Find Median From Data Stream LeetCode

The **median** is the middle value in an ordered integer list. If the size of the list is even, there is no middle value, and the median is the mean of the two middle values.

- For example, for arr = [2,3,4], the median is 3.
- For example, for arr = [2,3], the median is (2 + 3) / 2 = 2.5.

Approach 1: Class for the Brute Force approach to find the median

- **Functionality:**
  - **addNum(int num)**: Adds a number to the container.
  - **findMedian()**: Finds and returns the median of the numbers in the container.
- **Explanation:**
  - Numbers are added to a vector container.
  - When finding the median, the vector is sorted.
  - The median is calculated based on whether the size of the vector is even or odd.
- **Time Complexity:**
  - **addNum()**: **O(1)**
  - **findMedian(): O(n log n) due to sorting.**
- **Space Complexity:**
  - **O(n) where n is the number of elements in the container.**

Approach 2: Class for the Optimized Heap approach to find the median

- **Functionality:**
  - **addNum(int num)**: Adds a number to the appropriate heap (leftMaxHeap or rightMinHeap) and ensures balance.
  - **findMedian()**: Finds and returns the median based on the heaps.
- **Explanation:**
  - Two heaps are maintained: **leftMaxHeap** for the smaller half of numbers and **rightMinHeap** for the larger half.
  - When adding a number, it is placed in the appropriate heap, and heaps are balanced.
  - The median is calculated based on the size of the heaps.

- **Time Complexity:**
    - **addNum()**: **O(log n) for balancing the heaps.**
    - **findMedian(): O(1).**
- **Space Complexity:**
    - **O(n) where n is the number of elements in the stream.**

Conclusion

Both approaches achieve the goal of finding the median as numbers are added to the stream. The brute force approach relies on sorting, resulting in a higher time complexity for finding the median. On the other hand, the optimized heap approach utilizes two heaps to maintain a balanced state, achieving a lower time complexity for finding the median.