Course Information

텍스트

Logic Design Lab.

Fall 2019

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Notification

- **For the report**

  No sample form

  Put today's results and homework altogether and make it as one file

  pdf

  Submit your report on eTL assignment

- **Lab computer account**

  Use designated lab account on lab class

- **Contact**

  Check your e-mail address on eTL

  Feel free to contact TA

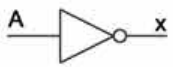
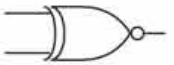
  - About lectures, labs, schedule, etc.

Contents

- **Combinational logic practice**
  - Lab 1 review
  - Tactile switches
  - LEDs
  - Pull-up & pull-down resistors
  - Practice: Half-adder implementation
- **Homework**

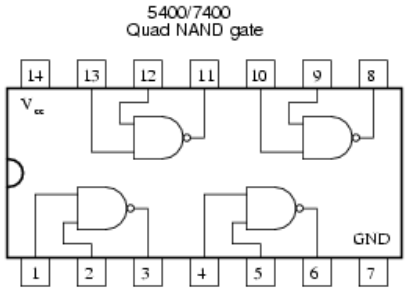
Lab 1 review

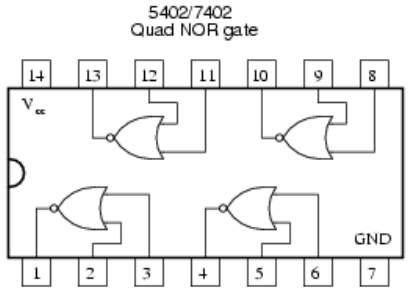
Logic Gates

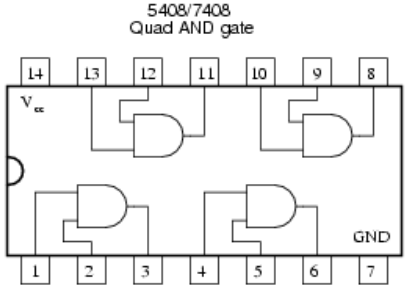
Name	NOT	AND	NAND	OR	NOR	XOR	XNOR
Alg. Expr.	$\overline{A}$	AB	$\overline{AB}$	$A+B$	$\overline{A+B}$	$A \oplus B$	$\overline{A \oplus B}$
Symbol							
Truth Table	A | X 0 | 1 1 | 0	B A | X 0 0 | 0 0 1 | 0 1 0 | 0 1 1 | 1	B A | X 0 0 | 1 0 1 | 1 1 0 | 1 1 1 | 0	B A | X 0 0 | 0 0 1 | 1 1 0 | 1 1 1 | 1	B A | X 0 0 | 1 0 1 | 0 1 0 | 0 1 1 | 0	B A | X 0 0 | 0 0 1 | 1 1 0 | 1 1 1 | 0	B A | X 0 0 | 1 0 1 | 0 1 0 | 0 1 1 | 1

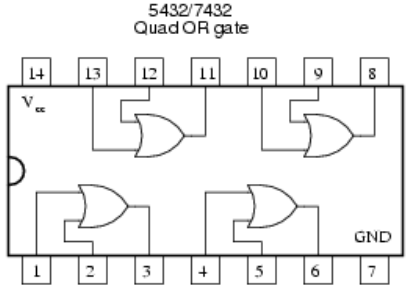
Lab 1 review

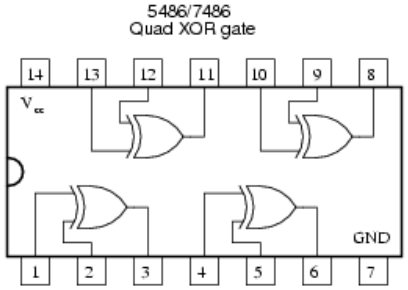
- **Logic Gates on IC chip**

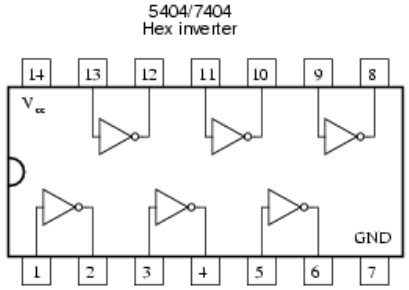








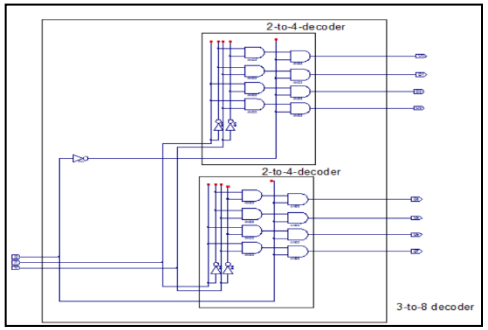




Lab 1 review

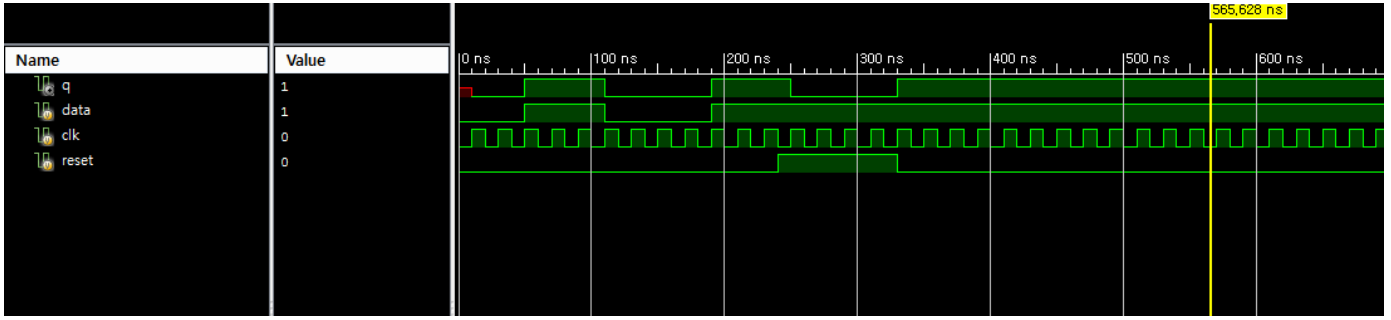
- **Computer Simulation**

Schematic Design



Hardware Description Language

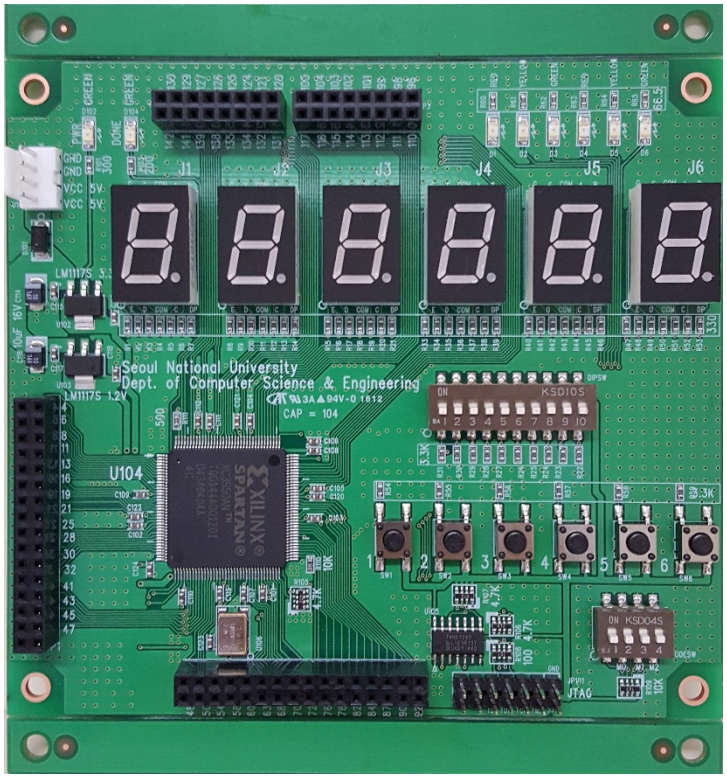
```
module seq_test_module(data, clk, reset, q);
   input data, clk, reset;
   output q;
   reg q;

   always @ (posedge clk)
   begin
      if (reset == 1)
         q <=0;
      else
         q <= data;
   end
endmodule
```



- **Prototyping**

Lab 1 review

- **Prototyping**



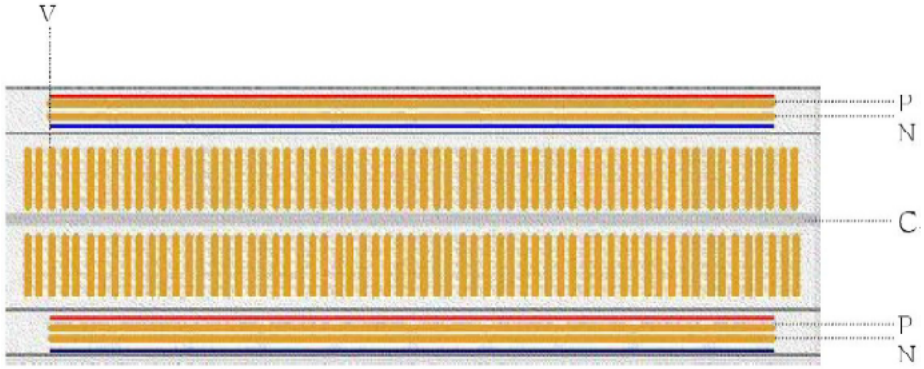
Evaluation Circuit Board

You can build your own board of your logic design with logic gates and electronic parts.

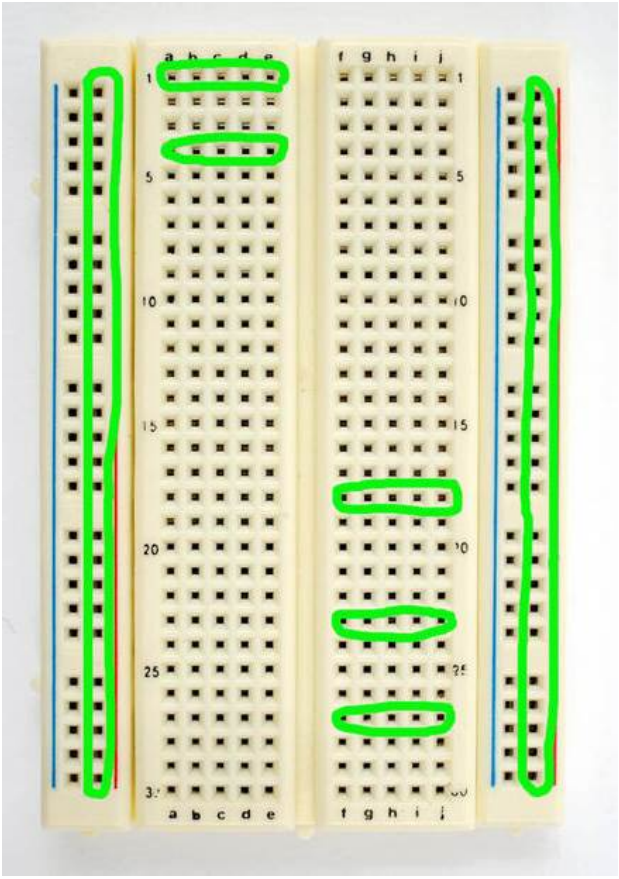
This is SNU's logic design evaluation circuit board.
You will make a computer with this for the term project.

Lab 1 review

✓ Bread board

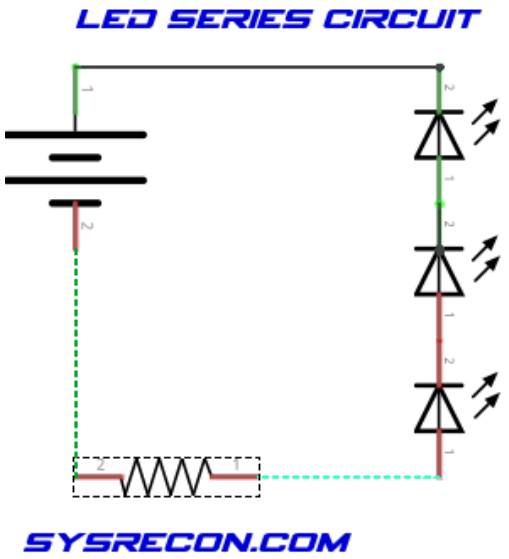


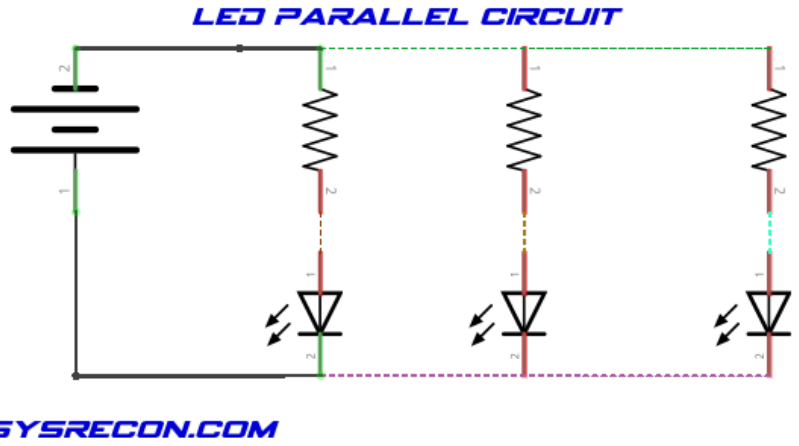
✓ Internal wiring of Bread board



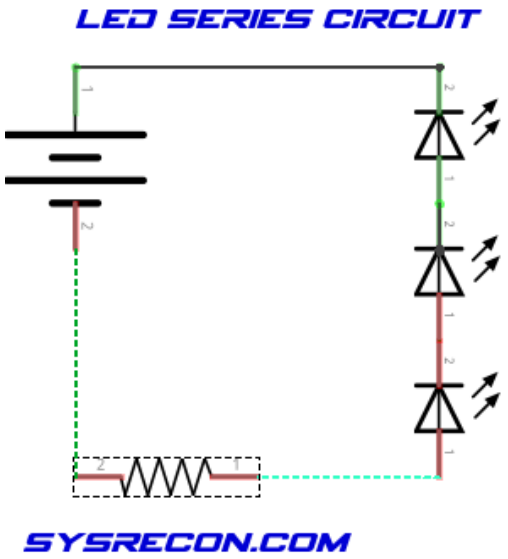
- You can construct testing the circuit using the bread board, before soldering or wrapping.

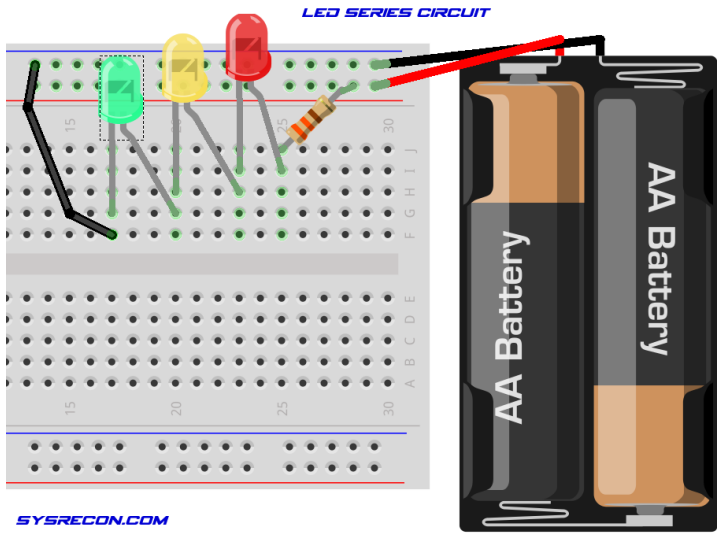
Lab 1 review

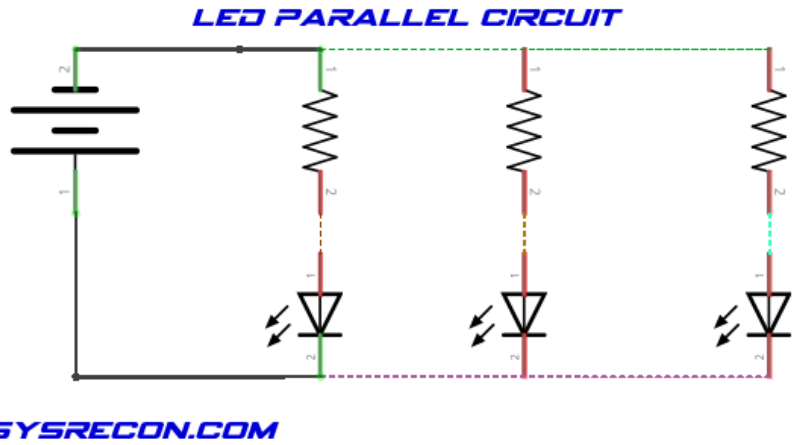

LED SERIES CIRCUIT
SYSRECON.COM

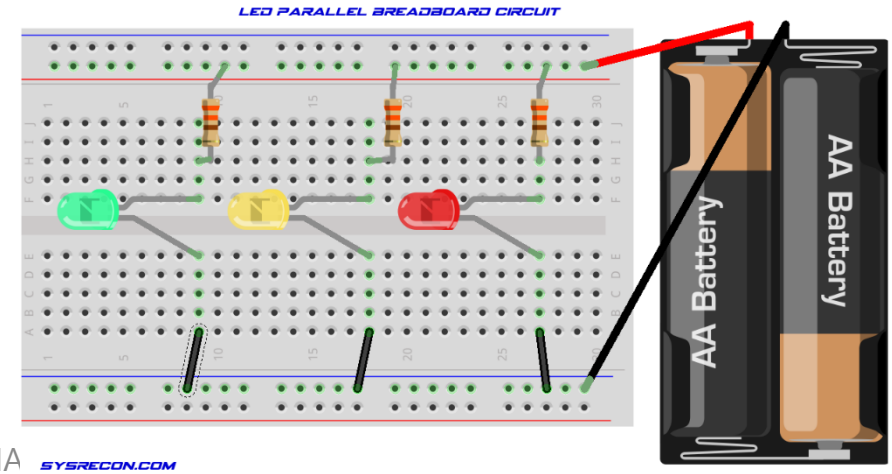

LED PARALLEL CIRCUIT
SYSRECON.COM

Lab 1 review


LED SERIES CIRCUIT
SYSRECON.COM

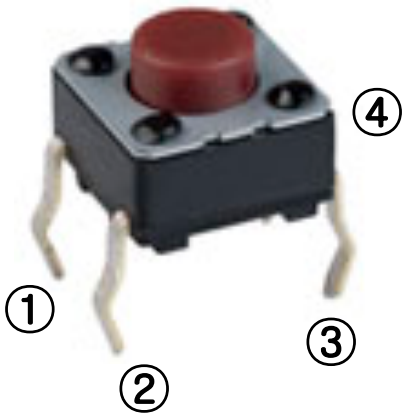

LED SERIES CIRCUIT
AA Battery
AA Battery
SYSRECON.COM


LED PARALLEL CIRCUIT
SYSRECON.COM

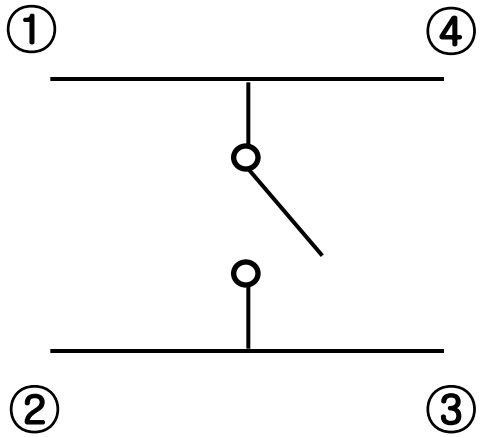

LED PARALLEL BREADBOARD CIRCUIT
AA Battery
AA Battery
SYSRECON.COM

Combinational Logic Practice

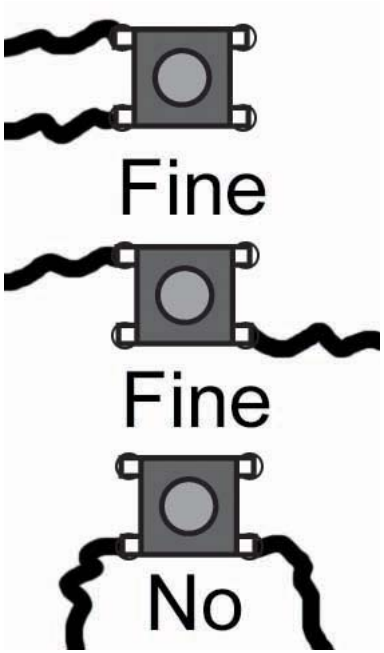
- **Tactile switches**



Tactile Switch



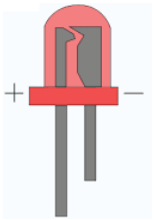
Circuit Diagram

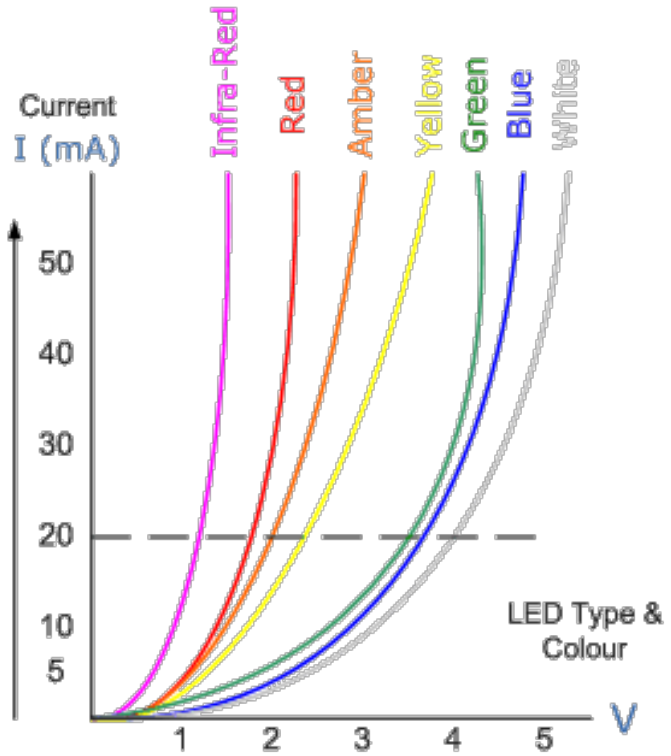


Usage

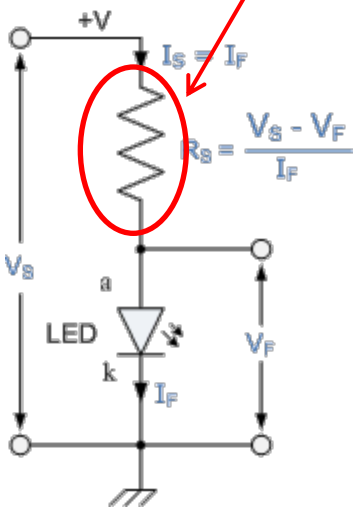
Combinational Logic Practice

- **LEDs**



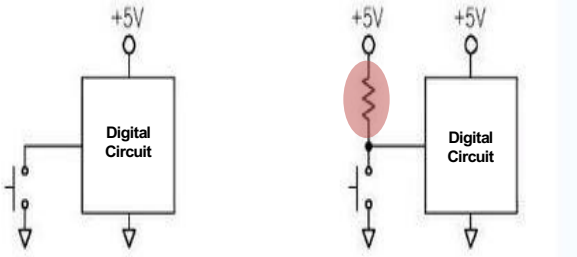


- LEDs emit colored light when passed through by forward current
- To protect LED from excessive current flow, using an appropriate resistor(around 3~400Ω) is necessary



Combinational Logic Practice

- **Pull-up & pull-down resistors**

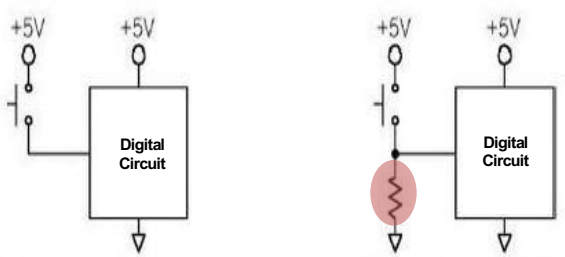


(a) Switch Only (b) Pull-up resistor

<Pic 1> L switch & Pull-up resistor

switch	ON	OFF
(a)그림	0V(Low)	Floating
(b)그림	0V(Low)	+5V(High)

Pull-up Resistor



(a) Switch Only (b) Pull-down resistor

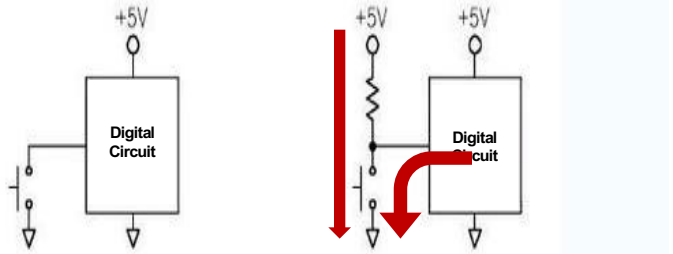
<Pic 2> H switch & Pull-down resistor

switch	ON	OFF
(a)그림	+5V(High)	Floating
(b)그림	+5V(High)	0V(Low)

Pull-down Resistor

Combinational Logic Practice

- **Pull-up & pull-down resistors**

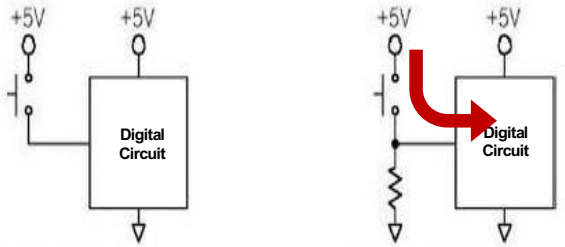


(a) Switch Only (b) Pull-up resistor

<Pic 1> L switch & Pull-up resistor

switch	ON	OFF
(a)그림	0V(Low)	Floating
(b)그림	0V(Low)	+5V(High)

Pull-up Resistor



(a) Switch Only (b) Pull-down resistor

<Pic 2> H switch & Pull-down resistor

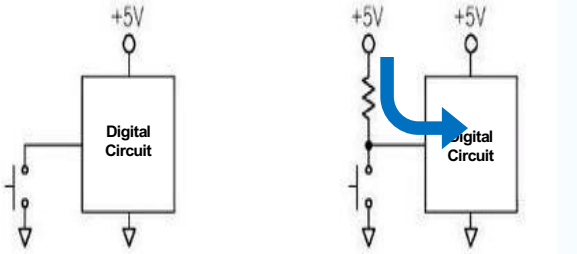
switch	ON	OFF
(a)그림	+5V(High)	Floating
(b)그림	+5V(High)	0V(Low)

Pull-down Resistor

Switch on Switch off

Combinational Logic Practice

- **Pull-up & pull-down resistors**

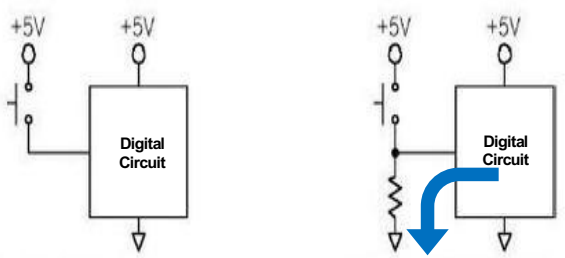


(a) Switch Only (b) Pull-up resistor

<Pic 1> L switch & Pull-up resistor

switch	ON	OFF
(a)그림	0V(Low)	Floating
(b)그림	0V(Low)	+5V(High)

Pull-up Resistor



(a) Switch Only (b) Pull-down resistor

<Pic 2> H switch & Pull-down resistor

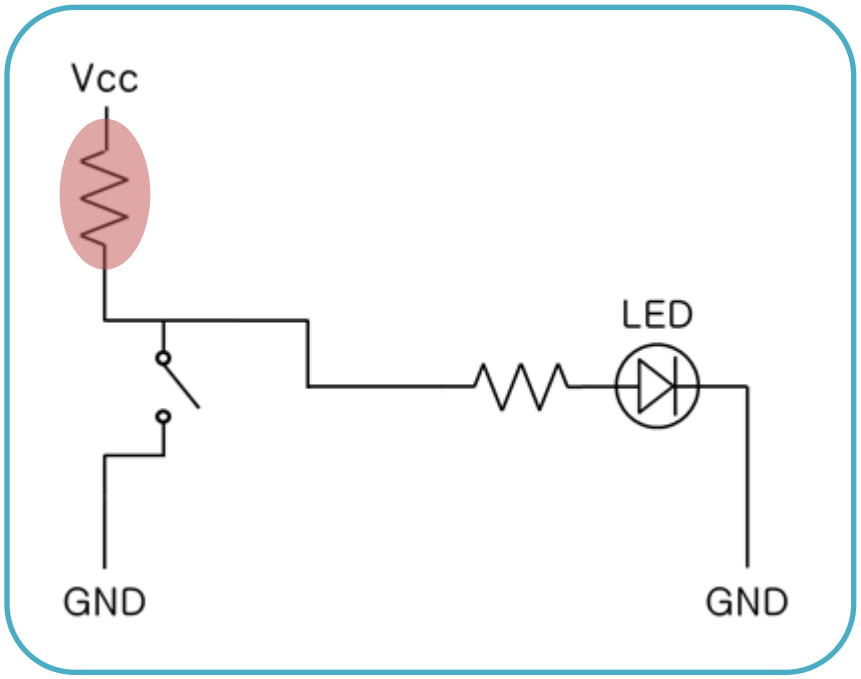
switch	ON	OFF
(a)그림	+5V(High)	Floating
(b)그림	+5V(High)	0V(Low)

Pull-down Resistor

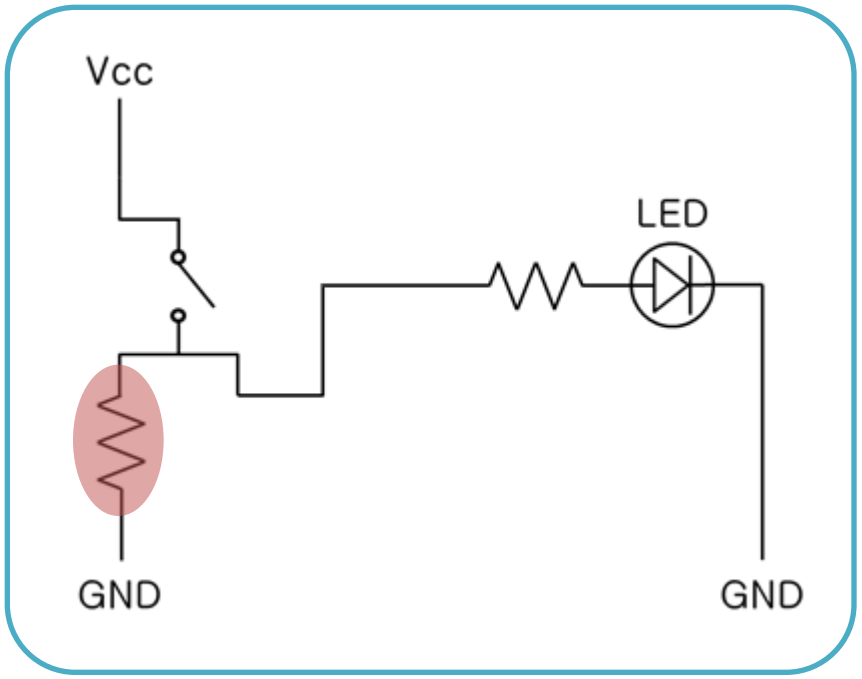
Switch on Switch off

Combinational Logic Practice

- **Pull-up & pull-down resistors**



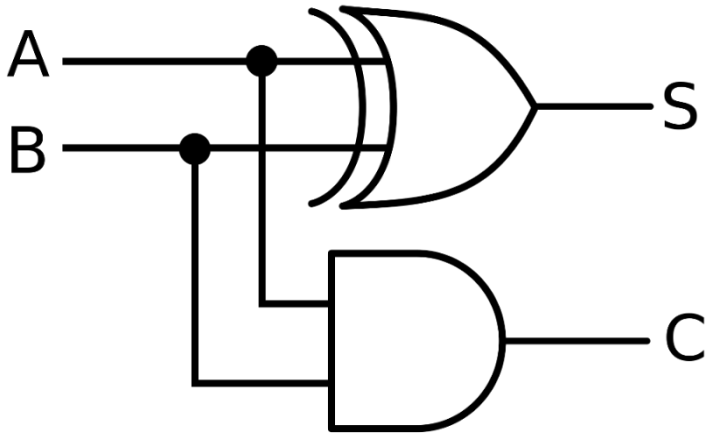
Pull-Up Resistor



Pull-Down Resistor

Combinational Logic Practice

- **Practice: Half-adder implementation**
  - Let's implement half-adder on breadboard.



Input		Output	
A	B	Sum	Carry
0	0	0	0
0	1	1	0
1	0	1	0
1	1	0	1

Homework

1. Draw a circuit schematic for the below formula using ONLY NOR gates and NOT gates. You can draw it by hand or using any of a computer program.
   - Y = A(B+CD)

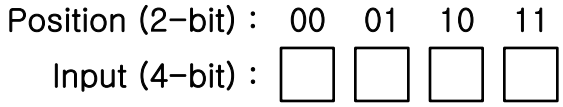
2. Y = AB + ABC + A'B + AB'C
   (1) Make a truth table
   (2) Minimize # of gates
   (3) Draw a circuit schematic

Homework

3.

Implement simple combinational logic circuits **1-1** and **1-2** using breadboard. (Take pictures to prove it's working)

- **3-1**. Implement a full adder using 2-input NAND gates only
- **3-2**. Implement LM1 & RM1 using NOR gates only
  - 4-bit input, 2-bit LM1 output, 2-bit RM1 output



  - LM1 (RM1) outputs position of leftmost (rightmost) 1 in input
  - E.g. LM1(1010) = 00, RM1(1010) = 10
    LM1(0100) = 01, RM1(0100) = 01
    LM1(0000) = XX, RM1(0000) = XX (don't care)

Homework

- Write a report
  - Either in Korean or in English
  - Must include the result and discussion of the practice
  - # of pages doesn't matter
  - **Due : 23 Sep., 7:00 pm (Before class, on eTL)**