Counting In Binary

10 min

Let's reinforce what we learned in the previous exercise by practicing our counting to eight in binary. Eight may seem like a random number to stop at, but check out the table below and try to pick up the pattern of the counting.

Decimal	**Binary**
0	0
1	1
2	10
3	11
4	100
5	101
6	110
7	111
8	1000

Each time we reach a power of two we have to add another digit. For example, when we reach the number 2 or 2^1, the binary value goes from 1 to 10.

Similarly, when we reach decimal 4 (2^2), in binary we go from 11 to 100. This pattern continues for all the powers of 2 (0, 2, 4, 8, 16, 32, 64, 128, etc).

In fact, this brings us to our first trick to figuring out a number in binary. The highest a binary number can be is $\mathbf{2^n - 1}$, where n is the number of digits in the binary number.

011010001010 is 12 digits long; therefore, the highest number that can be represented in binary with these digits is 4095:

$2^{12} - 1 = 4095$

If we changed all the digits of our 12-digit binary number to 1s, we get 4095 in decimal.

111111111111 = 4095

to Clipboard

Our next trick you may have picked up yourself. You will notice that all odd numbers in binary end in 1 and all even numbers end in 0. This is a quick way to double-check your work.

Instructions

1. Checkpoint 1 Passed

1.

Create a variable called answer1 and set it equal to the highest numerical value that can be represented in a 13-bit binary number, eg 1111111111111.

Hint

In order to find the maximum value that can be represented by a binary number, use the formula:

$2^n - 1$

2. Checkpoint 2 Passed

2.

Now let's try two more! Create two more variables called answer2a and answer2b and set them equal to the highest numerical value that can be represented in a 5-bit binary number and a 15-bit number respectively.

Hint

Count the total number of bits in the binary number, that is n. The formula is $2^n - 1$.

3. Checkpoint 3 Passed

3.

Finally, create two more variables, answer3a and answer3b. Set answer3a equal to the MSB and answer3b to the LSB of the binary number 011100100011.

Hint

Just like in the decimal numbering system, the most and least significant numbers are in the highest and lowest place values of the number.

script.py

answer1 = 8191

answer2a = 31

answer2b = 32767

answer3a = 0

answer3b = 1