

[My Courses](#) / [My courses](#) / [Algorithms and Data Structures, MSc \(Spring 2023\)](#) / [Mandatory Activities](#)
/ [Sums, relations, Thanos search, Dodo hashing](#)

Information

Thanos Search

You are good friends with *Thanos*, an intergalactic super-villain appearing in children's entertainment franchises.

Thanos is willing to help you with your searching algorithm. For a sequence **A** and key **k**, a call to **thanos(A, k)** will remove from **A** exactly half of the entries, but not **k**. (We assume that **k** appears at most once in **A** to make this well-defined.) To fix notation, let's agree that **A** has length **n**. The time for a call to **thanos** is $T(n)$; the function modifies **A** in place, so after

```
A = [1, 5, 7, 10]
thanos(A, 8)
```

the length of **A** is 2. (Maybe it would have been better to write **A.thanos(8)**, but Thanos doesn't really worry too much about proper naming conventions for object-oriented programming.)

A search algorithm should present itself: on input **A** and **k**, call **thanos(A, k)** repeatedly until **A** has length **1**, then inspect **A[0]**.

Question 8

Answer saved

Marked out of 1.00

Express the running time $S(n)$ of Thanos-search on inputs of length n as a recurrence relation. Let's say that $S(1) = 1$. (We could elevate the "number of comparisons" to our canonical operation. But it's hard to say what happens inside **thanos** – superhero space magic! –, so it doesn't make much sense to be too precise about this anyway.)

- ☐ a. $S(n) = S(n/2) + 1$
- ☒ b. $S(n) = T(n) + S(n/2)$
- ☐ c. $S(n) = T(n)$
- ☐ d. $S(n) = S(n) + T(n)$
- ☐ e. $S(n) = T(n/2) + S(n)$
- ☐ f. $S(n) = T(n/2) + 1$
- ☐ g. $S(n) = S(n/2) + T(n/2)$

[Clear my choice](#)

Question 9

Answer saved

Marked out of 1.00

Assume a single call to `thanos(A, k)` takes 1 unit of time – he just snaps his fingers, and it's done. What is the running time of Thanos search?

- ☐ a. quadratic in n
- ☐ b. linear in n
- ☒ c. logarithmic in n
- ☐ d. linearithmic in n

[Clear my choice](#)

Question 10

Answer saved

Marked out of 1.00

Does ``A`` have to be sorted for Thanos-search to work?

- ☒ a. No, that's the whole point. Otherwise I could just use binary search and wouldn't need the supervillain-god.
- ☐ b. Thanos' part works either way (literally by magic), but the outer loop needs a linear number of iterations if ``A`` is not sorted.
- ☐ c. Yes if the datatype of `A` is comparable (i.e., implements `Comparable` or `__lt__`). Else no.
- ☐ d. Yes, because every searching data structure implicitly requires its input to be sorted.

[Clear my choice](#)