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Analysis Document — Assignment 3

1. My Partner for this assignment was Zijia (Harry) Xie, and they submitted our assignment on the GradeScope group.

2. The pair programming experience went fairly well on this assignment. We wrote all the code together over the course of about 5 hours for the initial code and debugging, and 4 additional hours testing and timing. We would try to switch roles every 30 minutes, but occasionally lost track of time. I served as Navigator more often than Driver and want to do better at switching more in future assignments. For the next assignment I suggest using my computer instead of Harry’s and hope this will make it more natural to drive more often. I enjoy working with Harry, but noticed at times we had some difficulties explaining our thought process when trying to debug the code together. We are going to do assignment 4 together, and I want focus on better two way communication while we are trying to solve issues with the code.

3. If we had backed the set with a Java ArrayList instead of a basic array, we would need to make a few implementation changes in order to make the code work properly. The first change would be to check for data types when adding items to the array, ArrayList cannot take primitive types like int, and would need to convert them to Integers instead. ArrayList also sizes automatically, in our code using a basic backing array we needed to check for indexes out of bounds and double the array size in our code before adding values to an already full array. ArrayList already has methods for many of the operations like add, remove, and checking for an empty array, while we needed to write them for a basic array in the assignment. ArrayList also adds each new item to the end of the list. For the purposes of this assignment without calling a sort method, we need to be able to insert new elements at specific indexes to keep the set in order. From what I understand using an ArrayList may have been faster during program development, but may have reduced runtime at execution due to the automatic changing size of the array when adding and deleting elements and would require us to sort the array before doing a binary search.

4. **contains method:** For this timing experiment we used a value of 1,000,000 times to loop with each N starting at N=100,000 to N=2,000,000 increasing N in steps of 100,000. After looking at the code I expect this method to have a Big-O = O(Log(N)) because it implements a binary search operation with no other loops. Shown below in Graph 1 is the data collected from timing analysis and the accompanying graph. Upon inspection using an analysis check, we see the data looks close to linear, but even closer to a logarithmic function. This is what we would expect, although we do see some jumps of higher values in our data which continued to be present even as we increased our times to loop.

A graph with a line going up

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Graph

5. **add Method:** For this timing experiment we used a value of 10,000 times to loop with each N starting at N=100,000 to N=2,000,000 increasing N in steps of 100,000. We expect the Big-O notation of this method to be O(N\*log(N)). It first uses a binary search to find the location to insert the new element, and then must shift all the elements after the insertion point, which is an order O(N) operation. After analysis check, the growth rate of the add method seems to best fit O(N\*log(N)) as we predicted.

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