

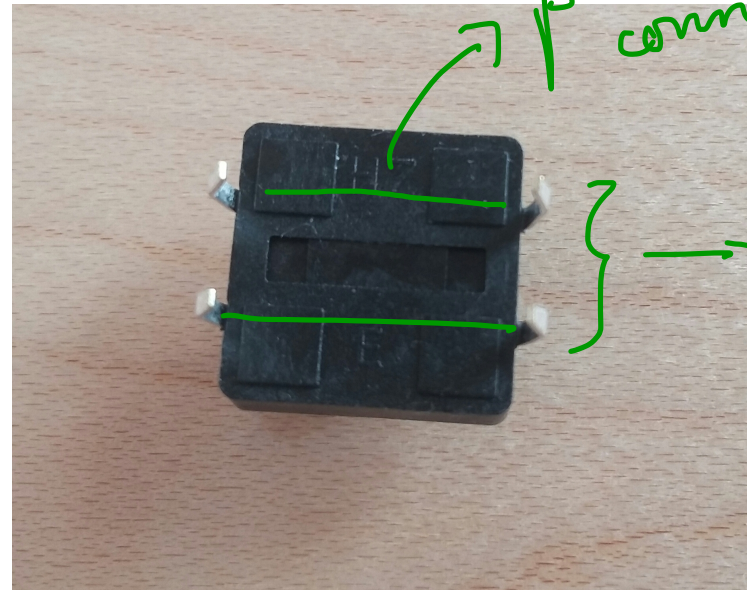
CPSC 1000: Introduction to Computer Science

Reading the state of a button

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(Week 4)

Simplest user input



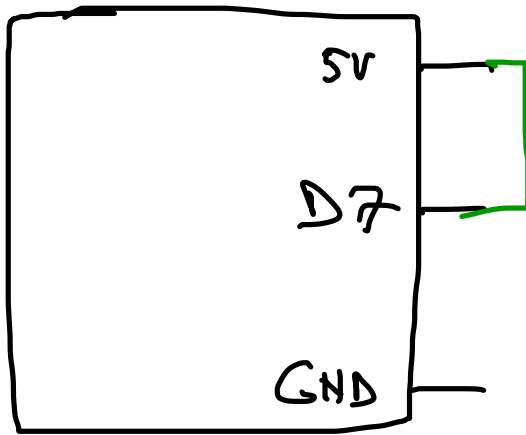
permanent
connection

connection
whole button is
pressed

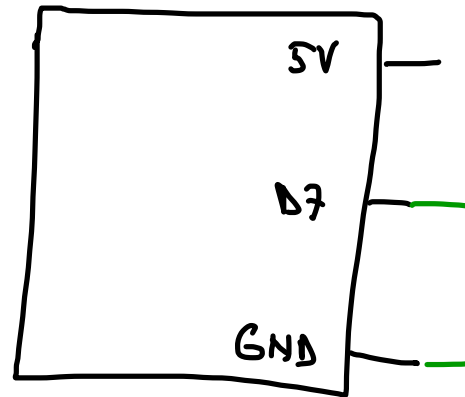
Digital input : we are using the button to generate a digital signal \rightarrow High \rightarrow Low

- ▶ `pinMode(digital_pin, INPUT)` \rightarrow configure the pin into a "measuring" device.
- ▶ Connect the input pin to bit 1:

(`pinMode(7, INPUT);`)



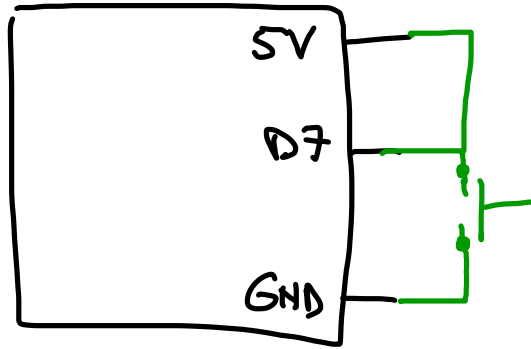
- ▶ Connect the input pin to bit 0:



— page 3 —

Digital input (pull up circuit)

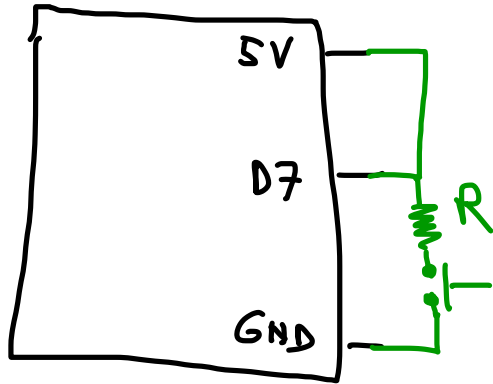
- ▶ Connect the input pin to 0 when pressed and to 1 when depressed.



- ▶ ... using a resistor. \rightarrow insert resistor between GND & 5V to limit the current. For the lab, $R = 10\text{ k}\Omega$.

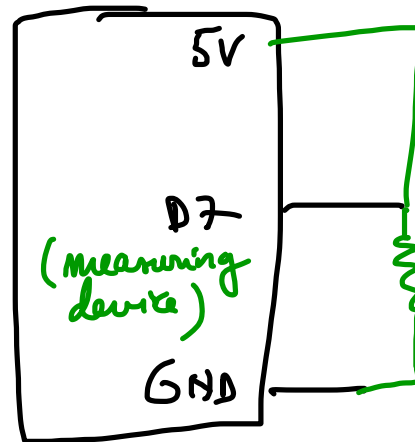
Where to put the resistor?

Case 1



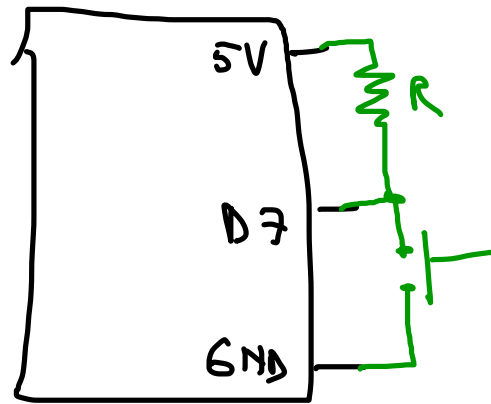
a) Button not pressed: equivalent circuit on page 3.
We read bit 1 ✓

b) Button pressed: we read 5V (bit 1)

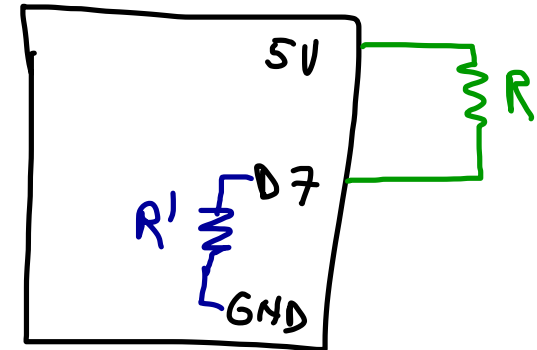


(state does not change to 0...)

Case 2 :

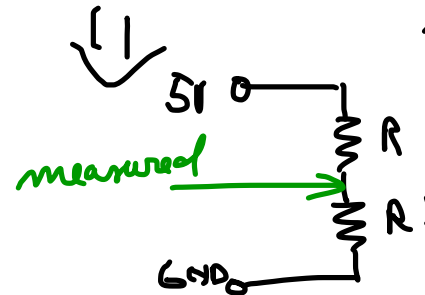


button not pressed
→



Do we measure bit 1 ?

Internally, D7 (any pin configured for input) is connected to GND via a very large resistor $R' \approx 1 \text{ M}\Omega$ ($10^6 \Omega$)

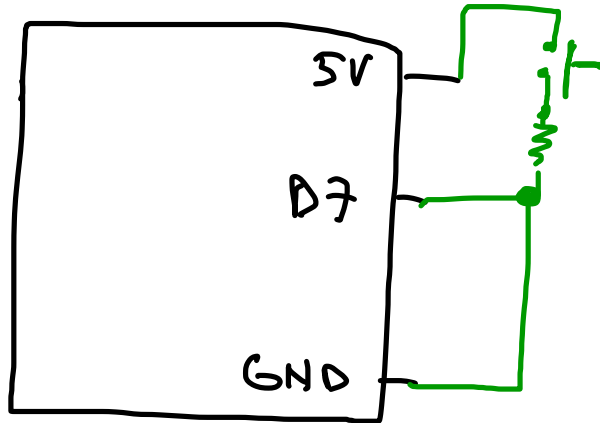


$R \approx \frac{R'}{100}$, there is a small potential difference on R. We measure almost 5V.

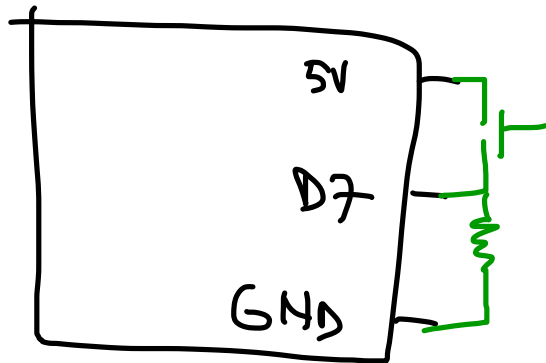
Luckily, `digitalRead()` returns high when the voltage is a little bit smaller than 5V.

Digital input (pull-down resistor)

- ▶ Connect the input pin to 1 when pressed and to 0 when depressed (using a resistor).

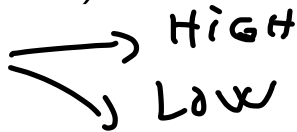


← why this does not work?



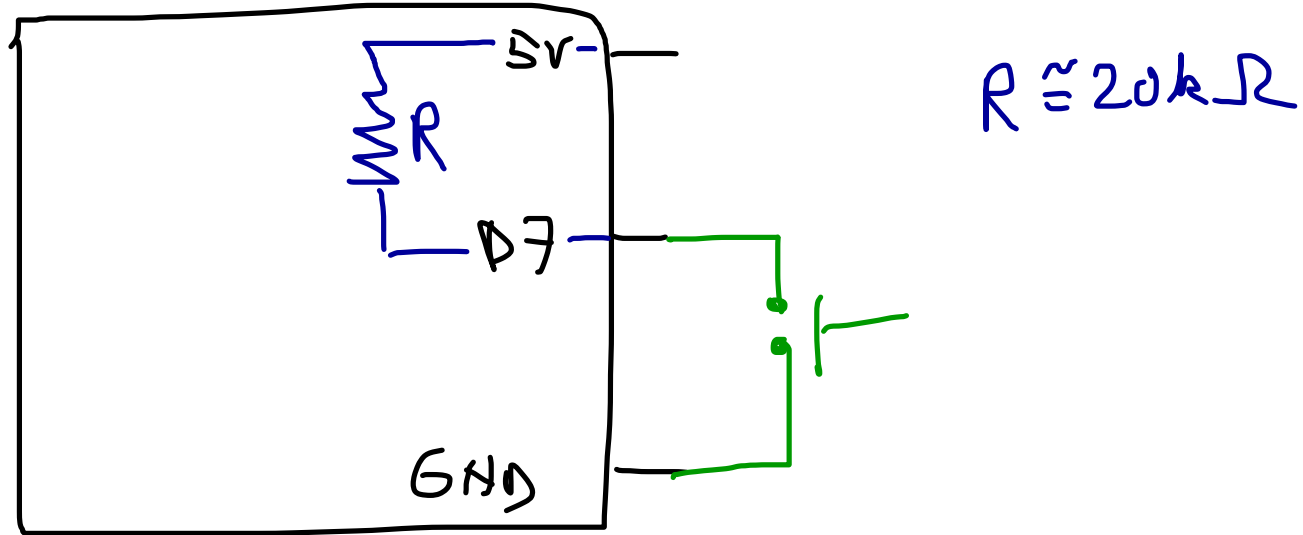
→ analyze this diagram. Is it correct?

Programming

- ▶ `pinMode(digital_pin, INPUT);`
- ▶ `digitalRead(digital_pin)` 
- ▶ The return value for pressed/depressed button state depends on the type of circuit.
- ▶ If pin is not connected to Vcc or GND, the return value is either HIGH or LOW non-deterministically.

Programming, built-in pull-up

- ▶ `pinMode(digital_pin, INPUT_PULLUP);`
- ▶ `digitalRead(digital_pin):` returns HIGH unless pin connected to GND.



An external resistor is not needed, it is provided by the Arduino.

Exercises

Configure digital pin 7 with the built-in pull-up resistor. Draw a circuit that allows detecting the pressing of a button. What is the corresponding Arduino code?