

Electromania lecture and problem  
statement discussion

ELECTRONICS CLUB

# A quick review

# Electronic Circuits: Analog and Digital



analog

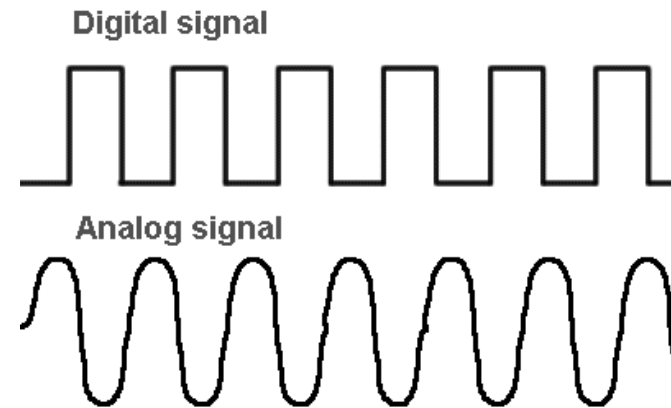
vs



digital

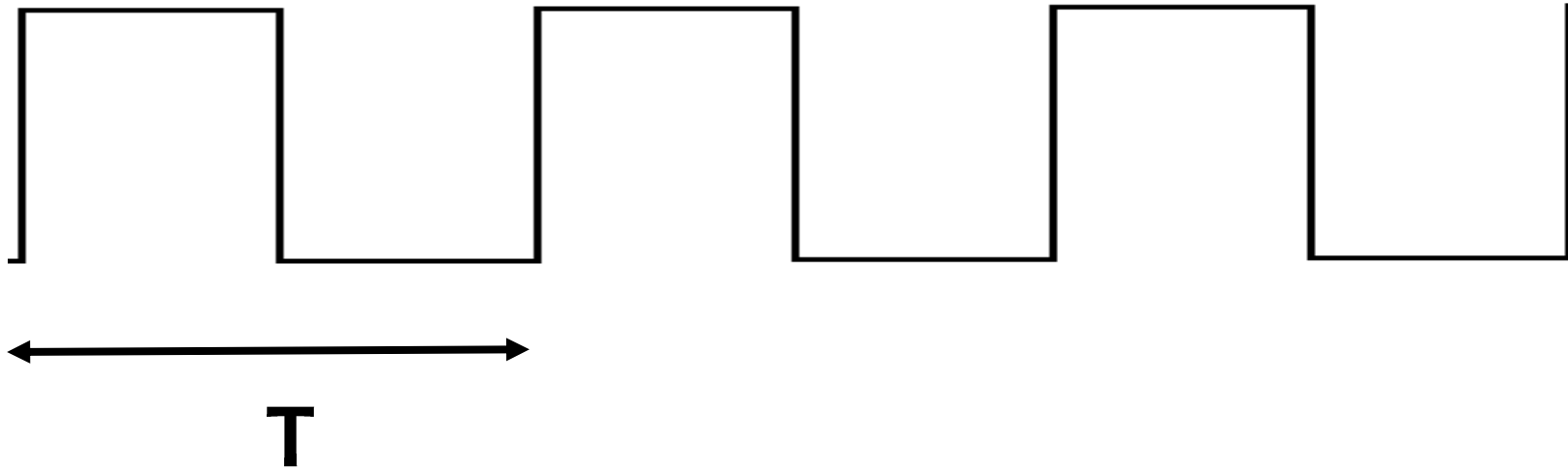
# Digital Electronics

- Deals with discrete values
- Voltage higher than a particular threshold corresponds to 1.
- Voltage lower than that threshold corresponds to 0.



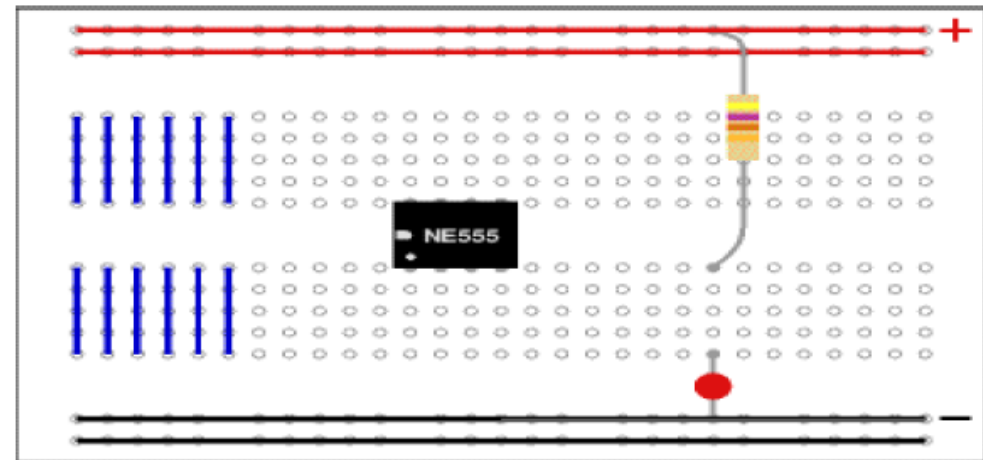
# What's a clock?

- \* At the basic level, just a special waveform.



# What hardware do we need?

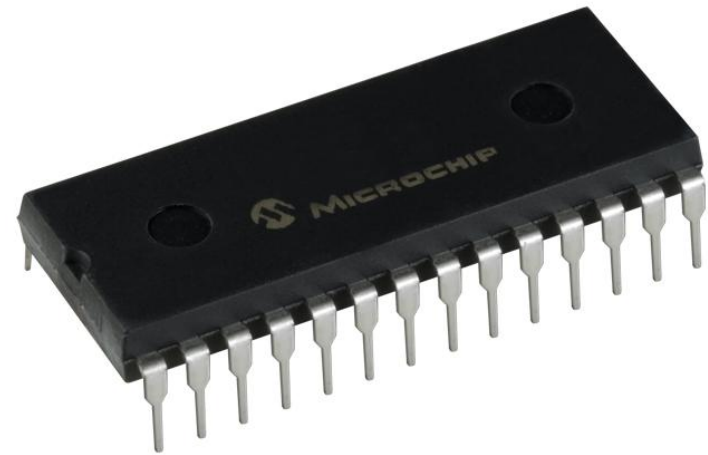
- \* IC(s)
- \* Breadboards



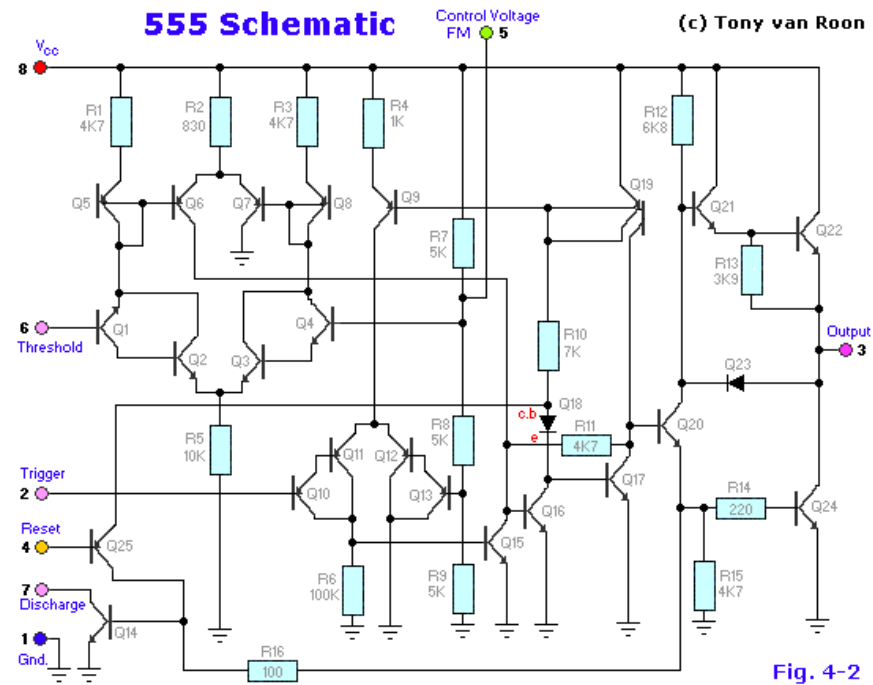
Breadboard

# What's an IC?

- An integrated circuit.
- For our purposes, we will treat it as a black box.
- We do not concern ourselves about the insides of an IC.
- We look at it from the outside, from an input/output standpoint.



# What's inside an IC?





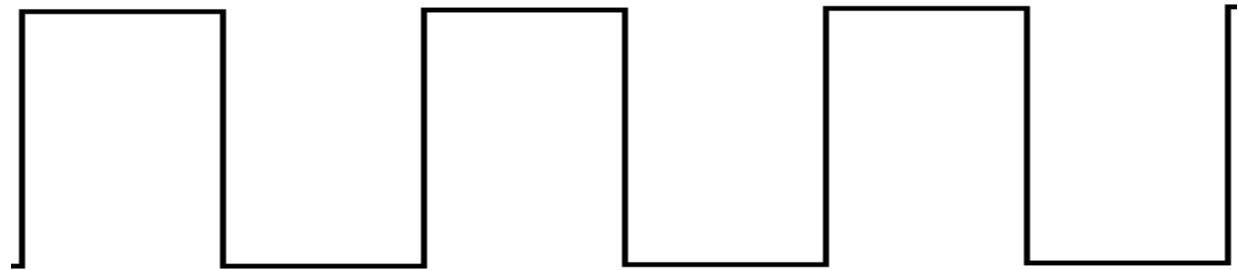
# We will learn several ICs today

- 555
- 4029
- 7447
- Mux-Demux (4051/4052)
- Flipflops (4027)
- Logic Gates (AND/OR/NOT)

# The Clock – 555 (Astable Mode)

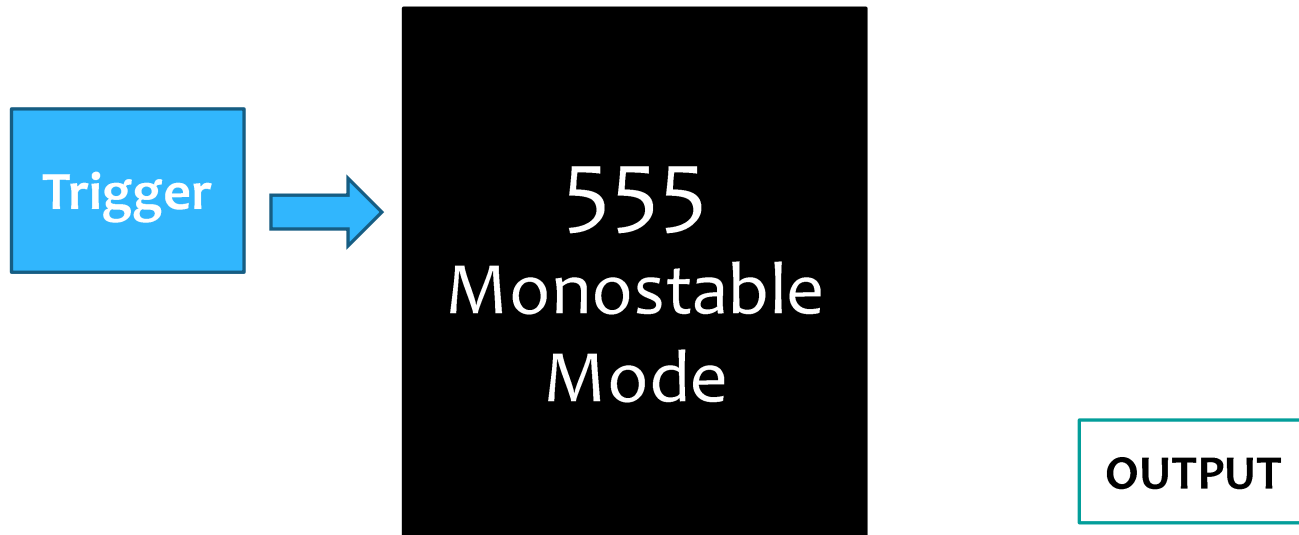


OUTPUT

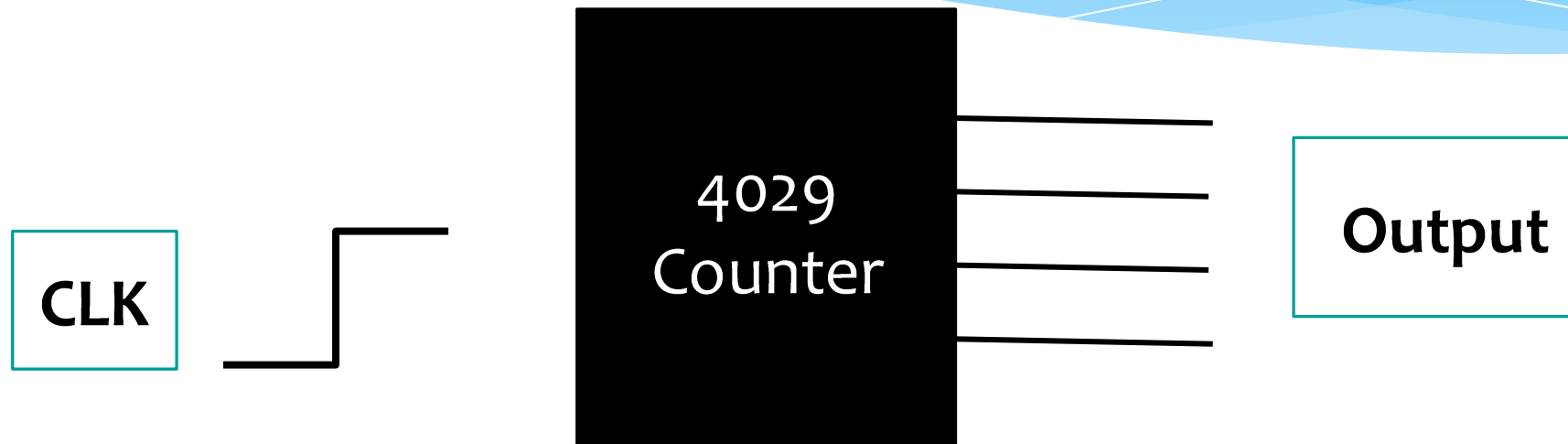


# 555 in Monostable Mode

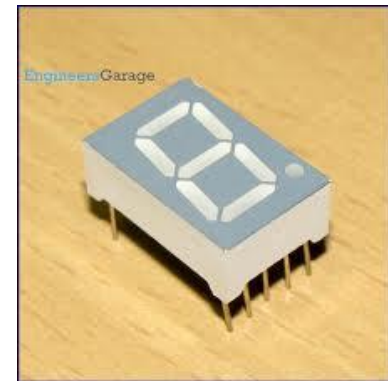
- Generates Clock pulse when triggered



# The Counter - 4029



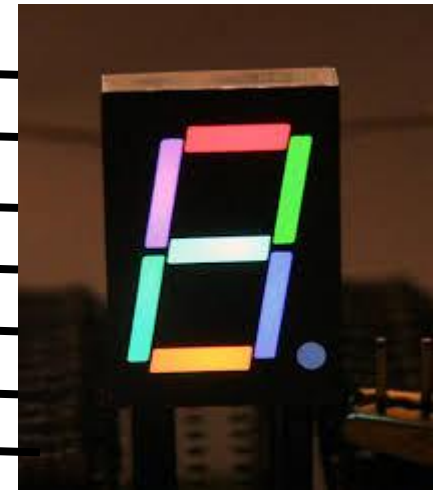
# The Display



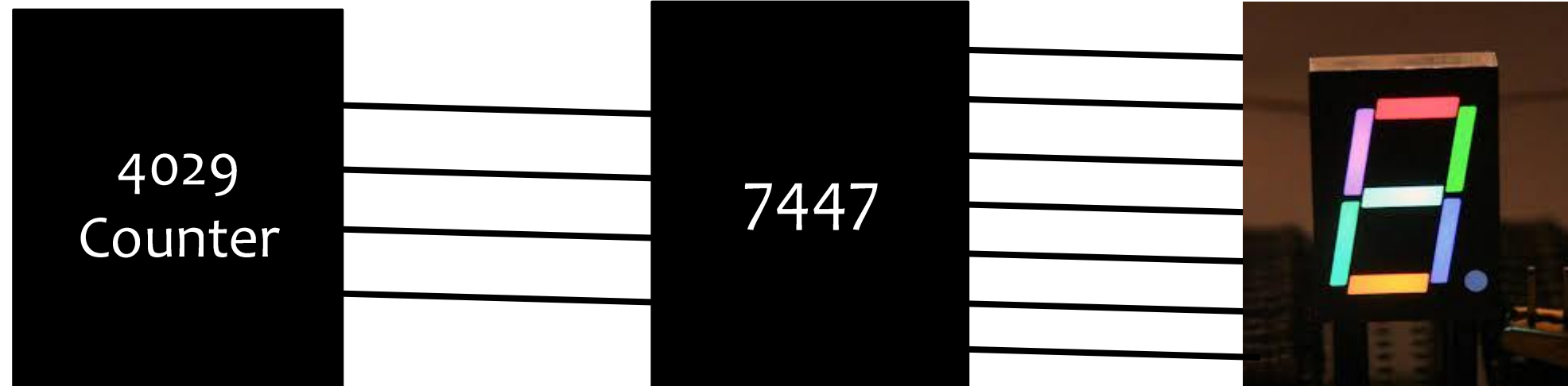
# The Problem - Binary to Decimal?

4029  
Counter

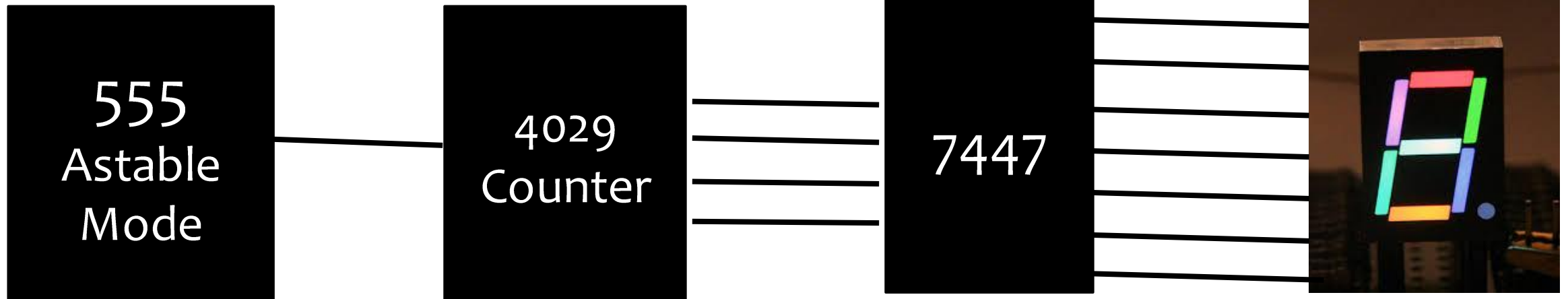
??



# The Solution - 7447



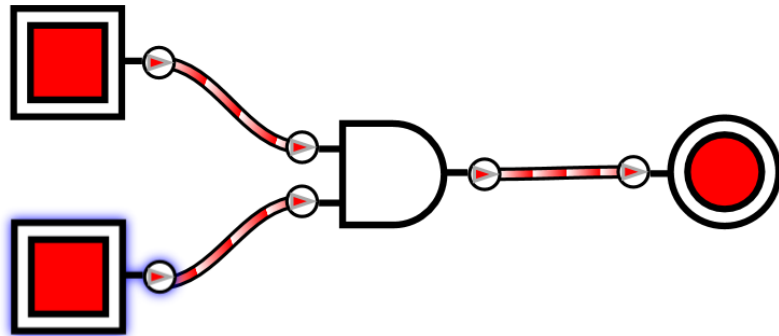
# The Final Circuit





How do I put the 'Logic'?

# AND GATE

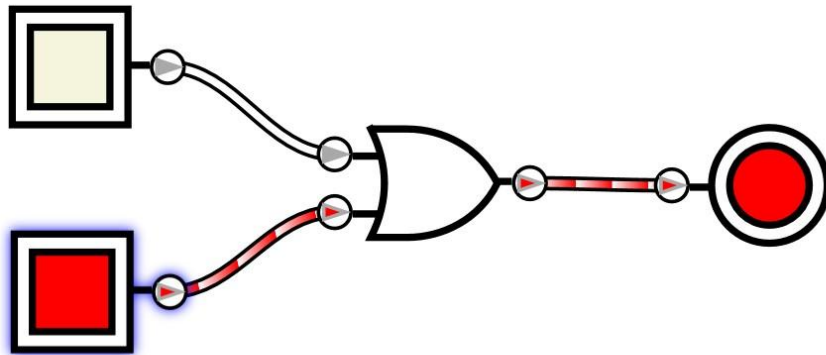


Truth Table(A.B)

INPUT		OUTPUT
A	B	A AND B
0	0	0
0	1	0
1	0	0
1	1	1

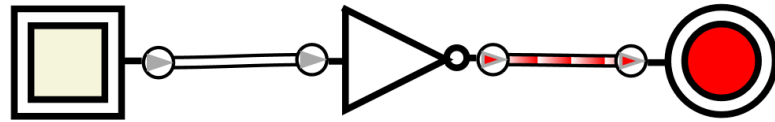
# OR GATE

Truth Table(A+B)



INPUT		OUTPUT
A	B	A AND B
0	0	0
0	1	1
1	0	1
1	1	1

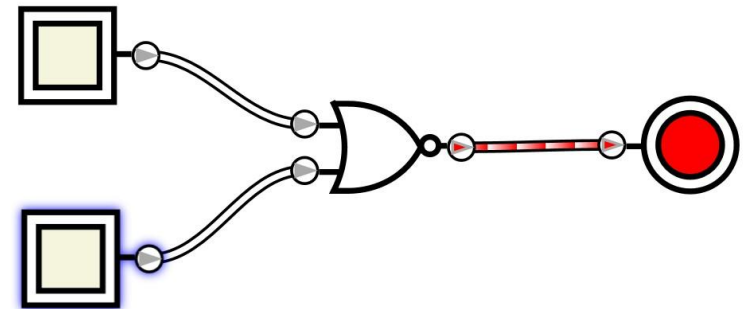
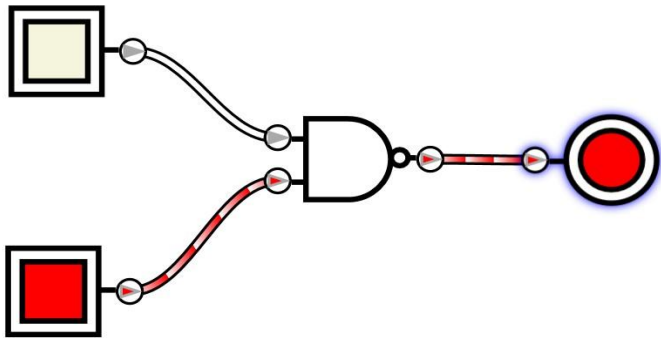
# NOT GATE



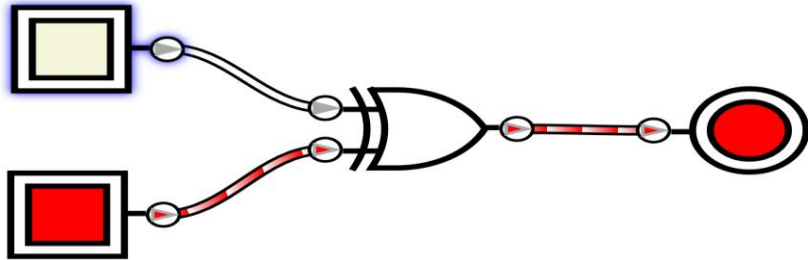
Truth Table( $\sim A$ )

INPUT	OUTPUT
A	NOT A
0	1
1	0

# NAND, NOR



# XOR GATE



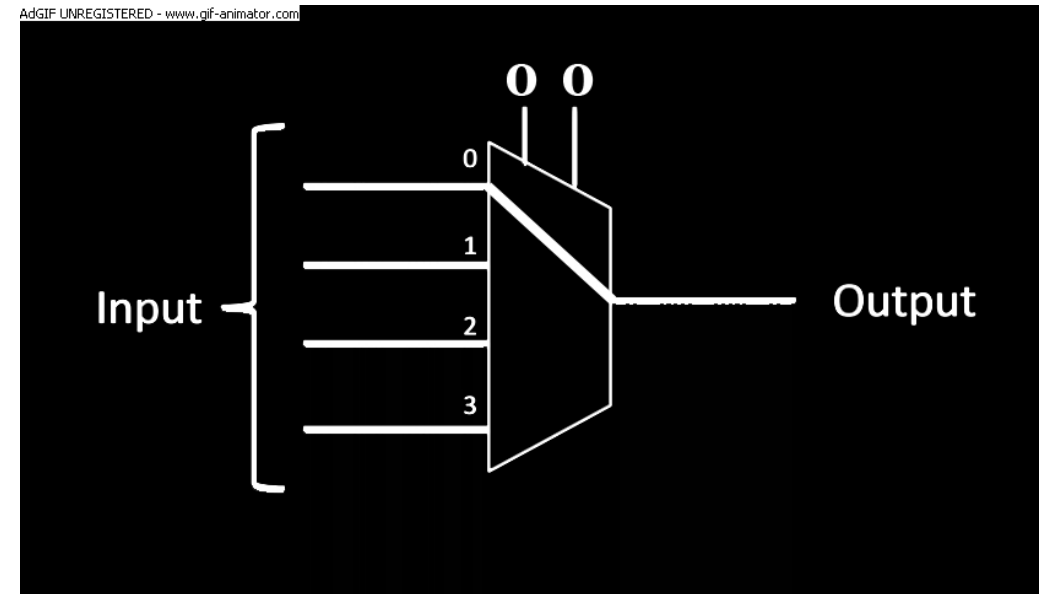
Truth Table

INPUT		OUTPUT
A	B	A AND B
0	0	0
0	1	1
1	0	1
1	1	0

# Multiplexers and Demultiplexers

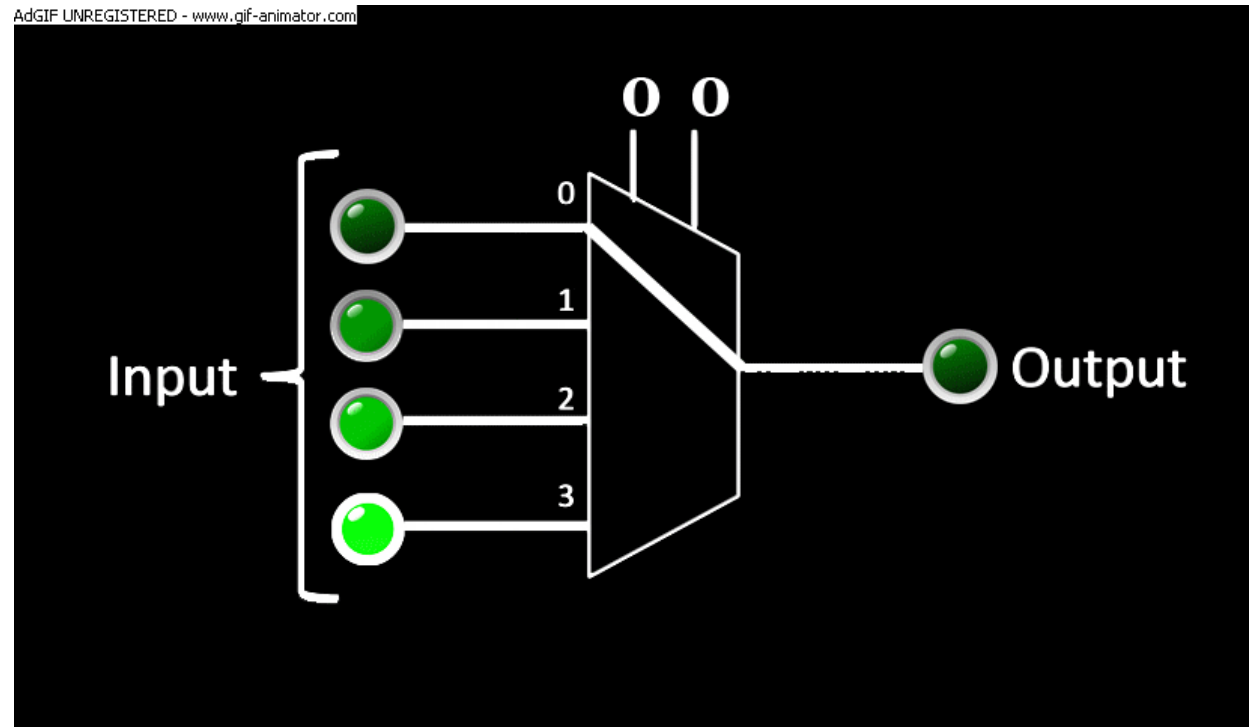
# Multiplexers

- Multiple input, one output
- A single line is connected electrically to the output
- The selection of the input which is to be connected to the output is done via selection pins



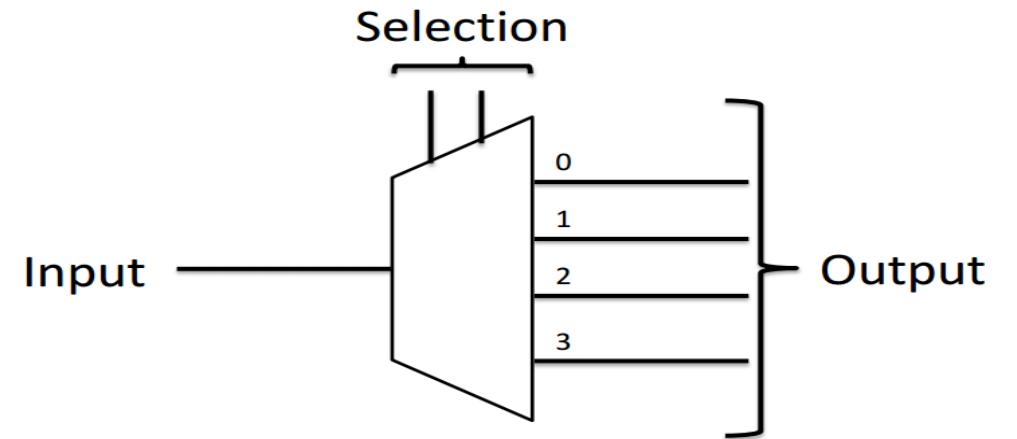


# Electrical Connection



# Demultiplexers

- A mirror of the multiplexer
- Multiple output, one input
- One of the output is electrically connected to the input
- The selection of the input which is to be connected to the output is done via selection pins

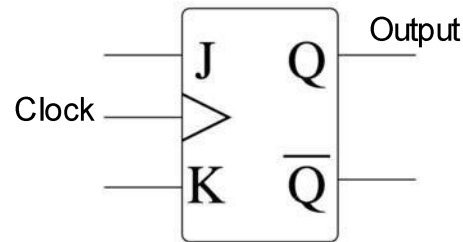
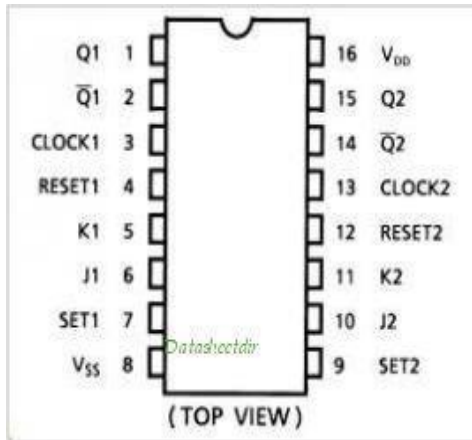


Do we need two separate devices?

No!

# Flipflops (4027)

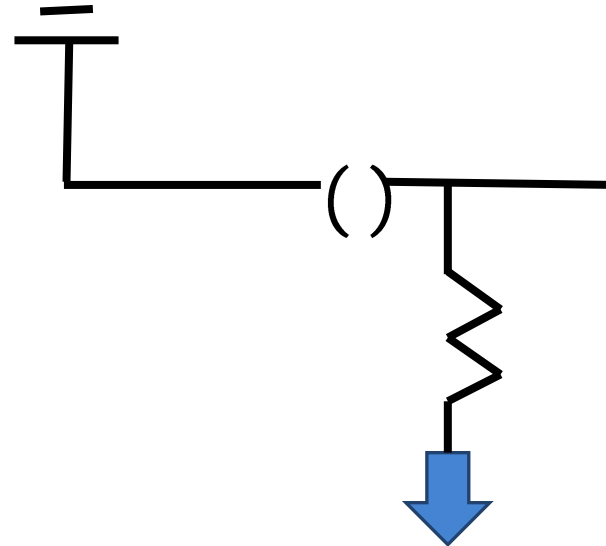
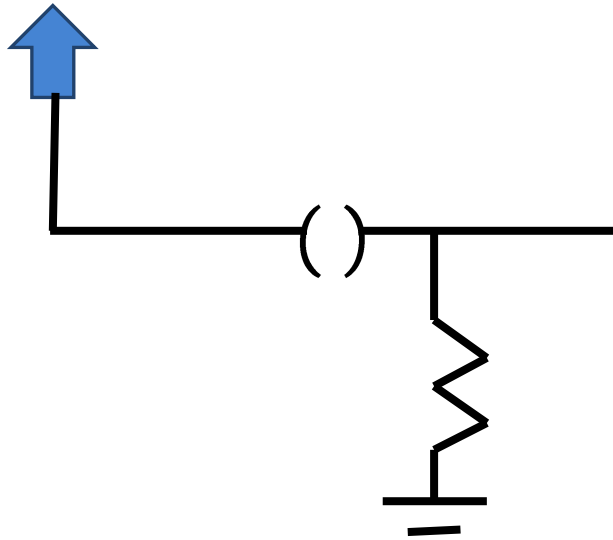
- \* Flipflops are the memory devices. They remember the last output and changes its state according to two inputs J and K.



J	K	$Q_{(t+1)}$
0	0	$Q_{(t)}$ <i>unchanged</i>
0	1	0 <i>reset</i>
1	0	1 <i>set</i>
1	1	$\bar{Q}_{(t)}$ <i>output inversion</i>

# Using switches

- Never leave a input pin unconnected.
- Pull Up/Pull Down.



# Some Useful Advice

- Tight, clean, non-overlapping connections, which must follow wire colour conventions
- Test each and every small part of the circuit, do not allow the circuit to grow too big before testing it.
- Use gates for combining input, do not combine by direct shorting.
- Do NOT leave any input pin unconnected, pull it up/down.
- Do NOT divide one output into many wires.
- Be very careful while making power connections: this may burn your IC.
- Regularly meet club secretaries, and when needed, the coordinators.

# Join Us

Website : <http://students.iitk.ac.in/eclub/>

FB Group : <https://www.facebook.com/groups/eclub.iitk/>

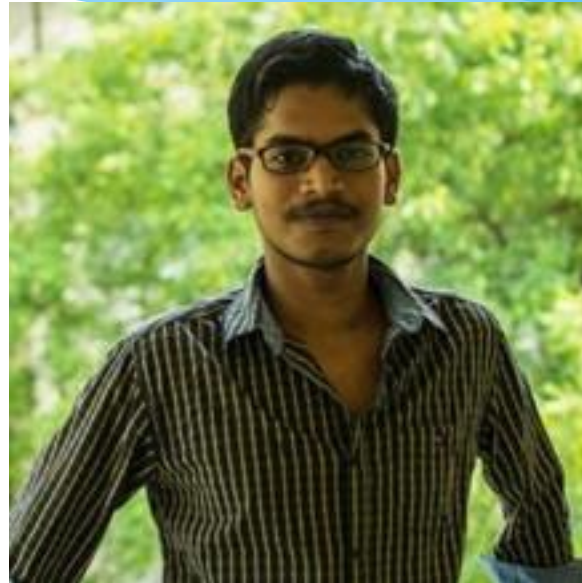
E-mail : [eclub.iitk@gmail.com](mailto:eclub.iitk@gmail.com)

YouTube : <http://www.youtube.com/user/electronicsclub>

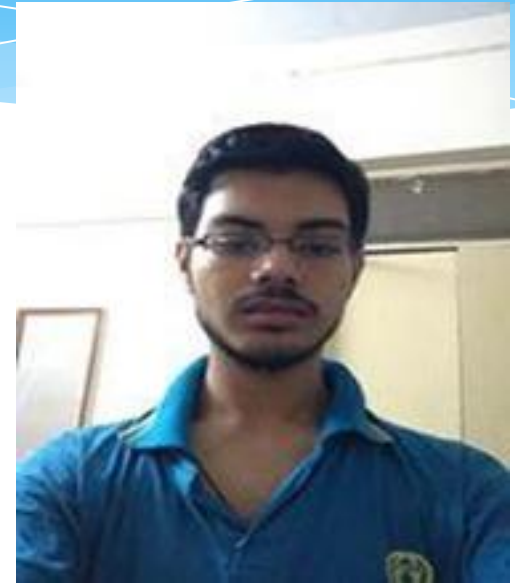
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