

## 26 November 2025

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## Single Non-Duplicate

$\{1, 1, 2, 3, 3, 4, 4, 8, 8\}$

$$n = 9$$
$$l=0, \delta=2$$

while ( $l < r$ )

$$m = 0 + \left( \frac{8-0}{2} \right) = 4$$

Diagram illustrating a 1D array structure with 10 slots. The values in the slots are: 1, 1, 2, 3, 3, 4, 4, 8, 8. Below the first slot is an upward arrow labeled  $l$ , below the fifth slot is an upward arrow labeled  $m$ , and below the ninth slot is an upward arrow labeled  $r$ .

$m = 2 \Rightarrow$  even

$[m] \neq (m+1) \Rightarrow \text{single } 0 \text{ in left} \Rightarrow \sigma = m$   
 $\sigma = 4$

1	1	2	3	3	4	4	0	0
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[illegible]

$$m_2 = 0 + \left( \frac{4 - 0}{2} \right) = 2$$

$m=2 \Rightarrow$  even

$m \neq m+1 \Rightarrow$  single in left  
 $\Rightarrow x = m$

$$\begin{array}{|c|c|c|c|c|c|c|c|}
 \hline
 11 & 1 & 2 & 1 & 3 & 1 & 4 & 1 & 4 & 1 & 2 & 2 \\
 \hline
 \uparrow & \uparrow & \uparrow & & & & & & & & & \\
 \ell & m & \alpha & & & & & & & & & 
 \end{array}$$

$$m=1 \Rightarrow \text{odd}$$
$$\Gamma_m = m-1 \Rightarrow 0$$

So  $\text{mid} = \text{mid} + 1 \Rightarrow l = m + 2 \Rightarrow 0 + 2 \Rightarrow 2$

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1 | 2 | 3 | 3 | 4 | 4 | 8 | 8 | ~~10~~

1 | 1 | 2 | 3 | 3 | 4 | 4 | 8 | 8 | ~~10~~

↑↑  
2x

So  $l = r$ , Return  $l \Rightarrow$  Return 2