The Binary System

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Just how does that computer work???

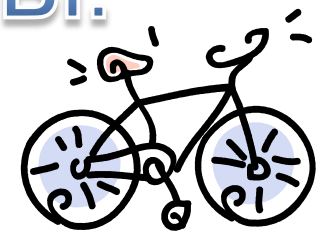
Key words

- Digital
- Binary System
- Data
- Base-10
- Base-2
- Switch (Electronics)

Let's pull it apart

Bi:

Bi-cycle



Bi-focals

So Bi means "two"

Nary

- Dictionary definition:
- "Not one"

Binary=

two not one

What is the binary system and how is it used in computing?

- We use number systems everyday.
- Hold up your hand-how many fingers do you see?
- TEN! We use a base-10 number set
- Base-10 has 0,1,2,3,4,5,6,7,8,9
- Our computers uses a number set too-the binary system!

Electronics-How do they work?

On

Off

Computers and circuits are in 2 states:

- On
- Off

- This is encoded by the Binary System! The Binary System tells computers and circuits which wires need to be on and which need to be off.

Binary System:

- Number system computers use at the most basic levels.
- It is made of:
  - 0
  - 1
- It is also called the Base-2 system because it has 2 numbers

But how does it work???

- Base-10 or the decimal system
  - 0,1,2,3,4,5,6,7,8,9
- Base-2 or Binary system:
  - 0,1
- 0=Off and 1=On

Binary System

0, 1

10, 11

100, 101, 110, 111

1000, 1010, 1011, 1100, 1101, 1110, 1111

- All data is stored as binary numbers

Binary System

- Binary numbers are created by powers of 2 because there are only 2 numbers in the binary system
- "Binary uses two digits, so each column is worth twice the one before."
  - 1,2,4,8,16,32…

Let's try it...

1	$2^{?}$	2^{2}	$2^{?}$	2^{4}	2^{5}
1	2x1	2x2	2x2x2	2x2x2x2	2x2x2x2x2
1	2	4	8	16	32

Now turn 17 into a binary number...

17 falls between 16 and 32

Turning decimal into binary...

16	8	4	2	1
1	0	0	0	1

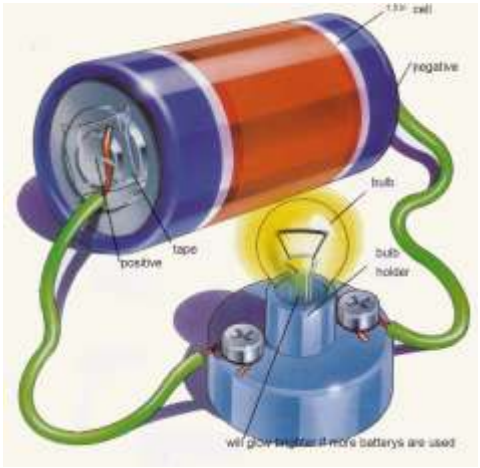
16 + 0 + 0 + 0 + 1 = 17

17 in binary form is:

10010

Binary System

- "Binary is an effective number system for computers because it is easy to implement with digital electronics"
  - All circuits are either switched on or off



Let's work it out...

Can you guess this binary numbers decimal form?

0100

How do I do that?

0 1 0 0

4x1 2x0 1x0

4 + 0 + 0 = 4

The decimal number for 0100 is 4 !

Now let's try it the other way...

Can you figure out this base-10's binary number?

20

How do I do that?

32 16 8 4 2 1

20

1 0 1 0 0

1x16 0x8 1x4 0x2 0x2

16 + 0 + 4 + 0 + 0 = 20

The binary number for 20 is **10100**!

Great!

- What numbers are in the base-2 or binary number system
  - 0,1

- Why do we use this system in computers?
  - We use it because computers are in 2 states-on or off- 1 or 0.

Resources and References

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