Electronics

Lecture 17
Section C.2 (on CD)

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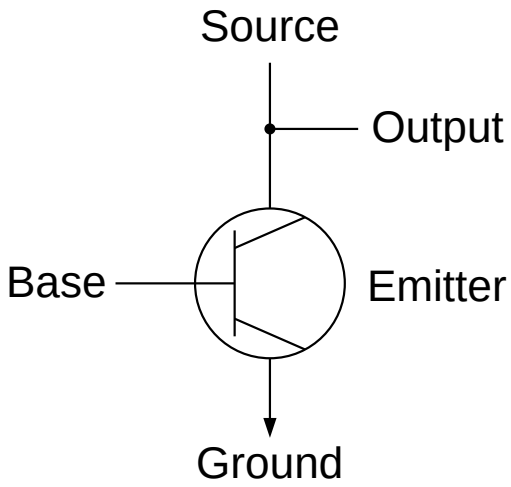
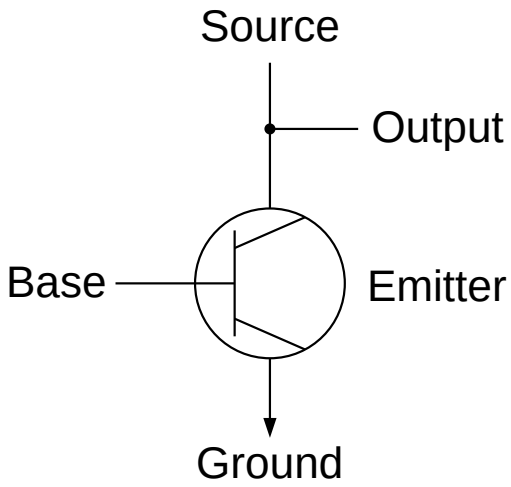
Outline

The Transistor



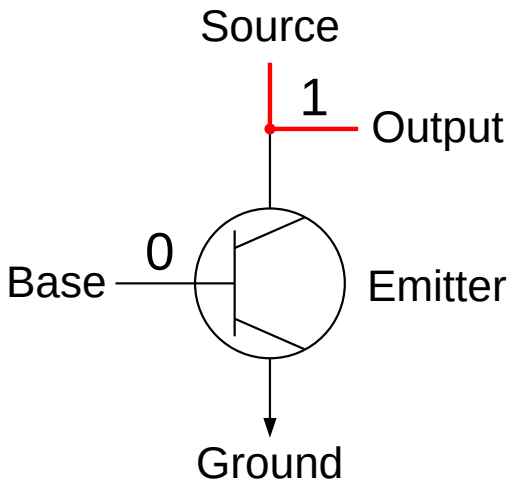
A transistor acts as an electronic switch.

The Transistor



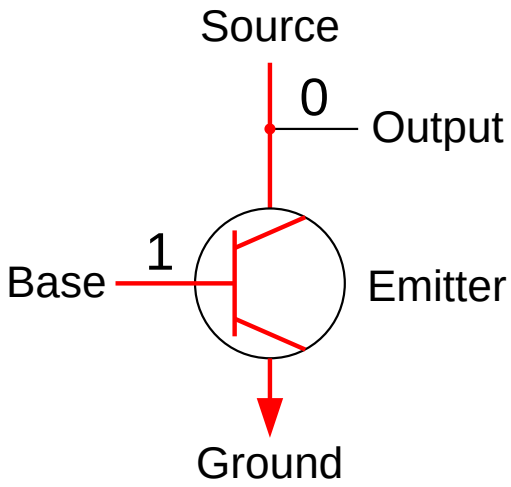
A voltage applied to the source sends current either to the output or to ground, depending on the state of the switch.

The Transistor



If no voltage (0) is applied to the base, then the switch is open, sending current to the output (1).

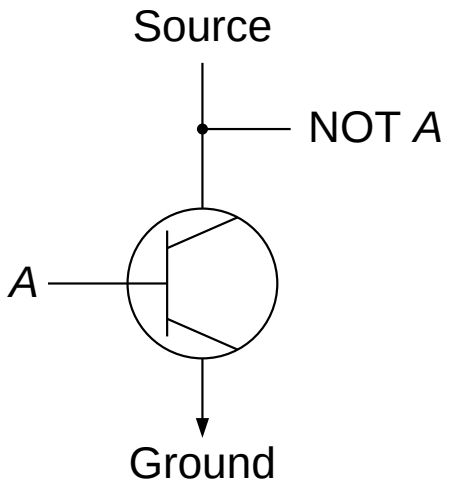
The Transistor



If voltage (1) is applied to the base, then the switch is closed, sending current to ground, making the output 0.

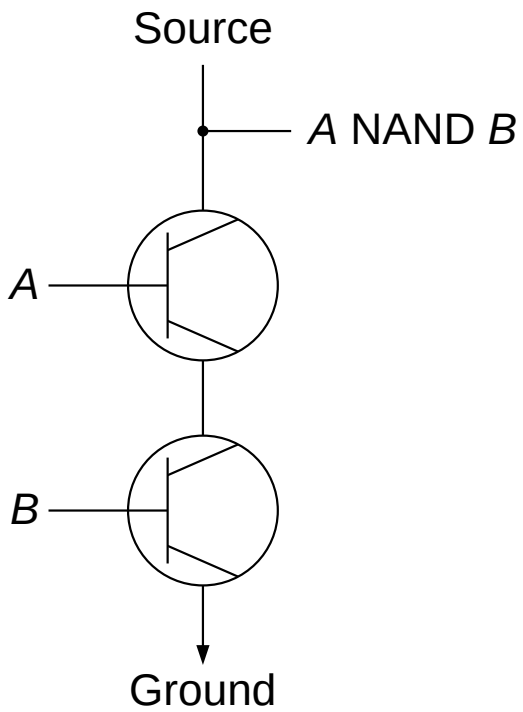
Outline

NOT Gate



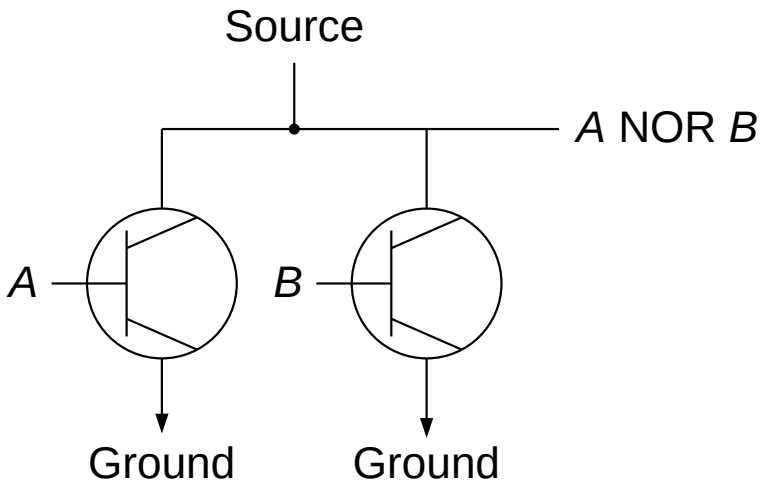
NOT Gate (Inverter)

NAND Gate



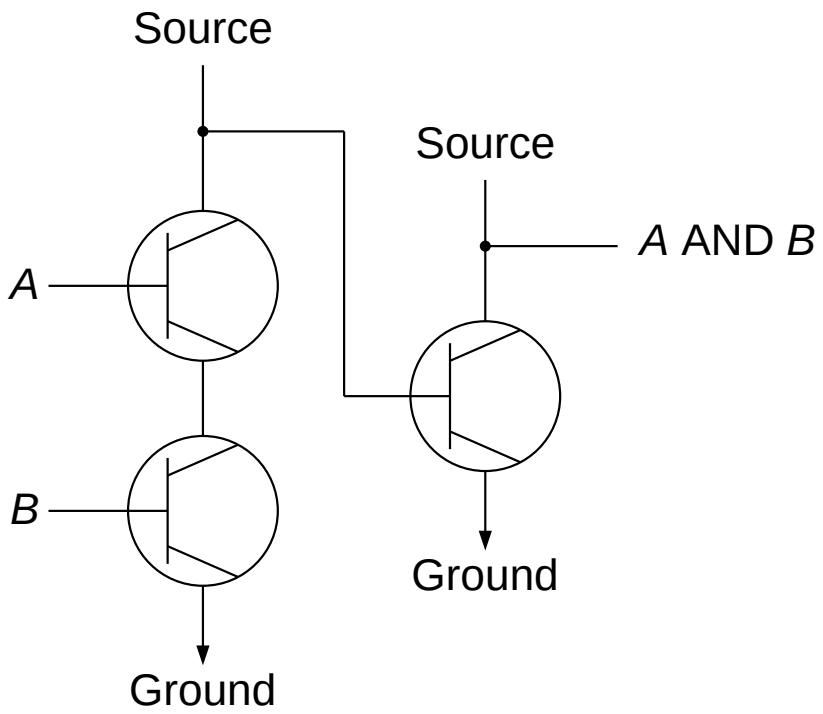
NAND Gate

NOR Gate



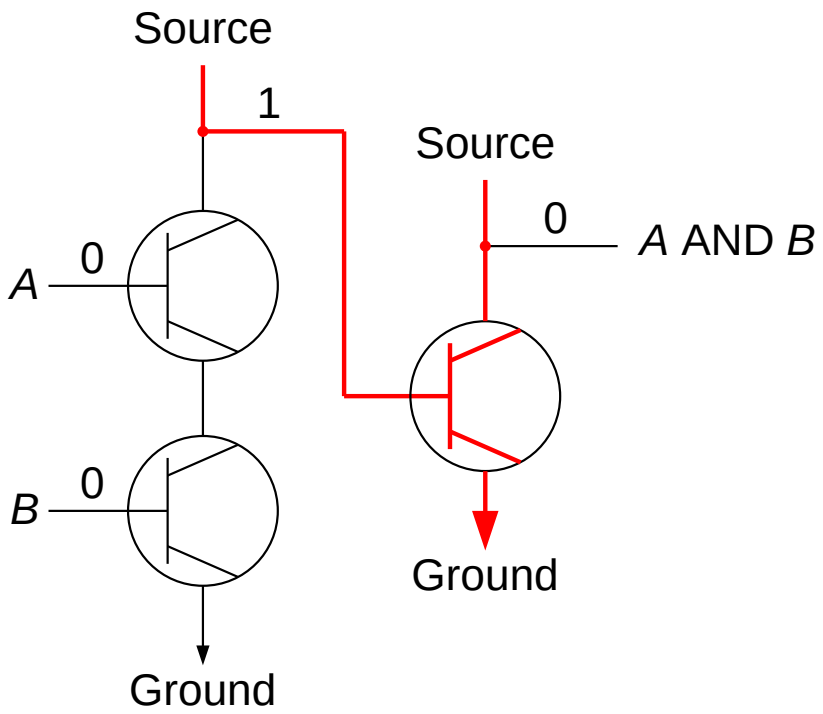
NOR Gate

AND Gate



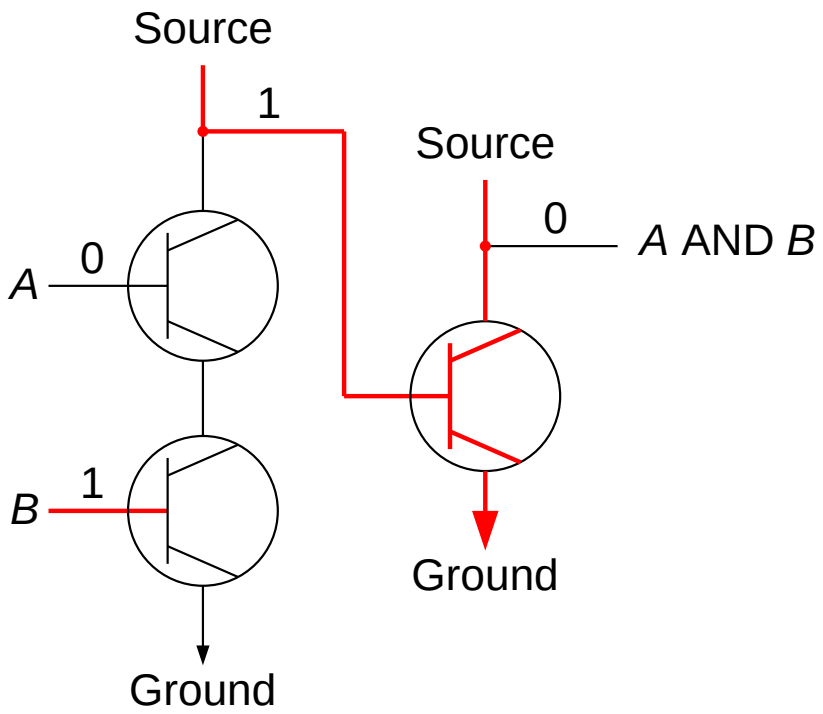
AND Gate

AND Gate



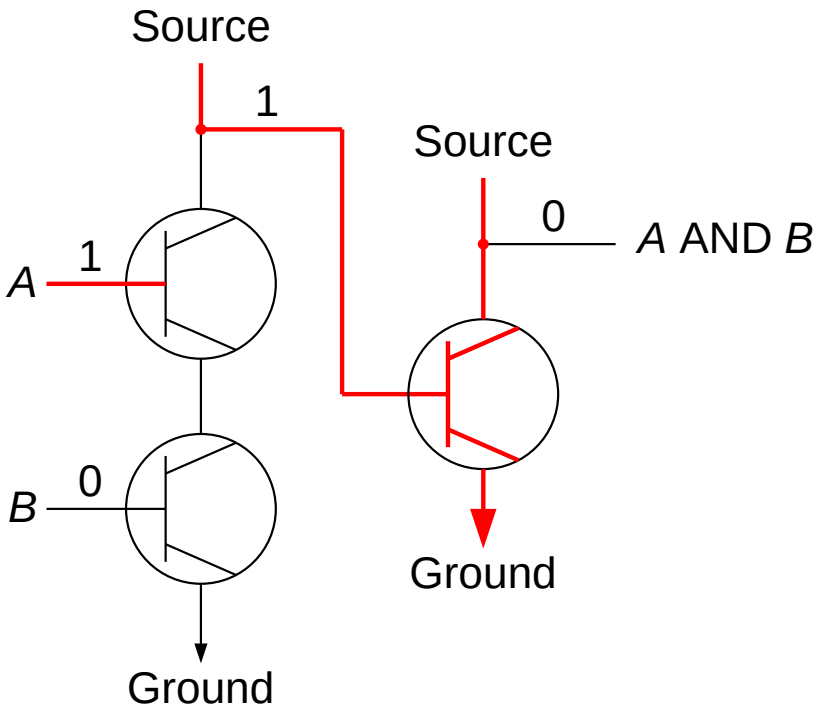
AND Gate

AND Gate



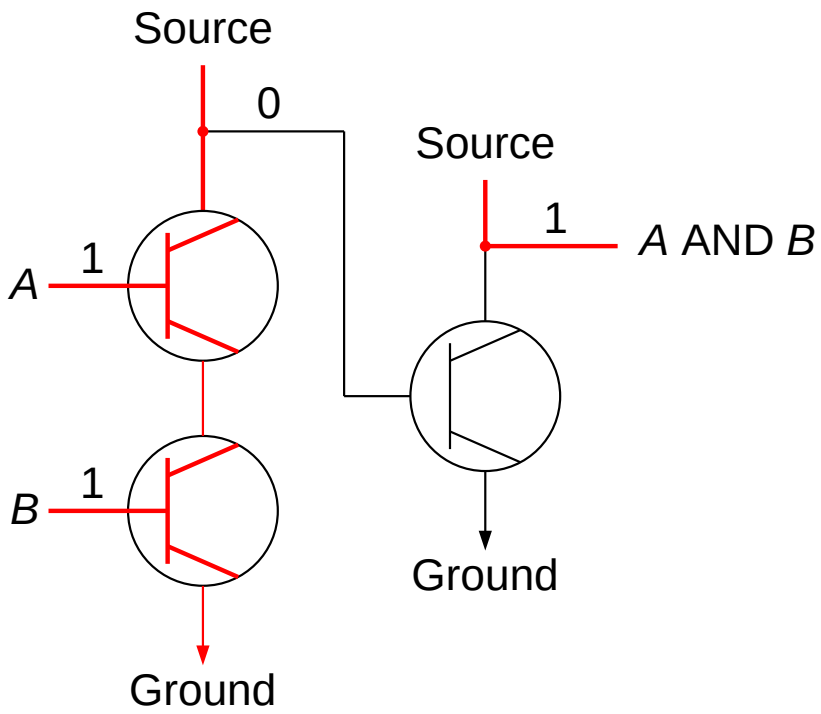
AND Gate

AND Gate



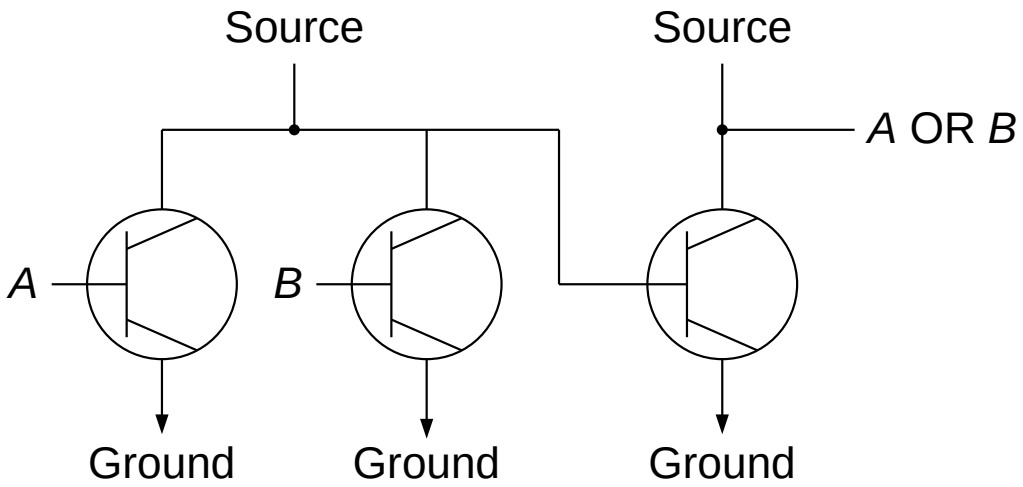
AND Gate

AND Gate



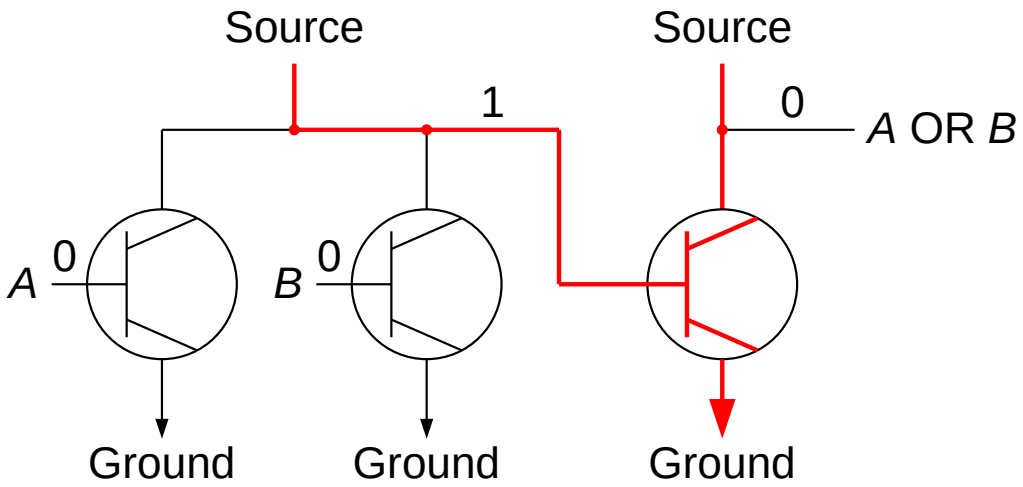
AND Gate

OR Gate



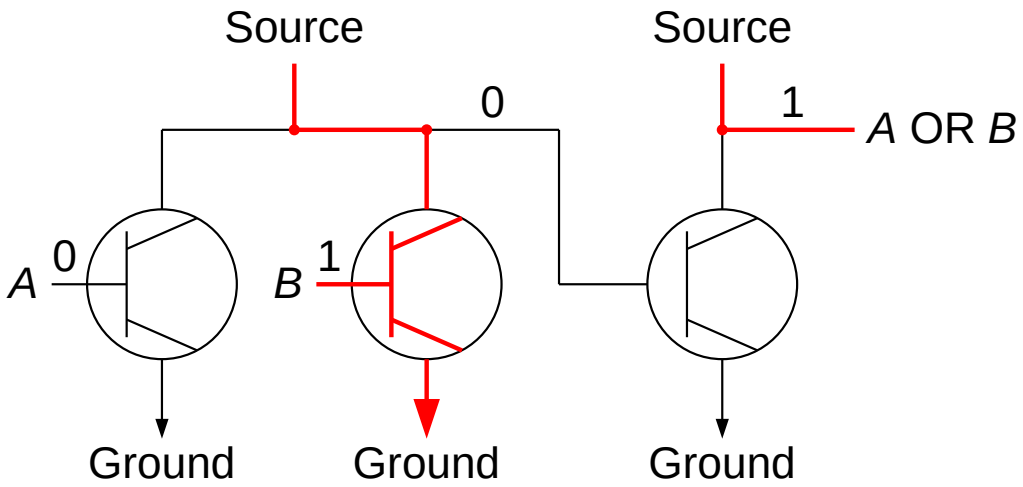
OR Gate

OR Gate



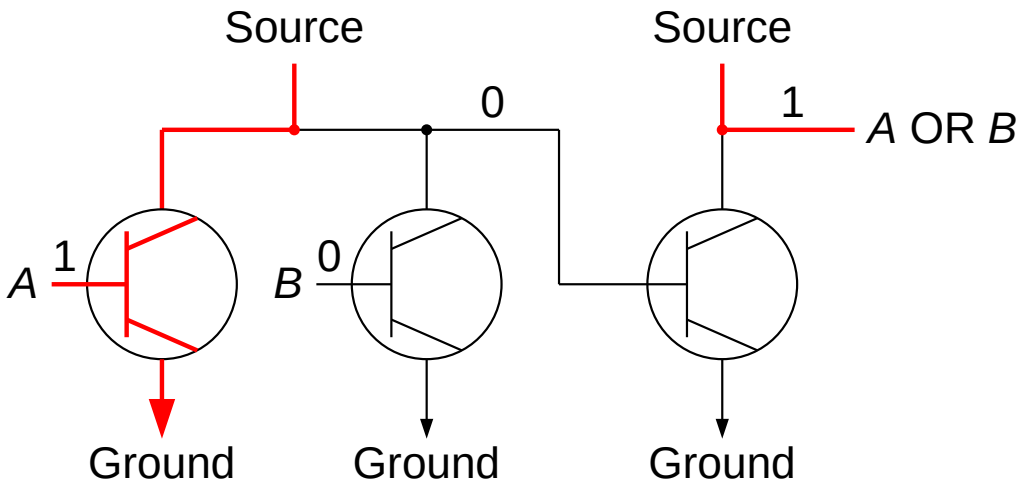
OR Gate

OR Gate



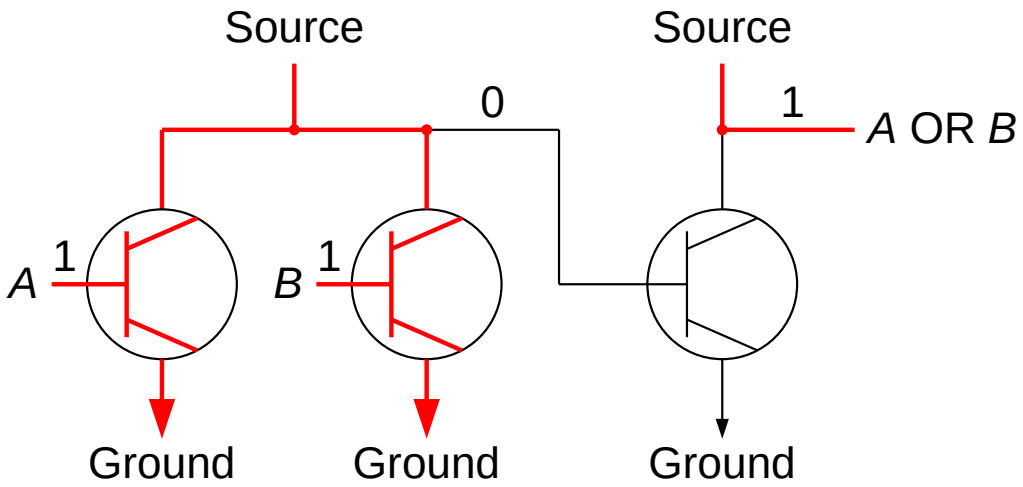
OR Gate

OR Gate



OR Gate

OR Gate



OR Gate

Outline

Combinational Circuits

Example (Combinational Circuit)

A	B	C	Output
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	1
1	0	0	1
1	0	1	1
1	1	0	1
1	1	1	1

- Using AND, OR, and NOT gates, design circuit for the above truth table.

Combinational Circuits

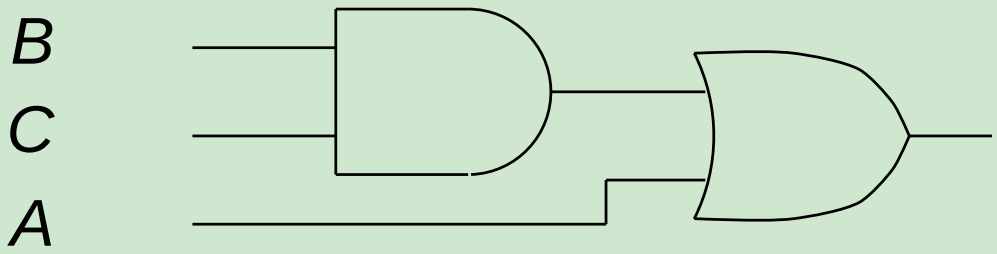
Example (Combinational Circuit)

$$\begin{aligned}\overline{A}BC + A\overline{B}\,\overline{C} + A\overline{B}C + AB\overline{C} + ABC &= \overline{A}BC + A\overline{B}(\overline{C} + C) + AB(\overline{C} + C) \\ &= (A + B)(A + C) \\ &= A + BC.\end{aligned}$$

- Which is better: $A + BC$ or $(A + B)(A + C)$?

Combinational Circuits

Example (Combinational Circuit)



- Replace the Boolean operators with the appropriate gates.

Combinational Circuits

Example (Combinational Circuit)

Simplify the Boolean expression $AB + BC(B + C)$ and design a combinational circuit for it.

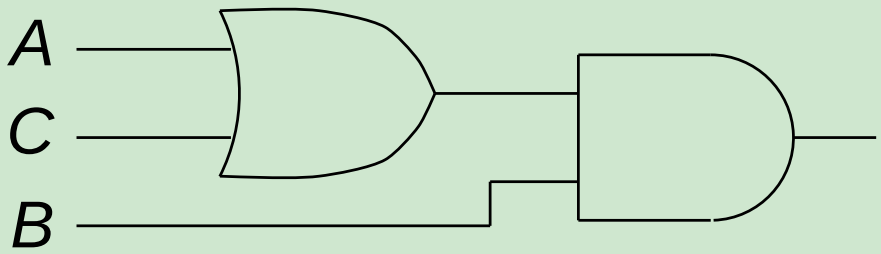
Combinational Circuits

Example (Combinational Circuit)

$$\begin{aligned} AB + BC(B + C) &= AB + BCB + BCC \\ &= AB + BC + BC \\ &= AB + BC \\ &= B(A + C). \end{aligned}$$

Combinational Circuits

Example (Combinational Circuit)



Outline

Assignment

Assignment

- Read Section C.2 (on CD).
- Exercises C.5, C.6, C.7 on page C-80.