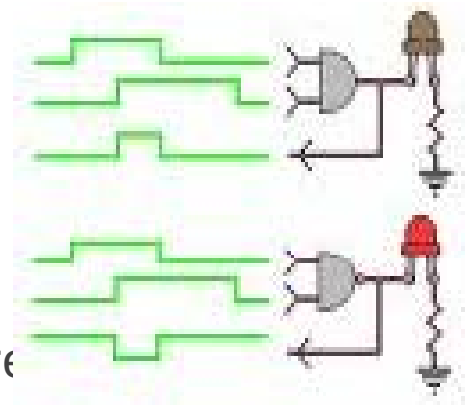
# BASIC LOGIC GATES

PRESENTATION OF THE PROJECTX-FINAL LEVEL 1.

# GENERAL DESCRIPTION

- **Title of the ProjectX**
- **BASIC LOGIC GATES**
- **Core area**
- GENERAL / KNOWLEDGE: Electronics
- PARTICULAR / ACTIVITY: Assembly, Measure
- **Promoting school**
- Meram Vocational and Technical High School
- **Schools participants in the revision of the ProjectX**
- Valdorio (Portugal)
- University of Pitesti (Romania)
- **Level of the students (according to EQF) - [see Europass supplement certificate]**
- EQF LEVEL 2



# Learning Outcomes achieved (to be developed in the future related with ECVET credit system)

- 1. Understand binary number system.
- 2. Understand basic logic gates symbol and truth table.
- 3. Be able to apply simple circuits using basic logic gates.
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- **Time that is necessary to do the ProjectX (in hours)**
- Theory:8
- Practice: 20
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- **Link to real companies in your region (it is just informative)**
- NAME: Teknomiks WORKPLACE: Digital Laboratory

# Understand decimal, binary, hexadecimal number systems and Bolean Algebra, basic logic IC.

- Numbering Systems

- Speculation is that origin of the base 10 system is the fact that human beings have 10 fingers.
- Humans use base 10 (*decimal*) arithmetic, and computers use the base 2 (*binary*) system.
- **In base 10** are 10 distinct symbols, 0, 1, 2, ...9.
- **In base 2** there are only two symbols, the binary digits 0 & 1 - commonly referred to as *bits.*
  - The binary system is used in computers because 0 & 1 represent the two voltage levels of *off* & *on*.
- Base 16, or the *hexadecimal* system is a convenient representation of binary numbers, using 16 digits.
  - The first ten digits, 0 to 9, are the same as in decimal. For the remaining six digits, letters A, B, C, D, E, and F are used.
    - (1453 )10 = (10110101101) 2 = (5AD) 16

# Understand decimal, binary, hexadecimal number systems and Bolean Algebra, basic logic IC.

## Boolean Algebra

Boolean functions have arguments that take two values ({T,F} or {1,0}) and they return a single or a set of ({T,F} or {1,0}) value(s).

Boolean functions can always be represented by a table called a "Truth Table"

Boolean Functions: NOT, AND, OR, XOR,...

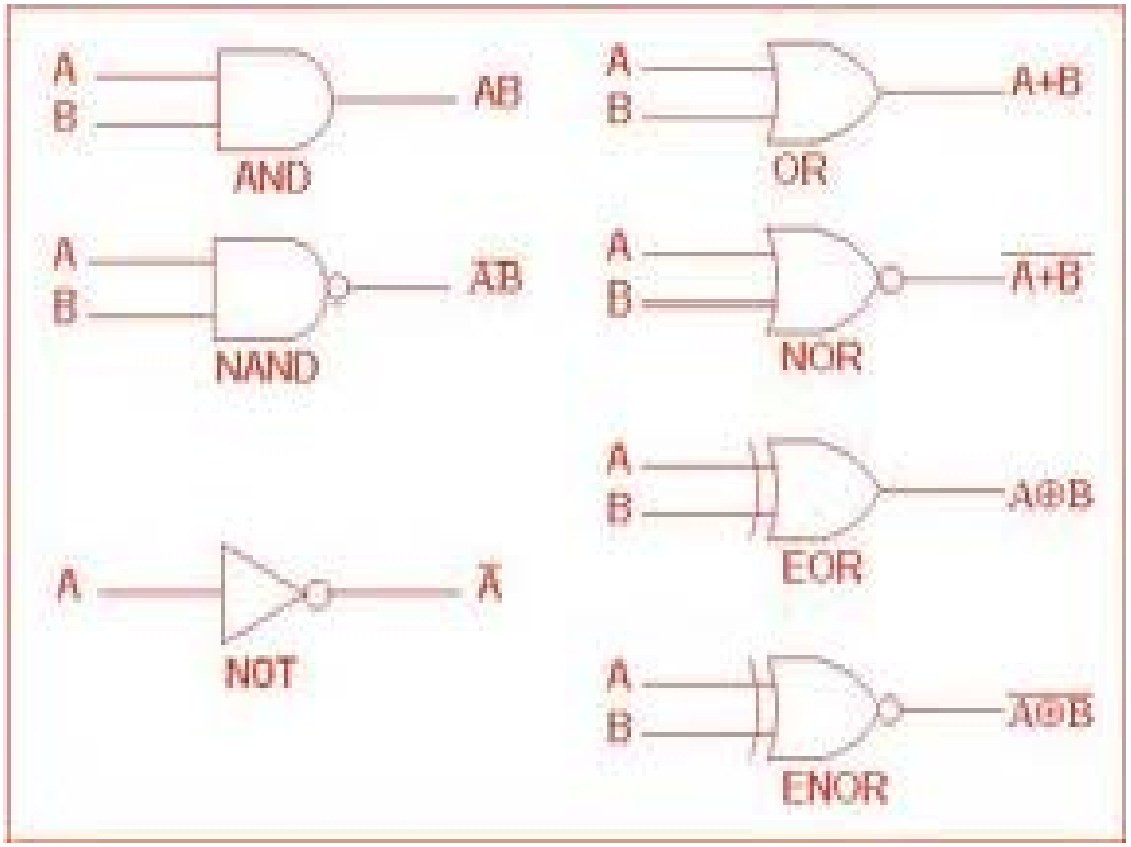
Boolean Algebra Notation : NOT (* or . ), OR (+) NOT (- or ~ )

It can be evaluated the Boolean expression with all possible argument values to construct a truth table.

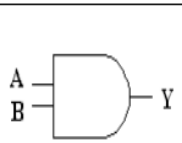
Boolean expressions can be simplified by using the following rules

- A*A = A
- A+A = A
- A*B = B*A
- A* 0 = 0
- A+0 = A
- A*(B+C) = (B+C)*A = A*B + A*C
- A*1 = A
- A+1 = 1
- A*~A = 0
- A+~A = 1

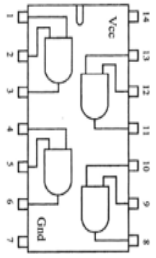
# Understand basic logic gates symbols, TTL ICs and truth tables.



# Understand basic logic gates symbols, TTL ICs and truth tables

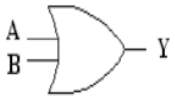



$Y = A\,B$

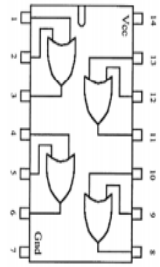



7408 – Quad 2-input AND gate

| A | B | Y |
|---|---|---|
| 0 | 0 | 0 |
| 0 | 1 | 0 |
| 1 | 0 | 0 |
| 1 | 1 | 1 |

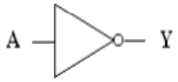



$Y = A + B$

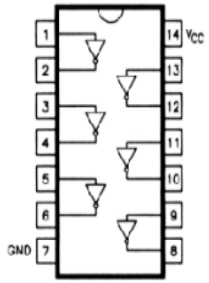



7432 – Quad 2-input OR gate

| A | B | Y |
|---|---|---|
| 0 | 0 | 0 |
| 0 | 1 | 1 |
| 1 | 0 | 1 |
| 1 | 1 | 1 |

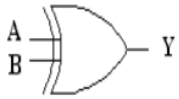



$Y = \overline{A}$

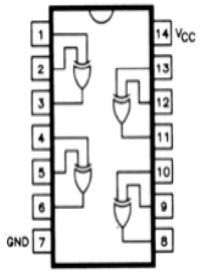



7404 – HEX INVERTER

| A | Y |
|---|---|
| 0 | 1 |
| 1 | 0 |




$Y = A\overline{B} + \overline{A}B$

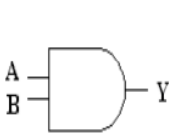


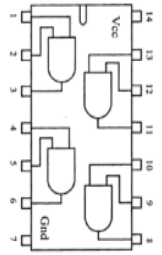

7486 – Quad 2-input XOR gates

| A | B | Y |
|---|---|---|
| 0 | 0 | 0 |
| 0 | 1 | 1 |
| 1 | 0 | 1 |
| 1 | 1 | 0 |

# Understand basic logic gates symbols, TTL ICs and truth tables.

*A) AND GATE*



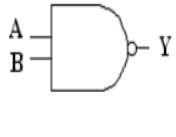



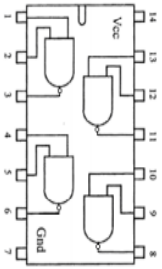

7408 – Quad 2-input AND gate

| A | B | Y |
|---|---|---|
| 0 | 0 | 0 |
| 0 | 1 | 0 |
| 1 | 0 | 0 |
| 1 | 1 | 1 |

*B) NAND GATE*

- *Complement of an AND gate (NOT-AND)*



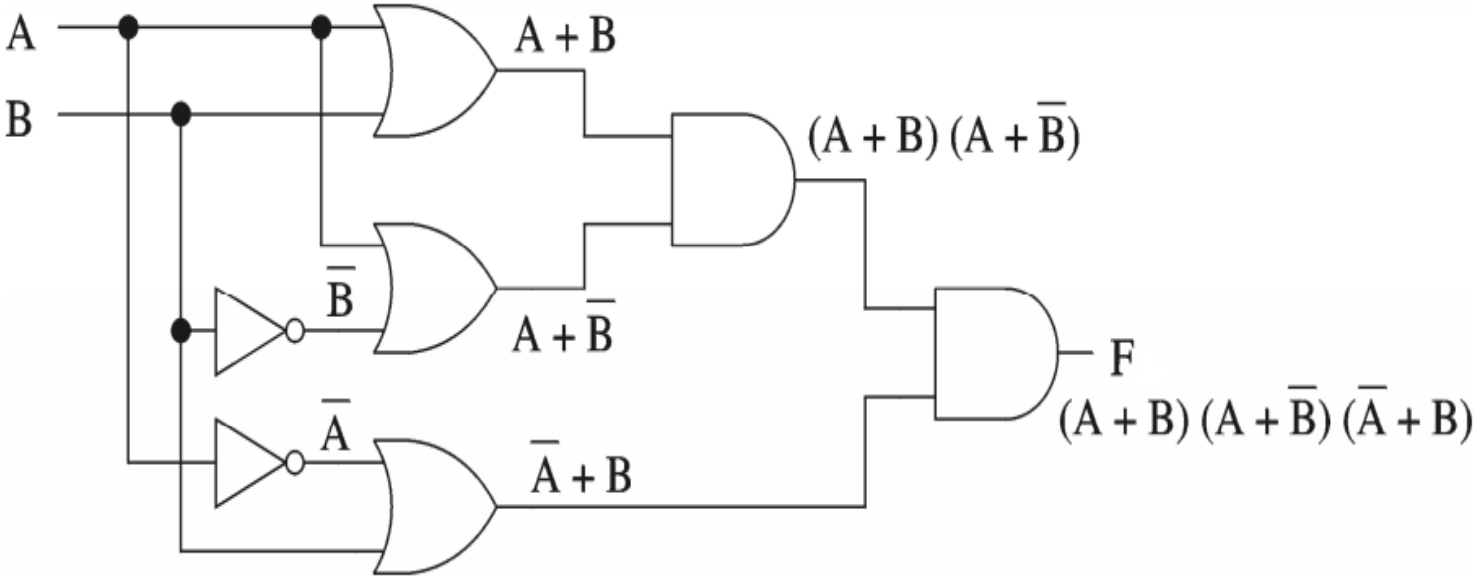




7400 – Quad 2-input NAND gate

| A | B | Y |
|---|---|---|
| 0 | 0 | 1 |
| 0 | 1 | 1 |
| 1 | 0 | 1 |
| 1 | 1 | 0 |

# Be able to obtain the function of logic circuit with basic logic gates

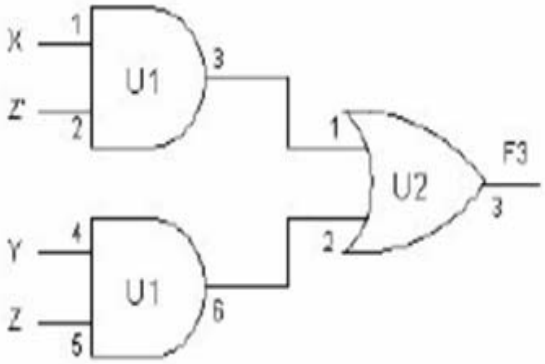
- F=(A+B)(A+~B)(~A+B)
- The function of logic circuit (F) can be drawn with basic logic gates



# Be able to apply simple circuits using basic logic gates.

F3= YZ + XZ'

Logic diagram




Layout diagram - position on the breadboard