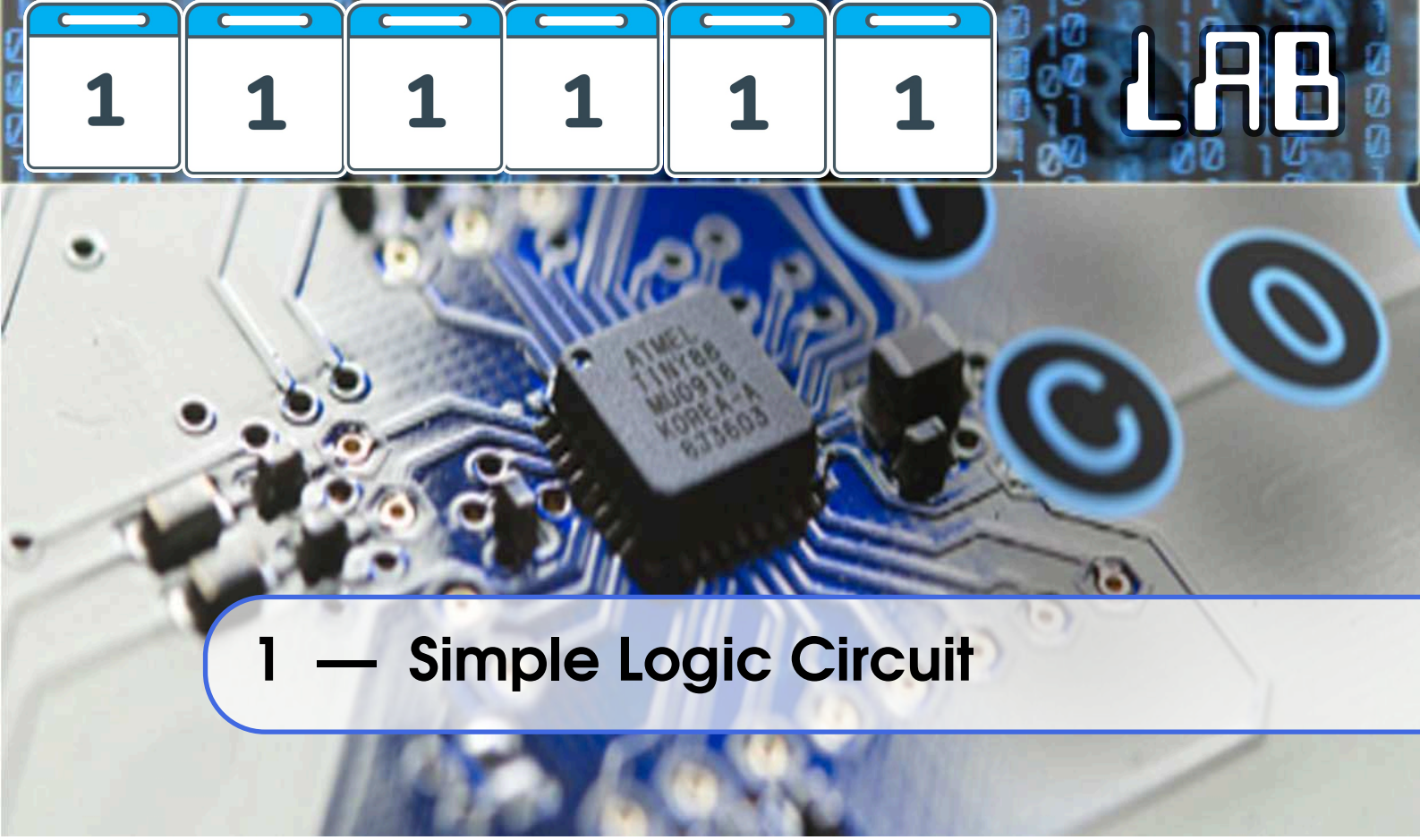

1 — Simple Logic Circuit

LAB Objectives

The aim of this LAB experiment is to familiarize students with the Virtual Breadboard (VBB) emulator through the implementation of a simple logic circuit consisting of a 2-input OR gate. You need to refer to the VBB user manual for more details on using the VBB software.

1.1 Hardware Required

1. Breadboard
2. 74*LS*32 (Quad 2-input positive-OR gates)
3. Red LED
4. Resistor (220 Ω)
5. Toggle Switch

1.2 Circuit

The circuit to be implemented in this experiment is the simple OR logic expressed in Table 1.1. The schematic of the circuit, as shown in Figure 1.1, consists of the following components :

- One *TTL*7423 quad 2-input positive-OR gates IC chip to implement the OR logic,
- Two toggle switches to control the two binary inputs of the OR gate,
- One LED to display the output of OR gate, and

– One resistor to protect the LED.

Table 1.1 – The OR gate Boolean function.

A	B	F = A + B
0	0	0
0	1	1
1	0	1
1	1	1

The implementation of the OR logic circuit using Virtual Breadboard software is show in Figure 1.2. To build this circuit follow the steps below :

1. On the *Toolbox* menu, locate the *Breadboard* subenu item and expand it.
2. On the expanded breadboard submenu, locate the *VBBExpress* breadboard component and place it on the current *DesignSheet*.
3. On the expanded breadboard submenu, locate the following components and place them on the *VBBExpress* breadboard component as in Figure 1.2 : Power Supply (*VDD*), Circuit Ground (*VSS*), *Toggle Switch*, *Resistor* and *LED*.
4. On the *Toolbox* menu, locate the *TTL74XX* subenu item and expand it.
5. On the expanded *TTL74XX* submenu, locate the *TTL7432* component (OR gates) and place it on the *VBBExpress* breadboard component as shown in Figure 1.2.
6. Connect the circuit components as follows :
   (a) Connect the power supply (*VDD*) to the top and bottom power buses (below the red lines) using red wires.
   (b) Connect the circuit ground (*VSS*) to the top and bottom ground buses (above the green lines) using black wires.
   (c) Connect the left pins of the two toggle switches to the bottom ground bus using black wires.
   (d) Connect the right pins of the two toggle switches to the bottom power bus using red wires.
   (e) Connect the *GND* pin of the *TTL7432* chip to the bottom ground bus using a black wire.
   (f) Connect the *VCC* pin of the *TTL7432* chip to the top power bus using a red wire.
   (g) Connect the middle pin of the first toggle switch (left one) to the $2A$ pin of the *TTL7432* chip using a blue wire.
   (h) Connect the middle pin of the second toggle switch (right one) to the $2B$ pin of the *TTL7432* chip using a blue wire.
   (i) Connect the short leg of the LED (the negative leg, called the *cathode*) to bottom ground bus using a black wire.
   (j) Connect the long leg of the LED (the positive leg, called the *anode*) to pin $2Y$ of the *TTL7432* chip using the resistor.

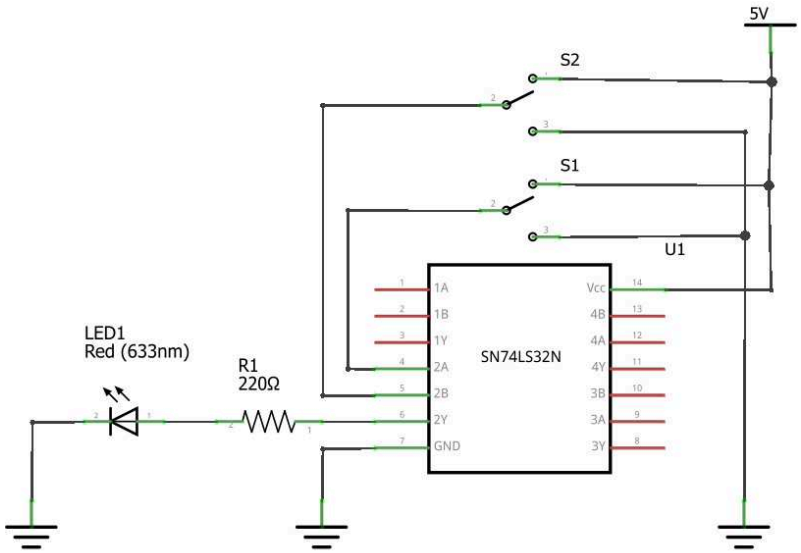

Figure 1.1 – Schematic of the OR logic circuit.

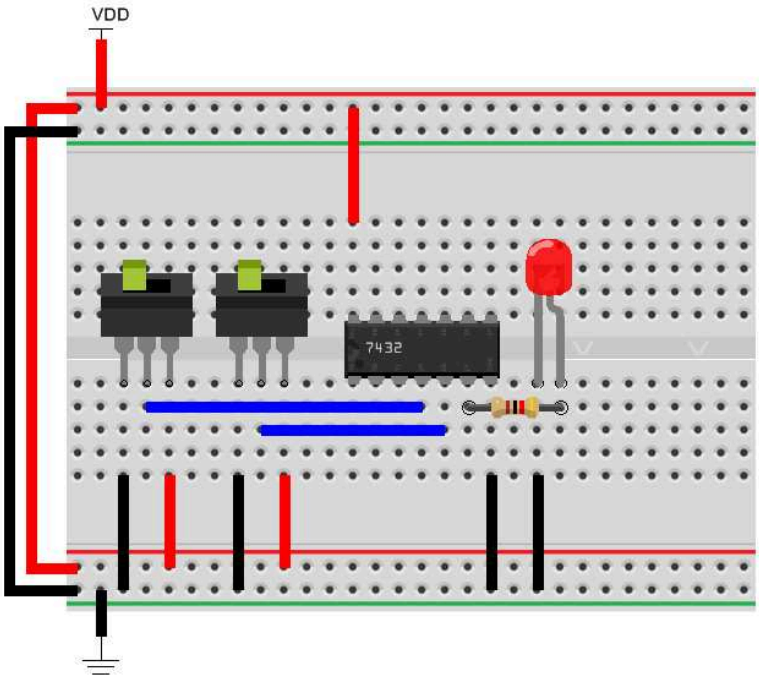

Figure 1.2 – The OR circuit.

1.3 Circuit Emulation

To validate your design, emulate the circuit by clicking the run button located on the *Application Toolbar*. Test your circuit by applying different binary combinations to the toggle buttons and observing the corresponding output on the LED. Validate the circuit outputs according to Table 1.1.

Exercise 1.1 Modify the circuit in Figure 1.2 to implement a 3-input AND gate using the TTL7411 IC chip. ■