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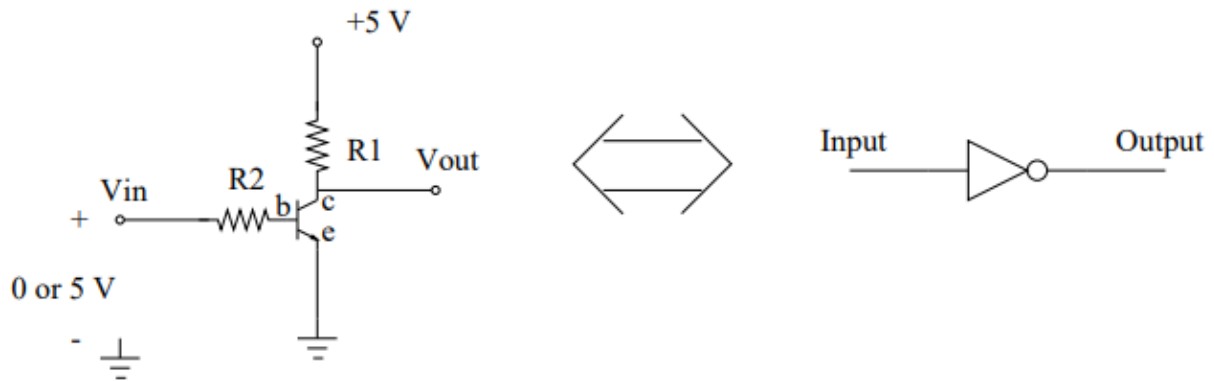
Lab 5: Developing gates from transistors

Objective: To build NOT, NOR, OR, and AND gates using transistors.

Provided: $R1 = 500\Omega$ (3), $R2 = 2000\Omega$ (4), NPN transistors (4) multimeter, breadboard

1 Building a NOT gate (inverter)

- Using components provided build a NOT gate (inverter) as shown in Figure 1: Apply 0V



Logic	V_{in}	V_{out}	Logic Out
0	0V	0.008V	1
1	5V	5.19V	0

2 Building a NOR gate

1. Build a NOR gate as shown in Figure 2: Apply 0V (Logic 0) and 5V (Logic 1) at the inputs (V_{in}), and measure the output using the multimeter:

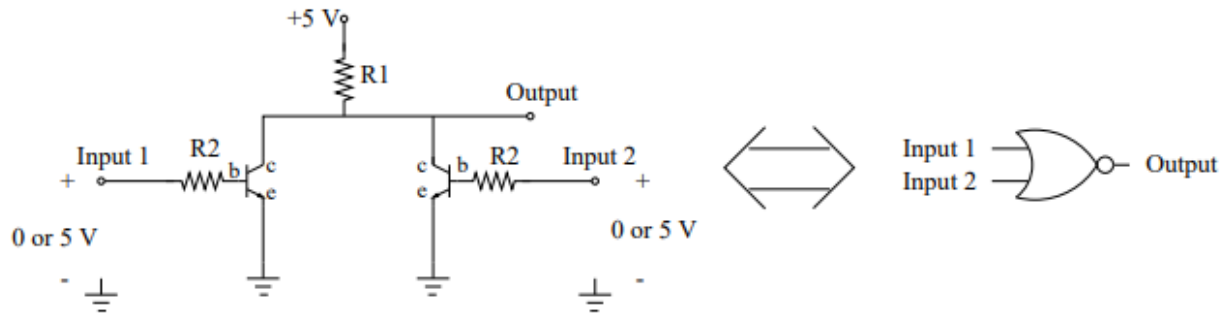


Figure 2: The NOR gate

Logic Inputs		Voltage Input			
Input1	Input2	Input1	Input2	Ouput	Logic Out
0	0	0V	0V	5V	1
0	1	0V	5V	0.107V	0
1	0	5V	0V	0.068V	0
1	1	5V	5V	0.062V	0

3 Building an AND gate

1. raw and build an AND gate by using NOR and NOT transistor circuits. Note the construction of the AND gate in Figure 3: Apply 0V (Logic 0) and 5V (Logic 1) at the inputs (V_{in}),

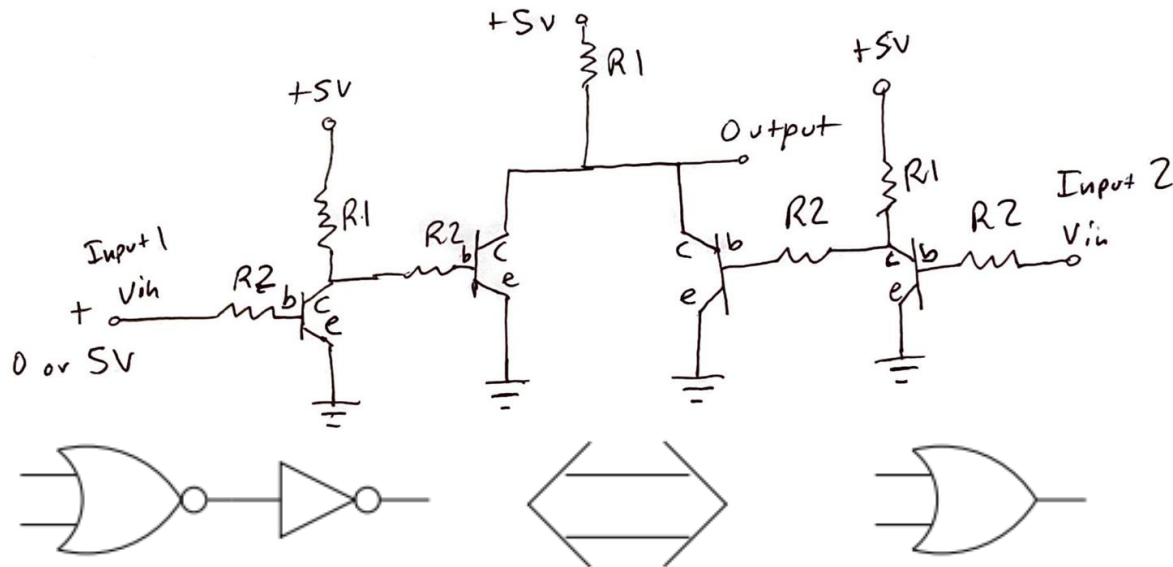


Figure 4: The OR gate

Logic Inputs		Voltage Input		Output	Logic Out
Input1	Input2	Input1	Input2		
0	0	0V	0V	0.061V	0
0	1	0V	5V	0.05V	0
1	0	5V	0V	0.063V	0
1	1	5V	5V	5V	1