Lab 5: Developing gates from transistors

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

Provided: $R_1 = 500\Omega$ (3), $R_2 = 2000\Omega$ (4), NPN transistors (4) multimeter, breadboard

Background (Brief review of transistors)

1 Building a NOT gate (inverter)

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

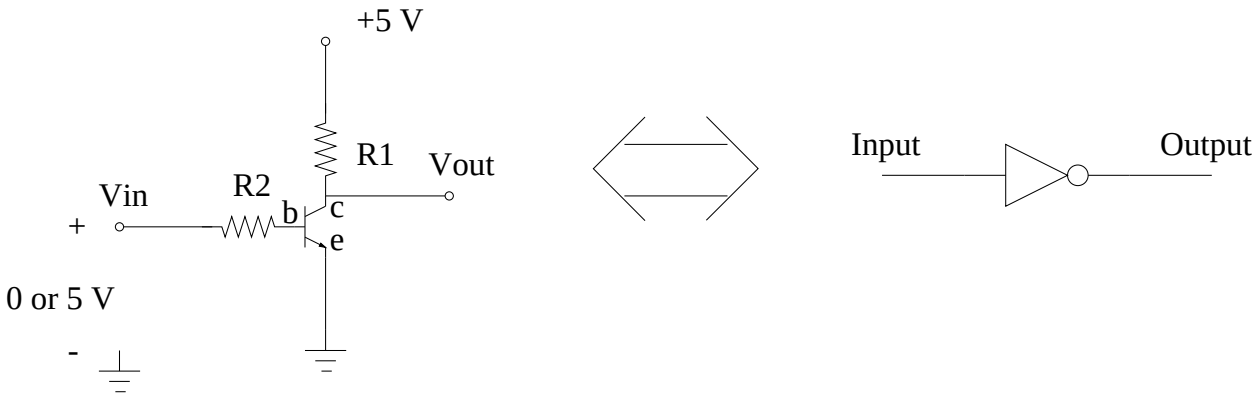

Figure 1: The NOT gate (Inverter)

(Logic 0) and $5V$ (Logic 1) at the input (V_{in}), and measure the output (V_{out}) using the multimeter:

Logic	V_{in}	V_{out}	Logic out
0	0 V		
1	5 V		

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:

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

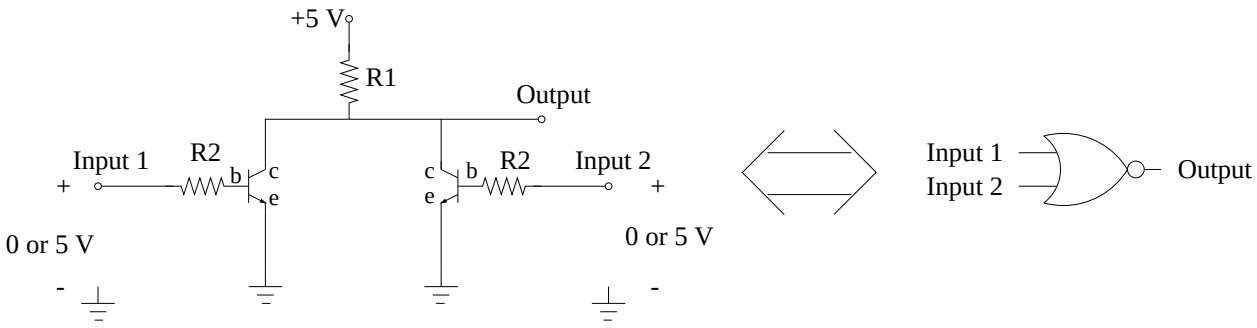

Figure 2: The NOR gate

3 Building an AND gate

1. Draw 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}),

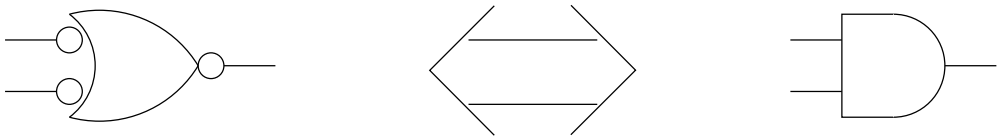

Figure 3: The AND gate

and measure the output using the multimeter:

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

4 Building an OR gate

1. Draw and build an OR gate by using NOR and NOT transistor circuits. Note the construction of the OR gate in Figure 4.

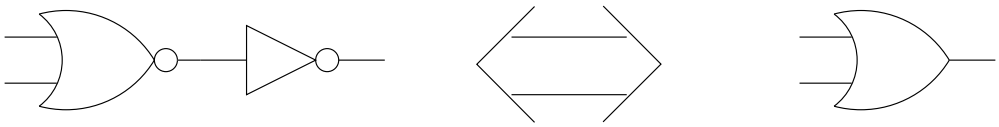

Figure 4: The OR gate

Apply $0V$ (Logic 0) and $5V$ (Logic 1) at the inputs (V_{in}), and measure the output using the multimeter:

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