

Insert Interval

For this problem we are given sorted, non-overlapping intervals and need to insert a new interval while maintaining the same properties (sorted, non-overlapping).

[Key Observations:]

- Intervals are already sorted by start.
- We only need to merge where overlaps occur with newInterval.
- Process in three phases:
 1. Add all intervals before newInterval (no overlap).
 2. Merge all overlapping intervals with newInterval.
 3. Add all intervals after newInterval.

[Algorithm:]

1. Initialize result vector.
2. Iterate through intervals:
 - If $\text{interval.end} < \text{newInterval.start}$: push interval (before merging).
 - Else if $\text{interval.start} > \text{newInterval.end}$: push newInterval, then rest intervals (after merging).
 - Else: merge intervals by updating newInterval.start and newInterval.end.
3. If newInterval hasn't been added, push it at the end.

[Complexity:]

- Time: $O(n)$ - traverse intervals once.
- Space: $O(n)$ - result array