

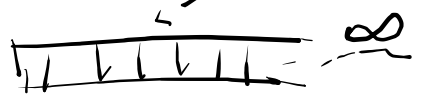
Set / Map / Not ordered
ordered
 Binary Trees
 Search

HashTable

contains $O(1)$
max $\approx O(n)$
min $\approx O(n)$

$O(\log n)$
max $\rightarrow O(\log n)$
min $\rightarrow O(1 \sim n)$

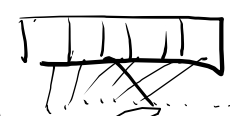
key \rightarrow hashcode / hash \rightarrow array
 • uniform
 • random
 • deterministic
 • efficient



Collisions

↑ pigeon hole principle

→ Birthday problem



→ probing

366

→ linear

16

→ quadratic



→ max 1100010010011100111000
 X 100011101 ~ XOR

$$\begin{array}{r}
 .110110 \\
 \text{XOR } .011100 \\
 \hline
 +101010
 \end{array}$$