

# Course Information

Logic Design Lab.

Fall 2019

Prof. Sungjoo Yoo  
([yeonbin@snu.ac.kr](mailto:yeonbin@snu.ac.kr))

TA. Hyunsu Kim

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TA. Hyunyoung Jung  
([gusdud1500@gmail.com](mailto: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 ([gustnchodjs@gmail.com](mailto:gustnchodjs@gmail.com))  
TA. Hyunyoung Jung ([gusdud1500@gmail.com](mailto: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

Logic Design Lab.

Fall 2019

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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

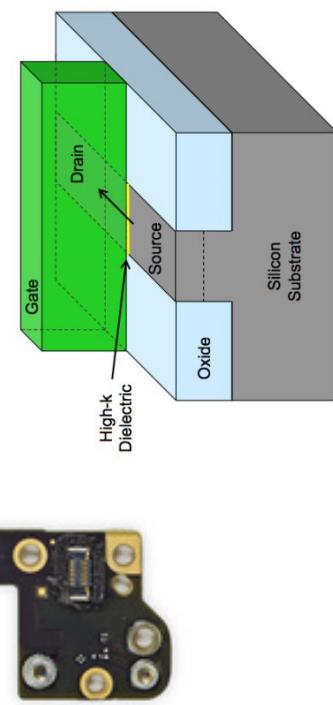


# HW Design: A9 Chip

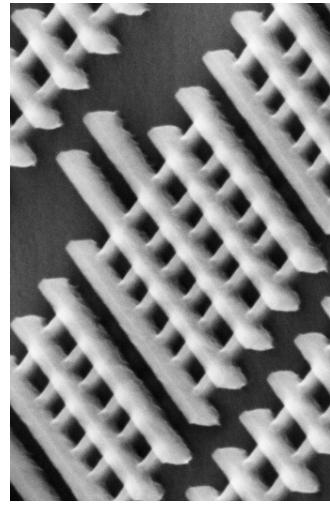
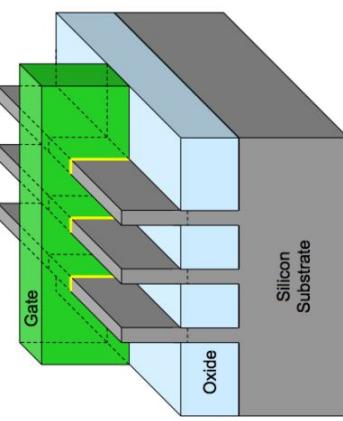
How many transistors on A9 chip?



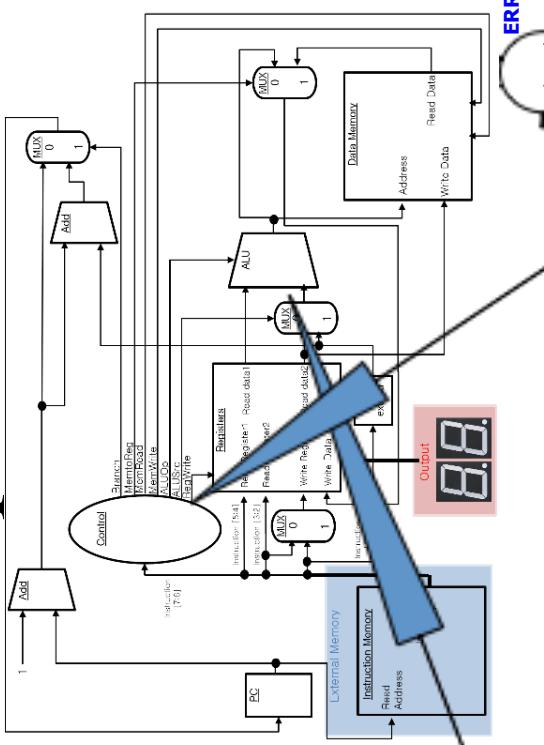
Traditional Planar Transistor



22 nm Tri-Gate Transistor

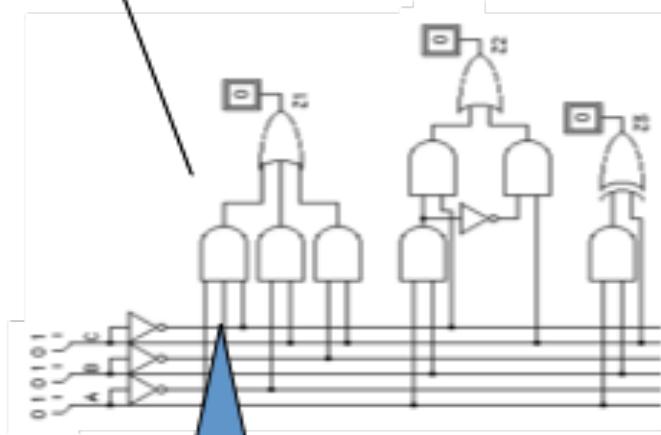
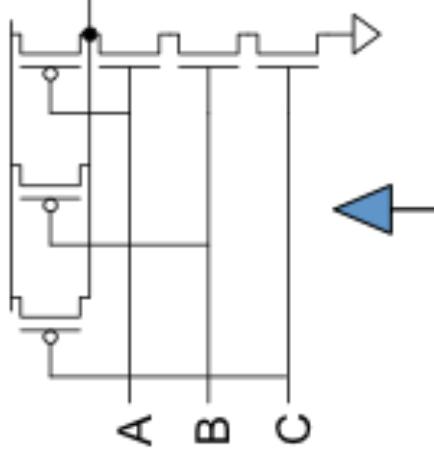


# HW Design: Logic Gate to Microprocessor

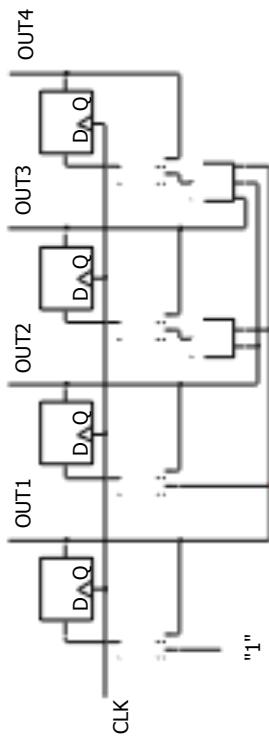
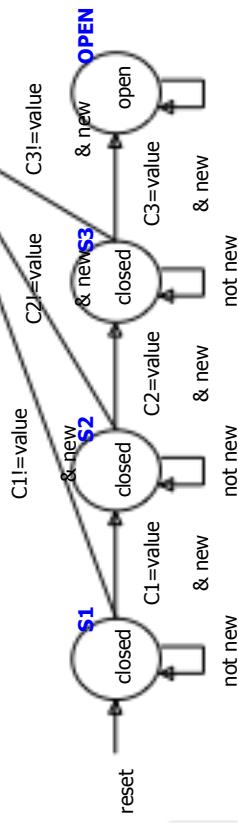
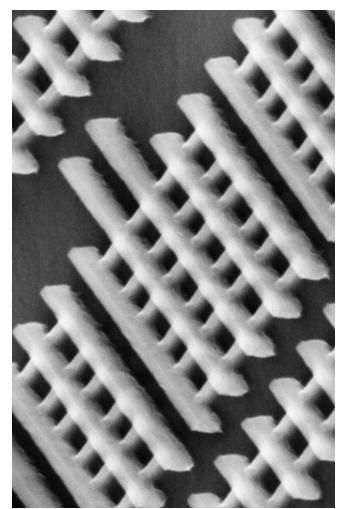


**Microprocessor**

**Circuit**

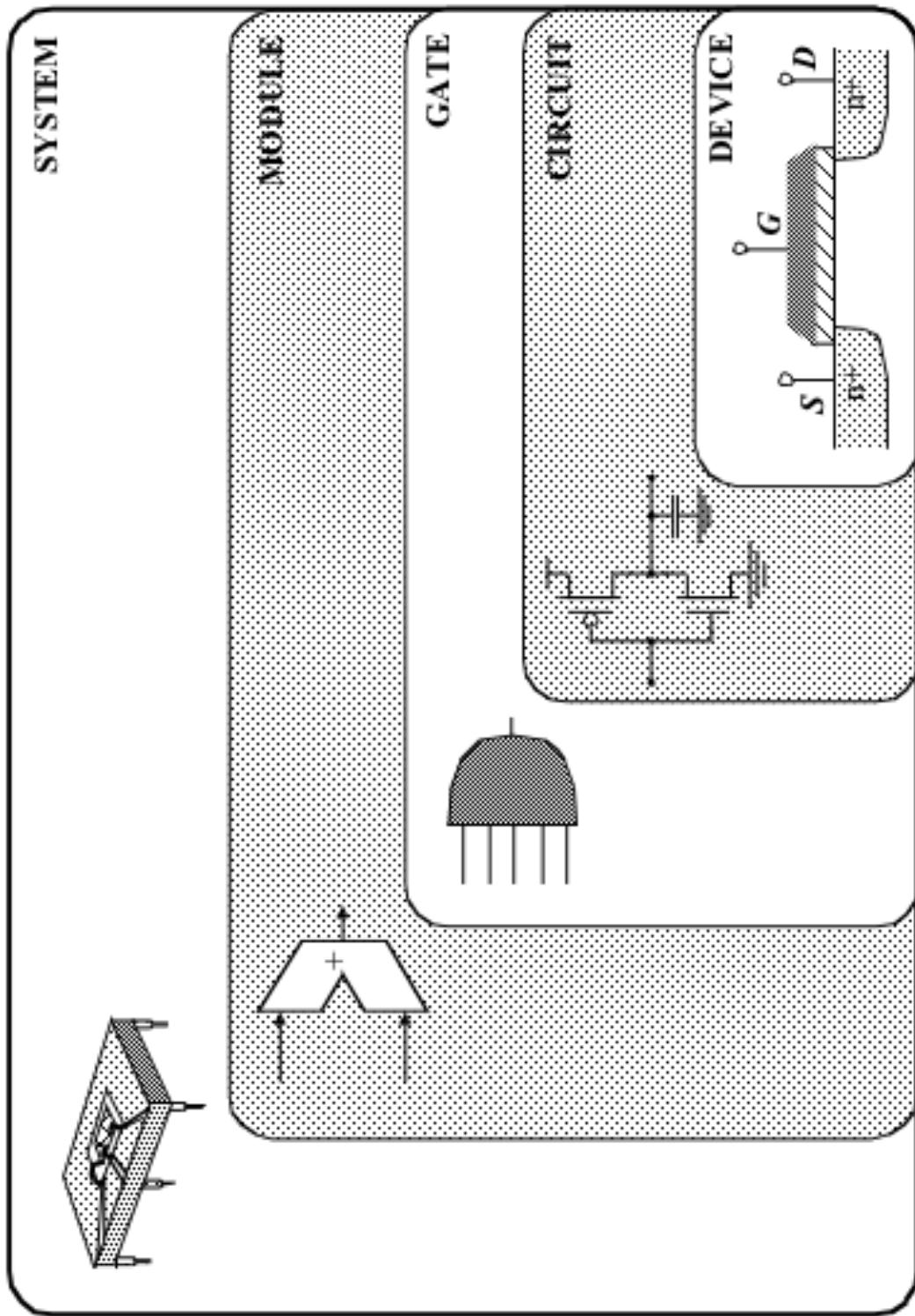


**Logic Gates**  
in Combinational circuit

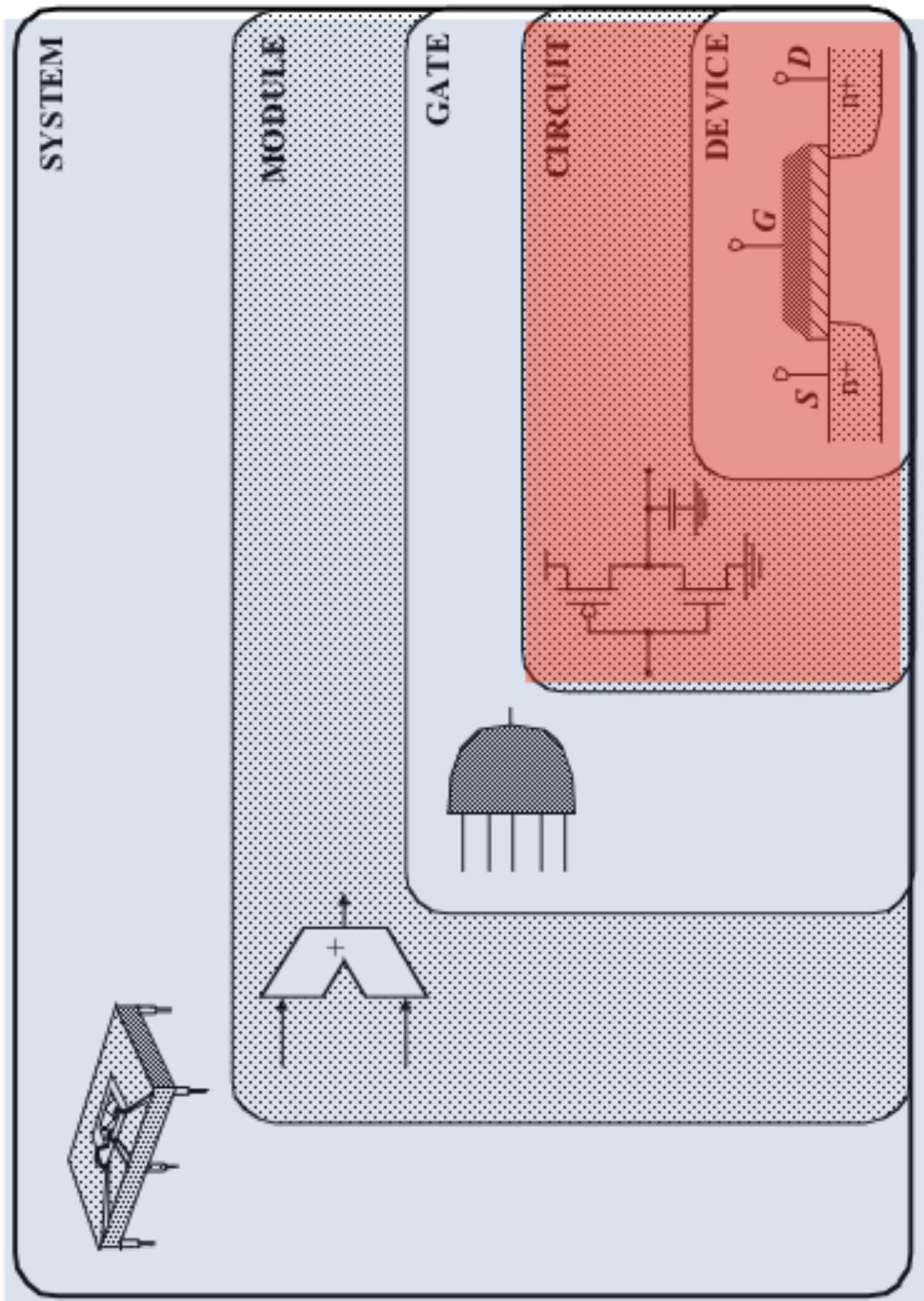


**Finite State Machine**  
& Sequential circuit

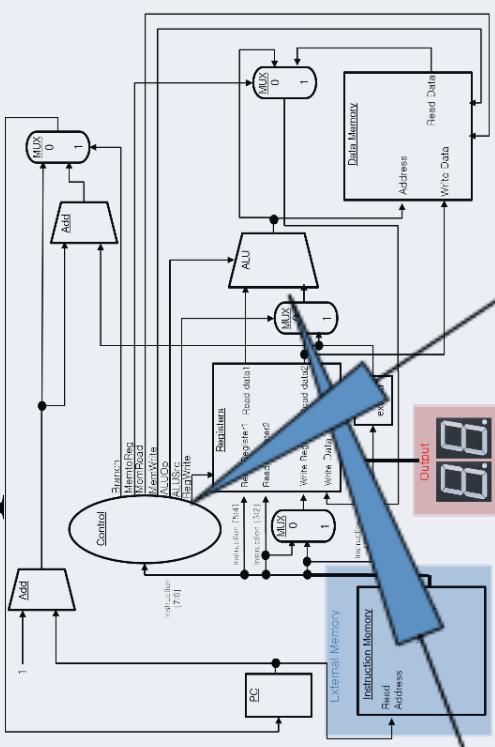
# Terminologies: Hierarchical design



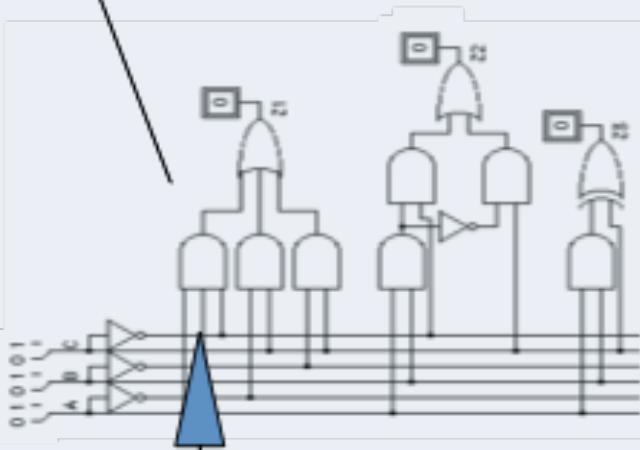
# Terminologies: Hierarchical design



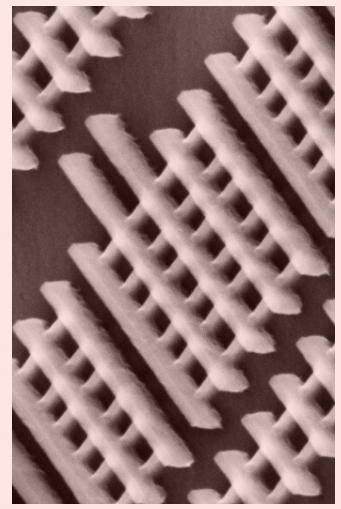
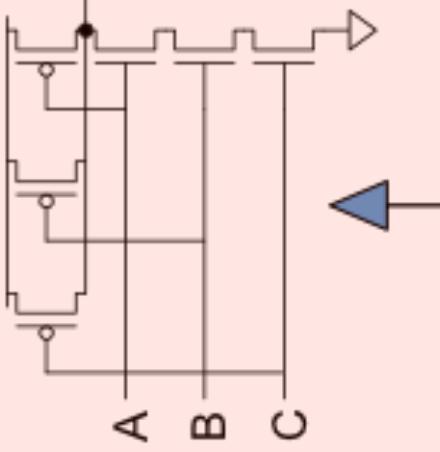
# HW Design: Logic Gate to Microprocessor



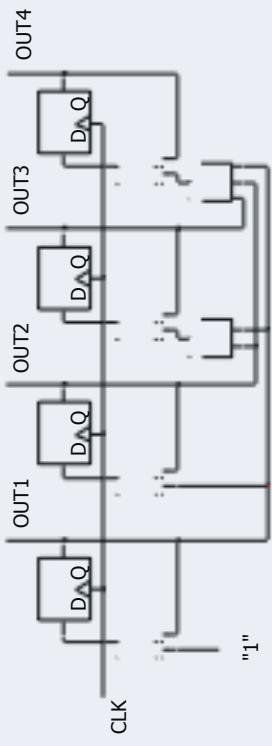
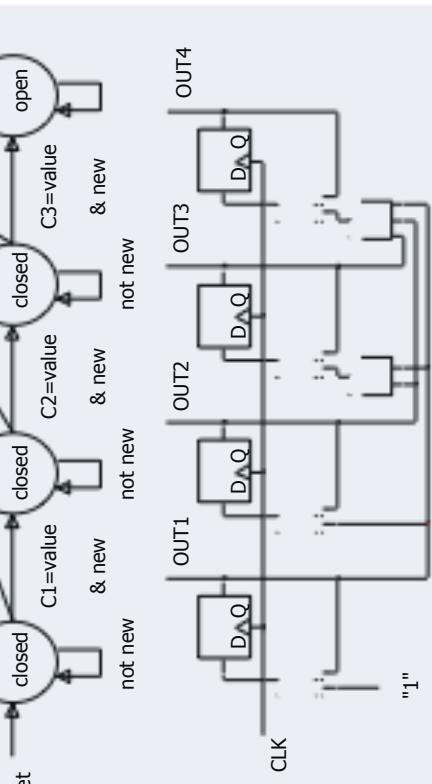
Microprocessor



Circuit



Logic Gates  
in Combinational circuit

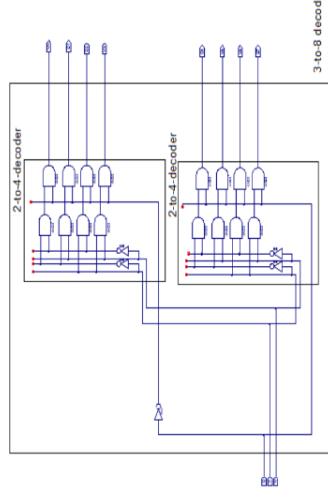


Finite State Machine  
& Sequential circuit

# Test method

## • Computer Simulation

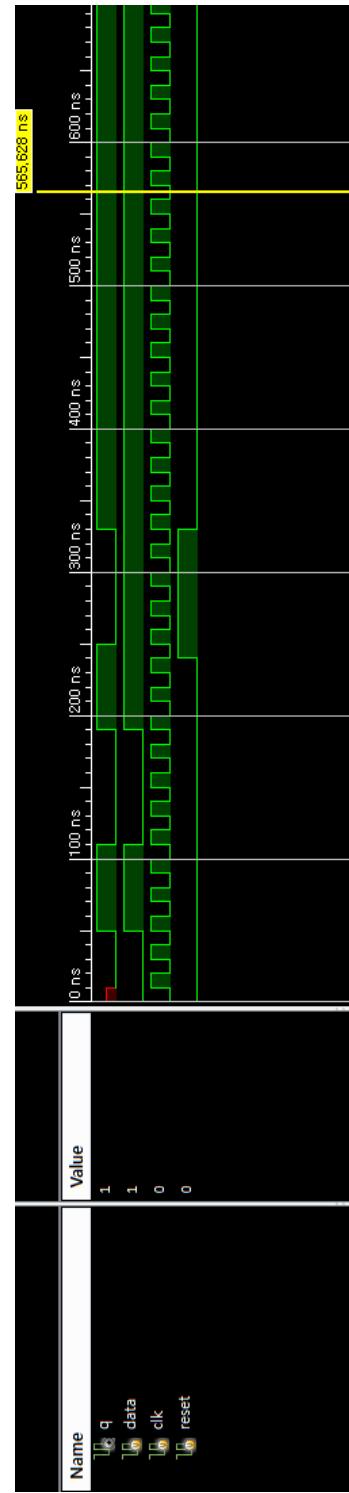
### Schematic Design



### 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

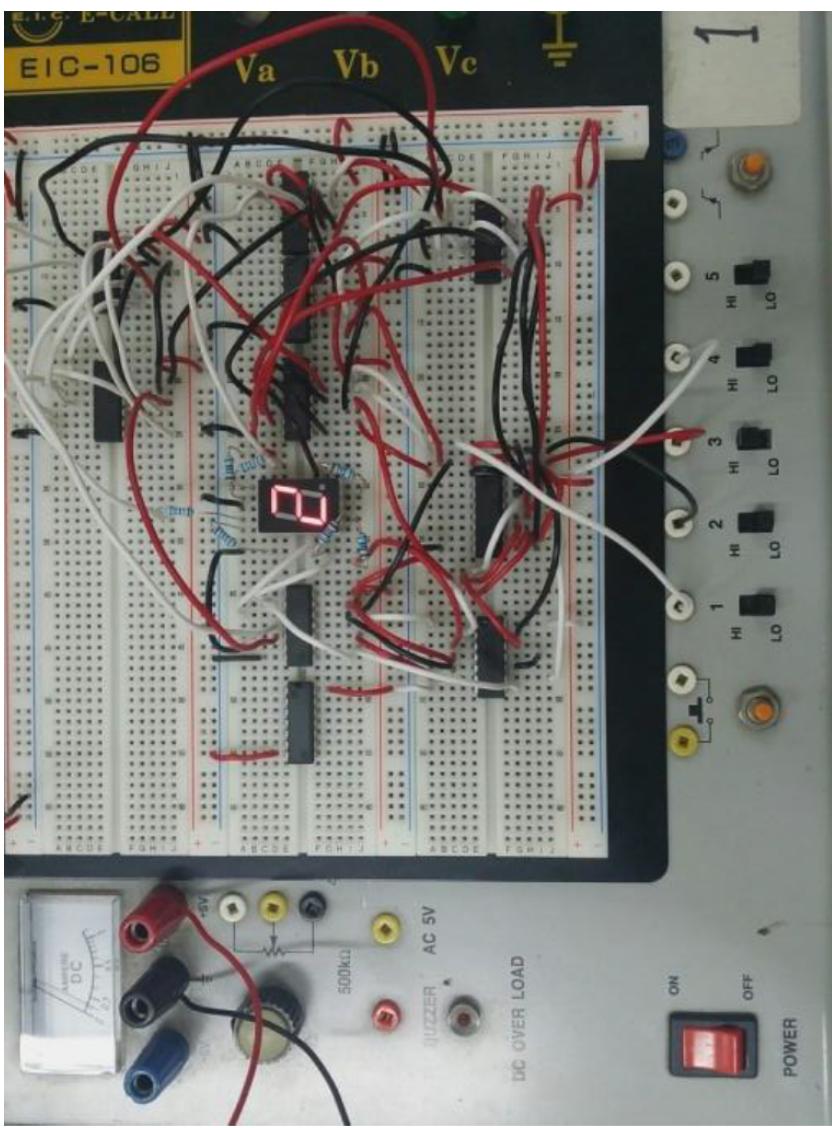
- **Prototyping**

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)**

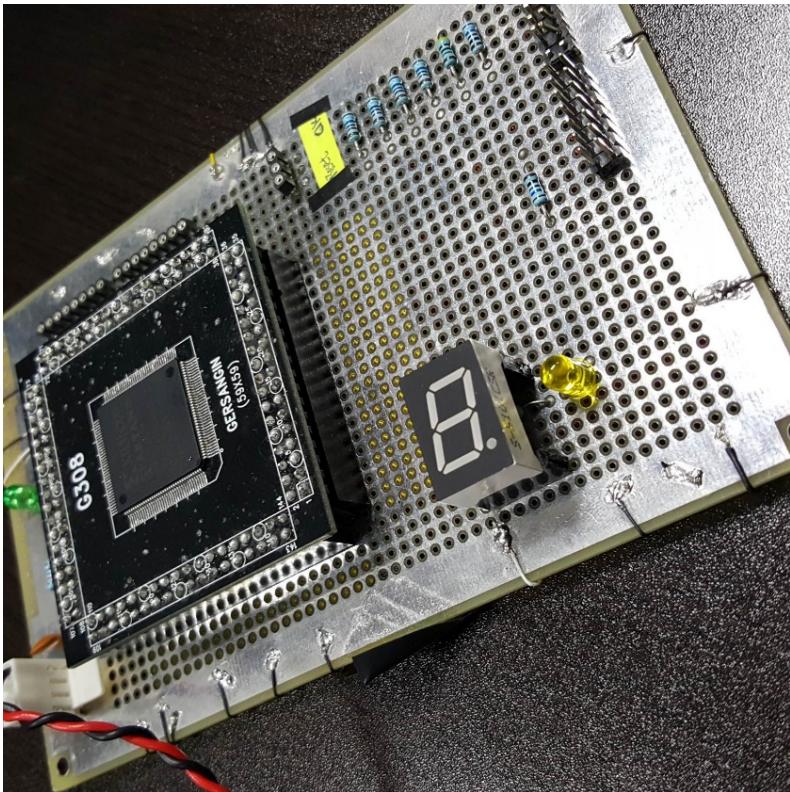
# Prototyping: Breadboard

- Breadboard

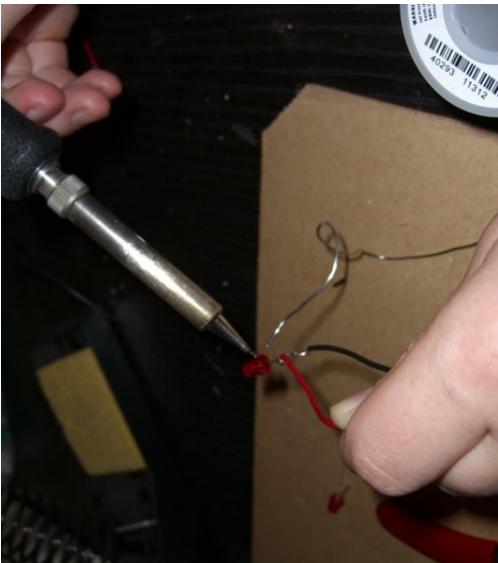


# Prototyping: Universal board

- Universal Board (Wire wrapping & Soldering)



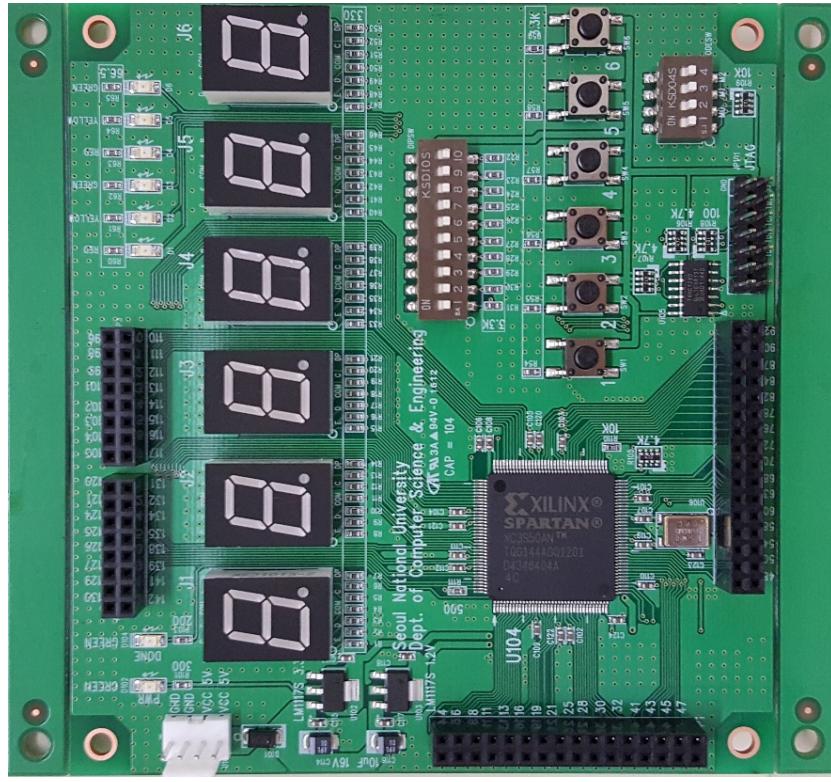
Wire wrapping



Soldering

# Prototyping: FPGA

- Actual Circuit Board



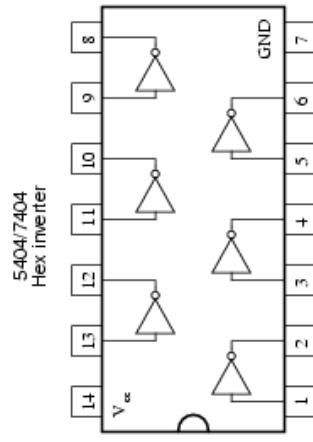
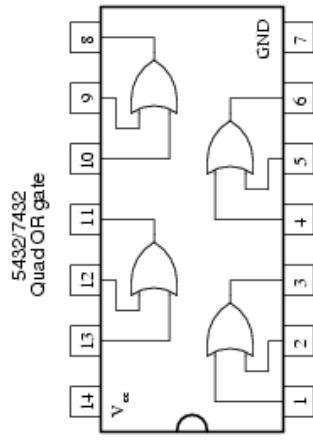
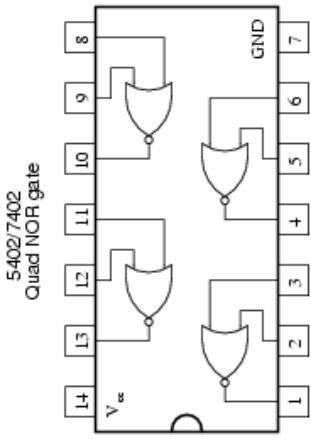
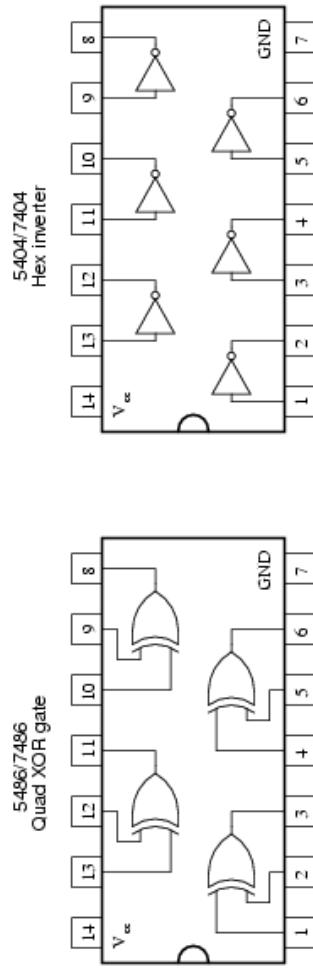
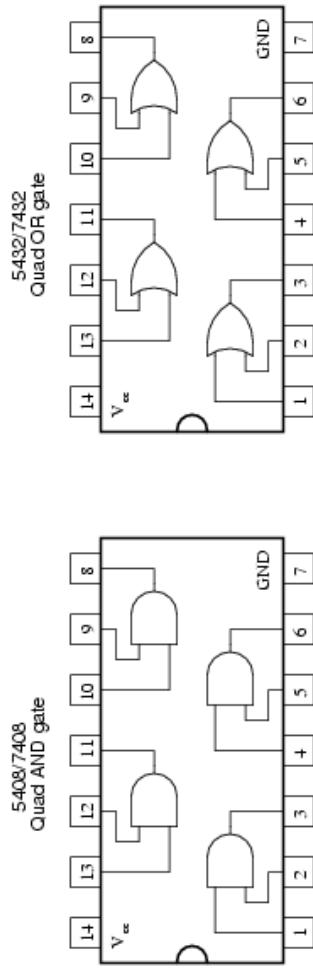
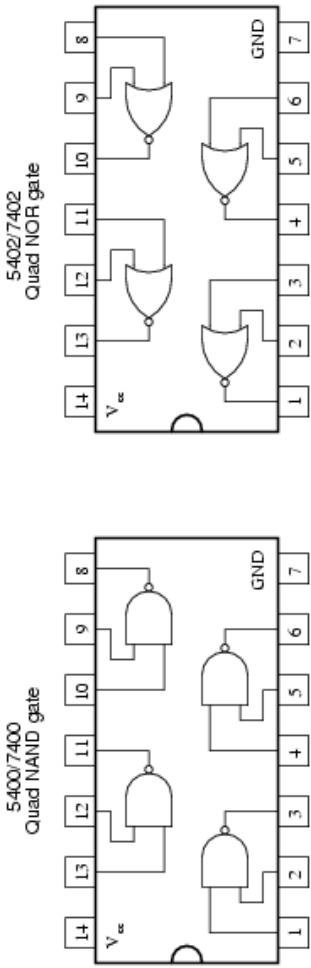
You can build your own board of your logic design with logic gates and electronic parts.

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

Evaluation Circuit Board

# Logic gates

- Logic Gates



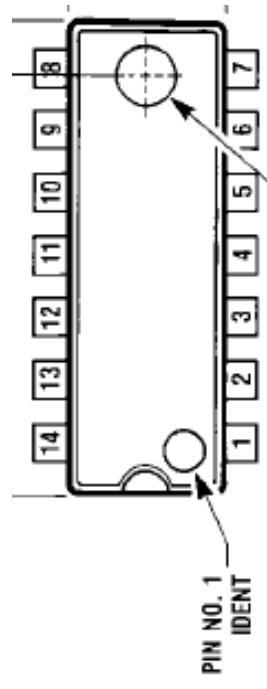
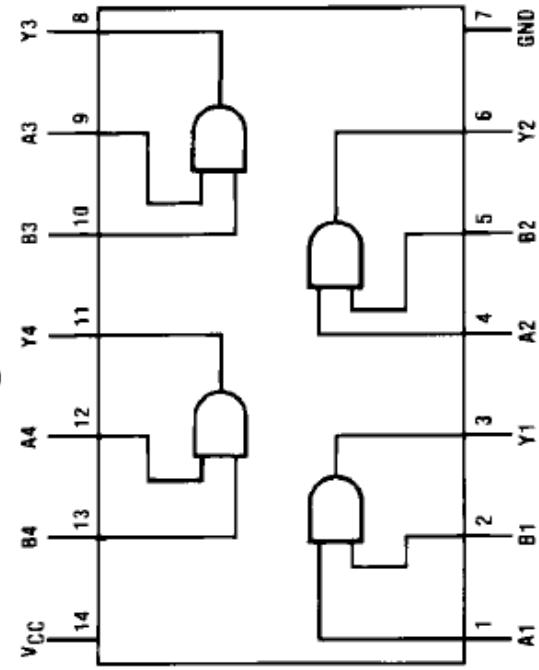
# Logic gates

- 2-Input AND Gate (7408)

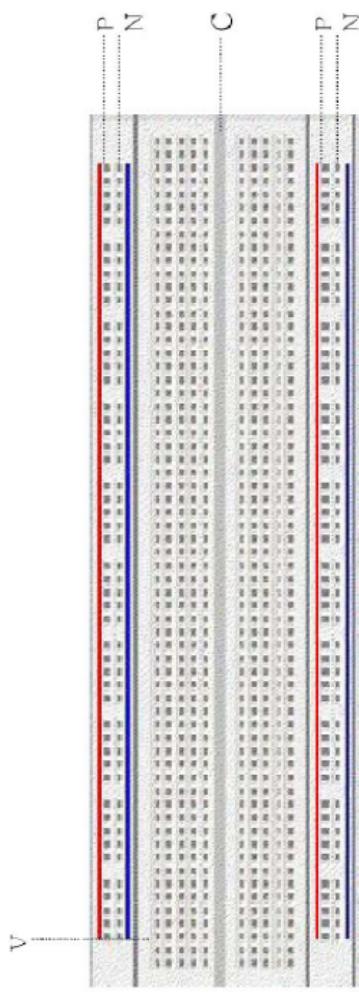
$$Y = A \cdot B$$

| Inputs |   | Output |
|--------|---|--------|
| A      | B | Y      |
| 0      | 0 | 0      |
| 0      | 1 | 0      |
| 1      | 0 | 0      |
| 1      | 1 | 1      |

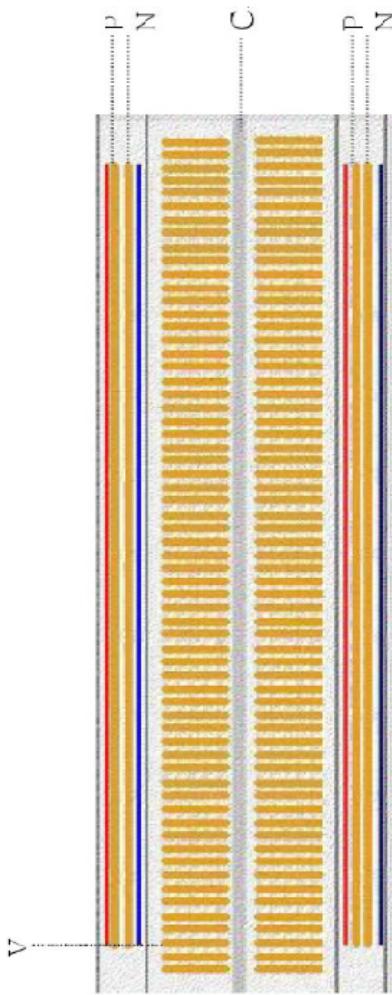
Connection Diagram



# Breadboard

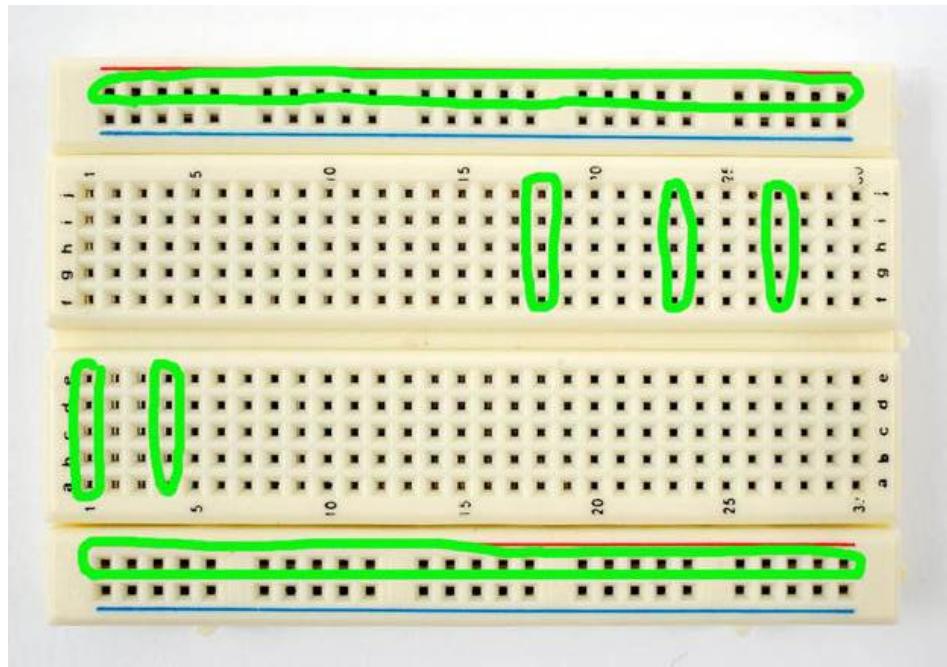


- Bread board



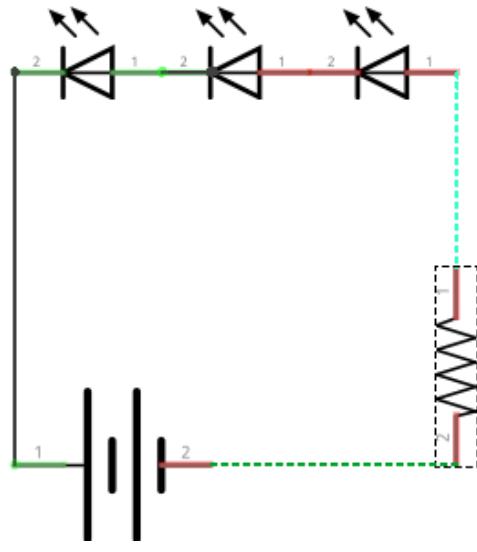
- Internal wiring of Bread board

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

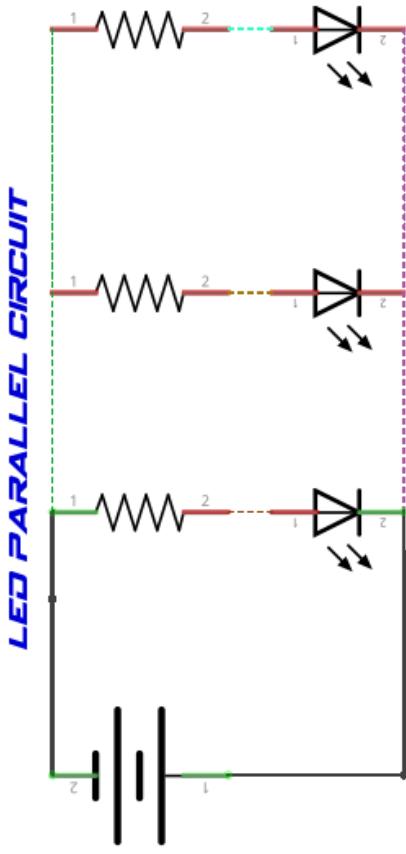


# Breadboard

**LED SERIES CIRCUIT**



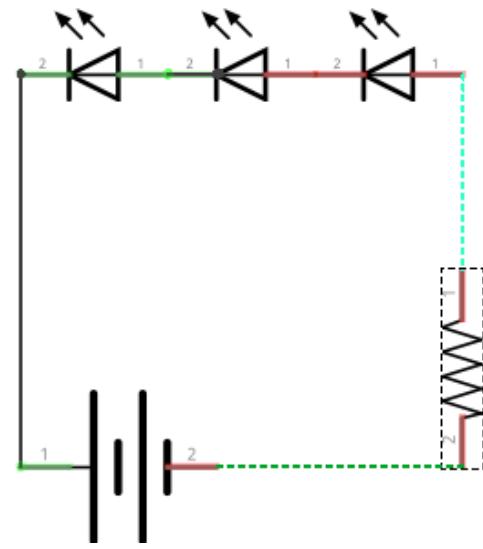
**SYSRECON.COM**



**SYSRECON.COM**

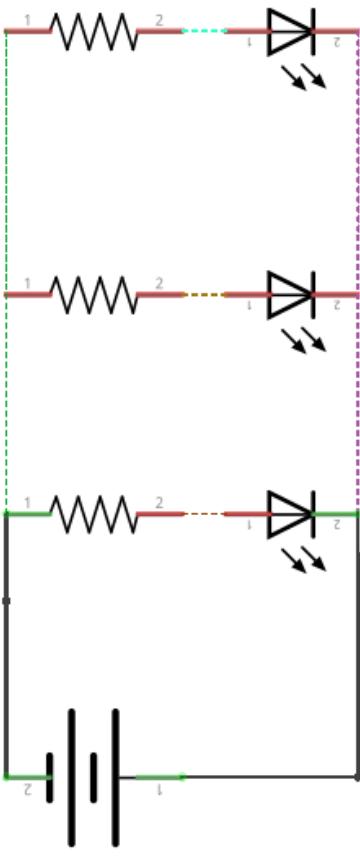
# Breadboard

**LED SERIES CIRCUIT**



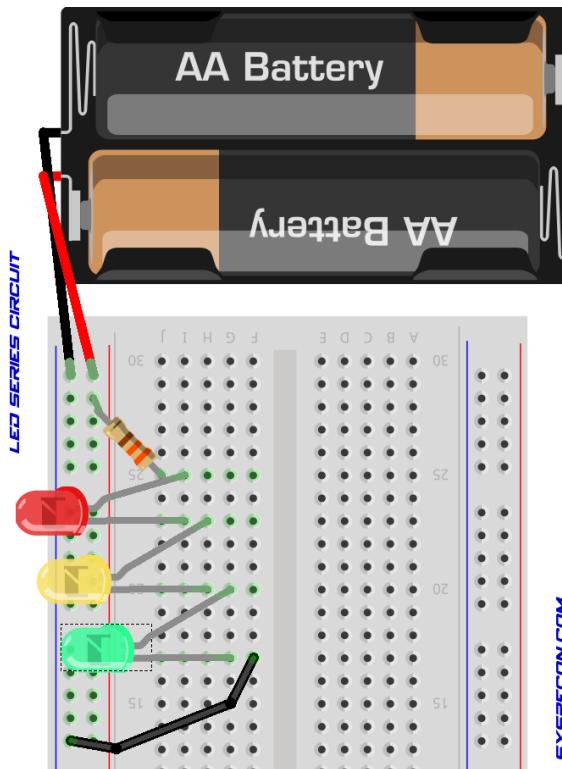
SYSRECON.COM

**LED PARALLEL CIRCUIT**



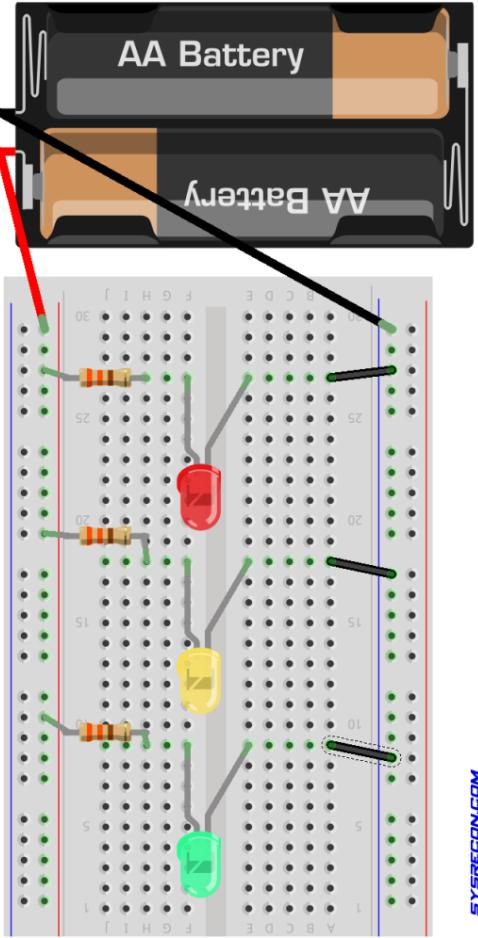
SYSRECON.COM

**LED SERIES CIRCUIT**



SYSRECON.COM

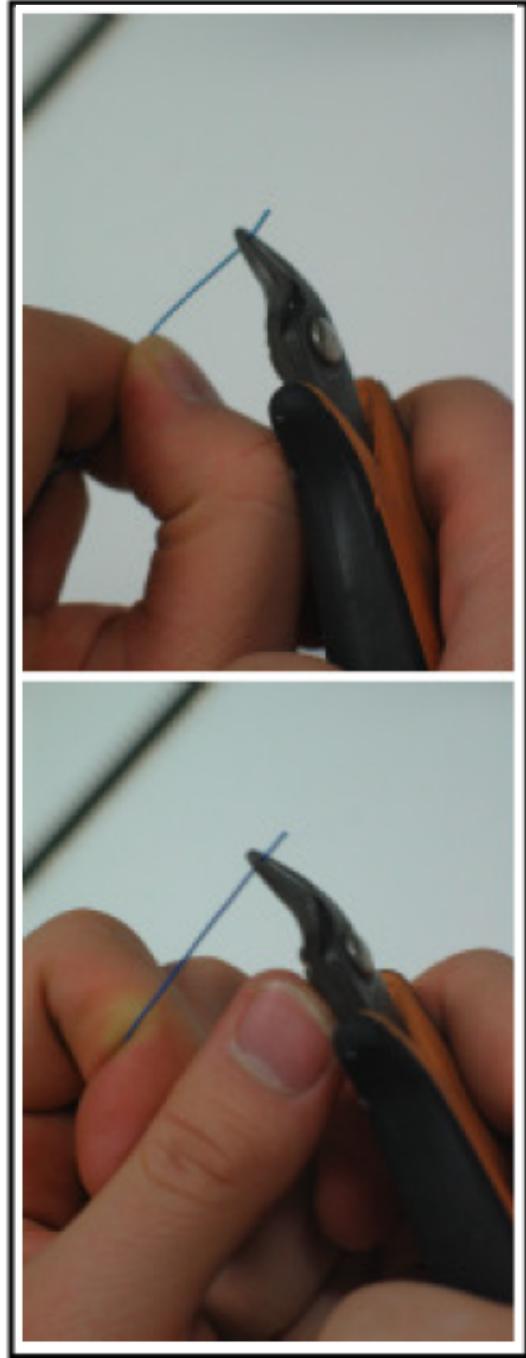
**LED PARALLEL BREADBOARD CIRCUIT**



CM. SYSRECON.COM

# 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

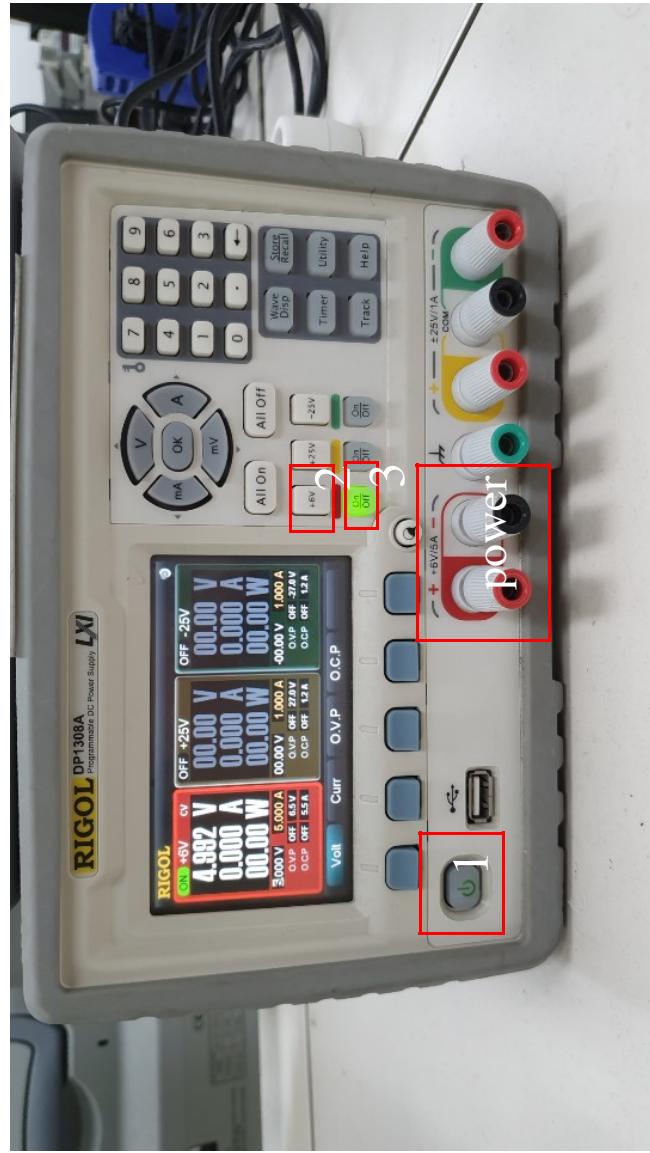
# Breadboard

- 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.

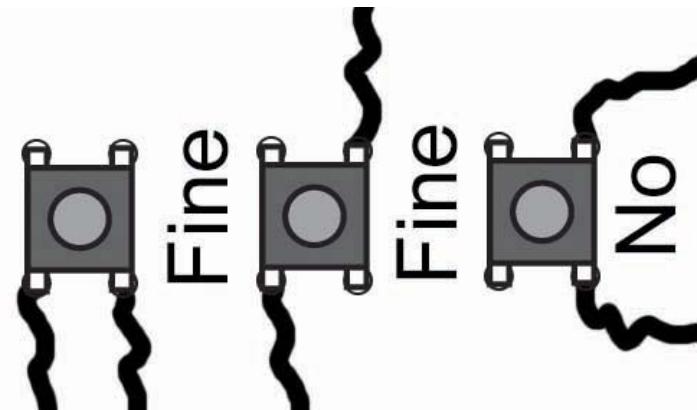


# Practice

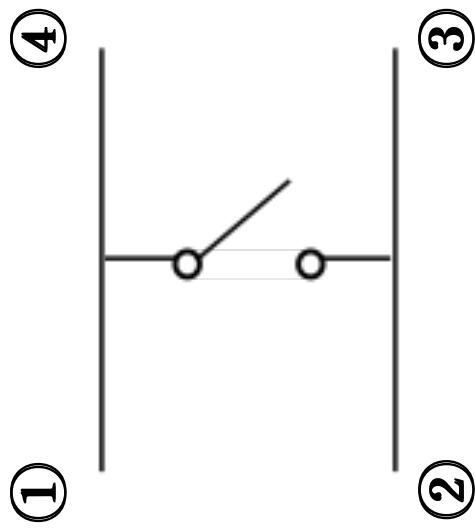
- Show TA that 7400 NAND Gate works on Breadboard
  - Use LEDs, wires, resistor and switches from lab cabinet

# Appendix: tactile switch

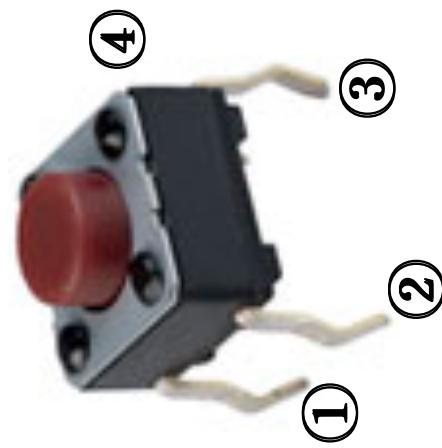
- Tactile switches



Usage



Circuit Diagram



Tactile Switch

# Homework

1. Explain each of the instruments below

- DC Power Supply



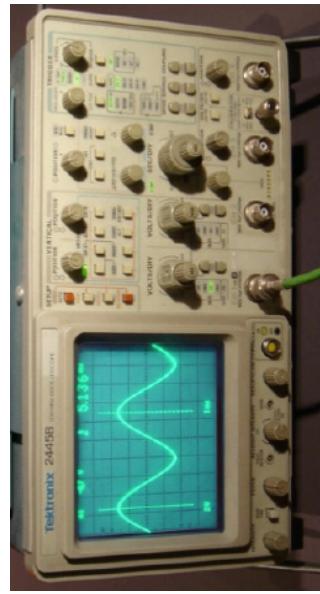
- Multimeter



- Function Generator



- Oscilloscope



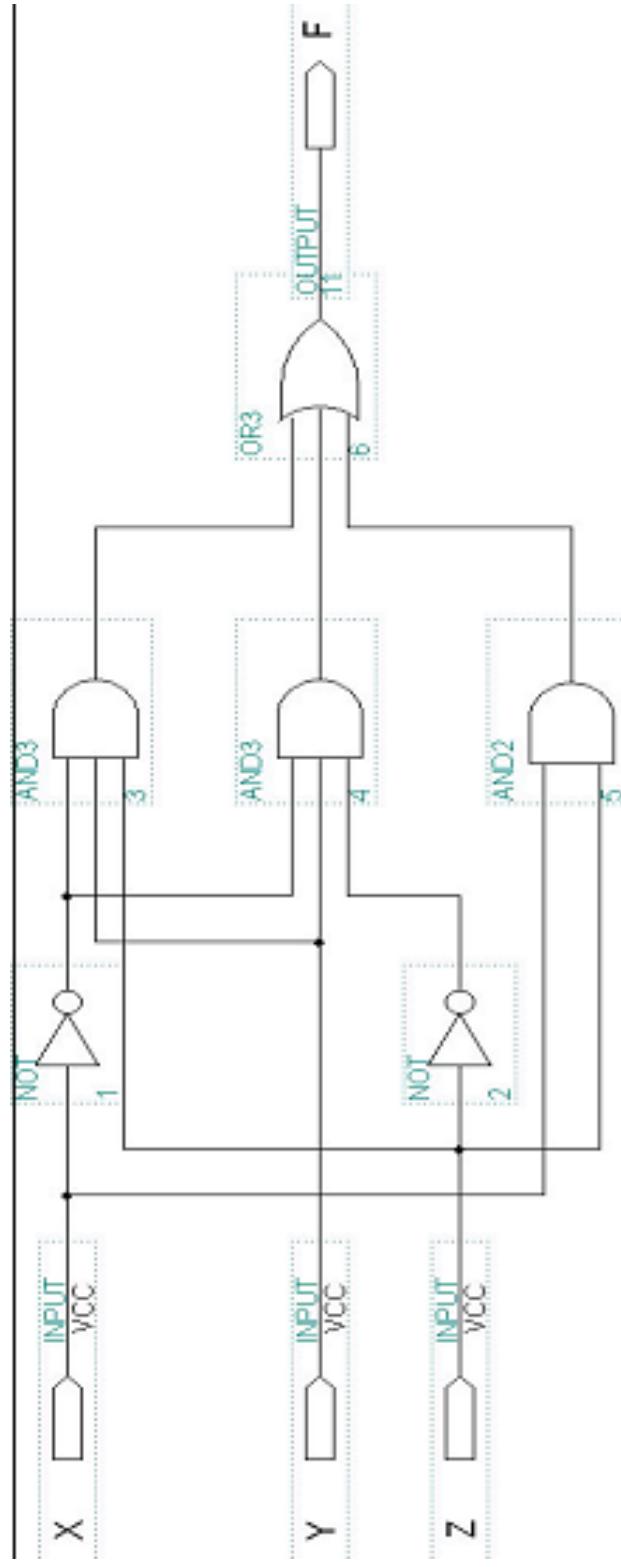
# Homework

2. Explain how to read resistor color coding



# Homework

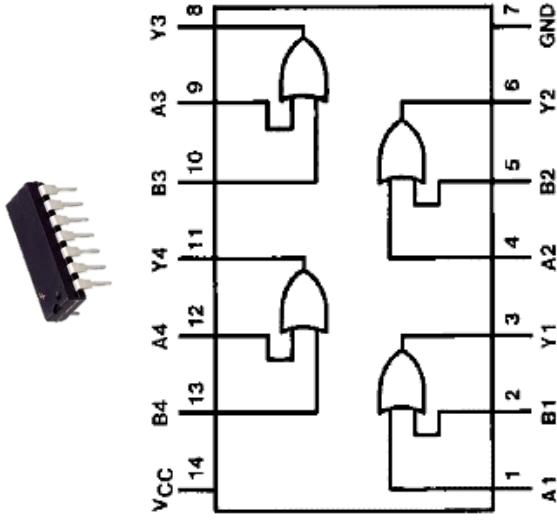
3.



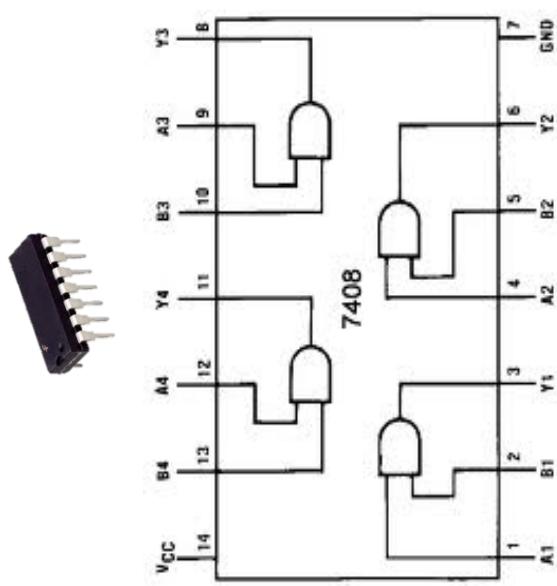
a) Build a truth table for the circuit above

# Homework

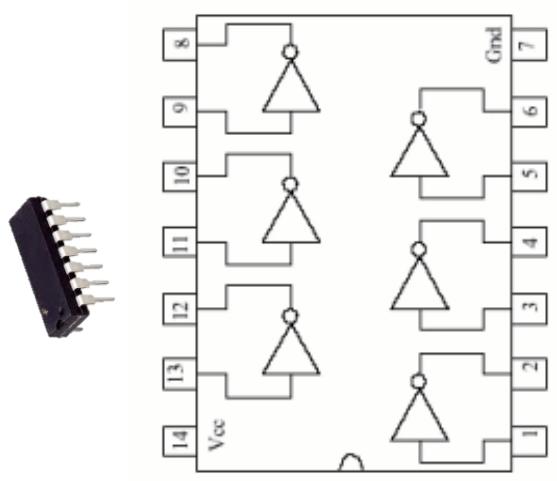
3. b) Draw the circuit wiring diagram for using NOT gate, AND gate and OR gate



2-input OR gate (7432)



2-input AND gate (7408)



NOT gate (7404)

# Ex) Circuit wiring diagram

