Section 4.3: Logarithmic Growth

Tuesday, October 15, 2019 10:22 AM

Suppose you need to find the position of a particular entry in an ordered list

$$[12, 13, 27, 35, 52, 71, 89]$$

Where in the list is the number 52?

method #1: start at the left-most entry and look at each entry in order until you get to the entry of interest

→ this method is $O(n)$

method #2: look at the entry in the middle of the list. If it's the entry of interest, stop! If it's not, is the entry of interest before or after the middle entry?

$$[12, 13, 27, 35, 52, 71, 89]$$

where is 52?

↑

is $52 = 35$? no

is $52 > 35$? yes

now discard half of the list

[52, 71, 89]

↑

is 52 = 71? no!

if 52 > 71? no

now discard again

[52]

is 52 = 52? yes! STOP

for method #2, if your list has one million entries, you need a maximum of 20 searches to find your entry of interest

→ essentially, you are solving

$2^n = 1000\,000$

this requires a new function called a logarithm

$2^n = 1000\,000$

is equivalent to

$n = \log_2(1000000)$

on a calculator, if there's no base, default is base 10

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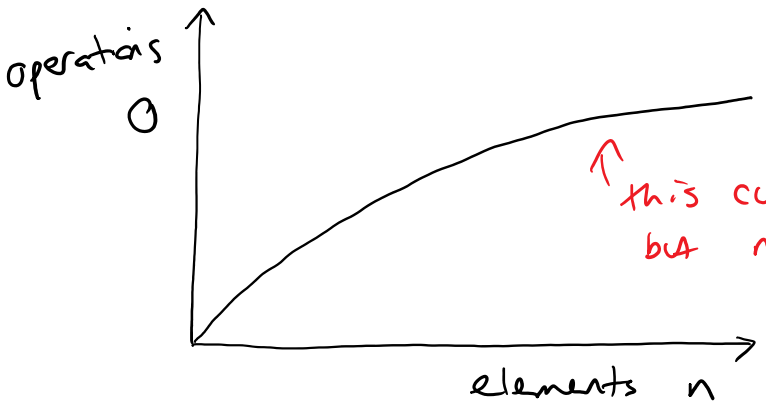
$$n = \frac{\log(1000\,000)}{\log 2}$$

what you need to know for this course:



this curve is always increasing, but more slowly as n gets larger

what about $O(n \log n)$?