Summarizer 0010

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Part I - Digital Electronics
Part II - Computer Architecture

Code Cadet Luis Lopes <A/C_>

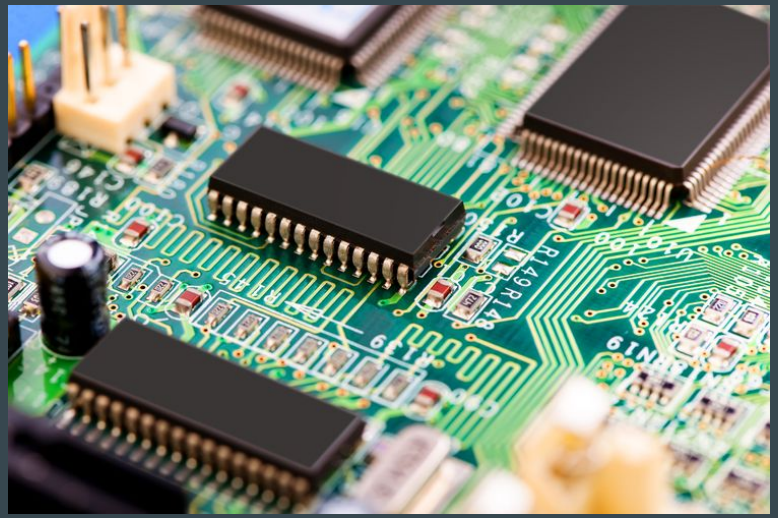
Digital electronics

Electronics that operate on digital signals.

We can do lot’s of cool things with them!

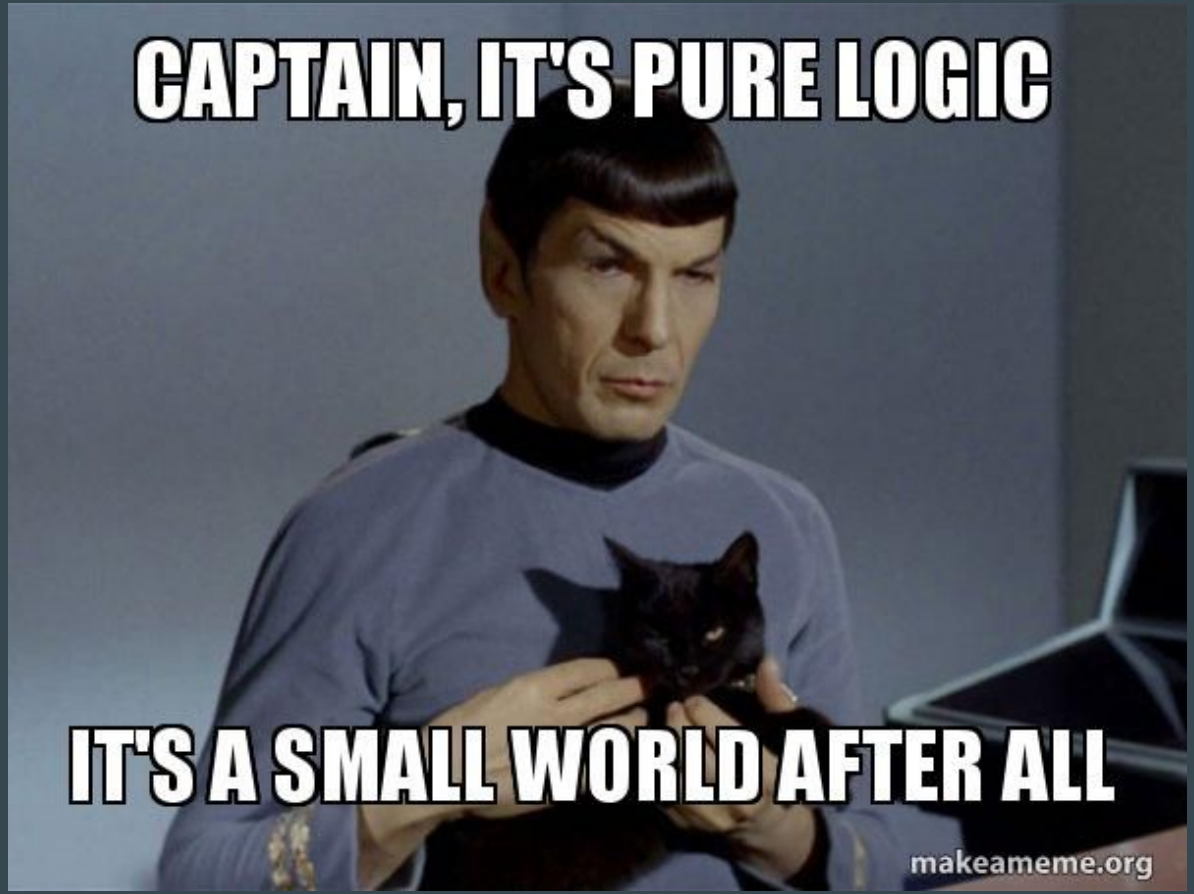
Digital electronics perform highly complex operations

But... how do they work?



Boolean Logic

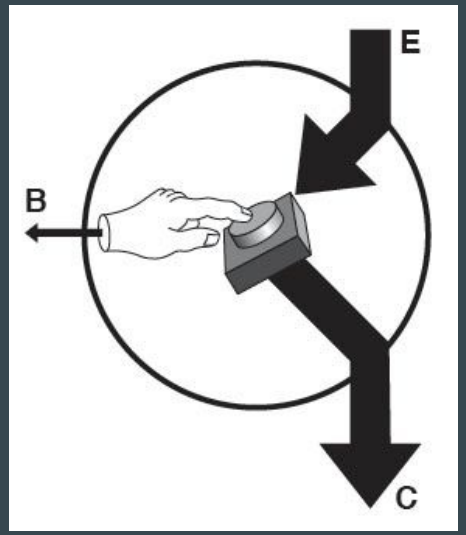
A form of algebra in which all values are reduced to Either TRUE or FALSE.

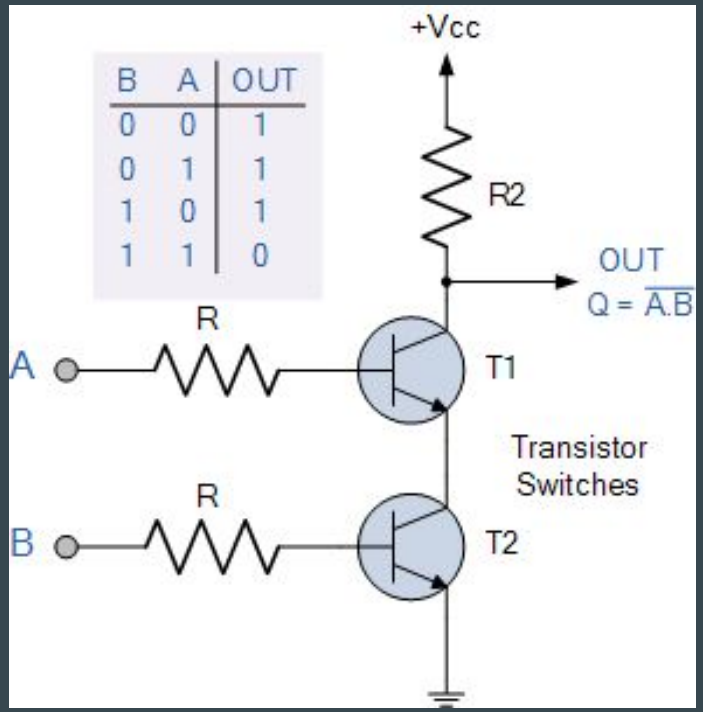


Transistor Switches

Fits with binary numbering system: 0 and 1,

ON or OFF





Boolean algebra

Boolean Operations

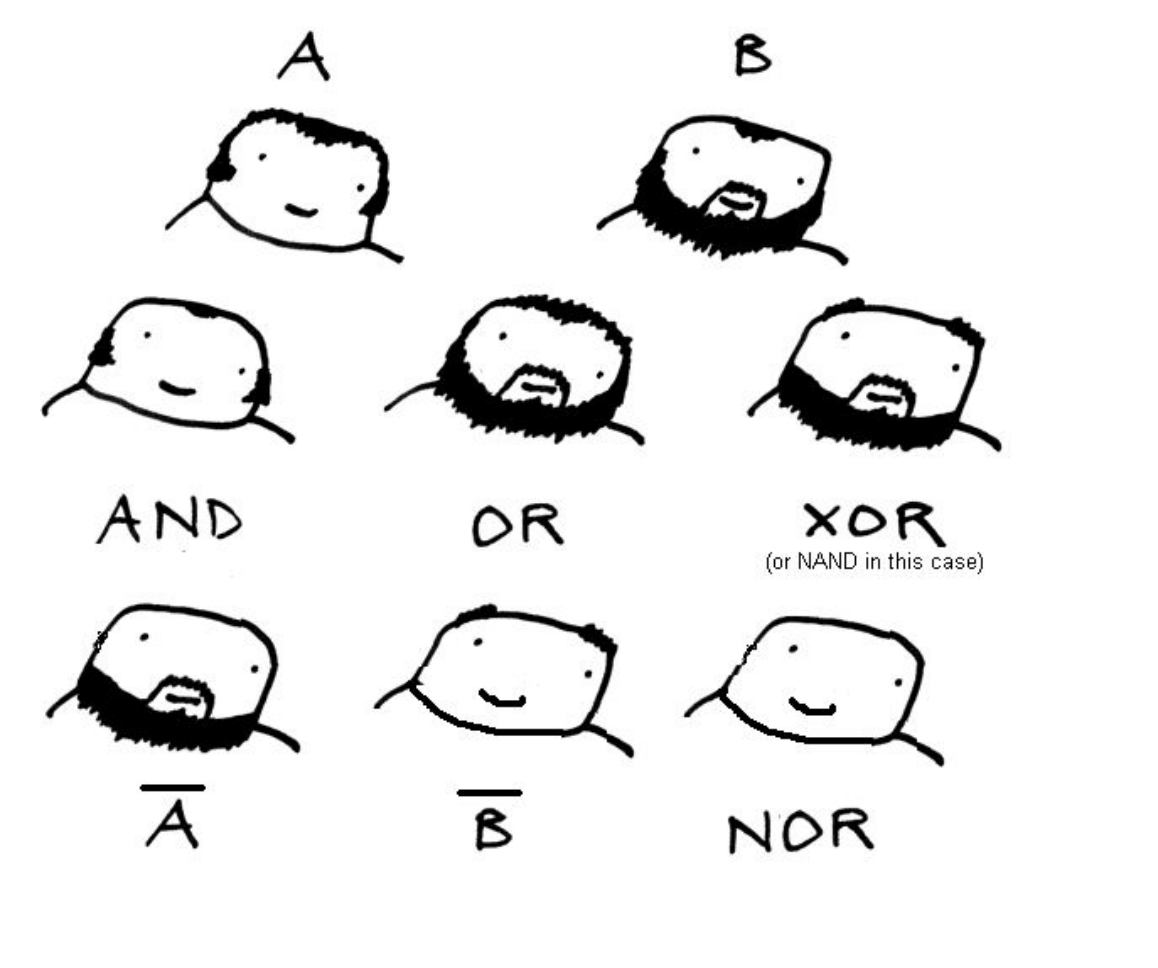
AND

OR

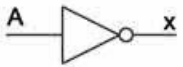
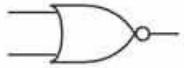
XOR

NAND

NXOR



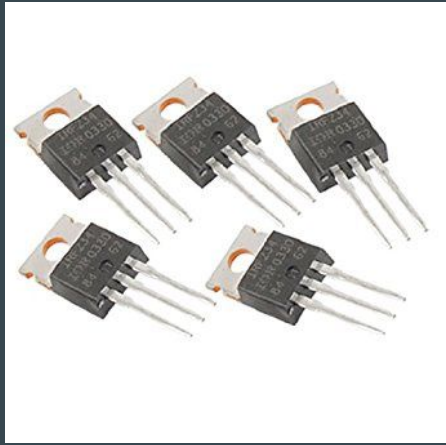
Logic Gates

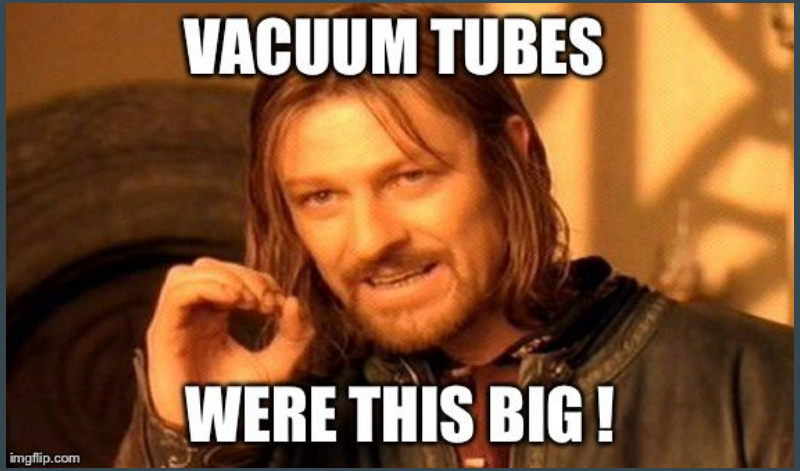
Name	NOT	AND	NAND	OR	NOR	XOR	XNOR
Alg. Expr.	$\overline{A}$	AB	$\overline{AB}$	$A+B$	$\overline{A+B}$	$A \oplus B$	$\overline{A \oplus B}$
Symbol							
Truth Table	A | X 0 | 1 1 | 0	B A | X 0 0 | 0 0 1 | 0 1 0 | 0 1 1 | 1	B A | X 0 0 | 1 0 1 | 1 1 0 | 1 1 1 | 0	B A | X 0 0 | 0 0 1 | 1 1 0 | 1 1 1 | 1	B A | X 0 0 | 1 0 1 | 0 1 0 | 0 1 1 | 0	B A | X 0 0 | 0 0 1 | 1 1 0 | 1 1 1 | 0	B A | X 0 0 | 0 0 1 | 1 1 0 | 0 1 1 | 1

Implementing Logic gates

Relays (electromagnets), valves (vacuum tubes)

and transistors can be used to create logic gates

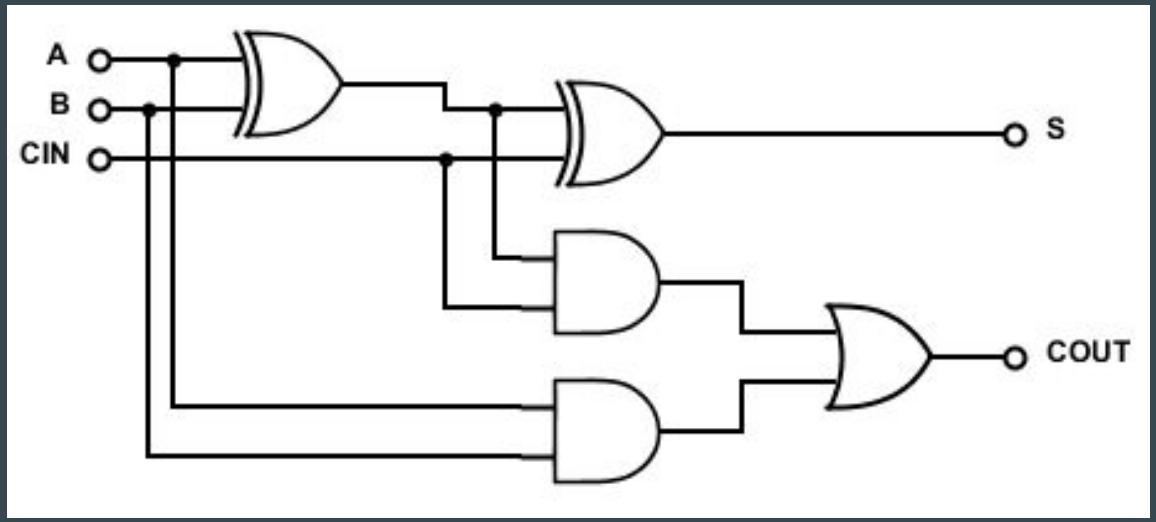




Digital Circuits

Logic gates can be combined to produce complex circuits and logic

Ex: 1-bit adder



Controlling a Calculator display with Logic Gates

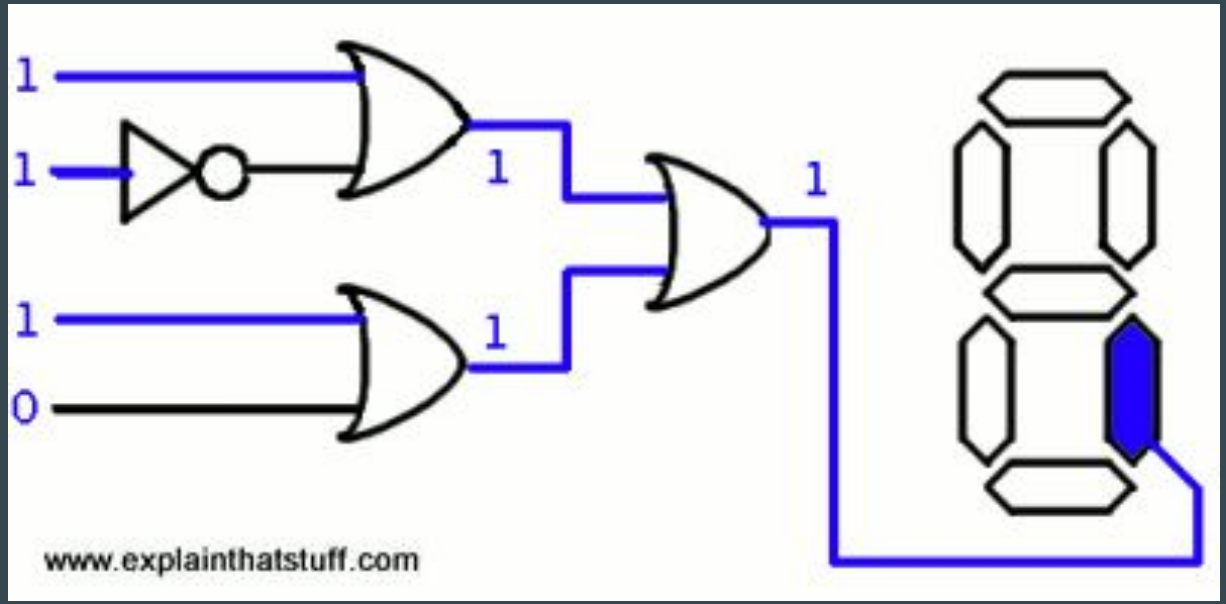
The display is switched on and off by a series of logical gates

By feeding number 7

Binary number 0111

the gate will turn on

the segment



Part II - Computer Architecture

Modern computers: How are they built ???

Definition of a computer

Word “Computer” first recorded as being used

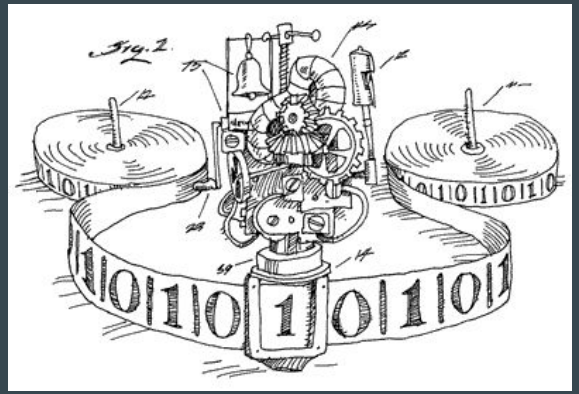
In 1613 and originally was used to describe a human

Who performed calculations or computations.

It is an electronic device, composed of any digital circuits that stores and processes data according to instructions given to it by a program stored in memory.

Principle for modern computers

Controlling the machine's operations by means of a program of coded instructions stored in the computer memory.



In 1936 Alan Turing creates The Turing machine.

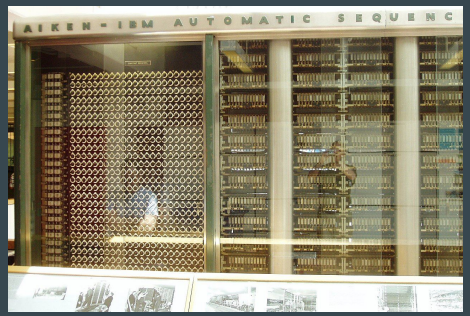
A device that prints symbols on paper emulating

a person following a series of logical instructions.

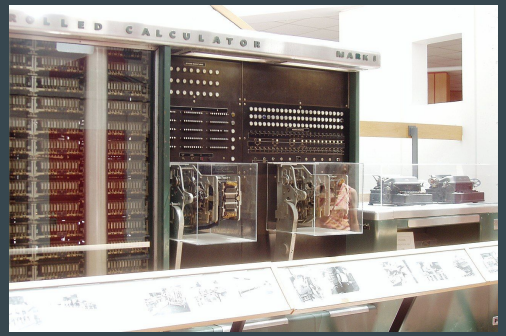
Electromechanical Computers - Earliest computers

Switches were opened and closed by magnetic fields produced by relays.

Example: IBM ASCC aka Harvard Mark I



Left end with relays for computing



Right end with data and program readers

And automatic typewriters

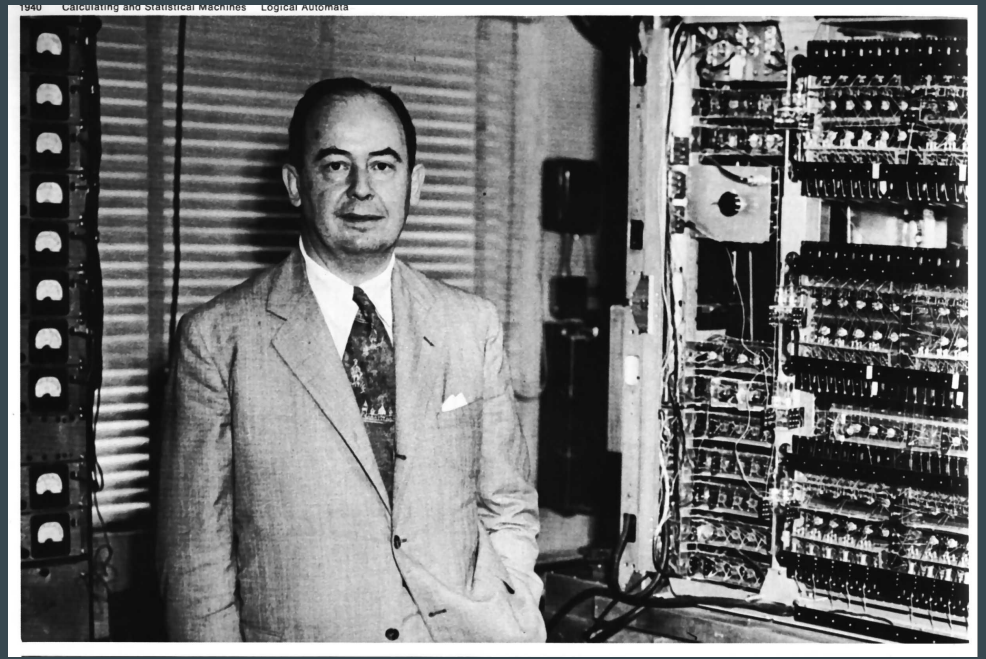
The Von Neumann Architecture

One of the first programs to run on the Mark I was initiated on 1944

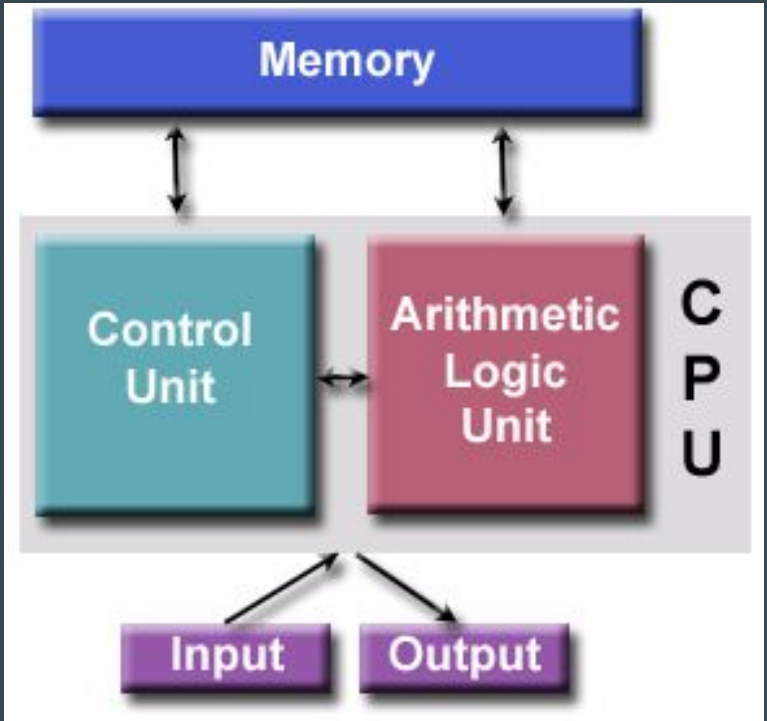
By John Von Neumann.

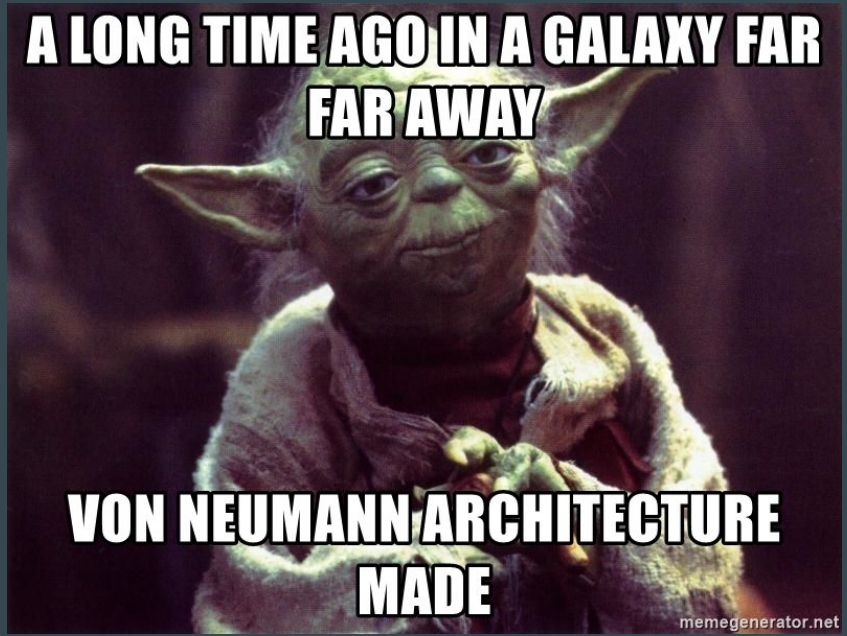
Nowadays, modern computers still use...

The Von Neumann Architecture!!

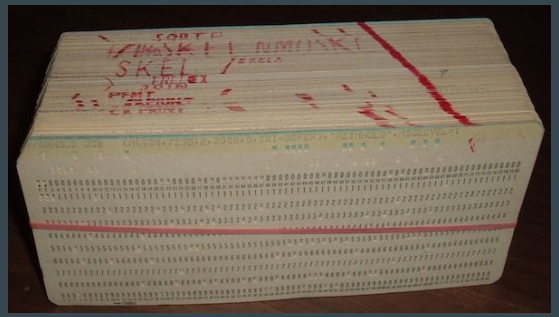


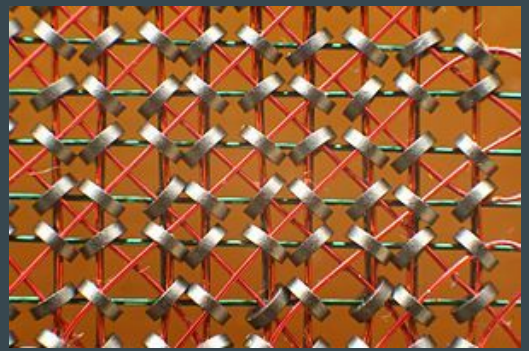
A design architecture for an electronic digital computer





Memory - Subsystems



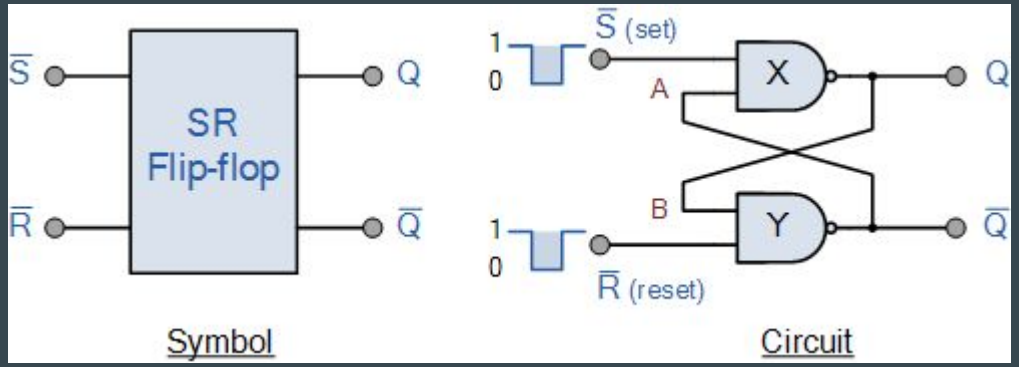


How to store memory - The basic SR Flip-flop Circuit

Connecting a pair of cross-coupled

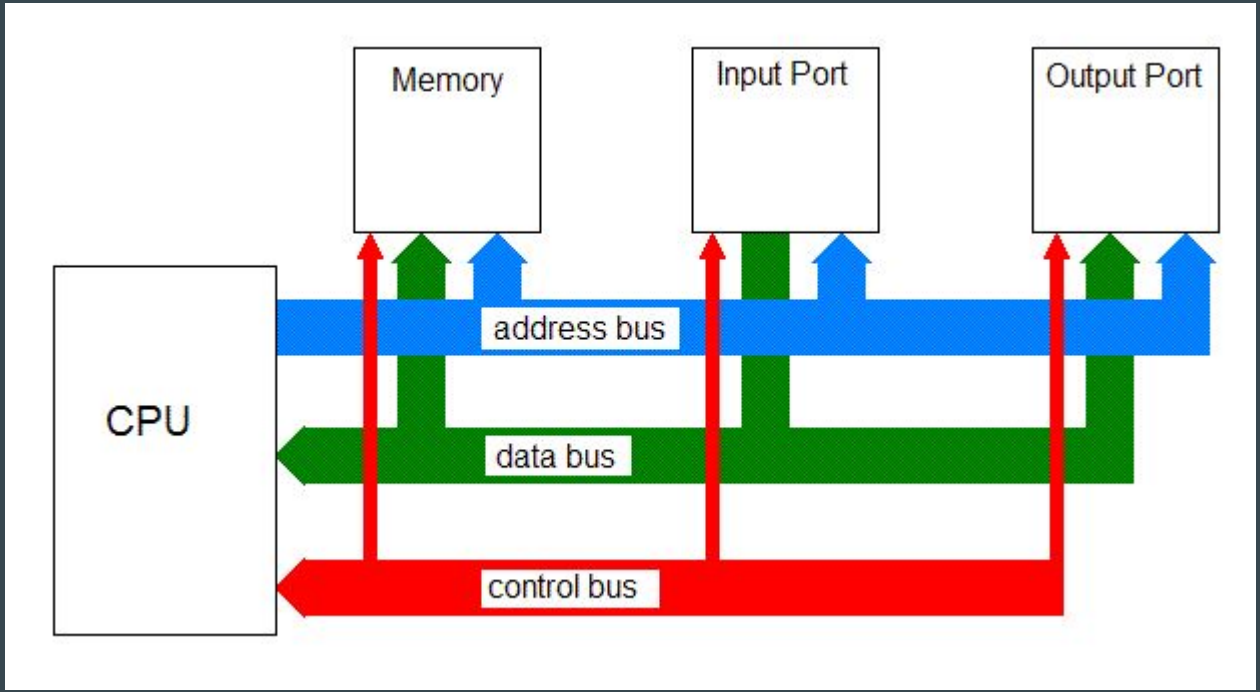
2- input NAND gates we get a SR Flip-flop, or latch.

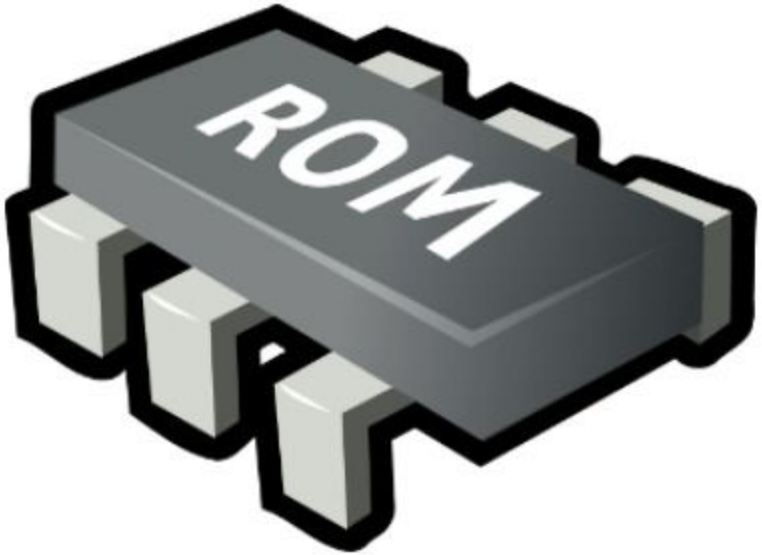
With 2 stable outputs, it's possible to store 1-bit!



$\bar{S}$	$\bar{R}$	Q	State
1	1	Previous State	No change
1	0	0	Reset
0	1	1	Set
0	0	?	Forbidden

Travels destinations





RAM Vs ROM


BUT WAIT
THERE'S MORE!

Character encoding schemes

It’s possible to store numbers and characters!

ASCII, ANSI, UNICODE

UTF-8, UTF-16, UTF-32

ASCII - American Standart Code for Information Interchange

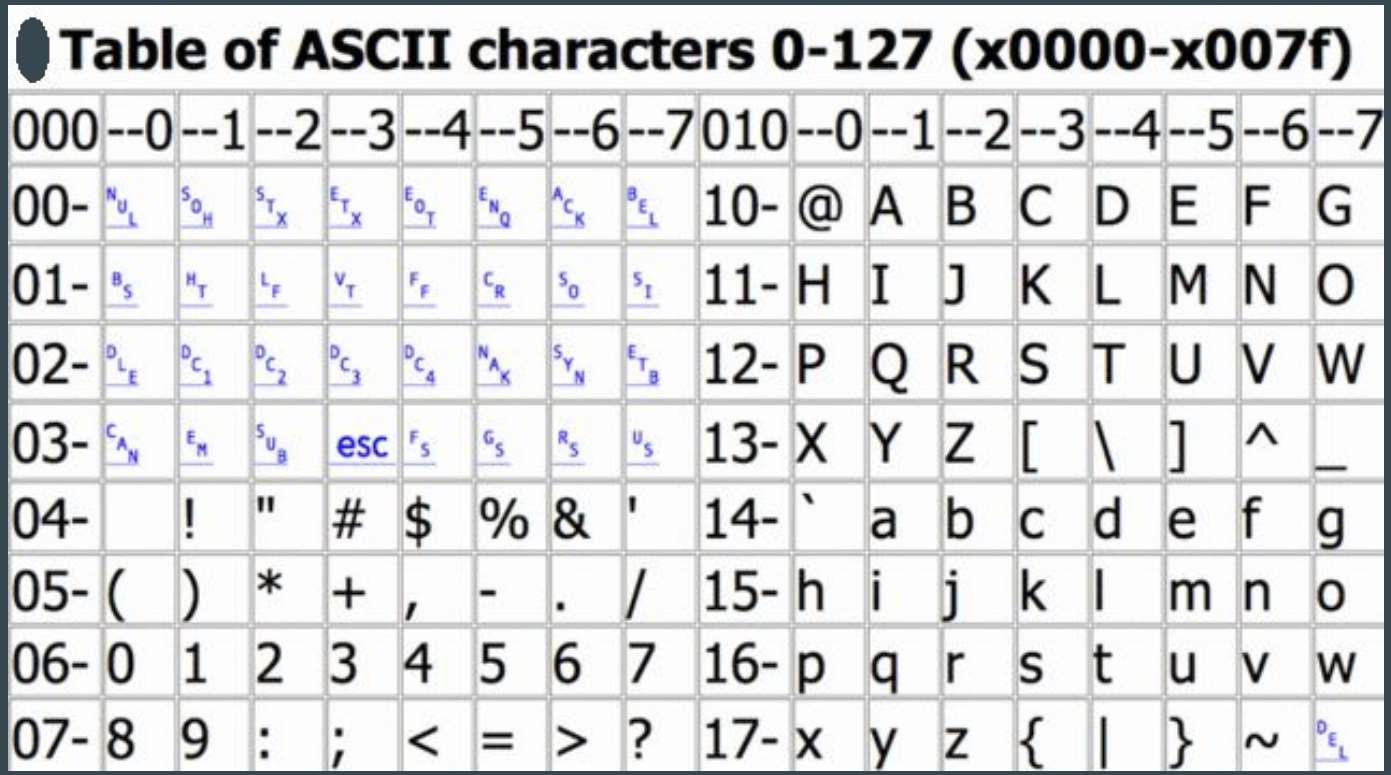
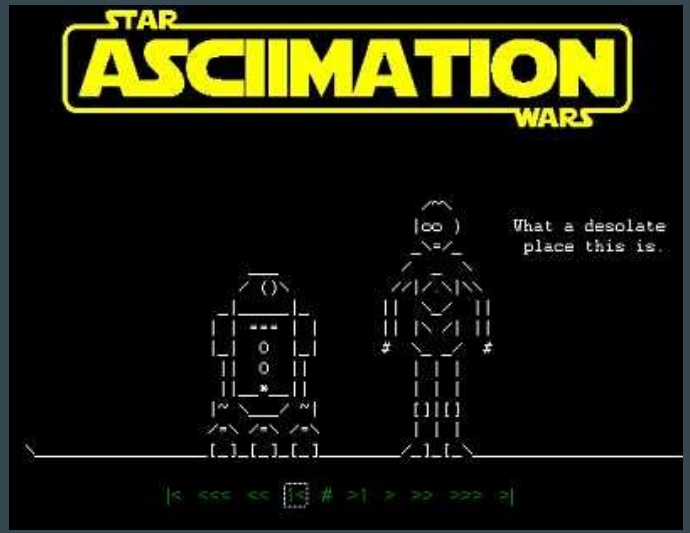
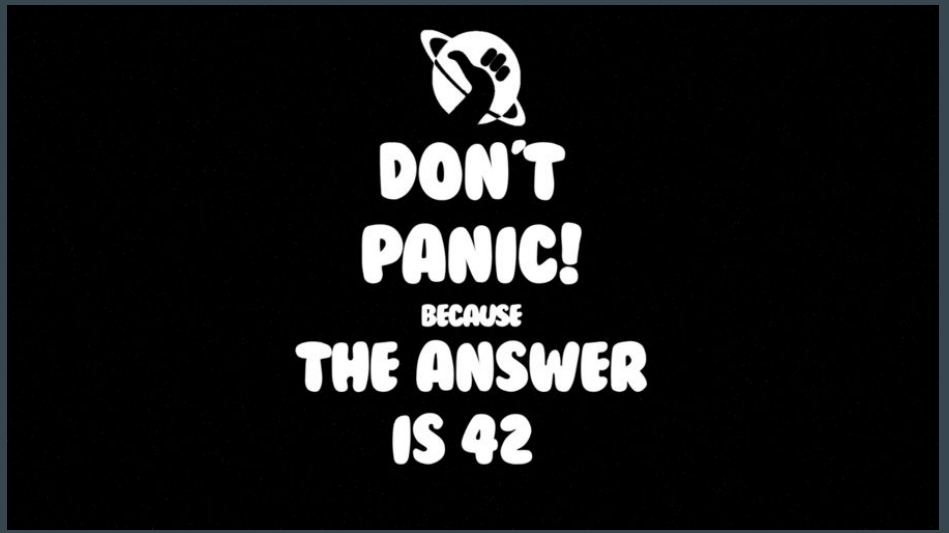


Table of ASCII characters 0-127 (x0000-x007f)

000	--0	--1	--2	--3	--4	--5	--6	--7	010	--0	--1	--2	--3	--4	--5	--6	--7
00-	NUL	SOH	STX	ETX	EOT	ENQ	ACK	BEL	10-	@	A	B	C	D	E	F	G
01-	BS	HT	LF	VT	FF	CR	SO	SI	11-	H	I	J	K	L	M	N	O
02-	DLE	DC1	DC2	DC3	DC4	NAK	SYN	ETB	12-	P	Q	R	S	T	U	V	W
03-	CAN	EM	SUB	esc	FS	GS	RS	US	13-	X	Y	Z	[	\	]	^	_
04-		!	"	#	$	%	&	'	14-	`	a	b	c	d	e	f	g
05-	(	)	*	+	,	-	.	/	15-	h	i	j	k	l	m	n	o
06-	0	1	2	3	4	5	6	7	16-	p	q	r	s	t	u	v	w
07-	8	9	:	;	<	=	>	?	17-	x	y	z	{	|	}	~	DEL

We can be very creative with ASCII!





Thanks for watching and happy learnings!
Special thanks to Enuminatti for the visit!!