the adversary game

part 1: Claude's Education Begins

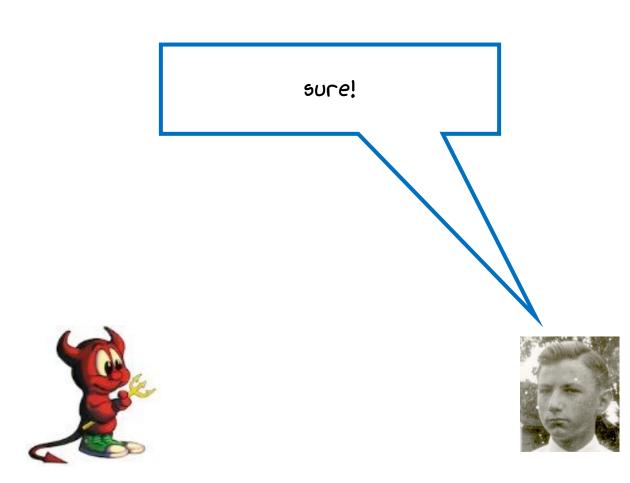


twenty questions...

I guess a number N between I and 2^{20}.

you ask yes/no questions of the form "is N <= blah",
and after 20 questions you must tell me what N is.







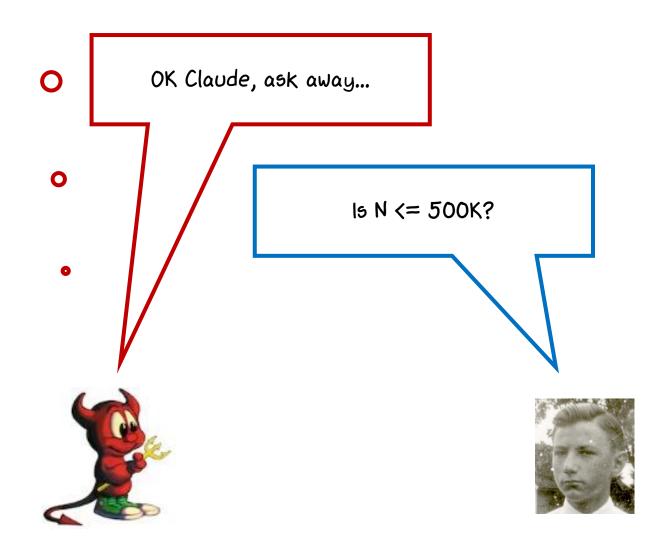
I will not think of a single N, of course.

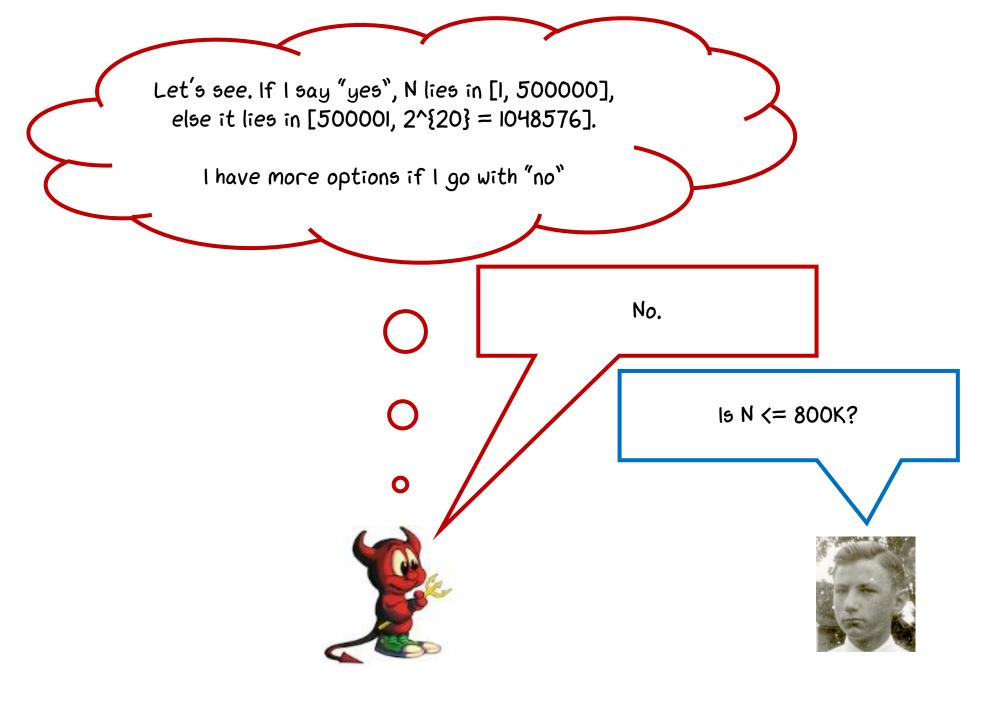
Each time I will try to answer in such a way that at the end, there are at least 2 numbers satisfying all the answers I have given.

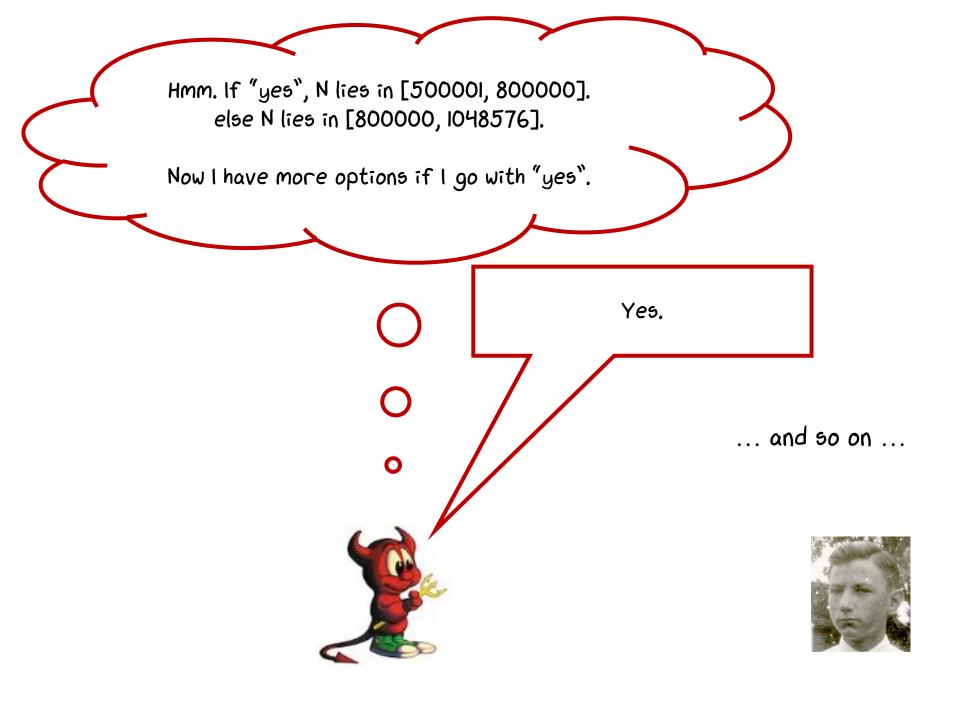
So whatever number he says at the end, I can say N was the other number! hee hee.



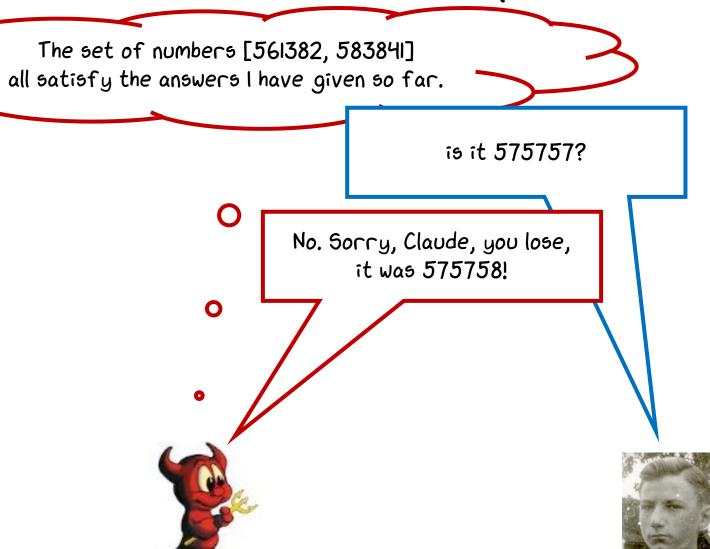
Initially, no answers given: N could be any number in [1,2^{20}]







after the 20th question...









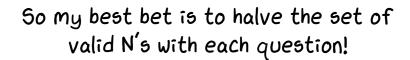
Hmm, I see what he did there. He did not really fix a single "true" N...

He answered so that the "set of valid N's" was at least half of the previous set.

Since at least two valid No remained, I lost.





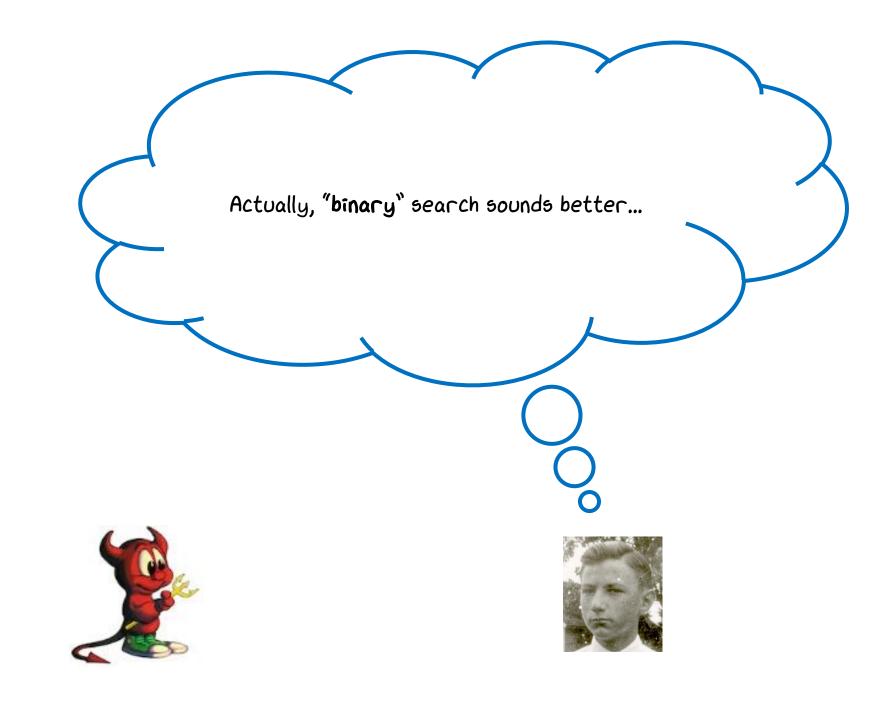


(I messed up earlier: I did not halve each time.)

Let me call this "halving" search







btw, can I win if I do binary search?

At the start, there are 2^{20} possible N's Each time I will exactly halve this range.

(and I can exactly halve each time)

So after 20 questions I can get the range down to a single value of N. And win.





Hmm. Also, 19 questions would not have been enough to find a number in [1,2^{20}].

(unless the adversary is silly, which he is not.)

This sounds like a general principle.



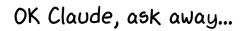


ok, adversary, let's play again





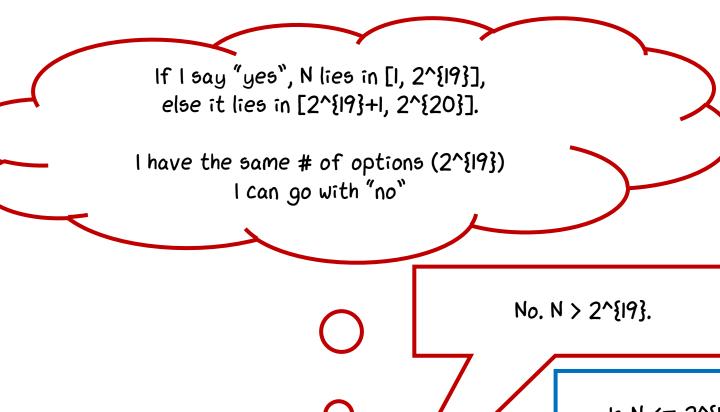
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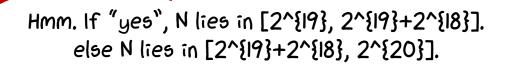
Is
$$N \le 2^{19} = 524288$$
?



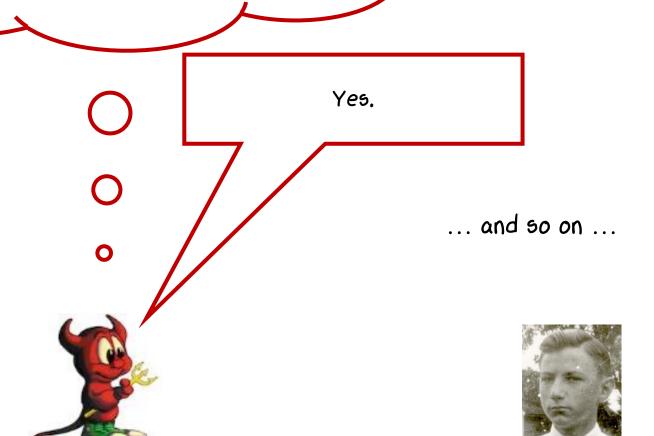


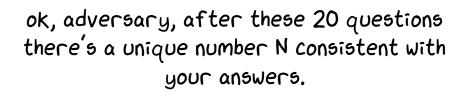






Equal number of options again. I can go with either answer. Let me choose one.





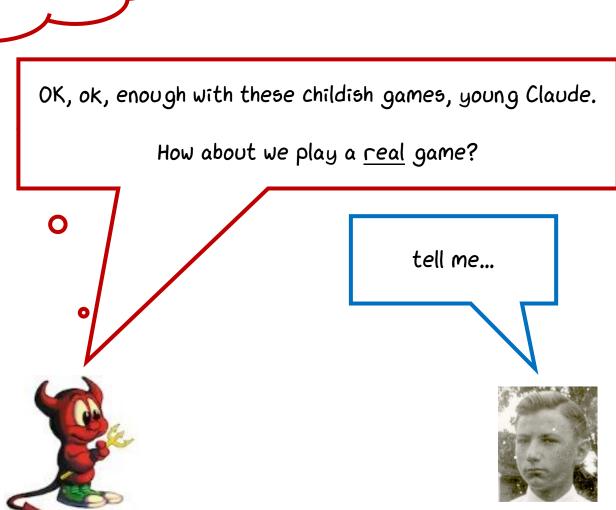
I win.

You just got lucky...



after a few games...





I think of integer N in [1, 2^{20} + 1]...

But now you can ask me any twenty yes/no questions about N.

After 20 questions you must tell me what N is.

E.g., you can ask me:

Is N in the set {7,19,63,256,1079993}

or is 2^{2^N} - I a prime number?

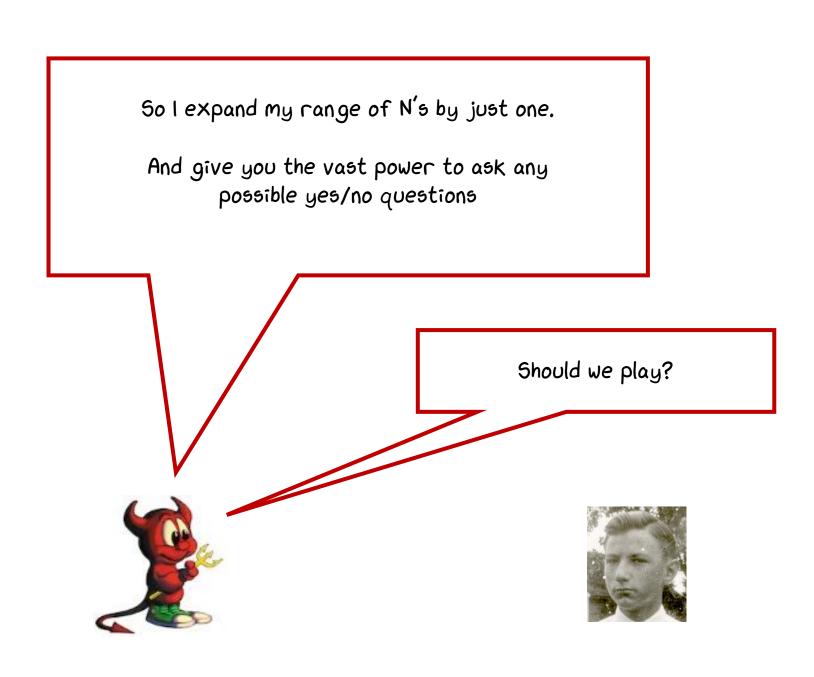
or is the 7th bit of N set?

or are (N,N+2) a Goldbach pair?

whatever yes/no questions you want.







should Claude play?

why/why not?

Where will these games end?

stay tuned for the answers...





featuring

BSD "beastie" deamon ... the adversary Claude Elwood Shannon ... Claude

BSD Daemon image from <u>Wikipedia</u> (which is from the CD-ROM for FreeBSD 2.0) based on original artwork by Phil Foglio
Shannon image from the Shannon Centennial Celebration <u>webpage</u> at U.Mich.

xkcd font by Randall Monroe, at https://github.com/ipython/xkcd-font