Data Storage

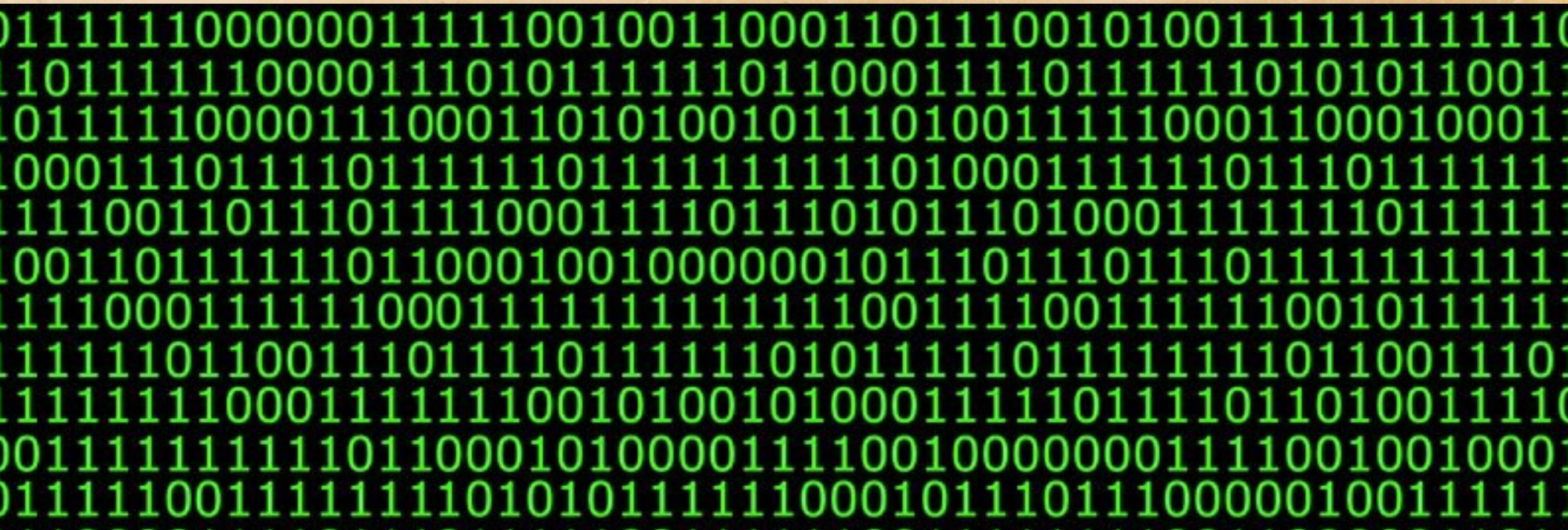
Zeros and Ones

Lecture Contents

- The electronics behind computers
  - Switches (transistors)
  - Logic Gates
  - Flip Flops

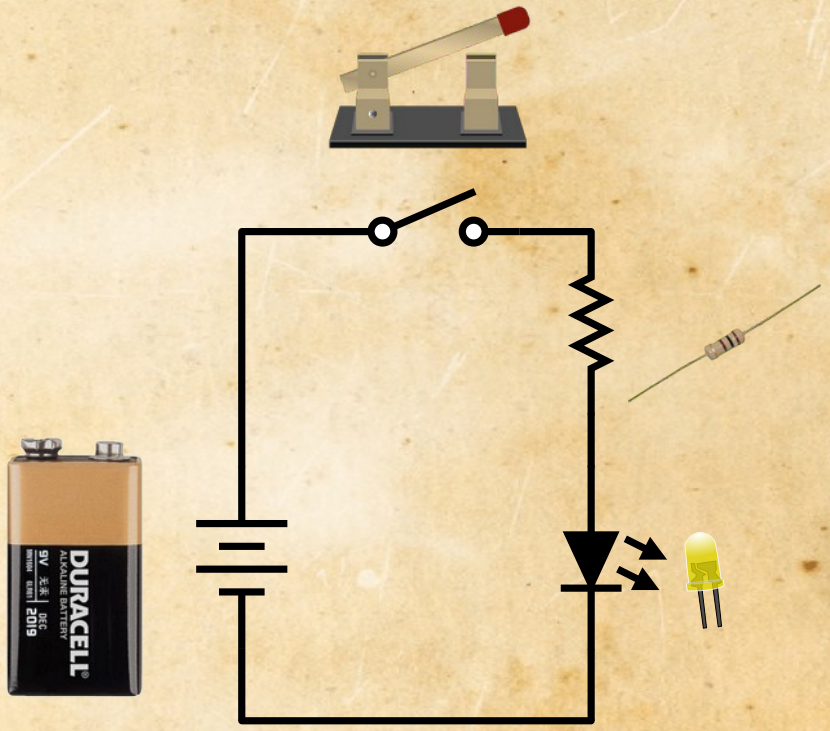
Digital Data

- Computers store data as zeros and ones…
  - each zero or one is referred to as a “**bit**” (**bi**nary digi**t**)



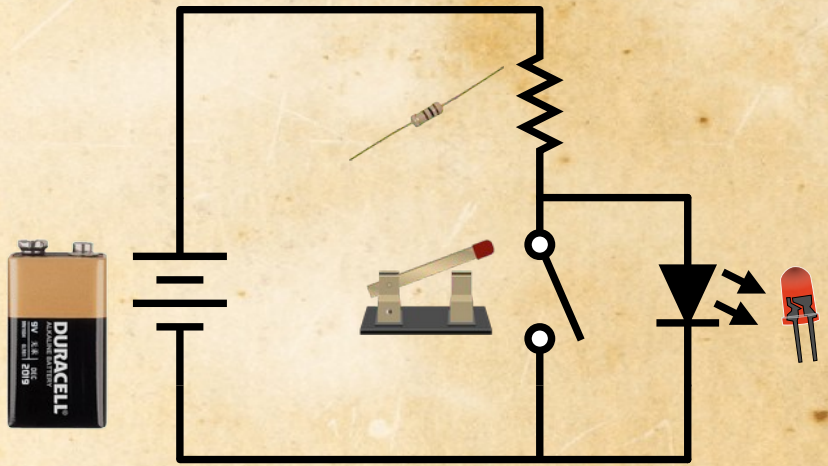
Switches

- When will the light turn on?



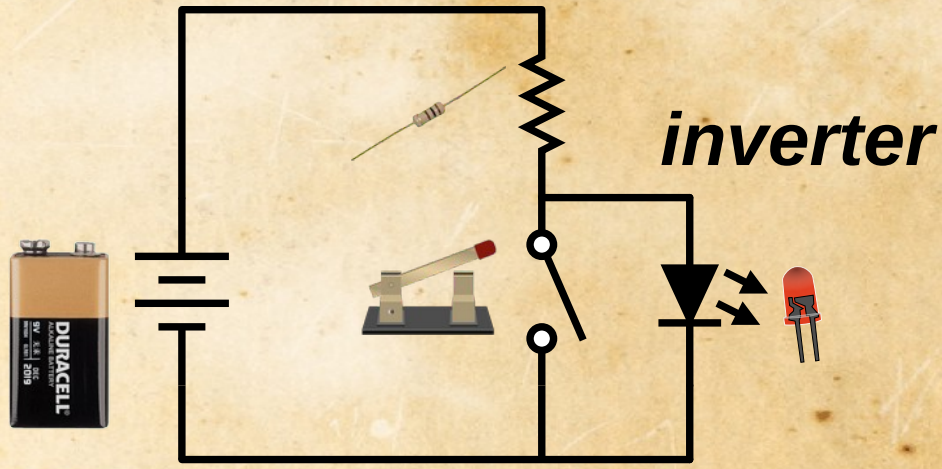
Switches

- When will the light turn on?



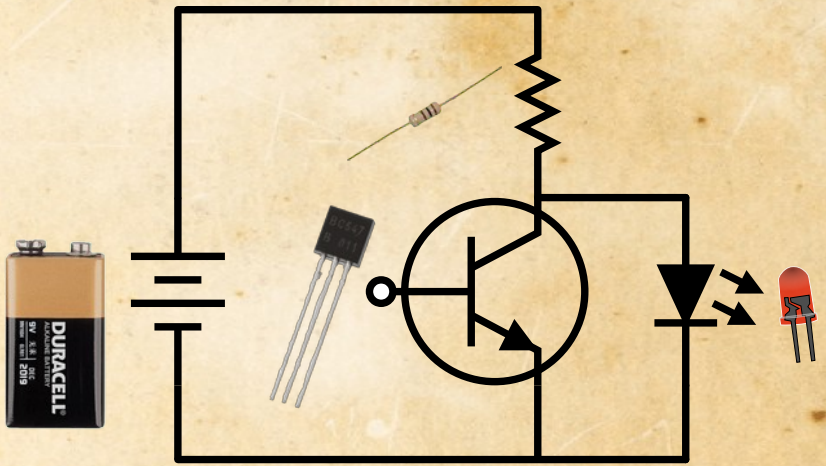
Switches

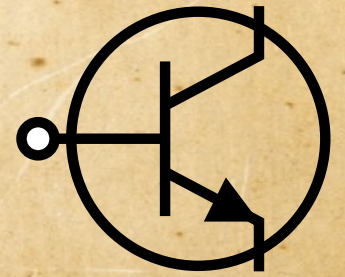
- When will the light turn on?



Switches

- ***Transistors*** are electrically controlled switches

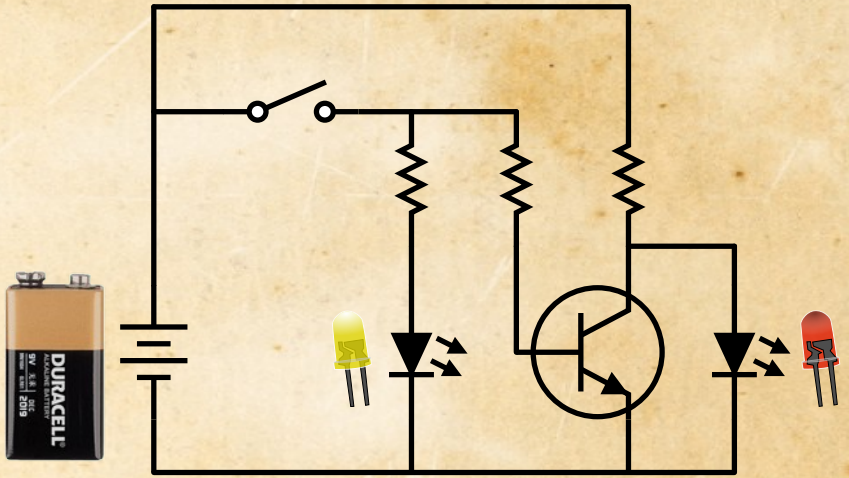




transistor

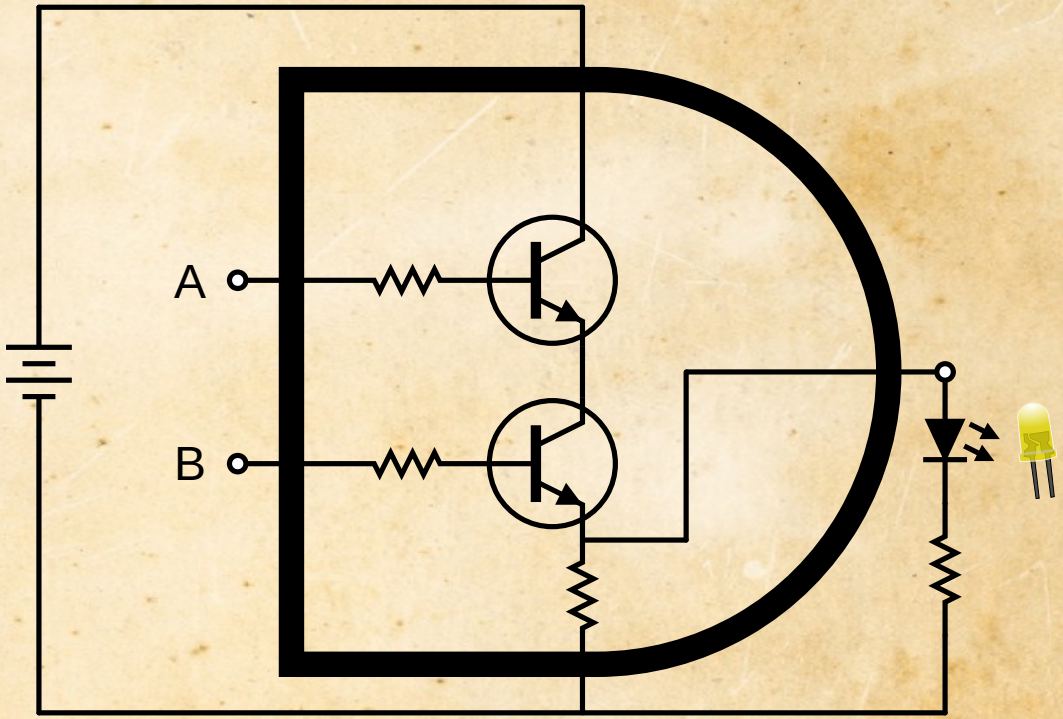
Digital Data

- Which will light?



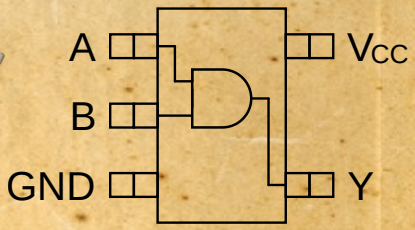
Gates

- AND gate



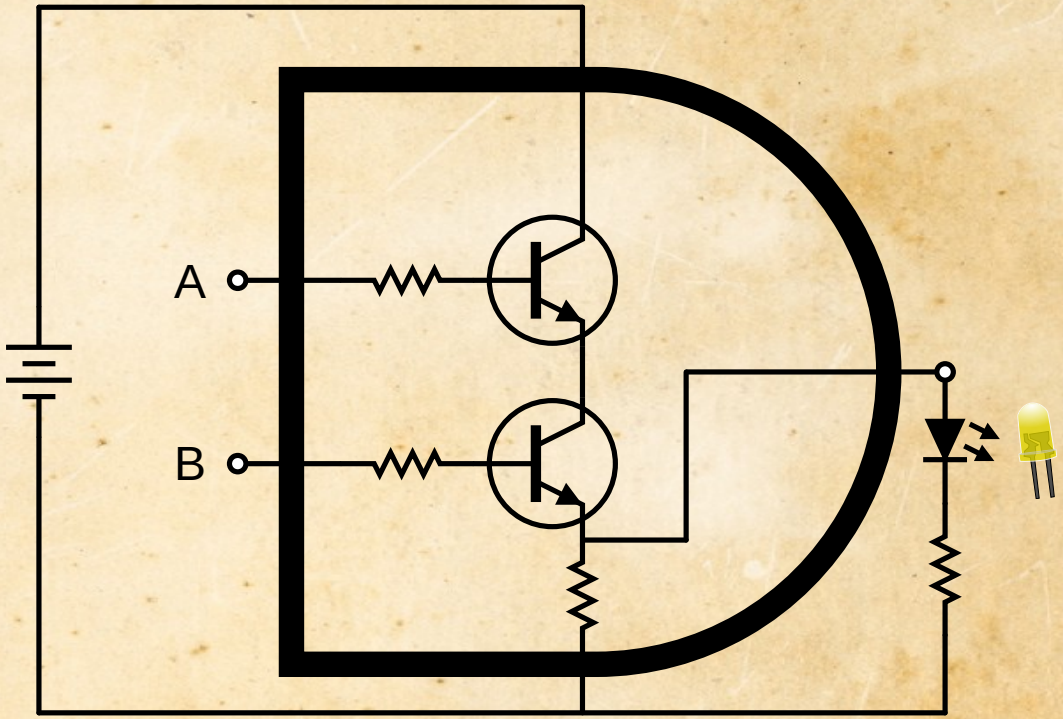
Truth Table

A	B	Y
0	0	
0	1	
1	0	
1	1	



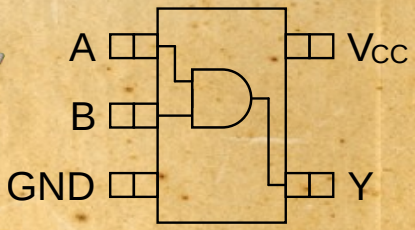
Gates

- AND gate



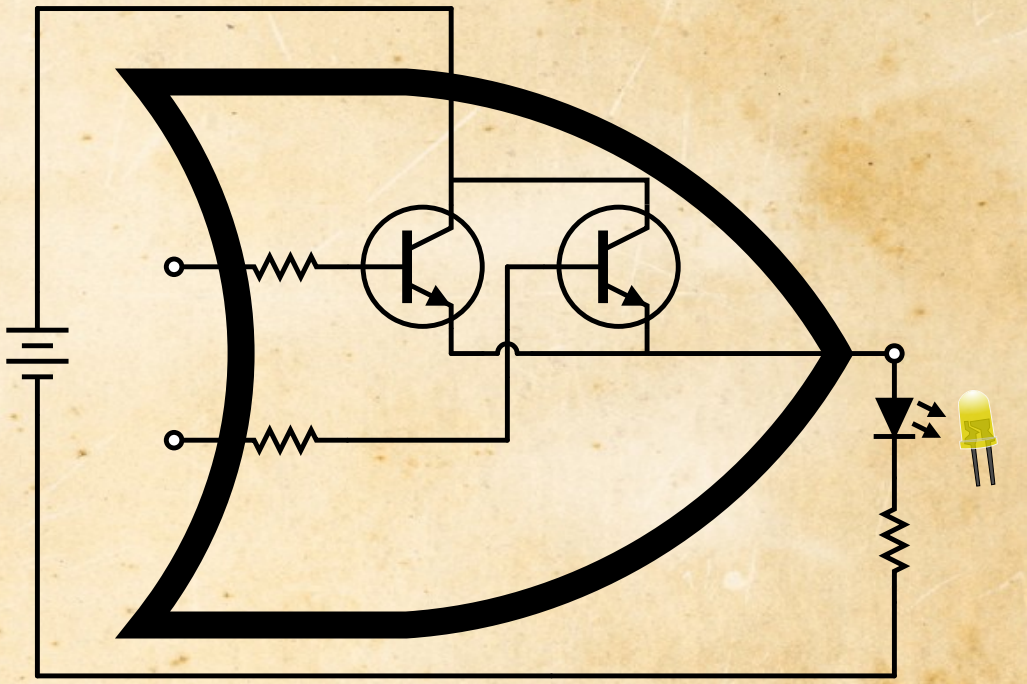
Truth Table

A	B	Y
0	0	0
0	1	0
1	0	0
1	1	1



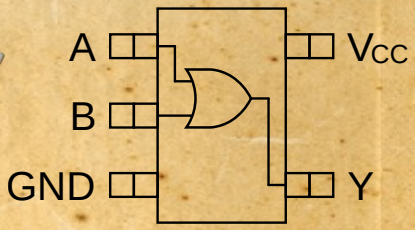
Gates

- OR gate



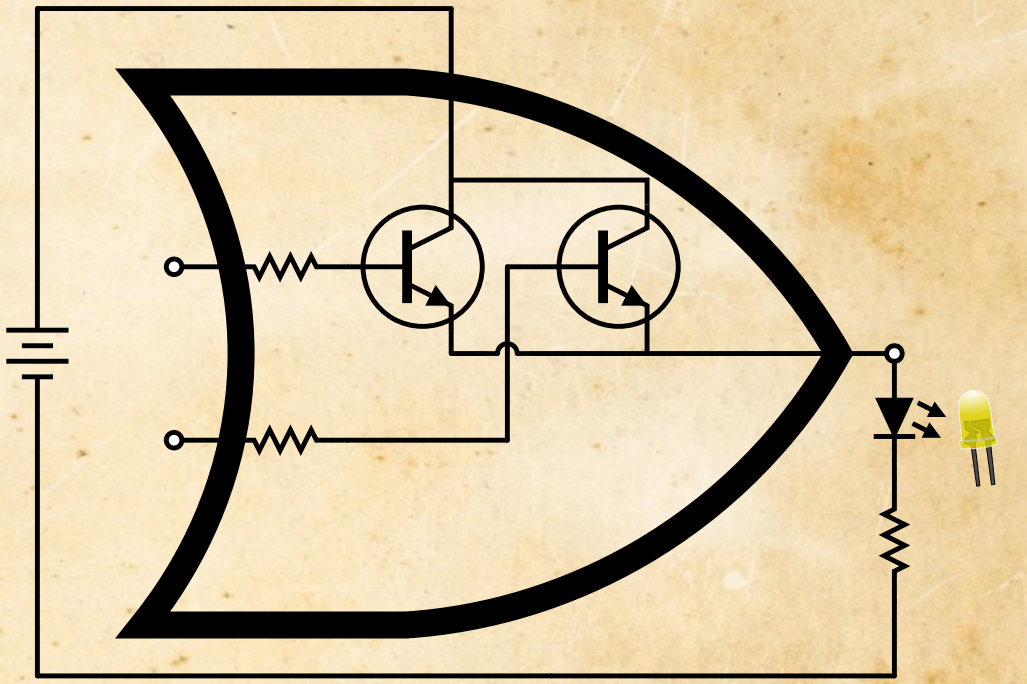
Truth Table

A	B	Y
0	0	
0	1	
1	0	
1	1	



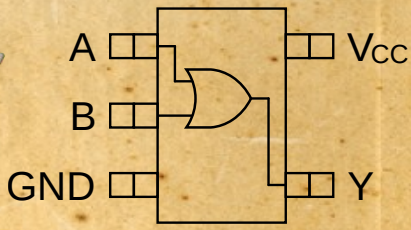
Gates

- OR gate



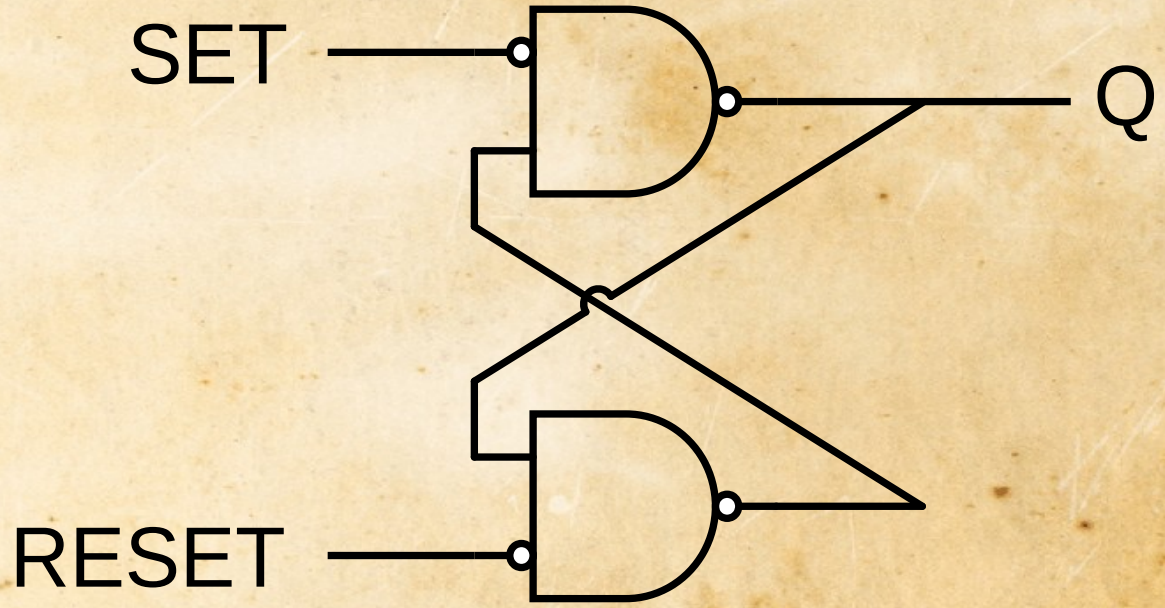
Truth Table

A	B	Y
0	0	0
0	1	1
1	0	1
1	1	1



Flip Flops

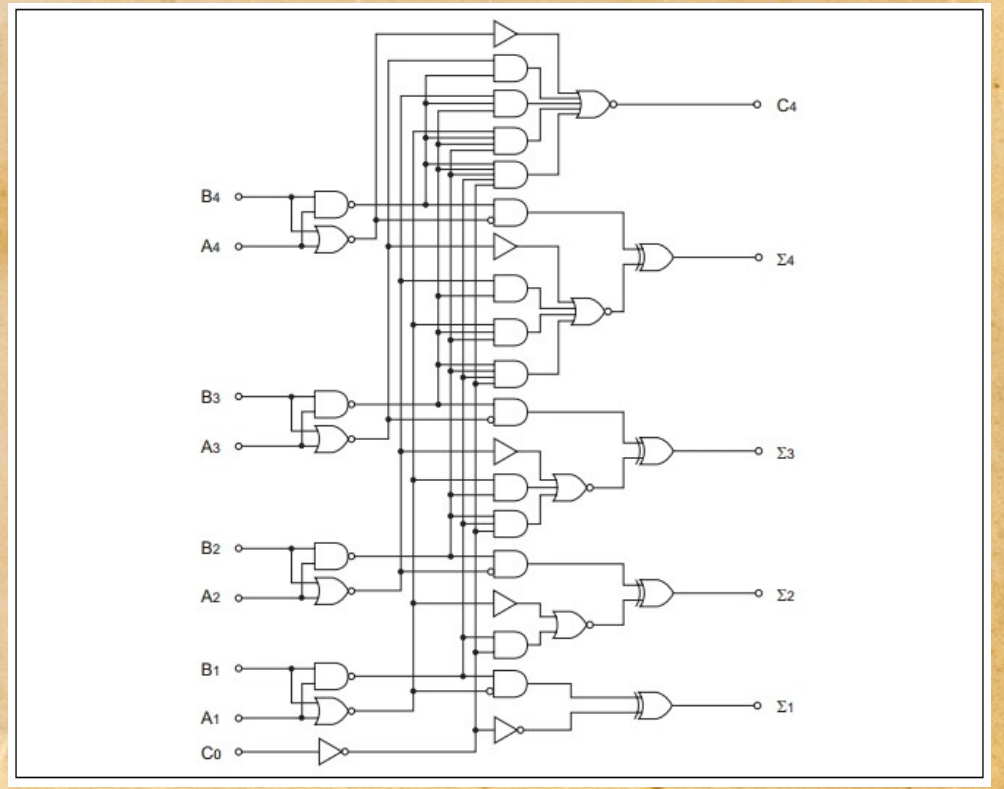
- A ***latch***, also called a ***flip flop*** will store a value



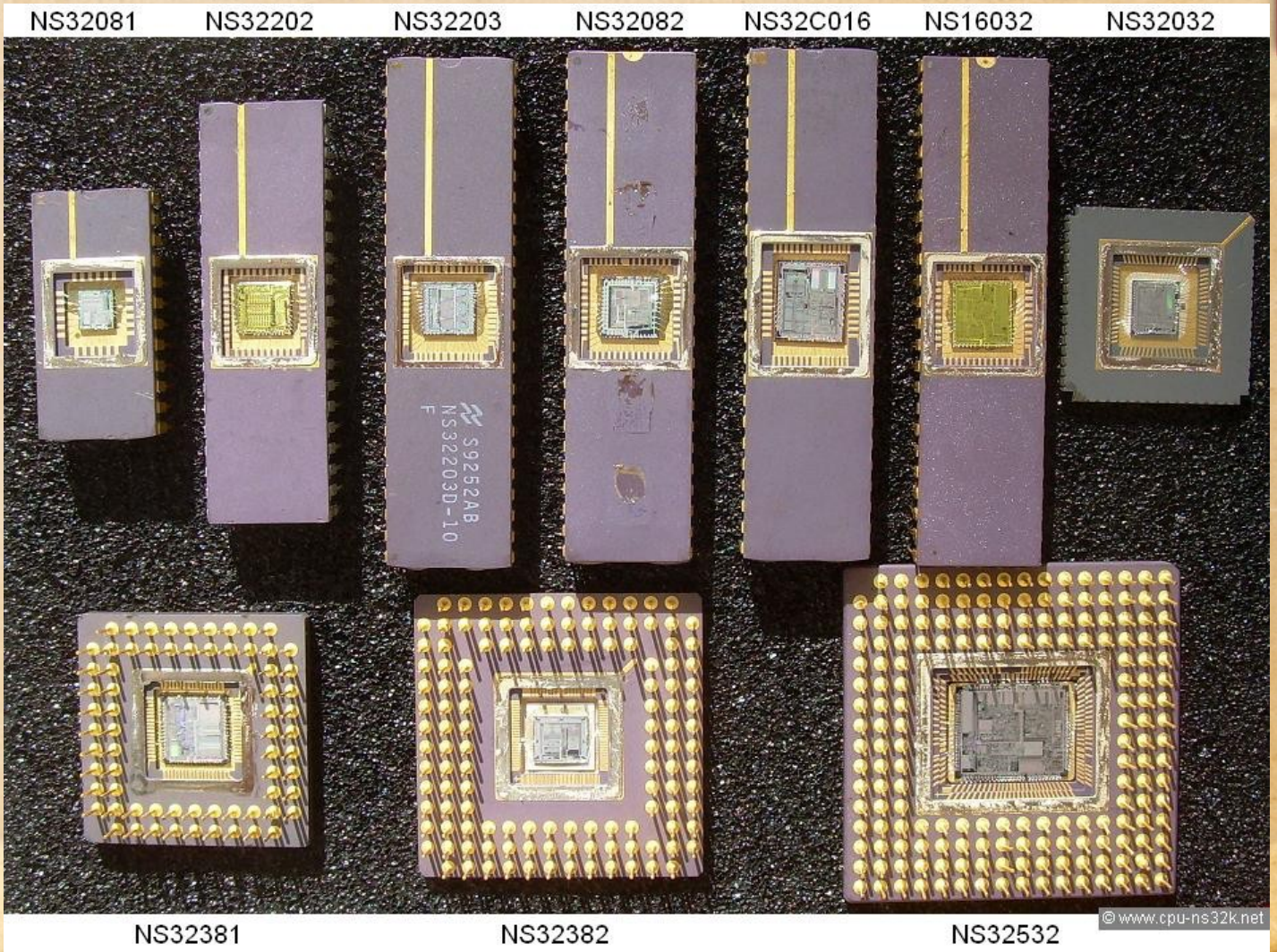
Binary

- Binary addition

$$\begin{array}{r} 1011 \\ +1101 \\ \hline 11000 \end{array}$$

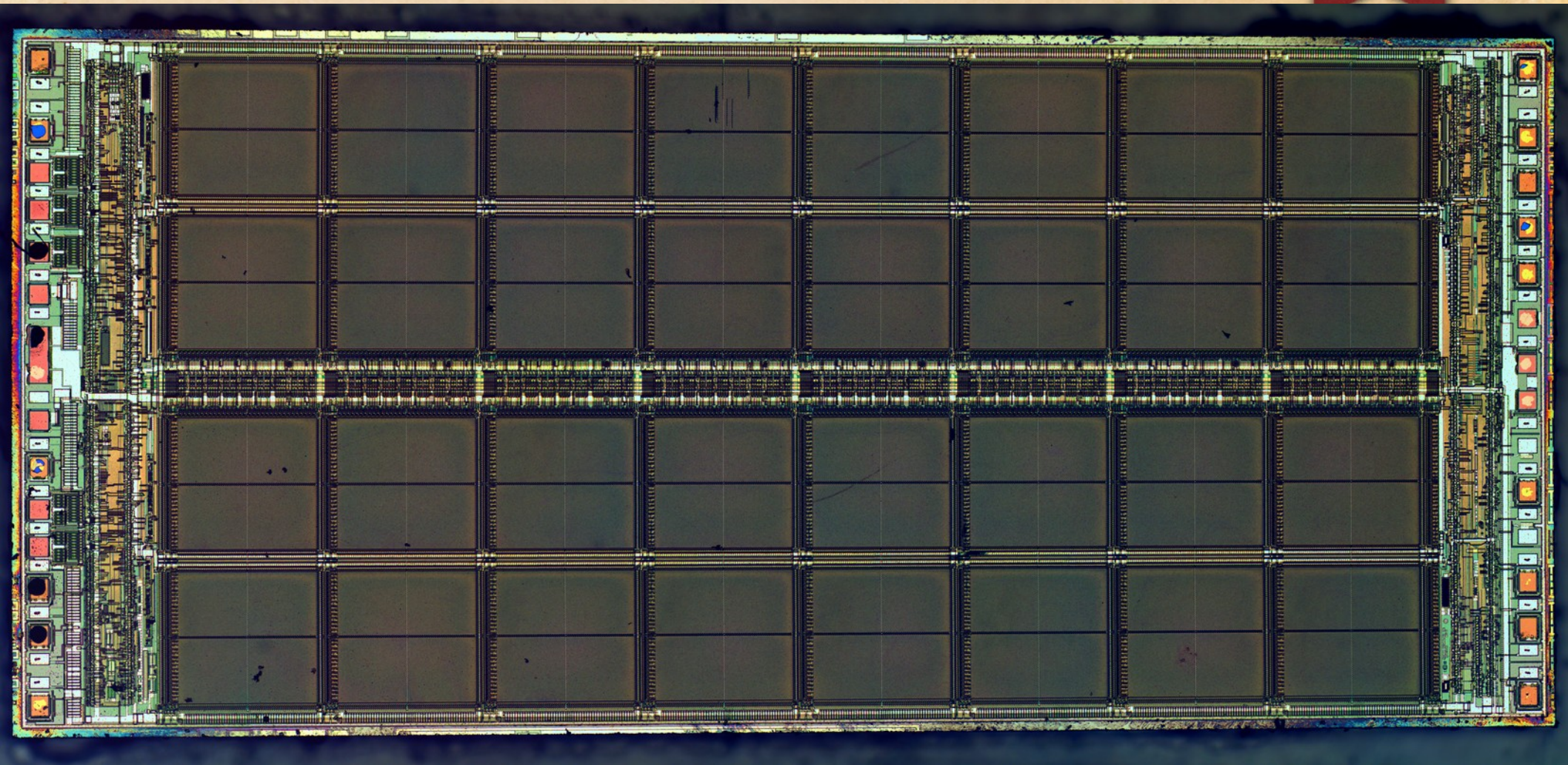


1980’s CPUs with up to 370k transistors



Intel i9: 16 (8+8) Core processor

128kB Dynamic Random Access Memory



Data Storage

Zeros and Ones