

Note: The other Tasks were all done in the Files Main.cpp, Functions.h and Matrix.h. Also all Questions were answered directly in the implementation using comments.

1 Task 7 - complexity analysis

Given the complexity analysis of Binary Search from the lecture:

Ex1) Improvement of Contains

Assumption: elements in the array are sorted

$c = 8$ $S =$ 1 4 7 8 10 15 17 19 20 $n = 9$

1 4 7 8

7 8

8

↑
found

contains $H(\text{left}, \text{right}, c)$

Runtime analysis:

$T_{\text{best}}(n) \in O(1)$

$T_{\text{worst}}(n) \in ?$

Assumption: $n = 2^k - 1$ $k \in \mathbb{N}_{\geq 1}$

$T(1) = a$

$T(n) = b + T\left(\frac{n+1}{2} - 1\right) = b + b + T\left(\frac{n+1}{4} - 1\right) = \dots = \underbrace{b + \dots + b}_{\log_2(n) \text{ steps}} + T(1) = b \cdot \log_2(n) + a \in O(\log_2(n))$

Binary search thus has a complexity of $\mathcal{O}(\log_2(n))$.

Trinary search