LIS-3353

Everything is a number

aka "**Binary**"

aka "I get to bring back this thing that a lot of people hate because cryptocurrency is a thing these days"

Binary System

0 and 1

How many light switches..

..would it take to store "what season is it?"

A minimum of 2:

Winter	OFF-OFF	00
Fall	OFF-ON	01
Spring	ON-OFF	10
Summer	ON-ON	11

Binary System

0 and 1

Humans counting things !!!!

Humans counting!

In the beginning, there was...probably just a buncha lines, right?

THEN....Tally Marks

THEN ...Roman Numerals

THEN..Arabic Numerals

Humans counting!

In the beginning, there was...probably just a buncha lines, right?

THEN....Tally Marks

THEN ...Roman Numerals

THEN..Arabic Numerals?

Humans counting!

In the beginning, there was...probably just a buncha lines, right?

THEN....Tally Marks

THEN ...Roman Numerals

THEN..Arabic Numerals

uh... 5.

Humans counting!

THEN...

 Arabic Numerals

and (this is huge)

"Place Value"

Humans counting!

THEN...

 Arabic Numerals

and (this is huge)

"Place Value"

05.00

Let's get weird:

Let's get weird:

5

v

5.0

2 + 3

Let's get weird:

5
V
5.0
2 + 3
cinco
"five"
"dedos en su mano"
"number of fingers on one hand for the majority of people."
.
.
101   (wtf)

Place Value

Arabic numerals include ZERO.
This is important for two related reasons:

ONE: Sometimes you want to talk about nothing.
TWO: This enables place value. That is, 10 unique symbols, but both SYMBOL and its LOCATION are important: (would you take the following salary?)

5

Place Value

And now, you can do magic amazing ridiculous things in your head.

5436   v   5438

101 (Dalmatians)

(100s) (10s) (1s)

100x1 + 10x0 + 1x1

(10^2)x1 + (10^1)x0 + (10^0)x1

"101" (fingers)

(4s) (2s) (1s)

4x1 + 2x0 + 1x1

(2^2)x1 + (2^1)x0 + (2^0)x1

decimal (base 10) v. binary (base 2)

0	1	2	3	4	5	6	7	8	9	10	11
0	1	10	11	100	101	110	111	1000	1001	1010	1011

Let's get even weirder...

So, decimal is good because "people,

Binary is good because computers.

What about both?
(e.g, something "binary-like"
but also "compact and easy to read?"

Let's get even weirder...

We need a power of 2 that's close to 10.

Could do 8, but why not go with 16?'

We just need 6 more familiar symbols...

hexadecimal.
(6 + 10)

decimal (base 10) v. binary (base 2) v. hexadecimal (base 16)

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
0	1	10	11	100	101	110	111	1000	1001	1010	1011	1100	1101	1110	1111	10000	10001	10010
0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	10	11	12

Quick Binary Review and some bad jokes

How many fingers and toes do you have?

In Base Ten(10) or Decimal?

20

(Twenty)

10x2 + 1x0

Quick Binary Review and some bad jokes

How many fingers and toes do you have?

In Base Two (2) or Binary?

10100

- 16x1 8x0 4x1 2x0 1x0

Quick Binary Review and some bad jokes

How many fingers and toes do you have?

In Base Sixteen (16) or Hexadecimal?

14

16x1 + 1x4

Place Value

Decimal	4-bit Binary	Hexadecimal
0	0000	0
1	0001	1
2	0010	2
3	0011	3
4	0100	4
5	0101	5
6	0110	6
7	0111	7
8	1000	8
9	1001	9
10	1010	A
11	1011	B
12	1100	C
13	1101	D
14	1110	E
15	1111	F
16	0001 0000	10 (1+0)
17	0001 0001	11 (1+1)

The jokes...

"There are 10 kinds of people, those who understand binary, and those who don't."

If you want to get technical, ALL bases are Base 10.

Exponential growth =
Wide range of possibilities

Exponential REDUCTION =
"Easy to specify things"

The "shape" of computer numbers

e.g. – 128, 256, 1024, etc.

(why hard drive sizes are "wrong")

Where this comes up today...

IP addresses – e.g.

MAC addresses e.g.

(are more similar than you thought)

Where this comes up today...

IP addresses:

127.0.0.1

192.168.0.1

146.201.195.214

Where this comes up today...

0-255!

BUT, MAC addresses are like:

ac:d5:b8:c0:e1:03

0-FF?

SAME THING! See, also RGB Colors!

Where this comes up today...

HTML Web Safe Colors

www.beginnersguidetohtml.com

Also, computer "gibberish?"

Like...

0x19C653CB3D30EeEe2F99f9f4B987E3b22880FFCF

Also, computer "gibberish?"

Like...

0x19C653CB3D3OEeEe2F99f9f4B987E3b22880FFCF

Public address for cryptocurrency; here, ethereum.
Also, simply a big ol' **base 16** number
Is this real? Maybe send it some money and find out :)

(later in the class, how are you not able to steal my
money now that you have this?)