

Course Information

Logic Design Lab.

Fall 2019

Prof. Sungjoo Yoo

(yeonbin@snu.ac.kr)

TA. Hyunsu Kim

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TA. Hyunyoung Jung

(gusdud1500@gmail.com)

Course Information

- **Course board**

<http://etl.snu.ac.kr>

Practice slides and notice will be uploaded on eTL

Please check the eTL board very often

Submit your homeworks on eTL

- **Lab computer account**

Use your CSE account

- **Contact**

TA. Hyunsu Kim (gustnxodjs@gmail.com)

TA. Hyunyoung Jung (gusdud1500@gmail.com)

Course Information

▪ Grading 1: Assignments(up to 35% of final score)

- Attendance/Active participation 30%
 - ✓ Attendance check : **7:00 pm**
 - ✓ An excuse for inevitable absence or lateness must be sent to TA by email, **BEFORE** class starts.
(The excuse must be reasonable following by the department regulation.
Unless it would not be accepted.)
 - ✓ 2 lateness → 1 absence
- Quizzes, reports and assignments 30%
- Term Project 40%

▪ Grading 2: Practice evaluation(10% of final score)

- **TA will check whether students finished everyday lab**
- ✓ Any report of ill-mannered action → -50% point from each week
 - ✓ Any kind of residue on the table
 - ✓ Careless use of measurement system(e.g., power supply)

Course Information

■ Assignment (report)

- Must include the result and discussion of the practice in one file
- # of pages doesn't matter
- The file size should be **less than 15MB**
- **Due: Before next class begins (7:00pm)**
 - Late Policy:
 - 24 hour late: -20%
 - 48 hour late: -50%
 - 72 hour late: -100%
 - Details on lecture syllabus

Course Information

- **Laboratory Manners**

- Save material
- Place back on the right place (ex. TTL gate)
- Cleaning up your desk and turn off the computer, power supply, oscilloscope..

- **Cheating**

- Quiz, reports(assignments) must be your personal
- Cheating will be reported to the professor, and all the grades will turn to **ZERO**

Lab. 01

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Contents

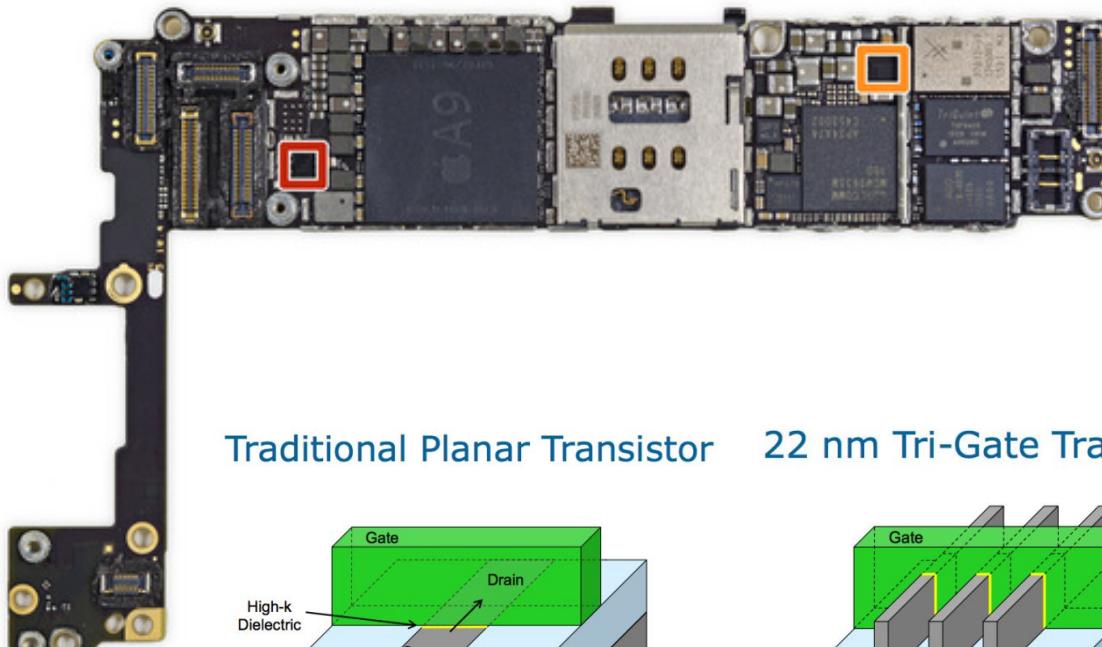
- **Introduction to Logic Design Lab.**
 - Hardware design
 - Test method
 - Computer Simulation
 - Prototyping
- **Practice**
 - Logic gates
 - Breadboard
- **Homework**

HW Design: iPhone Teardown

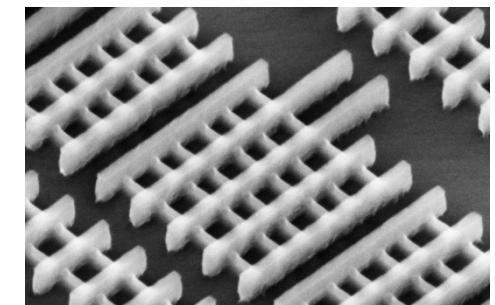
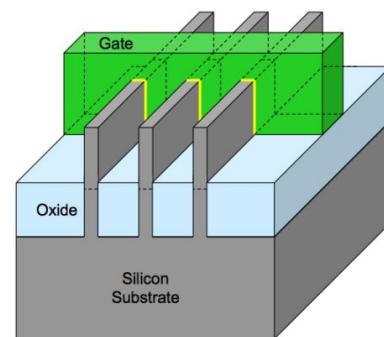
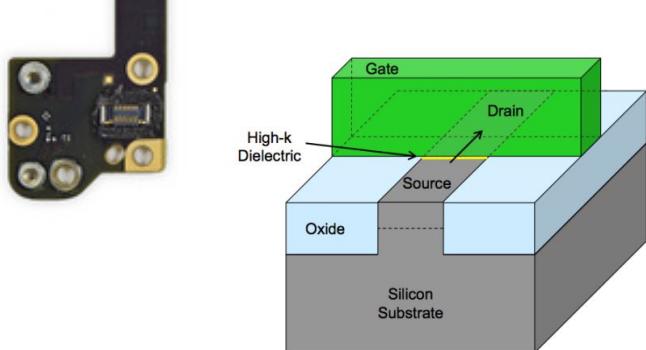


HW Design: A9 Chip

How many transistors on A9 chip?

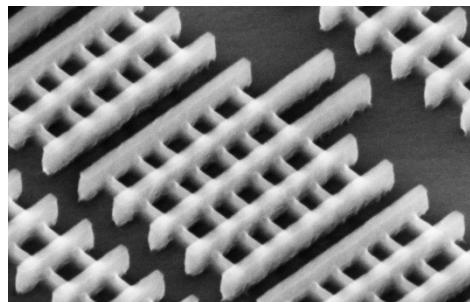
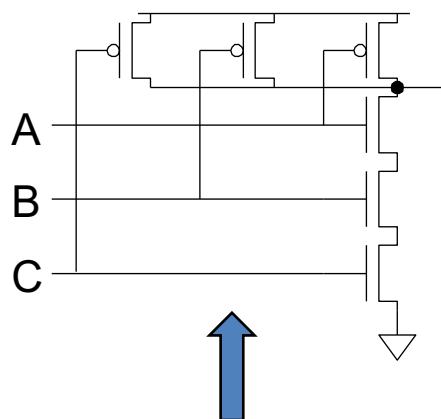


Traditional Planar Transistor 22 nm Tri-Gate Transistor



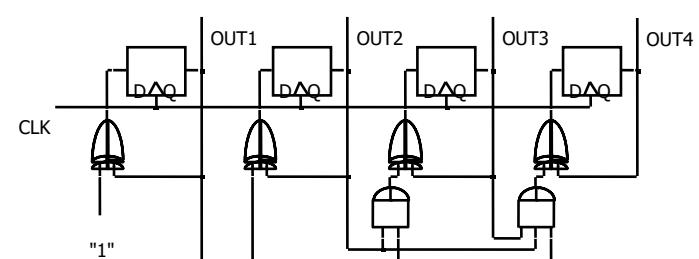
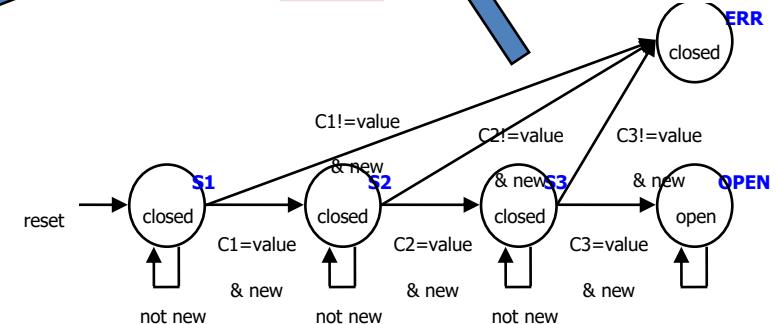
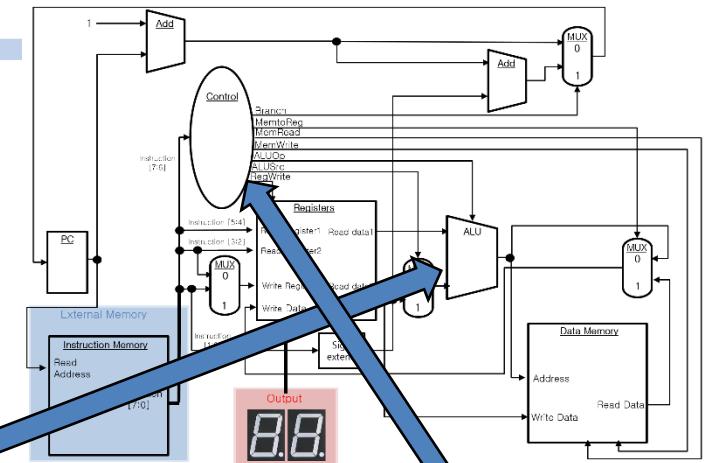
HW Design: Logic Gate to Microprocessor

Circuit



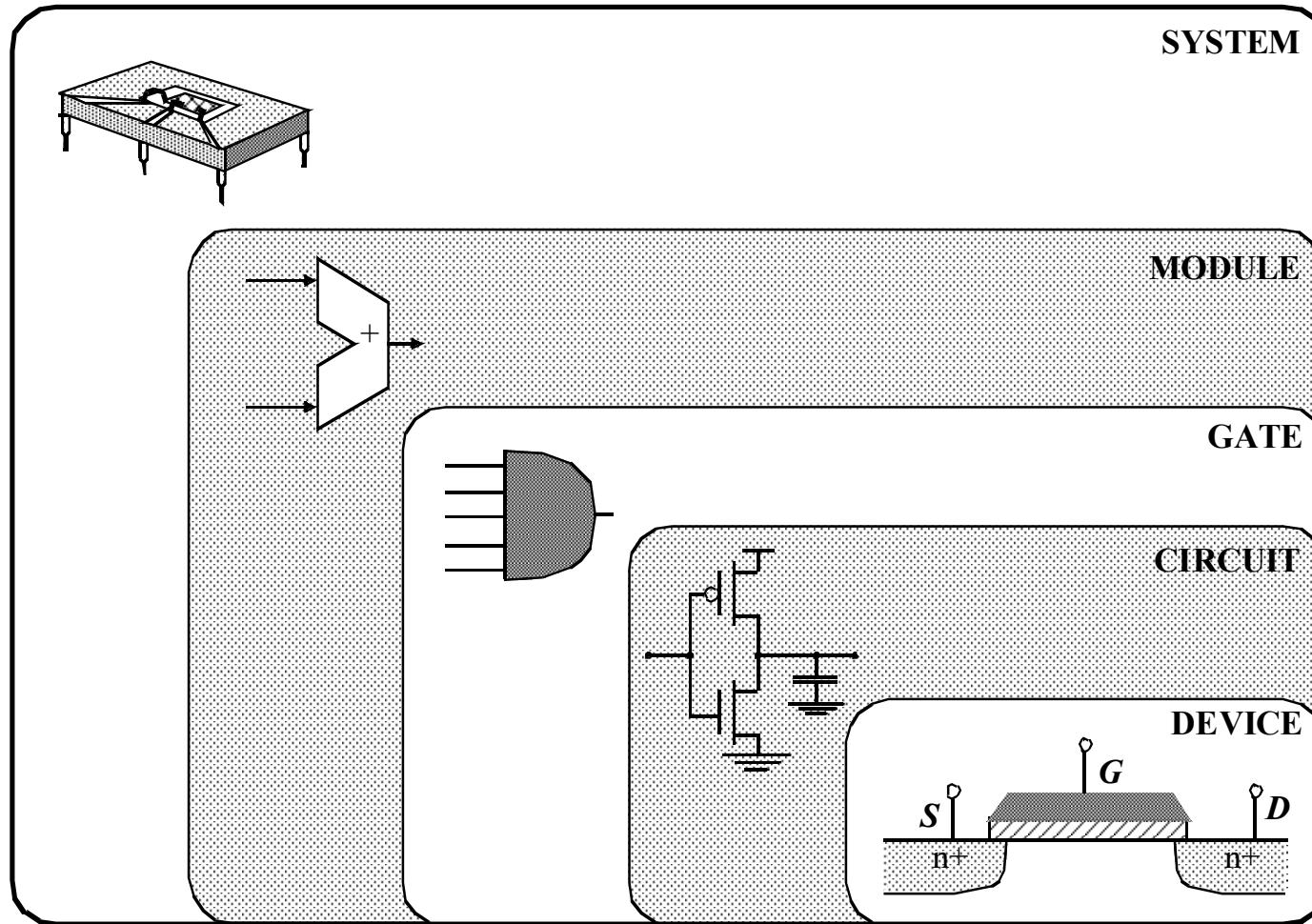
Logic Gates
in Combinational circuit

Microprocessor

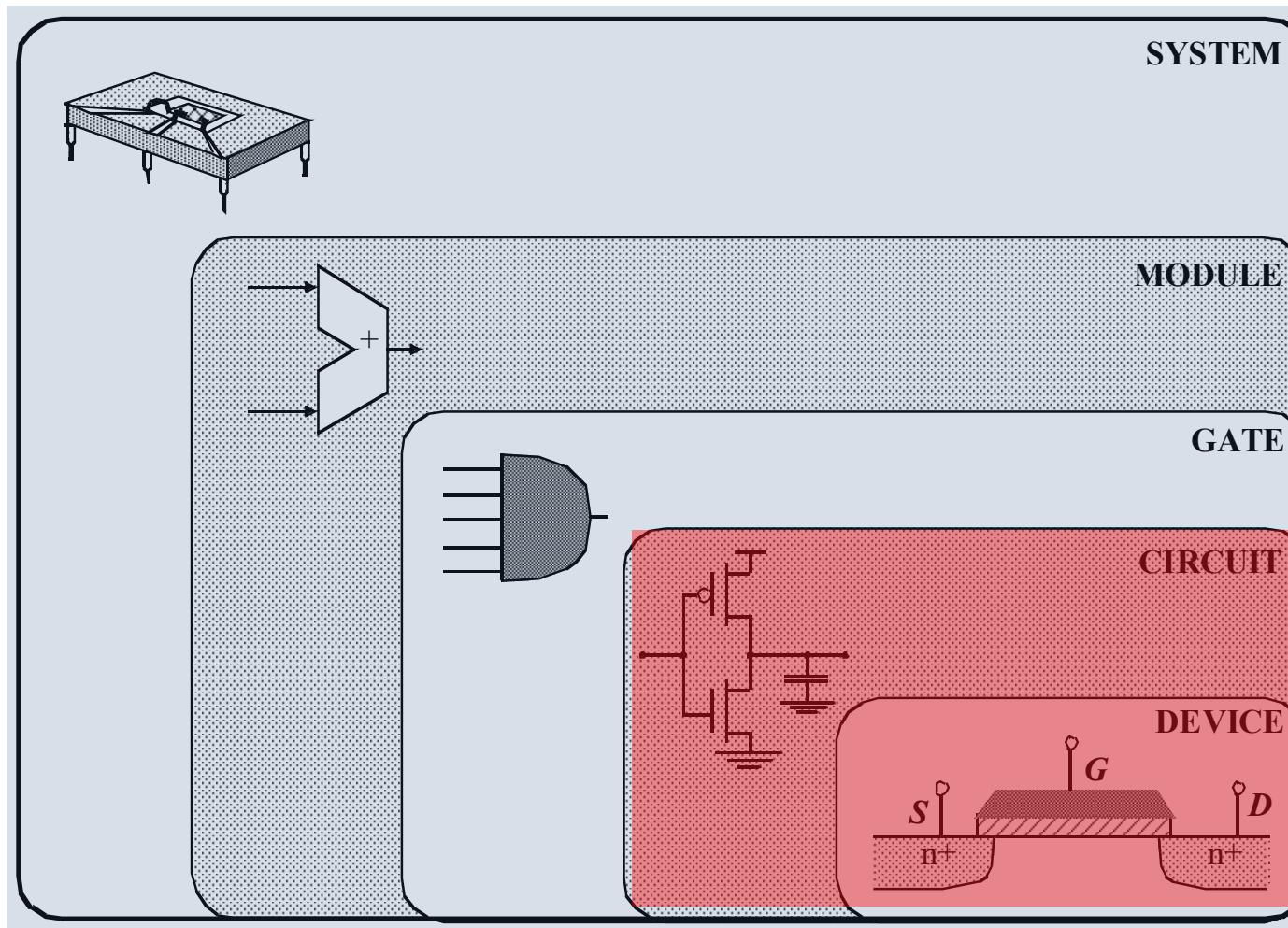


Finite State Machine
& Sequential circuit

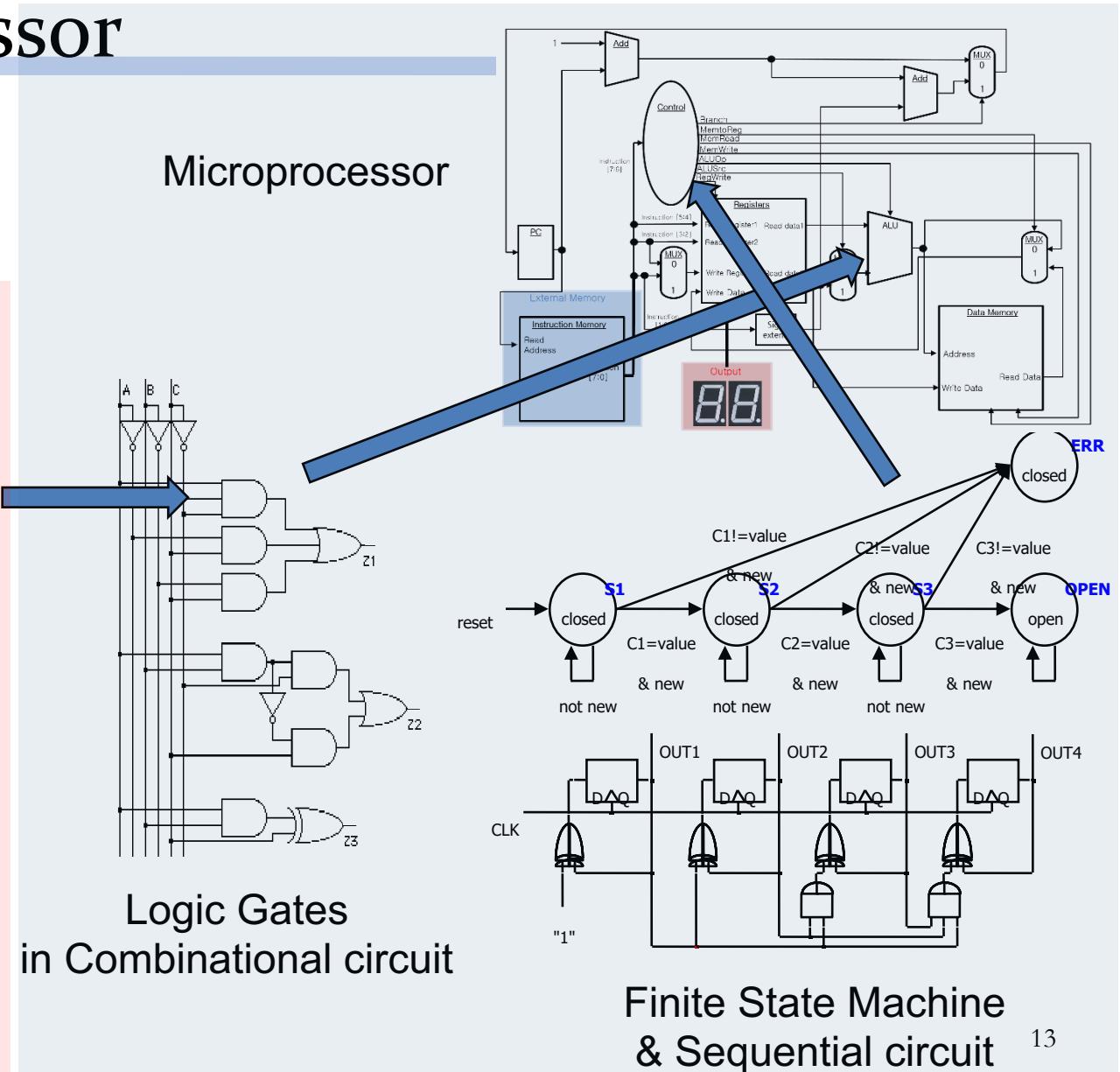
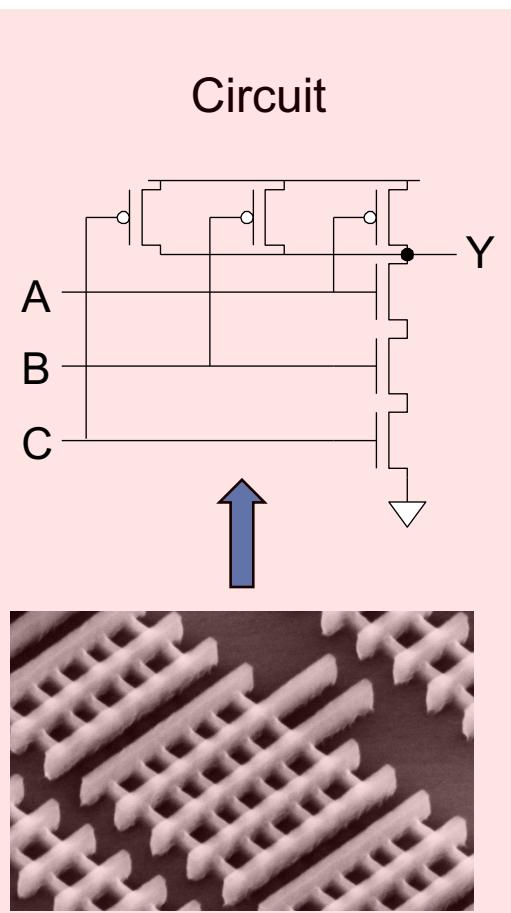
Terminologies: Hierarchical design



Terminologies: Hierarchical design



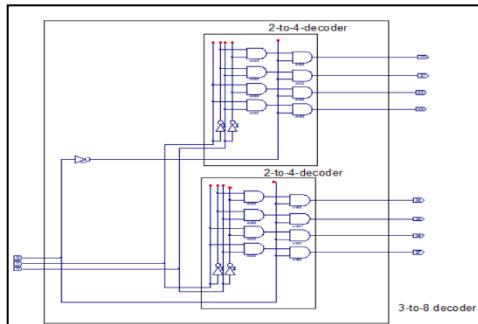
HW Design: Logic Gate to Microprocessor



Test method

■ Computer Simulation

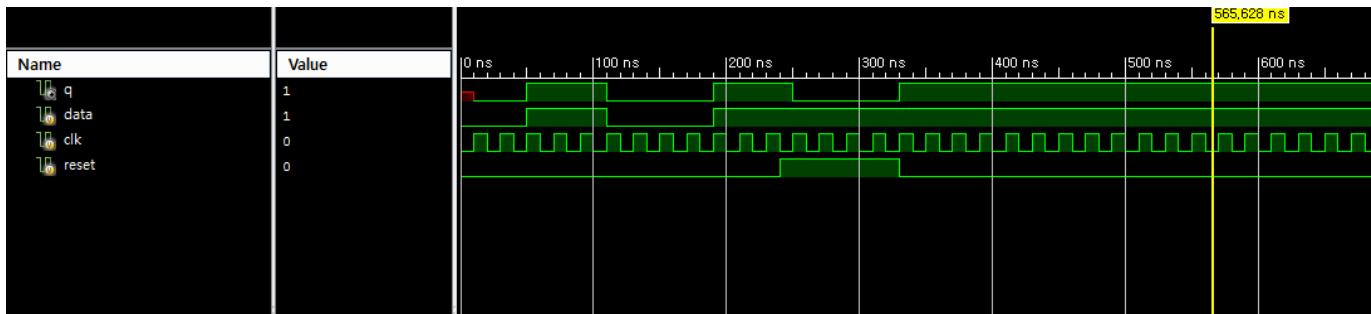
Schematic Design



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
```



Test method

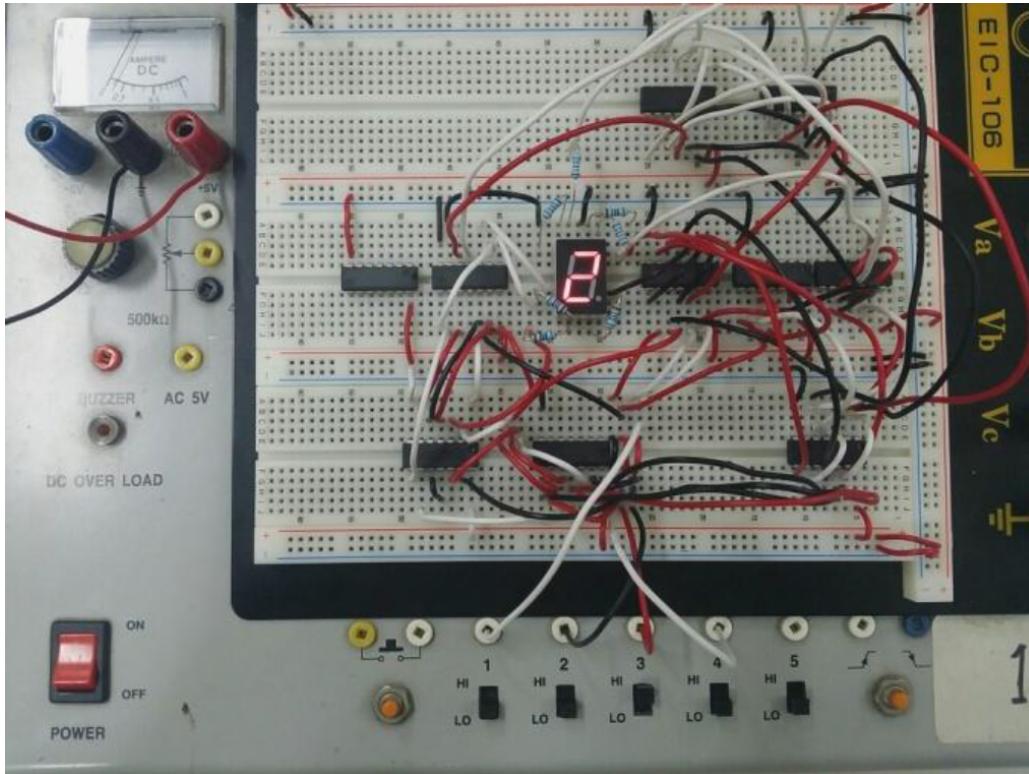
▪ **Prototyping**

Building an actual circuit to a theoretical design to verify that it works, and to provide a physical platform for debugging it if it does not.

- **Breadboard**
- **Universal Board (Wire wrapping / Soldering)**

Prototyping: Breadboard

- **Breadboard**



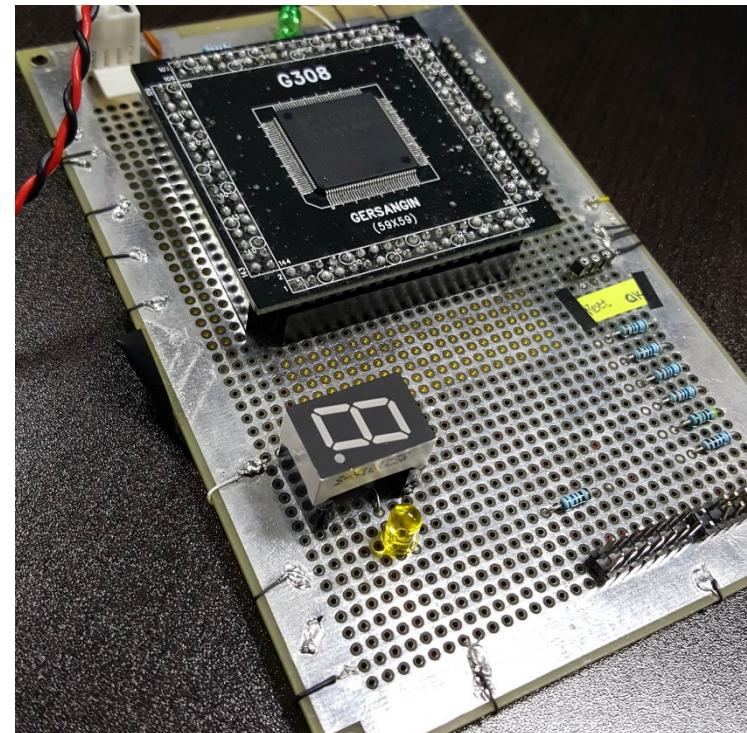
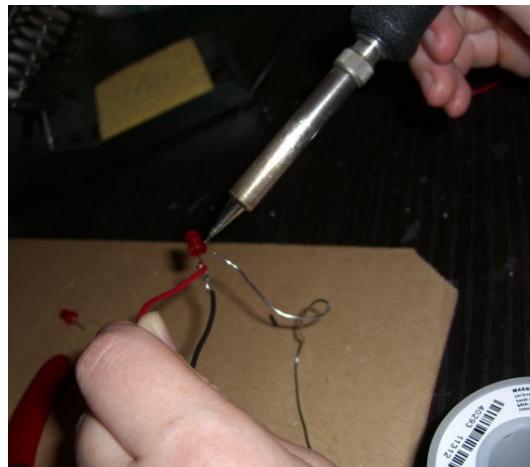
Prototyping: Universal board

- **Universal Board (Wire wrapping & Soldering)**

Wire wrapping

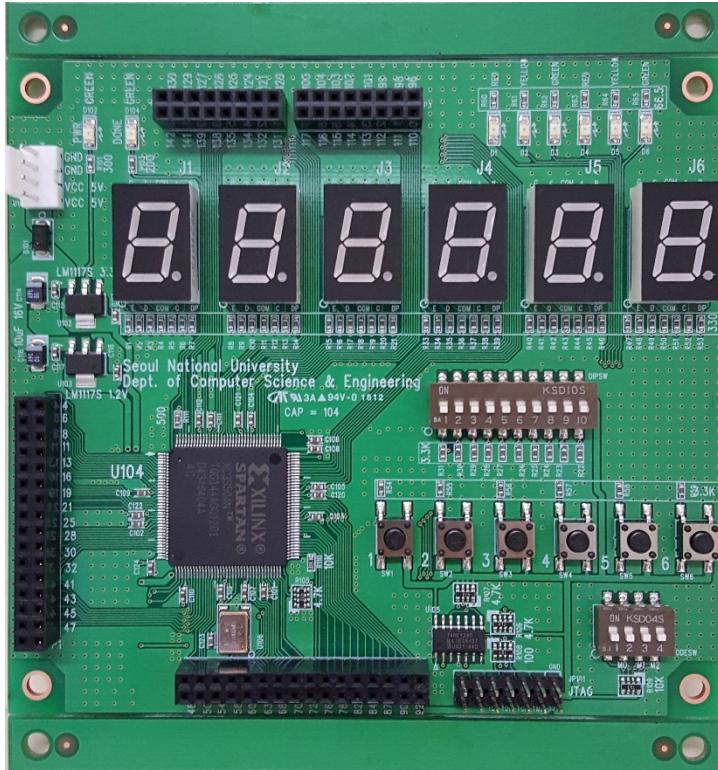


Soldering



Prototyping: FPGA

- Actual Circuit Board



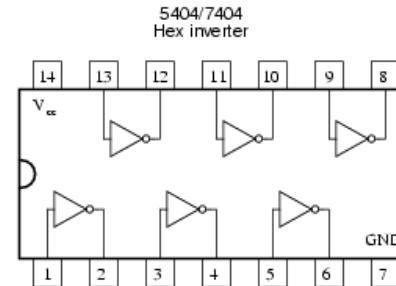
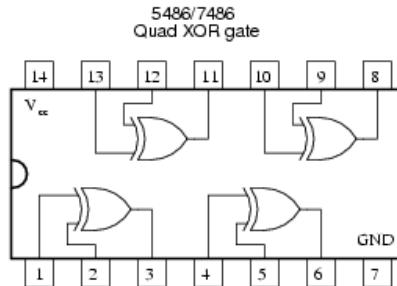
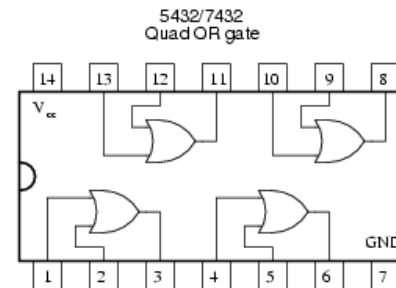
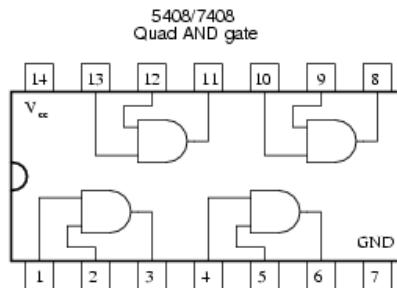
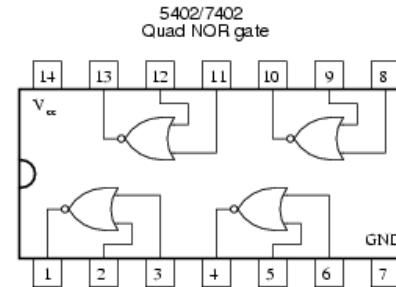
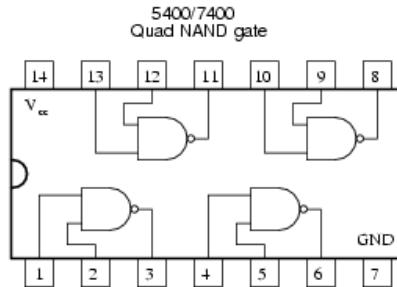
Evaluation Circuit Board

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.

Logic gates

■ Logic Gates



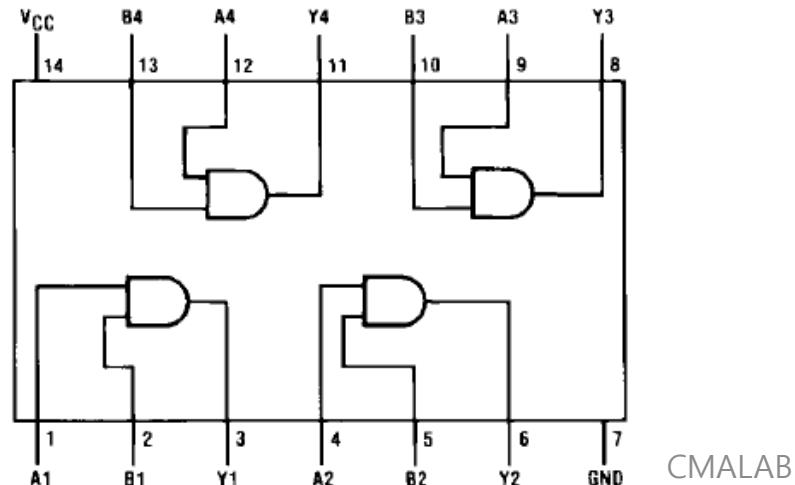
Logic gates

- 2-Input AND Gate (7408)

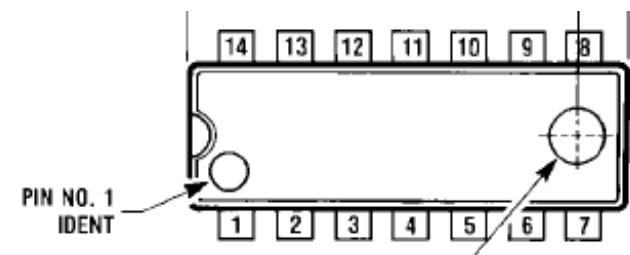
$$Y = A \cdot B$$

Inputs		Output
A	B	Y
0	0	0
0	1	0
1	0	0
1	1	1

Connection Diagram



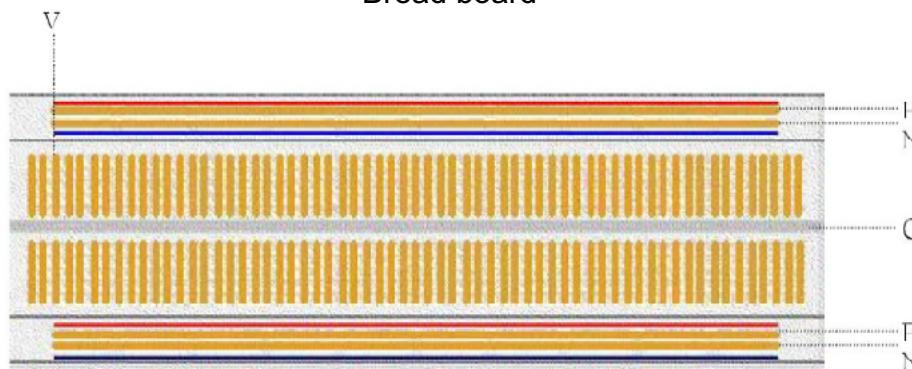
CMALAB



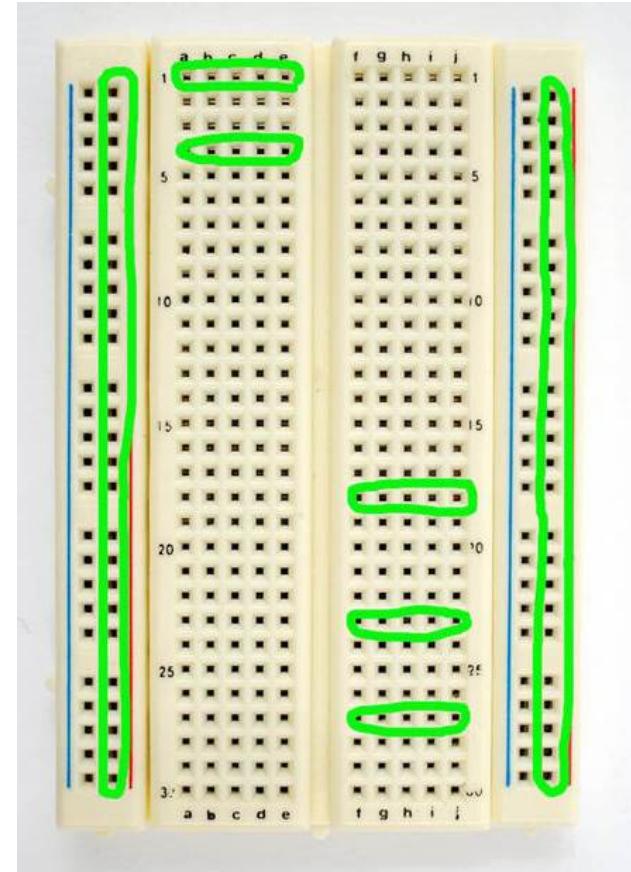
Breadboard



✓ Bread board



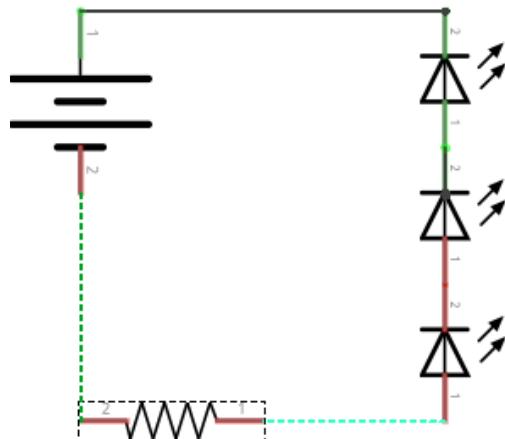
✓ Internal wiring of Bread board



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

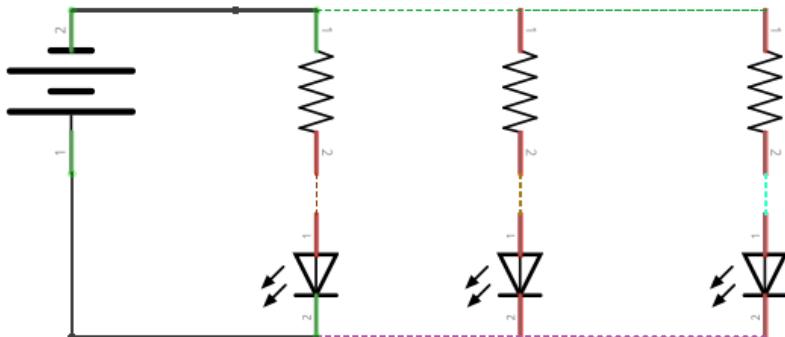
Breadboard

LED SERIES CIRCUIT



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LED PARALLEL CIRCUIT

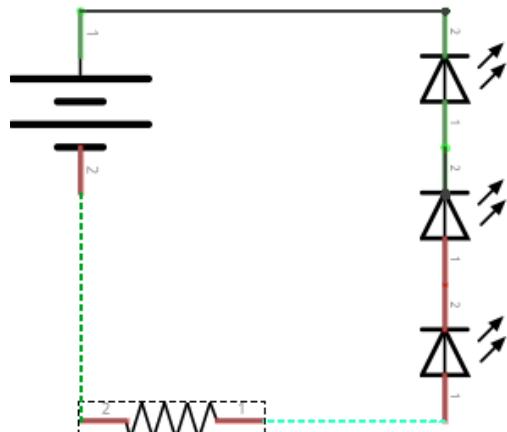


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MALAB

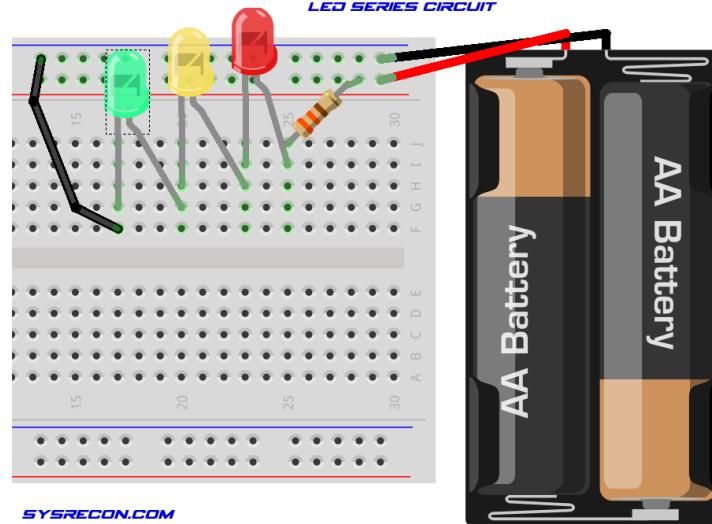
Breadboard

LED SERIES CIRCUIT

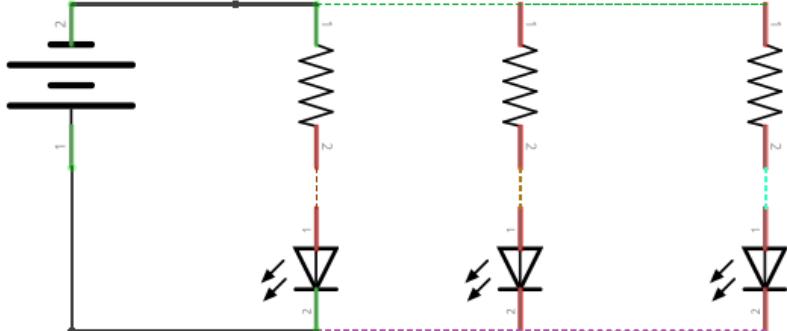


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LED SERIES CIRCUIT

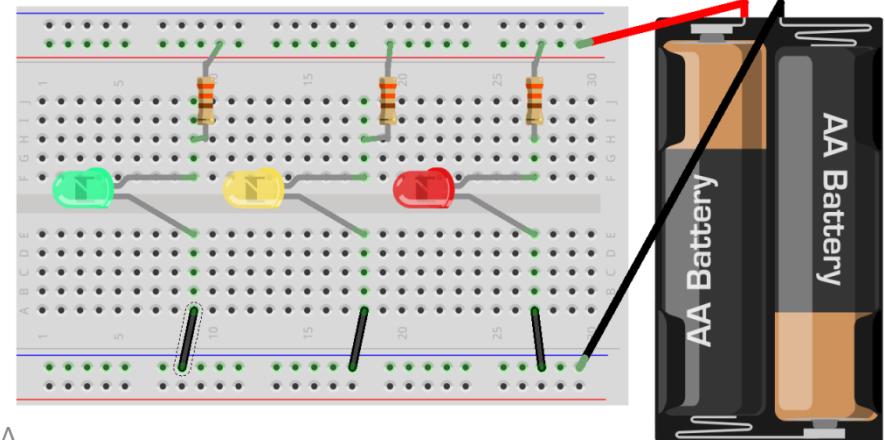


LED PARALLEL CIRCUIT



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LED PARALLEL BREADBOARD CIRCUIT

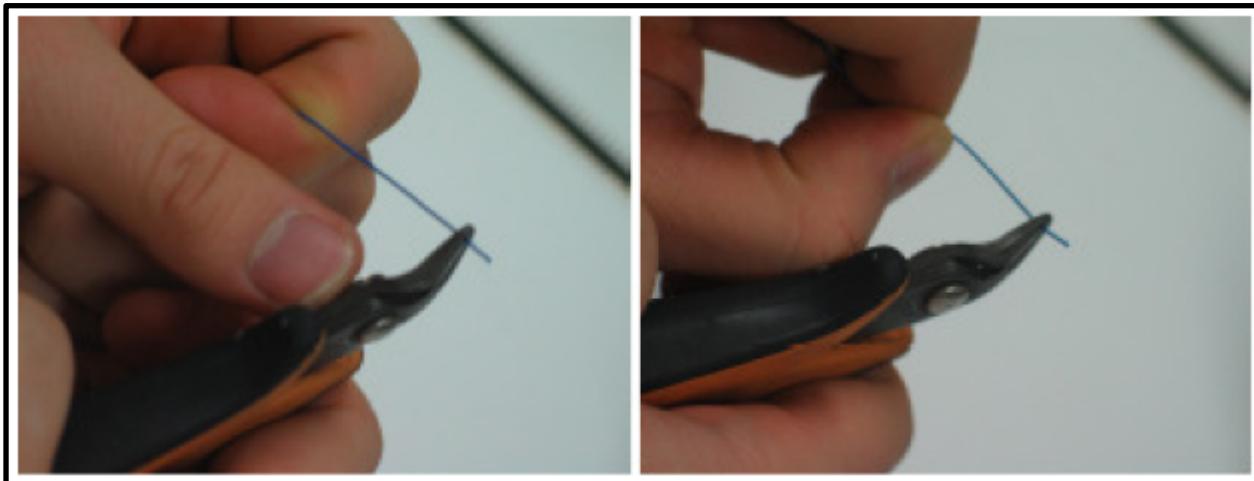


MA
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Breadboard

▪ Wiring

- Use 'bead nipper' to rip off coating.
- Push 'bead nipper' using your tip or joint of left thumb (as Figure above) – for the right-hander.



Ripping off coating

Breadboard

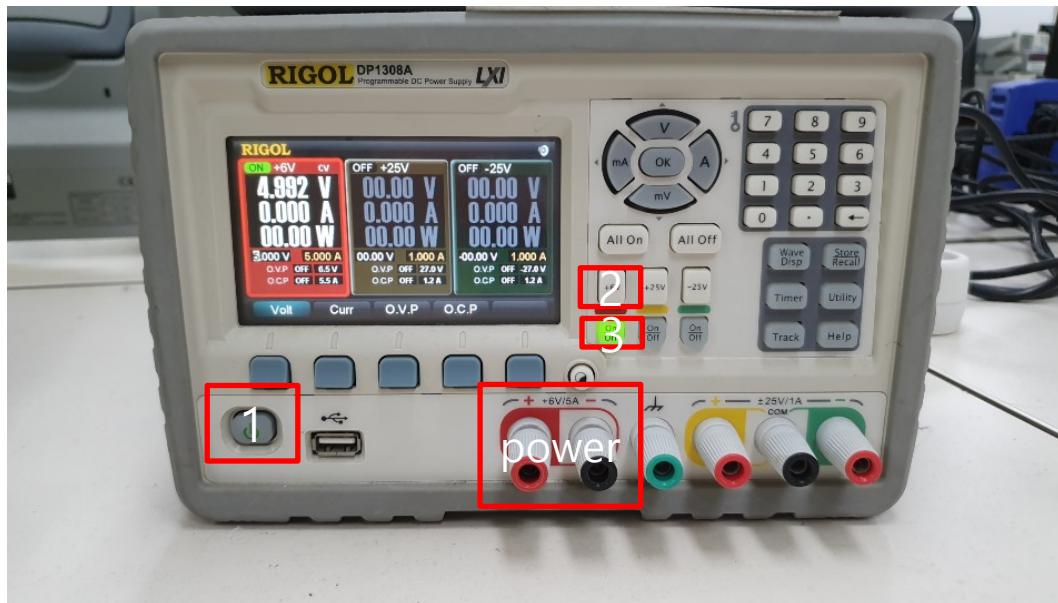
- **Extracting chips**

- To extract IC chips, use the IC Chip extractor.
- Do not extract by hands, in order to reuse chips.



DC Power Supply

- Press according to the number written.

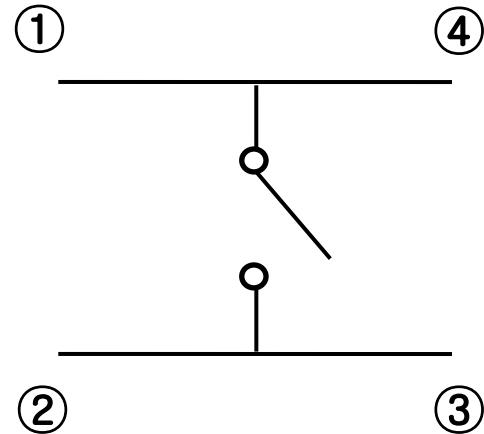
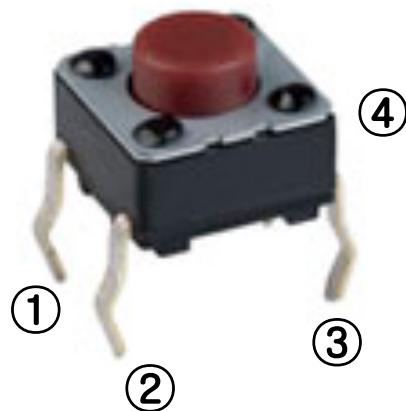


Practice

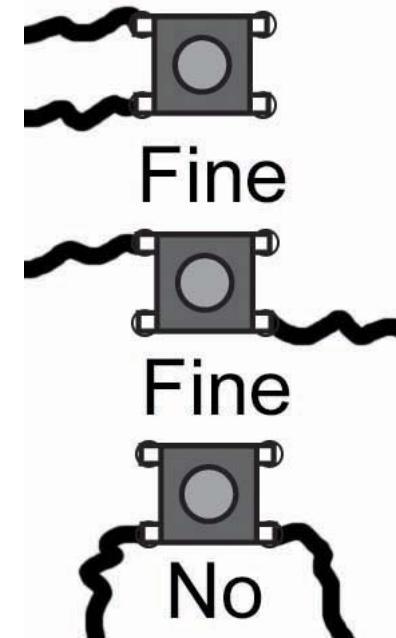
- Show TA that 7400 NAND Gate works on Breadboard
 - Use LEDs, wires, resistor and switches from lab cabinet

Appendix: tactile switch

- **Tactile switches**



Tactile Switch



Circuit Diagram

Usage

Homework

1. Explain each of the instruments below

- DC Power Supply



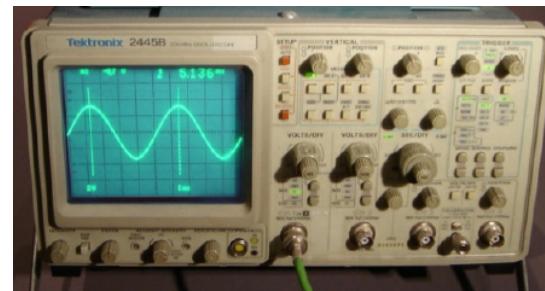
- Multimeter



- Function Generator



- Oscilloscope

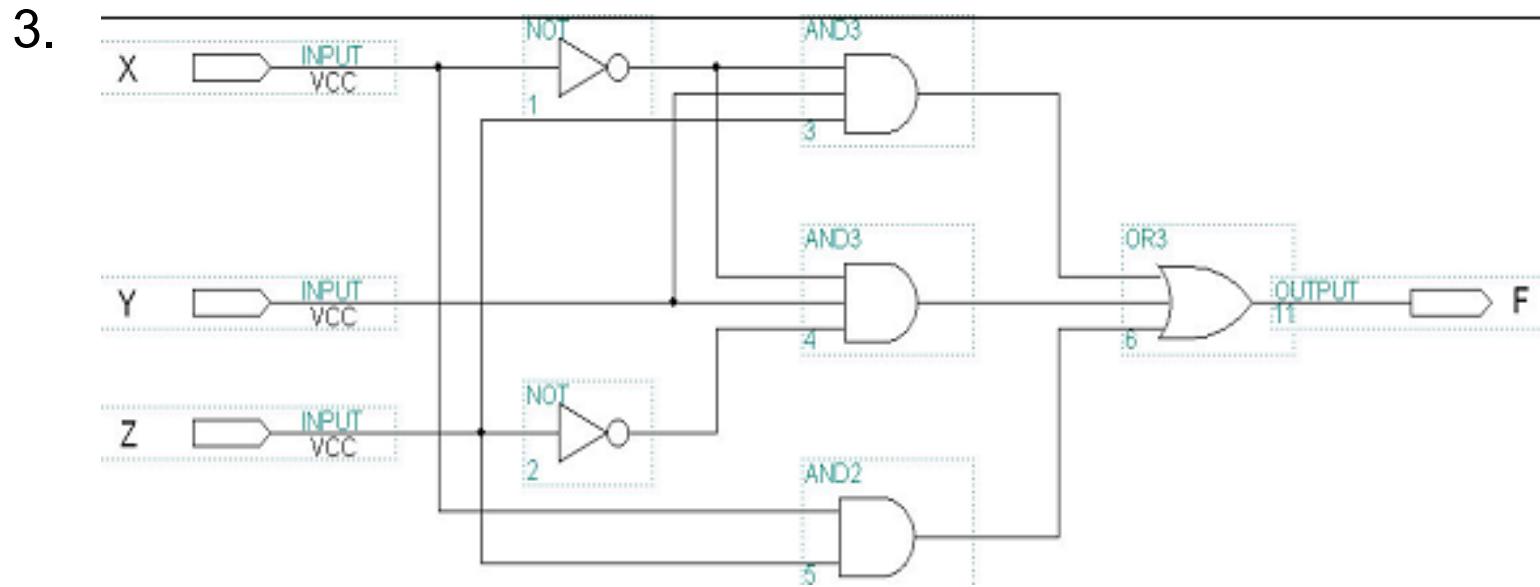


Homework

2. Explain how to read resistor color coding



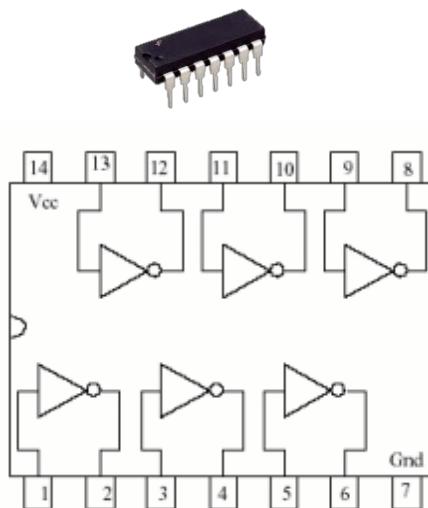
Homework



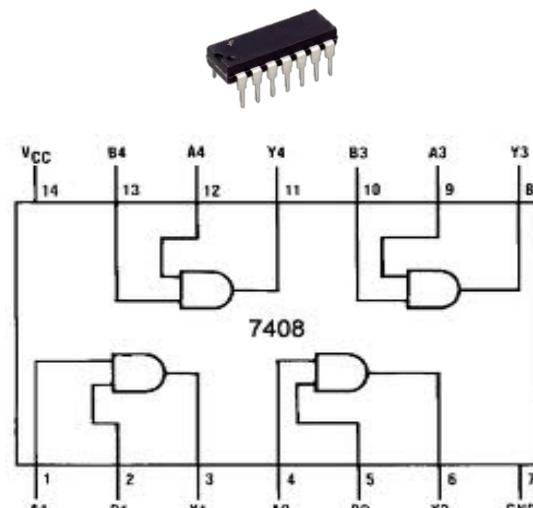
a) Build a truth table for the circuit above

Homework

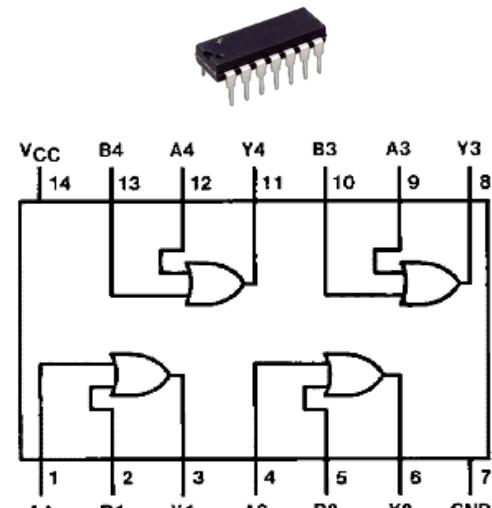
3. b) Draw the circuit wiring diagram for using NOT gate, AND gate and OR gate



NOT gate (7404)



2-input AND gate (7408)



2-input OR gate (7432)

Ex) Circuit wiring diagram

