

Binary Division ($m=2$)

function find-one-index (v , left, right):

if right - left == 1

return left

else:

mid = left + (right - left) // 2

sum-left = 0

for i in range (left, mid):

sum-left += $v[i]$

if sum-left == 1:

return find-one-index (v , left, right)

else:

return find-one-index (v , mid, right)

($m > 2$)

function find-one-index (v , left, right, m):

if right - left == 1:

return left

length = right - left

chunk-size = $\text{Ceil}(\text{length} / m)$

chunk-start = left

for k in range (m):

chunk-end = mid (left + ($k+1$) * chunk-size, right)

if chunk-start == right:

break

$$S = 0$$

for i: ~~in~~ⁱⁿ range (chunk_start, chunk_end):

$$S += v[i]$$

if $S == 1$:

return find_one_index_in (v, chunk_start, chunk_end, m)

return -1

—————, $m=2$

$$T(n) = \frac{n}{2} + T\left(\frac{n}{2}\right), \quad T(1) = 0$$

Soln

$$T(n) = \frac{n}{2} + \frac{n/2}{2} + \frac{n/4}{2} + \dots$$

$$T(n) = \frac{n}{2} + \frac{n}{4} + \dots + 0$$

$$T(n) = n \left(\frac{1}{2} + \frac{1}{4} + \dots \right) = n \cdot \left(1 - \frac{1}{2^{\infty}} \right)$$

$$T(n) = n - 1$$

—————, $m=3$

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