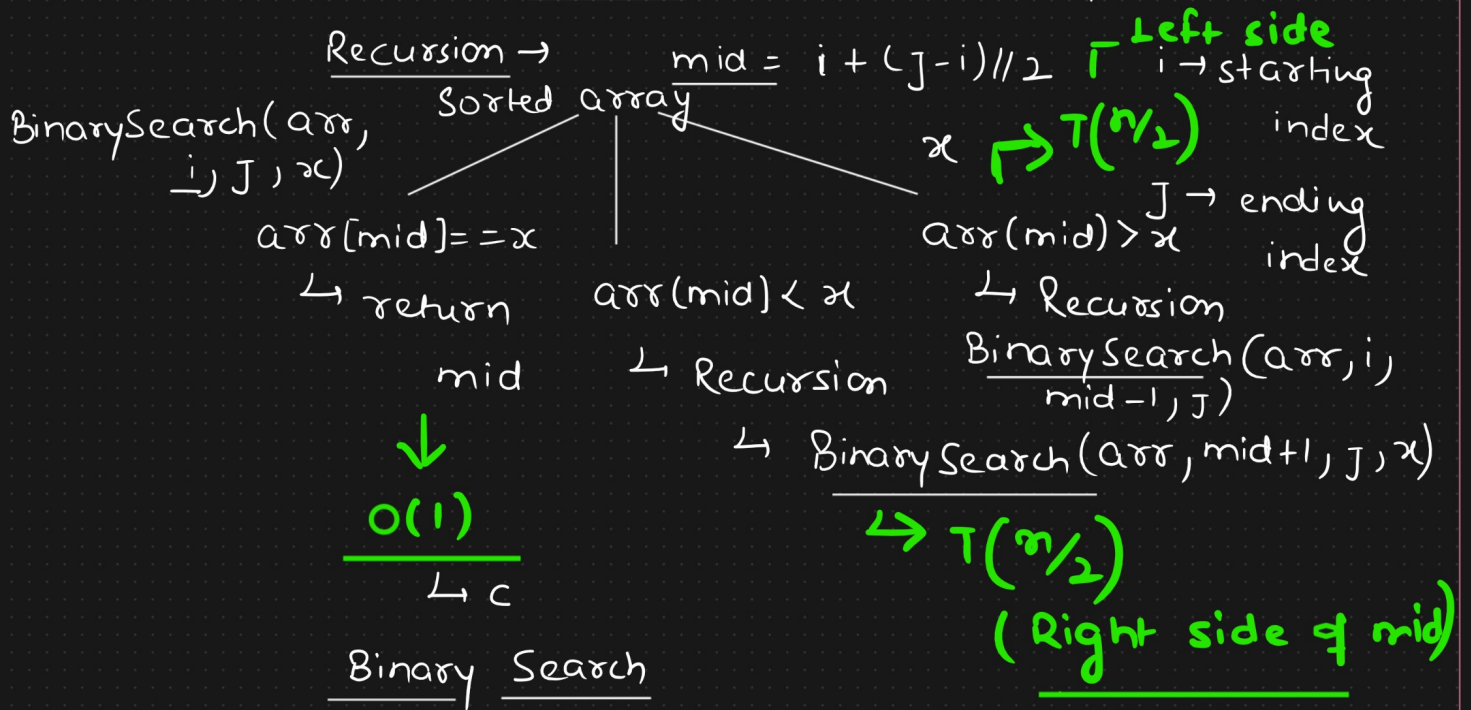


Recurrence Relation (Binary Search)



Recurrence Relation

$$T(n) = \begin{cases} 1 & n = 1 \\ T\left(\frac{n}{2}\right) + c & n > 1 \end{cases}$$

Left side Right side

$$a = 1, b = 2$$

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

$$f(n) = \Theta(n^k \log^p c)$$

$$k = 0, p = 0$$

Master's Theorem :-

$$\log_b a = \log_2 1 = 0$$

$$\log_b a = k \rightarrow \text{case 2}$$

$$\Rightarrow \Theta(c \cdot \log n)$$

$$\Rightarrow \underline{\underline{\Theta(\log n)}}$$

Substitution

Method

$$T(n) = T\left(\frac{n}{2}\right) + c \quad \text{—— 1st}$$

$$T(n) = T\left(\frac{n}{2^2}\right) + \frac{c + c}{1} \text{ --- 2nd}$$

$$= T \left(\frac{n}{2^3} \right) + c + \underbrace{c + c}_{\text{3rd}} - 3rd$$

$$\frac{T(1)=1}{\underbrace{\quad}_{k \text{ times}}} \left\{ \frac{3}{2^k} = 1 \Rightarrow 3 = 2^k \right.$$

$$k = \log_2 3$$

$$\Rightarrow T\left(\frac{n}{2^k}\right) + c \cdot k$$

$$\Rightarrow T\left(\frac{n}{2^{\log_2 n}}\right) + c \cdot \log_2 n$$

$$\Rightarrow T\left(\frac{n}{n \log_2 n}\right) + c \cdot \log_2 n$$

$$\Rightarrow 1 + c \cdot \log_2 n$$

$$\Rightarrow \underline{O(\log_2 n)}$$