

# Exploring Computer Science

Binary

# This coming week

- More on how computers work
- I'm out Thurs and Fri for a conference 😞
  - I will miss you
- Movie! Pirates of the Silicon Valley
- Short writing assignment: Macs vs PCs.

# Recall: What is binary?

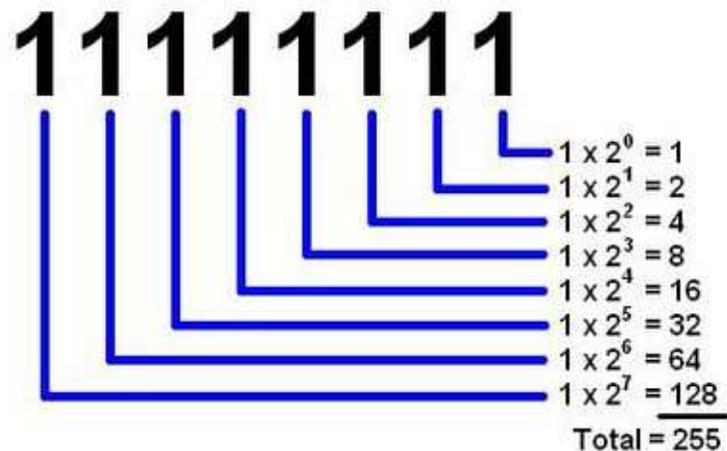
- Base-2 number system
- Way computers represent all data
- '0s and 1s'

# Convert from binary

$2^4 = 16$	$2^3 = 8$	$2^2 = 4$	$2^1 = 2$	$2^0 = 1$	
0	1	1	0	1	
	8	+	4	+	1 = 13

$2^4 = 16$	$2^3 = 8$	$2^2 = 4$	$2^1 = 2$	$2^0 = 1$	
1	1	1	0	0	
16	+	8	+	4	= 28

## Base Two Number System



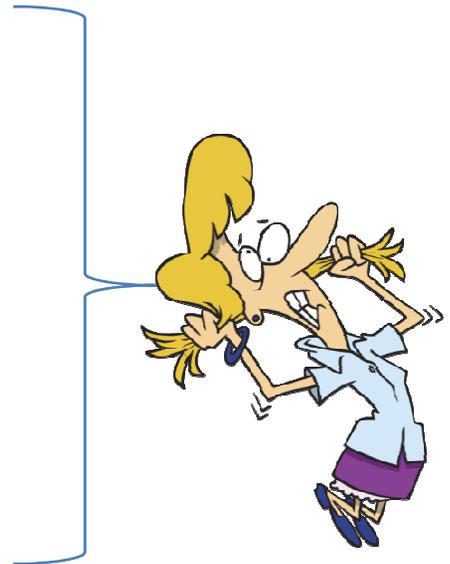
# Recall: 7-segment displays

- How many switches did we need to represent all 9 digits?
  - 4
- How many decimal numbers could we have represented if we had a bigger display?
  - 16 (0 through 15)

# Bits and bytes

- We needed 4 bits to drive our 7-segment display
- Generally, computer storage is measured in bytes – 8 bits – and its multiples

Decimal			Binary		
Value	<u>SI</u>		Value	<u>IEC</u>	
1000	k	<a href="#">kilo</a>	1024	Ki	kibi
1000 <sup>2</sup>	M	<a href="#">mega</a>	1024 <sup>2</sup>	Mi	mebi
1000 <sup>3</sup>	G	<a href="#">giga</a>	1024 <sup>3</sup>	Gi	gibi
1000 <sup>4</sup>	T	<a href="#">tera</a>	1024 <sup>4</sup>	Ti	tebi
1000 <sup>5</sup>	P	<a href="#">peta</a>	1024 <sup>5</sup>	Pi	pebi



# Representing letters

- Given our alphabet, at least how many bits would we need to represent every letter?
  - 5 bits
- Why might we want more?
- What if we want capitalization and numbers?
  - 6 bits

# ASCII

Binary	Glyph		
100 0001	<u>A</u>	100 1110	<u>N</u>
100 0010	<u>B</u>	100 1111	<u>O</u>
100 0011	<u>C</u>	101 0000	<u>P</u>
100 0100	<u>D</u>	101 0001	<u>Q</u>
100 0101	<u>E</u>	101 0010	<u>R</u>
100 0110	<u>F</u>	101 0011	<u>S</u>
100 0111	<u>G</u>	101 0100	<u>T</u>
100 1000	<u>H</u>	101 0101	<u>U</u>
100 1001	<u>I</u>	101 0110	<u>V</u>
100 1010	<u>J</u>	101 0111	<u>W</u>
100 1011	<u>K</u>	101 1000	<u>X</u>
100 1100	<u>L</u>	101 1001	<u>Y</u>
100 1101	<u>M</u>	101 1010	<u>Z</u>

# Character encodings

- Binary can be interpreted many ways
  - File needs to include info on how it is encoded
  - Computer needs program to decode properly
- Pandora's box!
- Why your files sometimes end up looking like:  
□□□,ŕŚŪΔΦ□□□□□●□□□□□→

# Webquest

- I'm tired of talking. You're tired of listening.
- You can spend more time on things that interest you and less on ones that bore you
- I will grade on how complete and accurate your answers are