

* Missing Element? $\{1, 2, 3, 5, 6, 7\}$ or $\{1, 2, 3, 4, 5, 6\}$

① if $arr[mid] = mid + 1$
 \rightarrow right $s = mid + 1$

② if $arr[mid] \neq mid + 1$
 \rightarrow left
 \rightarrow checking
 if $(mid == 0 \parallel arr[mid-1] == mid)$
 $\rightarrow mid + 1$

③ return $n + 1$

Bubble Sort (4) $n \rightarrow (n-1)$ iterations

① $\begin{matrix} 0 & 1 \\ 7 & 6 & 4 & 3 \end{matrix}$
 $\begin{matrix} 6 & 7 & 4 & 3 \\ 6 & 4 & 7 & 3 \\ 6 & 4 & 3 & 7 \end{matrix}$
 us \downarrow S
 $\begin{matrix} 1 & n-1 \\ 2 & 4-1 \end{matrix}$
 $\begin{matrix} n-2 \\ 3 \end{matrix}$

② $\begin{matrix} 6 & 4 & 3 & 7 \\ 4 & 6 & 3 & 7 \\ 4 & 3 & 6 & 7 \end{matrix}$
 us \downarrow S

③ $\begin{matrix} 4 & 3 & 6 & 7 \\ 3 & 4 & 6 & 7 \end{matrix}$
 for \rightarrow iterations
 for \rightarrow swap
 $f \rightarrow (n) \times (n)$
 $f \rightarrow (n^2)$

(n^2) Selection Sort (swap) (n^2) Insertion Sort (shift)

$\begin{matrix} i & j \\ 5 & 2 & 9 & 1 & 6 & 4 \end{matrix}$ ($n-1$)
 $\begin{matrix} 0 & 1 & 2 & 3 & 4 & 5 \end{matrix}$
 $min\ index = i$
 $j = i + 1$ till n
 $\begin{matrix} 1 & 2 & 9 & 5 & 6 & 4 \end{matrix}$
 $f \quad i \quad i$
 $f \quad 1 \quad 2 \quad 4 \quad 5 \quad 6 \quad 9$

$\begin{matrix} i & j \\ 8 & 2 & 1 & 4 & 3 & 0 \end{matrix}$ $temp = 2$
 $\begin{matrix} 0 & 1 \\ 2 & 8 & 1 & 4 & 3 & 0 \end{matrix}$
 $\begin{matrix} 2 & 8 & 1 & 4 & 3 & 0 \end{matrix}$
 Sorted \downarrow Unsorted
 $\begin{matrix} 2 & 8 & 4 & 3 & 0 \end{matrix}$
 UNO \rightarrow shift
 $O(n)$
 $n-1$
 $O(n)$
 $O(n^2)$

* Merge two sorted Arrays: Two Pointer Approach

$i = 0$
 $j = 0$
 $k = 0$

$a1 = \begin{matrix} i & i & i & i \\ 0 & 1 & 2 & 3 \\ 0 & 0 & 5 & 7 & 9 \end{matrix}$
 $a2 = \begin{matrix} 0 & 1 & 2 \\ 0 & 1 & 2 \\ 0 & 0 & 0 \end{matrix}$

if $(a1[i] < a2[j])$
 $a3[k] = a1[i]$
 $k++, i++$

else $(a2[j] < a1[i])$
 $a3[k] = a2[j]$
 $k++, j++$

while $(i < n1)$
 $arr[k++] = a3$
 $a1[i++]$
 while $(j < n2)$
 same

$a3 = \begin{matrix} 1 & 2 & 3 & 4 & 5 & 6 & 7 & 9 \end{matrix}$
 $\begin{matrix} 0 & 1 & 2 & 3 & 4 & 5 & 6 & 7 \end{matrix}$
 $k \quad k \quad k$

Merge Sort Algorithm \rightarrow

Divide & Conquer \rightarrow Repetitive Division

Input $\leftarrow \begin{matrix} 9 & 2 & 1 & 4 & 6 & 3 & 0 & 8 \end{matrix}$
 $\begin{matrix} 0 & 1 & 2 & 3 & 4 & 5 & 6 & 7 \end{matrix}$
 Dividing $\rightarrow \log N$
 Merge $\rightarrow N$
 $(N \log N)$

Single Elements $\leftarrow \begin{matrix} 9 & 2 \\ 1 & 4 \\ 6 & 3 \\ 0 & 8 \end{matrix}$
 Sorted Array $\rightarrow \begin{matrix} 1 & 2 & 4 & 9 \end{matrix}$
 $\begin{matrix} 0 & 1 & 2 & 3 \end{matrix}$
 Sorted Array $\rightarrow \begin{matrix} 6 & 3 & 0 & 8 \end{matrix}$
 $\begin{matrix} 0 & 1 & 2 & 3 \end{matrix}$
 Sorted Array $\rightarrow \begin{matrix} 0 & 1 & 3 & 6 & 8 \end{matrix}$
 $\begin{matrix} 0 & 1 & 2 & 3 & 4 & 5 & 6 & 7 \end{matrix}$
 Merged Sorted Array

mid = $\frac{s + e}{2}$
 $= \frac{7}{2}$
 $= 3$

right length $\rightarrow e - m$
 $7 - 3 = 4$
 left length $\rightarrow m - s + 1$
 $3 - 0 + 1 = 4$

* OOPs + Exception Handling + File Handling

Spring MVC | Boot

FE + SQL \downarrow MySQL

CRUD
 create Folder
 File
 delete Folder
 File
 text \leftarrow read File
 excel \leftarrow write File