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 interval.end < newInterval.start: push interval (before merging).
   - Else if interval.start > 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