

Find index of 17 if it is present.

$$L=0 \quad R=13 \quad M = \frac{L+R}{2} = 6$$

$$17 > 11 \quad L=M+1=7$$

$$L=7 \quad R=13 \quad M = \frac{7+13}{2} = 10$$

$$17 < 19 \quad R=M-1=9$$

$$L=7 \quad R=9 \quad M = \frac{7+9}{2} = 8$$

$$17 > 15 \quad L=M+1=9$$

$$L=9 \quad R=9 \quad M = \frac{9+9}{2} = 9$$

$$M = L + \frac{(R-L)}{2} \quad SC = O(1)$$

$$\text{Binary Search} \rightarrow TC = O(\log_2(N)) \quad \text{steps} = 4$$

linear traversal = 14 = N elements

$$N \rightarrow \frac{N}{2} \rightarrow \frac{N}{2^2} \rightarrow \frac{N}{2^3} \dots \frac{N}{2^k} = 1$$

$$\Rightarrow N = 2^k \Rightarrow k = \log_2(N) \quad \checkmark$$

$$L=0 \quad R=N-1$$

while ($L < R$) {

$$M = L + (R-L)/2;$$

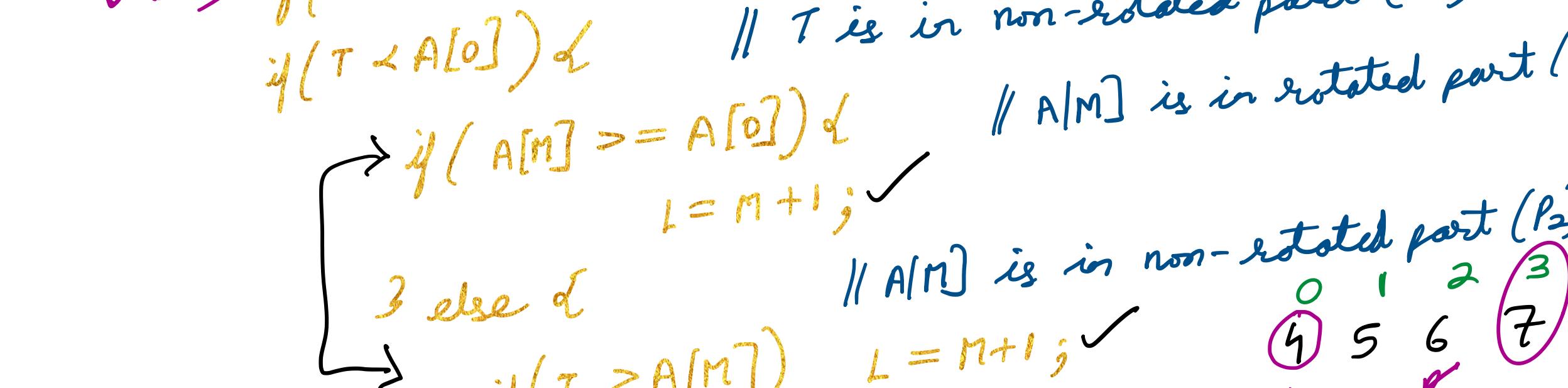
→ if ($\text{Target} == A[M]$) return M ; \checkmark

if ($\text{Target} < A[M]$) $R = M-1$; \checkmark

else $L = M+1$; \checkmark

$$x \gg 1 = x/2$$

3 return -1;



Find index of any element.

$$Ex \rightarrow 25 \quad \text{target} \quad \checkmark$$

$$T < A[0] \rightarrow \text{check } T \text{ in } P_2 \quad \checkmark$$

$$T \geq A[0] \rightarrow \text{check } T \text{ in } P_1 \quad \checkmark$$

$$25 < 50 \rightarrow T \text{ can be in } P_2$$

Elements in $P_1 >$ Elements in P_2 \checkmark

Any element $x < A[0] \rightarrow x \text{ can be present in } P_2$ but not in P_1 -(i) \checkmark

$x \geq A[0] \rightarrow x \text{ can be present in } P_1$ but not in P_2 -(ii) \checkmark

If mid element is in $P_1 \rightarrow$ go right \checkmark $L=M+1$

$9 < 50 \rightarrow n \text{ is in } P_2 \rightarrow A[M] < T \rightarrow$ go right

$A[M] > T \rightarrow$ go left

// If T \rightarrow target = $T \rightarrow A[M] = T \rightarrow$ return M ; \checkmark

$$L=0 \quad R=N-1$$

while ($L < R$) {

$$\rightarrow M = L + (R-L)/2; = 0$$

✓ → if ($T == A[M]$) return M ;

if ($T < A[0]$) { // T is in non-rotated part (P_2)

→ if ($A[M] >= A[0]$) { // $A[M]$ is in rotated part (P_1)

$L = M+1$; \checkmark

 3 else { // $A[M]$ is in non-rotated part (P_2)

 if ($T > A[M]$) $L = M+1$; \checkmark

 else $R = M-1$; \checkmark

 3 else { // $A[M] \rightarrow (P_2)$

 if ($A[M] < A[0]$) { // $A[M] \rightarrow (P_1)$

$R = M-1$; \checkmark

 else if ($A[M] > A[0]$) $L = M+1$; \checkmark

 else $R = M-1$; \checkmark

 3 else { // $A[M] \rightarrow (P_2)$

 if ($A[M] < A[0]$) { // $A[M] \rightarrow (P_1)$

$R = M-1$; \checkmark

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