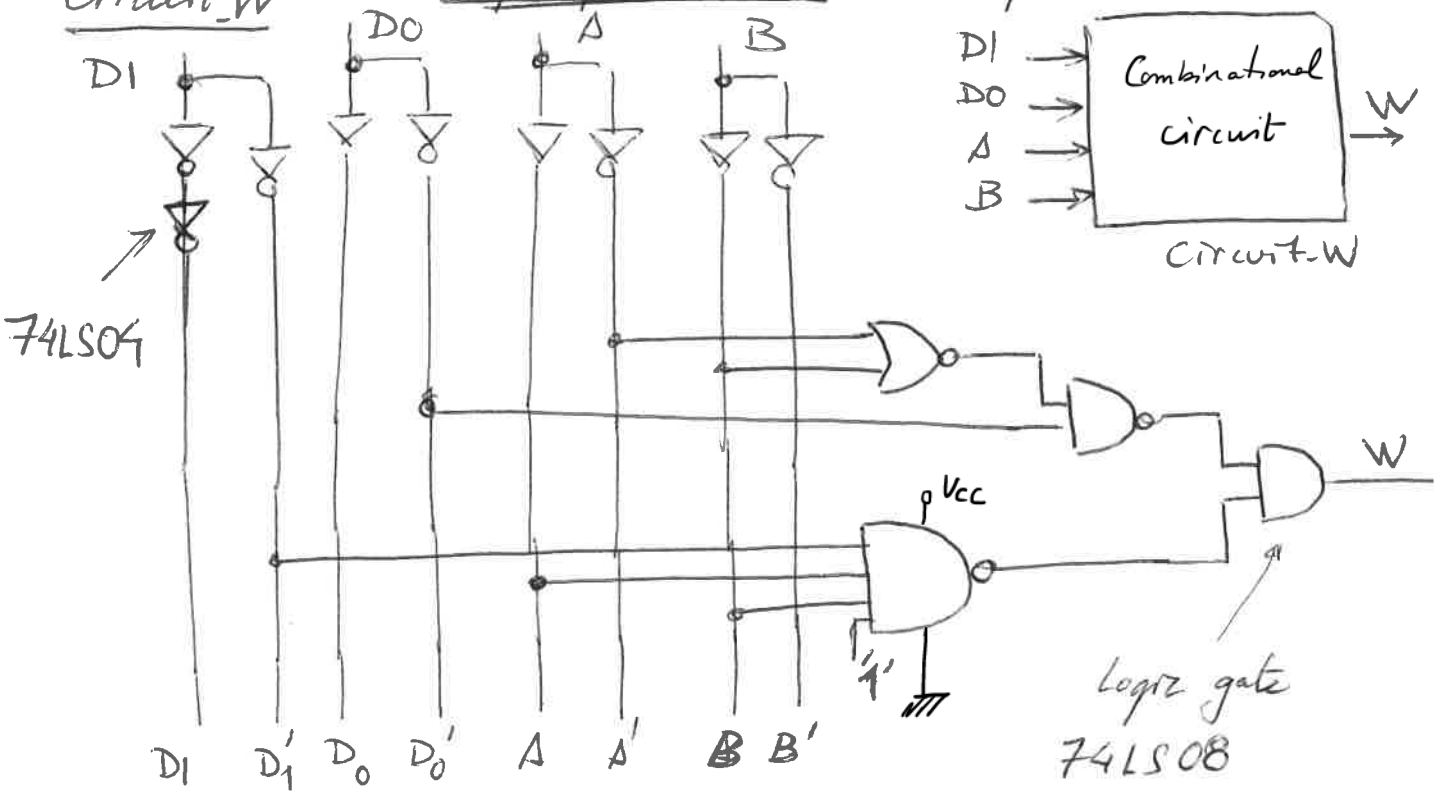
Tutorial on the analysis of a combinational circuit

1. Specifications and theory

Circuit_W



GND = 0V '0' Vcc = 5V '1'

Technology LS-TTL

→ Objective: Find the truth table using Proteus virtual laboratory simulator

$W = f(D_1, D_0, A, B)$

/ variables order

D1	D0	A	B	W
0	0	0	0	
0	0	0	1	
⋮	⋮	⋮	⋮	?
1	1	1	1	

Fill in all the values of the output W

→ Here you can add pages on theory on logic gates and their truth tables, equations and symbols

(This page of specifications can be used 3 times, only changing

Proteus simulation (Method I) by WolframAlpha engine (Method II) or algebraic equations (method III)

2. Planning → It is intended to learn about how to use Proteus

Circuit-W

This is for exposing the concepts and the detailed procedure to follow when developing

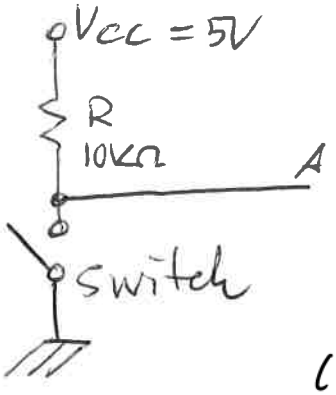
- Find a similar circuit in the web to copy and adapt
- Project folder C:\CSD\P1\Lab1_1\Circuit_W\Proteus\
- Modify the circuit editing gats and wires
- Run the simulation and apply all the combinational vectors from "0000" → "1111" annotate the output in table format (or sum of minterms
- Compare with your peers to check the result) or product of maxterms)

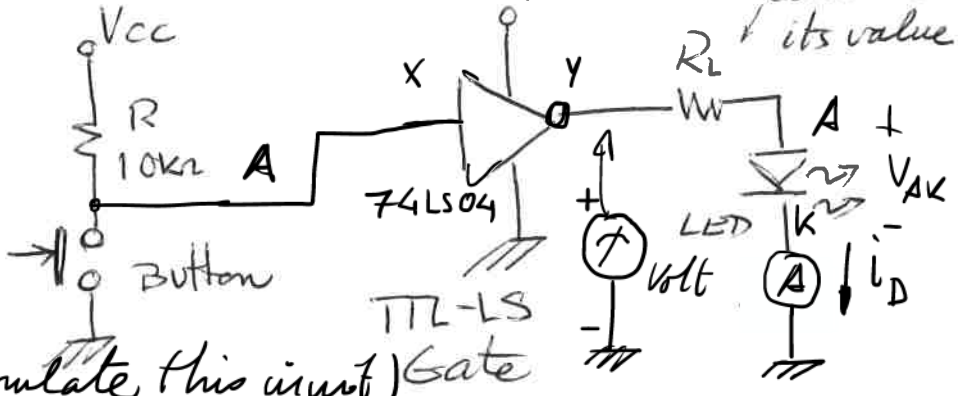
Truth table

D1	D0	A	B	W
0	0	0	0	?
!				⋮
1	1	1	1	?

Solve it using method III to study how algebraic functions work.

- Pay attention to logic families TTL, TTL-LS, HC, HCT,
- Find gates for family TTL-LS → Datasheet of a 74LS08
- Use LED and buttons to apply values and 'see' the outputs. Use a voltmeter to measure



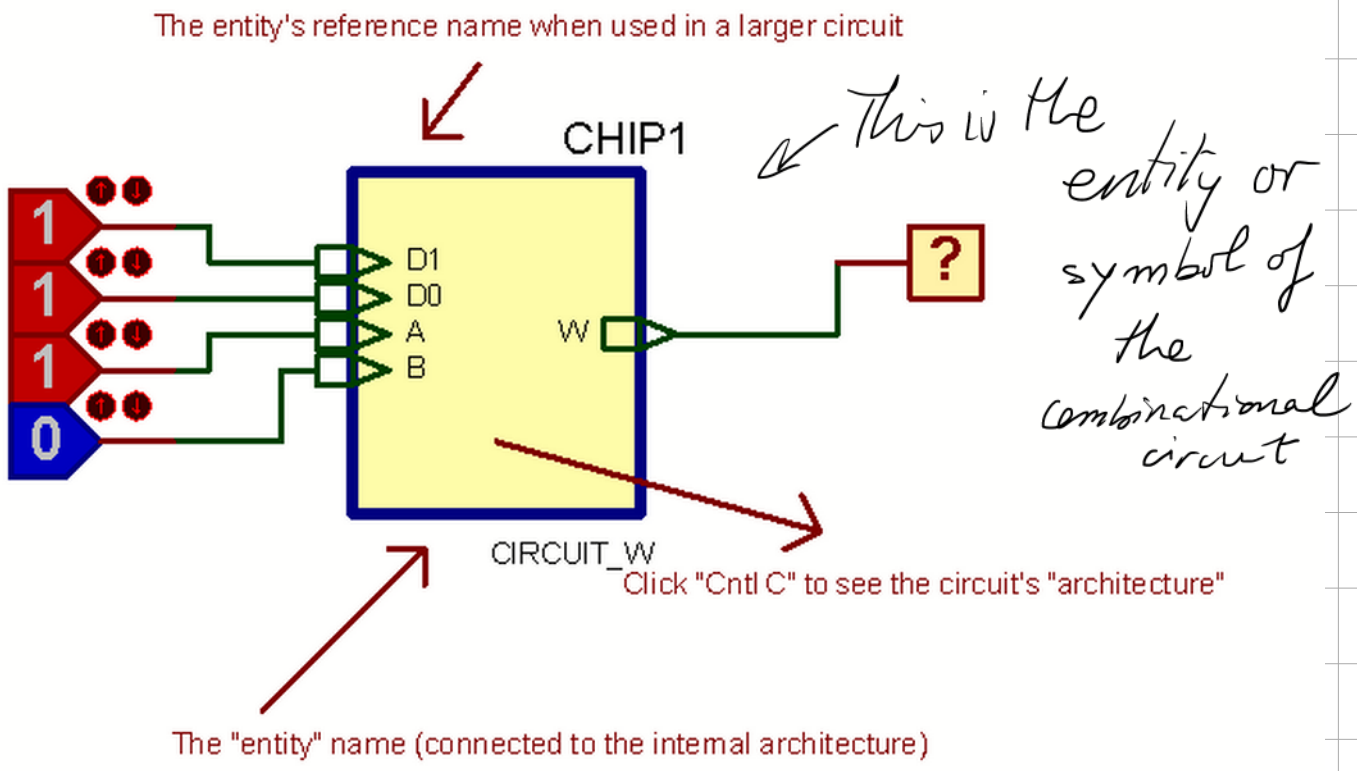


3. Development

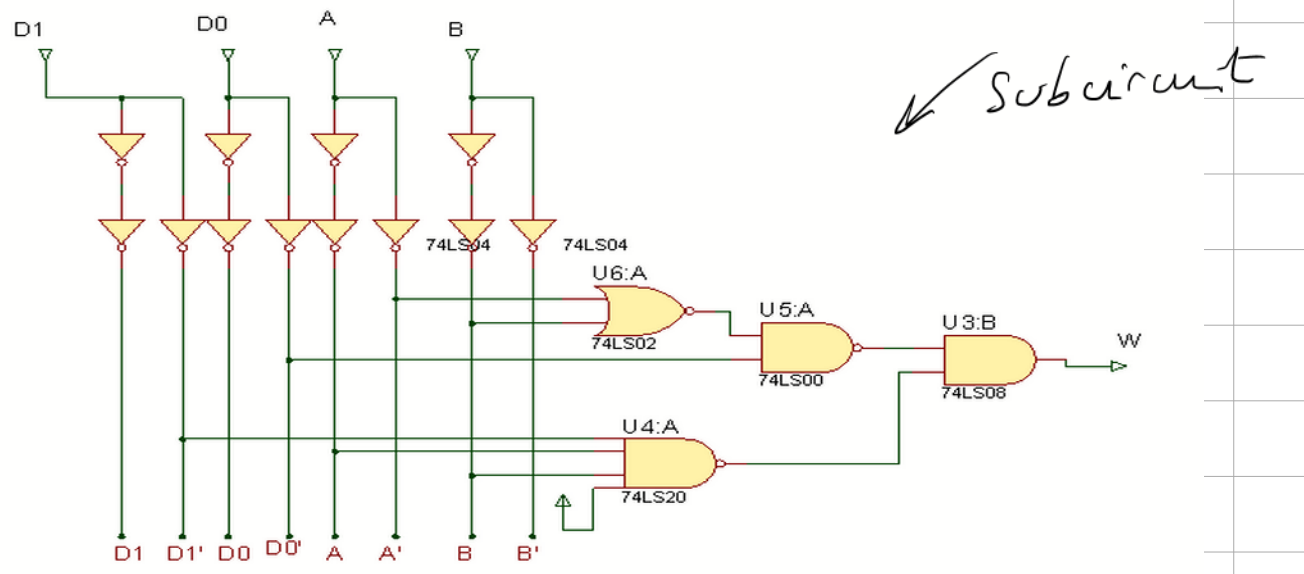
Here you must paste and comments pictures from the Proteus circuit capture

⇒ DO NOT COPY THE DEVELOPMENT FROM SOMEONE ELSE

⇒ DO IT ALL BY YOURSELF



This is the circuit's architecture captured in Proteus

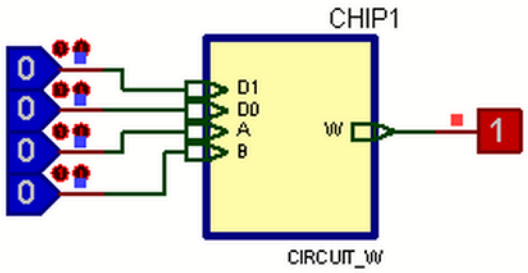


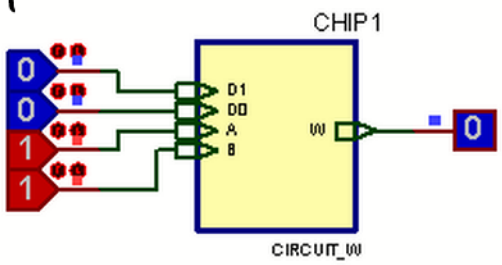
This is how the complete truth table is obtained
→ running simulations for all input combinations.

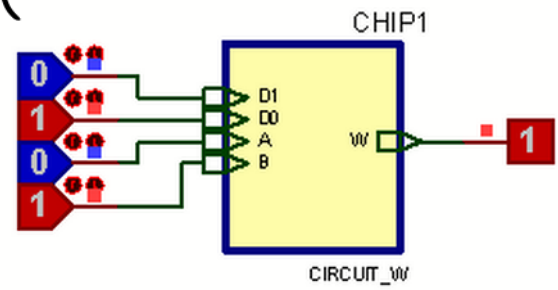
Decimal value		D_1	D_0	A	B	W
0	0	0	0	0	0	1
1	1	0	0	0	1	1
2	2	0	0	1	0	0
3	3	0	0	1	1	0
4	4	0	1	0	0	1
5	5	0	1	0	1	1
6	6	0	1	1	0	1
7	7	0	1	1	1	0
8	8	1	0	0	0	1
9	9	1	0	0	1	1
A	10	1	0	1	0	0
B	11	1	0	1	1	1
C	12	1	1	0	0	1
D	13	1	1	0	1	1
E	14	1	1	1	0	1
F	15	1	1	1	1	1

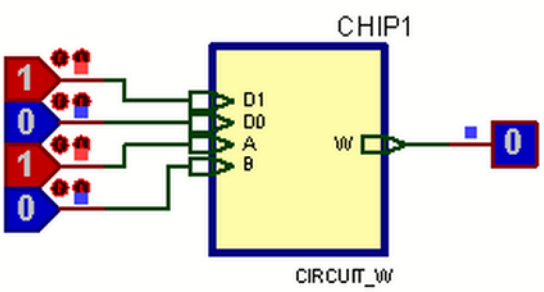
Hexadecimal value

all the combinations









$$W = f(D_1, D_0, A, B) = \prod_4 M(2, 3, 7, 10)$$

4. Test and verification

You can compare the truth table with other students in class, or with your own results from the analysis in WolframAlpha (method II) or the algebraic analysis using boolean equations (method III).

This method I solution is the same that I got from method III on algebraic equations ✓