Transistors are much better in NAND gates so we prefer them.

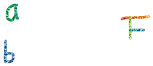
NAND and NOR gates are universal logic gates. You can design any kind of logical circuit with these 2 gates.

**Implementing Circuits by NAND Gates**

|  |  |  |  |
| --- | --- | --- | --- |
| a | b | AND | NAND |
| 0 | 0 | 0 | 1 |
| 0 | 1 | 0 | 1 |
| 1 | 0 | 0 | 1 |
| 1 | 1 | 1 | 0 |

NOT GATE:





x = 0 ---> a = 0 , b = 0 ---> F = 1

x = 1 ---> a = 1 , b = 1 ---> F = 0

AND GATE:

A picture containing tool, scissors

Description automatically generated

OR GATE:

a + b =  =

Diagram

Description automatically generated

Example:

Implement the sum output of half adder by using NAND gates.

S = a’b + ab’

A picture containing hanger

Description automatically generated

Text

Description automatically generated with medium confidence

You can ignore this part because you are taking not of not, nothing change.

A picture containing chart

Description automatically generated

Example:

a’bd + cd = d(a’b + c)

Diagram

Description automatically generated

**NOR Gates for Circuit Design**

|  |  |  |  |
| --- | --- | --- | --- |
| a | b | OR | NOR |
| 0 | 0 | 0 | 1 |
| 0 | 1 | 1 | 0 |
| 1 | 0 | 1 | 0 |
| 1 | 1 | 1 | 0 |

NOT GATE:

A pair of glasses

Description automatically generated with medium confidence

AND GATE:

ab =  =

A pair of glasses

Description automatically generated with medium confidence

OR GATE:

A pair of glasses

Description automatically generated with low confidence

Example:

Sum for the half adder : S = a’b + ab’

Diagram

Description automatically generated with low confidence

Text

Description automatically generated