Practice 1

BASIC CONCEPTS.
INTRODUCTION TO THE USE OF EQUIPMENT

Objectives:

The aim of this practice is that the students have a first contact with the lab and become familiar with the management of the basic instrumentation.

FIRST PART

Verification of the truth table of a NAND gate

Duration of practice: 2 hours

Instrumentation in the lab
- Power supply
- Digital multimeter
- Connectors

Material the student must bring

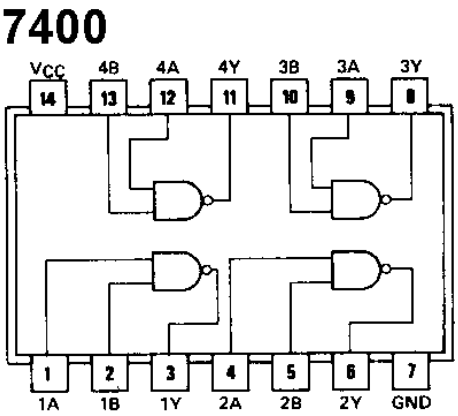
Common to all practices

The equipment needed (**per pair**) will be:
• Breadboard (placa de inserción)
• flat nose pliers (alicates de punta plana)
• Wire stripper, scissors (Electrician), wire cutters or similar (pelacables,, tijeras de elecrtricista)
• Small screwdriver (destornillador pequeño)
• Thin wire to connect components (without threads and rigid with the thickness suitable for insertion). (cable para conexión)

Specific to this practice

• Integrated circuit 7400: two-input NAND gates.
• LED.
• Two resistors of 1K and one of 2K2.
• Microswitchs.

Characteristics of CI 7400:



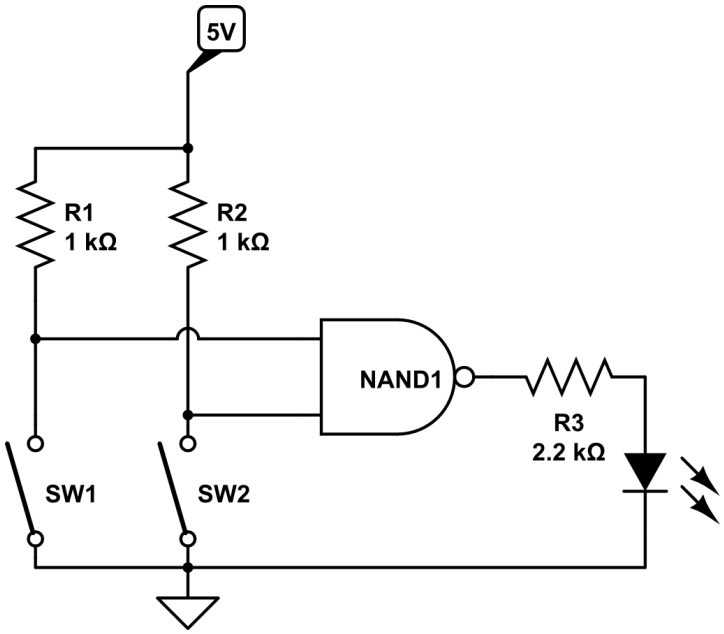
DC CHARACTERISTICS OVER OPERATING TEMPERATURE RANGE (unless otherwise specified)

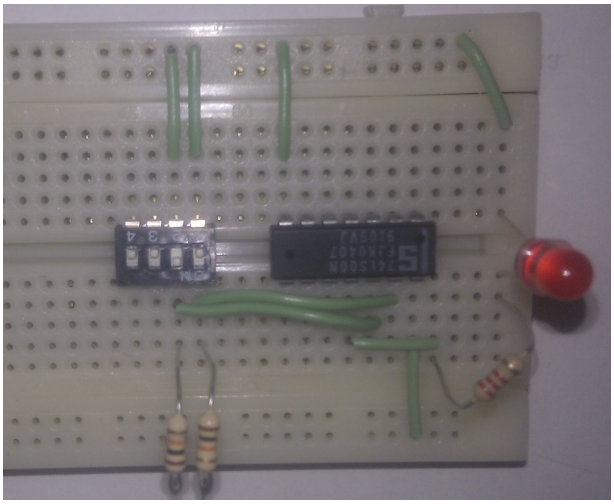
Symbol	Parameter	Limits			Unit	Test Conditions	
		Min	Typ	Max			
V_{IH}	Input HIGH Voltage	2.0			V	Guaranteed Input HIGH Voltage for All Inputs	
V_{IL}	Input LOW Voltage			0.8	V	Guaranteed Input LOW Voltage for All Inputs	
V_{IK}	Input Clamp Diode Voltage		−0.65	−1.5	V	V_{CC} = MIN, I_{IN} = −18 mA	
V_{OH}	Output HIGH Voltage	2.7	3.5		V	V_{CC} = MIN, I_{OH} = MAX, V_{IN} = V_{IH} or V_{IL} per Truth Table	
V_{OL}	Output LOW Voltage		0.25	0.4	V	I_{OL} = 4.0 mA	V_{CC} = V_{CC} MIN, V_{IN} = V_{IL} or V_{IH} per Truth Table
			0.35	0.5	V	I_{OL} = 8.0 mA	
I_{IH}	Input HIGH Current			20	μA	V_{CC} = MAX, V_{IN} = 2.7 V	
				0.1	mA	V_{CC} = MAX, V_{IN} = 7.0 V	
I_{IL}	Input LOW Current			−0.4	mA	V_{CC} = MAX, V_{IN} = 0.4 V	
I_{OS}	Short Circuit Current (Note 1)	−20		−100	mA	V_{CC} = MAX	
I_{CC}	Power Supply Current						
	Total, Output HIGH			1.6	mA	V_{CC} = MAX	
	Total, Output LOW			4.4			

Note 1: Not more than one output should be shorted at a time, nor for more than 1 second.

Practice Development:

For practical development we use the circuit shown in the following figure. The photograph is an indication to facilitate mounting components, do not follow exactly the assembly shown therein.





1. Assembly and performance

Assemble the previous circuit and verify the truth table of the NAND gate.

A	B	NAND
0	0	
0	1	
1	0	
0	0	

Measure the input and output voltages for the different values of the truth table.

A (Voltios)	B (Voltios)	NAND (Voltios)

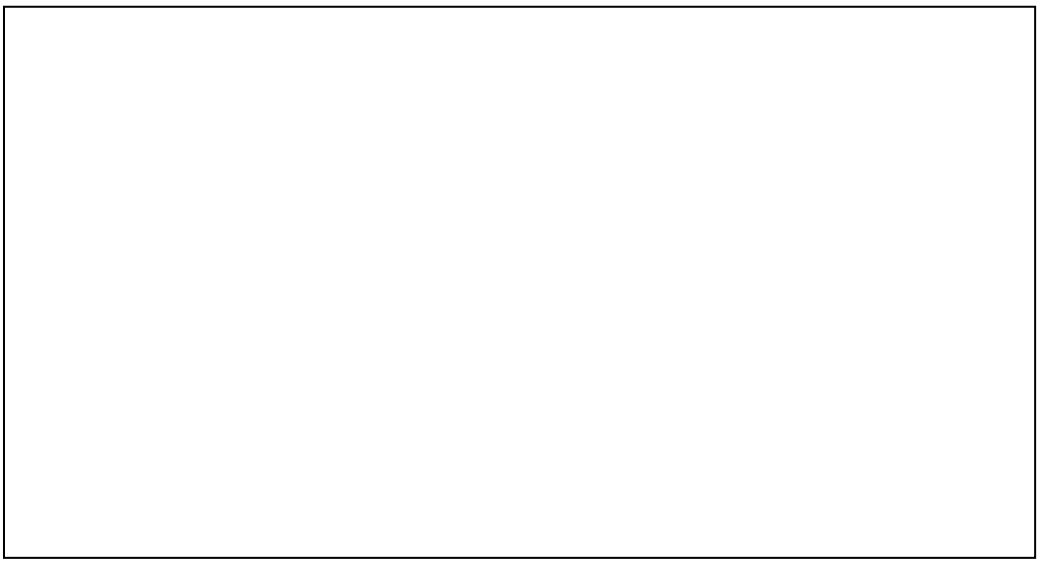
Verify that the LED intensity is in the ranges indicated by the characteristics.

SECOND PART
Functions with NAND gates

Duration of practice: 2 hours

1. 3-input NAND gate

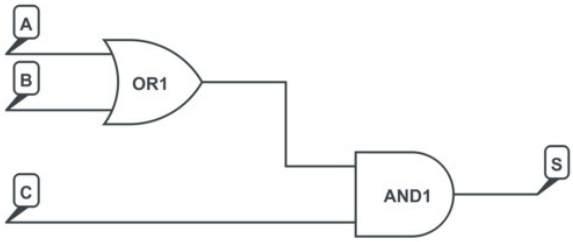
Making a 3-input NAND gate with two input NAND gates. Apply de Morgan laws. Assemble the circuit and verify the truth table.



A	B	C	NAND
0	0	0	
0	0	1	
0	1	0	
0	1	1	
1	0	0	
1	0	1	
1	1	0	
1	1	1	

2. logic Functions

Deduce the logic function performed by the following circuit.



Describe the truth table of the logic function.

A	B	C	S
0	0	0	
0	0	1	
0	1	0	
0	1	1	
1	0	0	
1	0	1	
1	1	0	
1	1	1	

Implement the logic function with NAND gates and check the truth table.