Captain Kraken, is math the same everywhere?

Arrr... What do ya mean, lad?

I mean, in all of your pirate adventures, have you ever met monsters that do math differently?

There be one island where numbers look very different than they do here on Beast Island.

‘Tis called Binary Island.

What’s so different about math on Binary Island?

On Beast Island, there be ten digits... 0, 1, 2, 3, 4, 5, 6, 7, 8, and 9.

But on Binary Island, there be only two digits! 0 and 1.

Great question!

Whoa.

Weird!

How does that work?
On Beast Island, we can write the numbers zero through nine usin’ only one o’ the ten digits.

But, we be needin’ a tens place to write the number ten.

With just two digits on Binary Island, they can only write the numbers zero and one with a single digit.

Do they need a twos place to write the number two?

There be no digit 2 on Binary Island. So, to write two, they be needin’ a twos place.

Whoa. So, on Binary Island, this number means “two”?

I get it. On Beast Island, this number has 1 ten and 0 ones.

But on Binary Island, the 1 is in the twos place. So, this number has 1 two and 0 ones.

How do they write the number three on Binary Island?
To write three, you could just put a 1 in the twos place, and a 1 in the ones place.

1 two and 1 one makes three.

But, how do you write the number four?

1 two and 2 ones makes four.

Oh, so we need another two!

But that gives us a 2 in the twos place.

We can’t have that, either.

Aye. On Binary Island, 100 be right after 11.

How can ye be writin’ the numbers from five to eight on Binary Island?

1 two and 2 ones makes four.

Grogg, there’s no digit 2 on Binary Island!

So, you can’t have a 2 in the ones place.

2 ones makes 2!

Like this?

To write four, we need a fours place.

Try it.
After 100 comes 101. There’s a 1 in the fours place, and a 1 in the ones place, which makes five.

Then, six has a 1 in the fours place and a 1 in the twos place.

And to write seven, we need 1 four, 1 two, and 1 one.

The place values keep doubling!

Seven is the largest 3-digit number on Binary Island.

To write eight, we need an eights place!

Aye. Usin’ ten digits on Beast Island, each place value be ten times bigger than the one before it.

But, usin’ just two digits on Binary Island, each place value be twice as big as the one before it.
Aye.
On Binary Island, 1,000,000 be the number sixty-four.

Imagine me disappointment upon voyagin’ to Binary Island in search o’ the famed treasure of 1,000,000 pearls...

So, on Binary Island, 10,000 means sixteen.

And 100,000 means thirty-two.

And 1,000,000 means sixty-four!

...only to discover that on Binary Island, 1,000,000 means sixty-four.