Familiarization with exclusive OR (XOR) gate.

Exp No 3

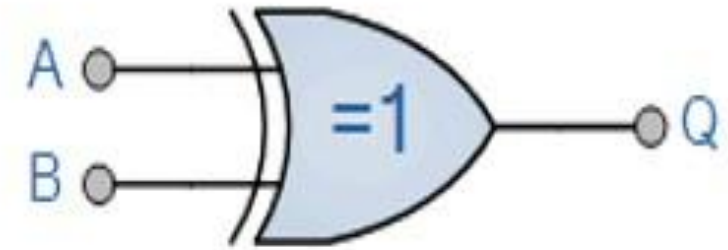
Objectives:

- Verify the operation of exclusive OR (XOR) gate using complete set.
- Verify the operation of exclusive OR (XOR) gate using IC7486 or IC4030.
- Construct three input XOR gate using only two input XOR gate.
- Construction of XOR gate using two input NAND gates .
- Construct two input XOR gate using only two input NAND gates and verify its property.
- Construct two inputs XOR gate using only two input NOR gates and verify its property.

Theory

Exclusive OR gate

ExOR Symbol / Truth Table

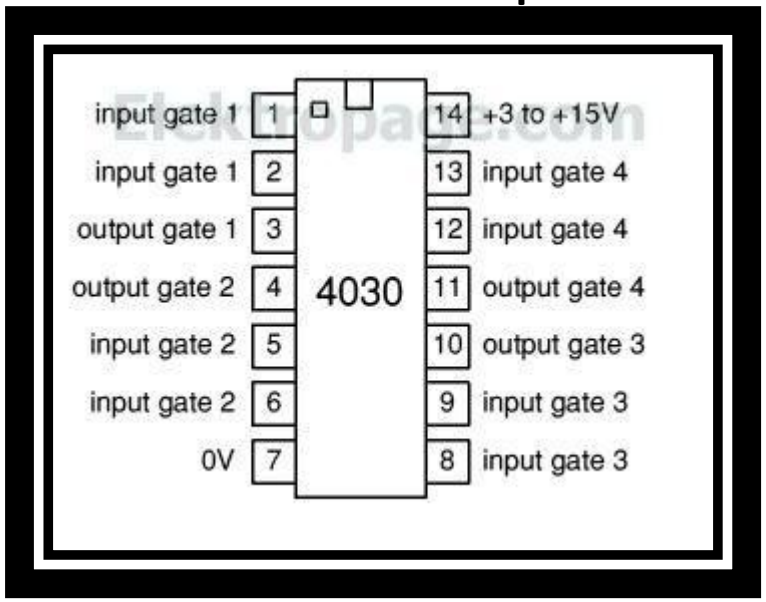
SYMBOL	TRUTH TABLE		
 2-input Ex-OR Gate	A	B	Q
	0	0	0
	0	1	1
	1	0	1
	1	1	0
Boolean Expression : Q = A.B'+ A'.B	A OR B but NOT BOTH gives Q		

Definition

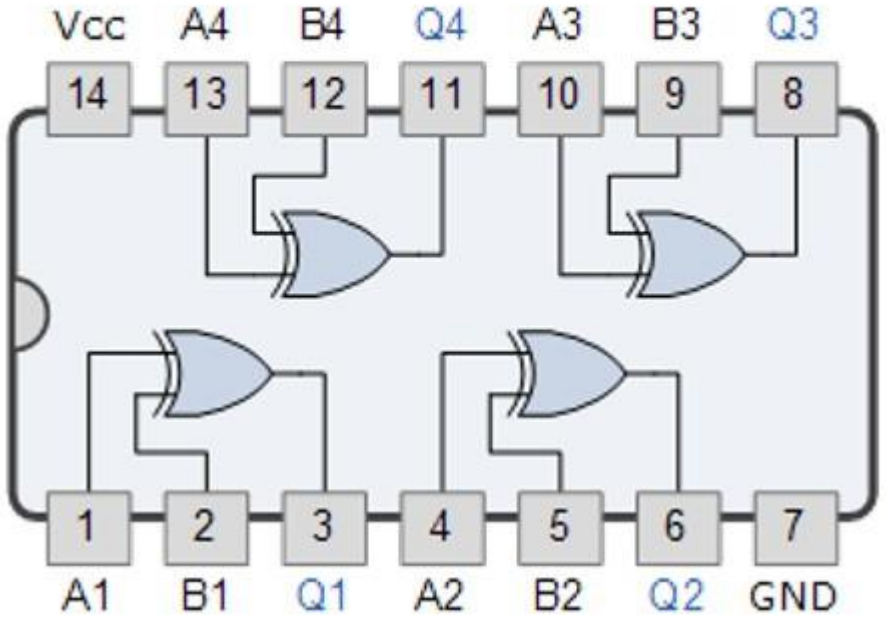
- ExOR gate is the logic gate whose output is high when its inputs are different (Regarding TWO inputs only).
- Otherwise It is defined as the logic gate whose output is high when there are odd numbers of 1’s at its inputs.
- The **Exclusive-OR** logic function is a very useful circuit that can be used in many different types of computational circuits.
- The two-input “Exclusive-OR” gate is basically a modulo two adder, since it gives the sum of two binary numbers.

Commonly available digital logic Exclusive-OR gate IC's include:

- **TTL Logic Ex-OR Gates**
- 74LS86 Quad 2-input
- **CMOS Logic Ex-OR Gates**
- CD4030 Quad 2-input



7486 Quad 2-input Exclusive-OR Gate



EQUIPMENTS AND COMPONENTS REQUIRED:

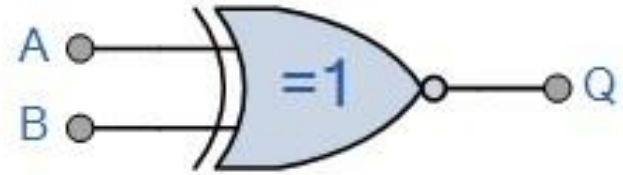
- PC with proteus installed.
- Digital logic trainer which contains:

a) Power supply unit.
b) SPDT switches and LED’s.
c) Quad two input OR gate (7432) – 1 pc.
d) Quad two input AND gate (7408) – 1 pc.
e) Quad two input X-OR gate (4030) – 1 pc.
f) Hex inverter (7404)
g) Quad two input NAND gate (7400) – 1 pc.
h) Quad two input NOR gate (7402) – 1 pc.
i) Required number of connecting wires.

Familiarization with exclusive NOR (XNOR) gate.

- Verify the operation of exclusive NOR (XNOR) gate using IC 4077.
- Construct two inputs XNOR gate using only two input NAND gate and verify its property.
- Construct two inputs XNOR gate using only two input NOR gate and verify its property.

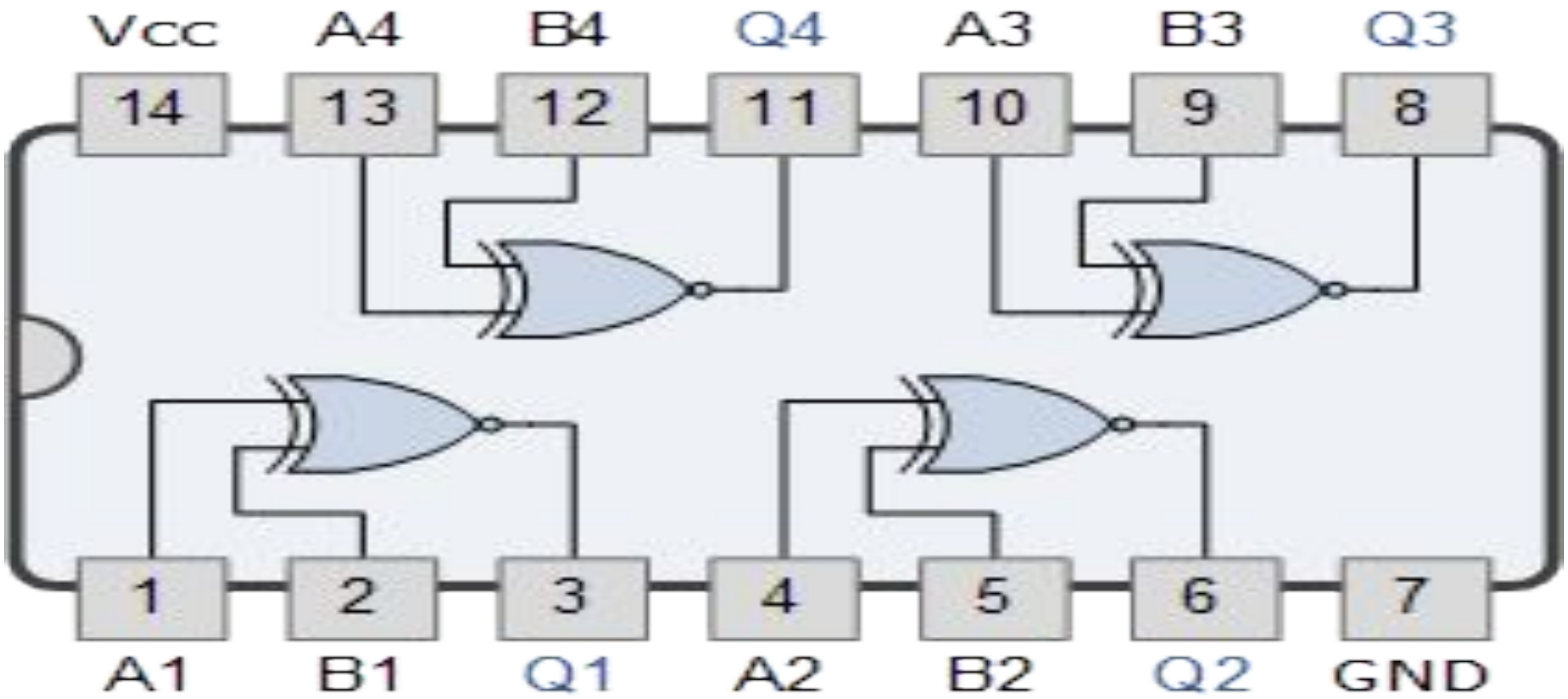
ExNOR Symbol / Truth Table

SYMBOL	TRUTH TABLE		
 2-input Ex-NOR Gate	A	B	Q
	0	0	1
	0	1	0
	1	0	0
	1	1	1
Boolean Expression : Q = A'.B'+ A.B	A OR B but NOT BOTH gives Q		

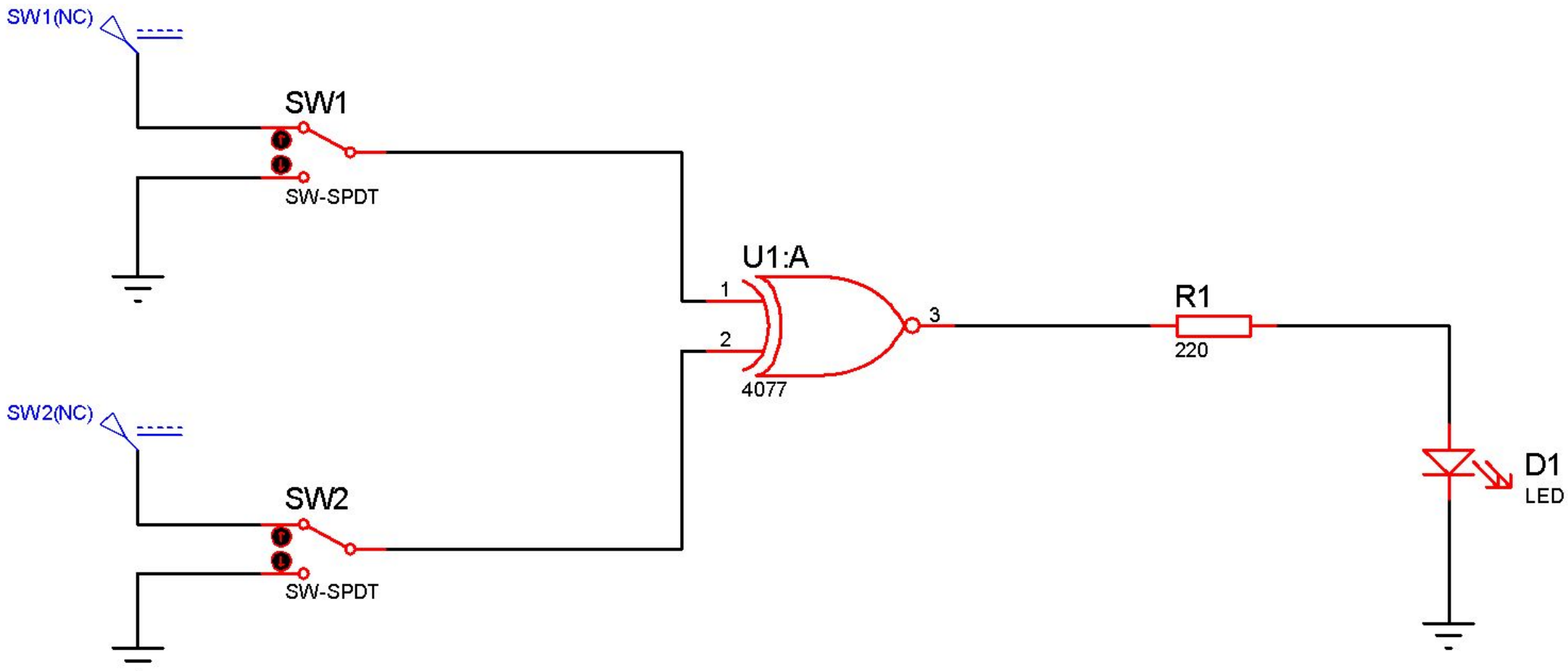
EXNOR gate Definition

- The output of a digital logic Exclusive-NOR gate only goes “HIGH” when its two input terminals, A and B are at the “same” logic level .
- which can be either at a logic level “1” or at a logic level “0”.
- In other words, an even number of logic “1’s” on its inputs gives a logic “1” at the output, otherwise is at logic level “0”.
- The logic symbol for an Exclusive-NOR gate is simply an Exclusive-OR gate with a circle or “inversion bubble”, (A⊙B) at its output to represent the NOT function.

4077 Quad 2-input Ex-NOR Gate



Verification of X-NOR using 4077 IC.



Construction of three input XOR gate using only two input XOR gates.

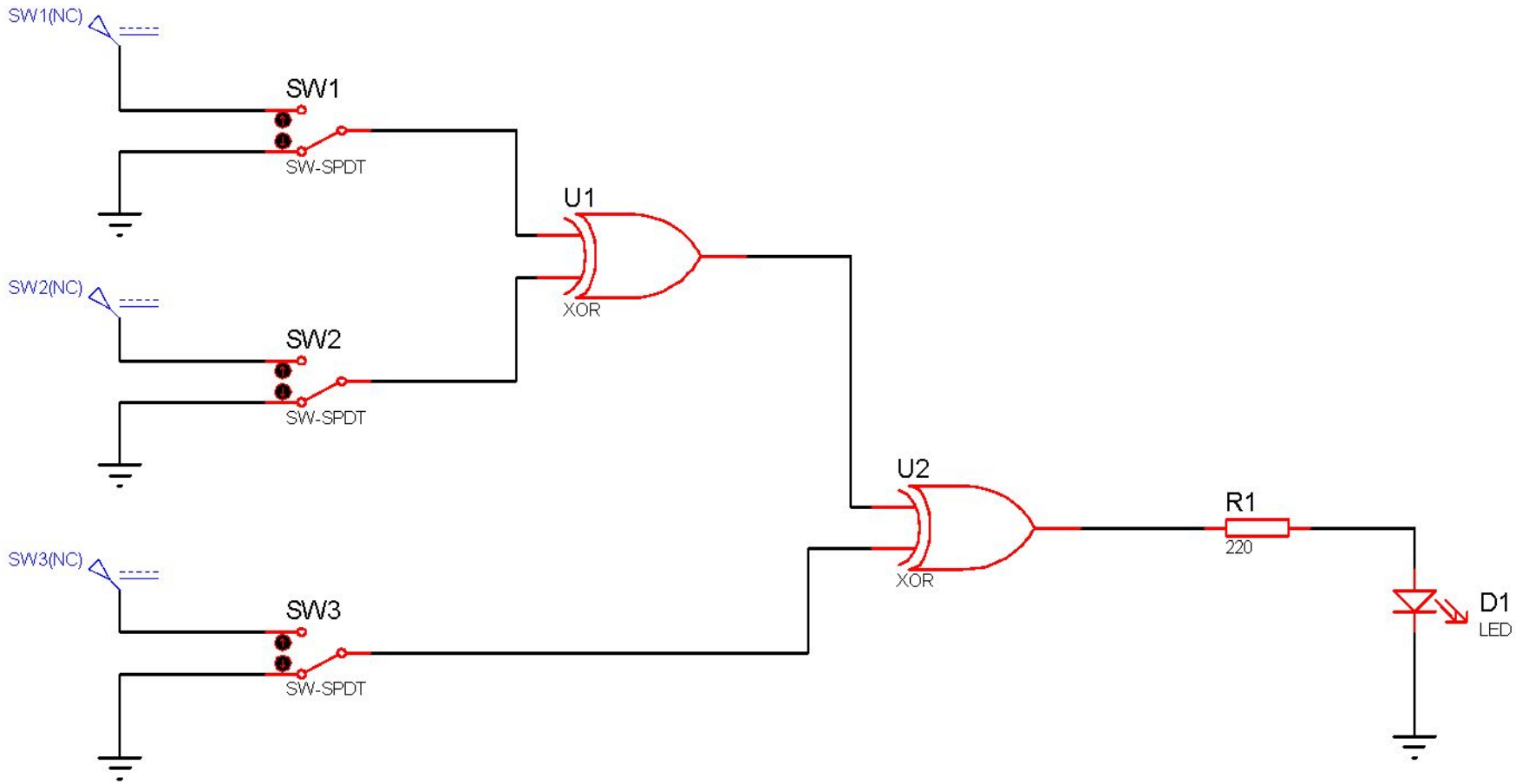


Table for three input XOR

SW1	SW2	SW3	LED
OFF	OFF	OFF	OFF
OFF	OFF	ON	ON
OFF	ON	OFF	ON
OFF	ON	ON	OFF
ON	OFF	OFF	ON
ON	OFF	ON	OFF
ON	ON	OFF	OFF
ON	ON	ON	ON

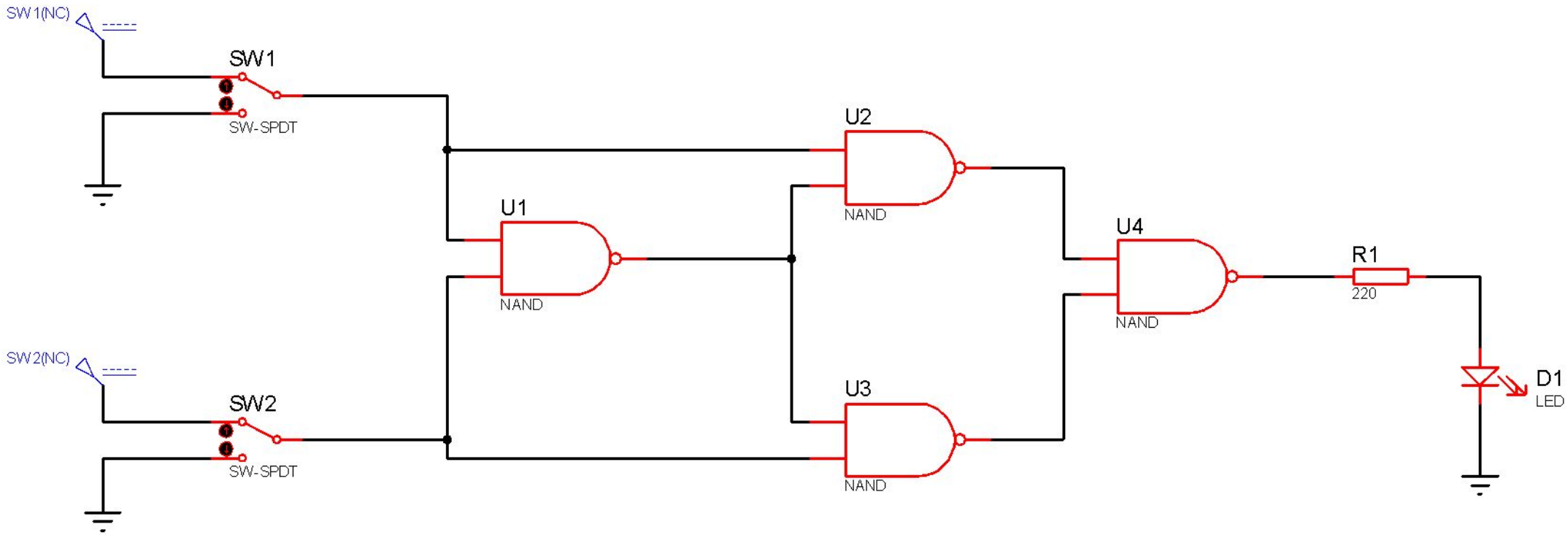
Familiarization with exclusive NOR (XNOR) gate.

- Verify the operation of exclusive NOR (XNOR) gate using IC 4077.
- Construct two inputs XNOR gate using only two input NAND gate and verify its property.
- Construct two inputs XNOR gate using only two input NOR gate and verify its property.

Expression for XOR realizing by NAND (least)

- $=A \oplus B$
- $= (A \odot B)'$
- $= (A'B' + AB)'$
- $= (A'B')' . (AB)'$
- $=(A + B) (AB)'$
- $=\{ A (AB)' + B (AB)' \}$
- $=\{ A (AB)' + B (AB)' \}''$
- $=[\{ A (AB)'\}'.\{ B (AB)'\}']'$

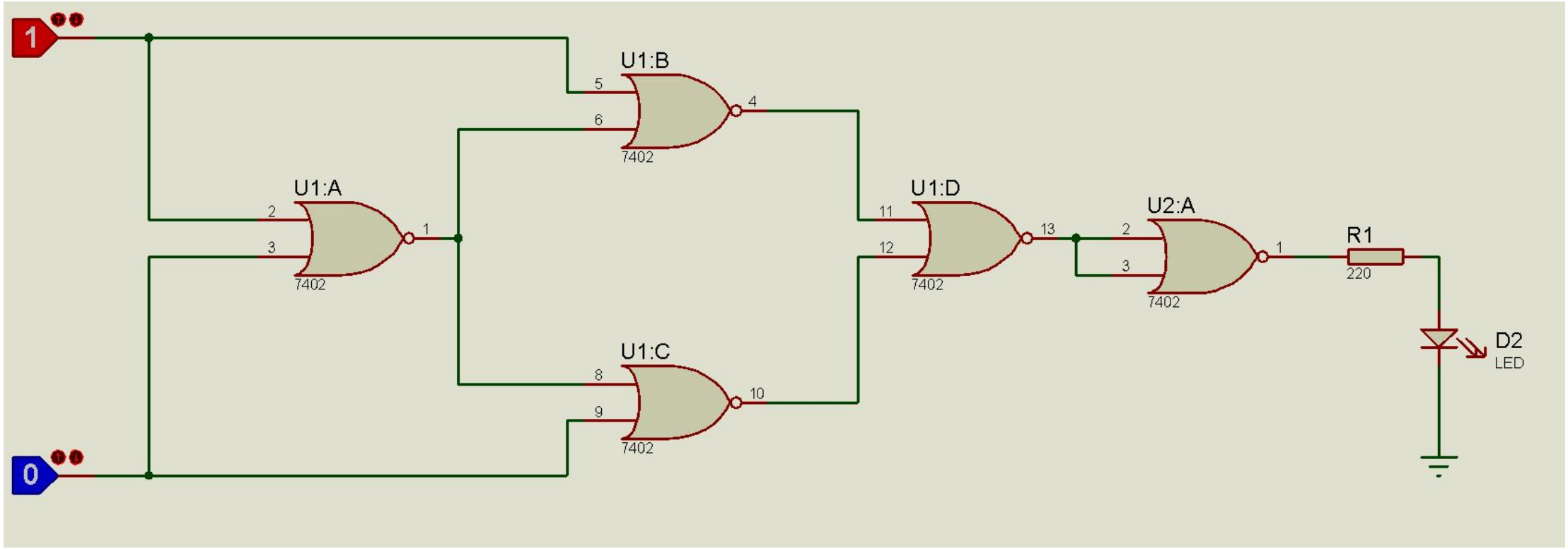
Practical Diagram to realize XOR using NAND



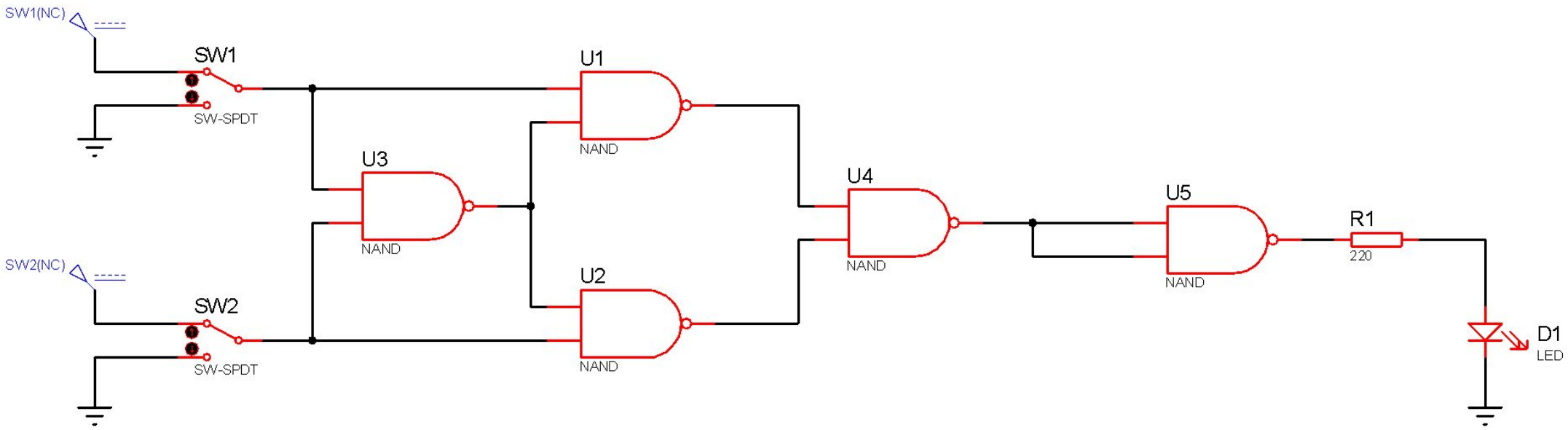
Expression for XOR realizing by NOR (least)

- =A⊕B
- = (A⊙B)’
- = (A’B’ + AB)’
- = (A’B’)’ . (AB)’
- = (A + B) (AB)’
- = (A+B) (A’+B’)
- = {A’(A+B)+B’(A+B)}
- = {A’(A+B)}’’+{B’(A+B)}’’
- = {A+(A+B)’}’+{B+(A+B)’}’
- = [{A+(A+B)’}’+{B+(A+B)’}’]’’

Practical Diagram to realize XOR using NOR



Construction of two input XNOR using only NAND gates and verify its property.



Familiarization with parity bits.

- To construct and verify 3 bit even parity generator.
- To construct and verify 3 bit odd parity generator.
- To construct and verify 3 bit even parity checker.
- To construct and verify 3 bit odd parity checker.