2^n grows fast

$\log_2 n$ shrinks fast

thank u

the POWER of 2

a zine about big numbers by igor

hi!

this is a

ZINE

about

MEOW

$O(2^n)$

♡

BIG

NUMBERS

$O(\log n)$

and this scales!

atoms in a human body:

7×10^{27}

$\log_2 \Rightarrow$ 92

atoms in the observable universe:

4×10^{79}

$\log_2 \Rightarrow$ 264

even if you have

18 QUINTILLION

records, that will only require **64** comparisons to find a value.

$$\log_2(18'446'744'073'709'551'616) = 64$$

this means:

if you had 18 quintillion dresses, you would only have to try on 64 of them to find the right size!

MY NAME IS IGOR

@igorwhilefalse

ON THE TWITTERWEB

---

i have a

sticker on my phone

---

i got it from @b0rk!

FIRST, LET'S TALK ABOUT EXPONENTIATION

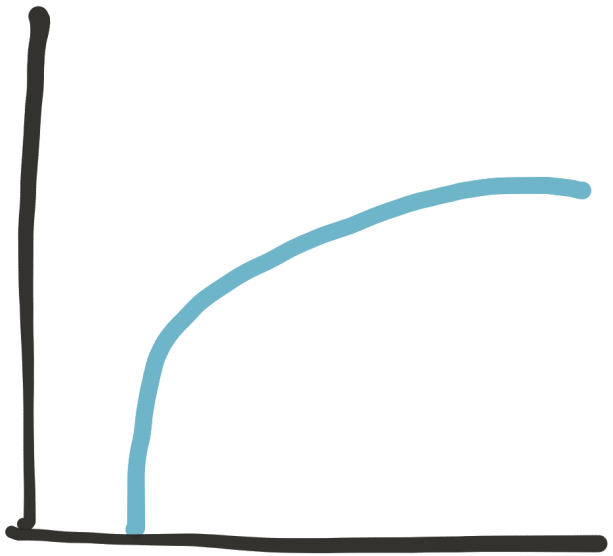
2^n

THAT MEANS:

$2 \times 2 \times 2 \times \ldots$

n

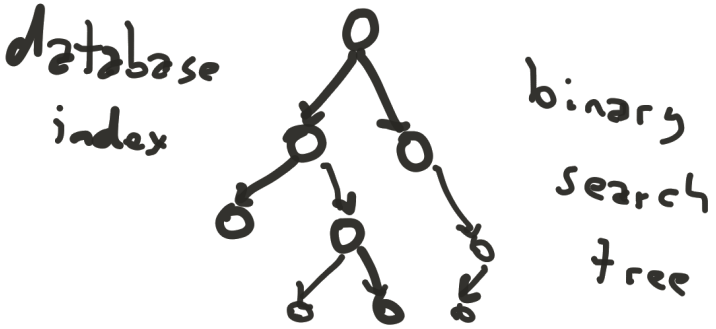
$\log_2 n$ shrinks fast!



OMG

databases use binary search

they are **literally** the same thing as finding a fitting dress



this is why database work and are FAST

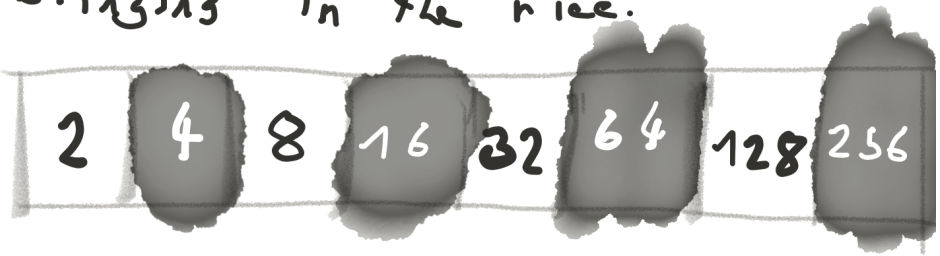
THE STORY OF

SISSA BEN DAHIR

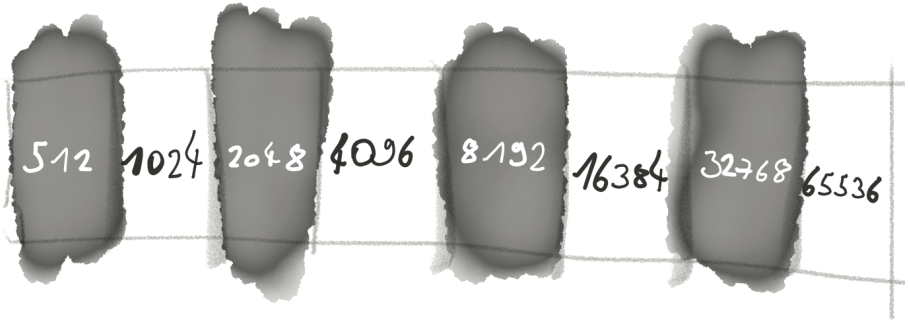
he goes to the Queen and gives her a chess-board.

i have 1 grain of RICE. for the first sqare, give me 2 grains. for the second, give me 4. for the third give me 8. 2x

she agrees, so they start bringing in the rice.



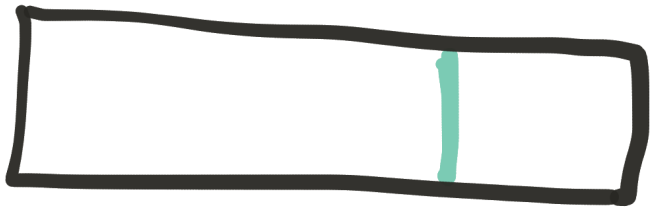
after one row we have 256 grains.



but after two rows we are already at 65k!

OH NO

you will quickly approach the size you are looking for



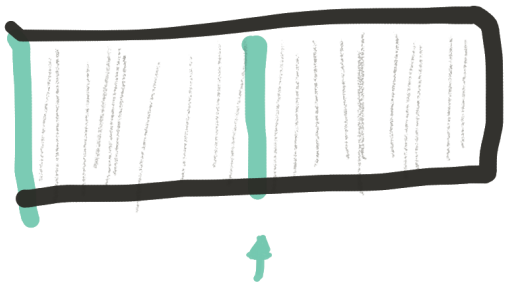
this works because the dresses are sorted. the algorithm is called a

BINARY SEARCH

it will let you find a fitting dress in

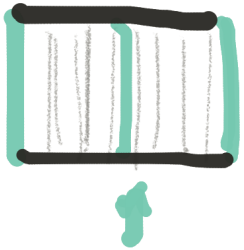
LOGARITHMIC TIME

so you move to the middle of the upper half, take out a dress, try it on.

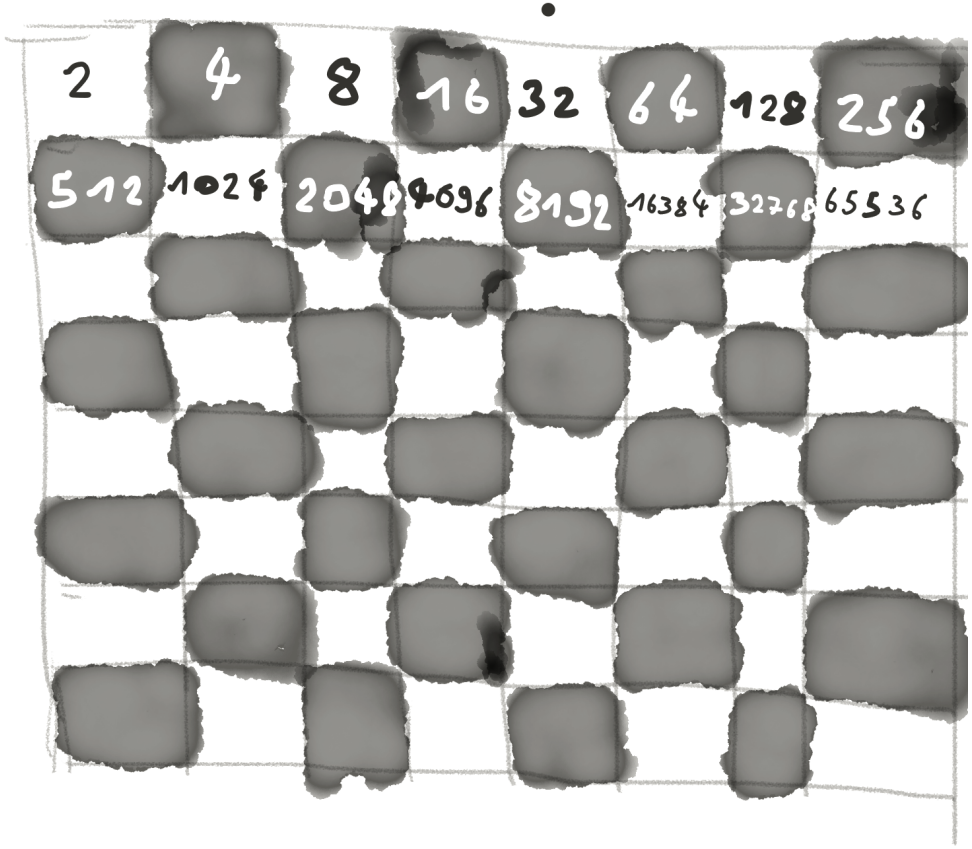


if it's too large, the dress must be somewhere in the lower half.

so you go to the middle..



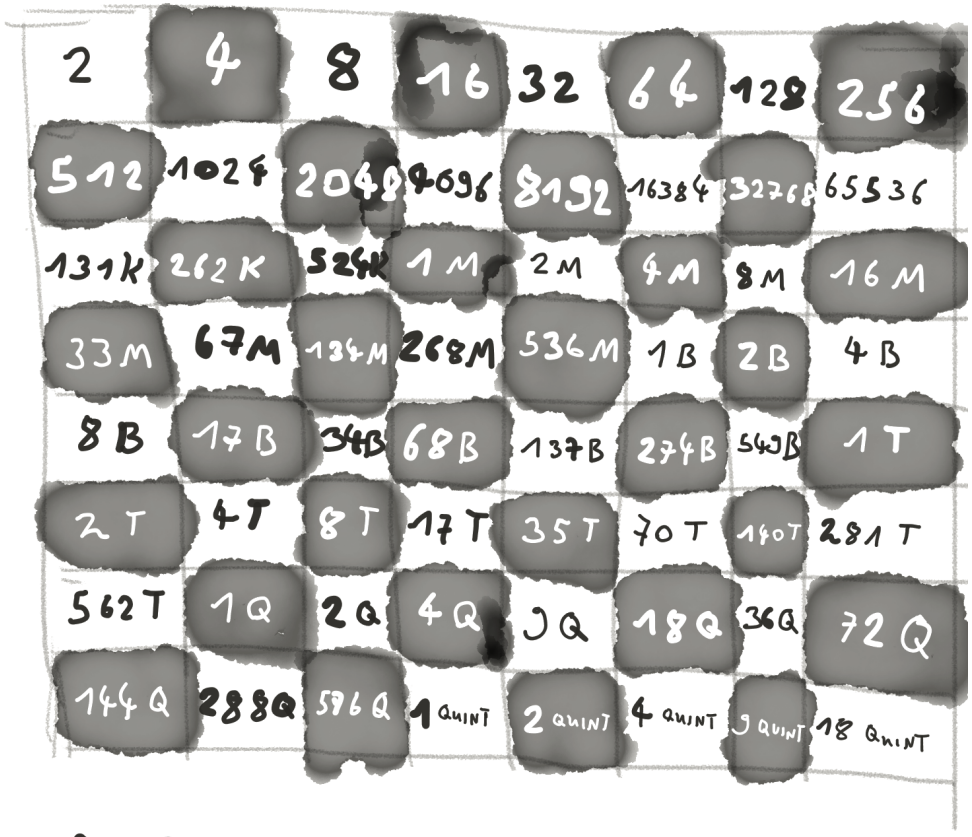
WHAT HAPPENS IF WE KEEP GOING ?



How much rice?

IF WE COMPLETE THE BOARD

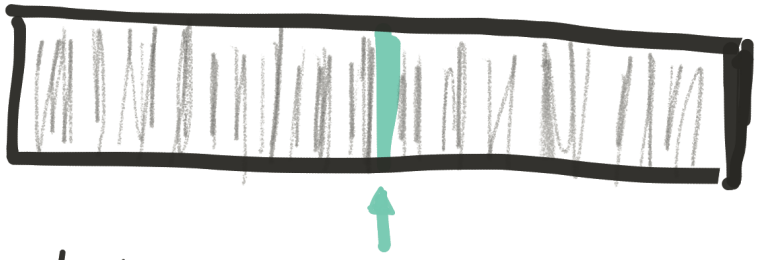
...



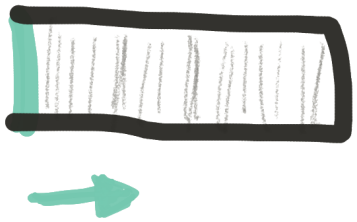
WE END UP WITH

18 QUINTILLION

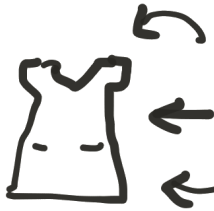
There is an algorithm that lets you do that!



start in the middle. take out a dress, try it on. if it's too small, you know your dress is in the upper half.



let's say you go DRESS SHOPPING and you see a super cute dress WITH POCKETS !



YAY CHECK OUT That dress !

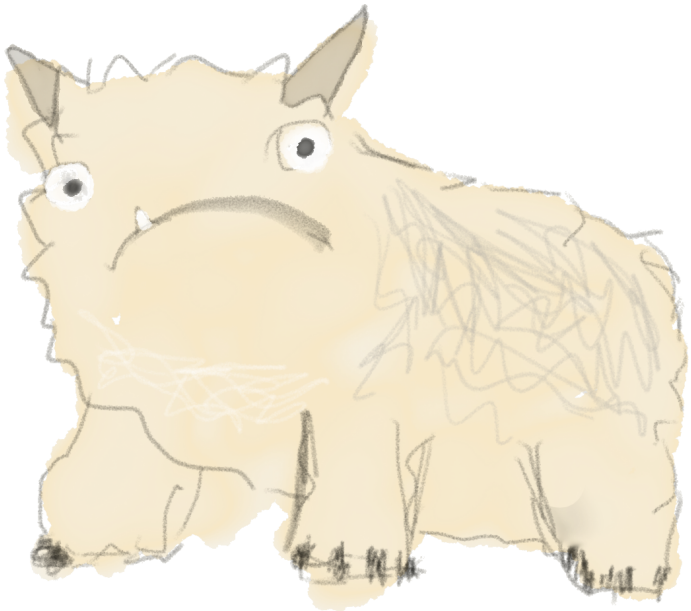
it comes in 200 sizes.

you want to find one that fits.

they're sorted by size

18'446'744'073'709'551'616

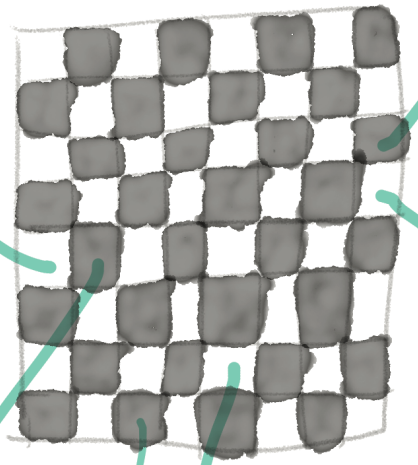
Grains of rice



of rice

BIG NUMBERS

To compare



hex color codes
16 M

WORLD POPULATION
7.5B
PEOPLE

CPUs
3B
TRANSISTORS

AGE OF THE UNIVERSE
13B YEARS

INDIA'S ANNUAL RICE PRODUCTION
~10 QUADRILLION
GRAINS

435 QUADRILLION
SECONDS

NEXT UP

The logarithm

$\log_2 n$

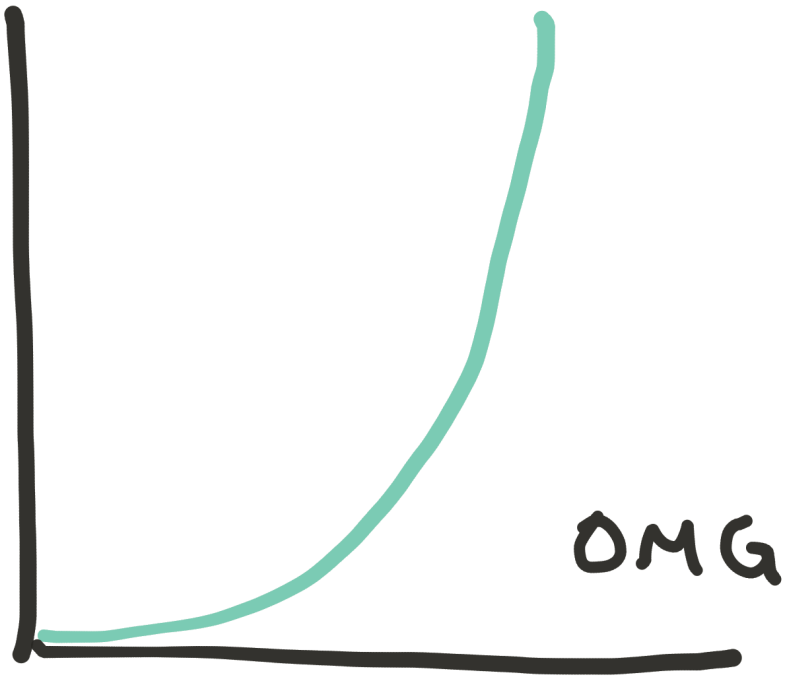
$n \div 2 \div 2 \ldots = 1$

$\longrightarrow y$

This is going to BLOW YOUR MIND!

JUST WANTED TO
LET YOU KNOW
COMPUTERS
ARE GREAT
(I love them)
but don't ~~forget~~
about HUMANS

2^n grows fast



other examples of

EXPONENTIAL GROWTH

- POPULATION
- ZOMBIE INFECTION
- ECONOMIC MODELS (LOL)
- MOORE'S LAW

COMPUTERS KEEP GETTING
≡ FASTER
(BUT NOT FOREVER)

exponential growth makes your password safe

1 char = 16 possible values
2 chars = 256 possible values
16 chars = 18 QUINTILLION

Same for a 64-bit key

2^{64} = 18 QUINT.

CRYPTO