54 68 65 72 65 27 73 20 6f 6e 6c 79 20 31 30 20 74 79 70 65 73 20 6f 66 20 70 65 6f 70 6c 65 20 69 6e 20 74 68 69 73 20 77 6f 72 6c 64 2e 20 54 68 6f 73 65 20 77 68 6f 20 75 6e 64 65 72 73 74 61 6e 64 20 68 65 78 61 64 65 63 69 6d 61 6c 2c 20 61 6e 64 20 46 20 74 68 65 20 72 65 73 74 2e

Number Systems And Computer Hardware

Binary Ruins Everything

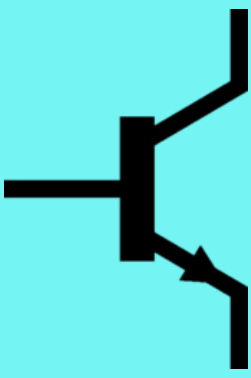
- Bi-nary: A number system that uses 2 digits 0 & 1

128's	64's	32's	16's	8's	4's	2's	1's	
1	0	1	0	0	1	0	1	= 1000101
128	+	32	+		4	+	1	= 165

- The above sequence is 8-bit (1 byte)
- A 64-bit storage can store numbers up to 9,223,372,036,854,775,808

Transistors

- Turns off and on billions of times/sec
- 7 nanometers thick

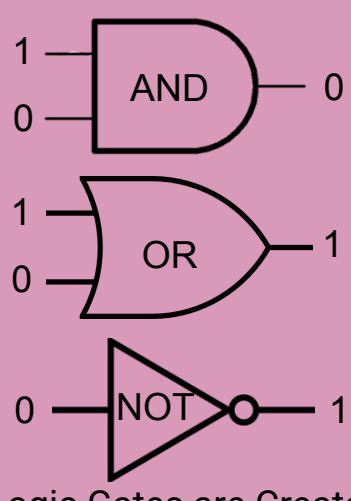


When it is on, it sends 1

When it is off, it sends 0

Logic Gates

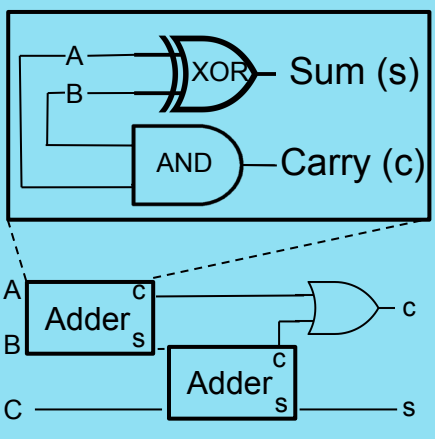
Takes input(s) & gives output based off logic arguments



Logic Gates are Created From Transistors

The ALU

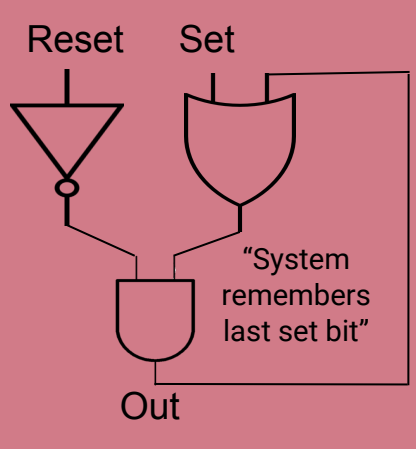
Performs Arithmetic & Logic Operations on Binary



Repeat these steps to create complex ALUs

The RAM

Allows data to be read and stored inside the memory



Combine similar components to form RAM

Keyboard - a circuit fires, sending a string of binary information every time a button is pressed
Hard Drives - Binary data is stored on a ferromagnetic material, which changes the direction of magnetism when it is measured
Monitor - creates an image from binary bits it receives that encodes RGB data
Sound Card - samples the voltage of an analog signal many times a second, and records the voltage in 4, 8, 16, 24, or 32 bits. Recording the voltage with 24-bits is approximately the quality of a CD
Motherboard - a circuit that uses electricity to communicate binary data with different parts (CPU, Hard Drive, Different cards etc.)
Network Adapter - converts radio waves to binary data in a similar way sound cards work and passes it on to the CPU
Printer - receives CMYK data from binary bits and uses it to determine the pattern of the ink when the image is actually printed
Scanners - reflects light on a scanned image and back unto a photosensitive material, which transfers the color data via electrical signals in binary bits
Everything Else - All hardware can only recognize two states: on & off. Although other bases may be more efficient when packaging data together, at the end the computer will only recognize the binary data

What about Octal & Hexadecimal

- *Binary is great and all, but it's hard to read. We need to* `simplify it` and group them into higher-based systems
- Base-10 may seem natural, but it's hard to convert to binary

The bases of Octal and Hexadecimal are **powers** of base-2 (4-bits are encoded in ever 2 hex digits)

- Html colors are often represented as a 6-digit Hex Code

#6BDEDE #A4E5F5 #C4C0ED #D17B88 #D999B9

Letters + Words?

- Letters were encoded in 2-digit hex code in WWII
- ASCII encodes capital/lowercase letters, & punctuation in 7 bits (It's how Mark Watney talked to Houston)
  - ASCII was designed for English and didn't take in account foreign languages and emojis 💩
- In 1992, Unicode solved this problem with more bits. It is consisted of 17 planes and each plane is represented by 16-bits. Altogether, Unicode can store 1,114,112 digits