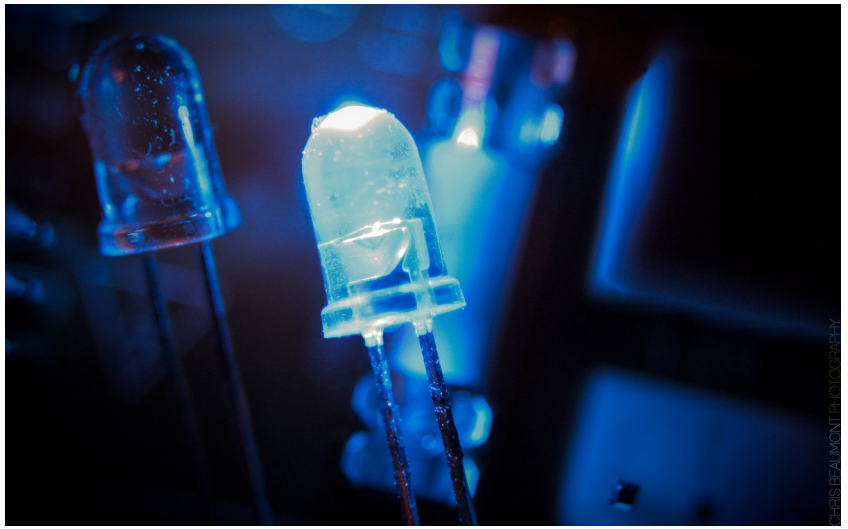


ELECTRON ICS CLUB

ELECTROMANIA LECTURE AND PROBLEM STATEMENT DISCUSSION

A quick review

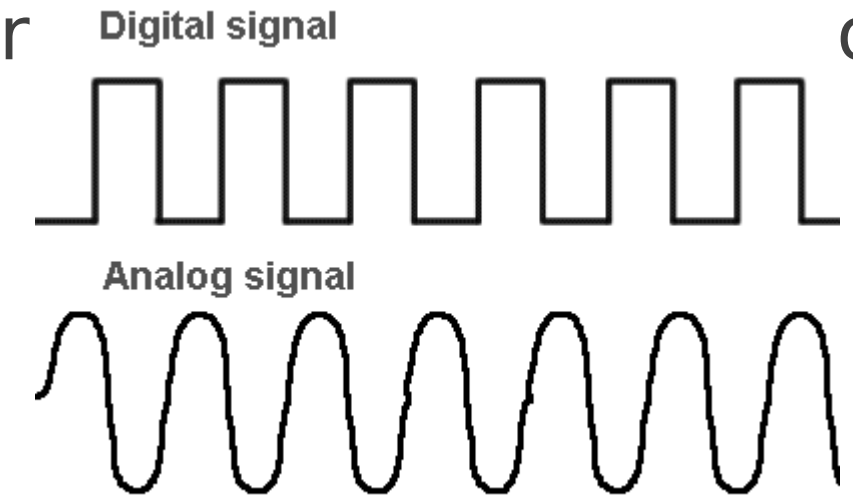
Electronic Circuits: Analog and Digital

Analog

Digital

Digital Electronics

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



Number Systems

Number Systems - Decimal

We have decimal system with 10 numbers, viz 0,1,2,.....,9

Decimal number system

1 1 0 9 10^0 = ones

10^1 = tens

10^2 = hundreds

10^3 = thousands

1*1000 + 1*100 + 1*10 + 9*1 = 1,109

Number Systems - Binary

Another method of number representation

Binary consists of two digits 0 and 1.

1 0 1 0 2^0 = ones

2^1 = twos

2^2 = fours

2^3 = eights

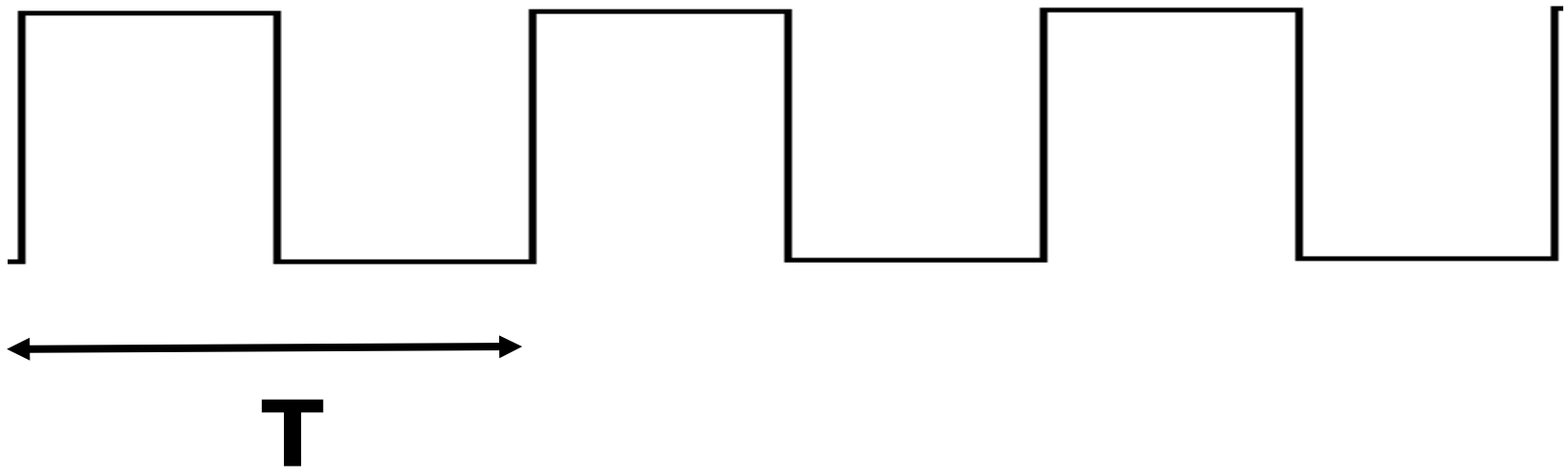
1*8 + 0*4 + 1*2 + 0*1 = 10(base-10)

1010(base-2) = 10(base-10)

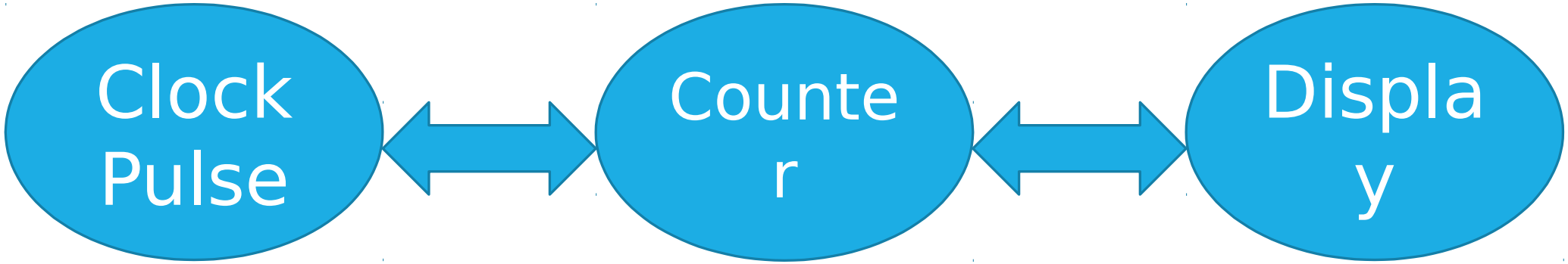
Basic Workshop - A digital Watch

What’s a clock?

At the basic level, just a special waveform.

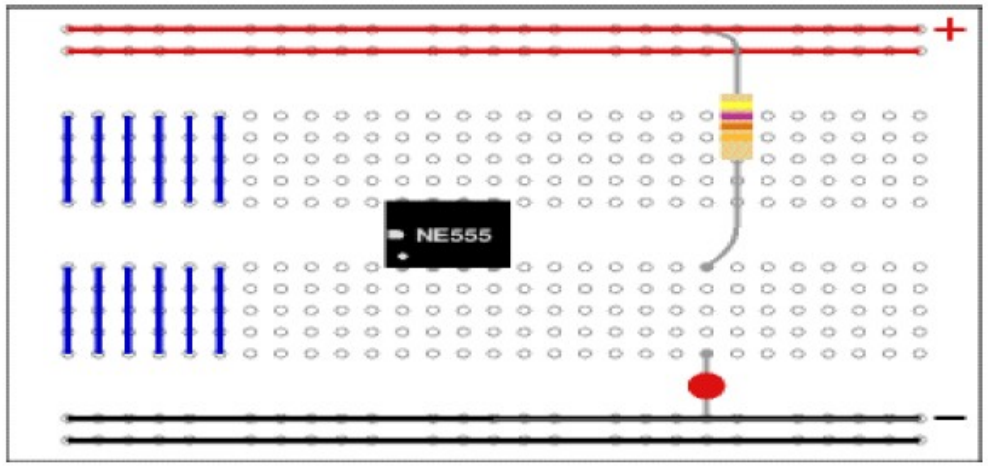


Flowchart



What hardware do we need?

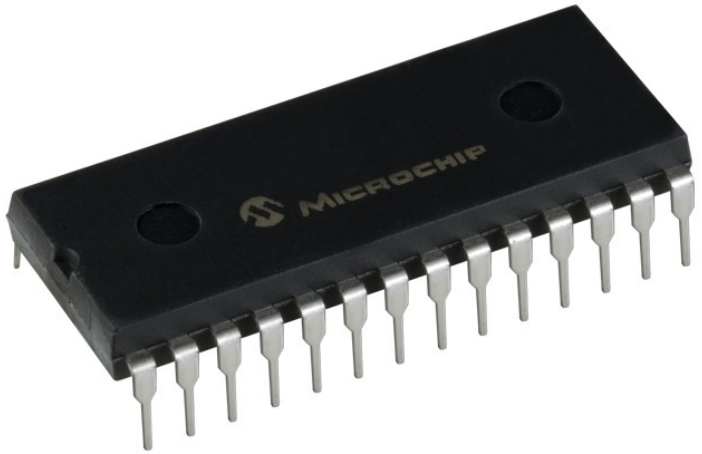
- IC(s)
- Breadboards



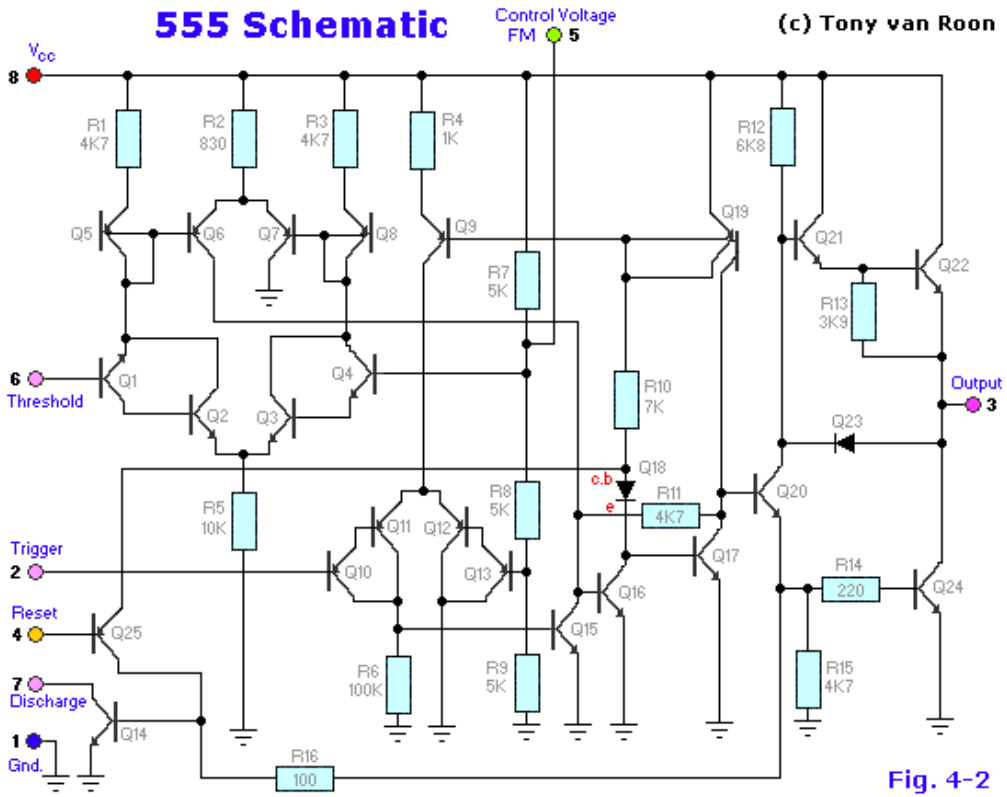
Breadboard

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.



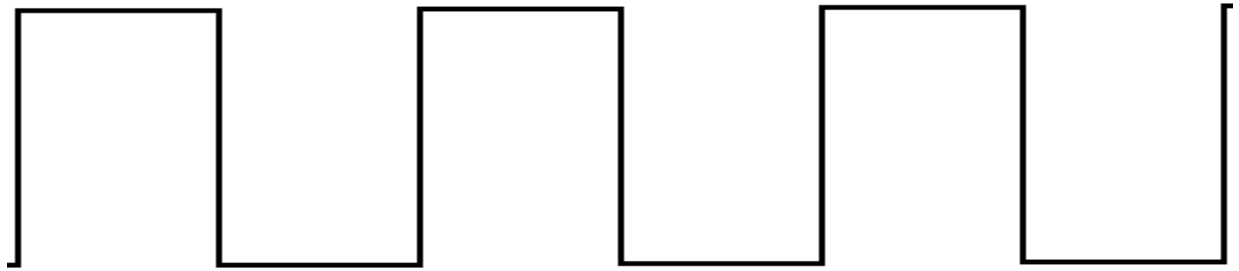
What’s inside an IC?



We will several three ICs today

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

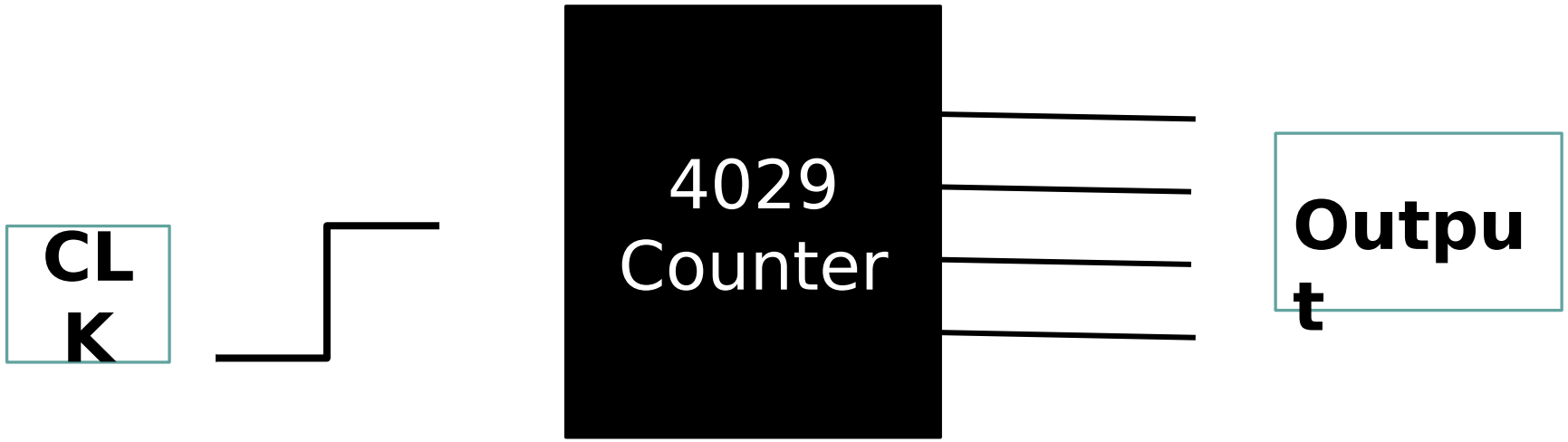
The Clock – 555 (Astable Mode)



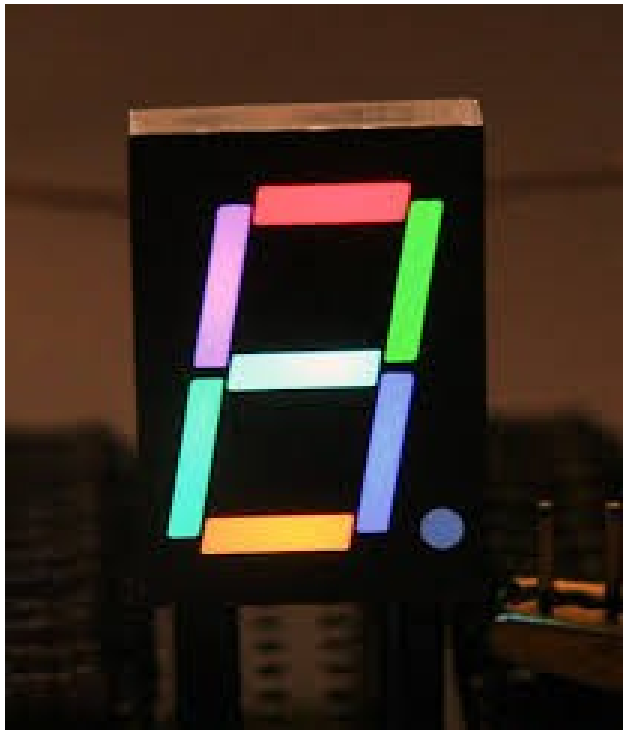
555 in Monostable Mode

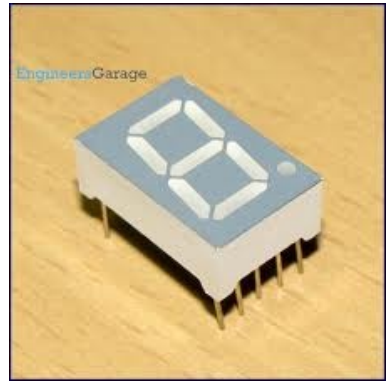
- Generates Clock pulse when triggered

The Counter - 4029

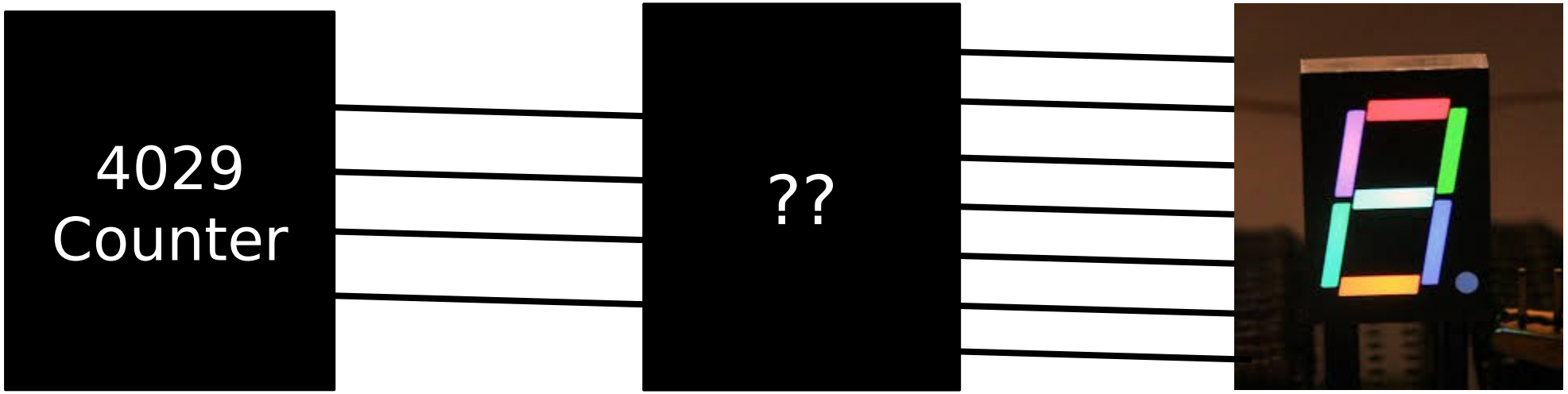


The Display

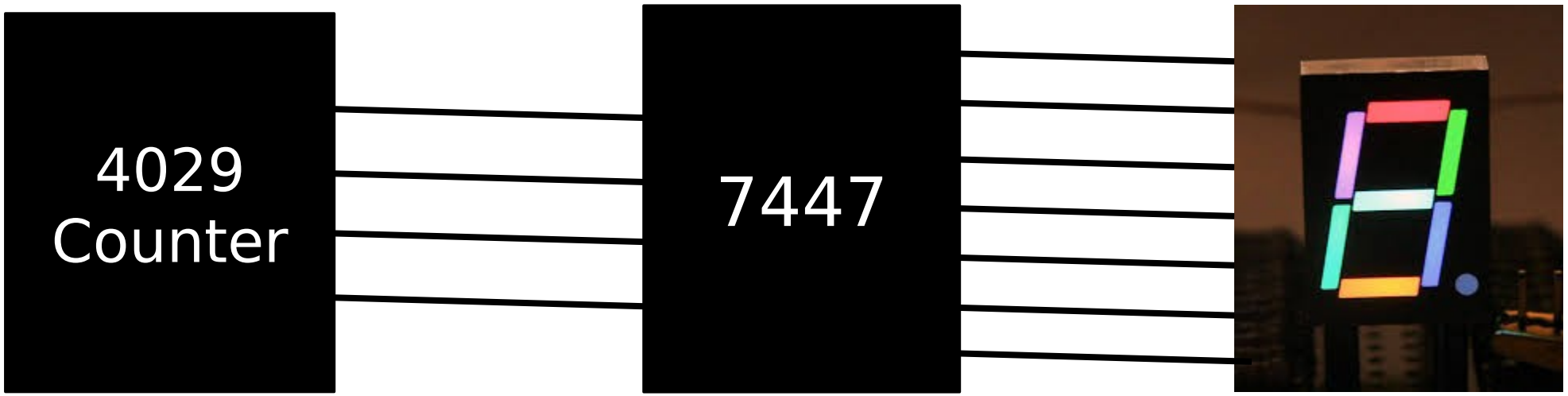




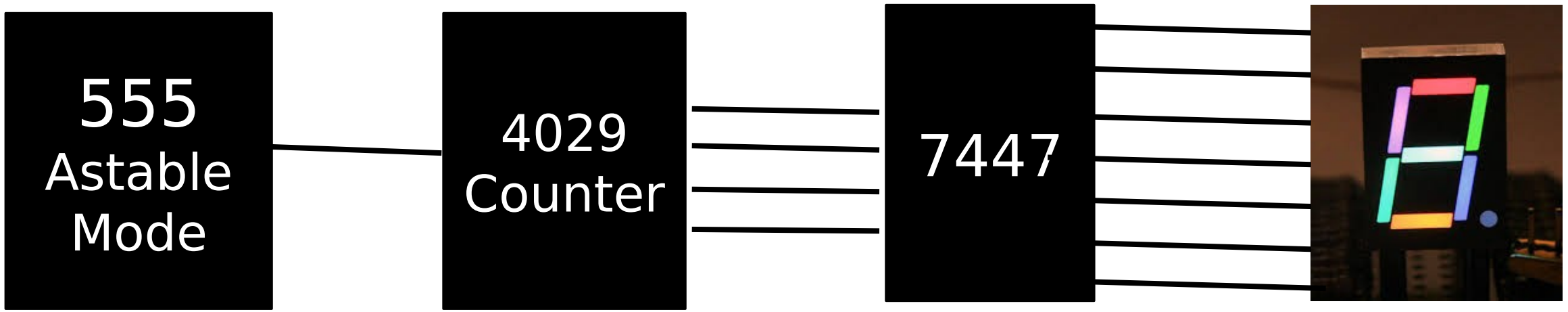
The Problem - Binary to Decimal?



The Solution - 7447

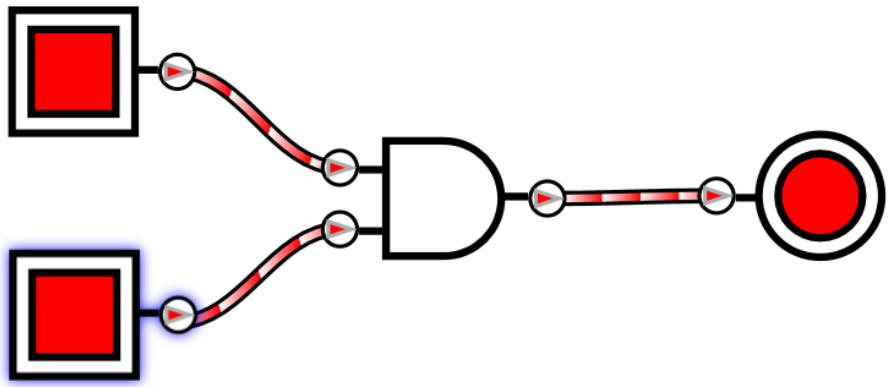


The Final Circuit



How do I put the ‘Logic’?

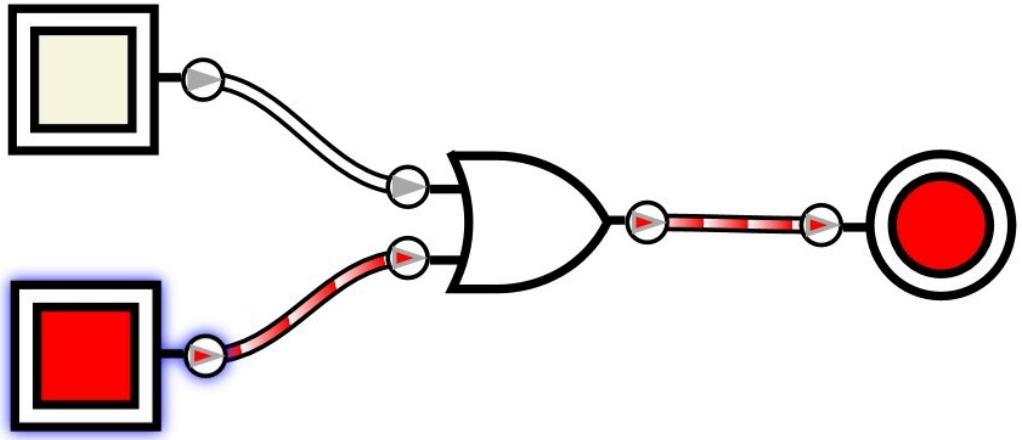
AND GATE



Truth Table(A.B)

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

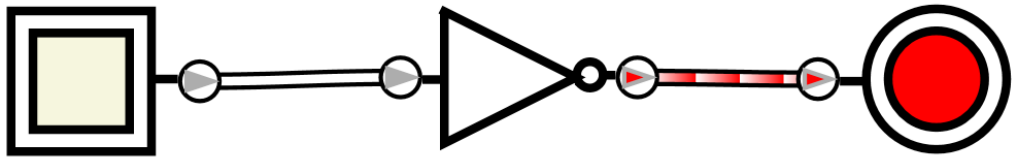
OR GATE



Truth Table(A+B)

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

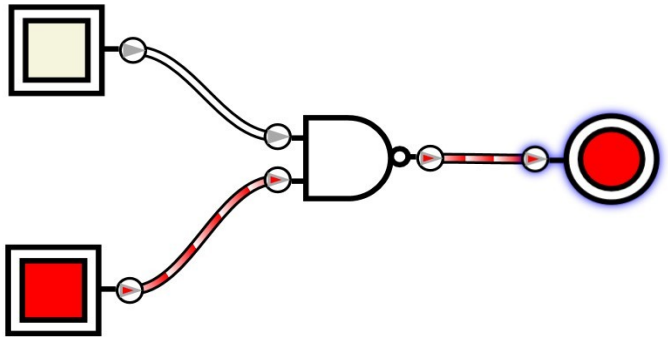
NOT GATE

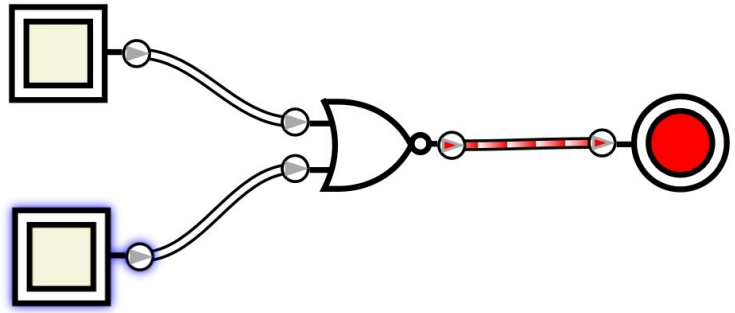


Truth Table(~A)

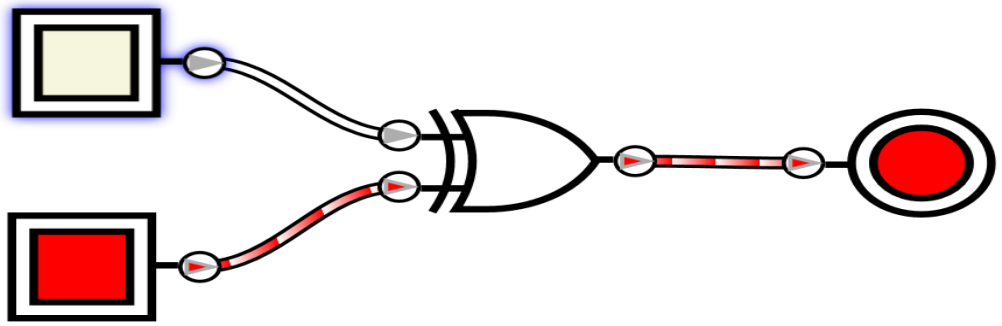
INPUT	OUTPUT
A	NOT A
0	1
1	0

NAND, NOR





XOR GATE



Truth Table

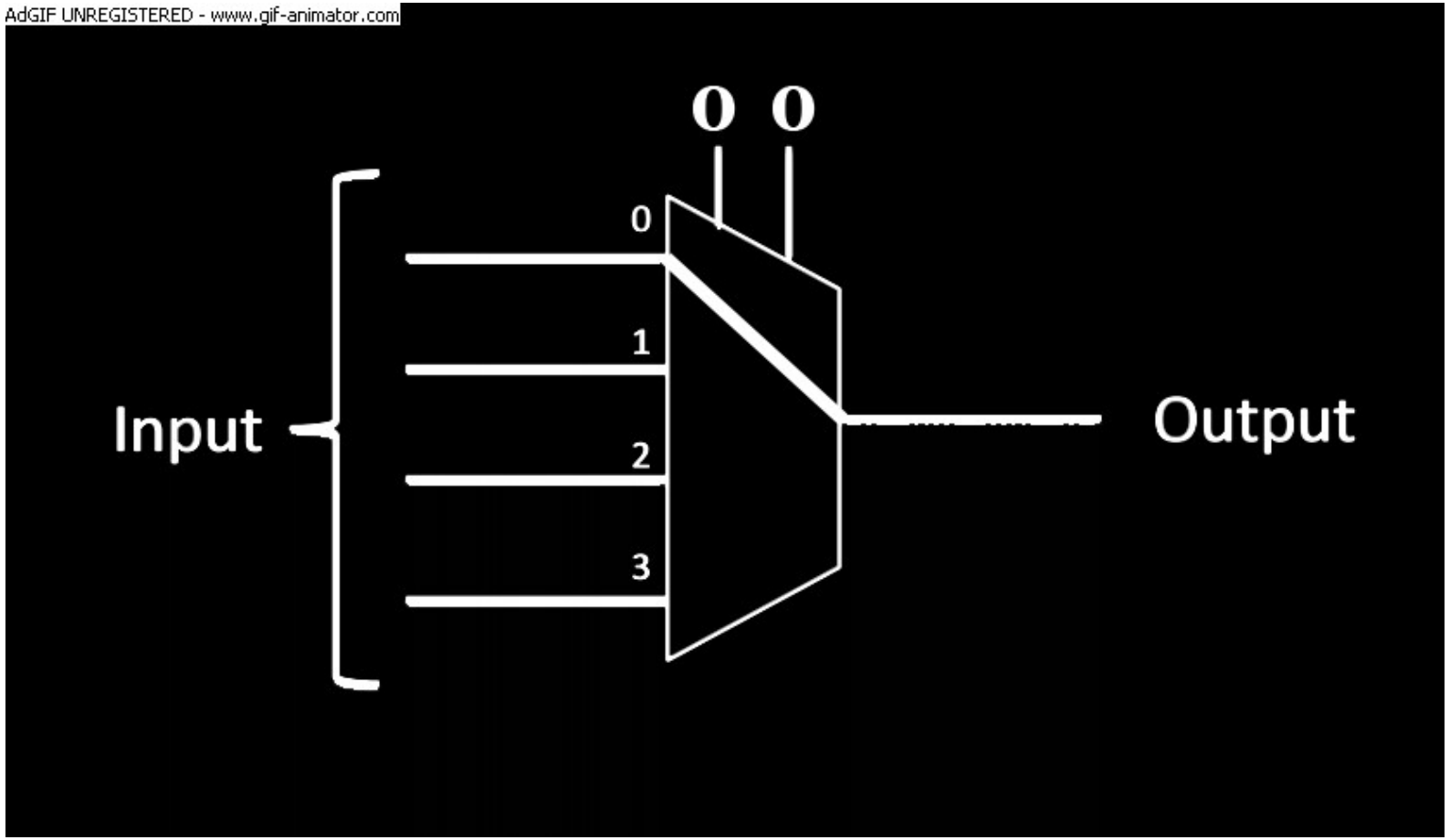
INPUT		OUTPUT
A	B	A AND B
0	0	0
0	1	1
1	0	1
1	1	0

Multiplexers and Demultiplexers

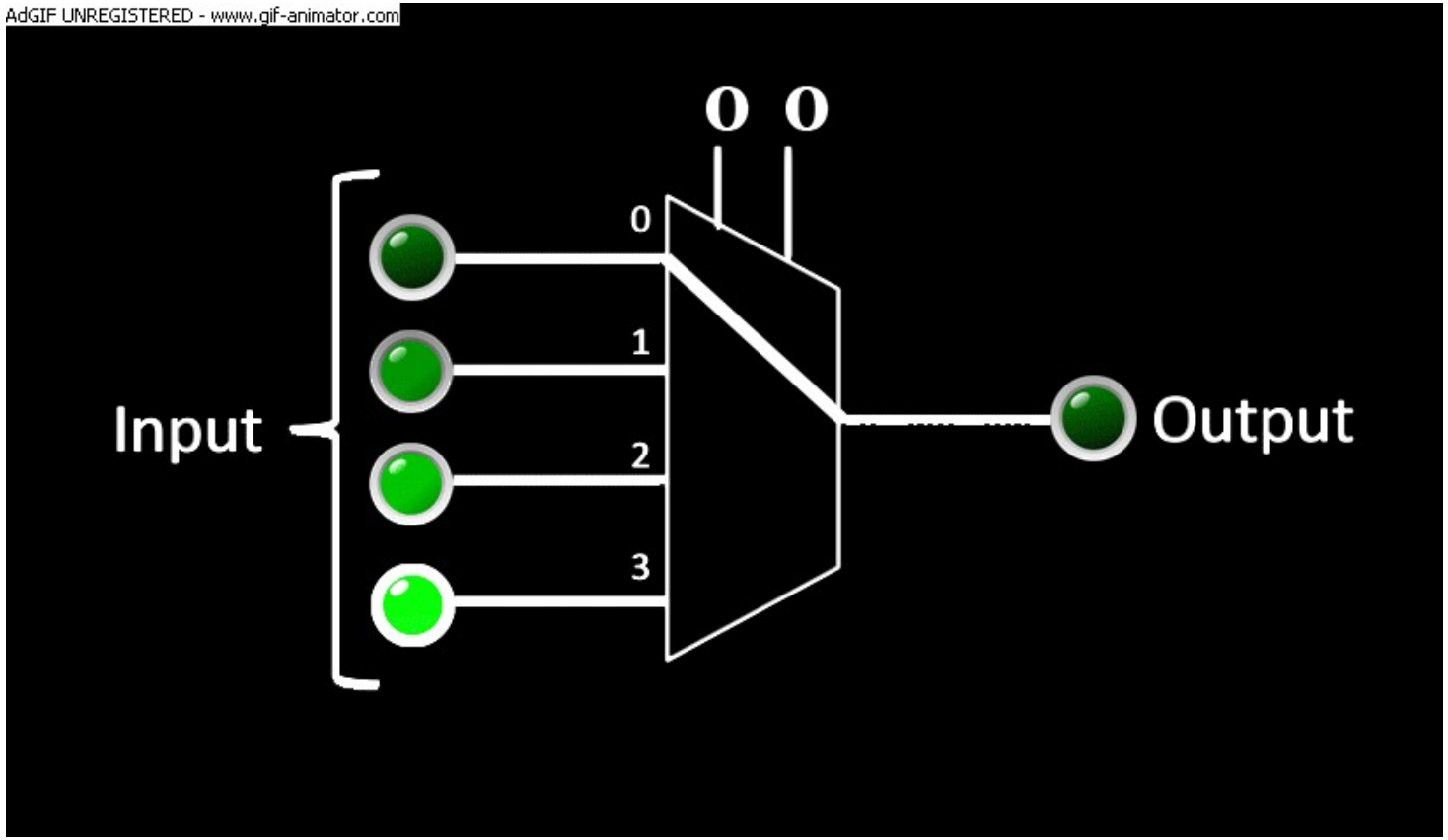
Multiplexers

- 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

Multiplexers



Electrical Connection



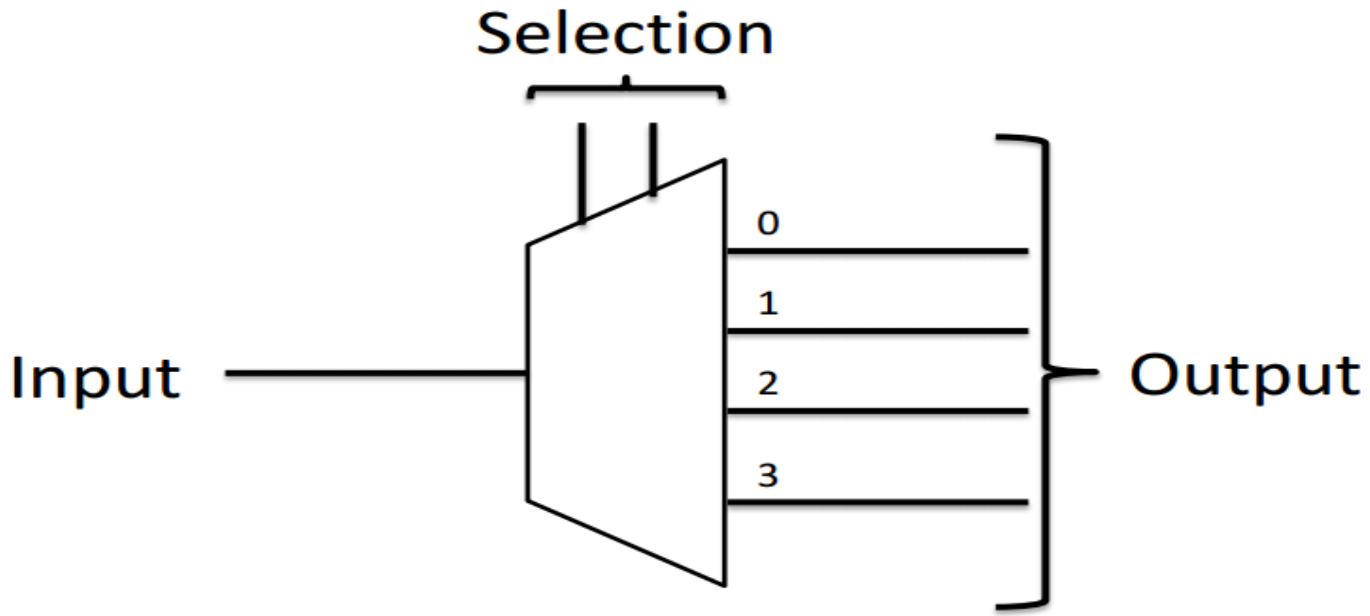
What’s an Electrical Connection?

- What we have are analog multiplexers
- Not a digital connection
- It is similar to the input and output being connected by a wire.

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

Demultiplexers

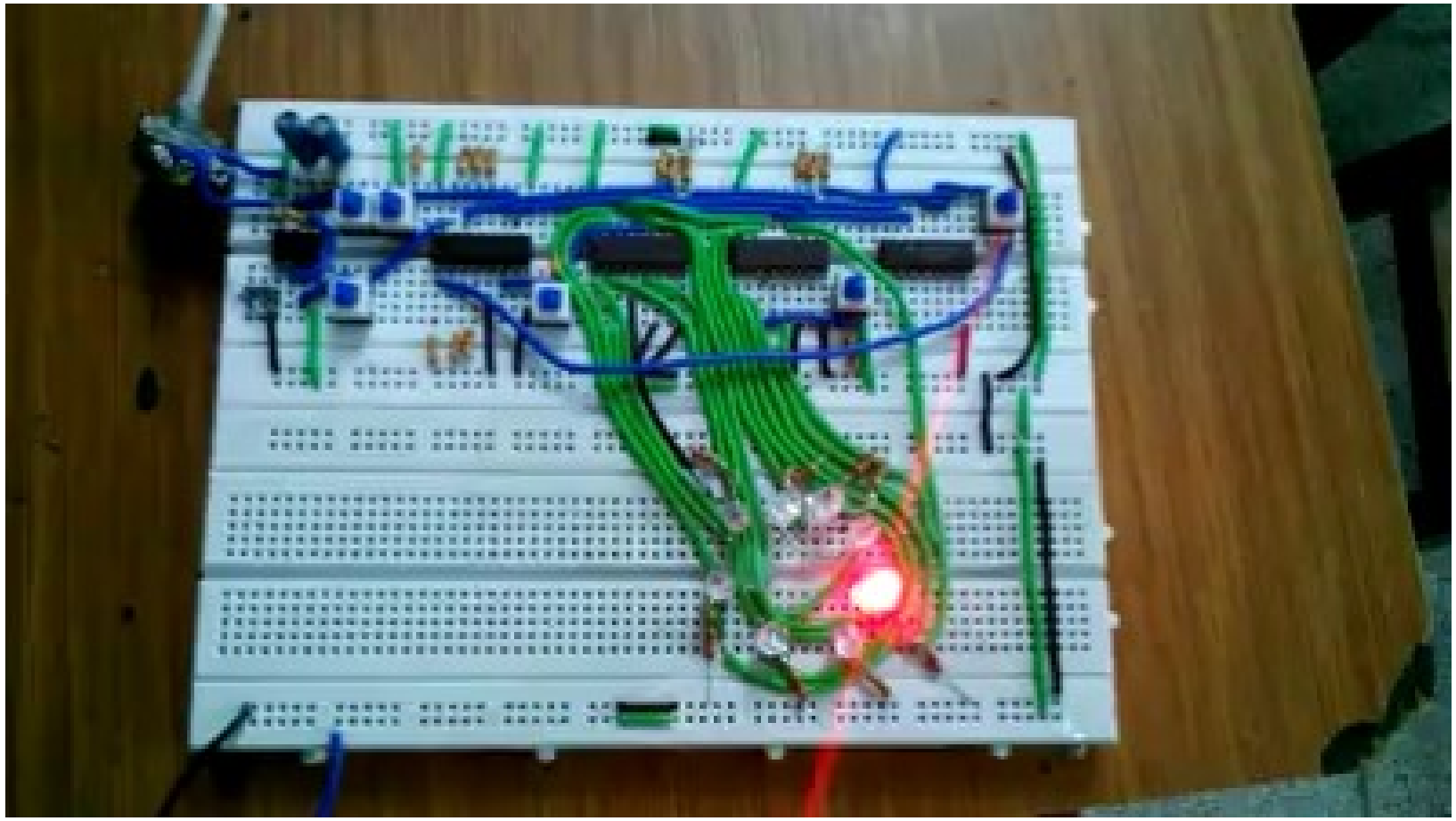


Do we need two separate devices?

What Mux-Demux are available?

- 4051 – 4bit Mux/Demux
- 4052 – 8bit Mux/Demux

Mux in Action!



Flipflops (4027)

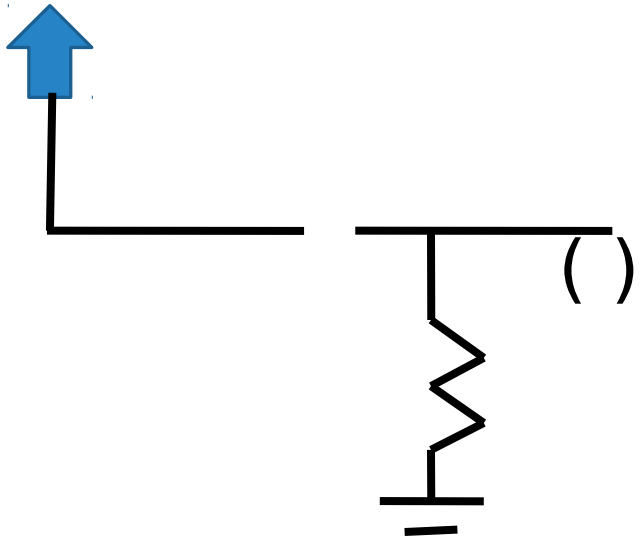
Inputs					Outputs	
S_d	C_d	CP	J	K	O_{n+1}	$\overline{O}_{n+1}$
L	L	⎍	L	L	O_n	$\overline{O}_n$
L	L	⎍	H	L	H	L
L	L	⎍	L	H	L	H
L	L	⎍	H	H	$\overline{O}_n$	O_n

Using switches

- Never leave a input pin unconnected.

- Pull Up/Pull Down.

( )



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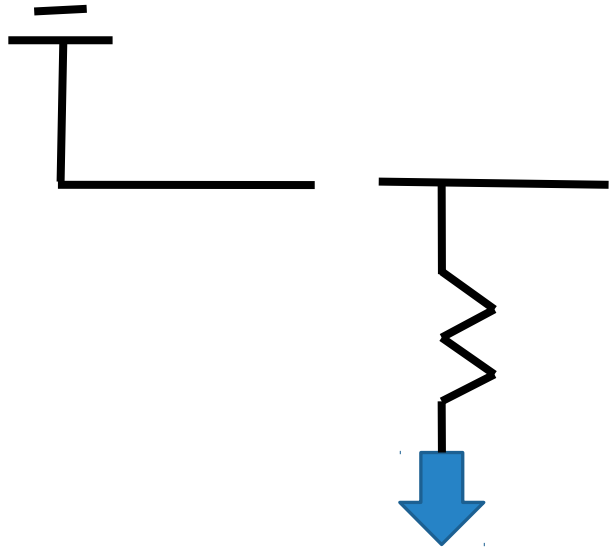


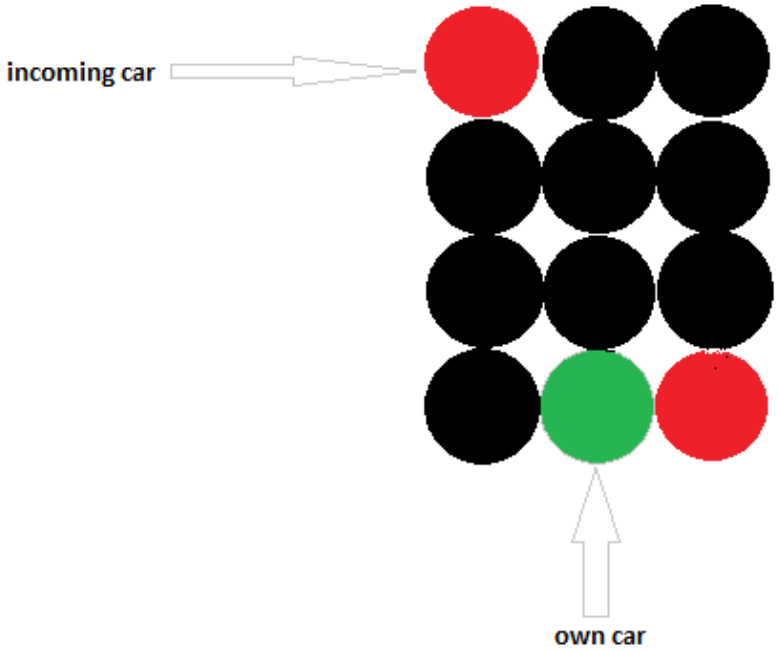
Some Useful Advice

- Tight, clean, non-overlapping connections, which must follow wire color 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.

Problem Statement

- The aim of the competition is to design and build a “Crazy Taxi” using LEDs for display.
- The object of the game is to avoid collisions with the incoming cars while driving on the wrong side of a busy road.

Problem Statement



Compulsory feature #1

Roads of LEDs :

- There must be at least 2 roads (rows) of LEDs with a minimum of 4 LEDs in each rows.
- A car depicted by a glowing LED must move continuously in each of the rows.

Compulsory feature #2

Navigation keys for car

- Left and Right navigation keys must be present to move the car in the horizontal direction.

Compulsory Feature #3

Collision Detection:

In case of collision of the frog with the car, it must be detected by the circuit and a signal must be generated (either by glowing a LED or any other way possible).

Additional Features

Apart from the compulsory features, various additional features can be added to the circuit like

1. 2 Cars on the same road instead of 1.
2. Different levels of game with different speed of cars.
3. Scoring Mechanism, etc.
4. Pausing the game, reset score button

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