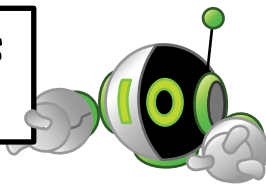


# Binary Representations for Integers



Hey guys! How do you negate numbers?

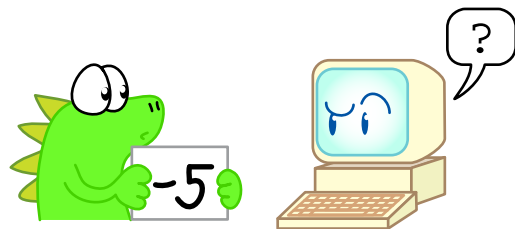


In the early days of computing, designers made computers express numbers using **unsigned binary**.

And they were content...



Until there were negative numbers.

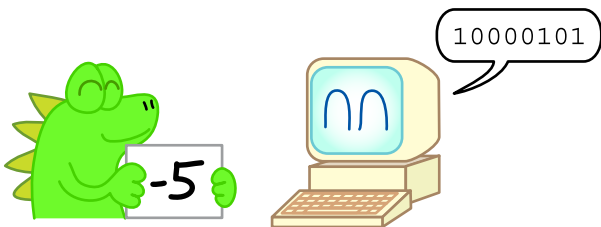


What's negation?

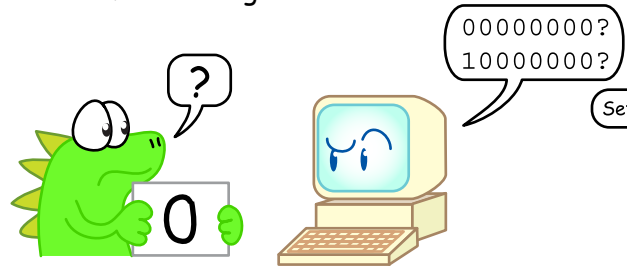


To include negative numbers, designers came up with **sign magnitude**.

That took care of the negative numbers...



But the computer had to count backwards for the negative numbers.



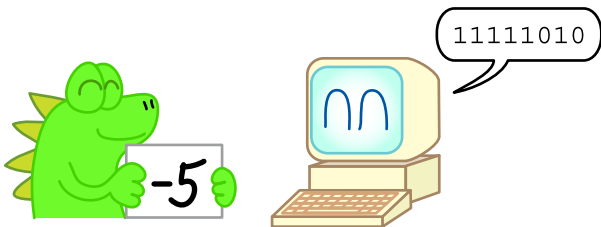
Set the sign bit!



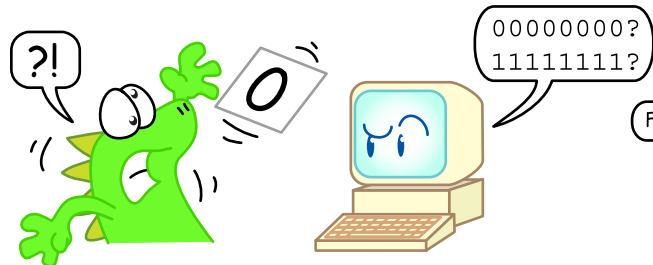
Plus, this introduced positive and negative zero.

Then designers created **one's complement**.

Now computers only had to count in one direction...



But there were still two zeroes!

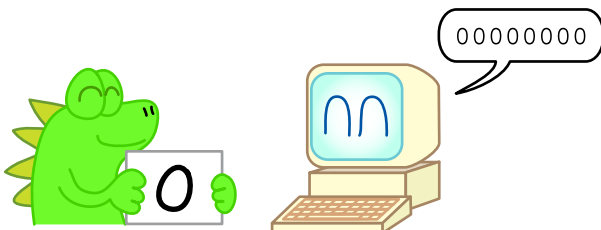


Flip the bits!



Finally, designers developed **two's complement**.

Now, there was only one zero...



And they were content.



Flip the bits and add 1!

