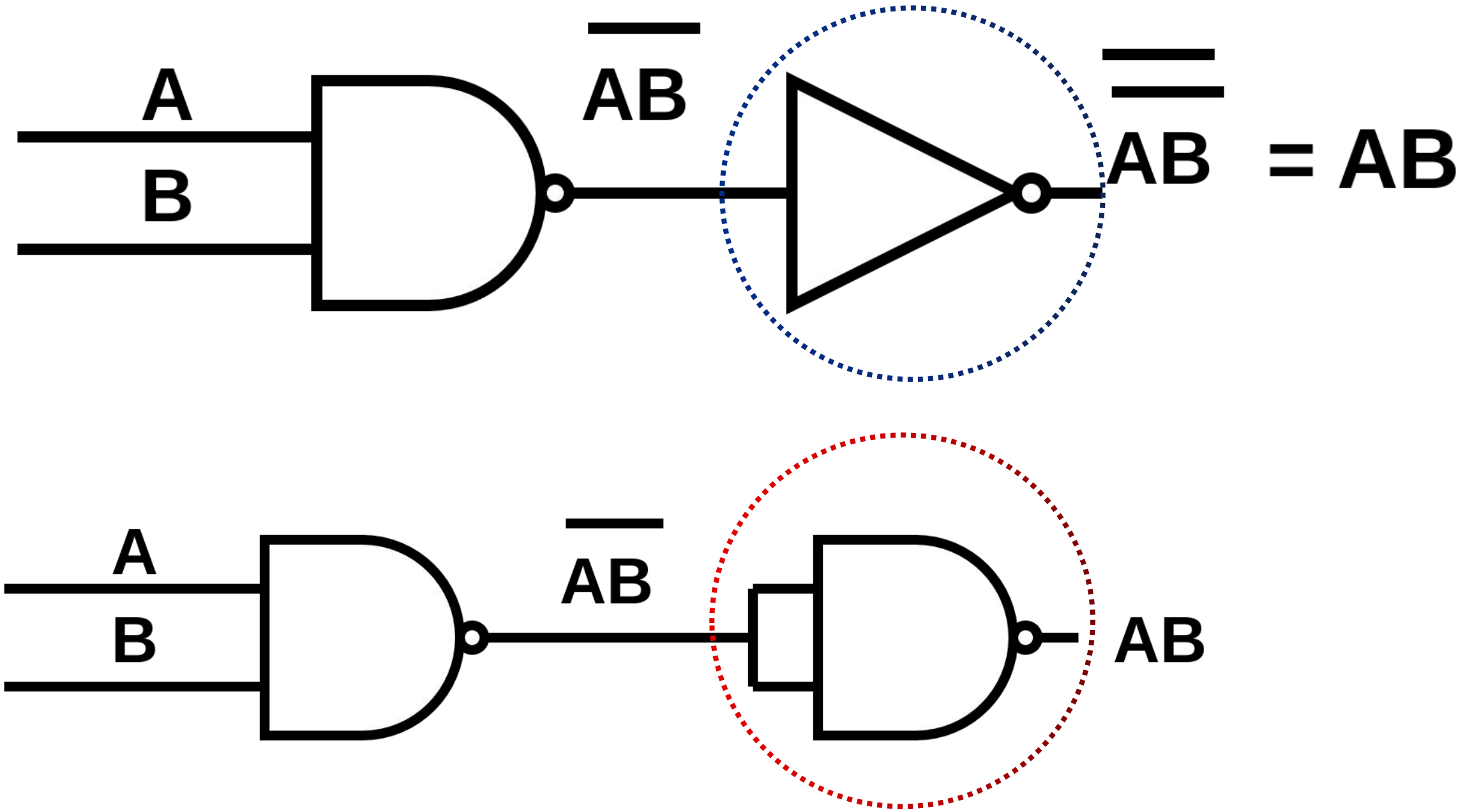

A
B
$\overline{AB}$

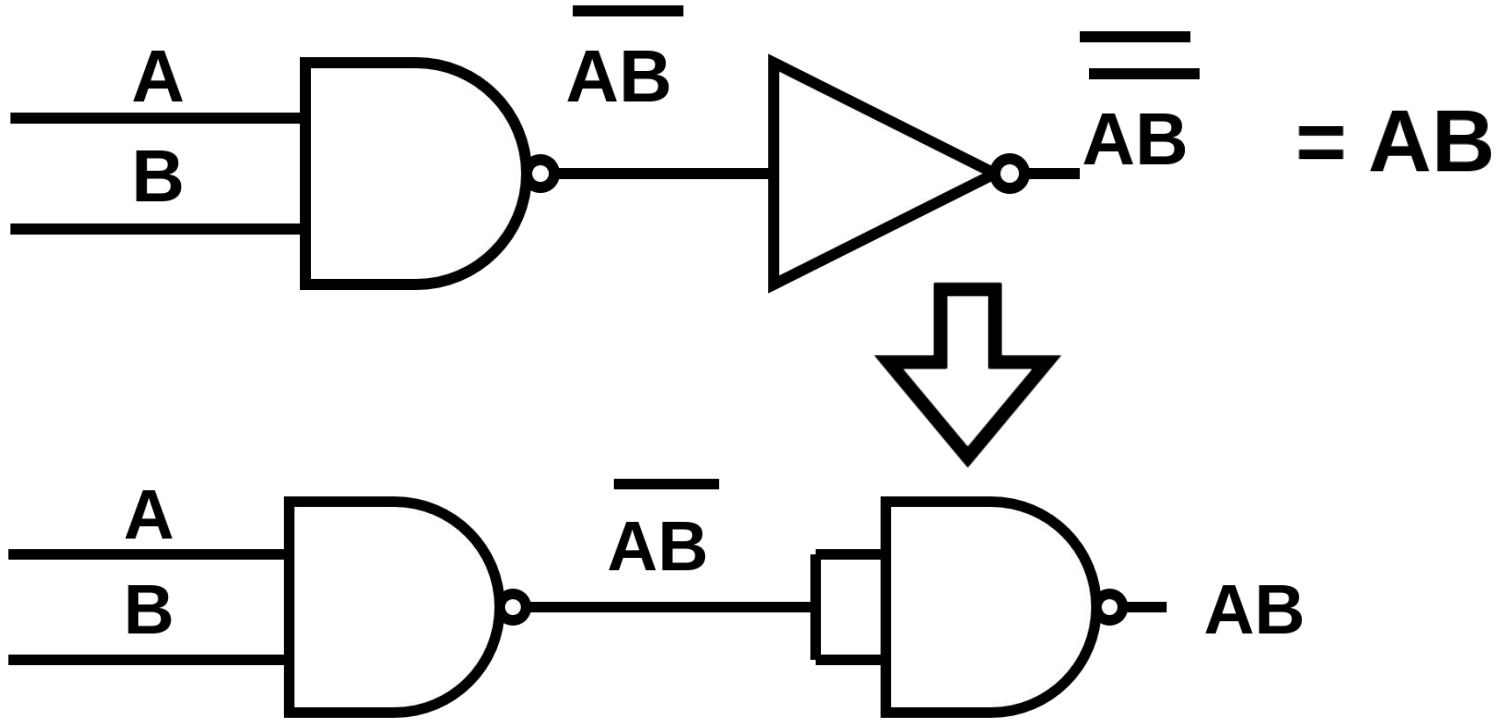

A
B
$\overline{AB}$
$\overline{\overline{AB}}$


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

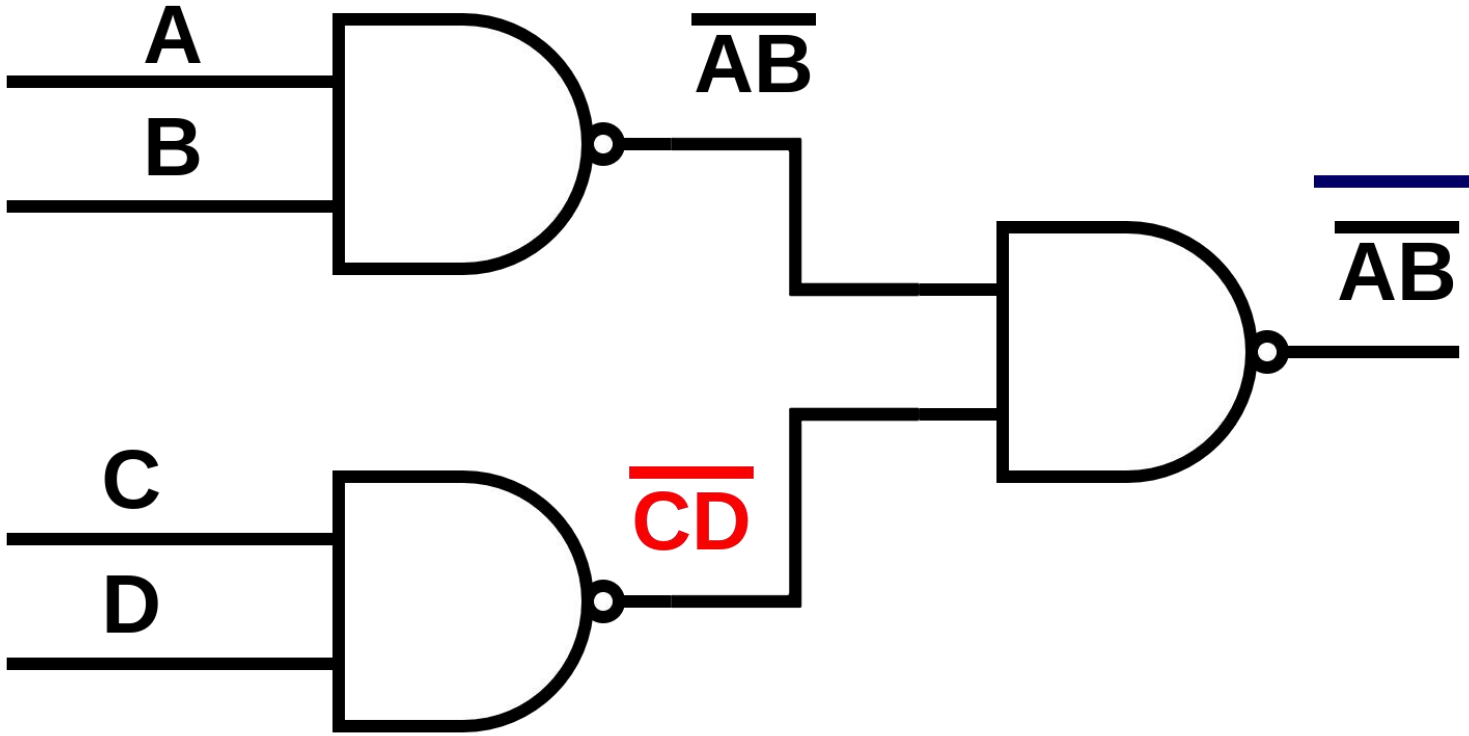

A
B
$\overline{AB}$
$\overline{\overline{AB}}$
= AB


A
B
AB


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



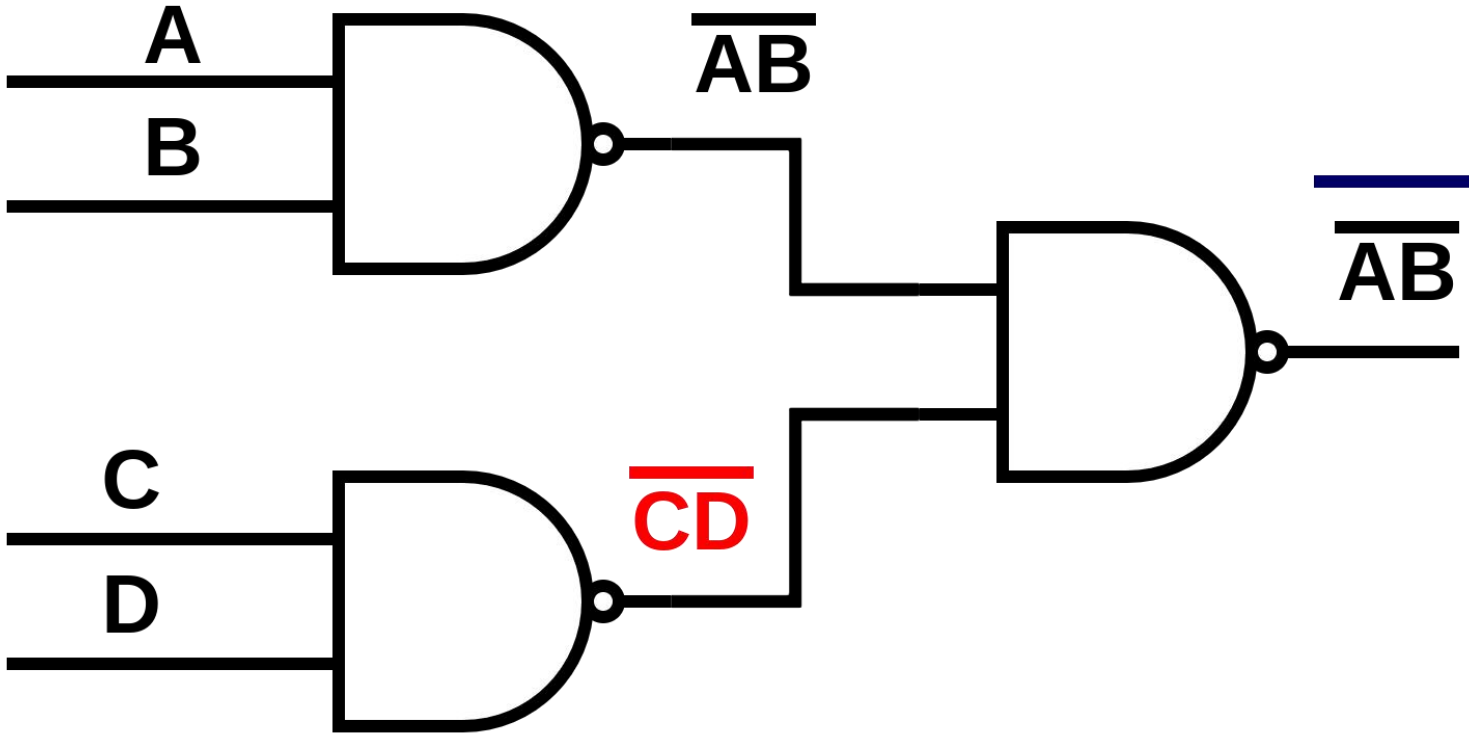
Two ***NAND*** are acting like ***AND*** Gate



$$\overline{\overline{AB}\ .\overline{CD}} = \overline{\overline{AB}} + \overline{\overline{CD}}$$

$$= AB + CD$$

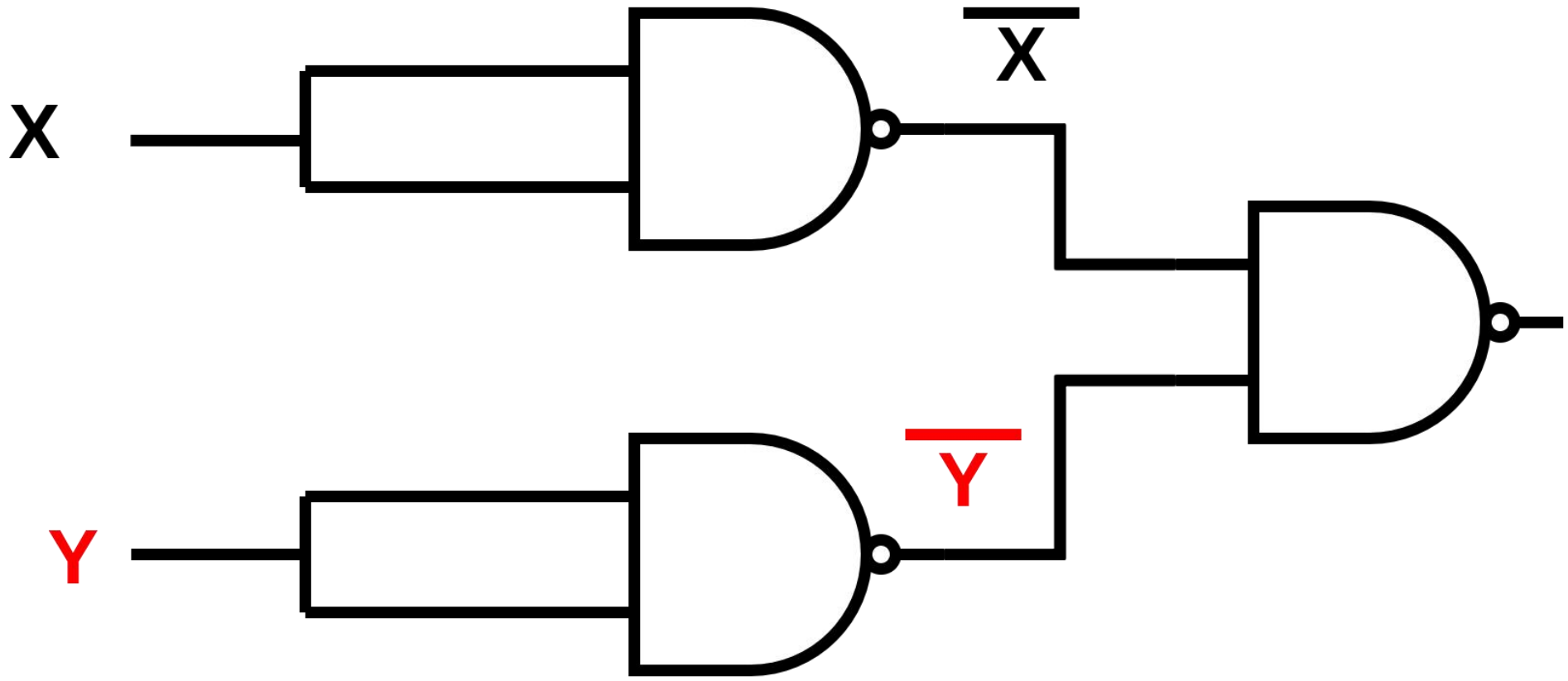
REMEMBER THIS LOGIC CIRCUIT?



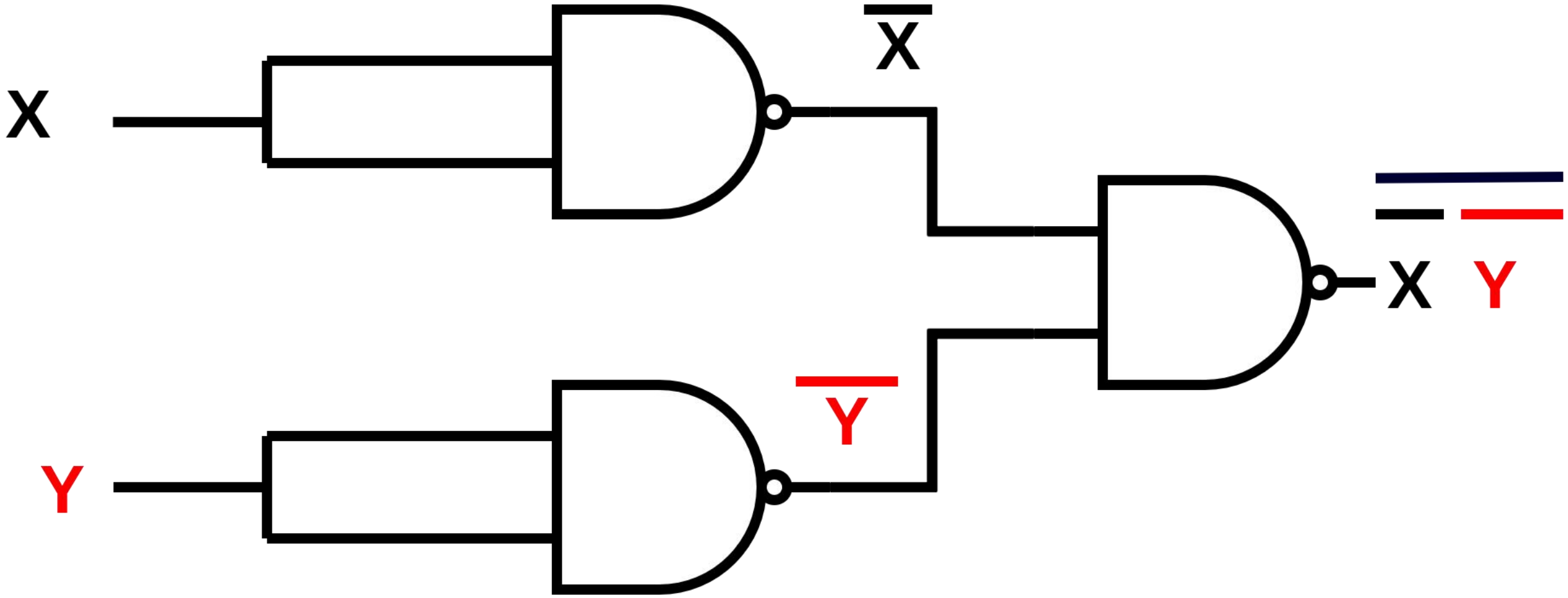
$$\overline{\overline{AB}\ .\overline{CD}} = \overline{\overline{AB}} + \overline{\overline{CD}}$$

$$= AB + CD$$

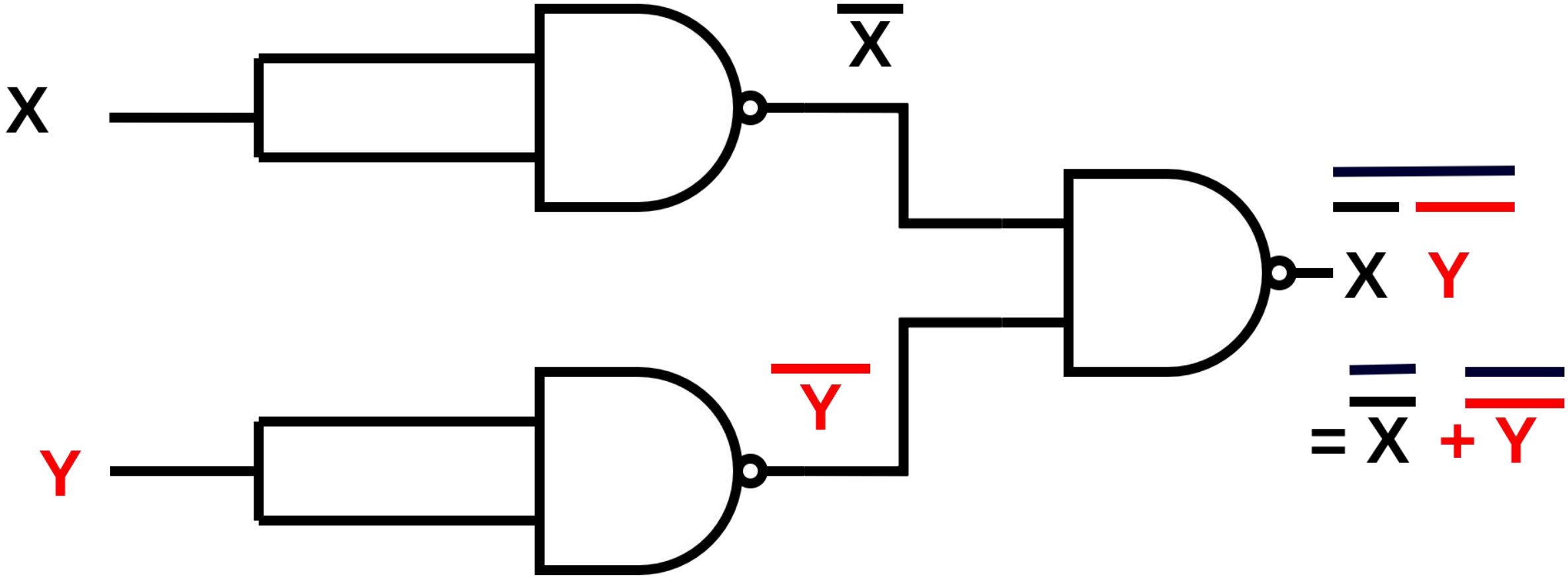
IF A=B=X & C=D=Y , THEN

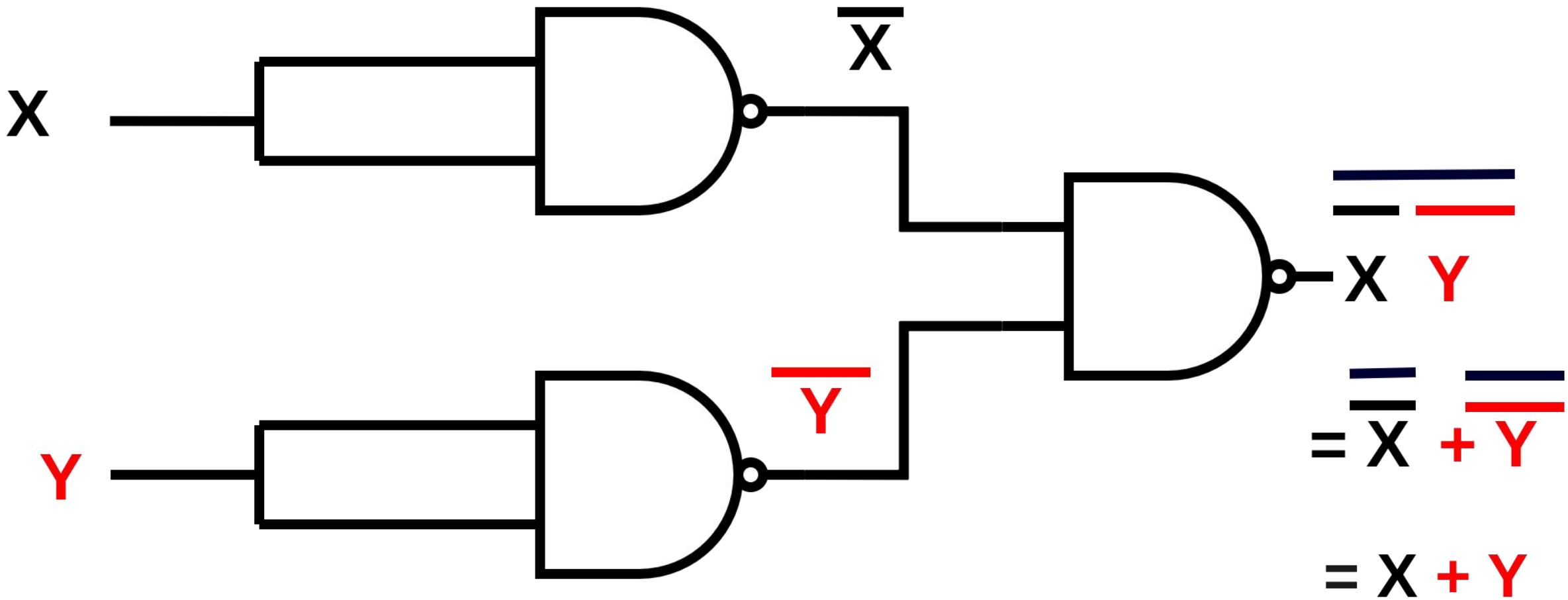


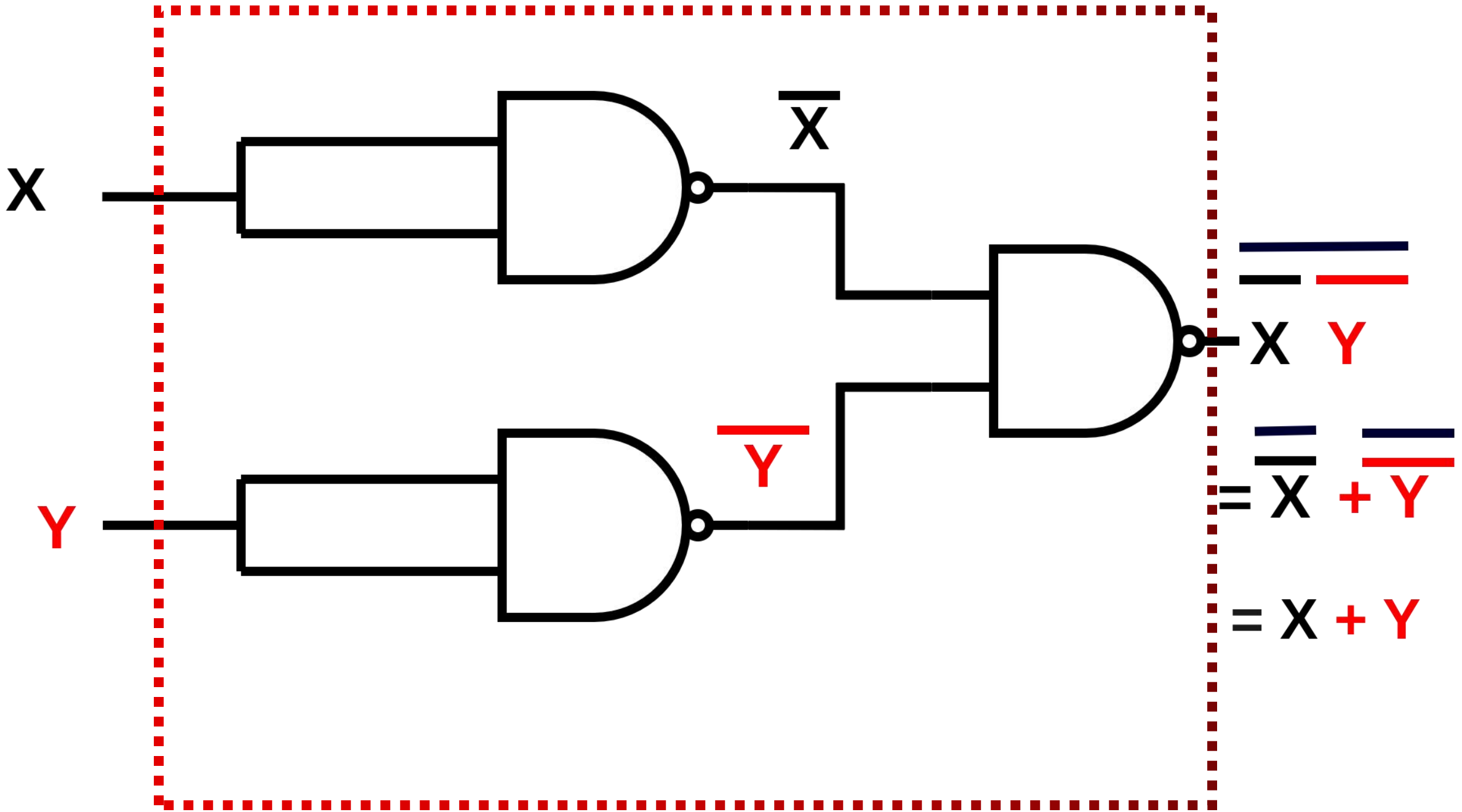
IF A=B=X & C=D=Y , THEN

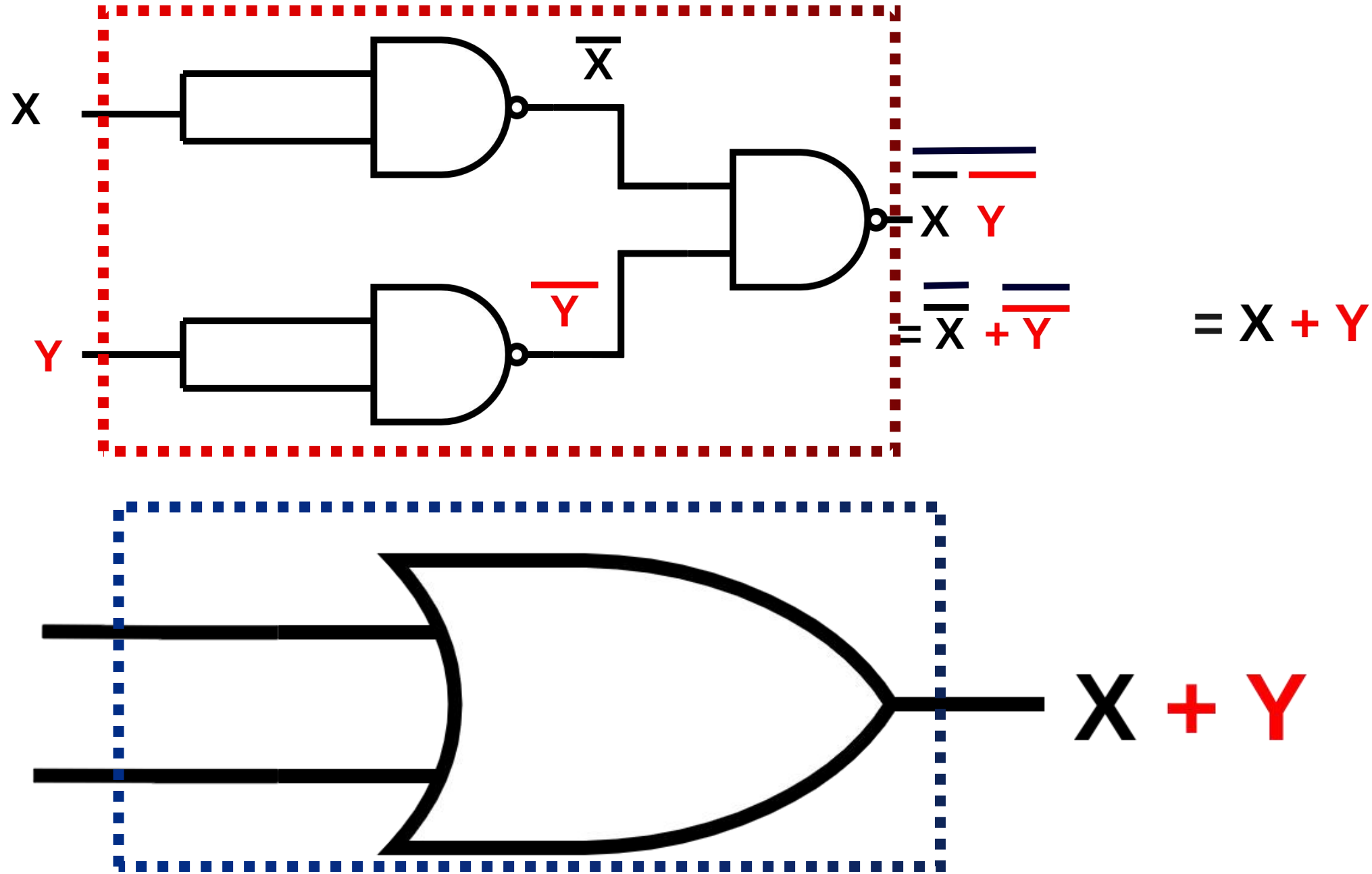


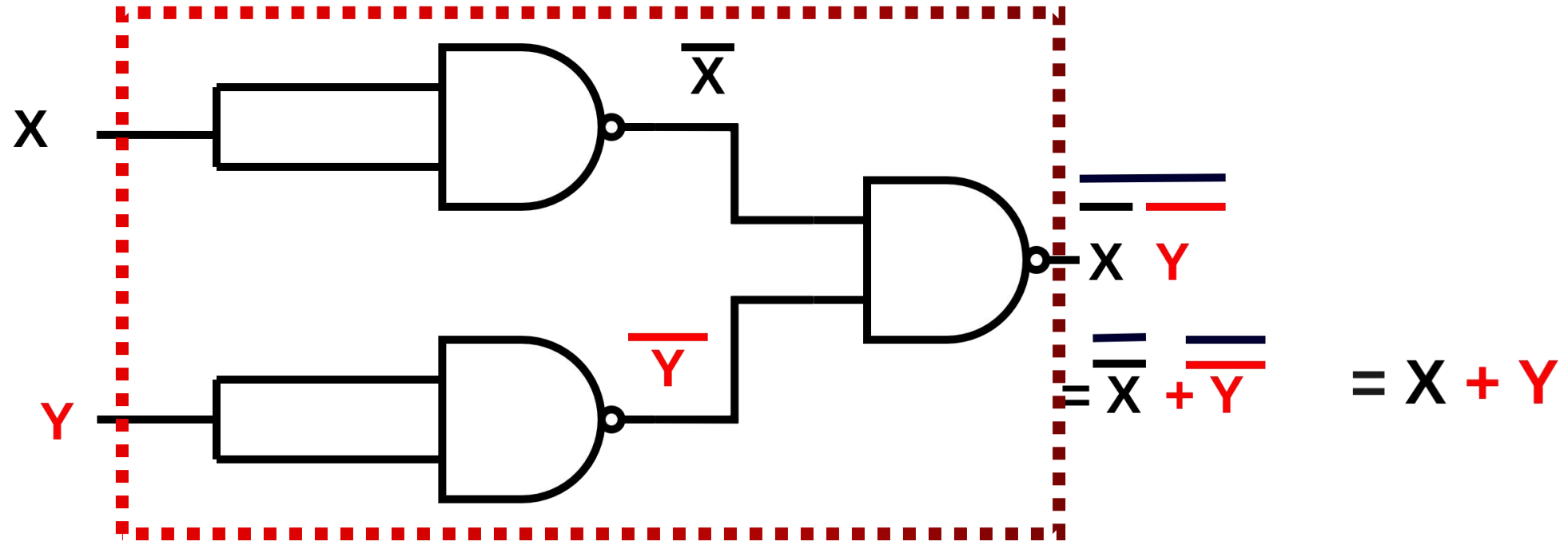
IF A=B=X & C=D=Y , THEN


X
Y
$\overline{X}$
$\overline{Y}$
$\overline{\overline{X}\ \overline{Y}}$
$= X + Y$


X
Y
$\overline{X}$
$\overline{Y}$
$\overline{\overline{X}\ \overline{Y}}$
$= \overline{\overline{X}} + \overline{\overline{Y}}$
$= X + Y$


X
Y
$\overline{X}$
$\overline{Y}$
$\overline{\overline{X}\ \overline{Y}}$
$= \overline{\overline{X}} + \overline{\overline{Y}}$
$= X + Y$

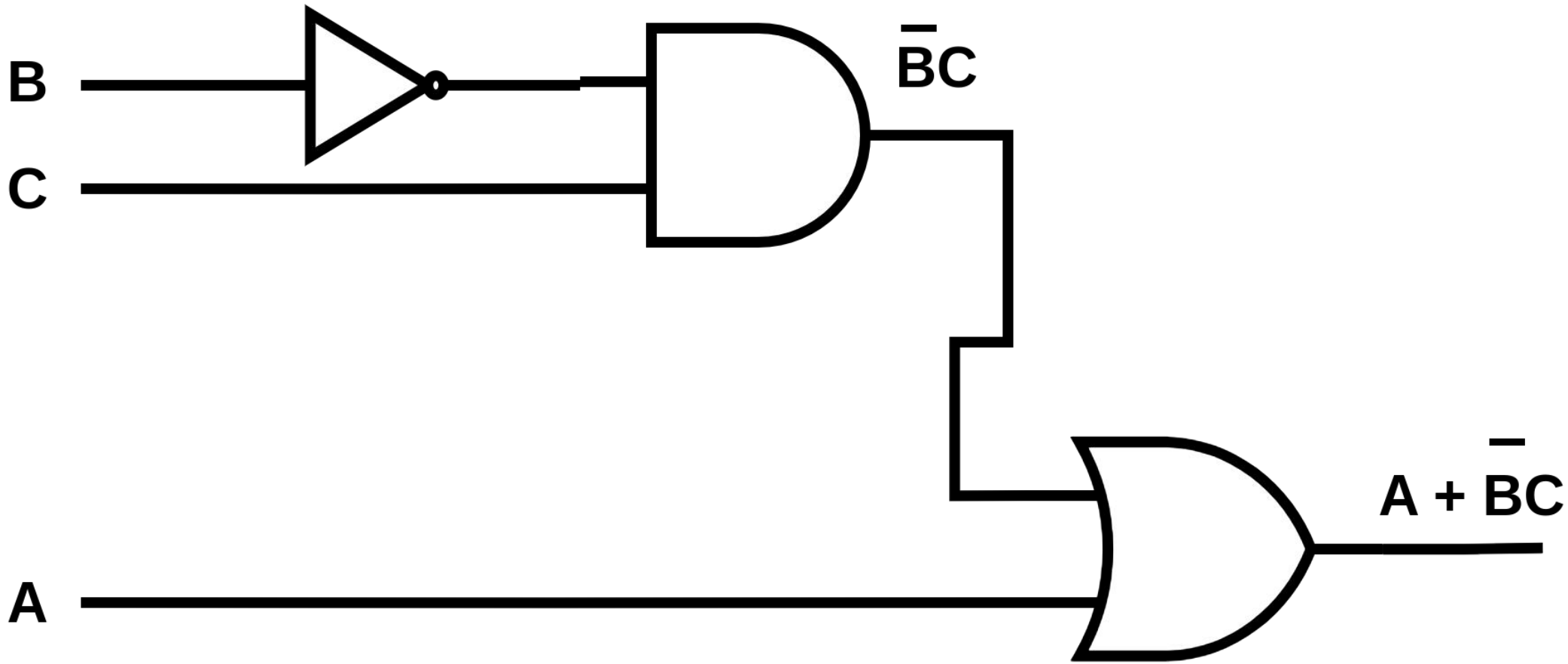

X
Y
$\overline{X}$
$\overline{Y}$
$\overline{X}$ $\overline{Y}$
= $\overline{X}$ + $\overline{Y}$
= X + Y
X
Y
X + Y



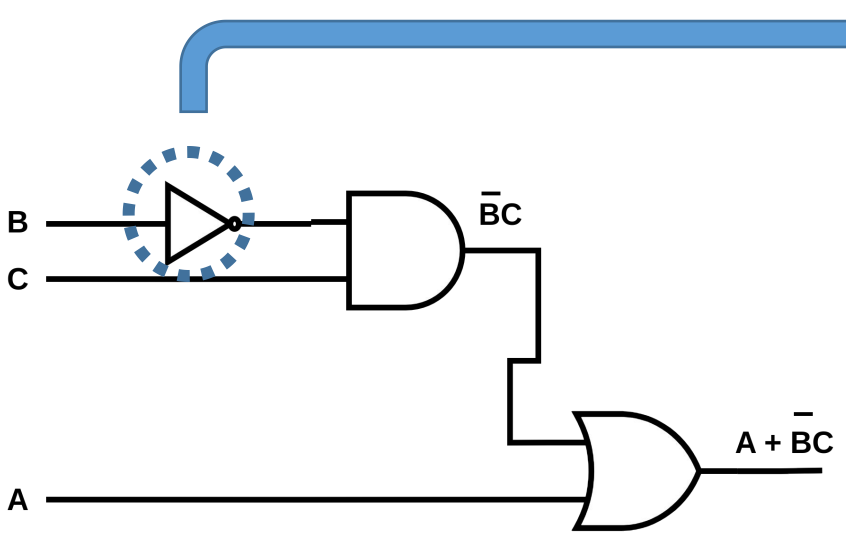
Three ***NAND*** are acting like ***OR*** Gate

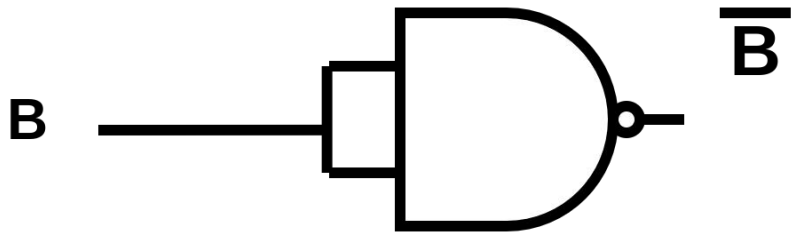
Design $F = A + \bar{B}C$ using Basic Gates

Design F = A+$\bar{B}$C using Basic Gates

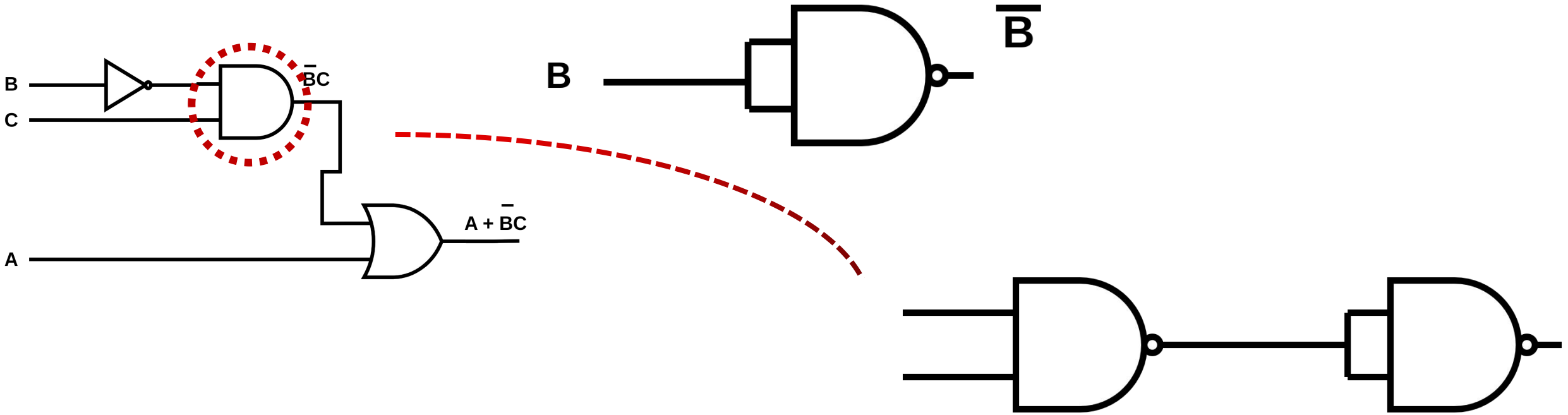


Design F = A+$\bar{B}$C using Basic Gates

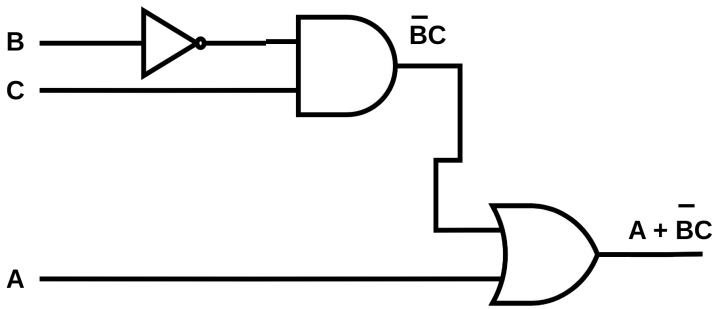


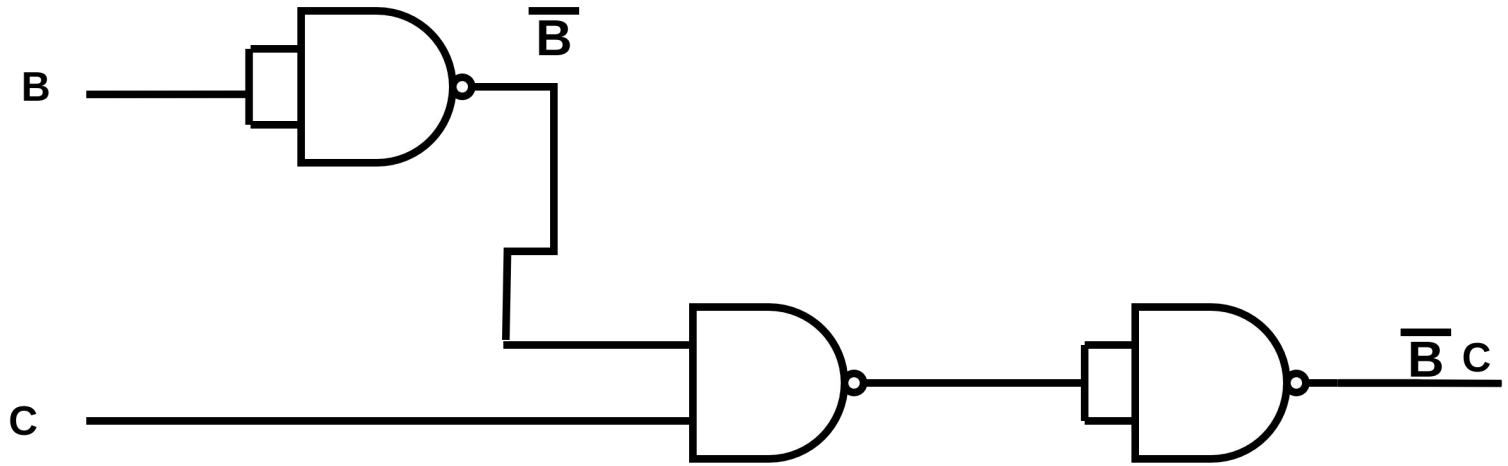


Design F = A+$\bar{B}$C using Basic Gates

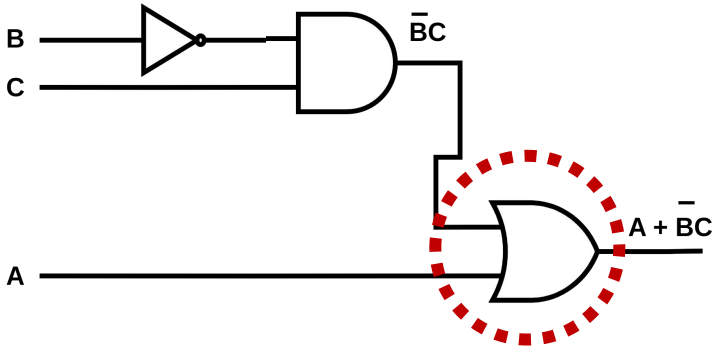


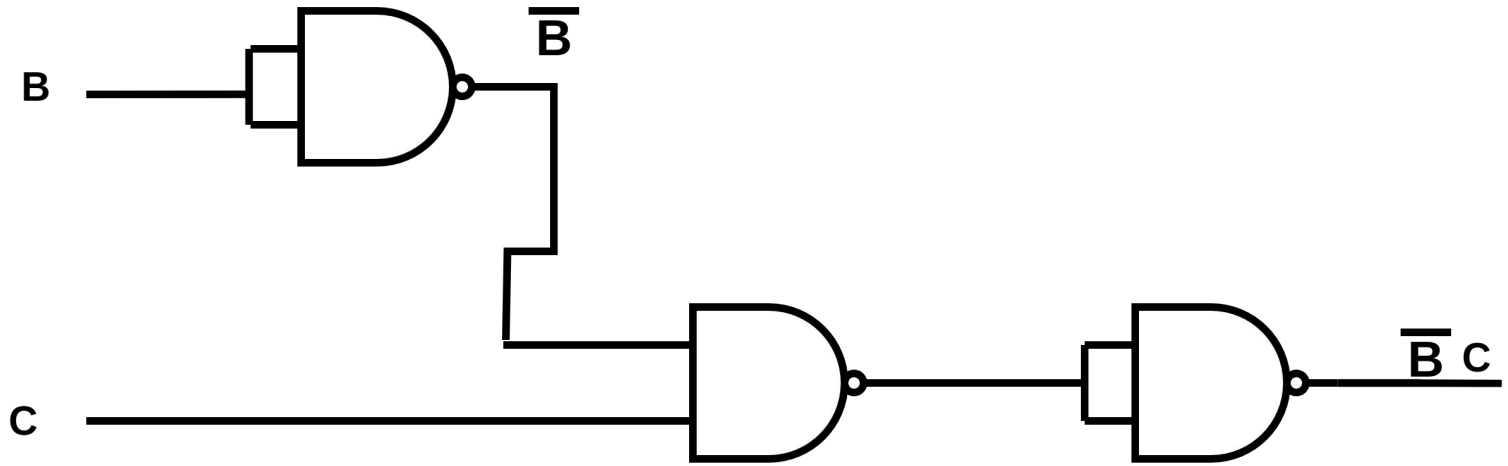
Design F = A+$\bar{B}$C using Basic Gates

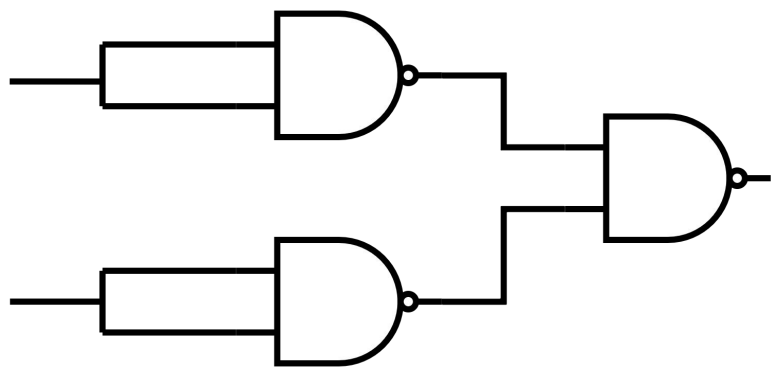




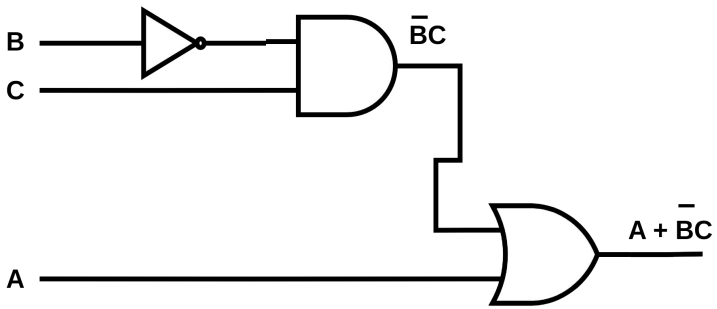
Design F = A+$\bar{B}$C using Basic Gates

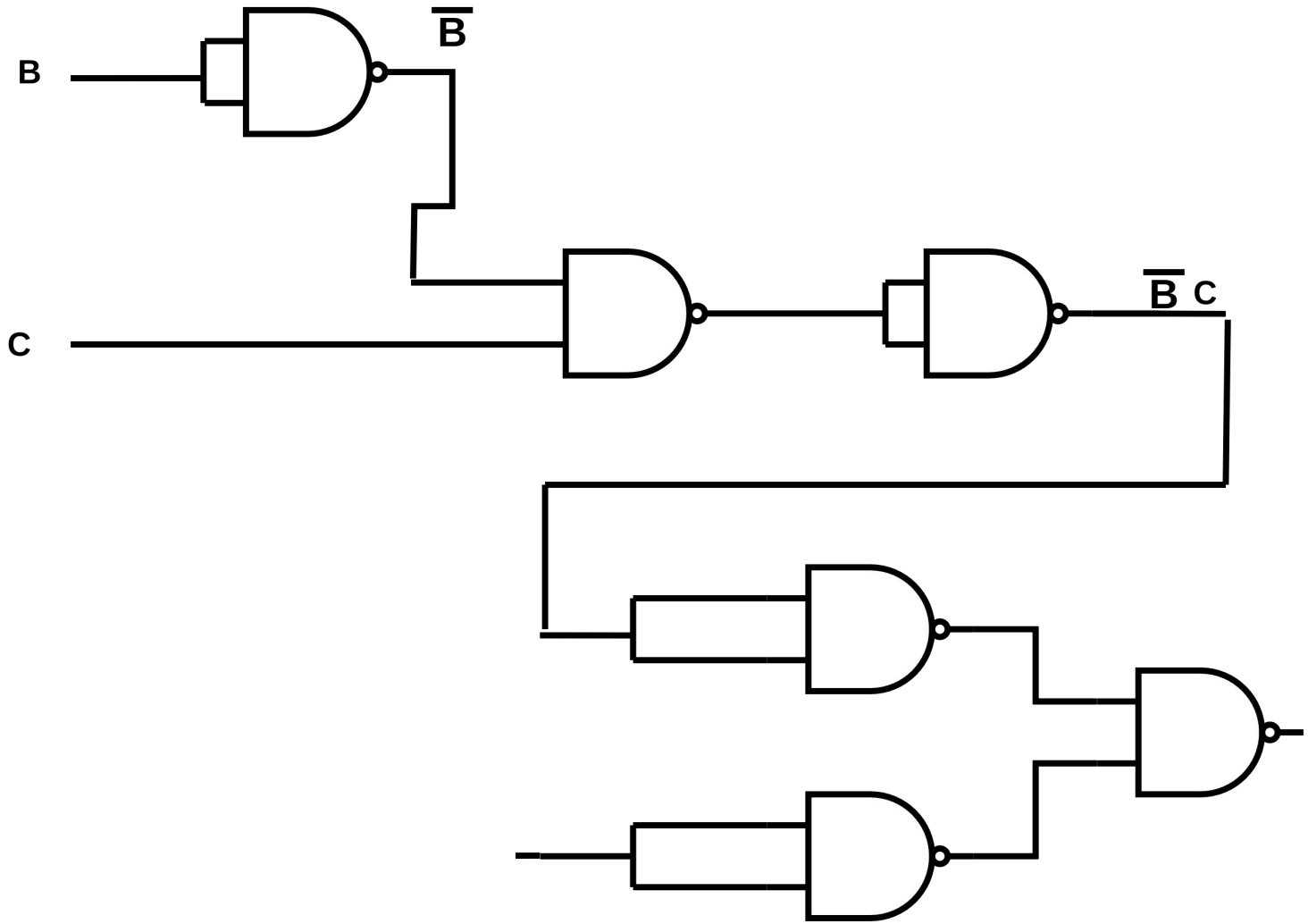




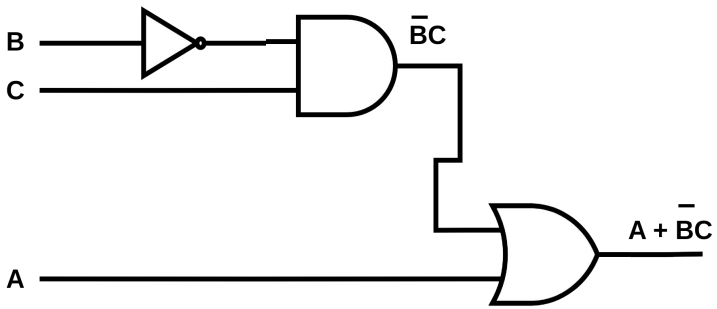


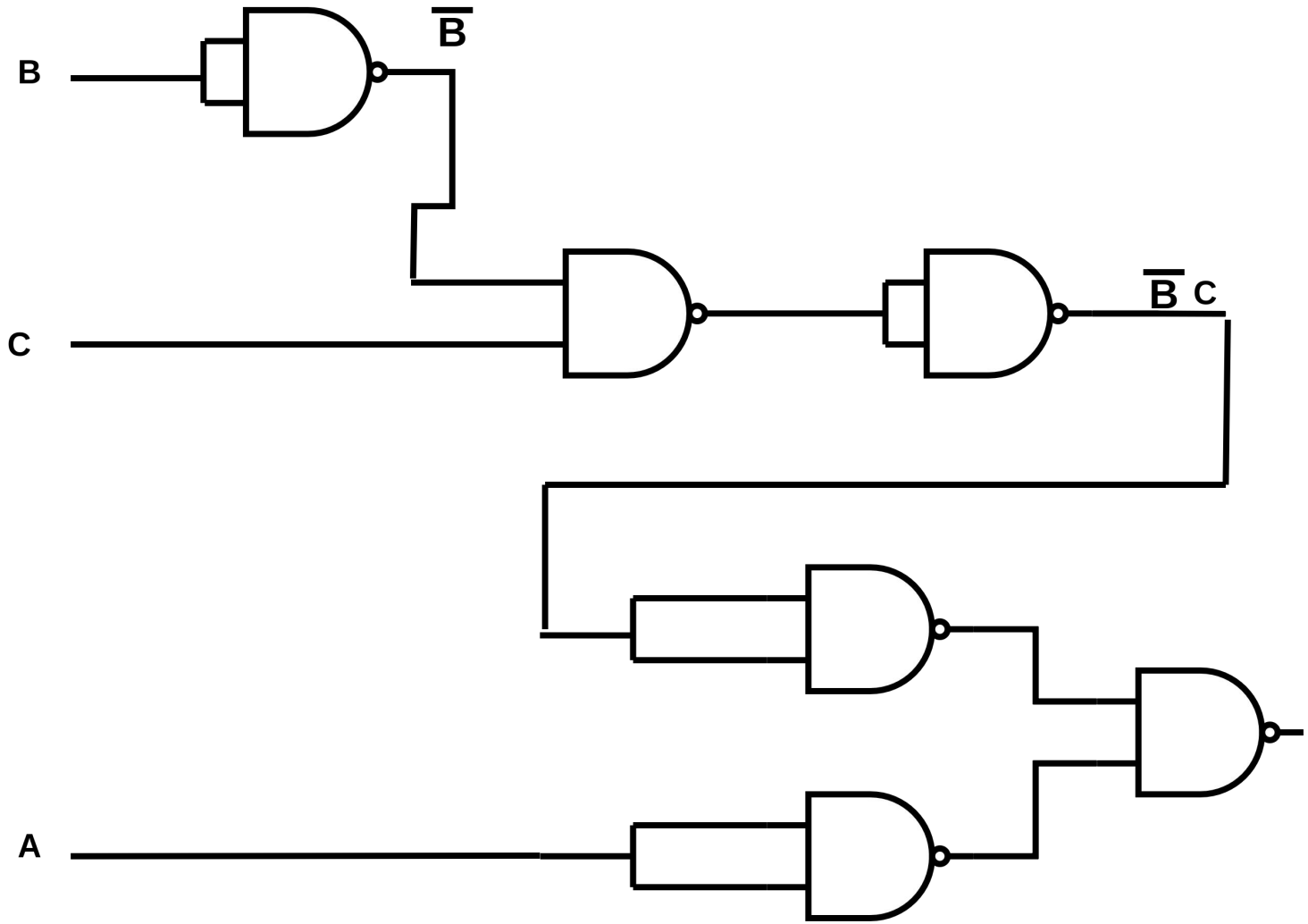
Design F = A+$\bar{B}$C using Basic Gates



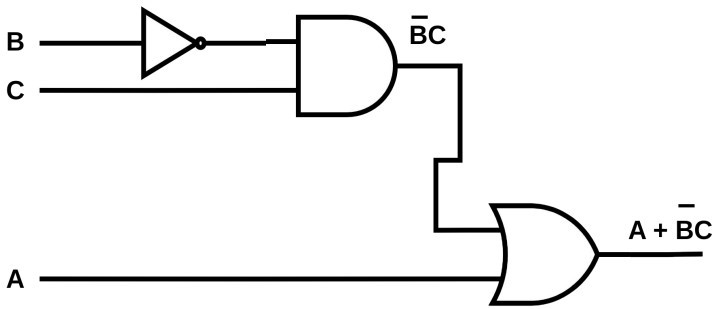


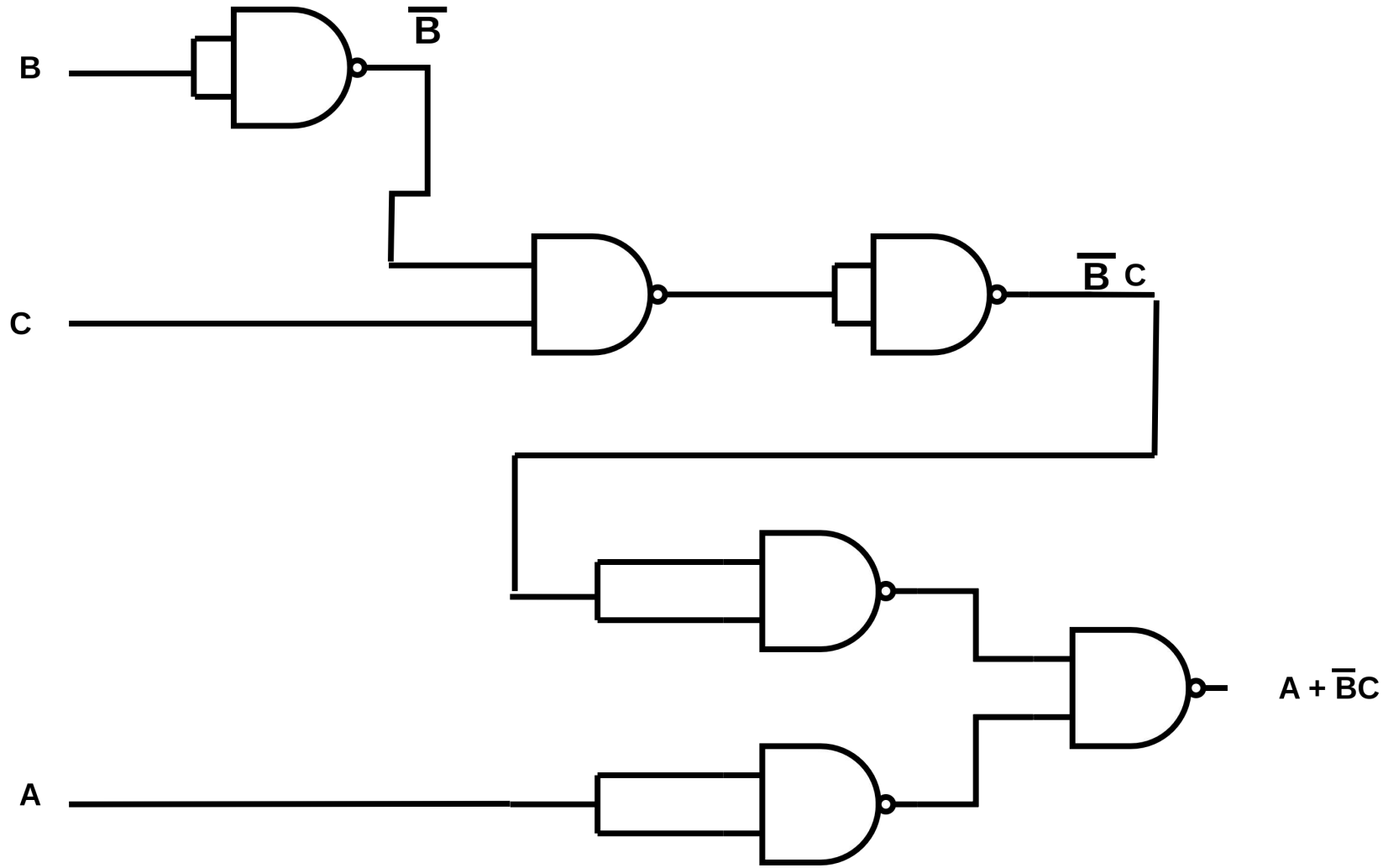
Design F = A+$\bar{B}$C using Basic Gates

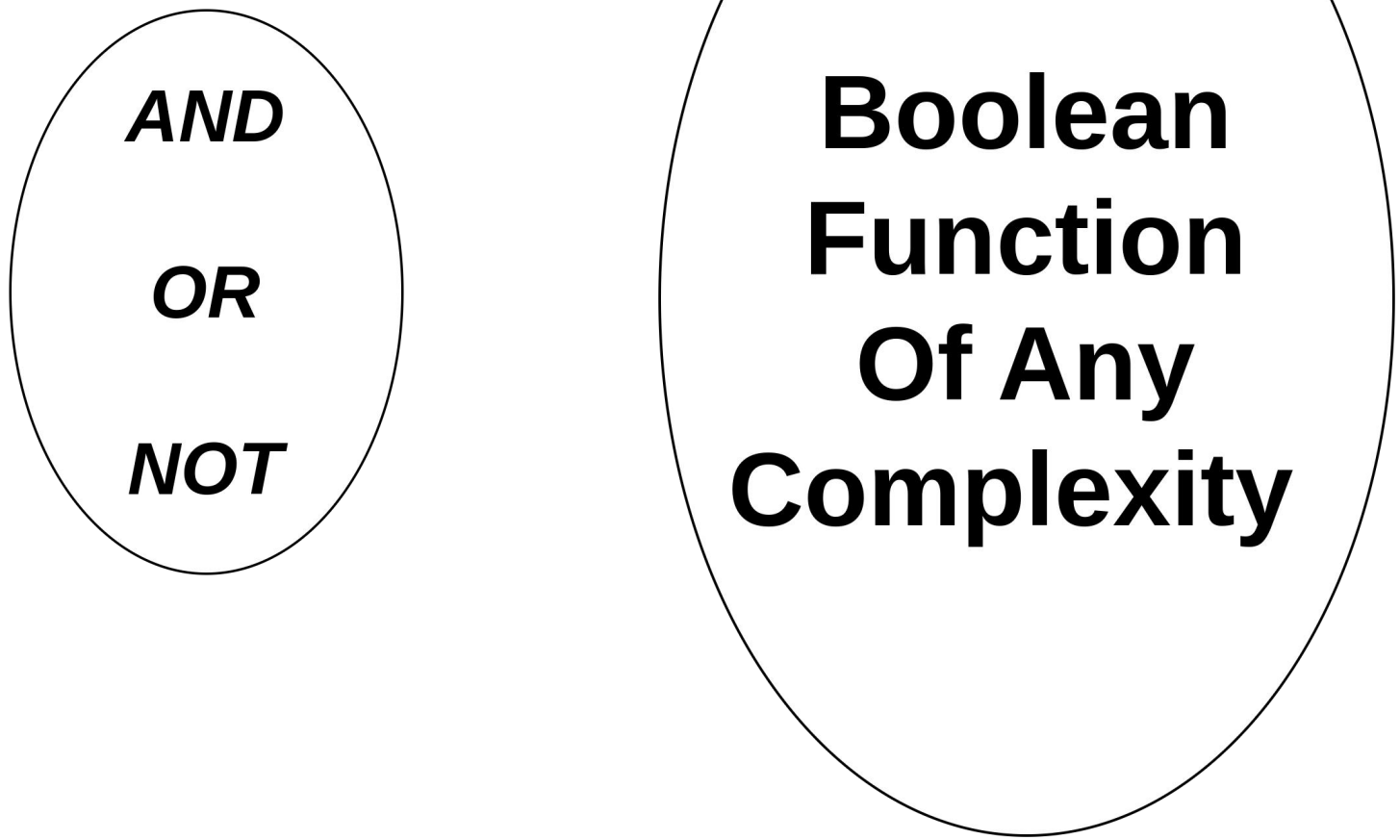


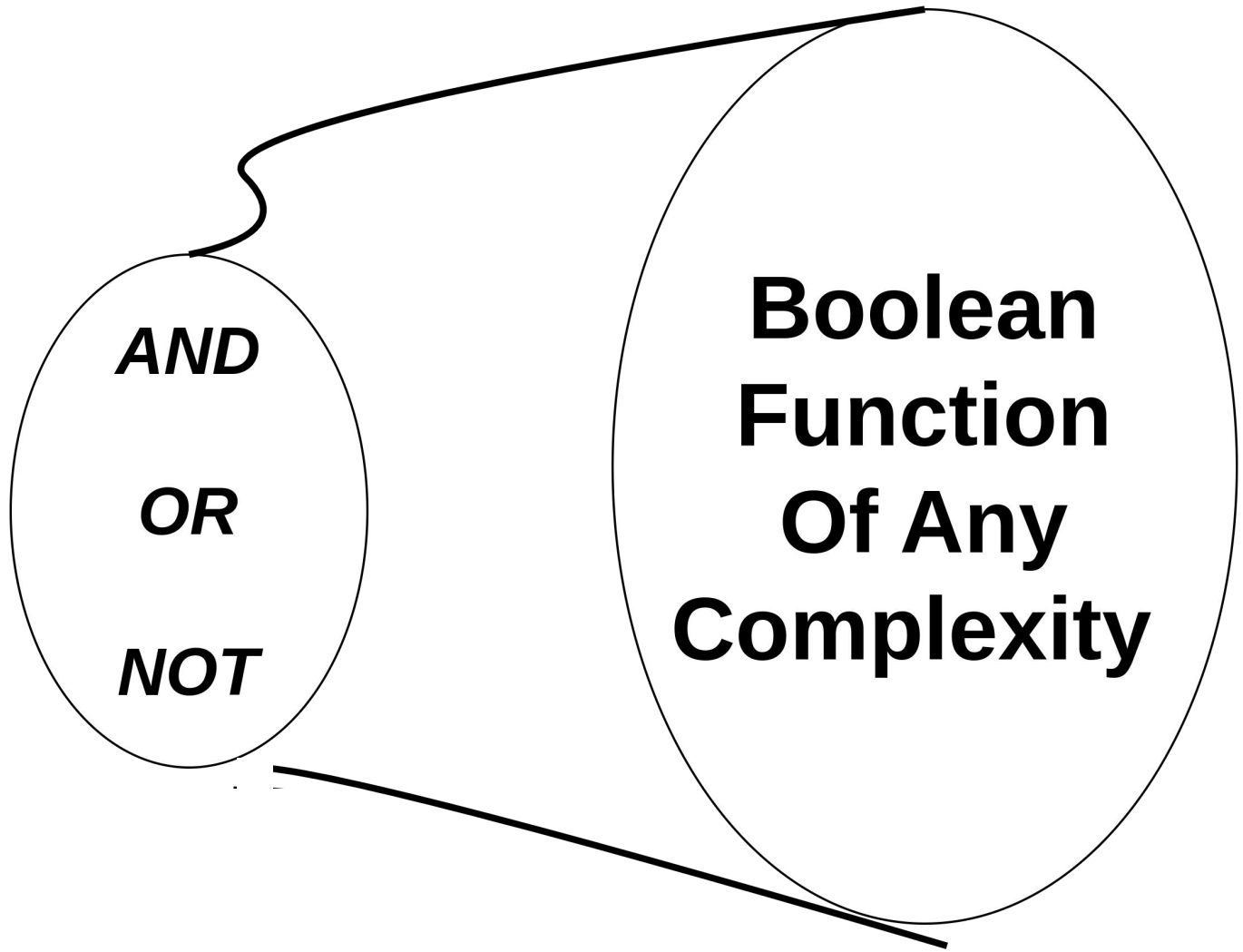


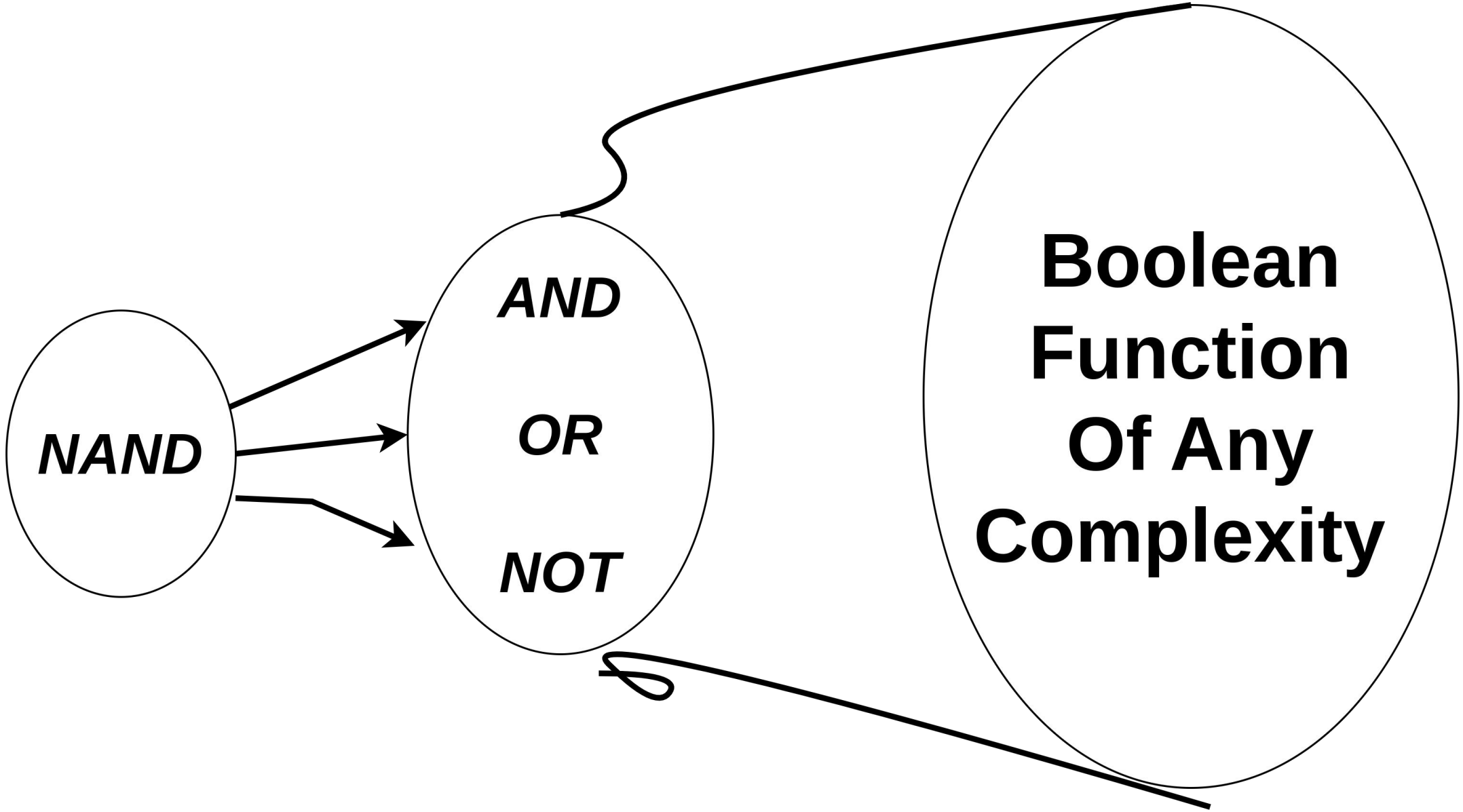
Design F = A+$\bar{B}$C using Basic Gates

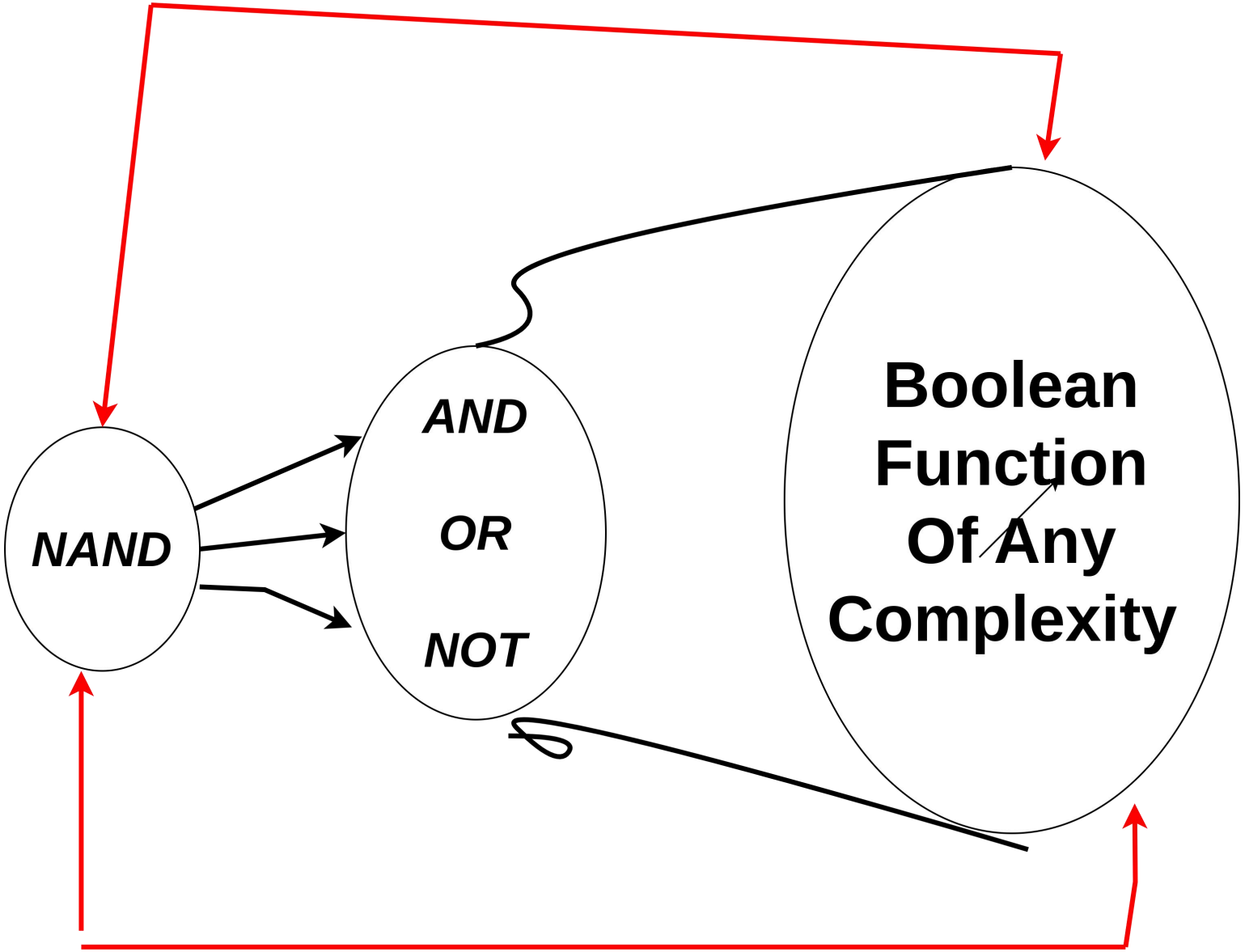




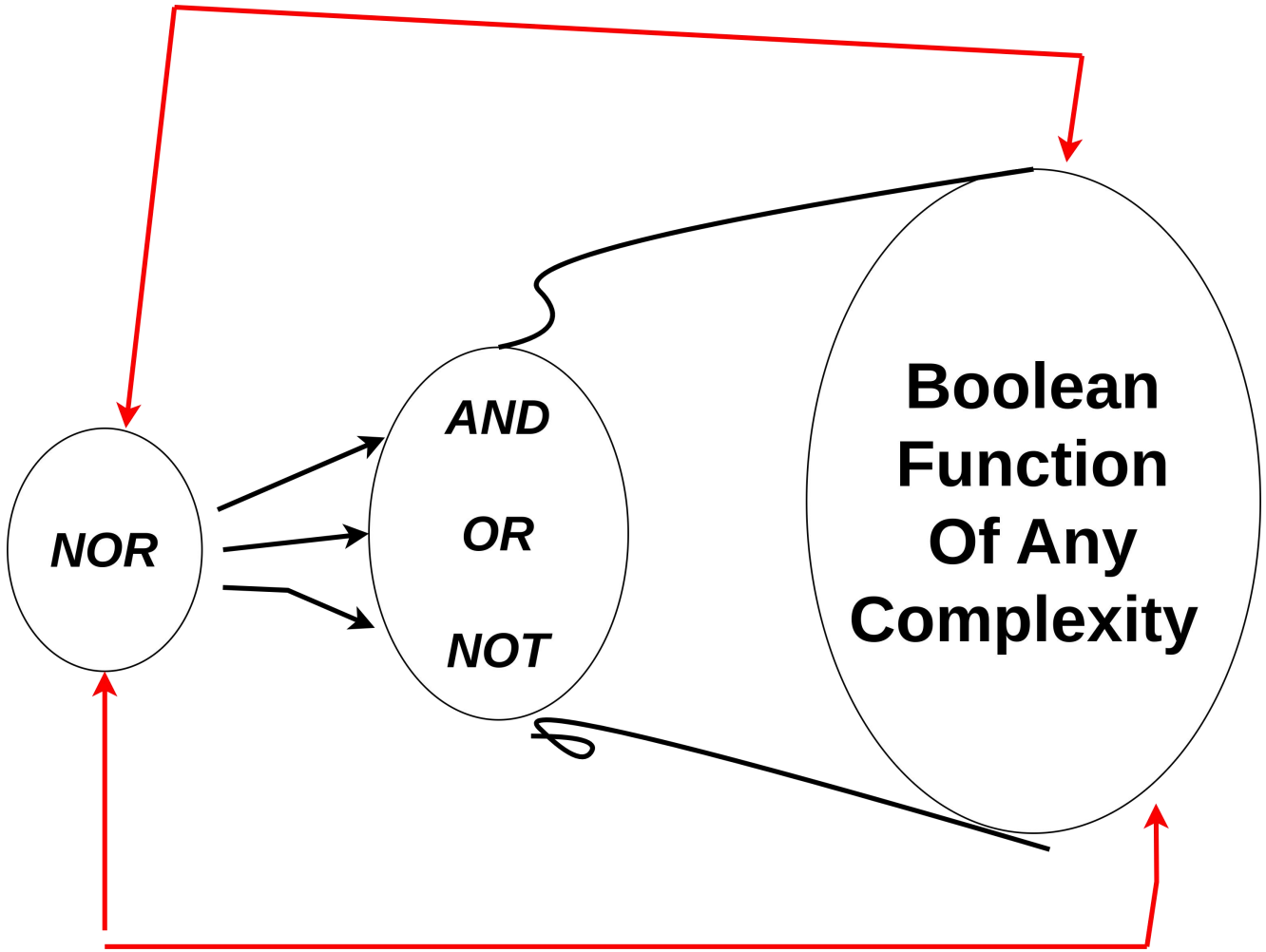

AND
OR
NOT
Boolean Function Of Any Complexity


AND
OR
NOT
Boolean
Function
Of Any
Complexity

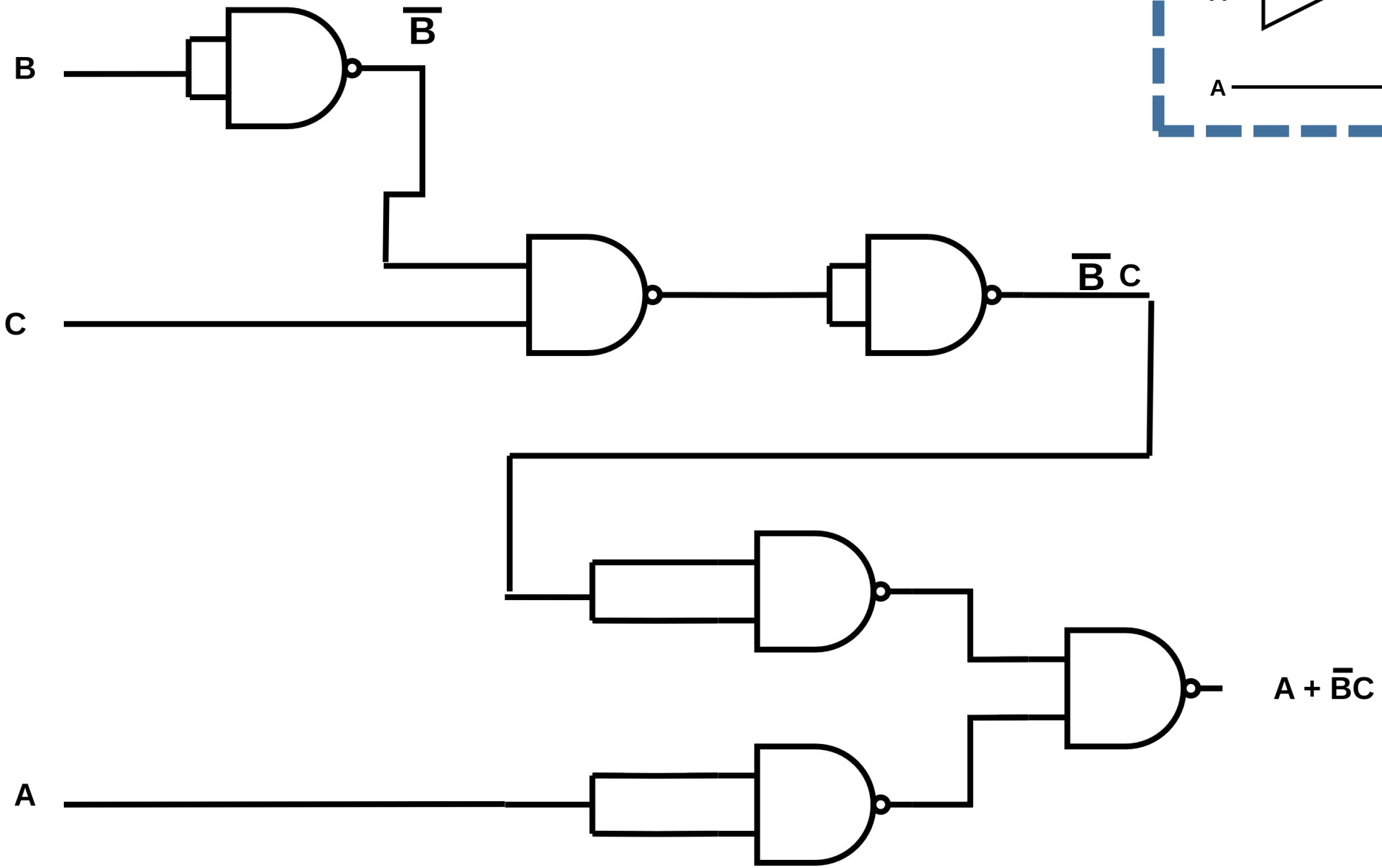

NAND
AND
OR
NOT
Boolean
Function
Of Any
Complexity

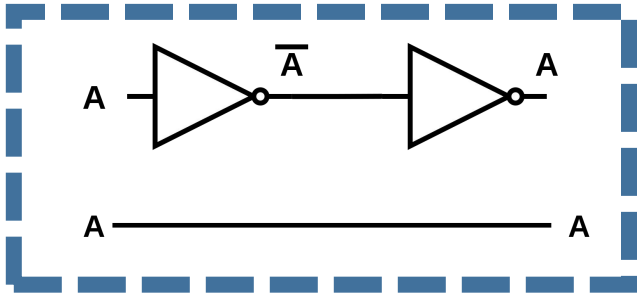


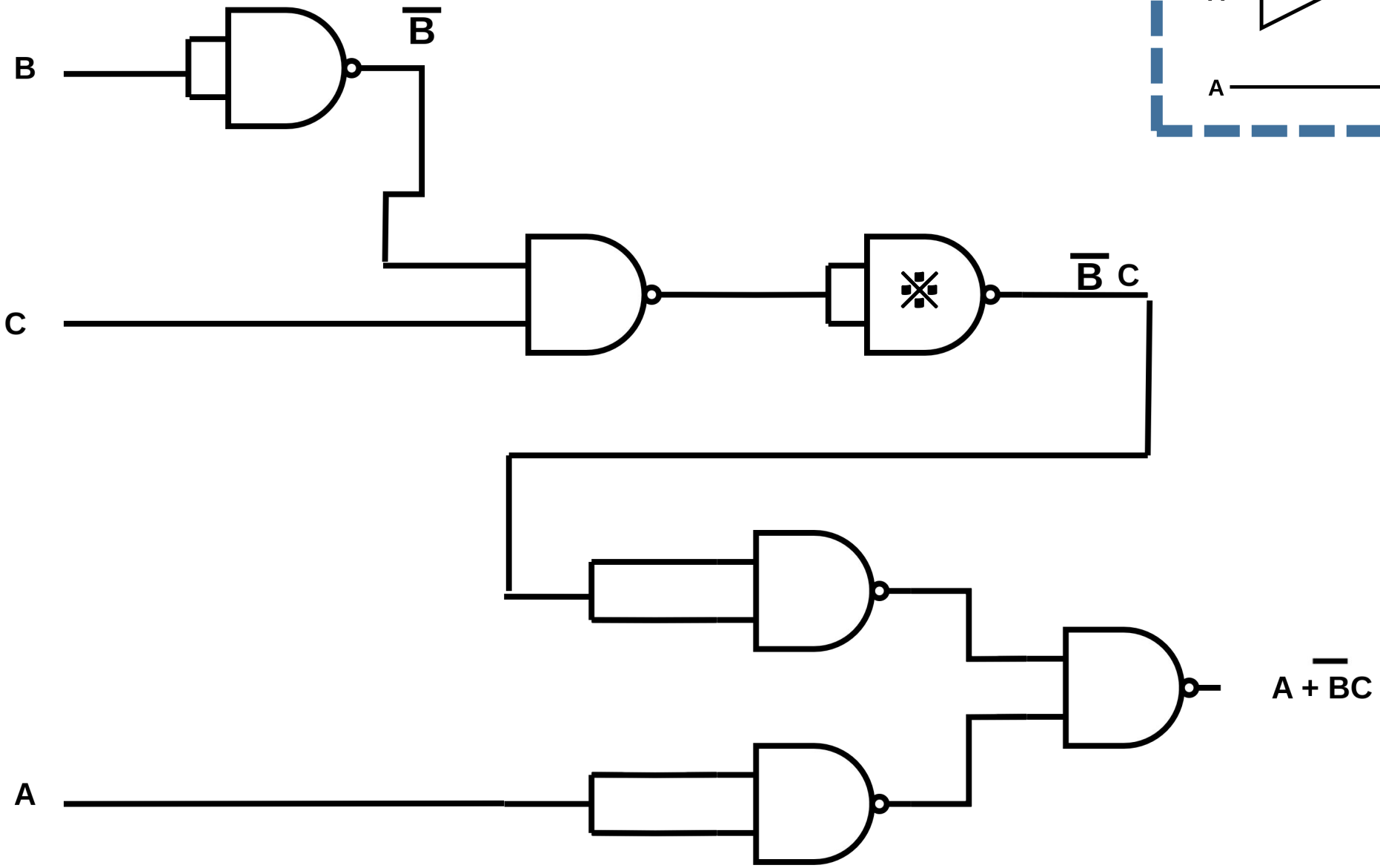
UNIVERSAL GATE

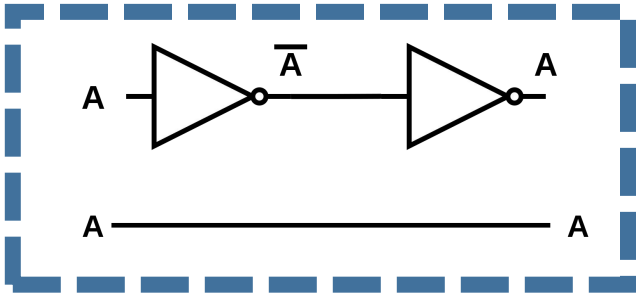


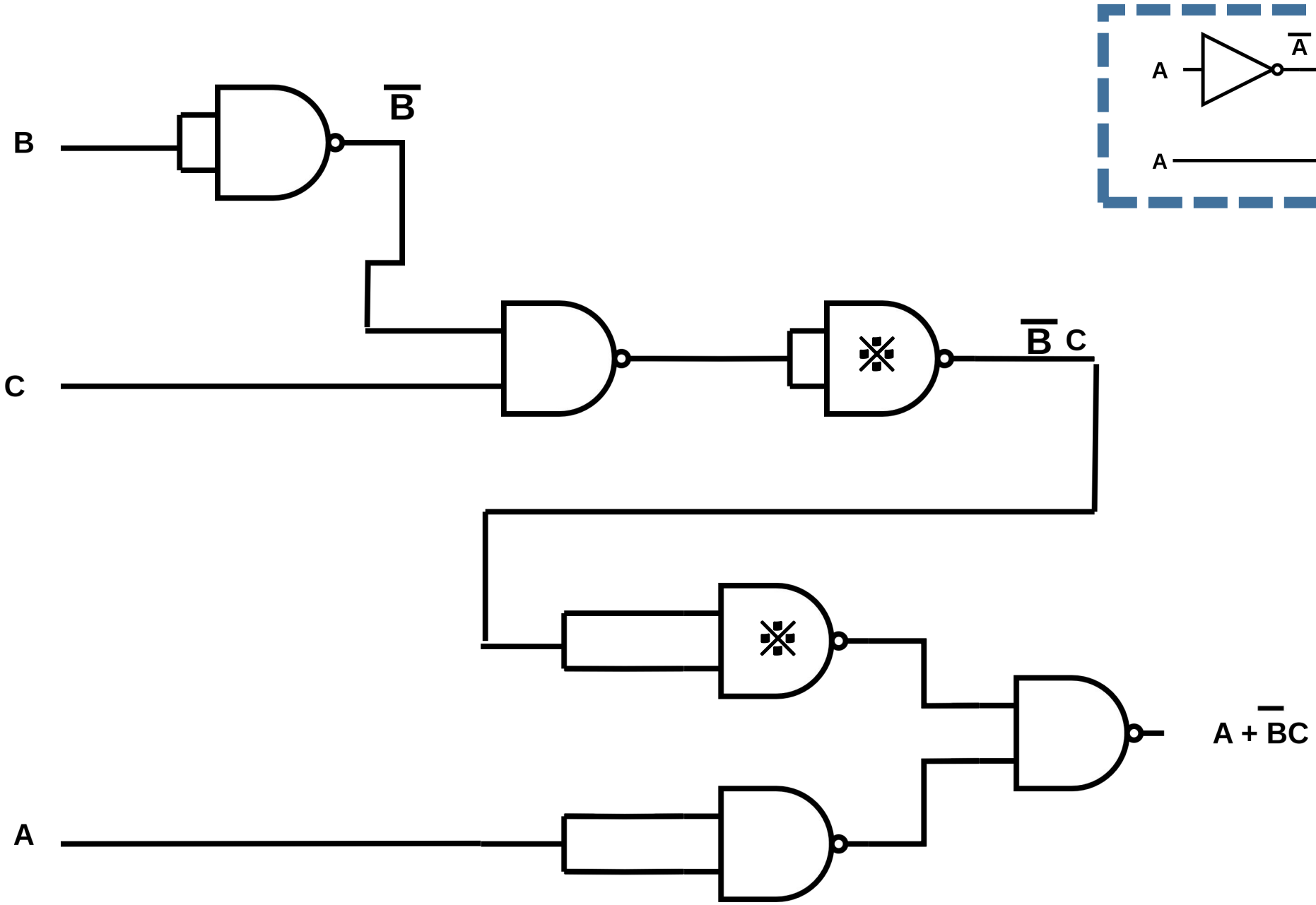
UNIVERSAL GATE

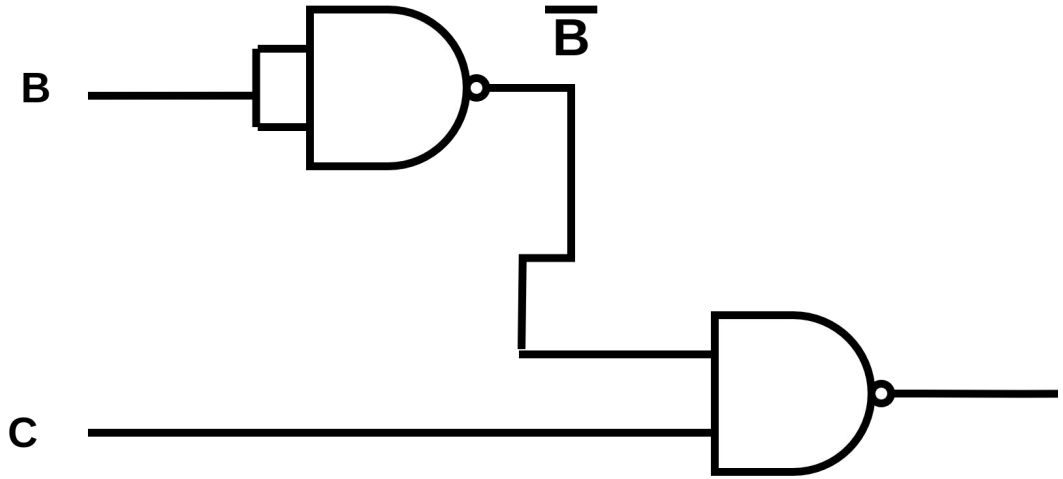

B
$\overline{B}$
C
$\overline{B}$ C
A
A + $\overline{B}$C

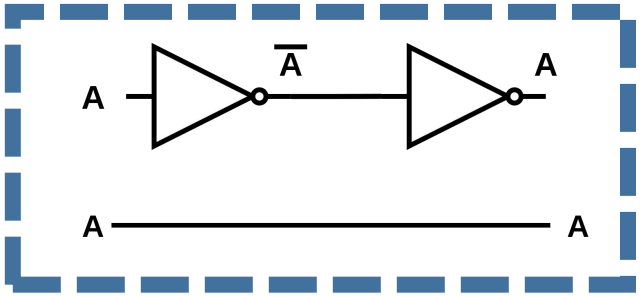

A
$\overline{A}$
A
A
A

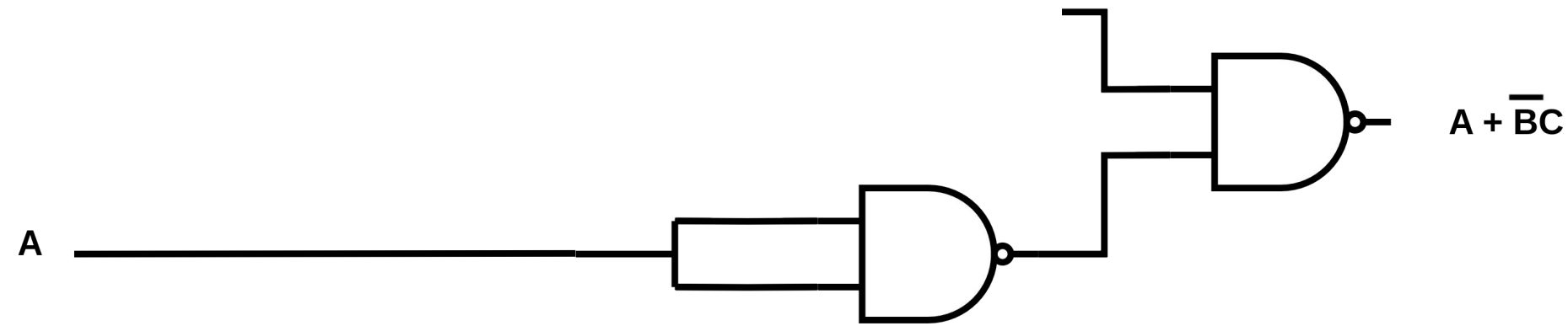

B
$\overline{B}$
C
$\overline{B}$ C
A
A + $\overline{B}$C

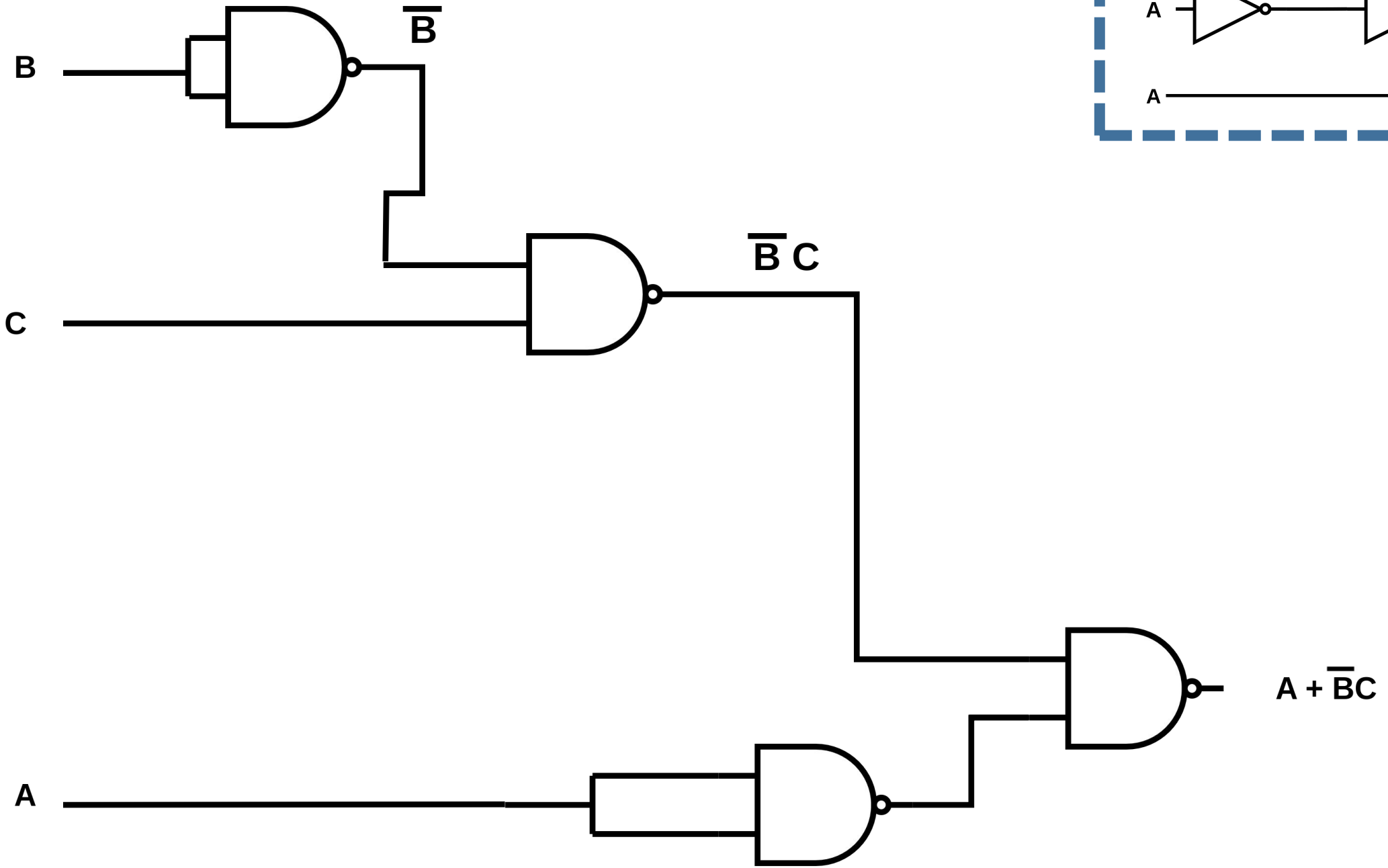

A
$\overline{A}$
A
A
A


A
$\overline{A}$
A
A
A
B
$\overline{B}$
C
$\overline{B}$ C
A
A + $\overline{B}$C

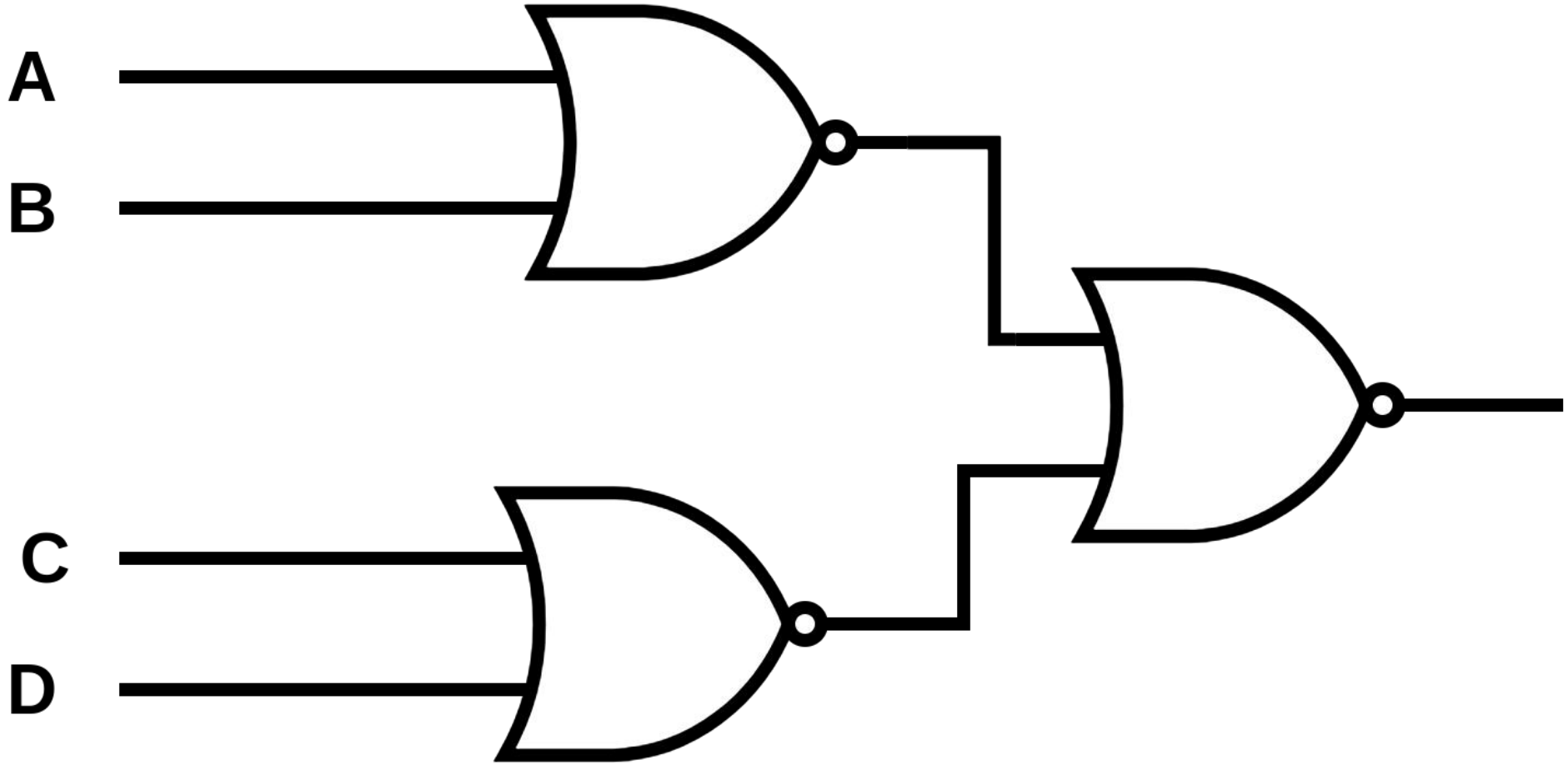

B
$\overline{B}$
C

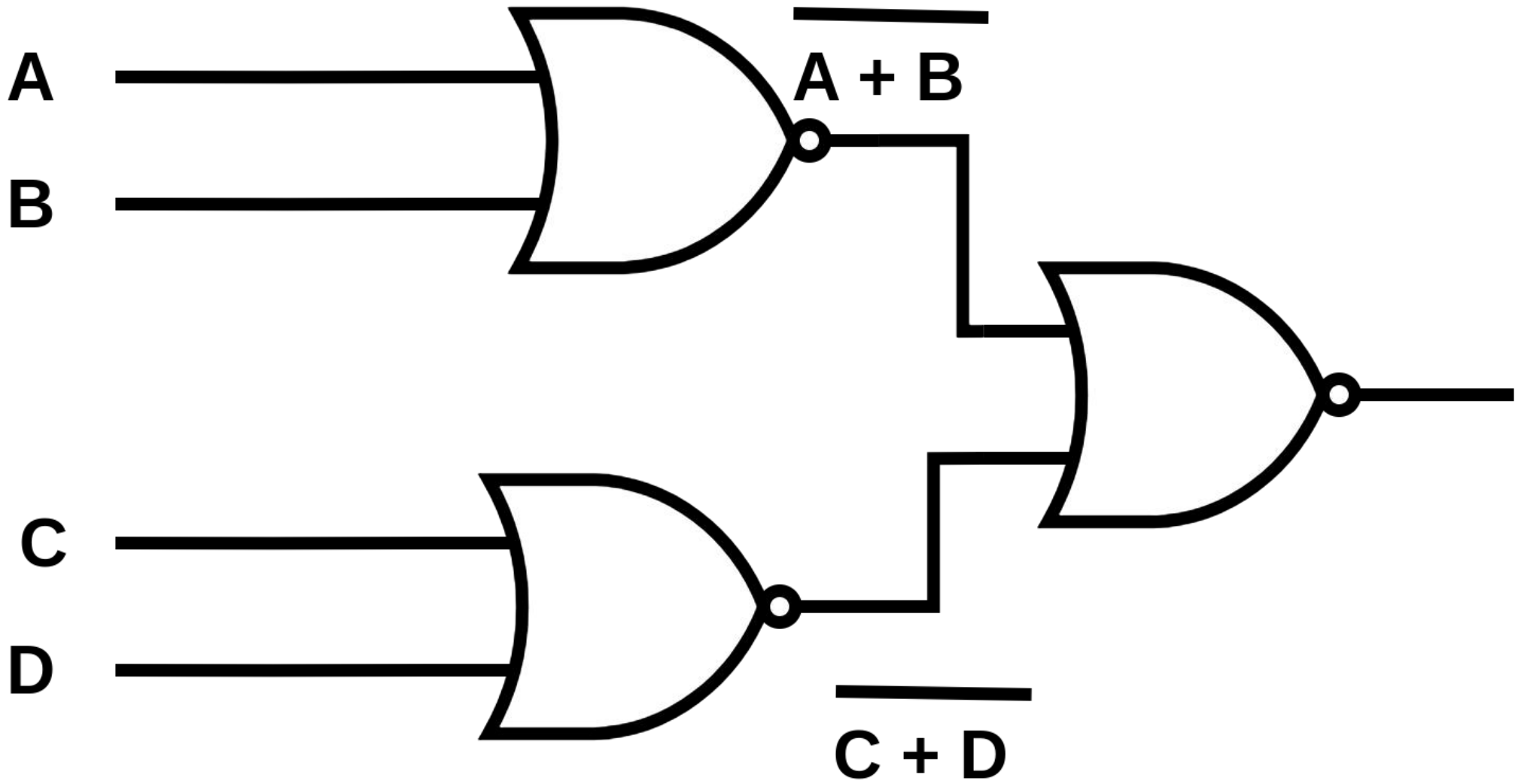

A
$\overline{A}$
A
A
A

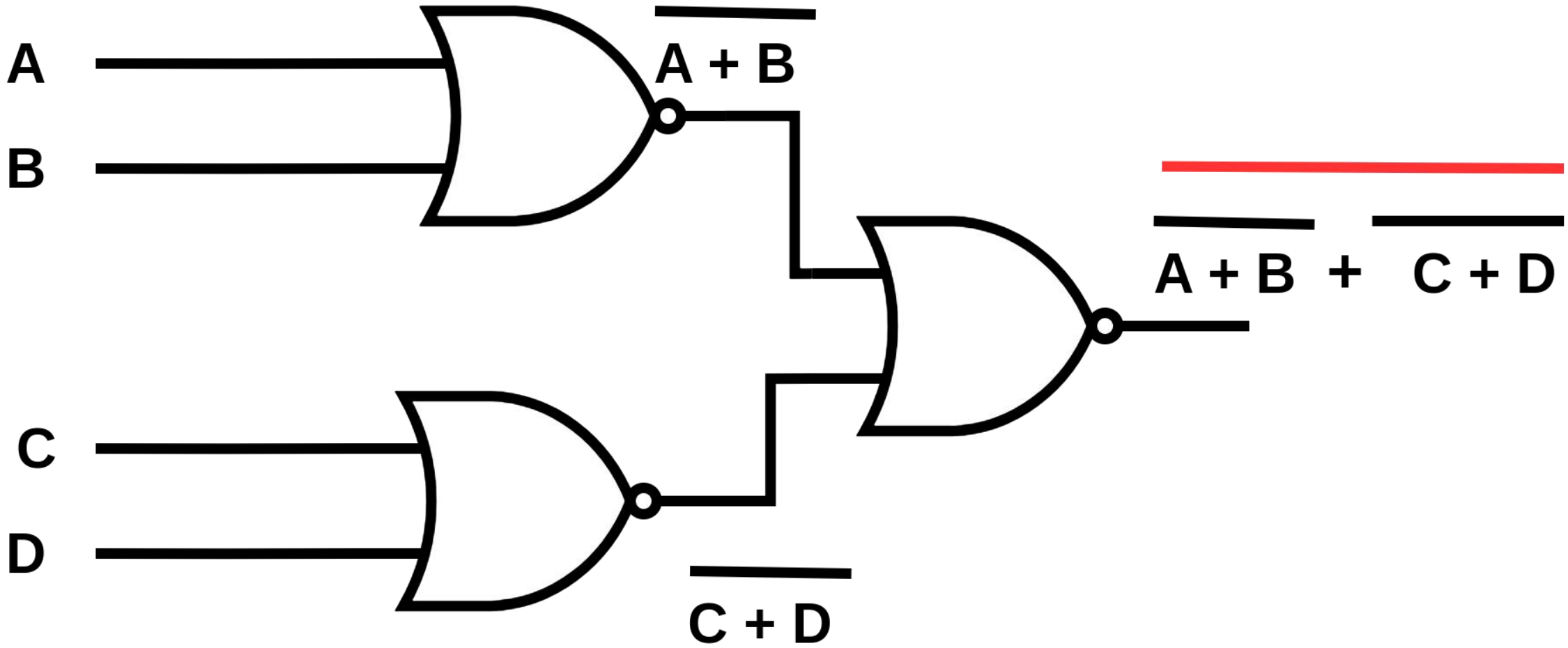

A
$A + \overline{B}C$

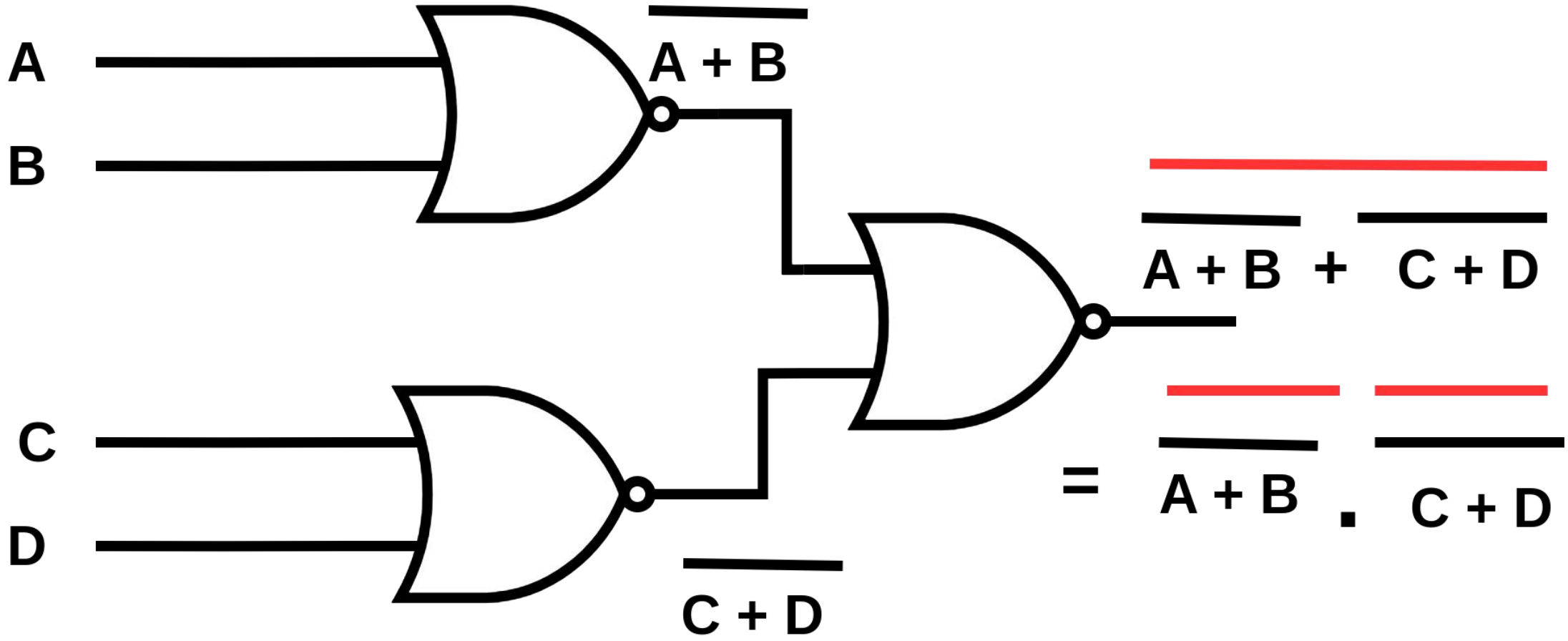

B
$\overline{B}$
C
$\overline{B}$ C
A
A + $\overline{B}$C
A
$\overline{A}$
A
A
A

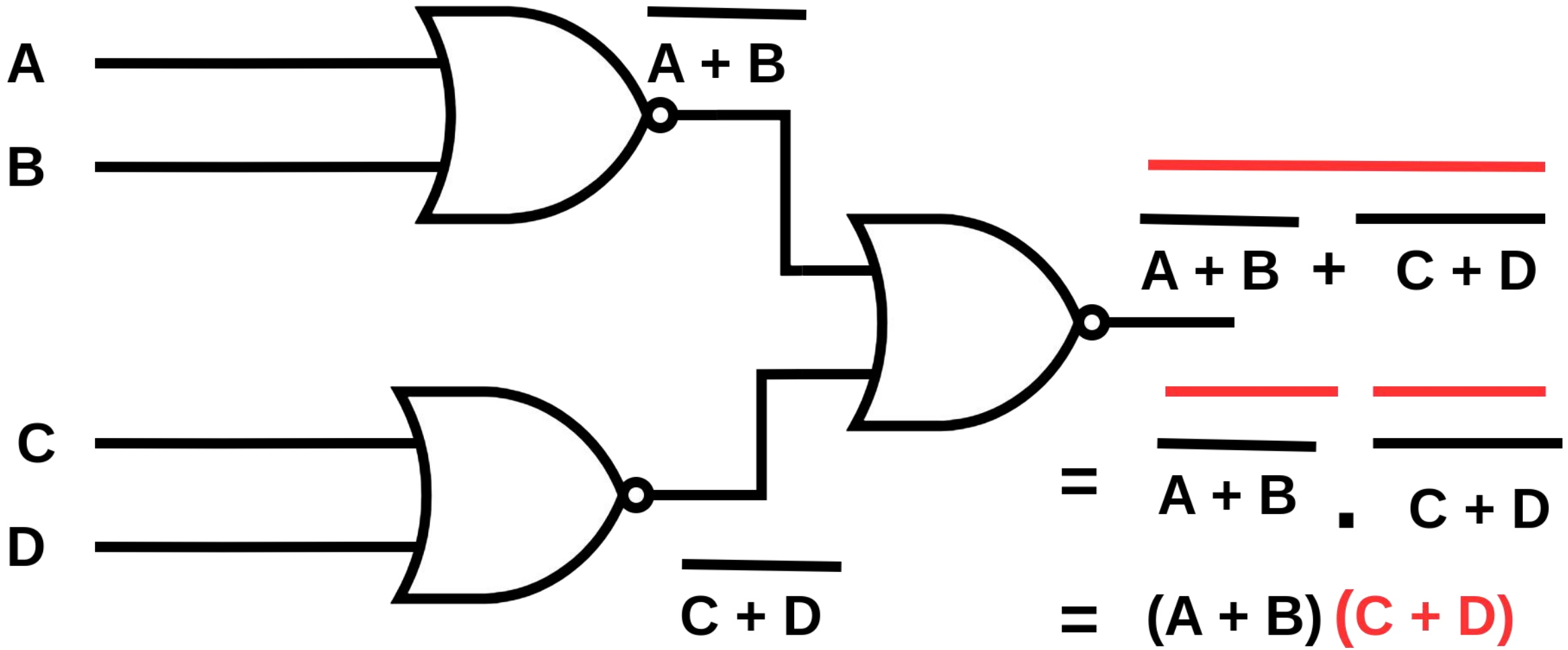
UNIVERSAL *NOR* GATE

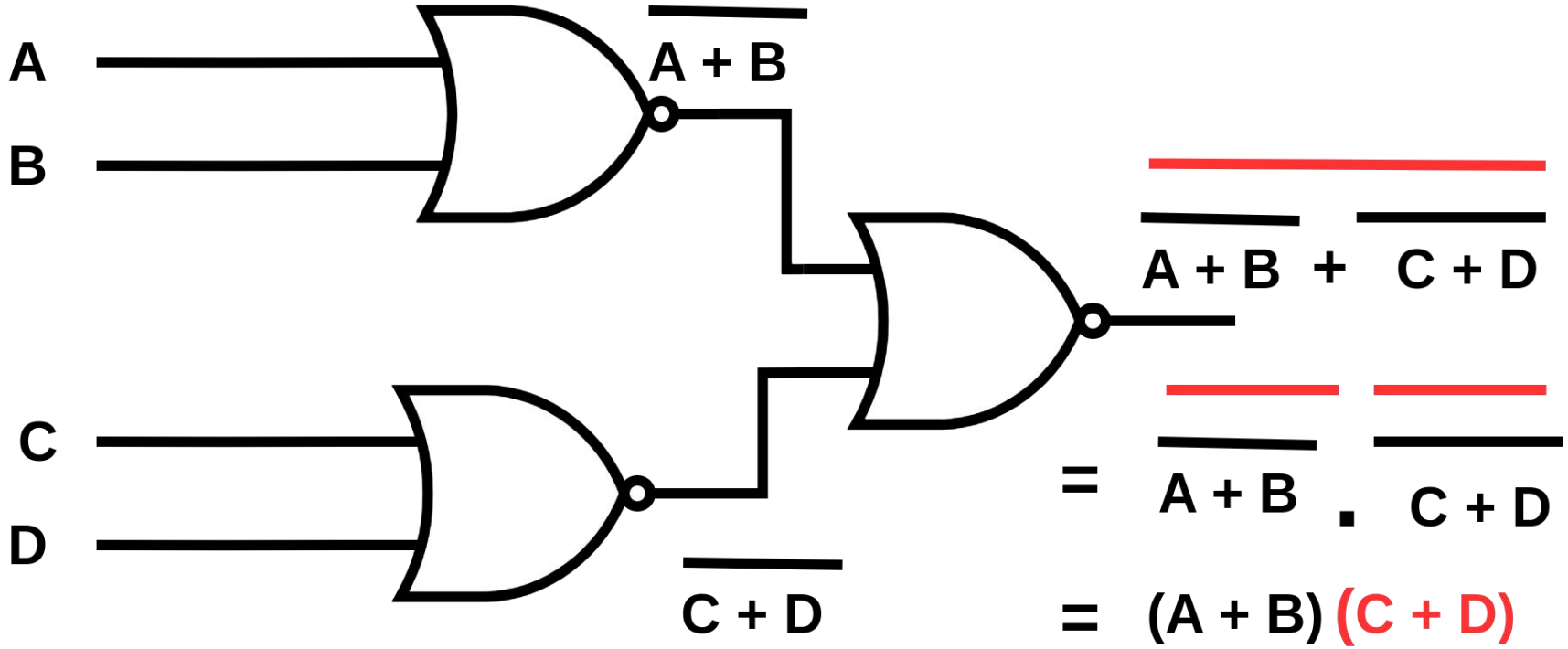

A
B
C
D


A
B
A + B
C
D
C + D

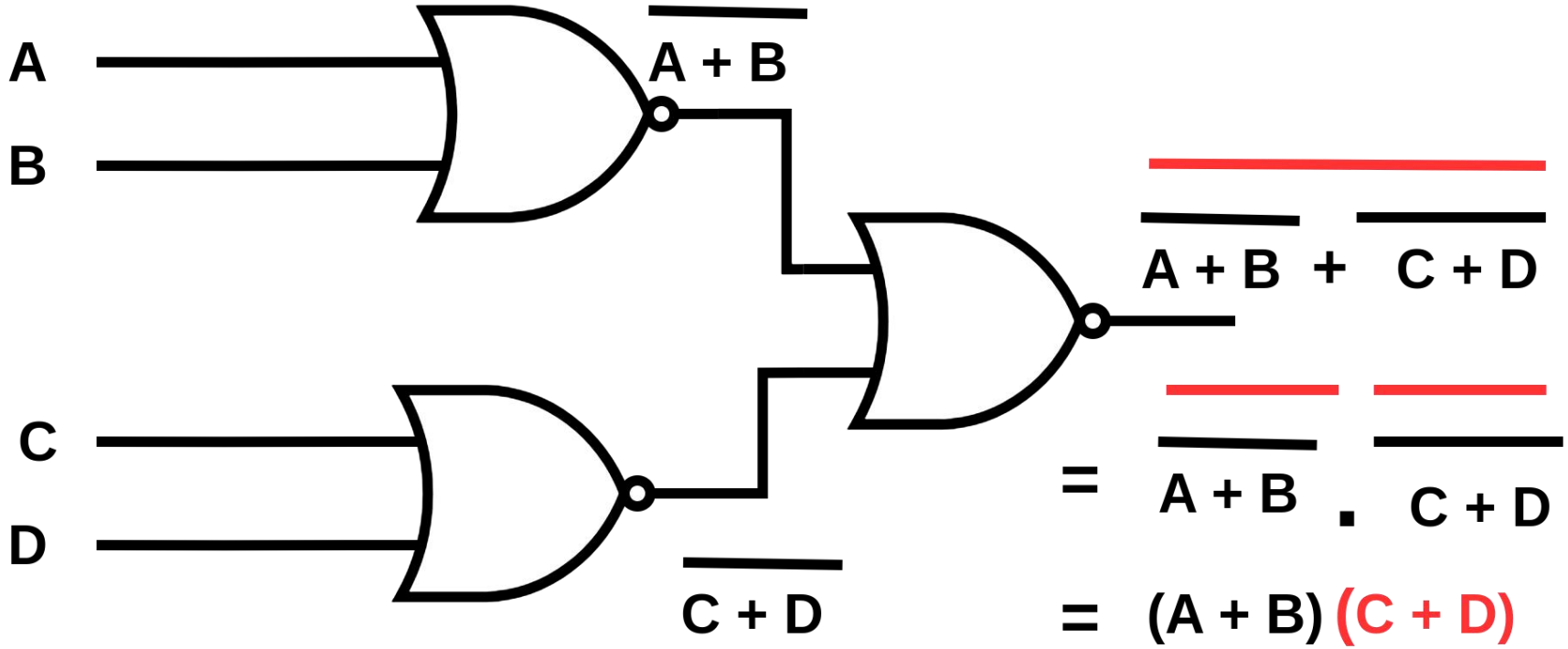

A
B
C
D
A + B
C + D
A + B + C + D


A
B
C
D
A + B
C + D
A + B + C + D
= A + B . C + D

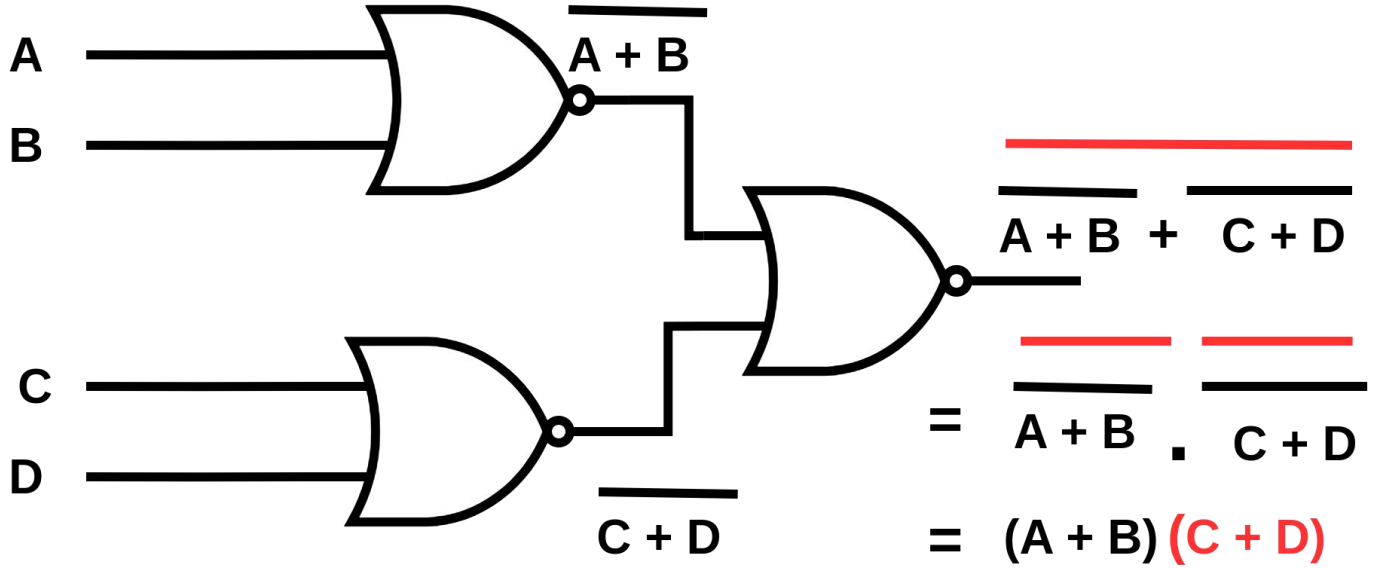

A
B
C
D
$\overline{A + B}$
$\overline{C + D}$
$\overline{A + B} + \overline{C + D}$
$= \overline{A + B} \cdot \overline{C + D}$
$= (A + B)(C + D)$

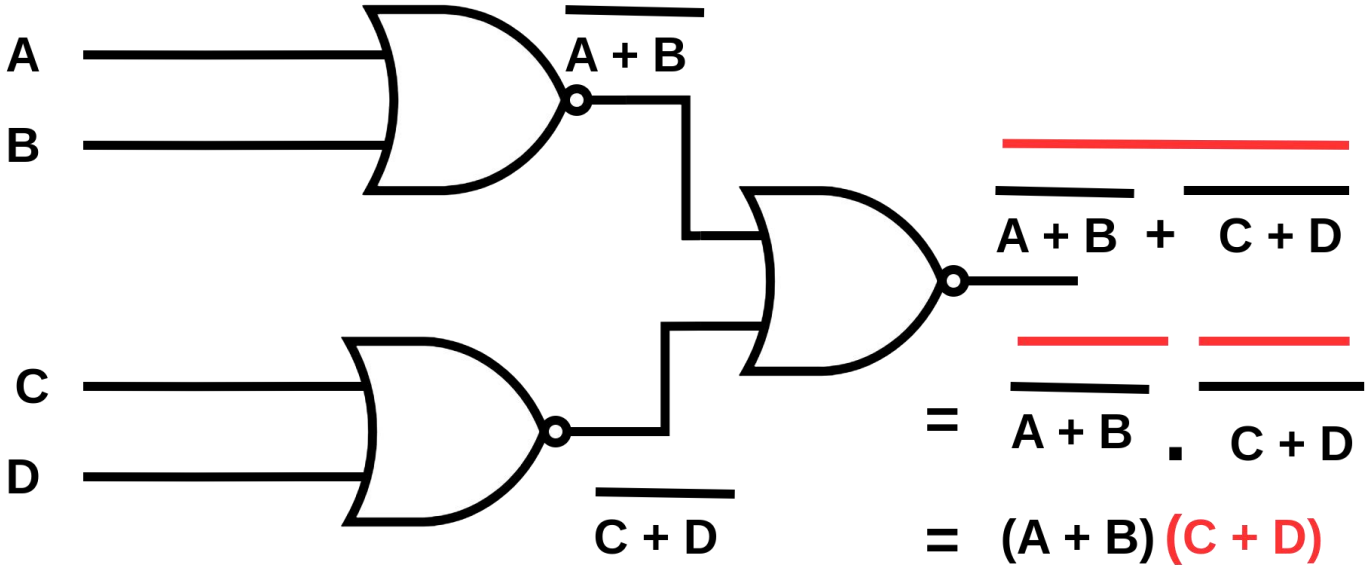


IF **A=B=X** and **C=D=Y**



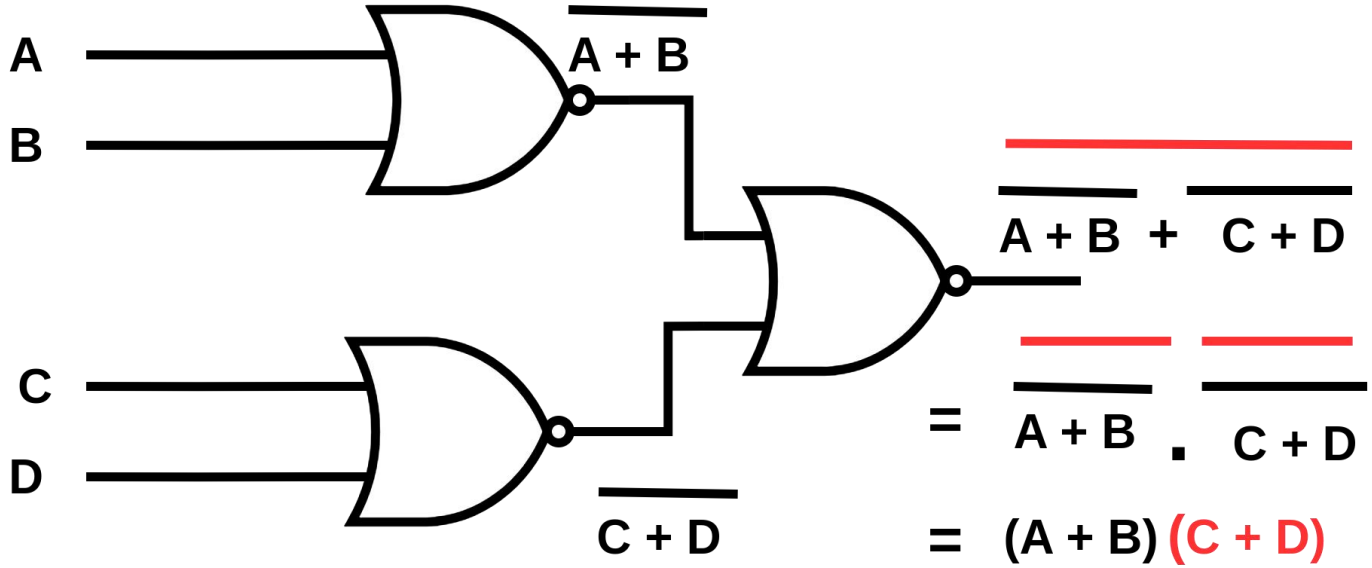
IF **A=B=X** and **C=D=Y**


A
B
C
D
A + B
C + D
A + B + C + D
= A + B . C + D
= (A + B) (C + D)



IF **A=B=X** and **C=D=Y**

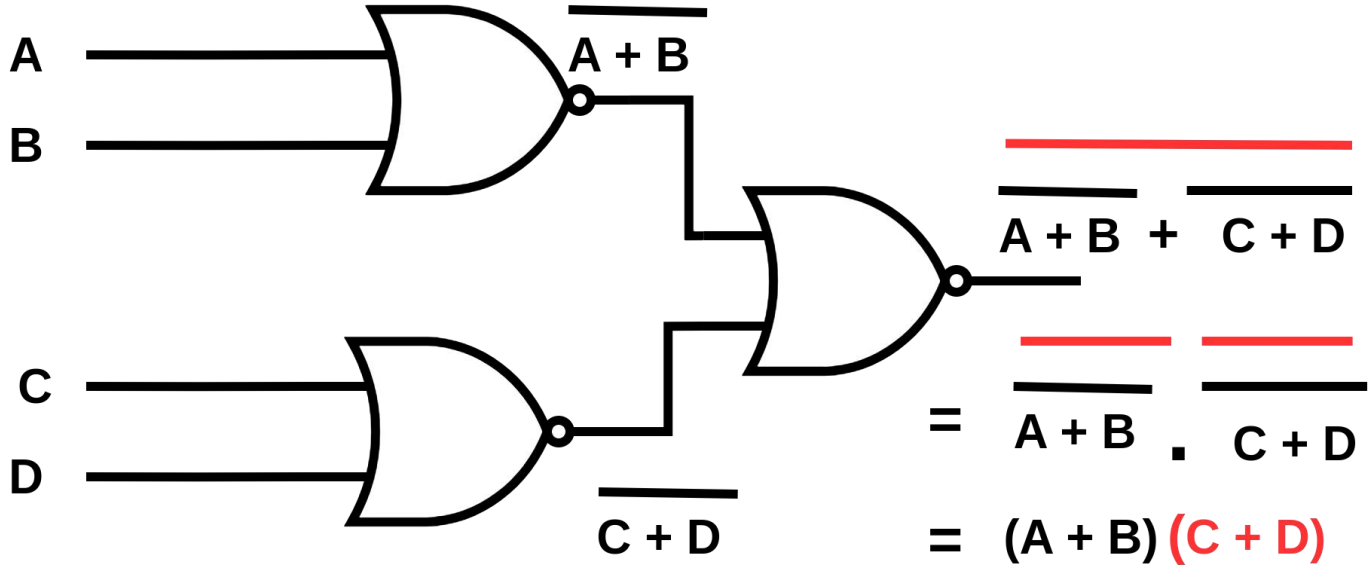
= (A + B) (C + D)



IF **A=B=X** and **C=D=Y**

= (A + B) (C + D)

= (X+X) (Y+Y)

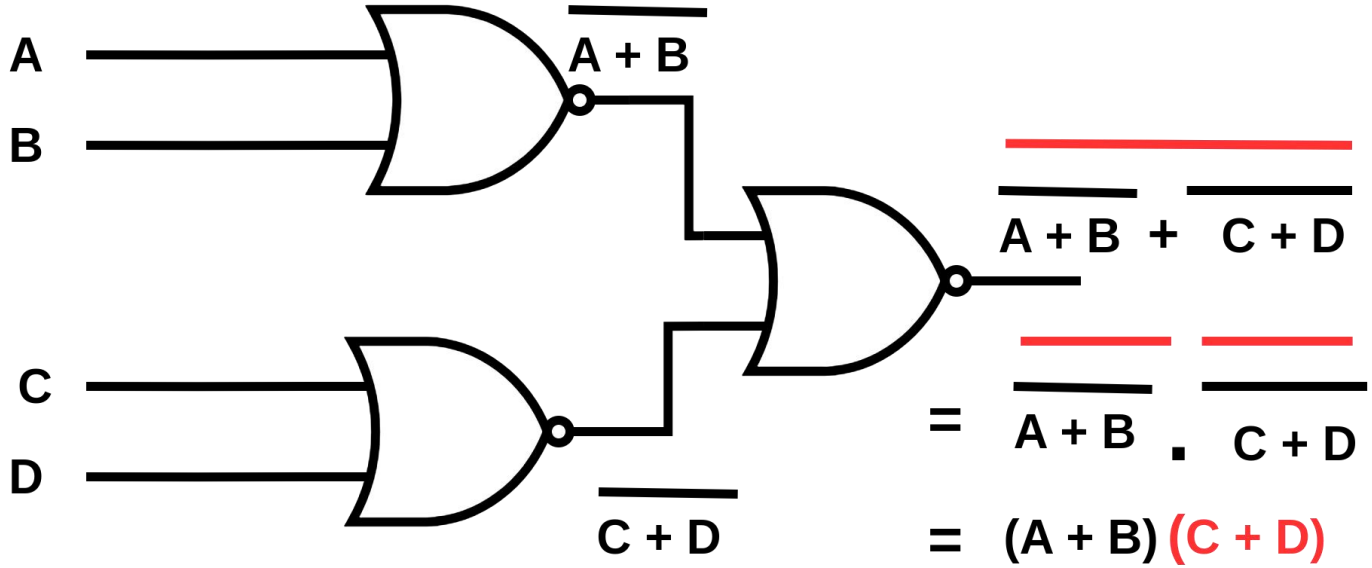


IF **A=B=X** and **C=D=Y**

= (A + B) (C + D)

= (X+X) (Y+Y)

= X Y

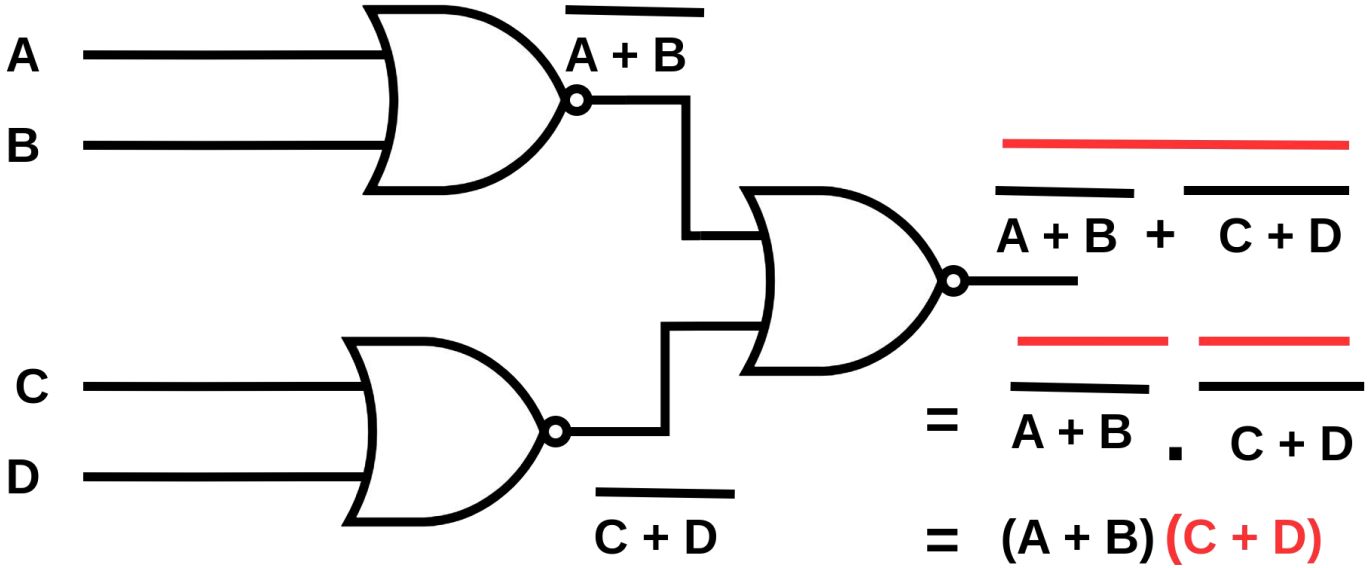


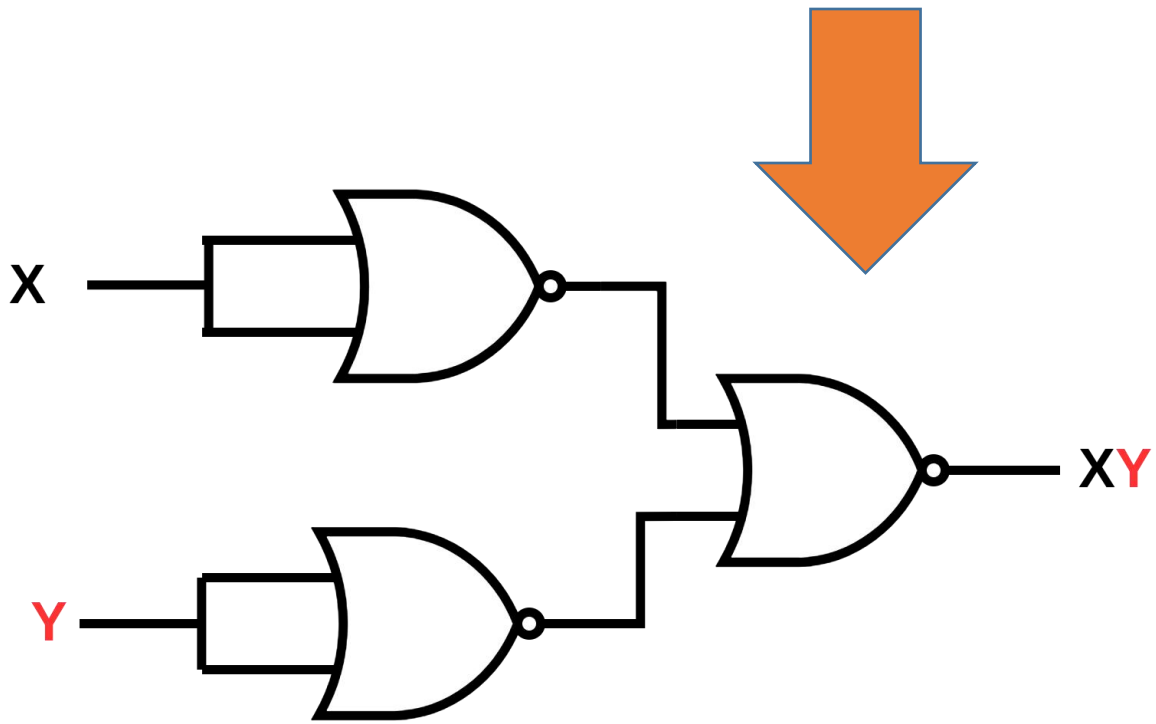
IF **A=B=X** and **C=D=Y**

= (A + B) (C + D)

= (X+X) (Y+Y)

= X Y



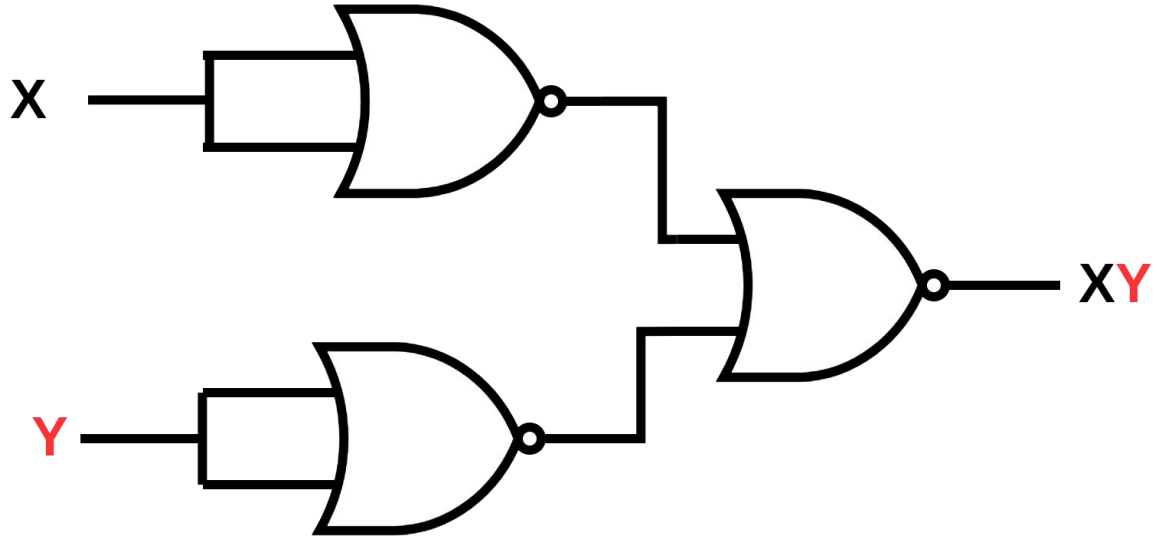


IF **A=B=X** and **C=D=Y**

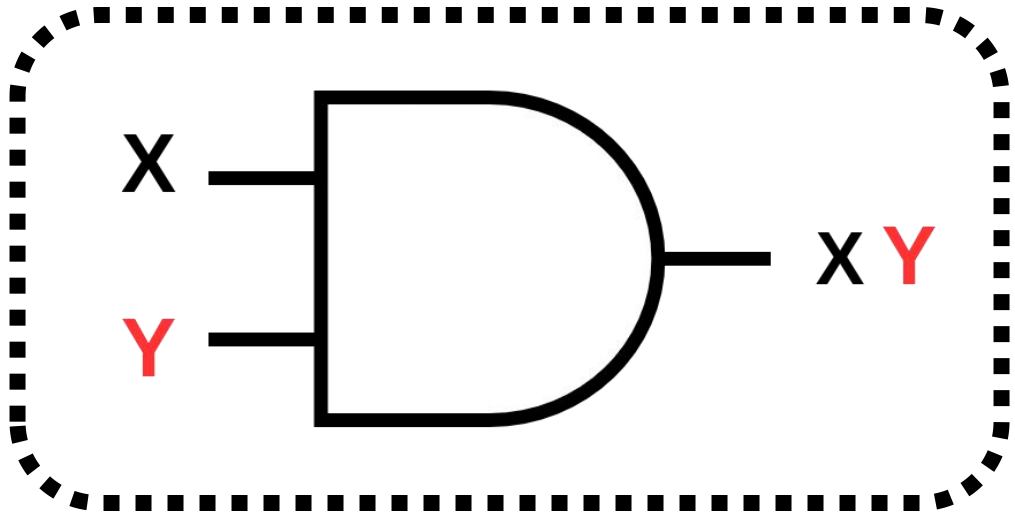
$$= (A + B)(C + D)$$

$$= (X+X)(Y+Y)$$

$$= X\,Y$$



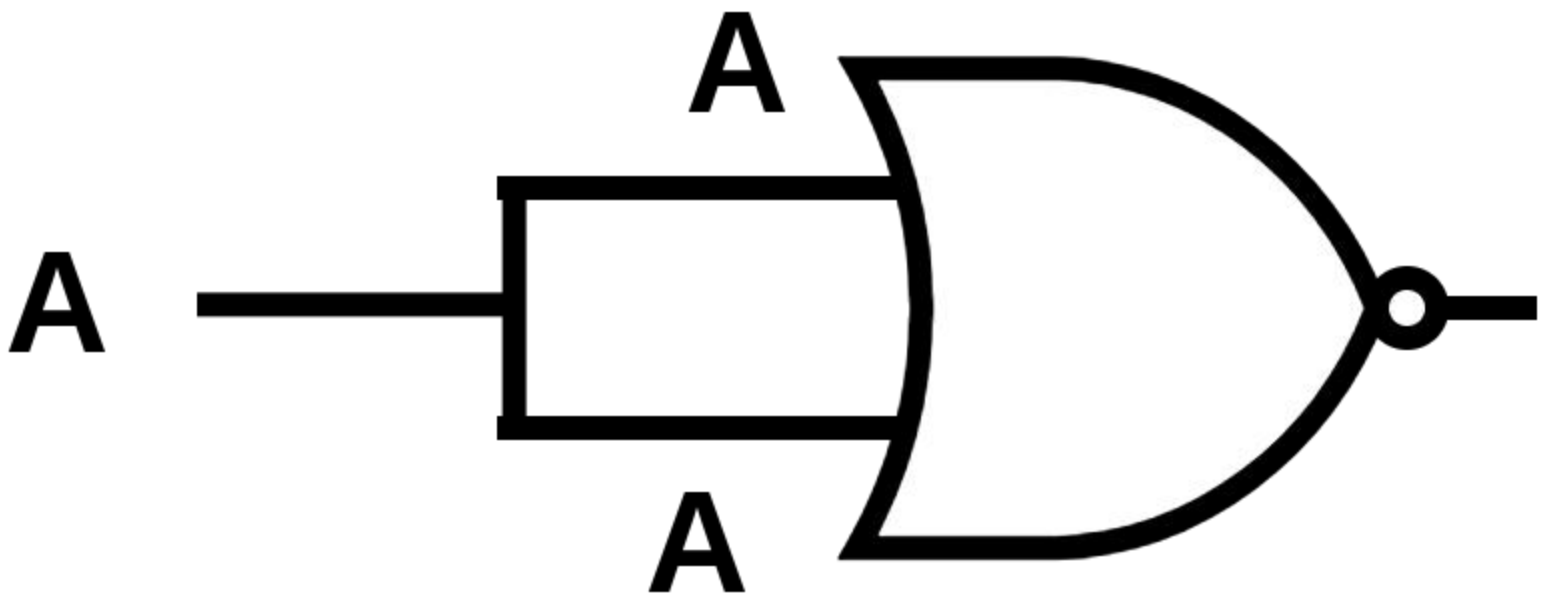
IF **A=B=X** and **C=D=Y**

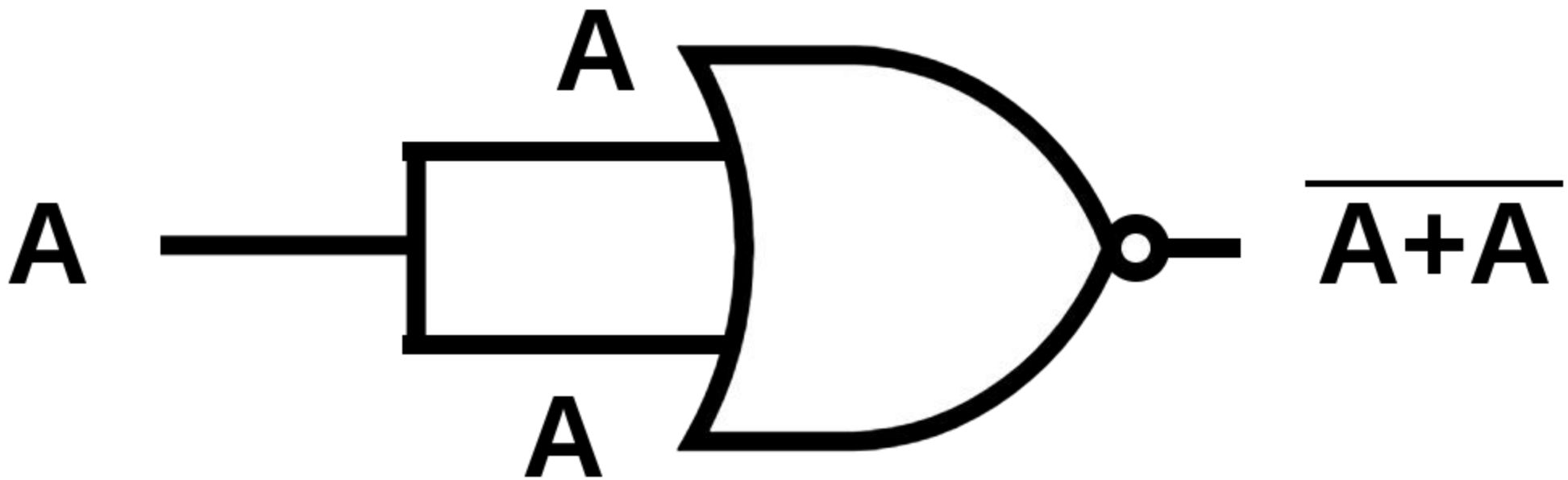


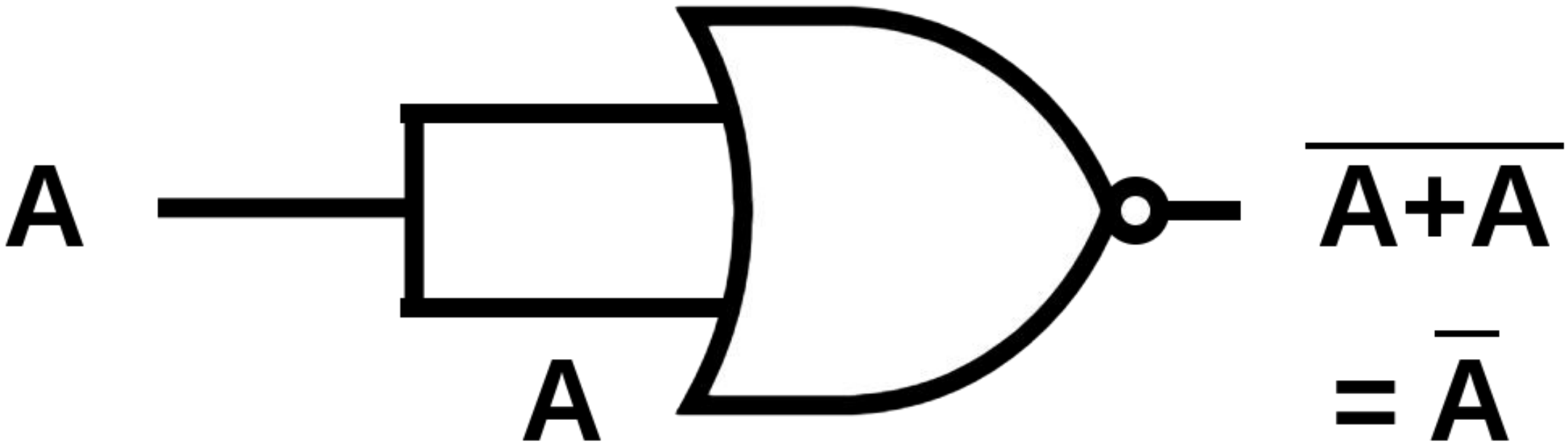
= (A + B) (C + D)

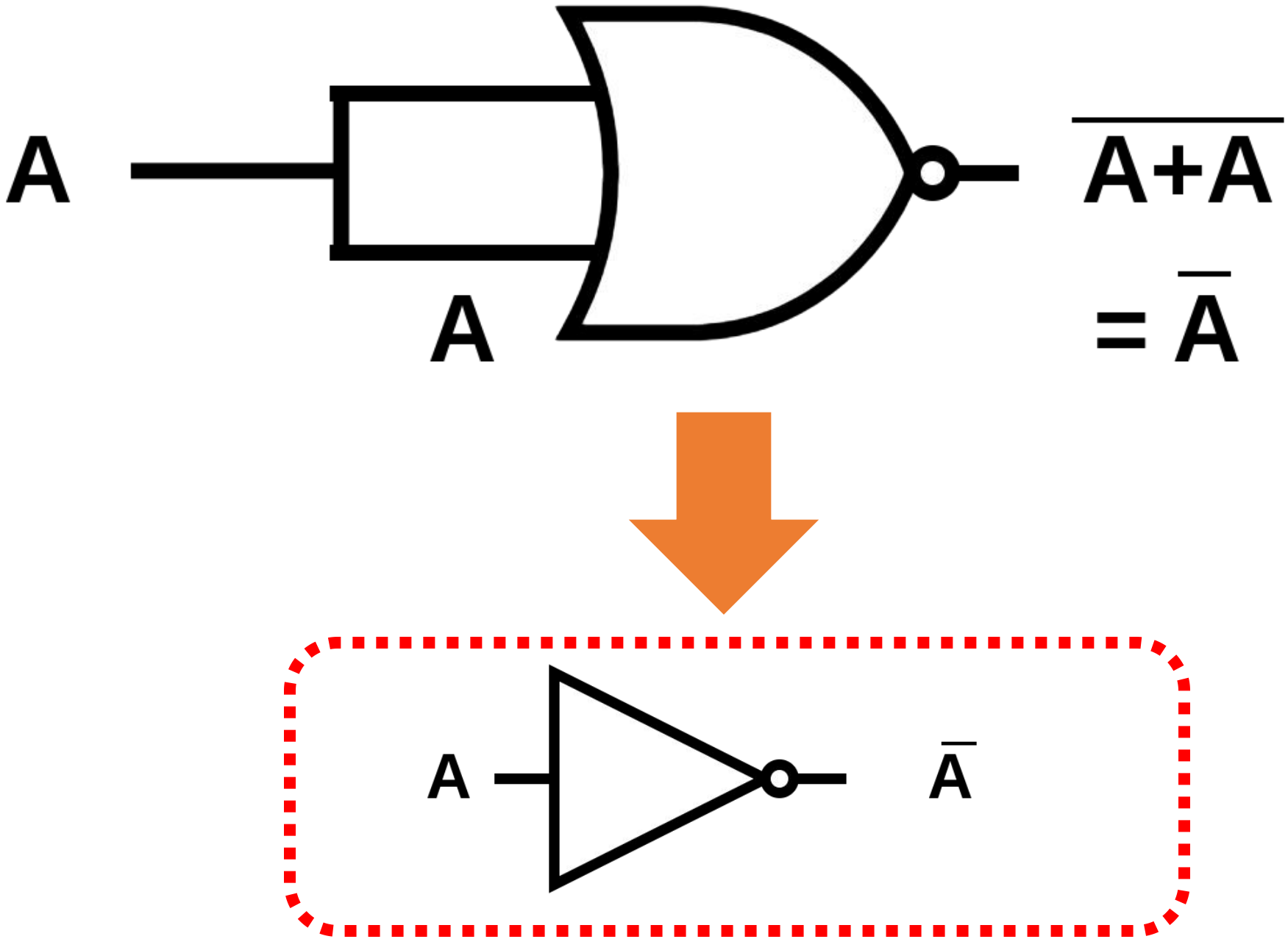
= (X+X) (Y+Y)

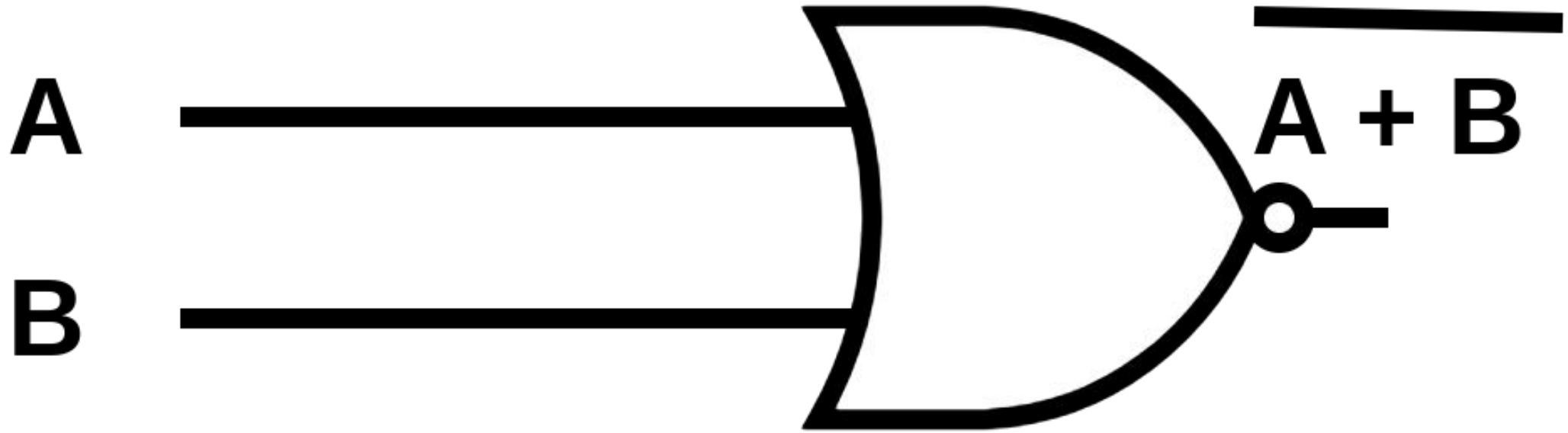
= X Y

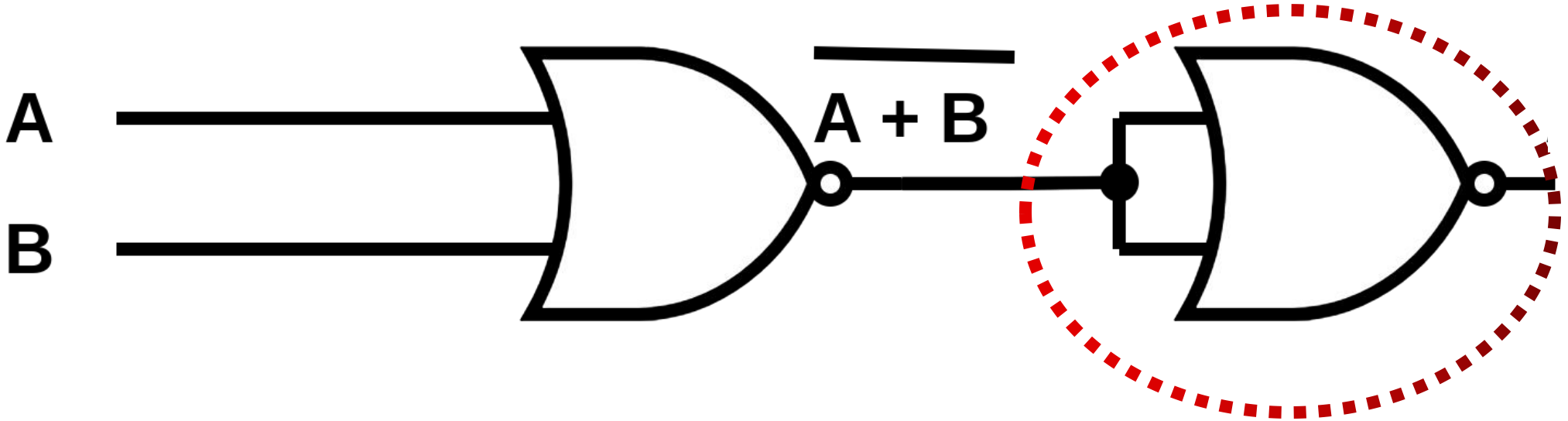

A
A
A

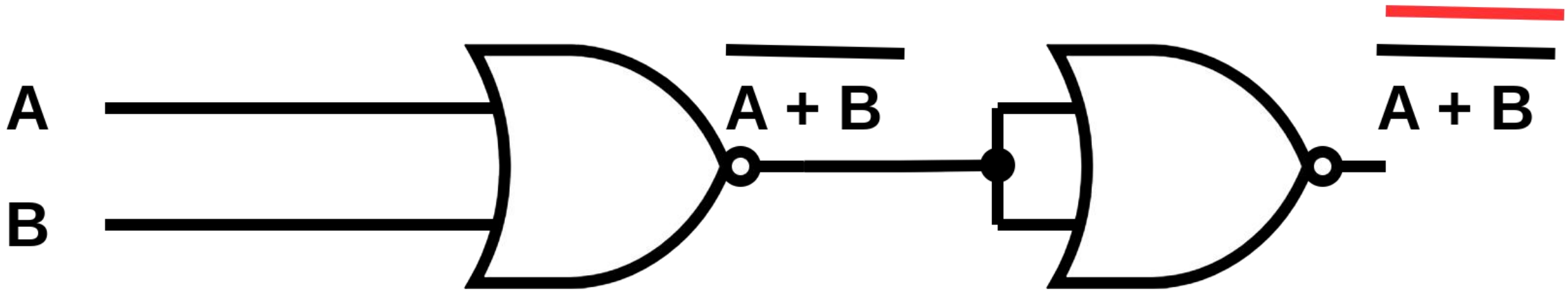

A
A
A
$\overline{A+A}$

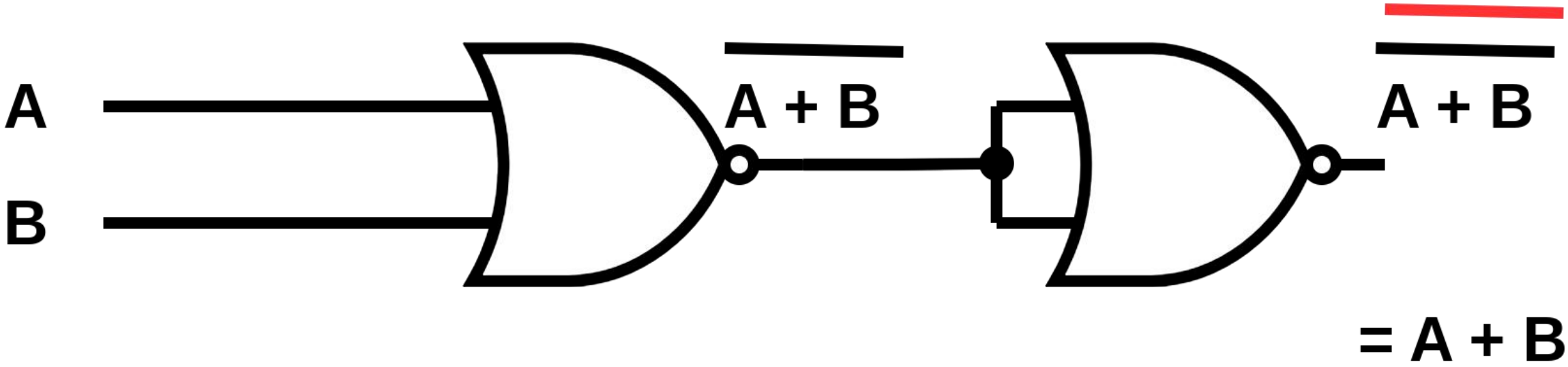

A
A
$\overline{A+A}$
$= \bar{A}$

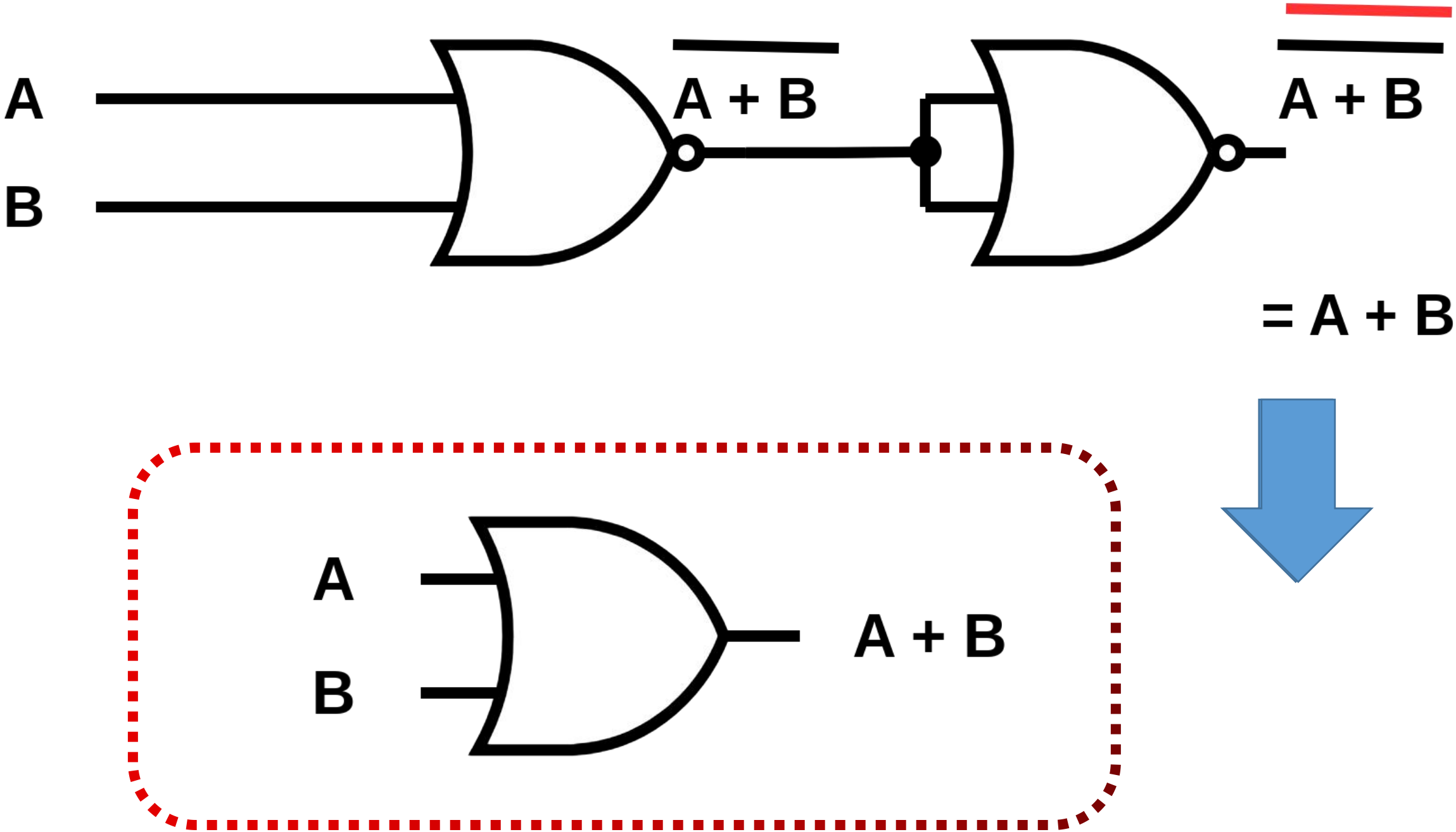

A
A
$\overline{A+A}$
$= \overline{A}$
A
$\overline{A}$


A
B
A + B


A
B
A + B


A
B
A + B
A + B


A
B
A + B
A + B
= A + B


A
B
A + B
A + B
= A + B
A
B
A + B

COMPLIMENT’S ARITHMETIC

COMPLIMENT'S ARITHMETIC

Solve *19-26* using 1's Complement

COMPLIMENT'S ARITHMETIC

Solve *19-26* using *1's* Complement

Let **19-26** = Result

19+(-26) = Result

Apply 1's Complement on Both Sides

1's Complement of 19 + 1's Complement of (-26)
= 1's Complement Of Result

COMPLIMENT'S ARITHMETIC

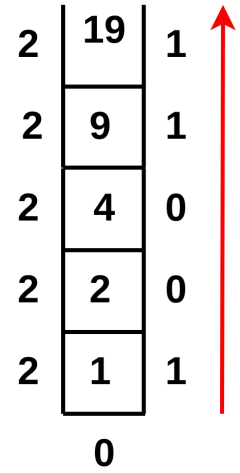
Solve *19-26* using 1's Complement

Let **19-26** = Result

19+(-26) = Result

Apply 1's Complement on Both Sides

1's Complement of 19 + 1's Complement of (-26) = 1's Complement Of Result



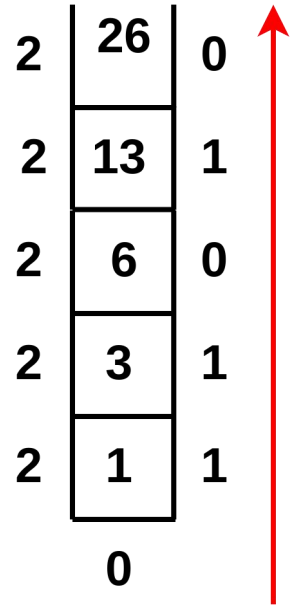
Binary Of **19** = **10011**

SMR Binary Of **+19** = **010011**

Since Its a positive number , Its 1's Complement is same

1's Of **+19** = **010011**

Now, Binary Of **26**= **11010**



SMR Binary Of **-26** = **111010**

Since Its a **-ve** number , Its **1's** Complement will be

1's Of **-26** =**100101**

COMPLIMENT'S ARITHMETIC

Solve *19-26* using 1's Complement

Let **19-26** = Result

19+(-26) = Result

Apply 1's Complement on Both Sides

1's Complement of 19 + 1's Complement of (-26) = 1's Complement Of Result

Binary Of **19** = **10011**

SMR Binary Of **+19** = **0**10011

Since Its a positive number , Its 1's Complement is same

1's Of **+19** = **0**10011

Now, Binary Of **26**= **11010**

SMR Binary Of **-26** = **1**11010

Since Its a **-ve** number , Its **1's** Complement will be

1's Of **-26** =**1**00101

010011

COMPLIMENT'S ARITHMETIC

Solve *19-26* using 1's Complement

Let **19-26** = Result

19+(-26) = Result

Apply 1's Complement on Both Sides

1's Complement of 19 + 1's Complement of (-26) = 1's Complement Of Result

Binary Of **19** = **10011**

SMR Binary Of **+19** = **0**10011

Since Its a positive number , Its 1's Complement is same

1's Of **+19** = **0**10011

Now, Binary Of **26**= **11010**

SMR Binary Of **-26** = **1**11010

Since Its a **-ve** number , Its **1's** Complement will be

1's Of **-26** =**1**00101

010011
+ **1**00101

COMPLIMENT'S ARITHMETIC

Solve *19-26* using 1's Complement

Let **19-26** = Result

19+(-26) = Result

Apply 1's Complement on Both Sides

1's Complement of 19 + 1's Complement of (-26) = 1's Complement Of Result

Binary Of **19** = **10011**

SMR Binary Of **+19** = **0**10011

Since Its a positive number , Its 1's Complement is same

1's Of **+19** = **0**10011

Now, Binary Of **26**= **11010**

SMR Binary Of **-26** = **1**11010

Since Its a **-ve** number , Its **1's** Complement will be

1's Of **-26** =**1**00101

$$\begin{array}{r} \mathbf{0}10011 \\ +\ \mathbf{1}00101 \\ \hline 111000 \end{array}$$

COMPLIMENT'S ARITHMETIC

Solve *19-26* using 1's Complement

Let **19-26** = Result

19+(-26) = Result

Apply 1's Complement on Both Sides

1's Complement of 19 + 1's Complement of (-26) = 1's Complement Of Result

Binary Of **19** = **10011**

SMR Binary Of **+19** = **010011**

Since Its a positive number , Its 1's Complement is same

1's Of **+19** = **010011**

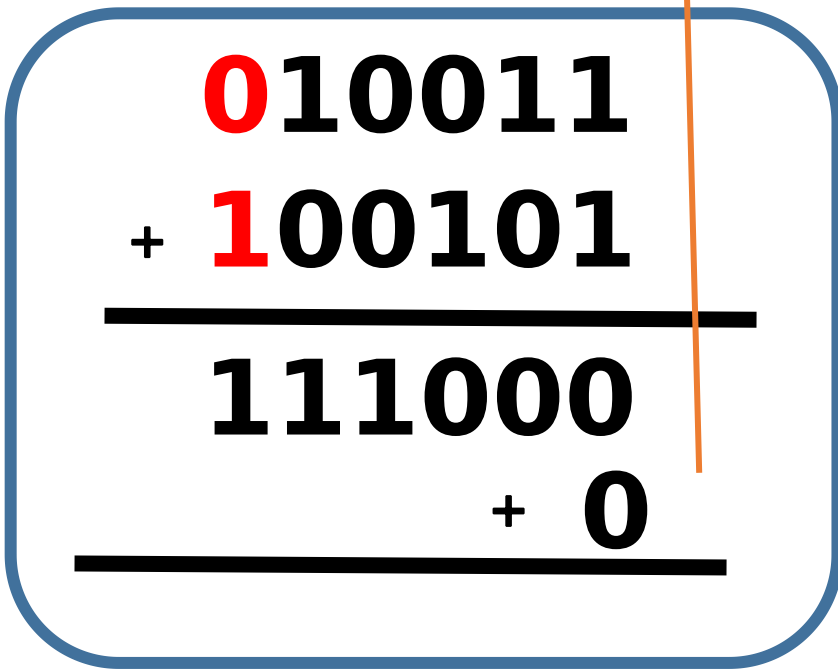
Now, Binary Of **26**= **11010**

SMR Binary Of **-26** = **111010**

Since Its a **-ve** number , Its **1's** Complement will be

1's Of **-26** =**100101**

End Around Carry



COMPLIMENT'S ARITHMETIC

Solve *19-26* using 1's Complement

Let **19-26** = Result

19+(-26) = Result

Apply 1's Complement on Both Sides

1's Complement of 19 + 1's Complement of (-26) = 1's Complement Of Result

Binary Of **19** = **10011**

SMR Binary Of **+19** = **010011**

Since Its a positive number , Its 1's Complement is same

1's Of **+19** = **010011**

Now, Binary Of **26**= **11010**

SMR Binary Of **-26** = **111010**

Since Its a **-ve** number , Its **1's** Complement will be

1's Of **-26** =**100101**

```
  010011
+ 100101
--------
  111000
+      0
--------
  111000
```

COMPLIMENT'S ARITHMETIC

Solve *19-26* using 1's Complement

Let **19-26** = Result

19+(-26) = Result

Apply 1's Complement on Both Sides

1's Complement of 19 + 1's Complement of (-26) = 1's Complement Of Result

Binary Of **19** = **10011**

SMR Binary Of **+19** = **010011**

Since Its a positive number , Its 1's Complement is same

1's Of **+19** = **010011**

Now, Binary Of **26**= **11010**

SMR Binary Of **-26** = **111010**

Since Its a **-ve** number , Its **1's** Complement will be

1's Of **-26** =**100101**

```
  010011
+ 100101
--------
  111000
+      0
--------
  111000
```

1's Com of Result: **111000**

COMPLIMENT'S ARITHMETIC

Solve *19-26* using 1's Complement

Let **19-26** = Result

19+(-26) = Result

Apply 1's Complement on Both Sides

1's Complement of 19 + 1's Complement of (-26) = 1's Complement Of Result

Binary Of **19** = **10011**

SMR Binary Of **+19** = **010011**

Since Its a positive number , Its 1's Complement is same

1's Of **+19** = **010011**

Now, Binary Of **26**= **11010**

SMR Binary Of **-26** = **111010**

Since Its a **-ve** number , Its **1's** Complement will be

1's Of **-26** =**100101**

```
  010011
+ 100101
--------
  111000
+      0
--------
  111000
```

1's Com of Result: **111000**

Result:

COMPLIMENT'S ARITHMETIC

Solve *19-26* using 1's Complement

Let **19-26** = Result

19+(-26) = Result

Apply 1's Complement on Both Sides

1's Complement of 19 + 1's Complement of (-26) = 1's Complement Of Result

Binary Of **19** = **10011**

SMR Binary Of **+19** = **010011**

Since Its a positive number , Its 1's Complement is same

1's Of **+19** = **010011**

Now, Binary Of **26**= **11010**

SMR Binary Of **-26** = **111010**

Since Its a **-ve** number , Its **1's** Complement will be

1's Of **-26** =**100101**

```
  010011
+ 100101
--------
  111000
+      0
--------
  111000
```

1's Com of Result: **111000**

Result: **1**

COMPLIMENT'S ARITHMETIC

Solve *19-26* using 1's Complement

Let **19-26** = Result

19+(-26) = Result

Apply 1's Complement on Both Sides

1's Complement of 19 + 1's Complement of (-26) = 1's Complement Of Result

Binary Of **19** = **10011**

SMR Binary Of **+19** = **010011**

Since Its a positive number , Its 1's Complement is same

1's Of **+19** = **010011**

Now, Binary Of **26**= **11010**

SMR Binary Of **-26** = **111010**

Since Its a **-ve** number , Its **1's** Complement will be

1's Of **-26** =**100101**

```
  010011
+ 100101
--------
  111000
+      0
--------
  111000
```

1's Com of Result: **111000**

Result: **100111**

COMPLIMENT'S ARITHMETIC

Solve *19-26* using 1's Complement

Let **19-26** = Result

19+(-26) = Result

Apply 1's Complement on Both Sides

1's Complement of 19 + 1's Complement of (-26) = 1's Complement Of Result

Binary Of **19** = **10011**

SMR Binary Of **+19** = **010011**

Since Its a positive number , Its 1's Complement is same

1's Of **+19** = **010011**

Now, Binary Of **26**= **11010**

SMR Binary Of **-26** = **111010**

Since Its a **-ve** number , Its **1's** Complement will be

1's Of **-26** =**100101**

```
  010011
+ 100101
--------
  111000
+      0
--------
  111000
```

1's Com of Result: **111000**

Result: **100111** **-7**

COMPLIMENT'S ARITHMETIC

Solve *26-19* using 1's Complement

COMPLIMENT'S ARITHMETIC

Solve *26-19* using 1's Complement

Let **26-19** = Result

26+(-19) = Result

Apply 1's Complement on Both Sides

1's Complement of **26** + 1's Complement of (**-19**) = 1's Complement Of Result

Binary Of **26** = **11010**

SMR Binary Of **+26** = **011010**

Since Its a positive number , Its 1's Complement is same

1's Of **+26** = **011010**

011010

Now,

Binary Of **19**= **10011**

SMR Binary Of **-19** = **110011**

Since Its a **-ve** number , Its **1's** Complement will be

1's Of **-19** = **101100**

COMPLIMENT'S ARITHMETIC

Solve *26-19* using 1's Complement

Let **26-19** = Result

26+(-19) = Result

Apply 1's Complement on Both Sides

1's Complement of **26** + 1's Complement of (**-19**) = 1's Complement Of Result

Binary Of **26** = **11010**

SMR Binary Of **+26** = **011010**

Since Its a positive number , Its 1's Complement is same

1's Of **+26** = **011010**

Now,

Binary Of **19**= **10011**

SMR Binary Of **-19** = **110011**

Since Its a **-ve** number , Its **1's** Complement will be

1's Of **-19** = **101100**

$$\begin{array}{r} 011010 \\ +\ 101100 \\ \hline 1000110 \end{array}$$

COMPLIMENT'S ARITHMETIC

Solve *26-19* using 1's Complement

Let **26-19** = Result

26+(-19) = Result

Apply 1's Complement on Both Sides

1's Complement of **26** + 1's Complement of (**-19**) = 1's Complement Of Result

Binary Of **26** = **11010**

SMR Binary Of **+26** = **011010**

Since Its a positive number , Its 1's Complement is same

1's Of **+26** = **011010**

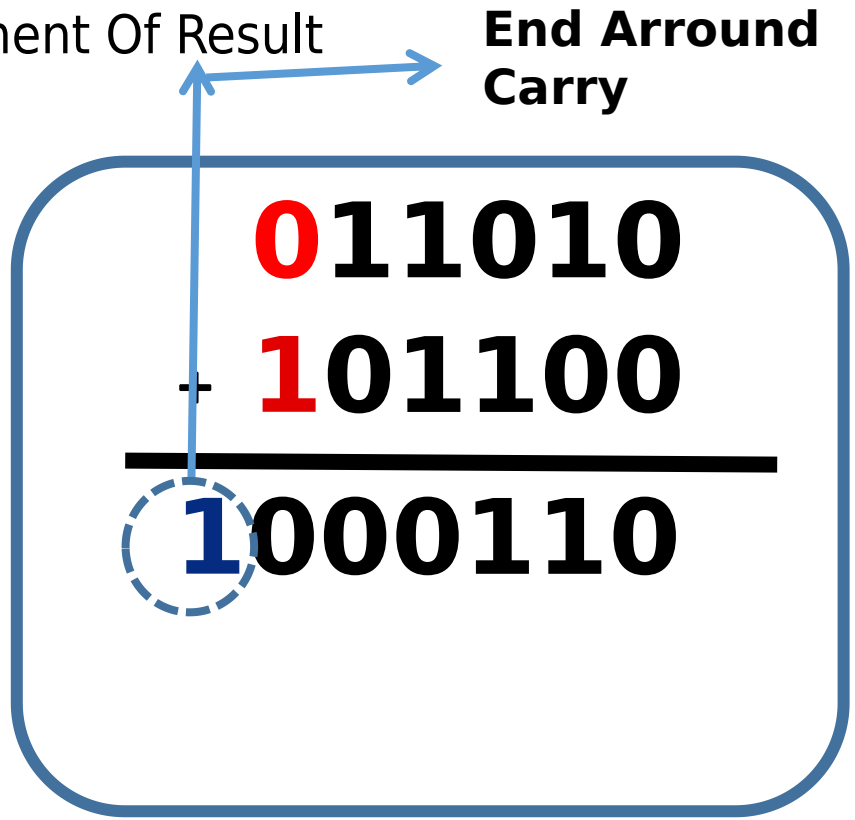
Now,

Binary Of **19**= **10011**

SMR Binary Of **-19** = **110011**

Since Its a **-ve** number , Its **1's** Complement will be

1's Of **-19** = **101100**



COMPLIMENT'S ARITHMETIC

Solve *26-19* using 1's Complement

Let **26-19** = Result

26+(-19) = Result

Apply 1's Complement on Both Sides

1's Complement of **26** + 1's Complement of (**-19**) = 1's Complement Of Result

Binary Of **26** = **11010**

SMR Binary Of **+26** = **011010**

Since Its a positive number , Its 1's Complement is same

1's Of **+26** = **011010**

Now,

Binary Of **19**= **10011**

SMR Binary Of **-19** = **110011**

Since Its a **-ve** number , Its **1's** Complement will be

1's Of **-19** = **101100**

$$
\begin{array}{r}
011010 \\
+\ 101100 \\
\hline
1000110 \\
+\ 1 \\
\hline
\end{array}
$$

COMPLIMENT'S ARITHMETIC

Solve *26-19* using 1's Complement

Let **26-19** = Result

26+(-19) = Result

Apply 1's Complement on Both Sides

1's Complement of **26** + 1's Complement of (**-19**) = 1's Complement Of Result

Binary Of **26** = **11010**

SMR Binary Of **+26** = **011010**

Since Its a positive number , Its 1's Complement is same

1's Of **+26** = **011010**

Now,

Binary Of **19**= **10011**

SMR Binary Of **-19** = **110011**

Since Its a **-ve** number , Its **1's** Complement will be

1's Of **-19** = **101100**

```
  011010
+ 101100
--------
 1000110
+      1
--------
  000111
```

COMPLIMENT'S ARITHMETIC

Solve *26-19* using 1's Complement

Let **26-19** = Result

26+(-19) = Result

Apply 1's Complement on Both Sides

1's Complement of **26** + 1's Complement of (**-19**) = 1's Complement Of Result

Binary Of **26** = **11010**

SMR Binary Of **+26** = **011010**

Since Its a positive number , Its 1's Complement is same

1's Of **+26** = **011010**

Now,

Binary Of **19**= **10011**

SMR Binary Of **-19** = **110011**

Since Its a **-ve** number , Its **1's** Complement will be

1's Of **-19** = **101100**

```
  011010
+ 101100
--------
 1000110
+      1
--------
  000111
```

1's Com of Result: **000111**

COMPLIMENT'S ARITHMETIC

Solve *26-19* using 1's Complement

Let **26-19** = Result

26+(-19) = Result

Apply 1's Complement on Both Sides

1's Complement of **26** + 1's Complement of (**-19**) = 1's Complement Of Result

Binary Of **26** = **11010**

SMR Binary Of **+26** = **011010**

Since Its a positive number , Its 1's Complement is same

1's Of **+26** = **011010**

Now,

Binary Of **19**= **10011**

SMR Binary Of **-19** = **110011**

Since Its a **-ve** number , Its **1's** Complement will be

1's Of **-19** = **101100**

```
  011010
+ 101100
--------
  1000110
+       1
--------
  000111
```

Sign Bit के छ ?

1's Com of Result: 000111

COMPLIMENT'S ARITHMETIC

Solve *26-19* using 1's Complement

Let **26-19** = Result

26+(-19) = Result

Apply 1's Complement on Both Sides

1's Complement of **26** + 1's Complement of (**-19**) = 1's Complement Of Result

Binary Of **26** = **11010**

SMR Binary Of **+26** = **011010**

Since Its a positive number , Its 1's Complement is same

1's Of **+26** = **011010**

Now,

Binary Of **19**= **10011**

SMR Binary Of **-19** = **110011**

Since Its a **-ve** number , Its **1's** Complement will be

1's Of **-19** = **101100**

```
  011010
+ 101100
--------
 1000110
+      1
--------
  000111
```

1's Com of Result: **000111**

Result: **000111** **7**

Using 2’s Complement

Solve *26-7* using 2's Complement

Let **26-7** = Result

26+(-7) = Result

Apply 2's Complement on Both Sides

2's Complement of **26** + 2's Complement of (**-7**) = 2's Complement Of Result

Binary Of **26** = **11010**

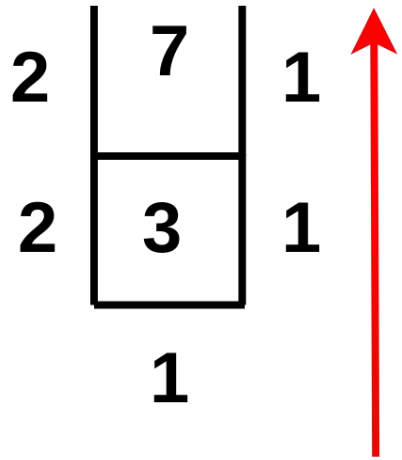
SMR Binary Of **+26** = **011010**

Since Its a positive number , Its 2's Complement is same

2's Of **+26** = **011010**

Now

Binary Of **7** = **111**



Note*: While doing Complement Arithmetic, Number of bits of second number should be equal to that of first Number

Solve *26-7* using 2's Complement

Let **26-7** = Result

26+(-7) = Result

Apply 2's Complement on Both Sides

2's Complement of **26** + 2's Complement of (**-7**) = 2's Complement Of Result

Binary Of **26** = **11010** → **5 Bits**

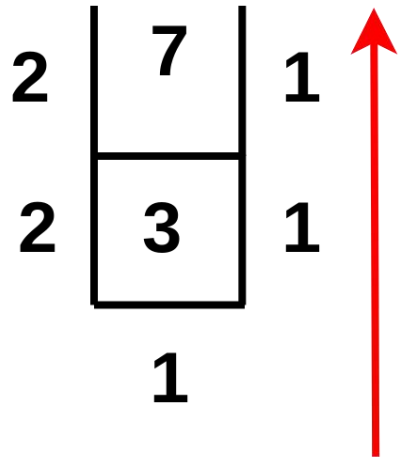
SMR Binary Of **+26** = **011010**

Since Its a positive number , Its 2's Complement is same

2's Of **+26** = **011010**

Now

Binary Of **7** = **111**



Note*: While doing Complement Arithmetic, Number of bits of second number should be equal to that of first Number

Solve *26-7* using 2's Complement

Let **26-7** = Result

26+(-7) = Result

Apply 2's Complement on Both Sides

2's Complement of **26** + 2's Complement of (**-7**) = 2's Complement Of Result

Binary Of **26** = **11010** → **5 Bits**

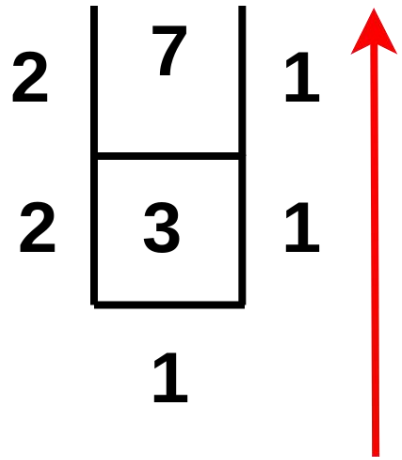
SMR Binary Of **+26** = **011010**

Since Its a positive number , Its 2's Complement is same

2's Of **+26** = **011010**

Now

Binary Of **7** = **00111** → **5 Bits**



Note*: While doing Complement Arithmetic, Number of bits of second number should be equal to that of first Number

Solve *26-7* using 2's Complement

Let **26-7** = Result

26+(-7) = Result

Apply 2's Complement on Both Sides

2's Complement of **26** + 2's Complement of (**-7**) = 2's Complement Of Result

Binary Of **26** = **11010**

SMR Binary Of **+26** = **011010**

Since Its a positive number , Its 2's Complement is same

2's Of **+26** = **011010**

Now

Binary Of **7** = **00111**

SMR Binary Of **-7** = **100111**

Since Its a **-ve** number , Its **2's** Complement will be

2's Of **-7** = .

Right Hande Side Bata हेर्दै जाने जब सम्मन 1 भेटीन्न, And When You Find First 1 , You copy as it is upto there and STOP

Solve *26-7* using 2's Complement

Let **26-7** = Result

26+(-7) = Result

Apply 2's Complement on Both Sides

2's Complement of **26** + 2's Complement of (**-7**) = 2's Complement Of Result

Binary Of **26** = **11010**

SMR Binary Of **+26** = **011010**

Since Its a positive number , Its 2's Complement is same

2's Of **+26** = **011010**

Now

Binary Of **7** = **00111**

SMR Binary Of **-7** = **100111**

Since Its a **-ve** number , Its **2's** Complement will be

2's Of **-7** = **1**

Right Hande Side Bata हेर्दै जाने जब सम्मन 1 भेटीन्न, And When You Find First 1 , You copy as it is upto there and STOP

Complement the Remaining MAgnitude Bits

Solve *26-7* using 2's Complement

Let **26-7** = Result

26+(-7) = Result

Apply 2's Complement on Both Sides

2's Complement of **26** + 2's Complement of (**-7**) = 2's Complement Of Result

Binary Of **26** = **11010**

SMR Binary Of **+26** = **011010**

Since Its a positive number , Its 2's Complement is same

2's Of **+26** = **011010**

Now

Binary Of **7** = **00111**

SMR Binary Of **-7** = **100111**

Since Its a **-ve** number , Its **2's** Complement will be

2's Of **-7** = **111001**

Right Hande Side Bata हेर्दै जाने जब सम्मन 1 भेटीन्न, And When You Find First 1 , You copy as it is upto there and STOP

Complement the Remaining Magnitude Bits

Solve *26-7* using 2's Complement

Let **26-7** = Result

26+(-7) = Result

Apply 2's Complement on Both Sides

2's Complement of **26** + 2's Complement of (**-7**) = 2's Complement Of Result

Binary Of **26** = **11010**

SMR Binary Of **+26** = **011010**

Since Its a positive number , Its 2's Complement is same

2's Of **+26** = **011010**

Now

Binary Of **7** = **00111**

SMR Binary Of **-7** = **100111**

Since Its a **-ve** number , Its **2's** Complement will be

2's Of **-7** = **111001**

011010

Solve *26-7* using 2's Complement

Let **26-7** = Result

26+(-7) = Result

Apply 2's Complement on Both Sides

2's Complement of **26** + 2's Complement of (**-7**) = 2's Complement Of Result

Binary Of **26** = **11010**

SMR Binary Of **+26** = **011010**

Since Its a positive number , Its 2's Complement is same

2's Of **+26** = **011010**

Now

Binary Of **7** = **00111**

SMR Binary Of **-7** = **100111**

Since Its a **-ve** number , Its **2's** Complement will be

2's Of **-7** = **111001**

011010

111001

Solve *26-7* using 2's Complement

Let **26-7** = Result

26+(-7) = Result

Apply 2's Complement on Both Sides

2's Complement of **26** + 2's Complement of (**-7**) = 2's Complement Of Result

Binary Of **26** = **11010**

SMR Binary Of **+26** = **011010**

Since Its a positive number , Its 2's Complement is same

2's Of **+26** = **011010**

Now

Binary Of **7** = **00111**

SMR Binary Of **-7** = **100111**

Since Its a **-ve** number , Its **2's** Complement will be

2's Of **-7** = **111001**

```
  1 1 0 0 0
  011010
+ 111001
--------
 1010011
```

Solve *26-7* using 2's Complement

Let **26-7** = Result

26+(-7) = Result

Apply 2's Complement on Both Sides

2's Complement of **26** + 2's Complement of (**-7**) = 2's Complement Of Result

Binary Of **26** = **11010**

SMR Binary Of **+26** = **011010**

Since Its a positive number , Its 2's Complement is same

2's Of **+26** = **011010**

Now

Binary Of **7** = **00111**

SMR Binary Of **-7** = **100111**

Since Its a **-ve** number , Its **2's** Complement will be

2's Of **-7** = **111001**

```
  1 1 0 0 0
  011010
+ 111001
--------
 1010011
```

DISCARD END CARRY

Solve *26-7* using 2's Complement

Let **26-7** = Result

26+(-7) = Result

Apply 2's Complement on Both Sides

2's Complement of **26** + 2's Complement of (**-7**) = 2's Complement Of Result

Binary Of **26** = **11010**

SMR Binary Of **+26** = **011010**

Since Its a positive number , Its 2's Complement is same

2's Of **+26** = **011010**

Now

Binary Of **7** = **00111**

SMR Binary Of **-7** = **100111**

Since Its a **-ve** number , Its **2's** Complement will be

2's Of **-7** = **111001**

```
  1 1 0 0 0
  011010
+ 111001
--------
 1010011
```

DISCARD END CARRY

2's Com of Result: 010011

Solve *26-7* using 2's Complement

Let **26-7** = Result

26+(-7) = Result

Apply 2's Complement on Both Sides

2's Complement of **26** + 2's Complement of (**-7**) = 2's Complement Of Result

Binary Of **26** = **11010**

SMR Binary Of **+26** = **011010**

Since Its a positive number , Its 2's Complement is same

2's Of **+26** = **011010**

Now

Binary Of **7** = **00111**

SMR Binary Of **-7** = **100111**

Since Its a **-ve** number , Its **2's** Complement will be

2's Of **-7** = **111001**

```
  1 1 0 0 0
  011010
+ 111001
--------
 1010011
```

DISCARD END CARRY

2's Com of Result: **010011**

Result:

Solve *26-7* using 2's Complement

Let **26-7** = Result

26+(-7) = Result

Apply 2's Complement on Both Sides

2's Complement of **26** + 2's Complement of (**-7**) = 2's Complement Of Result

Binary Of **26** = **11010**

SMR Binary Of **+26** = **011010**

Since Its a positive number , Its 2's Complement is same

2's Of **+26** = **011010**

Now

Binary Of **7** = **00111**

SMR Binary Of **-7** = **100111**

Since Its a **-ve** number , Its **2's** Complement will be

2's Of **-7** = **111001**

```
  1 1 0 0 0
  011010
+ 111001
--------
 1010011
```

DISCARD END CARRY

2's Com of Result: **010011**

Result:

Sign Bit के छ ?

Solve *26-7* using 2's Complement

Let **26-7** = Result

26+(-7) = Result

Apply 2's Complement on Both Sides

2's Complement of **26** + 2's Complement of (**-7**) = 2's Complement Of Result

Binary Of **26** = **11010**

SMR Binary Of **+26** = **011010**

Since Its a positive number , Its 2's Complement is same

2's Of **+26** = **011010**

Now

Binary Of **7** = **00111**

SMR Binary Of **-7** = **100111**

Since Its a **-ve** number , Its **2's** Complement will be

2's Of **-7** = **111001**

Sign Bit के छ ?

+ve , So No Change

```
  1 1 0 0 0
  011010
+ 111001
--------
 1010011
```

DISCARD END CARRY

2's Com of Result: 010011

Result:

Solve *26-7* using 2's Complement

Let **26-7** = Result

26+(-7) = Result

Apply 2's Complement on Both Sides

2's Complement of **26** + 2's Complement of (**-7**) = 2's Complement Of Result

Binary Of **26** = **11010**

SMR Binary Of **+26** = **011010**

Since Its a positive number , Its 2's Complement is same

2's Of **+26** = **011010**

Now

Binary Of **7** = **00111**

SMR Binary Of **-7** = **100111**

Since Its a **-ve** number , Its **2's** Complement will be

2's Of **-7** = **111001**

Sign Bit के छ ?

+ve , So No Change

```
  1 1 0 0 0
  011010
+ 111001
--------
 1010011
```

DISCARD END CARRY

2's Com of Result: 010011

Result: 010011

Solve *26-7* using 2's Complement

Let **26-7** = Result

26+(-7) = Result

Apply 2's Complement on Both Sides

2's Complement of **26** + 2's Complement of (**-7**) = 2's Complement Of Result

Binary Of **26** = **11010**

SMR Binary Of **+26** = **011010**

Since Its a positive number , Its 2's Complement is same

2's Of **+26** = **011010**

Now

Binary Of **7** = **00111**

SMR Binary Of **-7** = **100111**

Since Its a **-ve** number , Its **2's** Complement will be

2's Of **-7** = **111001**

```
  1 1 0 0 0
  011010
+ 111001
--------
 1010011
```

DISCARD END CARRY

2's Com of Result: **010011**

Result: **010011** **19**

Assignment Work

Solve *7-26* using 2’s Complement

Class Work

Solve *7-26* using 2's Complement

Let **7-26** = Result

7+(-26) = Result

Apply 2's Complement on Both Sides

2's Complement of 7 + 2's Complement of (**-26**) = 2's Complement Of Result

Binary Of **7** = **00111**

SMR Binary Of **+7** = **0**00111

Since Its a positive number , Its 2's Complement is same

2's Of **+7** = **0**00111

Now

Binary Of **26** = **11010**

SMR Binary Of **-26** = **1**11010

Since Its a **-ve** number , Its **2's** Complement will be

2's Of **-26** = **1**00110

$$\begin{array}{r} 000111 \\ +\ 100110 \\ \hline 0101101 \end{array}$$

2's Com of Result: **1**01101

Result: **1**10011

-19

The OverFlow

Solve Using 2’s Complement

a) -3+2

b) -2+3

c) 3+2

d) -3-2

The OverFlow

Solve Using 2’s Complement

a) -3+2 **b) -2+3**

c) 3+2 **d) -3-2**

Binary Of 2 = **10**

SMR Of 2 = **010**

2’s Complement Of +2 : **010**

SMR Of **-2** = **110**

2’s Complement Of -2 : **110**

Binary Of 3 = **11**

SMR Of 3 = **011**

2’s Complement Of +3 : **011**

SMR Of **-3** = **111**

2’s Complement Of -3 : **101**

The OverFlow

Solve Using 2’s Complement

a) -3+2 **b) -2+3**

c) 3+2 **d) -3-2**

Binary Of 2 = **10**

SMR Of 2 = **010**

2’s Complement Of +2 : **010**

Binary Of 3 = **11**

SMR Of 3 = **011**

2’s Complement Of +3 : **011**

SMR Of **-2** = **110**

2’s Complement Of -2 : **110**

SMR Of **-3** = **111**

2’s Complement Of -3 : **101**

The OverFlow

Solve Using 2’s Complement

a) -3+2 **b) -2+3**

c) 3+2 **d) -3-2**

2’s Complement Of +2 : **010**

2’s Complement Of -2 : **110**

2’s Complement Of +3 : **011**

2’s Complement Of -3 : **101**

The OverFlow

Solve Using 2’s Complement

a) -3+2 **b) -2+3**

c) 3+2 **d) -3-2**

2’s Complement Of +2 : **010**

2’s Complement Of -2 : **110**

2’s Complement Of +3 : **011**

2’s Complement Of -3 : **101**

a) -3+2 **b) -2+3** **c) 3+2** **d) -3-2**

The OverFlow

a) -3+2 b) -2+3

c) 3+2 d) -3-2

2’s Complement Of +2 : **010**

2’s Complement Of -2 : **110**

2’s Complement Of +3 : **011**

2’s Complement Of -3 : **101**

Solve Using 2’s Complement

a) -3+2

```
  101
+ 010
-----
```

b) -2+3

```
  110
+ 011
-----
```

c) 3+2

```
  011
+ 010
-----
```

d) -3-2

```
  101
+ 110
-----
```

The OverFlow

a) -3+2 b) -2+3

c) 3+2 d) -3-2

2's Complement Of +2 : **010**

2's Complement Of -2 : **110**

2's Complement Of +3 : **011**

2's Complement Of -3 : **101**

Solve Using 2's Complement

a) -3+2

101
+ 010

0111

2's Com Of Result = 111

= 101

Result = -1

b) -2+3

110
+ 011
---

c) 3+2

011
+ 010
---

d) -3-2

101
+ 110

The OverFlow

a) -3+2 b) -2+3

c) 3+2 d) -3-2

2's Complement Of +2 : **010**

2's Complement Of -2 : **110**

2's Complement Of +3 : **011**

2's Complement Of -3 : **101**

Solve Using 2's Complement

a) -3+2

```
  101
+ 010
-----
 0111
```

2's Com Of Result = 111

= 101

Result = -1

b) -2+3

```
  110
+ 011
-----
 1001
```

2's Com Of Result = 001

= 001

Result = 1

c) 3+2

```
  011
+ 010
-----
```

d) -3-2

```
  101
+ 110
-----
```

The OverFlow

Solve Using 2's Complement

a) -3+2 b) -2+3

c) 3+2 d) -3-2

2's Complement Of +2 : **010**

2's Complement Of -2 : **110**

2's Complement Of +3 : **011**

2's Complement Of -3 : **101**

a) -3+2

```
  101
+ 010
-----
 0111
```

2's Com Of Result = 111

= 101

Result = -1

b) -2+3

```
  110
+ 011
-----
 1001
```

2's Com Of Result = 001

= 001

Result = 1

c) 3+2

```
  011
+ 010
-----
 0101
```

2's Com Of Result = 101

= 111

Result = -3

d) -3-2

```
  101
+ 110
-----
```

The OverFlow

a) -3+2 b) -2+3

c) 3+2 d) -3-2

2's Complement Of +2 : **010**

2's Complement Of -2 : **110**

2's Complement Of +3 : **011**

2's Complement Of -3 : **101**

Solve Using 2's Complement

a) -3+2

101
+ 010
0111

2's Com Of Result = 111

= 101

Result = -1

b) -2+3

110
+ 011
1001

2's Com Of Result = 001

= 001

Result = 1

c) 3+2

011
010
0101

2's Com Of Result = 101

= 111

Result = -3

d) -3-2

101
+ 110
1011

2's Com Of Result = 011

= 011

Result = 3

The OverFlow

Solve Using 2's Complement

a) -3+2 b) -2+3

c) 3+2 d) -3-2

2's Complement Of +2 : **010**

2's Complement Of -2 : **110**

2's Complement Of +3 : **011**

2's Complement Of -3 : **101**

a) -3+2

```
  101
+ 010
-----
 0111
```

Result = -1

b) -2+3

```
  110
+ 011
-----
 1001
```

Result = 1

c) 3+2

```
  011
  010
-----
 0101
```

Result = -3

d) -3-2

```
  101
+ 110
-----
 1011
```

Result = 3

The Range Of The Decimal Number Which Can Be Represented using 3 bit 2's Complement form is -4 to 3.

$$-2^{n-1} \text{ to } 2^{n-1}-1$$

The Range Of The Decimal Number Which Can Be Represented using 3 bit 2's Complement form is -4 to 3.

$$-2^{n-1} \text{ to } 2^{n-1}-1$$

c) 3+2

d) -3-2

Opposite Signs Will Cancel Out Each Others Magnitude, So it will never be out of Range.

Same Signs Will Increase Magnitude, So there is chances Out Of Range.

For Example, 2+1 and -1-2 won't overflow, though they have same Sign

OverFlow May Occur On Addition Of Two Numbers with same sign.

The Range Of The Decimal Number Which Can Be Represented using 3 bit 2's Complement form is -4 to 3.

$$-2^{n-1} \text{ to } 2^{n-1}-1$$

c) 3+2

d) -3-2

Opposite Signs Will Cancel Out Each Others Magnitude, So it will never be out of Range.

Same Signs Will Increase Magnitude, So there is chances Out Of Range.

For Example, 2+1 and -1-2 won't overflow, though they have same Sign

OverFlow May Occur On Addition Of Two Numbers with same sign.

a) -3+2

```
  101
+ 010
------
 0111
```

b) -2+3

```
  110
+ 011
------
 1001
```

c) 3+2

```
  011
+ 010
------
 0101
```

d) -3-2

```
  101
+ 110
------
 1011
```

2 +ve Numbers Sum is Coming in -ve ढुक्क Overflow

a) -3+2

```
  101
+ 010
-----
 0111
```

b) -2+3

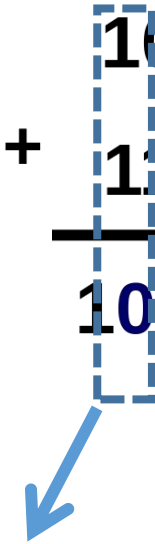
```
  110
+ 011
-----
 1001
```

c) 3+2

```
  011
+ 010
-----
 0101
```

d) -3-2

```
  101
+ 110
-----
 1011
```



2 -ve Numbers Sum is Coming in +ve

ढुक्क Overflow

Decision Of Overflow By Looking at the *carry*

a) -3+2

```
  101
+ 010
-----
 0111
```

b) -2+3

```
  110
+ 011
-----
 1001
```

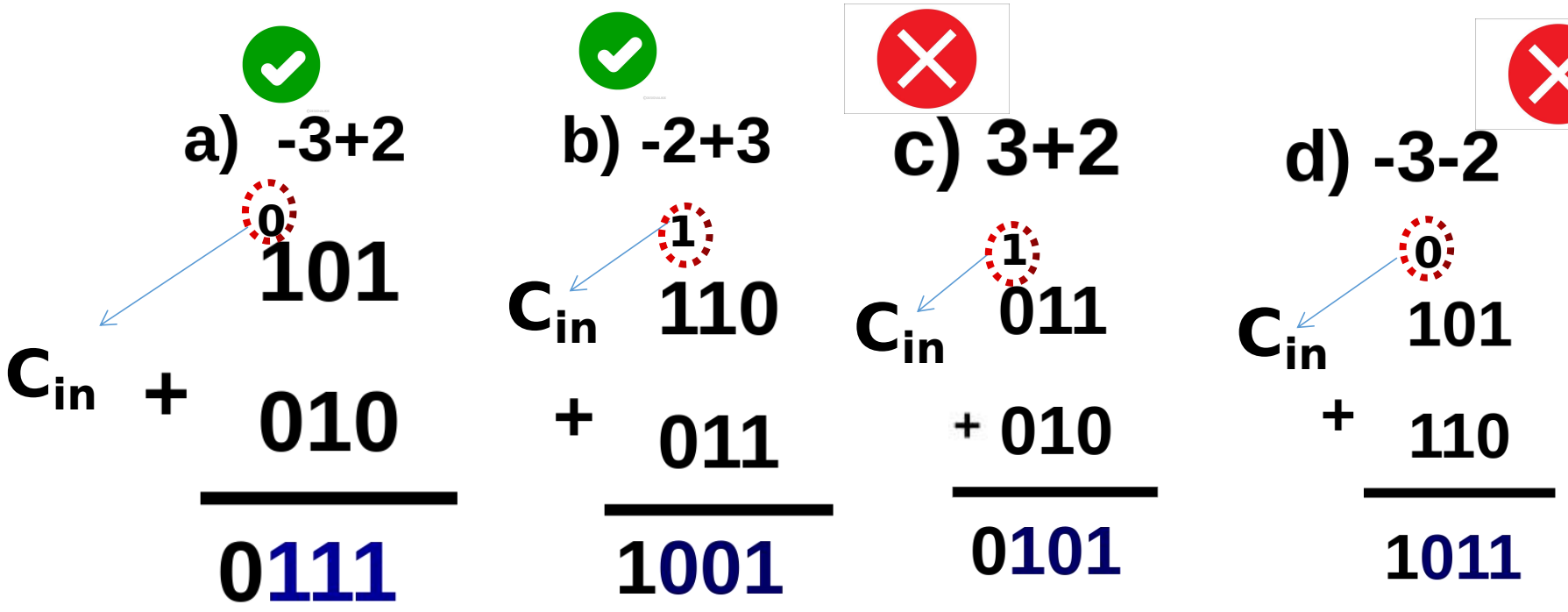
c) 3+2

```
  011
+ 010
-----
 0101
```

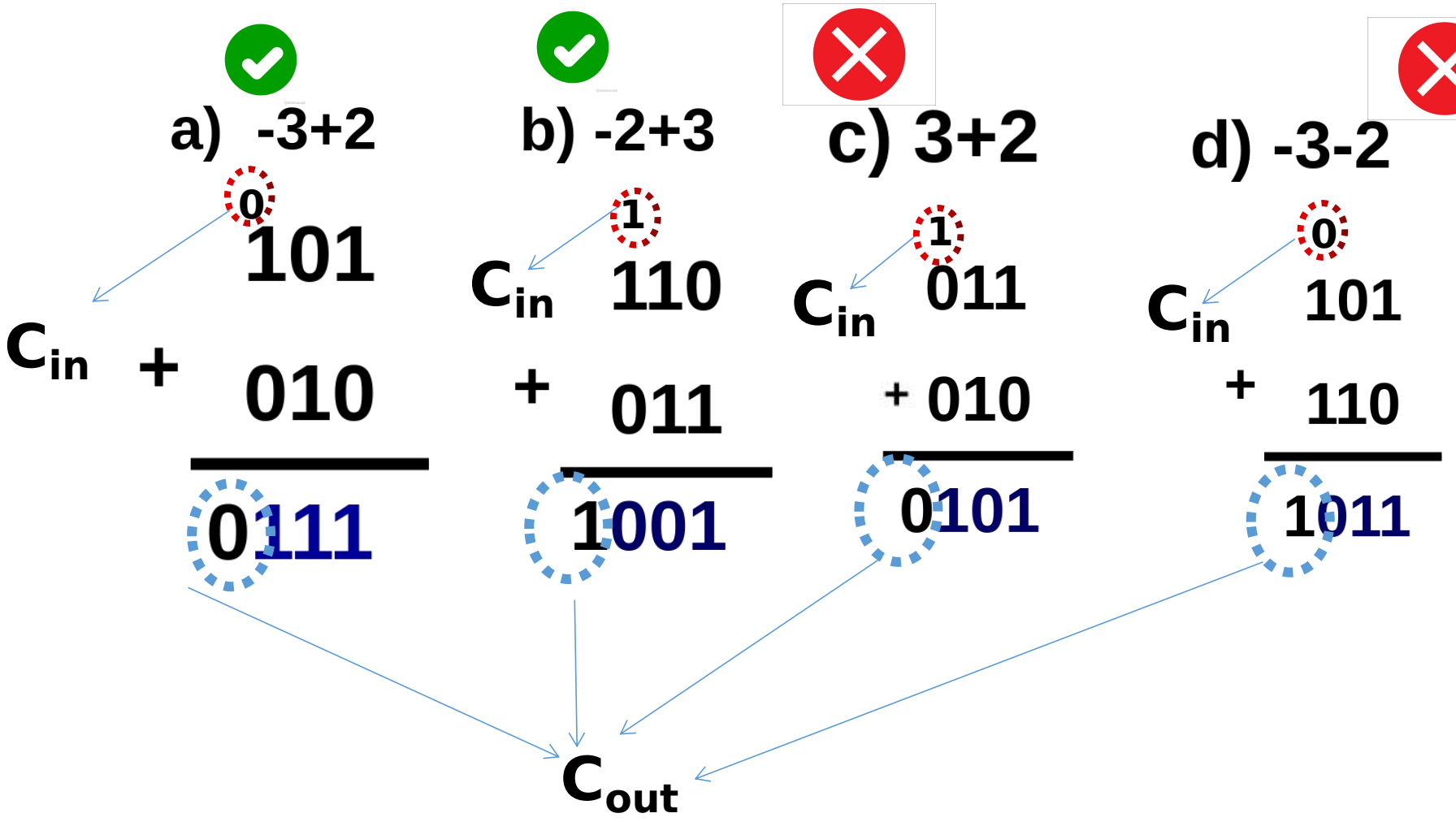
d) -3-2

```
  101
+ 110
-----
 1011
```

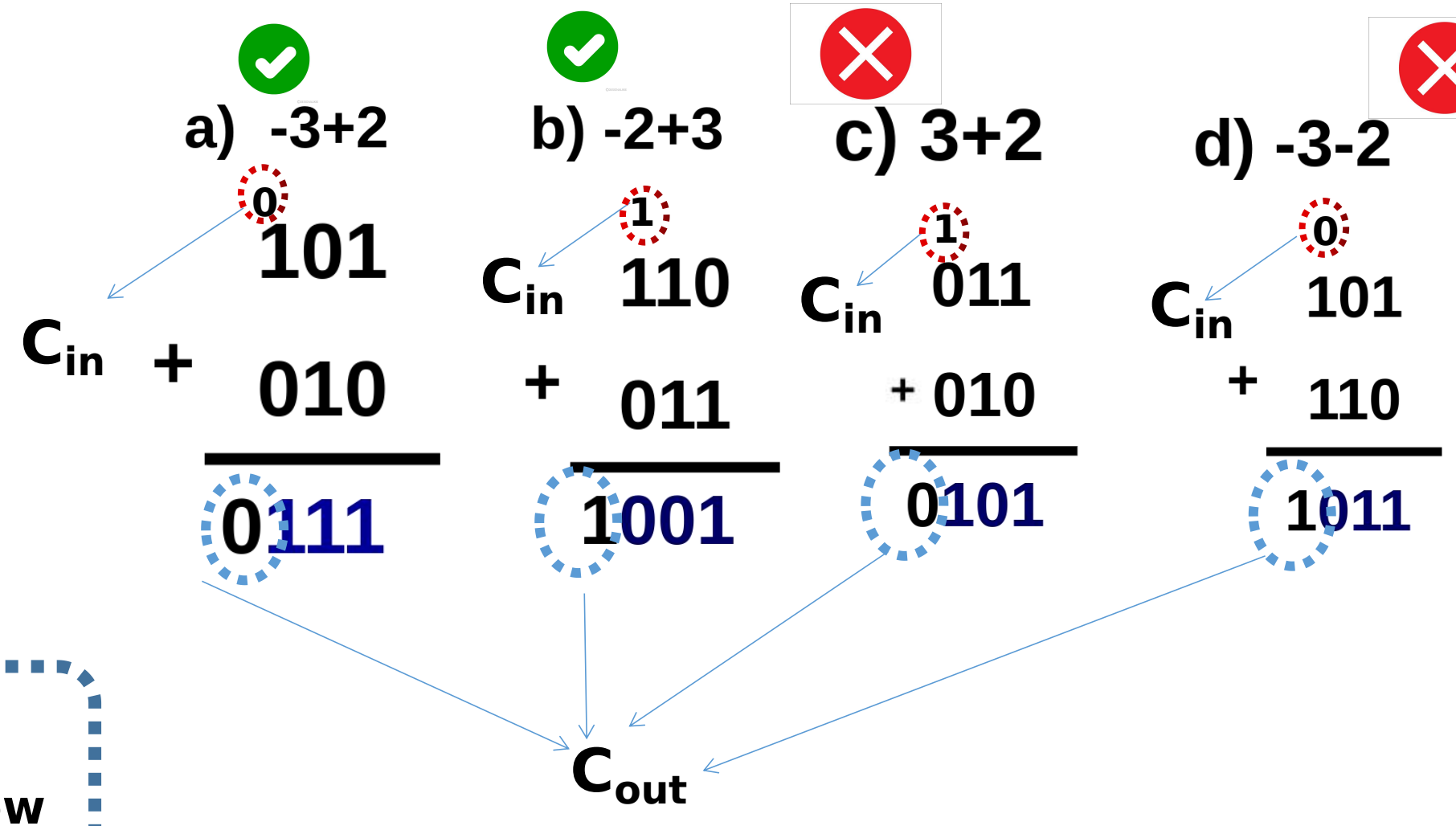
Decision Of Overflow By Looking at the *carry*



Decision Of Overflow By Looking at the *carry*



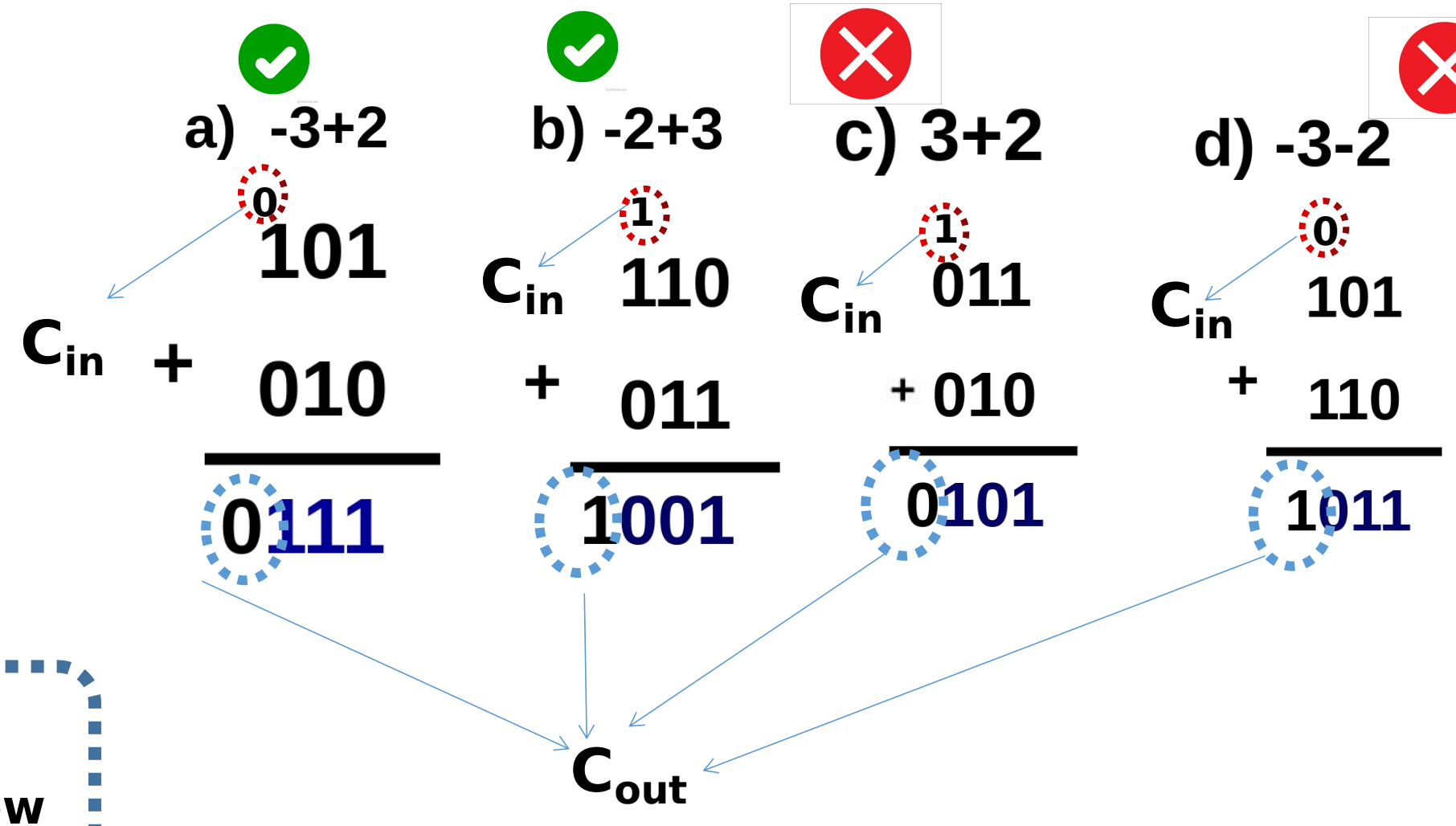
Decision Of Overflow By Looking at the *carry*



IF $C_{in} \oplus C_{out} = 0$

= No OverFlow

Decision Of Overflow By Looking at the *carry*



IF $C_{in} \oplus C_{out} = 0$

= No OverFlow

IF $C_{in} \oplus C_{out} = 1$

= 100% OverFlow