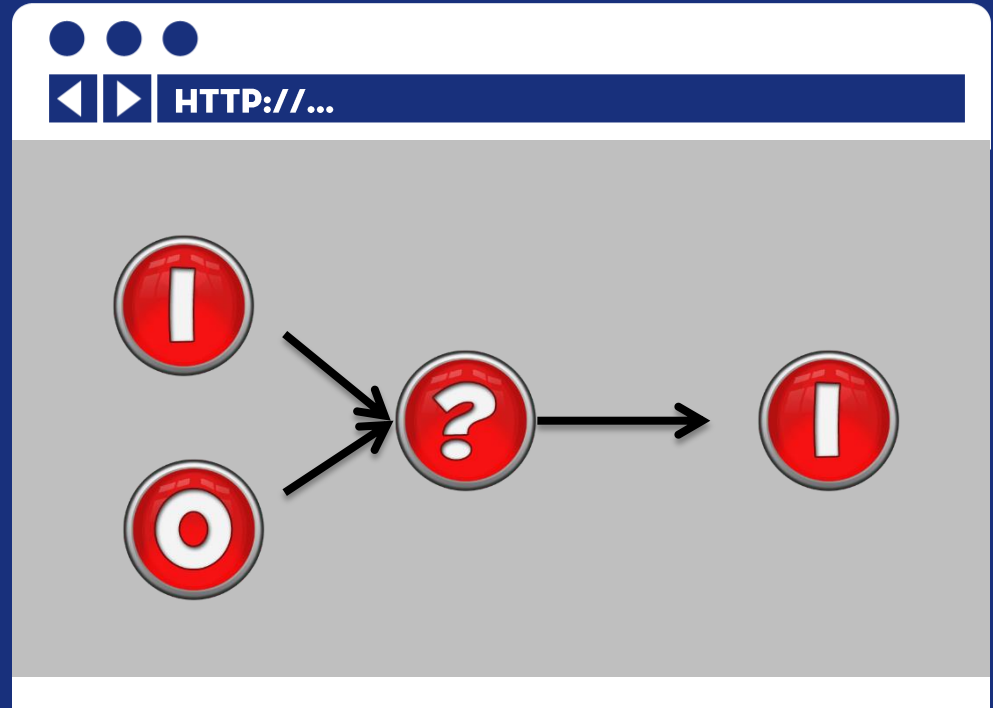


LOGIC GATES

WHAT IS IT?

PERFORMS BOOLEAN OPERATIONS

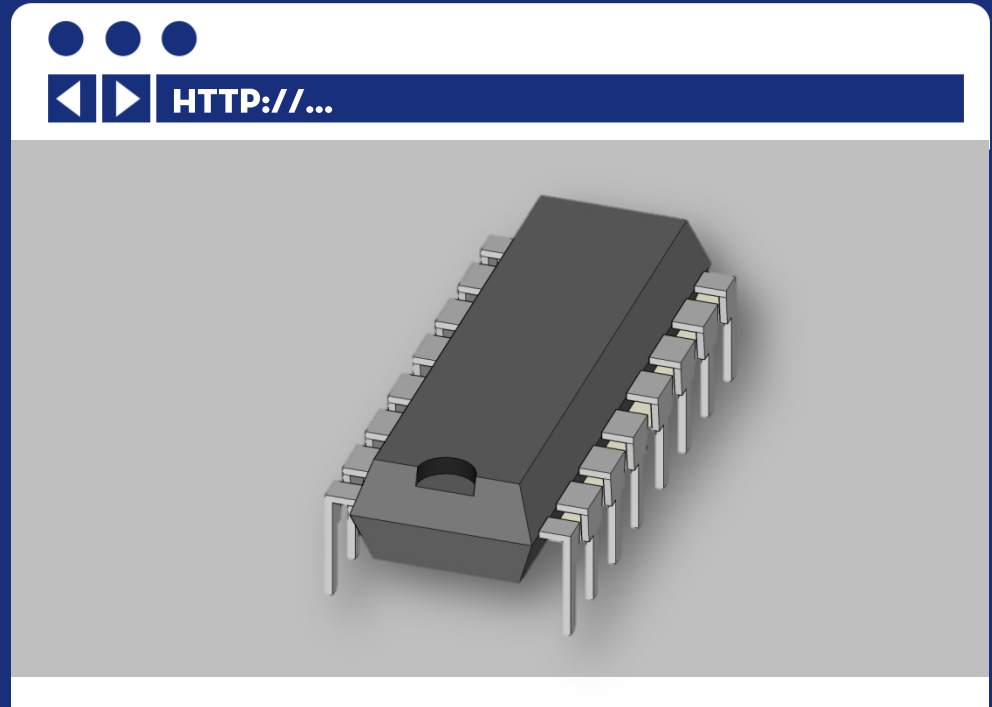
- TAKES ONE OR MORE LOGICAL INPUTS (1 OR 0) AND OUTPUTS A LOGIC RESULT (1 OR 0)
- DIFFERENT GATES PERFORM DIFFERENT OPERATIONS



APPEARANCE

STANDARD IC SHAPE

- PINS IN PARALLEL LINE ON A BLACK RECTANGULAR PACKAGE
- IDENTIFY ORIENTATION WITH “NOTCH” OR “DIMPLE”
- ORIENT SO NOTCH OR DIMPLE IS ON THE LEFT

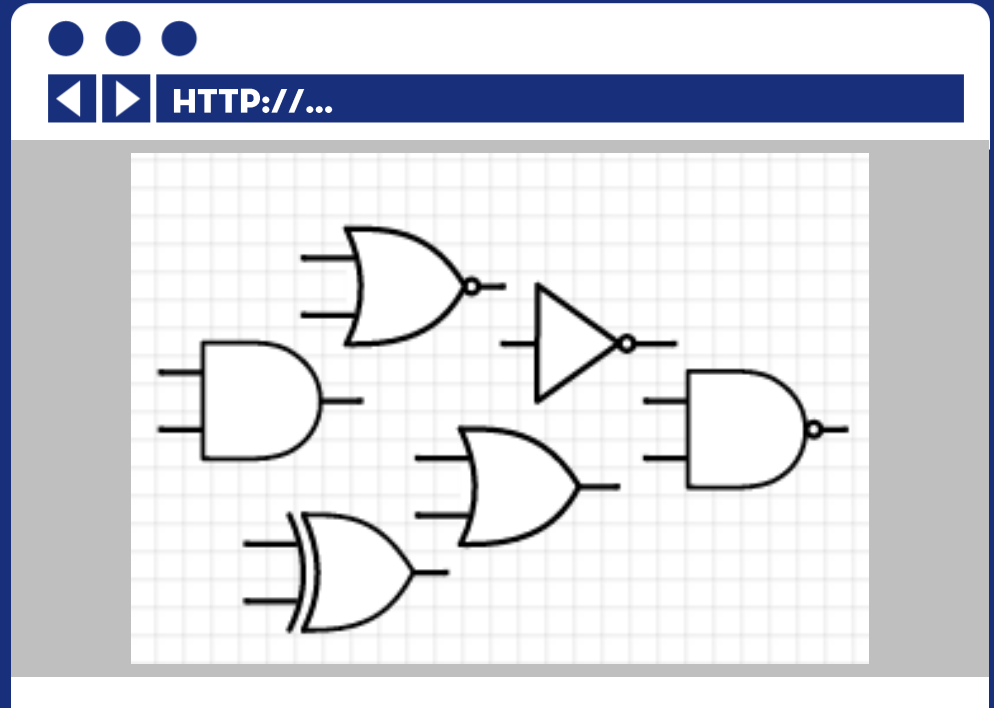


THE BASIC GATES

6 OF THEM

- NOT
- AND
- OR
- XOR
- NAND
- NOT

- MOST TAKE TWO INPUTS
- NOT GATE ONLY TAKES ONE INPUT

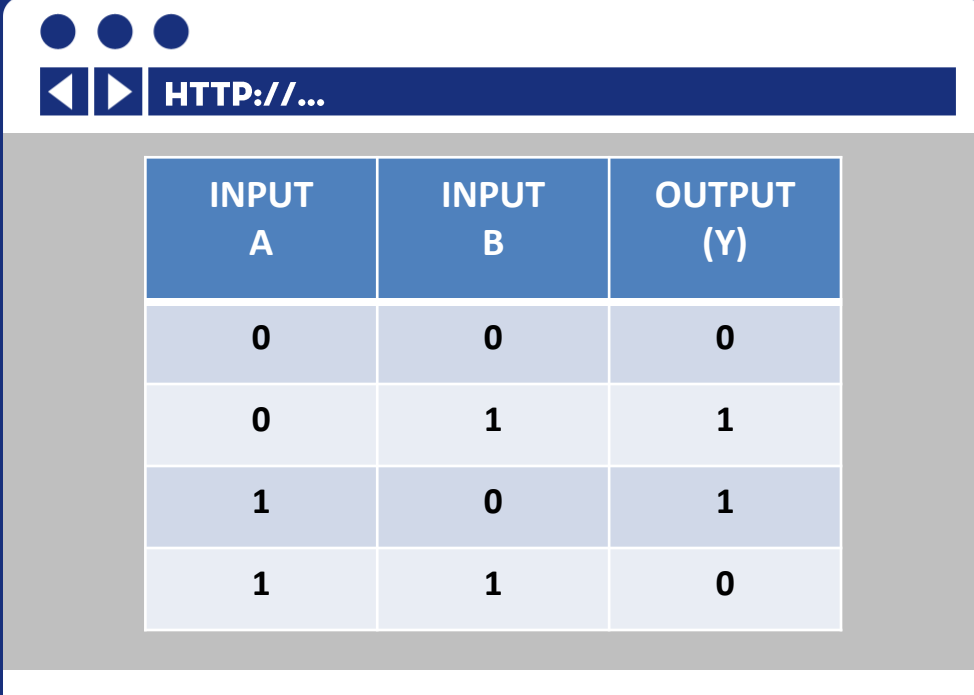


TRUTH TABLES

COMPUTER ENGINEERS DO!

▪ A TRUTH TABLE IS A COMPACT WAY TO SUMMARIZE HOW A PARTICULAR BOOLEAN OPERATION WORKS.

▪ INPUTS ARE LISTED WITH THEIR OUTPUTS TO SHOW WHAT TO EXPECT WITH THAT OPERATION.



INPUT A	INPUT B	OUTPUT (Y)
0	0	0
0	1	1
1	0	1
1	1	0

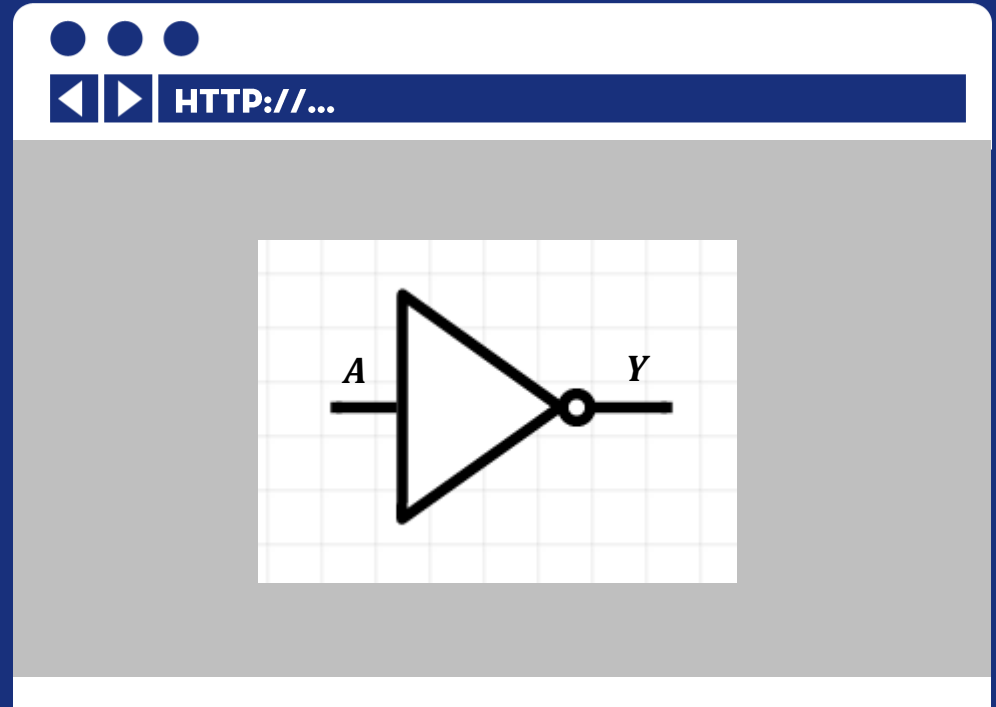
THE NOT GATE

NOT

▪THE NOT GATE SIMPLY OUTPUTS THE OPPOSITE OF WHATEVER IS BEING INPUTTED.

▪ALSO CALLED AN INVERTER

INPUT A	OUTPUT (Y)
0	1
1	0

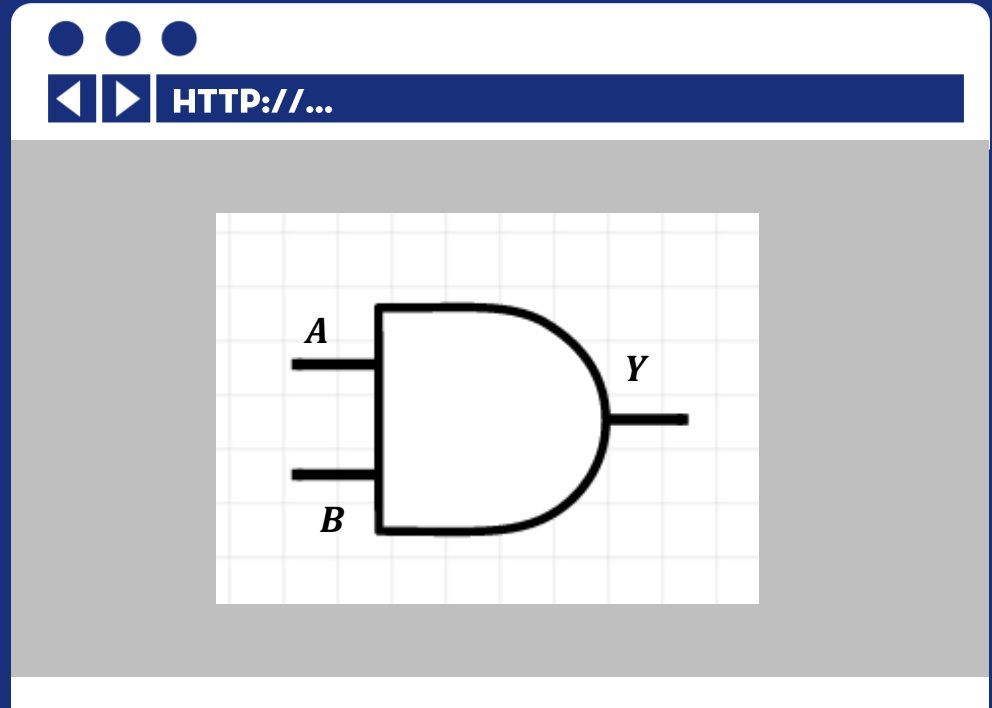


THE AND GATE

AND

- BOTH INPUTS MUST BE LOGICAL 1, OR “HIGH” FOR THE OUTPUT TO BE A 1
- OTHERWISE, OUTPUT IS 0, OR “LOW”

INPUT A	INPUT B	OUTPUT (Y)
0	0	0
0	1	0
1	0	0
1	1	1

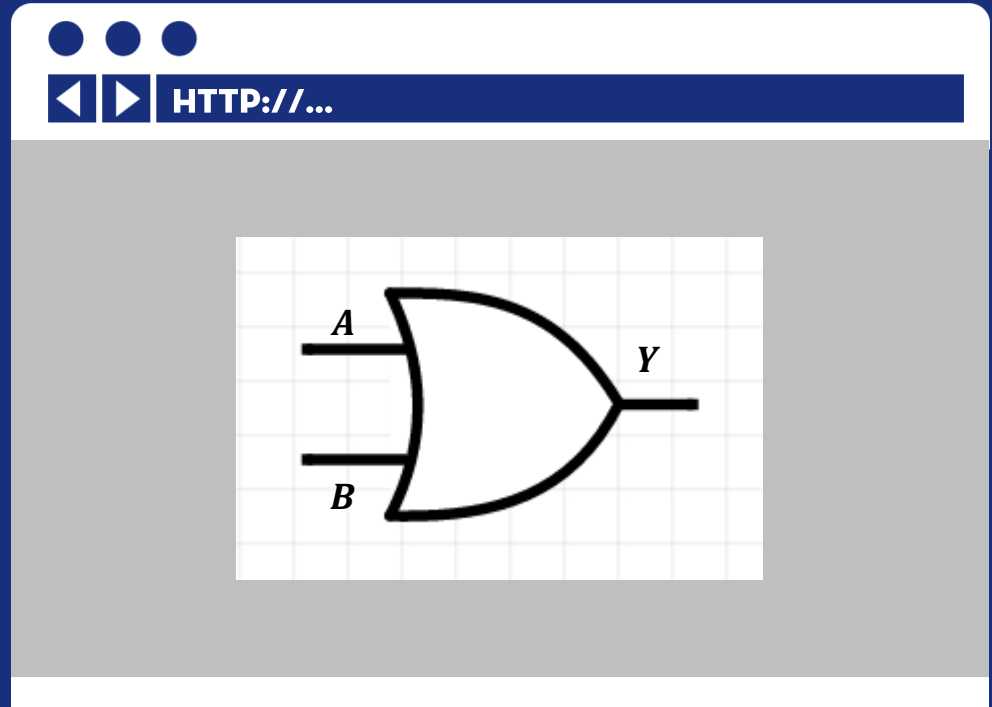


THE OR GATE

OR

- **OUTPUT WILL BE HIGH IF EITHER OF THE INPUTS IS HIGH**
- **ALSO WILL BE HIGH IF BOTH INPUTS ARE HIGH**
- **OTHERWISE, OUTPUT IS LOW**

INPUT A	INPUT B	OUTPUT (Y)
0	0	0
0	1	1
1	0	1
1	1	1

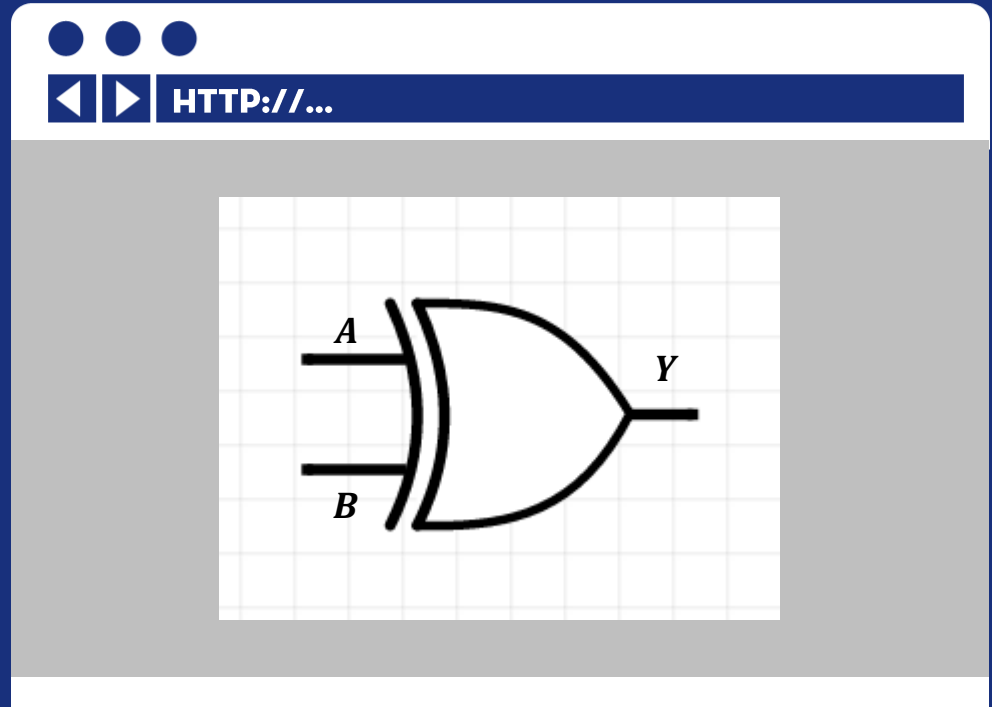


THE XOR GATE

XOR

- “EXCLUSIVE” OR
- ONLY ONE OF THE TWO INPUTS MUST BE HIGH
- BOTH INPUTS HIGH WILL RESULT IN A 0

INPUT A	INPUT B	OUTPUT (Y)
0	0	0
0	1	1
1	0	1
1	1	0

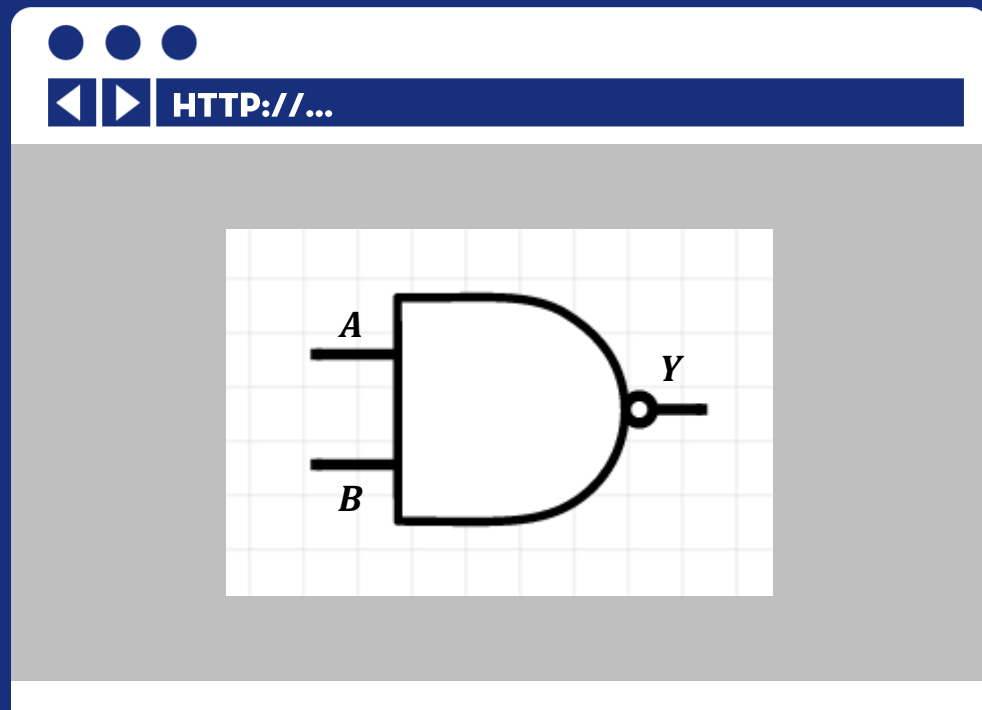


THE NAND GATE

NAND

- OPPOSITE OF AND
- OUTPUT HIGH UNLESS BOTH INPUTS ARE HIGH

INPUT A	INPUT B	OUTPUT (Y)
0	0	1
0	1	1
1	0	1
1	1	0

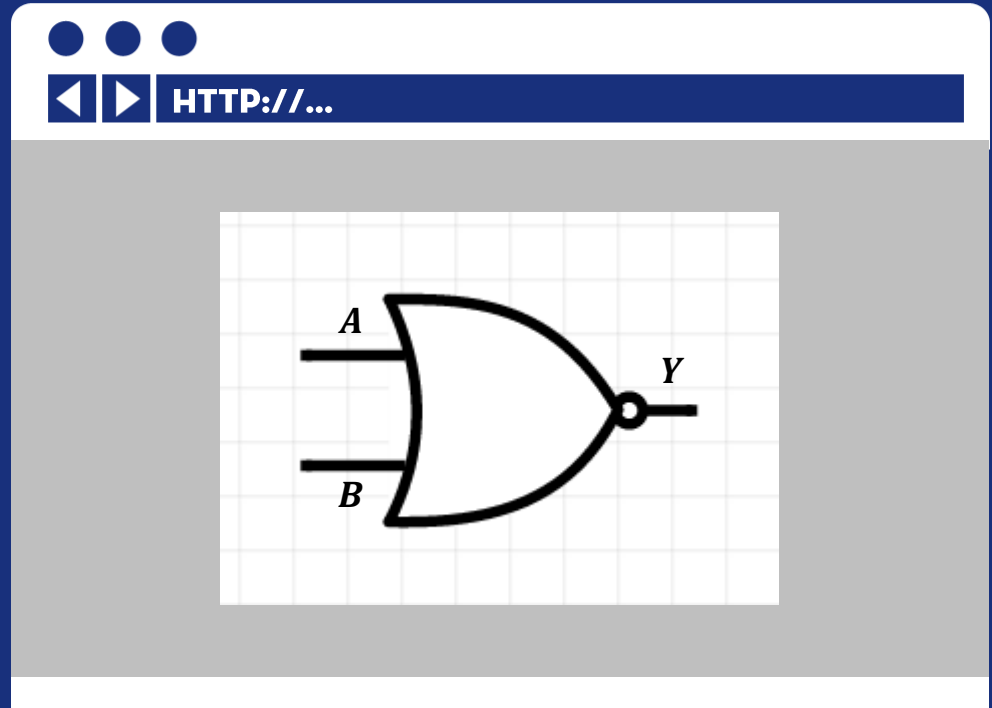


THE NOR GATE

NOR

- OPPOSITE OF OR
- OUTPUT ONLY HIGH IF BOTH INPUTS ARE LOW

INPUT A	INPUT B	OUTPUT (Y)
0	0	1
0	1	0
1	0	0
1	1	0



THE GATE ICs

INTEGRATED CIRCUITS

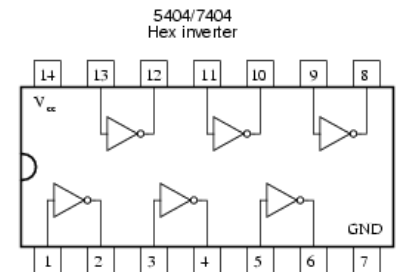
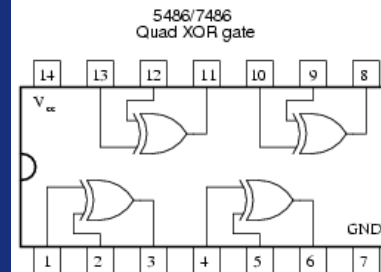
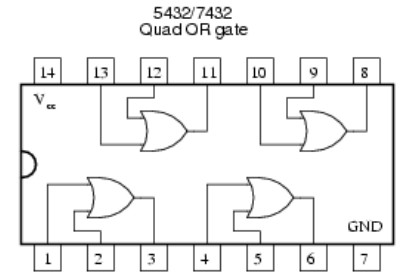
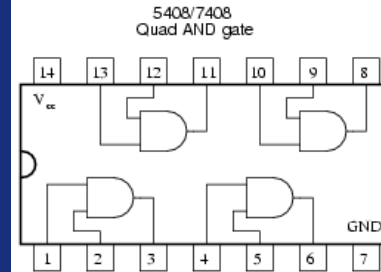
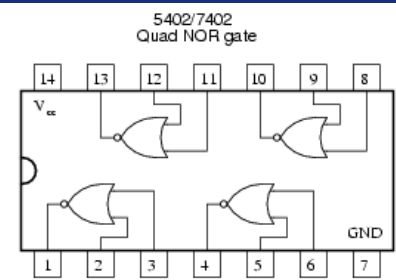
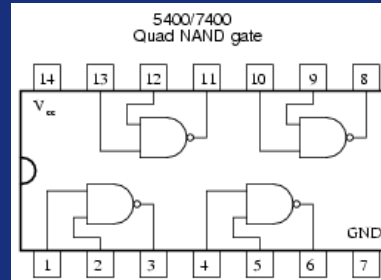
▪ A “PINOUT” DIAGRAM SHOWS THE FUNCTION OF EACH PIN IN THE IC

▪ PINOUTS FOR OUR 6 LOGIC GATE ICs HERE

▪ VCC - POSITIVE VOLTAGE SUPPLY

▪ GND - CURRENT RETURN PATH

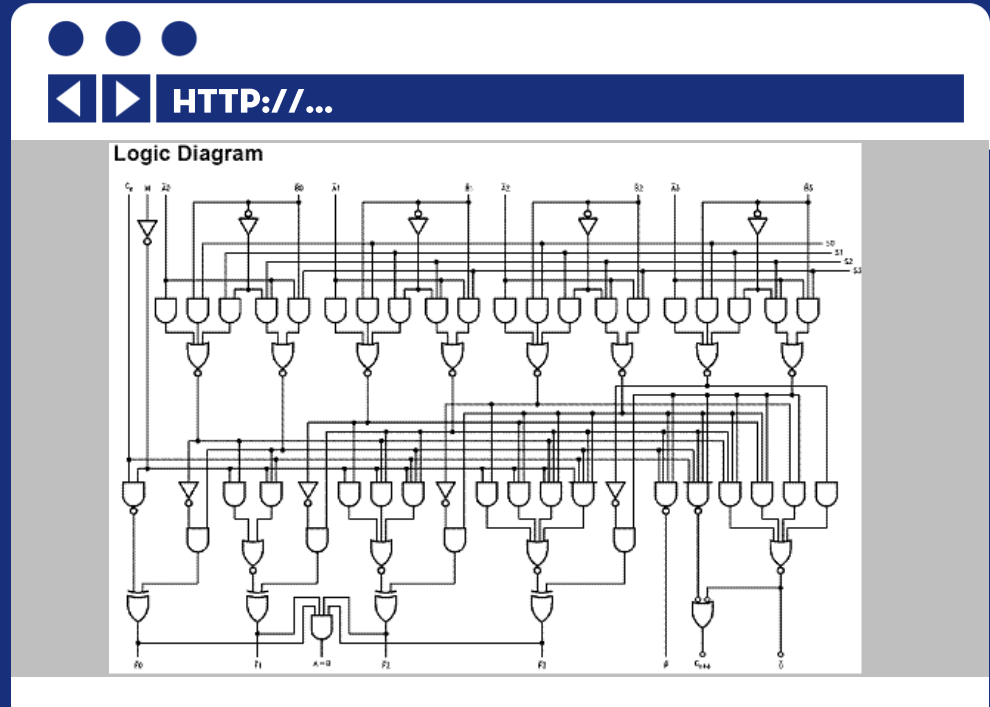
▪ REMEMBER: THE 7400 SERIES PART NUMBERS FOR EACH GATE IC



WHO CARES?

COMPUTER ENGINEERS DO!

- **LOGIC GATES ARE COMPOSED OF SIMPLER COMPONENTS LIKE TRANSISTORS AND RESISTORS**
- **COMBINING LOGIC GATES ALLOWS FOR COMPLEX BINARY OPERATIONS**
- **ESSENTIALLY, A COMPUTER CPU IS A COMPLEX ARRANGEMENT OF LOGIC GATES!**



BOOLEAN ALGEBRA

TRUE OR FALSE MATH

•THE OPERATIONS PERFORMED BY GATES ARE REPRESENTED WITH SYMBOLS AS WELL

NOT A: \bar{A}

A AND B: $A \cdot B$

A OR B: $A + B$

A XOR B: $A \oplus B$

A NAND B: $\overline{A \cdot B}$

A NOR B: $\overline{A \oplus B}$

THE END!