A graph with lines and numbers

Description automatically generatedLab 6 analysis

**Pair programming:** I’m Ray Ding, and Xiyao Xu is my parterner.

**Experiment 1:**

When inserting in-order data into a TreeSet, each insertion still requires a logarithmic time operation to find the correct position and maintain the tree's balanced nature. Thus, the total time complexity for creating the TreeSet with in-order data is O(NlogN). With permuted data, the randomness of the data does not siginificantly impact the insertion time complexity for a TreeSet. Therefore, the overall time complexity remains O(NlogN).

A graph with a line and a point

Description automatically generated

For a binary heap built from an in-order data, the heapify process runs in O(N). This is because the number of operations needed to heapify is bound by the height of the tree, and the amount of work done per level decreases as you move up the tree. Building the heap from a permuted list using the heapify process is also O(N). The randomness of the elements doesn’t significantly affect the complexity of heapify for a binary heap, as it still requires restructuring the entire array to maintain the heap property.

**Experiment 2:**

A graph of different colored lines

Description automatically generated

As shown by the above figure, the time complexity of TreeSet and Heap for removing all elements using removeMin() scale as O(NlogN) for both data structures. This is because each removal operation has a logarithmic cost, and there are N elements to remove.