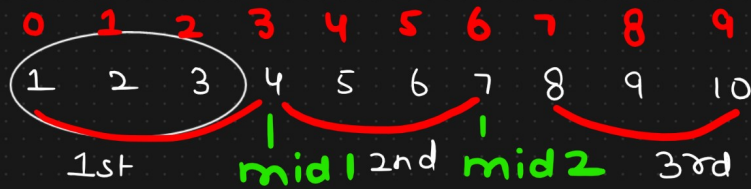


Ternary Search

↳ Sorted array

↳ Search space into three parts



$$\underline{\text{mid1}} = l + (r - l) // 3 = 0 + 9 // 3 = 3 \quad \underline{l = 0, r = 9}$$

$$\underline{\text{mid2}} = r - (r - l) // 3 = 9 - 9 // 3 = 6$$

$x = 5$ → Searching element

$$\text{arr}(\text{mid1}) == x$$

↳ return mid1

$$\text{arr}(\text{mid2}) == x$$

↳ return mid2

$$\underline{\underline{x = 2}}$$

→ 4

$$\underline{\underline{x < \text{arr}(\text{mid1})}}$$

$\underline{\underline{r = \text{mid1} - 1}} \Rightarrow$ 1st search space

→ 7

$$x > \text{arr}(\text{mid2})$$

$\underline{\underline{l = \text{mid2} + 1}} \Rightarrow$ 3rd search space

$$\underline{\underline{x = 9}}$$

else:

mid1 + 1, mid2 - 1

↳ 2nd search space

Recurrence Relation (Ternary Search)

$$T(n) = T\left(\frac{n}{3}\right) + c$$

$$T(n) = \begin{cases} 1 & n = 1 \\ T(n/3) + c & n > 1 \end{cases}$$

$$T(n) = T\left(\frac{n}{3^2}\right) + c + c$$

$$T(n) = T\left(\frac{n}{3^3}\right) + c + c + c$$

$$\underbrace{k \text{ times}} \left\{ \frac{n}{3^k} = 1 \right.$$

$$\frac{n}{3^k} = 1$$

$$n = 3^k$$

$$k = \log_3 n$$

$$T(n) = T\left(\frac{n}{3^k}\right) + c \cdot k$$

$$= T\left(\frac{n}{3^{\log_3 n}}\right) + c \cdot \log_3 n$$

$$\Rightarrow T\left(\frac{n}{n^{\log_3 3}}\right) + c \cdot \log_3 n$$

$$\Rightarrow \underline{\underline{O(\log_3 n)}}$$

Time complexity of Ternary search