ELECTRONIC PRINCIPLES AND DEVICES

Dr. Ananda M

Department of Electronics and Communication.

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Unit-3 Digital Electronics

Realization of Boolean expression using Universal Gates

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Realization of Boolean expression using Universal Gates

- **Universal Gates** : (i) NAND Gate
  (ii) NOR Gate

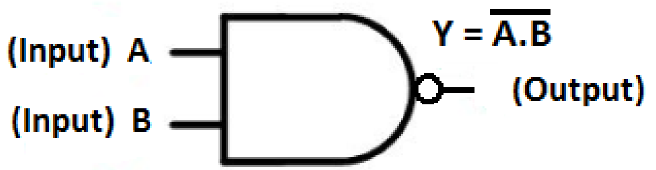
- Any digital logic circuit can be implemented by using NAND or NOR logic gates.

- NAND and NOR gates are easier to fabricate with electronic components and are used in all Integrated Circuit (IC’s) digital logic families.

Realization of Boolean expression using Universal Gates

❖ Realization of logic gates using NAND Gates:

Symbol

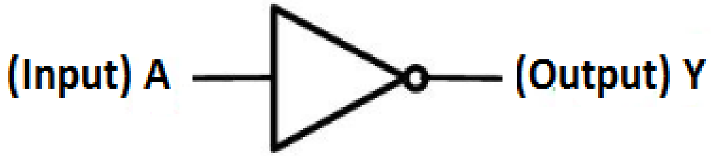


Truth Table

NAND		
Input		Output
A	B	Y
0	0	1
0	1	1
1	0	1
1	1	0

❖ NOT Gate:

Symbol



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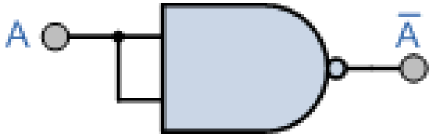
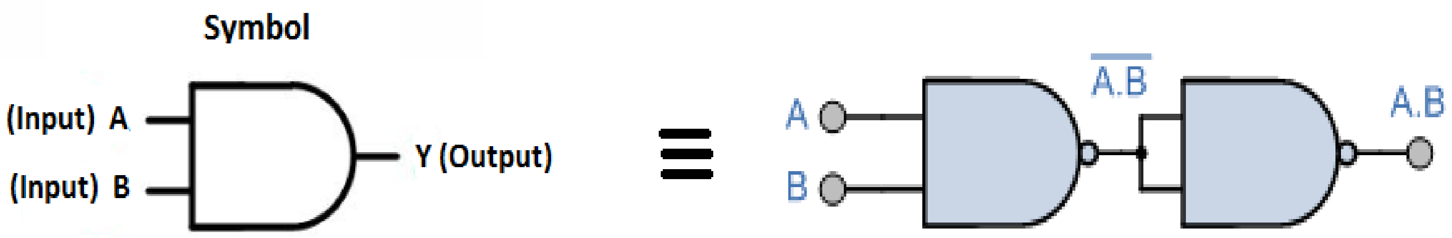


Y = (A.A)’ = (A)’ = A’

Reference: https://www.electronics-tutorials.ws/logic/universal-gates.html

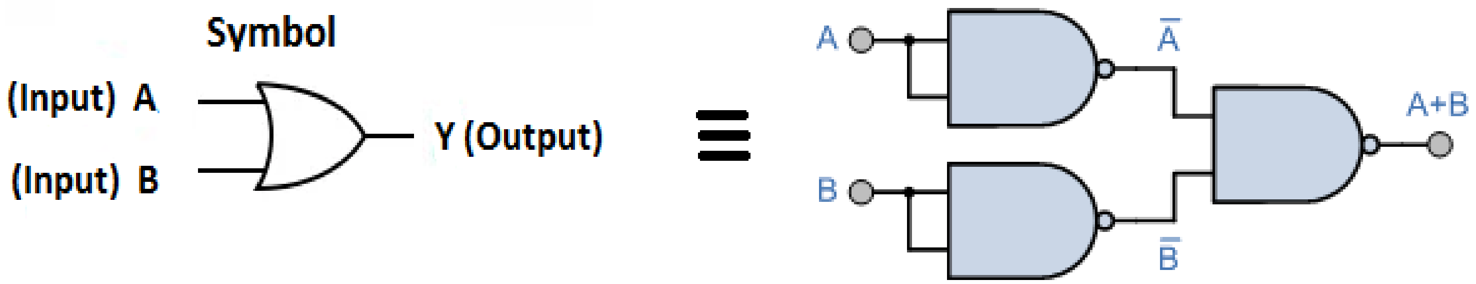
Realization of Boolean expression using Universal Gates

❖ AND Gate:



$Y = ((A.B)')' = A.B$

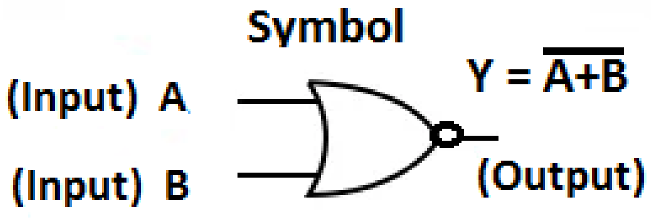
❖ OR Gate:



$Y = ((A+B)')' = (A' . B')' = A+B$

Realization of Boolean expression using Universal Gates

❖ NOR Gate:



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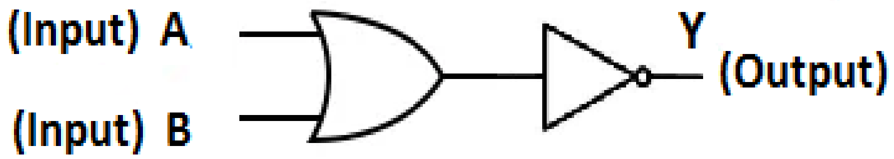

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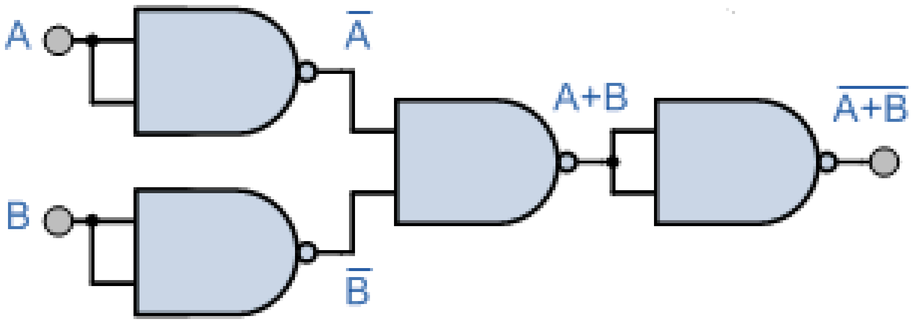
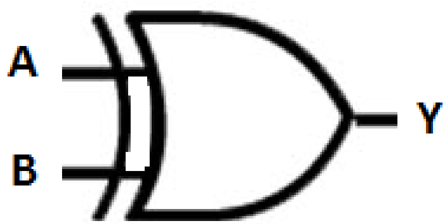


Realization of Boolean expression using Universal Gates

- **XOR Gate:**



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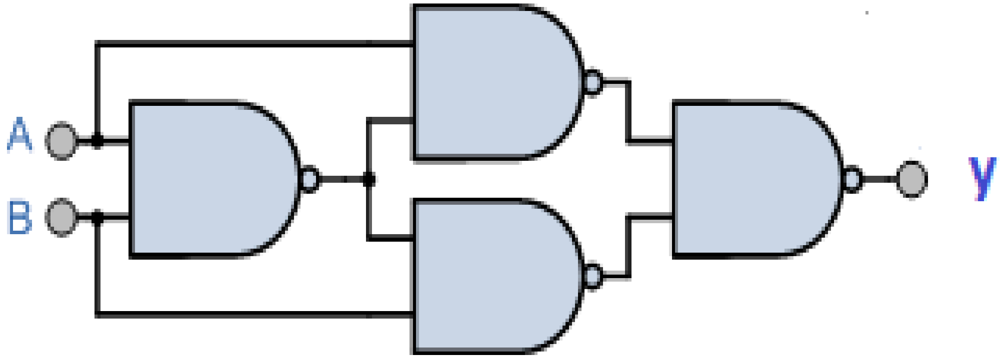


$Y = A \oplus B$

Y = A.B’ + A’B = A (A.B)’ + B. (A.B)’

Y = ((A (A.B)’ + B. (A.B)’)’)’

Y =((A. (A.B)’)’ . (B.(A.B)’)’)’

Y = A (A.B)’ + B. (A.B)’

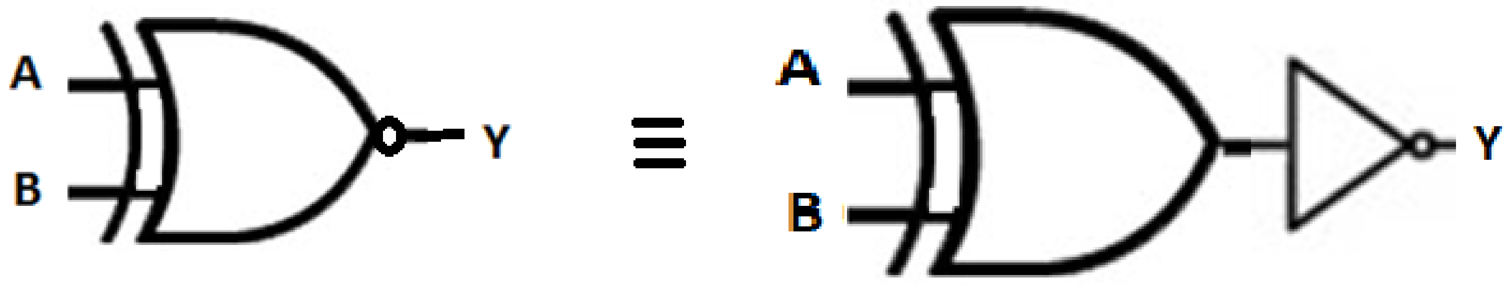
Y = A (A’ + B’) + B. (A’ + B’)

Y = A.A’ + A.B’ + A’.B + B.B’

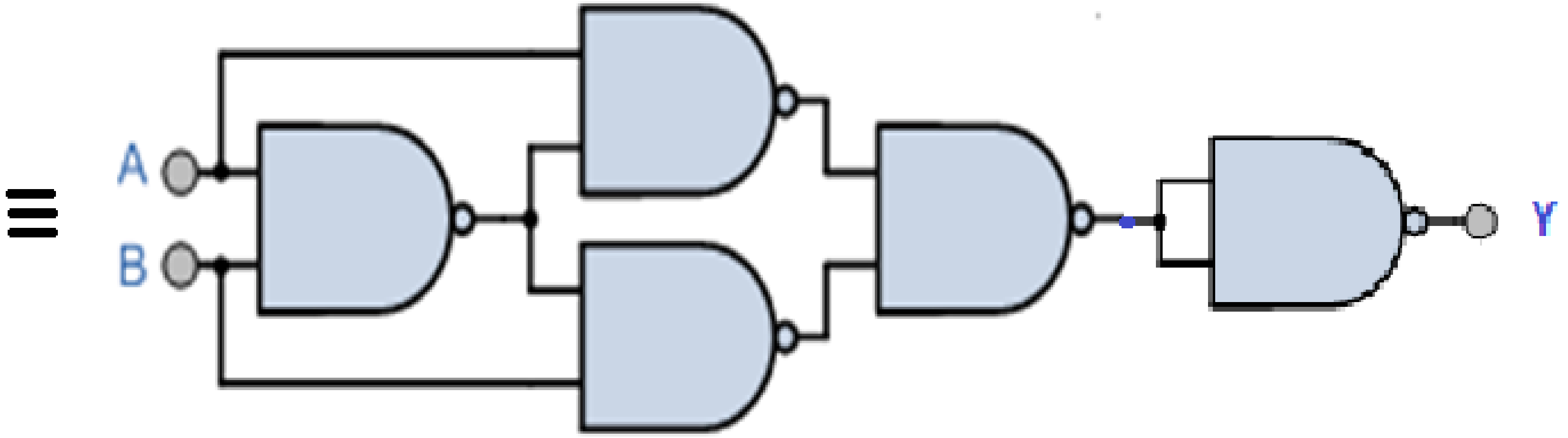
Y = A.B’ + A’.B

Realization of Boolean expression using Universal Gates

- **XNOR Gate**:



$Y = (A \oplus B)' = A \odot B$



Realization of Boolean expression using Universal Gates

❖ Realization of logic gates using NOR Gates:

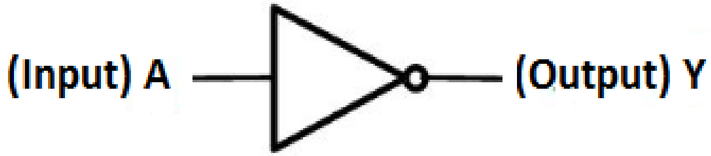
Symbol

Truth Table

NOR		
Input		Output
A	B	Y
0	0	1
0	1	0
1	0	0
1	1	0

❖ NOT Gate:

Symbol



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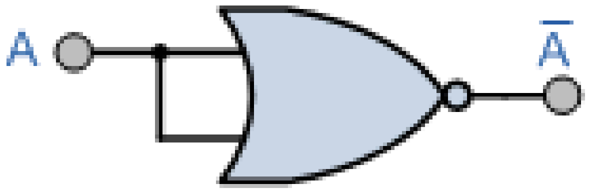
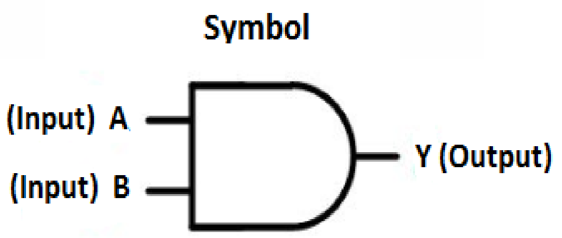


$Y = (A + A)' = (A)' = A'$

Realization of Boolean expression using Universal Gates

❖ AND Gate:



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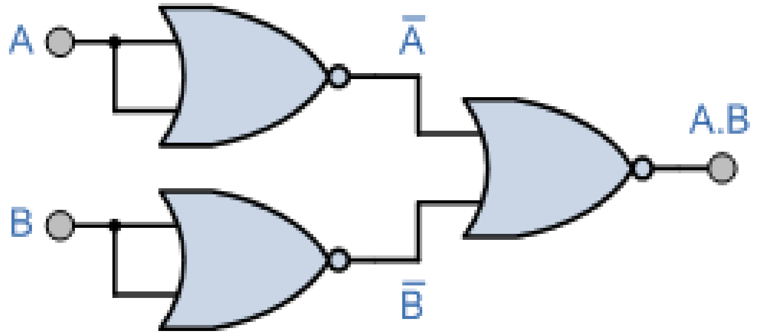
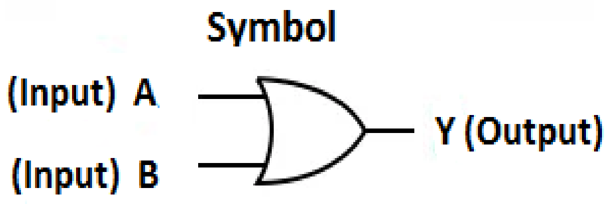


Y = ((A.B)’)’ = (A’ + B’)’ = A.B

❖ OR Gate:



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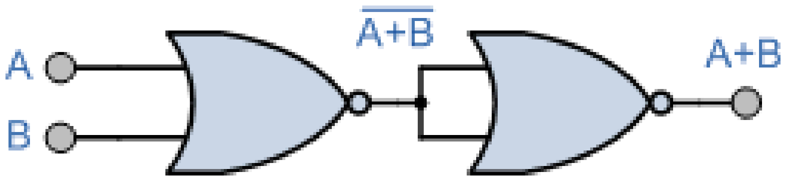
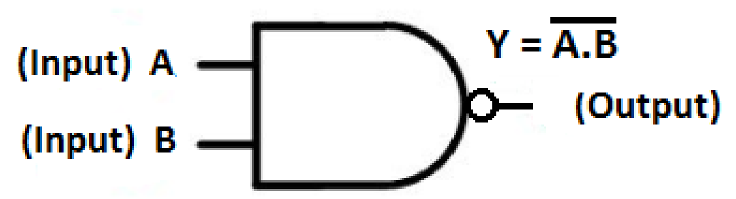


Y = ((A+B)’)’ = A + B

Realization of Boolean expression using Universal Gates

❖ NAND Gate:

Symbol



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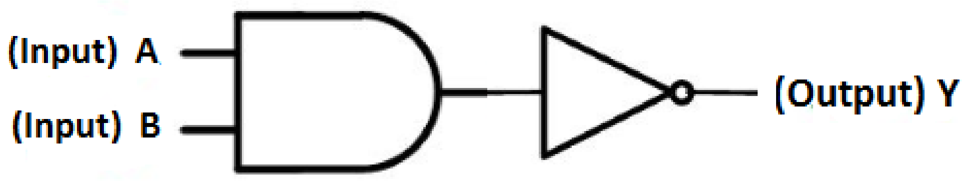

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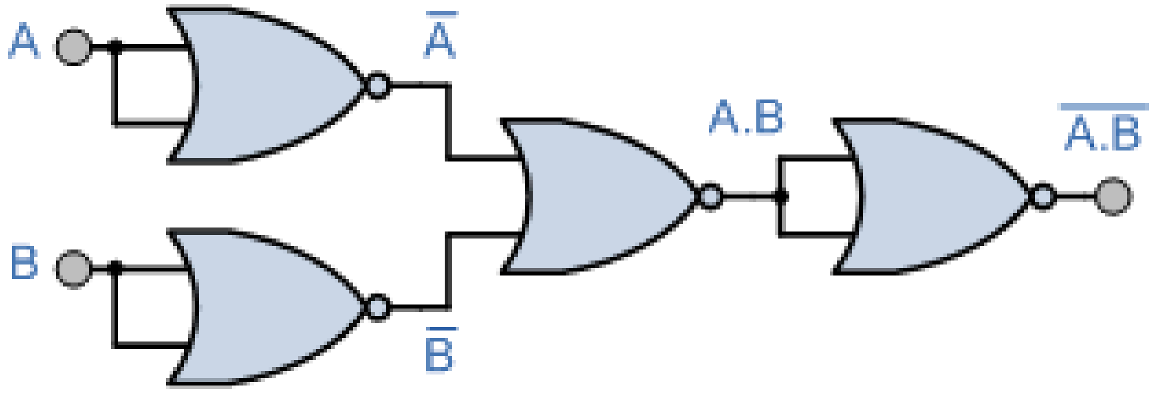
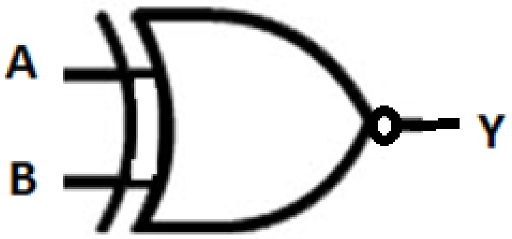


Realization of Boolean expression using Universal Gates

- **XNOR Gate**:



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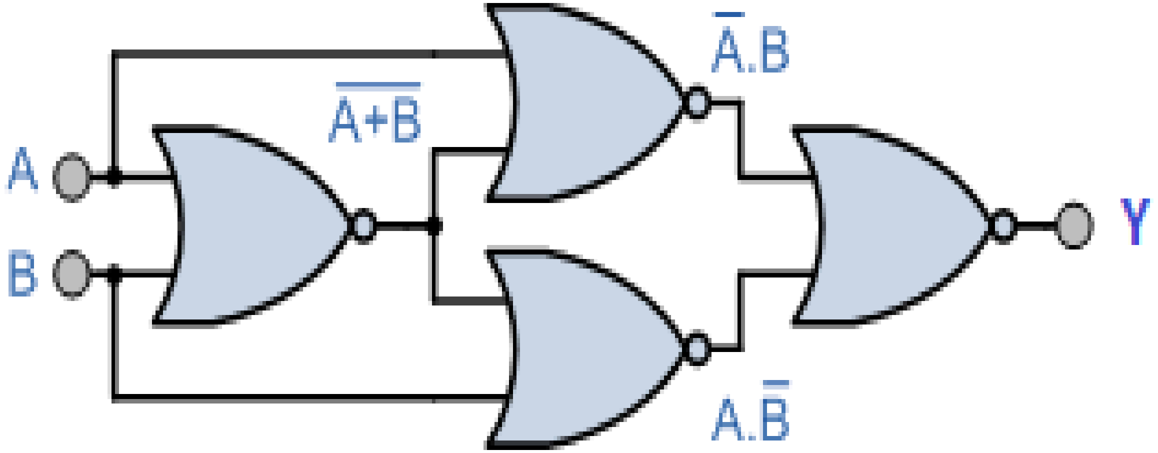


Y1 = ((A+B)’ + A)’ = (A+B). A’ = A’.B

Y2 = ((A+B)’ + B)’ = (A+B). B’ = A.B’

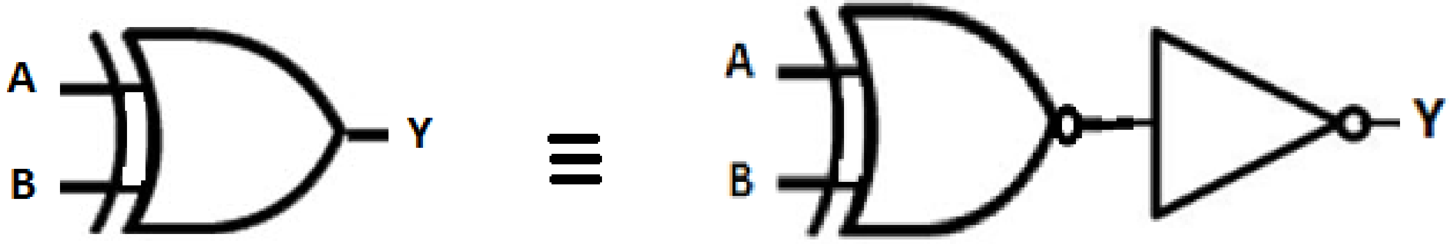
Y = (A’.B + A.B’)’ = (A’.B)’ . (A.B’)’ = (A + B’) . (A’ + B)

Y = A.B + A’.B’

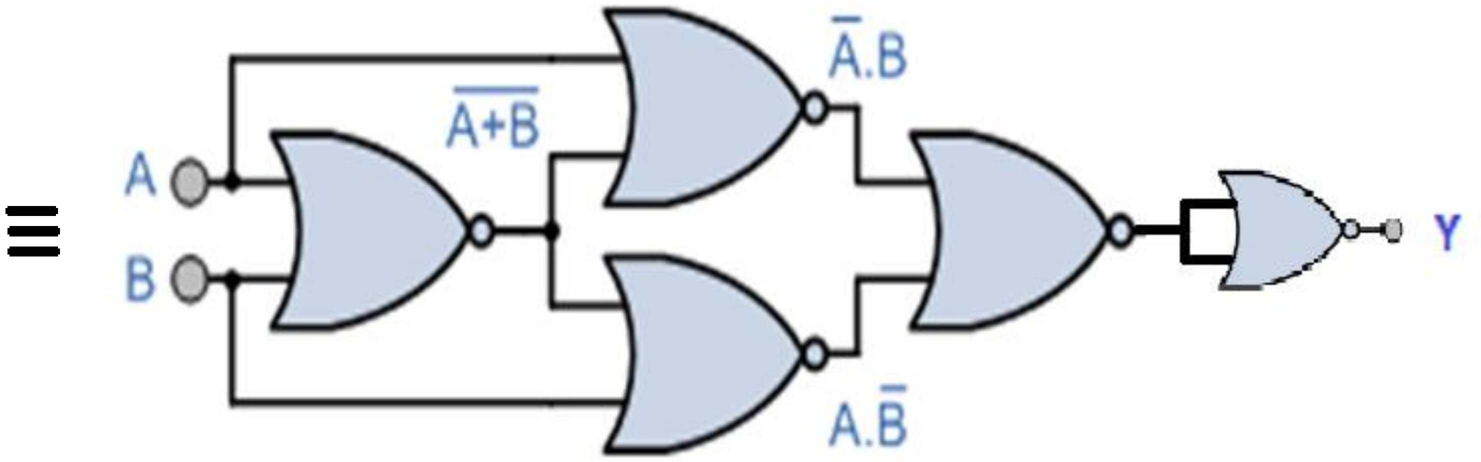
Y = A⨀B

Realization of Boolean expression using Universal Gates

- **XOR Gate:**



$Y = (A \odot B)' = A \oplus B$



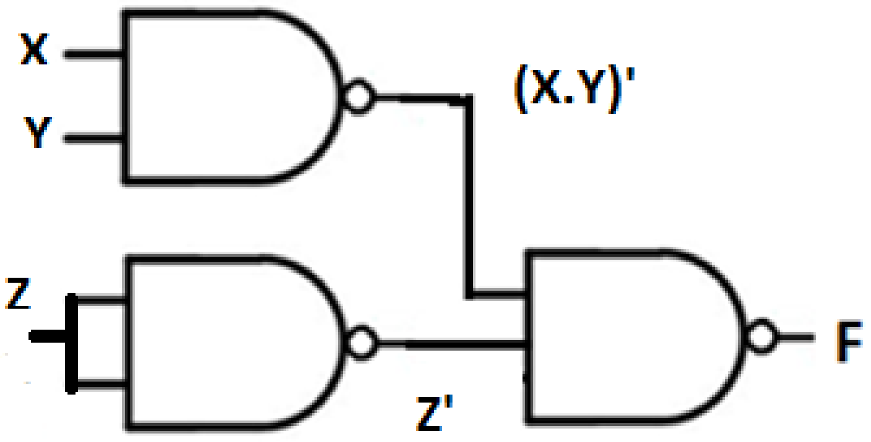
Realization of Boolean expression using Universal Gates

- **Implement the given function using NAND Gates only.**

$F = X.Y + Z$

$F = ((X.Y + Z)'\ )'$

$F = ((X.Y)'\ .\ Z')\ \ )'$



THANK YOU

Dr. Ananda M
Department of Electronics and Communication
anandam@pes.edu