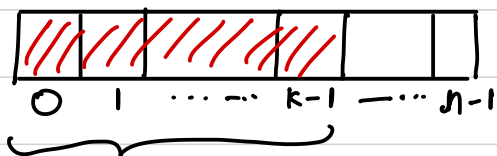


→ correctness of $O(N)$ solution: (zero base indexing)

let $0 \leq k < n$ be some integers

let first k elements be already in zig zag order.



Now our goal be to include element at k^{th} index into the already existing zig zag fashion.

if $k=0$, we can safely include the 0^{th} index element
else:

if k is odd

$k-1$ is even

if $arr[k-1] > arr[k] :$

we can safely swap $arr[k-1]$ & $arr[k]$.

because $arr[k-2] > arr[k-1]$

& $arr[k-1] > arr[k]$

i.e. $arr[k-2] > arr[k-1] > arr[k]$

after swapping $a_{k-2} > a_k < a_{k-1}$
 $\downarrow \qquad \qquad \downarrow$
even index odd index

if k is even

$k-1$ is odd

if $arr[k-1] < arr[k] :$

$arr[k-2] < arr[k-1] < arr[k]$

we can safely swap.

$a_{k-2} < a_k > a_{k-1}$
 $\overline{\text{odd}} \qquad \qquad \overline{\text{even}}$

We can apply the induction easily using the above algo.
Hence after $k=n-1$ step the final array be infact the zig-zag array.