**Navdeep Handa**

**Assignment 2 Writeup**

The implementation that was best for append was the StringBuilder, which took an average of 45 nanoseconds/operation and stayed at approximately constant O(1) time as N increased, which is to be expected, as appending to the end of an array, which is the underlying mechanism behind StringBuilder, is a constant operation. However, append for MyStringBuilder was quite close, with an average of 83 nanoseconds/operation and approximately constant O(1) time as N increased. Again, I expected this as MyStringBuilder kept track of the last node, so adding to the end of the linked list only required a link from the last node to the new node.

The implementation that was best for delete was far and away the MyStringBuilder, with an average of 71 nanoseconds/operation, while the other two objects had average runtimes in the thousands. MyStringBuilder stayed constant O(1) as expected because no shifting is required to delete a node, while shifting is required in an array implementation, explaining the linear O(N) runtimes of MyStringBuilder and String (whose concatenation operator uses MyStringBuilder to execute).

The implementation that was best for insert was definitely StringBuilder, with an average of 991 nanoseconds/operation vs runtimes in the tens of thousands for the other two objects. Interestingly, both StringBuilder and MyStringBuilder had linear big-O runtimes, but there seemed to be a very huge scaling constant that made the runtime for MyStringBuilder’s insert very high; I cannot figure out why that is.

The overall best implementation with respect to these three methods is definitely StringBuilder. Although MyStringBuilder had constant big-O times for append and delete, insert’s atrociously bad runtime trumps these runtimes. StringBuilder had consistently low runtimes across all three methods, even if 2 of the operations were linear. However, for a much larger dataset, I would choose MyStringBuilder because two of its operations are constant and one is linear, while StringBuilder has one constant operation and two linear operations.

Some plots supporting these conclusions are on the next page:

