



# EE301 – Electrical Engineering Laboratory

Faculty of Engineering, Thammasat University

## Lab One – Combinational Circuit Analysis

Name: \_\_\_\_\_ ID no. \_\_\_\_\_

\_\_\_\_\_ ID no. \_\_\_\_\_

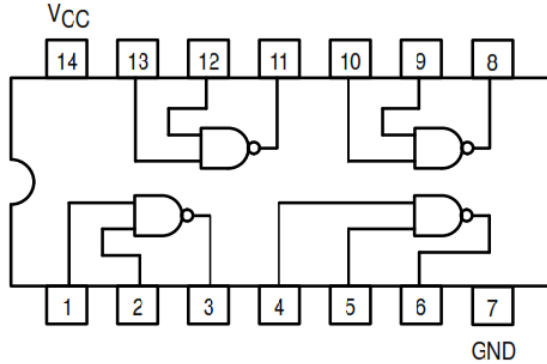
### Equipment Needed

- Digital Electronics Training Board
- IC 7404 (NOT) 1 chip
- IC 7408 (AND) 1 chip
- IC 7432 (OR) 1 chip
- IC 7400 (NAND) 2 chips

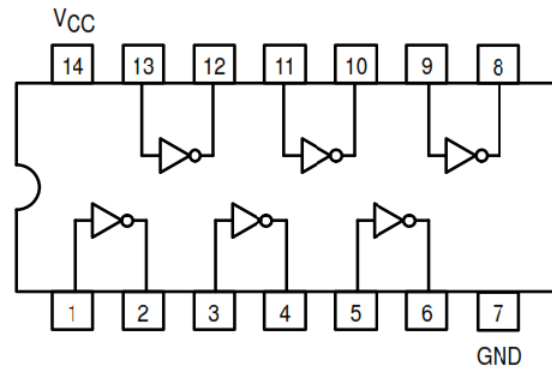
### Instructions

1. For your safety, unplug the power supply while you are building your logic circuits.
2. If you find the digital board operate incorrectly (i.e., LED lights are not turned on as they are supposed to be, etc), unplug the power supply. You may accidentally build a short circuit.

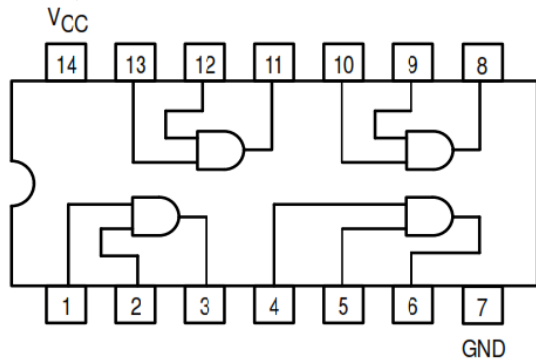
#### 7400



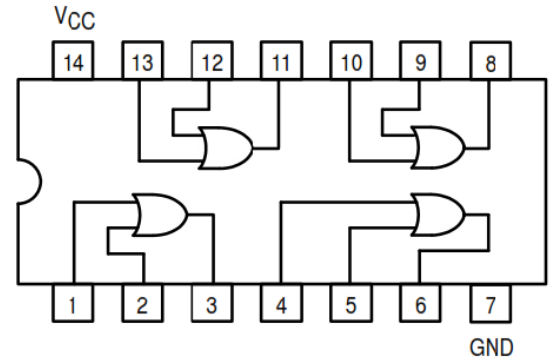
#### 7404



#### 7408



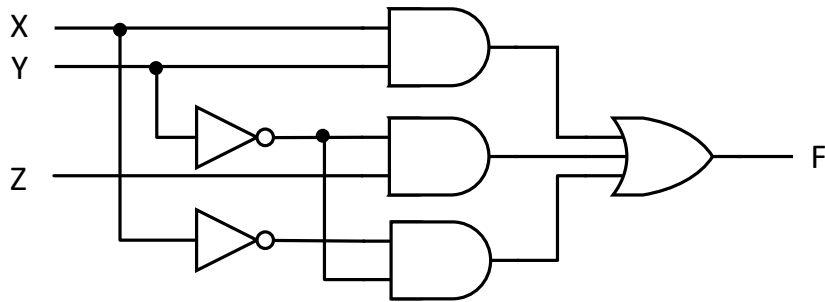
#### 7432



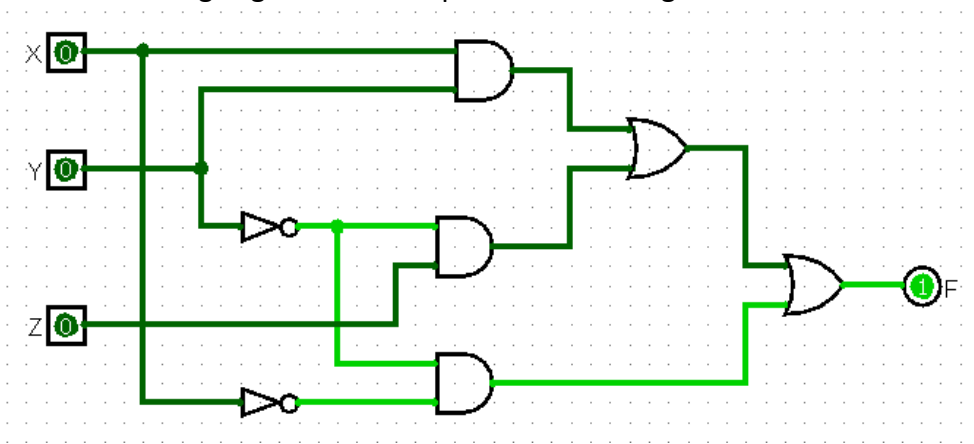
Pin assignments of the ICs

**EXE-1: Combinational Circuit Analysis**

We want to build a combinational circuit shown below.



This circuit can be drawn using Logisim with 2-input AND and OR gates as follows.



1.1 Simulate the truth table for this circuit (*Project -> Analyze Circuit -> Table*)

**Table 1.** Simulation results

X	Y	Z	F
0	0	0	
0	0	1	
0	1	0	
0	1	1	
1	0	0	
1	0	1	
1	1	0	
1	1	1	

1.2 Build this circuit on the digital board. Check your results to make sure that your circuit is working correctly and show it to the lab instructor.

Lab Instructor's Signature \_\_\_\_\_

## EXE-2: Designing A Half Adder Using Universal Gates (NAND)

A half adder is an arithmetic circuit that generates the sum of two bits as shown in Table 2.

**Table 2.** The truth table of a half adder

Input		Output	
A	B	C	S
0	0	0	0
0	1	0	1
1	0	0	1
1	1	1	0

The outputs S (sum) and C (carry) can be written as

$$S = \bar{A} B + A \bar{B}$$

$$C = A B$$

2.1 Use logisim to design this half adder using only NAND gates and verify the result.

2.2 Build this circuit on the digital board using only IC7400 (NAND) chips. Make sure that your circuit is working correctly and show it to the lab instructor.

Lab Instructor's Signature \_\_\_\_\_ Time: \_\_\_\_\_